UNIVERSITY OF BELGRADE
FACULTY OF CIVIL ENGINEERING

Nikola D. Tošić

BEHAVIOUR OF REINFORCED CONCRETE BEAMS MADE WITH RECYCLED AND WASTE MATERIALS UNDER LONG-TERM LOADING

DOCTORAL DISSERTATION

Belgrade, 2017

UNIVERZITET U BEOGRADU

GRAĐEVINSKI FAKULTET

Nikola D. Tošić

PONAŠANJE ARMIRANOBETONSKIH GREDNIH ELEMENATA OD BETONA SA RECIKLIRANIM I OTPADNIM MATERIJALIMA POD DUGOTRAJNIM OPTEREĆENJEM

DOKTORSKA DISERTACIJA

Beograd, 2017

Supervisor:

Prof. Snežana Marinković, PhD civ. eng.
University of Belgrade, Faculty of Civil Engineering

Committee Members:

Prof. Snežana Marinković, PhD civ. eng.
University of Belgrade, Faculty of Civil Engineering

Prof. Jorge de Brito, PhD civ. eng.
Instituto Superior Técnico, University of Lisbon

Assistant prof. Nenad Pecić, PhD civ. eng.
University of Belgrade, Faculty of Civil Engineering

Assistant prof. Ivan Ignjatović, PhD civ. eng.
University of Belgrade, Faculty of Civil Engineering

Defense date:

Abbreviations

ACI	**A**merica **C**oncrete **I**nstitute
CoV	**C**oefficient **o**f **V**ariation
CDW	**C**onstruction and **D**emolition **W**aste
EC2	**EN 1992-1-1**
FEM	**F**inite **E**lement **M**ethod
HVFAC	**H**igh **V**olume **F**ly **A**sh **C**oncrete
IPCC	**I**ntergovernmental **P**anel on **C**limate **C**hange
ITZ	**I**nterface **T**ransition **Z**one
LOI	**L**oss **O**n **I**gnition
NA	**N**atural **A**ggregate
NAC	**N**atural **A**ggregate **C**oncrete
MC10	**M**odel **C**ode 20**10**
OD	**O**ven-**D**ry
RAC	**R**ecycled **A**ggregate **C**oncrete
RCA	**R**ecycled **C**oncrete **A**ggregate
RH	**R**elative **H**umidity
SEM	**S**canning **E**lectron **M**icroscopy
SSD	**S**aturated-**S**urface **D**ry
w/c	**w**ater-**c**ement ratio
w/cm	**w**ater-**c**ementitious **m**aterials ratio
XRF	**X**-**R**ay **F**luorescence

Symbols

Symbol	Name	Unit
A_{sl}	longitudinal tensile reinforcement area	mm^2
E_{cm}	mean 28-day modulus of elasticity of concrete	GPa
F_c	compression force in concrete	kN
F_s	tensile force in reinforcement	kN
$F_{s'}$	compression force in reinforcement	kN
I_c	gross cross-section moment of inertia	mm^4
I_e	effective cross-section moment of inertia	mm^4
$I_{i,1}$	transformed cross-section moment of inertia in state 1	mm^4
$I_{i,2}$	transformed cross-section moment of inertia in state 2	mm^4
J	creep compliance	1/Pa
M	bending moment	kNm
M_{cr}	cracking moment	kNm
M_{ult}	flexural strength	kNm
V_a	volume of entrained air	$\mathrm{kg/m}^3$
W_i	section modulus of transformed reinforced concrete cross-section	mm^3
W_c	section modulus of gross concrete cross-section	mm^3
a	shear span	m
b	cross-section width	mm
d	cross-section effective depth	mm
d_1	tensile reinforcement center of gravity	mm

d_2	compressive reinforcement center of gravity	mm
d_k	carbonation depth	mm
d_{max}	maximum aggregate particle size	mm
g	distributed self-weight	kN/m
h	cross-section height	mm
h_0	notional size of a concrete member	mm
f_{ck}	characteristic 28-day concrete compressive cylinder strength	MPa
f_{cm}	mean 28-day concrete compressive cylinder strength	MPa
$f_{ct,fl}$	concrete flexural tensile strength	MPa
f_{ctm}	mean 28-day concrete axial tensile strength	MPa
$f_{ct,sp}$	concrete splitting tensile strength	MPa
f_{yl}	longitudinal reinforcement yield stress	MPa
l	span	m
m_c	cement mass	kg
m_{FA}	fly ash mass	kg
$m_{NA,I}$	natural sand 0/4 mm mass	kg
$m_{NA,II}$	natural gravel 4/8 mm mass	kg
$m_{NA,III}$	natural gravel 8/16 mm mass	kg
$m_{RCA,II}$	coarse RCA 4/8 mm mass	kg
$m_{RCA,III}$	coarse RCA 8/16 mm mass	kg
m_w	water mass	kg
$1/r$	curvature	1/m
$s_{r,max}$	maximum crack spacing	mm
t_0	loading age	days
t_s	age at start of environmental exposure	days
w_m	mean crack width	mm
w_k	characteristic crack width	mm
x	depth of compression zone	mm

Symbol	Name	Unit
γ_c	specific density of cement	kg/m^3
γ_{FA}	specific density of fly ash	kg/m^3
γ_{fresh}	concrete density in fresh state	kg/m^3
γ_{hard}	concrete density in hardened state	kg/m^3
$\gamma_{NA,I}$	natural sand 0/4 mm OD density	kg/m^3
$\gamma_{NA,II}$	natural gravel 4/8 mm OD density	kg/m^3
$\gamma_{NA,III}$	natural gravel 8/16 mm OD density	kg/m^3
$\gamma_{RCA,II}$	coarse RCA 4/8 mm OD density	kg/m^3
$\gamma_{RCA,III}$	coarse RCA 8/16 mm OD density	kg/m^3
γ_w	specific density of water	kg/m^3
ε_c	longitudinal strain in concrete	mm/mm
ε_{cas}	longitudinal autogenous shrinkage strain in concrete	mm/mm
ε_{cbc}	longitudinal basic creep strain in concrete	mm/mm
ε_{cdc}	longitudinal drying creep strain in concrete	mm/mm
ε_{cc}	longitudinal creep in concrete	mm/mm
ε_{cds}	longitudinal drying shrinkage strain in concrete	mm/mm
ε_{ci}	longitudinal initial strain in concrete	mm/mm
ε_{cs}	longitudinal shrinkage strain in concrete	mm/mm
ε_{pl}	longitudinal plastic strain in concrete	mm/mm
ε_r	longitudinal reversible strain in concrete	mm/mm
$\varepsilon_{s,c}$	longitudinal strain in compressive reinforcement	mm/mm
ε_{sm}	longitudinal mean strain in reinforcement	mm/mm
$\varepsilon_{s,t}$	longitudinal strain in tensile reinforcement	mm/mm
ε_{uk}	reinforcement elongation at maximum force	mm/mm
μ	mean value	(–)
ζ	distribution coefficient representing the extent of cracking	(–)
ξ	neutral axis position coefficient	(–)
σ	standard deviation	(–)

σ_c	axial stress in concrete	MPa
$\sigma_{s,c}$	axial stress in compressive reinforcement	MPa
$\sigma_{s,t}$	axial stress in tensile reinforcement	MPa
ρ	longitudinal tensile reinforcement ratio	
ρ'	longitudinal compressive reinforcement ratio	
ϕ	creep coefficient	(–)

Dedicated to the vision and effort of
professor Snežana Marinković

Acknowledgements

Perhaps there are doctoral dissertations which truly deserve to be signed by only one name. The one you are about to read is not among them.

The one person I am most indebted to for this work is my supervisor, professor Snežana Marinković. She has been the one from whom I have learned all that was necessary to complete this goal. She has been a true mentor on this journey. If there is any value to be found in this work, then it is thanks to her. All of the qualities of this dissertation go to her credit, and if there are any errors and faults, they are only mine.

To professor Ivan Ignjatović I owe special thanks for standing side by side me throughout my PhD studies. Alongside him, I developed a love for laboratory work and learned how to be excited about experiments.

To professors Nenad Pecić and Jorge de Brito I express my appreciation for their help during the writing of my thesis, for their valuable help, insight, comments and feedback. I hope I have achieved the level of quality of this dissertation that they believed it could reach.

I wish to thank Jelena Dragaš for all her help, she was my closest colleague during my PhD studies. I would also like to acknowledge the contributions of professor Branislav Bajat and colleagues Vedran Carević, Ivan Milićević, Aleksandar Radević, Milutin Pejović and Mladen Jović. Their help in carrying out the experiments and measurements is greatly appreciated. I especially want to thank Milutin Pejović for introducing me to the wonders of LaTeX in which this thesis was written.

Without the support of the University of Belgrade's Faculty of Civil Engineering and all of my colleagues, this dissertation could not be completed. The work presented herein was financially supported by the Ministry for Education, Science and Technological Development of the Republic of Serbia and the Swiss National Science Foundation. Important contributions were also made by companies Čelikinvest, Deneza M, Gradient and GP Planum AD. This support is gratefully acknowledged.

Acknowledgments for helping me in my work go not only for professional, but also personal and emotional support.

Limited space here does not allow me to fully express how thankful I am to my partner, Milica, for being my companion in life. With her, my every day is filled with love received and, I hope, love given back. This journey required support, patience and understanding and, luckily for me, she had all of them. I thank my father for teaching me so much about life, even though my learning at times caused him pain. I thank my mother for igniting within me the flame of curiosity and love for learning.

I also wish to express special thanks to Aleksandar Stojanović and professors Branislav Radeljić and Gordana Vuleta. Talks with them, as colleagues in academia and as dear friends, have been invaluable for my development as a researcher and a teacher.

UNIVERSITY OF BELGRADE

Abstract

Faculty of Civil Engineering
Department of Materials and Structures

Behaviour Of Reinforced Concrete Beams Made With Recycled And Waste Materials Under Long-term Loading

Concrete is the second most-used material in the world after water and its production places a large strain on natural resources and the environment. This has prompted the search for sustainable alternatives to traditional Portland cement concrete. Among these 'green concretes', most promising, in the case of Serbia, are recycled aggregate concrete (RAC) and high-volume fly ash concrete (HVFAC).

In recent decades, there has been a rising importance of serviceability limit states in the design of reinforced concrete structures, notably, the importance of deflections. For natural aggregate concrete (NAC), there is considerable literature concerning shrinkage, creep and deflections of reinforced NAC members, together with a significant number of calculation models. However, for RAC and HVFAC, no such models exist and the number of available experimental results in literature is limited.

In order to fill this knowledge gap, this thesis describes the results of an experimental programme in which reinforced NAC, RAC and HVFAC beams were tested under sustained load. Three concrete mixtures were prepared: NAC, RAC with 100% coarse recycled concrete aggregate and HVFAC in with a 1:1 cement:fly ash ratio. The mixtures were designed to have the same 28-day compressive strength and initial slump.

Six, 3.2 m-span simply supported reinforced concrete beams were made from all three mixtures (two beams from each mixture) and loaded in four-point bending with a sustained load at the ages of 7 and 28 days, maintained for 450 days. The load was determined so that beams loaded at the same age were loaded to an identical stress–to–strength at loading age ratio. On the beams, deflections, strains, crack spacing and crack widths were measured. Accompanying specimens were cast for measuring mechanical properties, shrinkage and creep.

Shrinkage was the highest for RAC, followed by NAC and then HVFAC. Creep was measured on RAC and HVFAC prisms loaded after 7 and 28 days. The creep coefficient was higher for RAC and no clear dependence on loading age was found. The results on all six beams showed a similar increase of normalized deflections: 2.03–2.36 times the initial deflection. The changes of compressive and tensile strains, crack spacing and crack widths were also presented and discussed.

Two models for calculating deflections were analysed: MC10 and ACI 435R (ACI). Both were assessed on individual deflection curves and a large database of 140 results on NAC beams using numerical integration of curvatures. Influencing parameters on both models' accuracy and precision were identified and corrections were proposed in the form of MC10+ and ACI+ models. The simplified versions of both models were compared with their respective rigorous methods and deviations between the models were corrected.

Finally, the corrected MC10+ and ACI+ models were tested on own and existing results from literature for deflections of RAC and HVFAC beams. The MC10+ model was shown to be applicable to RAC beams if corrections are introduced for shrinkage and creep. The ACI+ could not be shown to be directly applicable to RAC beams. For HVFAC, only own experimental results were available, but both models significantly overestimated their deflections, pointing to a possible difference in tension stiffening of HVFAC compared with NAC.

Key words: concrete; reinforced concrete beam; recycled concrete aggregate; fly ash; creep; shrinkage; deflections; modeling

Scientific field: Civil and Structural Engineering

Scientific sub-field: Concrete Structures

UDC number: 624.012.45.04(043.3)

UNIVERZITET U BEOGRADU

Rezime

Građevinski fakultet

Katedra za materijale i konstrukcije

Ponašanje armiranobetonskih grednih elemenata od betona sa recikliranim i otpadnim materijalima pod dugotrajnim opterećenjem

Beton je drugi najkorišćeniji materijal na svetu nakon vode i njegova proizvodnja je odgovorna za veliku potrošnju prirodnih sirovina i uticaj na životnu sredinu zbog čega su istraživači počeli potragu za održivim alternativama konvencionalnim betonima od Portland cementa. Među ovim 'zelenim betonima', u Srbiji najviše potencijala imaju betoni sa recikliranim agregatom (RAC) i betoni sa velikim sadržajem letećeg pepela (HVFAC).

Prethodnih decenija je došlo do porasta značaja graničnih stanja upotrebljivosti (pre svega ugiba) pri projektovanju armiranobetonskih konstrukcija. Za betone od prirodnog agregata (NAC), postoji brojna literatura o skupljanju, tečenju i ugibima armiranobetonskih NAC elemenata, zajedno sa značajnim brojem proračunskih modela. Međutim, za RAC i HVFAC, takvi modeli ne postoje, a broj postojećih eksperimentalnih rezultata je ograničen.

U cilju sticanja ovih nedostajućih znanja, u ovoj disertaciji su opisani rezultati eksperimentalnog programa u kome su armirane grede od NAC, RAC i HVFAC betona ispitane pod dugotrajnim opterećenjem. Spravljene su tri betonske mešavine: NAC, RAC sa 100% krupnog agregata od recikliranog betona i HVFAC sa odnosom cement:leteći pepeo 1:1. Mešavine su spravljene sa ciljanom istom čvrstocom pri pritisku nakon 28 dana i istim početnim sleganjem.

Šest armiranobetonskih grednih nosaca raspona 3.2 m je spravljeno od navedene tri mešavine (po dve grede od svake mešavine) i opterećeno koncentrisanim silama u trećinama raspona nakon 7 i nakon 28 dana tokom 450 dana. Grede opterećene pri istoj starosti su opterećene tako da se u njima postigne identičan odnos napon/čvrstoća pri pritisku u trenutku opterećivanja. Na gredama su mereni ugibi, dilatacije i razmaci i širine prslina. Izbetonirani su i prateći uzorci za merenje mehaničkih karakterisitka, skupljanja i tečenja.

Skupljanje je bilo najveće u slucaju RAC betona, praćeno NAC i HVFAC betonima. Tečenje je mereno na RAC i HVFAC betonima opterećenim nakon 7 i 28 dana. Koeficijent tečenja je bio veći u slucaju RAC betona ali nije primećena njegova zavisnost od vremena opterećivanja. Rezultati na gredama su pokazali slično uvećanje normalizovanih ugiba za svih šest greda: 2.03–2.36 puta početni ugib. Promene u naponima pritiska i zatezanja, razmaku i širini rslina su takođe prikazane i analizirane.

Analizirana su dva modela za proračun ugiba: MC10 i ACI 435R (ACI). Oba modela su ocenjena putem pojedinačnih vremenskih krivih ugiba i na velikoj bazi podataka sa 140 rezultata ugiba NAC armiranih greda, putem numeričke integracije krivina. Za oba modela su identifikovani parametri koji imaju uticaj na preciznost i tačnost modela i predložene su izmene u formi MC10+ i ACI+ modela. Pojednostavljene metode proračuna u oba modela su upoređene sa rigoroznim pristupom i rezlike su korigovane.

Na kraju, korigovani MC10+ i ACI+ modeli su ispitani na sopstvenim i postojećim rezultatima iz literature ugiba RAC i HVFAC armiranih greda. Za MC10+ model je utvrđeno da je primenjiv na RAC grede ukoliko se uvedu korekcije za tečenje i skupljanje. Za ACI+ model nije moguć utvrditi njegovu direktnu primenjivost na RAC grede. Za HVFAC armirane grede su bili dostupni samo sopstveni rezultati. Oba modela su značajno precenila ugibe ovih greda, ukazujući na mogucnost postojanja drugačijeg sadejstva zategnutog betona i armature u slučaju HVFAC betona.

Ključne reči: beton; armiranobetonska greda; agregat od recikliranog betona; leteći pepeo; tečenje; skupljanje; ugib; modeliranje

Naučna oblast: Građevinarstvo

Uža naučna oblast: Betonske konstrukcije

UDK broj: 624.012.45.04(043.3)

Contents

List of Figures

List of Tables

Chapter 1

Introduction to the Thesis

1.1 Background

The history of concrete closely follows the history of human development. Even though it existed in both ancient Rome and Egypt (Aćić, 2012), its use was limited and relatively rare. Then came the industrial revolution and with the abundance of newly available energy and means of production also came the concrete revolution.

In 1824 Johnson Aspden patented Portland cement, in the 1860s Joseph Monier invented reinforced concrete and finally, in the 1920s Eugene Freyssinet invented prestressed concrete (Aćić, 2012). The foundations of modern concrete had been laid. Further developments were extremely fast (superplasticizers, fibre reinforcement, self-compacting concrete, ultra-high performance concrete, etc.) and continue on today.

Owing to its many advantages over other construction materials, concrete has been the undisputed champion of the built environment. The possibility of it being reinforced to compensate for its low tensile strength; the ability to be cast in place or prefabricated in any desired shape; the ability to produce a wide variety of its properties suitable for any situation; the possibility of producing it with practically unskilled labour; these are all reasons why every developed country has relied and every developing country is relying on concrete—or, more broadly speaking, on cement-based materials—for its built environment. The conclusion of any analysis is the same: there can be no development and improvement in the conditions of human existence without concrete (Du Plessis, 2002). This is also a political statement, especially for developing countries in which 65% of the population lives in slums and for whom a better quality of life is a necessity (World Bank, 2016).

All the advantages of concrete presented so far are the reason why it is the second most-used material on Earth—the first one being water—with an annual global production of 20 billion tons (WBCSD, 2009). This huge amount of concrete requires equally large amounts of its component materials: 15 billion tons of aggregates (river or crushed stone) (Langer et al., 2004) and 4.2 billion tons of cement (USGS, 2015); the amount of cement produced is around 600 kg per capita, higher than annual per capita food consumption (Scrivener et al., 2016).

Although concrete has a low embodied energy compared with other materials, the sheer scale of its use means a significant impact on the environment. This impact is mostly expressed in two ways and both can be viewed from a local and global perspective.

The first impact is through the production of cement. Beside depleting natural resources, cement production necessarily releases CO_2 because of the chemical reaction involved in clinker production:

$$CaCO_3 + heat \rightarrow CaO + CO_2 \tag{1.1}$$

Using current practice, each kg of cement produced is associated with an average of 842 g of CO_2; however, Equation 1.1 imposes a natural limit of around 500 g of CO_2 per kg of ordinary Portland cement (Scrivener et al., 2016). Taking into account the global annual cement production of 4.2 billion tons, the cement industry is actually responsible for 7–10% of all anthropogenic CO_2 emissions (which are around 30 gigatons, while 780 gigatons come from natural sources) (Scrivener et al., 2016). If we consider that the Intergovernmental Panel on Climate Change (IPCC) mitigation scenario is 450 ppm of CO_2 in the atmosphere (0.045% and a 2°C increase in temperature relative to the pre-industrial level) then a 50% reduction in anthropogenic CO_2 emissions is necessary by 2050.

The second significant impact of concrete is its end-of-life, i.e. what happens after any concrete, plain or reinforced, has been decommissioned and demolished. Currently, most of it is still simply landfilled. What remains after the demolition of concrete structures is construction and demolition waste (CDW), and in huge quantities. In the EU alone, around 850 million tons of CDW are generated annually, accounting for approximately 30% of total waste generated (Fisher and Werge, 2011). Although CDW is generally inert and non-hazardous, its amount is posing a problem which is, in practice, mostly dealt with by countries with scarce natural resources or areas for landfilling such as the Netherlands and Japan (Ignjatović, 2009).

How will these problems be solved in the future? The construction industry is obviously an important part of the sustainability and sustainable development discourse since the built environment is of such importance for humanity's quality of life and since 'human beings are at the centre of concern for sustainable development' (UNEP, 1992).

Among several possible approaches being currently investigated, two are the subject of this thesis.

The first one is the recycling of CDW to produce recycled aggregates in order to replace natural ones in concrete. This approach has the benefit of saving natural resources and reducing the amount of CDW being landfilled. In this thesis, the focus will be on the product of reinforced or plain concrete recycling – recycled concrete aggregate or RCA, and on concretes in which it is used – recycled aggregate concrete or RAC. *RAC is any concrete in which there is a complete or partial replacement of fine, coarse or both fine and coarse fractions of natural aggregate by RCA*. There are several reasons why RCA and RAC are in the focus of this thesis. RCA has superior properties compared with other recycled CDW such as masonry; also, the share of reinforced concrete in total concrete production (which is currently around 25%) is expected to increase, particularly in developing countries (in Europe this share is close to 58%) (Scrivener et al., 2016).

The second approach is the partial replacement of cement by supplementary cementitious materials, usually industrial by-products. In this thesis, fly ash will be discussed in particular and the production of high-volume fly ash concrete or HVFAC. *HVFAC is any concrete in which more than 30% of the total cementitious material is fly ash.* Since it has pozzolanic properties, and is produced globally in large quantities— around 900–1000 megatons (Scrivener et al., 2016)—fly ash is an ideal candidate for cement replacement. This is not to say that the primary concern of sustainable development shouldn't be the reduction of dependency on coal as an energy source (fly ash being the by-product of its combustion in thermal power plants), but that something useful should be done with the waste already being generated.

These possible solutions are nothing new and have been investigated by researchers, in some cases for several decades. However, not all topics have been given equal attention. For example, out of almost 100 publications annually about the use of RCA in structural RAC (Silva, 2015) most deal with material properties (short-term mechanical or durability-related) and only a few about full-scale tests of structural elements; with HVFAC the situation is even worse. Scarce research exists on long-term material properties of RAC and HVFAC and on long-term behaviour of RAC and HVFAC structural elements, a topic that is obviously neglected but which is, for several reasons, important. Filling this gap is the aim of this thesis: shrinkage and creep of RAC and HVFAC and the long-term behaviour of RAC and HVFAC beams under sustained loads.

1.2 Motivation for the Research

It was stated in section 1.1 that the impact of concrete on the environment can be viewed from a global and local perspective. Both views have been the *spiritus movens* behind this thesis.

Globally, there is a question of the availability of RCA and fly ash to produce sufficient quantities of RAC and HVFAC to offset the negative impacts of concrete. Extensive research exists on this, examining the material flows in CDW recycling and coal combustion. The answer is that RCA and fly ash will not solve all of concrete's problems (Scrivener et al., 2016). They are merely one of the many solutions that must be implemented in order to achieve this. However, this is where the local perspective comes in: never mind that the global amounts of RCA and fly ash are insufficient for the global production of concrete if locally, e.g. in Serbia, zero kg of RCA and fly ash are used in structural concrete. The aim is to start and at least use these materials in the amounts in which they are available, i.e. better something than nothing.

Again from a global perspective, the motivation of this research was to fill existing gaps in knowledge on the behaviour of reinforced RAC and HVFAC members. The knowledge gap was identified in the long-term behaviour of these elements under sustained loads. But what would be the merit of such research?

Concrete is a unique material in the sense that it has time-dependent properties. These changes over time are mostly positive—reflected in the increase of mechanical properties—but they can also be negative or deleterious, such are durability-related properties and shrinkage and creep (properties very specific to concrete and explained in detail in Chapter 2). Additionally, the low tensile strength of concrete means that members subjected to bending crack and there is a change of stiffness and ultimately, deflections.

Through this research, the aim was to compare reinforced RAC and HVFAC beams with companion reinforced natural aggregate concrete (NAC) beams, observe the differences in their long-term behaviour under sustained loads and formulate new analytical expressions for prediction models so that they can be used on reinforced RAC and HVFAC beams. This would be directly useful for expanding knowledge on the behaviour of such members as well as enabling practicing engineers to reliably use design procedure for reinforced RAC and HVFAC members. There is significant importance in controlling deflection in reinforced concrete structures: controlling appearance, preventing damage to non-structural elements and loss of utility. Beside this, the research results could be indirectly useful in other applications through the knowledge gained on the shrinkage and creep behaviour of RAC and HVFAC compared with NAC, e.g. in controlling long-term losses of prestress force in prestressed RAC and HVFAC members.

1.3 Objectives of the Research

From the background and motivation for the research, come its objectives. It is necessary that the objectives be clearly defined, achievable and their completion measurable.

The first objective of the research is the systematisation in one place of the multidisciplinary knowledge on the long-term behaviour of concrete, deflections of reinforced concrete members made with recycled and waste materials. The primary goal of such a systematisation is to allow the description of the state-of-art in the field and the identification of possible knowledge gaps which then provide the justification for carrying out research on the selected topic. A secondary aim of this step is to allow any potential reader to find all the necessary information to understand the state-of-art in this field, the experimental results of the research and their interpretation as well as to point to significant literature for the interested reader.

The second objective is to design a suitable experimental programme for testing all the phenomena of interest (shrinkage, creep and deflections of reinforced concrete beams) and explain it in sufficient detail to allow reproducibility of the results. The objective should be to design the experiment in such a way as to overcome the deficiencies which have become evident from previous research campaigns.

Such an experimental programme will yield useful experimental results, enrich the existing database in literature so that detailed and meaningful analyses can be possible.

After gathering own and existing results, comprehensive analyses will be performed. Their objective is to reach accurate and precise methods for predicting the behaviour of NAC, RAC and HVFAC beams under sustained loads. In order to achieve this, existing method must be analysed in-depth and, if necessary, corrected. Only than can they be adapted to RAC and HVFAC.

In the end, important conclusions will be drawn about the potential of concretes made with recycled and waste materials (viz. RAC and HVFAC) to be used as structural concrete, from the aspect of deflections of members in bending.

1.4 Methodology and Outline of the Thesis

After defining all of the objectives of the research, a methodology has to be put forward through which these objectives will be reached and from the adopted methodology, the outline of the thesis will logically follow.

The first step in the research was a systematic literature review. Its purpose was to synthesize current knowledge of the phenomena of interest for the thesis: concrete shrinkage and creep, the deflections of reinforced concrete members, existing prediction models for shrinkage, creep and deflections and existing research on RAC and HVFAC. Throughout this section, an attempt was made to include as much multidisciplinary knowledge as possible, make connections with other field of research and also present a historic context for the development of research on this topic.

The second step was the design of a single-factor experiment – since a direct comparison of concretes made with recycled and waste materials and ordinary cement concrete was the objective, the type of concrete had to be the only variable in the experiment with all other parameters kept constant.

The analysis of results had to extract as much insights from the experiments as possible and at the same time build upon the knowledge gathered through the literature review. The analysis included the assessment of existing prediction models for shrinkage, creep and deflections themselves, and the assessment of how they behave when applied to RAC and HVFAC.

1.5 Organization of the Thesis

This document is prepared as a doctoral dissertation and presented to the University of Belgrade in fulfillment of the thesis requirement for the degree of Doctor of Philosophy in Civil Engineering. As such, it is prepared according to University guidelines concerning the thesis' appearance and organization.

The thesis is divided into six chapters.

Chapter 1, i.e. the current chapter, provides the general background and motivation for the research, presenting the sustainability problems of the concrete industry's current practice and the potential solutions investigated in the thesis. This chapter also presents the specific objectives of the thesis and the methodology and outline of how to achieve them: the investigation of long-term behaviour of reinforced RAC and HVFAC beams under sustained loads and their comparison with reinforced NAC beams.

Chapter 2 presents a literature review and state-of-art on phenomena of interest. The processes of concrete shrinkage and creep are briefly explained, relying on the results of newest research. The specifics of calculating deflections of reinforced concrete members subjected to bending are then presented. Afterward, existing experimental research on these topics is presented as well as models used for predicting these phenomena in the case of NAC. Finally, the 'green' concretes investigated in this thesis (RAC and HVFAC) are presented, briefly from a general aspect of their basic properties and specifics and in more detail concerning existing research on their long-term behaviour under sustained loads.

Chapter 3 explains in detail the experimental setup and design. Three concrete mixtures were prepared: NAC, RAC and HVFAC. Mixtures of all three concretes were designed and their rheological and mechanical properties were verified experimentally. The main part of the experiment consisted of casting six 3.2 m-span simply supported reinforced concrete beams loaded in four-point bending with a sustained load at ages of 7 and 28 days (two beams made from each concrete). The load was applied for 450 days and deflections, concrete and reinforcement strains were measured.

Chapter 4 is a systematical presentation of the experimental results. For all the tested concretes, fresh and hardened properties were tested and the results reported for workability of the mixtures, density, compressive and tensile strength and the modulus of elasticity. Further on the material level, shrinkage and creep results obtained on prisms are reported. As for the reinforced concrete beams, after a detailed description of the load calculation for each beams, the measured deflections and strains are presented.

Chapter 5 contains several analyses of the results. The first group of analyses concerns the mechanical properties of concrete: compressive and tensile strength and the modulus of elasticity. Code expressions were used to predict these values and agreement between experimental and calculated results was tested. The second group of analyses concerns experimental results on shrinkage and creep of prisms. Existing calculation models, presented in Chapter 2, were used for comparison with measured values. The flexibility of each model was tested by fitting predicted curves to experimental results through the variation of models' free parameters. The final group of analysis deals with beam deflections. First, existing calculation models, also presented in Chapter 2, were analysed in-depth on NAC beams and their performance was corrected, thus improving their accuracy and precision. After that, these models were tested on RAC and HVFAC beams, on own and existing experimental results, and necessary corrections were proposed in order to make these models equally applicable to RAC and HVFAC beams compared with NAC beams.

Chapter 6 presents the conclusions reached after carrying out the experimental programme and analysing the results. From the conclusions and their limitations, recommendations are drawn for further research necessary in this area.

Chapter 2

Literature Review – Shrinkage, Creep and Deflections of Reinforced Concrete Beams

2.1 Introduction

In section 1.1 it was stated that concrete is the second-most used material in the world after water. And yet, it is a product which is not produced under the same conditions everywhere, or according to the same or similar standards worldwide (unlike cement). It is a locally-manufactured material whose constituent materials and properties can vary widely.

Thus, from the same constituent materials, both ’good’ and ’bad’ concrete can be made; technology and knowledge of concrete chemistry is what makes a difference (Neville, 1995). ’Good’ concrete is one which has satisfactory properties in both the fresh and hardened state. In the fresh state, concrete has to maintain a consistency which enables adequate transport and placement, whereas in the hardened state it must possess sufficient strength and durability.

In its most basic form, concrete is produced from three components: water, cement and aggregates. When talking about structural (reinforced) concrete, ’cements’ are bonding materials, mostly comprising compounds of lime (calcareous cements) which exhibit a setting and hardening behaviour in contact with water; they are, therefore, called hydraulic cements.

The most common aggregate types used in the production of (structural) concrete are natural river sand and gravel or crushed stone aggregates. They are usually separated into so-called 'fine' aggregates (with particles smaller than 4 mm) and 'coarse' aggregates (particles larger than 4 mm).

In its most usual form, one cubic meter of concrete is produced using 300–400 kg/m^3 of cement, 150–200 kg/m^3 of water, 600–800 kg/m^3 of fine aggregate and 1000–1200 kg/m^3 of coarse aggregate. After mixing cement and aggregates and adding water, the silicates and aluminates of lime in cement (oxides) build complex compounds such as calcium hydroxide and calcium silicate hydrate, thus forming a paste matrix around the aggregates, binding them into an 'artificial rock'.

Because of its many advantages, most of which were already listed in section 1.1, concrete was the ideal material to pair with reinforcement and produce structural reinforced concrete. It is estimated that in European countries, as much as 58% of cement is used in reinforced concrete. Even if this percentage is smaller worldwide (only around 25%) it is still expected to rise (Scrivener et al., 2016). Hence, the great importance of producing concrete structures which will be versatile and long-lasting.

During the twentieth century, the average strength of structural concrete, steadily increased, up to the point at which now there are 'ultra high-strength concretes' readily available worldwide, with compressive strengths exceeding 100 MPa. This trend has led to the fact that strength requirements are no longer the deciding aspect in the design of reinforced concrete structures. Rather, the ruling criteria have become serviceability and durability requirements. In this thesis, the focus will be on serviceability.

Serviceability of a reinforced concrete structure is defined as its ability to 'perform adequately in normal use' (FIB, 2013). Most modern codes for the design of reinforced concrete structures deal with so-called Serviceability Limit States or SLS, i.e. limit states concerned with the performance of a structure under 'service loads' (characterized by the fact that partial safety coefficients are generally taken equal to 1.0).

As defined in (FIB, 2013), 'depending on the type and function of a structure or a structural element the verification of different serviceability limit states may be relevant, such as the limitation of

- stresses,
- crack widths,
- deformations and
- vibrations.

In the case of reinforced concrete elements such as slabs and beams (members mostly loaded in bending), the serviceability limit state of deformations refers to deflections, i.e. vertical displacements of the member relative to its supports.

It is precisely deflections which are the interest of this thesis. One major area where deflections are a critical factor in design are slabs; their thickness is usually decided after deflection control and not strength considerations. Furthermore, deflection control is becoming more important, in the light of increasing importance of serviceability limit states in the design of reinforced concrete structures. An interesting analysis of this trend is given by Andrew Beeby in (FIB Bulletin 52, 2010): 'In reinforced concrete members, the deflection is roughly proportional to the stress in the reinforcement and the levels of stress used in reinforcement has steadily increased. This has occurred firstly due to changes in the strength of reinforcing steels and secondly due to reductions in the overall safety factors as our confidence in the material has increased. A lower overall safety factor or use of a higher strength steel automatically means a higher level of stress under service loads. In addition to this, modern buildings tend to require longer spans than those designed 30 to 50 years ago and there has been constant pressure to economise by using less materials. Though it is not possible to draw definite conclusions, it could well be argued that structures designed today may be four or more times more flexible than those designed 50 years ago.'

The main reasons for controlling deflections in design have been given in section 1.2 and they refer to the serviceability of a structure – controlling appearance, preventing damage to non-structural elements and loss of utility. Control of appearance is mostly related to the discomfort that occupants of a room start to feel when they perceive a floor to be sagging. From research done on this topic, different limits in the form of a fraction of a structures' span have been proposed. For example, the general consensus is that no sagging will be noticed if the deflection of a reinforced concrete member, relative to its supports, is lower than span/250 (Beeby and Narayanan, 2005). The other important consideration is the damage to non-structural elements, mostly in the form of cracking of partitions and finishes. Although some limits have been proposed for these cases as well, clearly it is a more difficult limit to asses as it depends on the nature of the partition. The limits given in modern codes are usually in the range of span/300 to span/500 (only for the deflection that occurs after the partitions have been installed).

As will be seen later, calculating deflections of reinforced concrete members is a highly complex task depending on many factors and with many sources of variability – the fact that the stiffness of reinforced concrete members changes after cracking and due to creep and shrinkage, the fact that the concrete tensile strength has a high scatter and the modulus of elasticity is very difficult to adequately measure, etc. Even in controlled, laboratory conditions, it is not surprising (and is even a good result) when calculated deflections differ $\pm 20\%$ from measured ones. The relatively good precision of mathematical models for other aspects of reinforced concrete behaviour has unreasonably led many engineers to trust deflection calculations too much when in fact they are often only valid as a relative measure of a member's deformability.

Taking all of this into account, this section aims to present a state-of-the-art on the behaviour of reinforced concrete beams under long-term loading, with a special look on what work has been done on this topic for RAC and HVFAC.

The main influencing parameters of the long-term deflection behaviour of reinforced concrete beams will be explained in detail. The first two sections are dedicated to two aspects most specific to concrete and its long-term behaviour – shrinkage and creep. Afterward, in section 2.4, the remaining parameters of importance to reinforced concrete beams are presented.

Only describing and understanding a phenomenon is not the ultimate goal of any engineering endeavour; rather, it is the ability to make calculations, predictions and design.

First, existing experimental research on the material and structural level is discussed. After this, existing models for calculating shrinkage, creep and deflections are presented in section 2.5.

Finally, a review of the progress of research on RAC and HVFAC is given, in the area of shrinkage, creep and especially the behaviour of reinforced beams made from these concretes under long-term loading.

Throughout the chapter, beside trying to present the newest insights gained by researchers, it was also attempted to present things in a ’historical’ perspective. This kind of view can perhaps be helpful in understanding how the current knowledge was reached and what were the driving factors behind the progress or lack thereof.

2.2 Shrinkage

2.2.1 Introduction

Shrinkage of concrete can be basically, and in somewhat lay terms, defined as a time-dependent volumetric change of an unloaded concrete specimen at a constant temperature. Behind this definition, lies a 130 year-long history of trying to understand the underlying processes of shrinkage ever since it was first observed in 1887 (Le Chatelier, 1887). The complex nature of the material makes this a difficult task.

Shrinkage is a deformation, and deformation of concrete can occur under mechanical, thermal and hygral actions. Mechanical actions (external forces, displacements, etc.) and thermal actions (temperature variations of climatic or industrial origin) are not of interest since shrinkage is the deformation of *unloaded concrete at a constant temperature* (here, load is considered in the strictly mechanical sense). This leaves only hygral actions; they are actions related to the movement of water. Hygral actions result either from variations in ambient conditions (which generate flows and consequently, gradients) or from an internal source or sink (resulting in a loss of equilibrium with the environment and also in flows and gradients) (Acker and Ulm, 2001).

This water movement occurs in several stages and processes which will be discussed in the following subsections. Thus far, research has shown that the *free* or *unrestrained shrinkage* of concrete can be divided into three categories:

- plastic shrinkage,
- autogenous shrinkage, and
- drying shrinkage.

2.2.2 Plastic Shrinkage

There are four major compounds (all of them oxides) in Portland cement:

- Tricalcium silicate or C_3S $(3CaO \cdot SiO_2)$ – comprising 45–55% of cement,
- Dicalcium silicate or C_2S $(2CaO \cdot SiO_2)$ – comprising 20–30% of cement,
- Tricalcium aluminate or C_3A $(3CaO \cdot Al_2O_3)$ – comprising 6–10% of cement, and
- Tetracalcium aluminoferite or C_4AF $(4CaO \cdot Al_2O_3 \cdot Fe_2O_3)$ – comprising 15–20% of cement.

After adding water, these oxides build more complex compounds among which the most important are calcium hydroxide or CH $(Ca(OH)_2$ or $CaO \cdot H_2O)$ and calcium silicate hydrate or C-S-H (with a very complex formula). What is most important to note is that hydration itself produces so-called *chemical shrinkage* because the volume of hydrated products is smaller than the sum of volumes of unhydrated cement and water. For example, in the case of hydration of C_3S, chemical shrinkage can be in the order of 3–10% (Tazawa, 1999).

However, prior to the setting of concrete the extent of shrinkage is small. As soon some stiffness of the system has developed, contraction due to the consumption of water by hydration is significantly restrained. While hydration continues, water can also be lost (not consumed) by evaporation from the surface. This is called *plastic shrinkage* as the concrete is still in the plastic state. Plastic shrinkage is most affected by the amount of water lost from the surface – influenced by temperature, ambient relative humidity (RH) and wind speed. Also, plastic shrinkage increases with increasing cement content and decreasing water/cement (*w/c*) ratio (Neville, 1995).

However, although plastic shrinkage can present a danger to hardening concrete and cause cracking, it can be prevented by lowering (or eliminating) the rate of evaporation from the concrete surface, i.e. with proper curing. It is recommended that the rate of evaporation be under 1 kg/m^2 per h (Neville, 1995).

2.2.3 Autogenous Shrinkage

After initial setting, volume changes continue to occur. Because cement hydration continues beyond this point, a certain amount of water is necessary for it. This amount is a relatively small share of the mixing water: 15–20 l per 100 kg of cement, or less than half of the initial water in ordinary concrete (Acker and Ulm, 2001). If there is no external supply of water into concrete then a withdrawal of water from newly-formed capillary pores of the cement gel (produced in the process of chemical shrinkage) starts to take place. This process is known as *self-desiccation* and the resulting macroscopic volume change is called *autogenous shrinkage*. With continuing cement hydration, capillary and gel water are consumed. The hardened paste shows shrinkage because of the negative pressure caused by the formation of menisci in the pores. The precise mechanism of this process can be explained by capillary tension theory (Tazawa, 1999; Bažant et al., 1997).

The *autogenous shrinkage strain*, ε_{cas}, typically reaches values of about 0.04‰ after 28 days and 0.1‰ after five years (Neville, 1995). This is true for concretes with a *w/c* ratio greater than 0.45; it can quickly increase to 0.3‰ for *w/c* ratios lower than 0.4 (Acker and Ulm, 2001). Because of its low values for usual *w/c* ratios, autogenous shrinkage needn't, for practical purposes, be distinguished from shrinkage caused by drying of the concrete. It was, in fact, overlooked by researchers for a long time; since its evolution closely matches the evolution of compressive strength, most of it occurs in the first few days after setting, while shrinkage measurements (at least in the past) started several days after casting (Acker and Ulm, 2001).

Nonetheless, for certain concretes autogenous shrinkage is very important. Most notably, high-strength and ultra high-strength concretes with extremely low *w/c* ratios. This is also acknowledged by modern prediction models which treat autogenous shrinkage very seriously (Hubler et al., 2015b). Additionally, cements with high C_3A and C_4AF contents also experience higher autogenous shrinkage compared with ordinary concretes, while blended cements with fly ash generally show lower values (Neville, 1995).

2.2.4 Drying Shrinkage

If plastic shrinkage can be mitigated by proper curing, and autogenous shrinkage is generally negligible for ordinary concretes, then *drying shrinkage* must definitely be taken into account. While autogenous shrinkage is a process of water consumption, which could develop without moisture exchange with the environment, drying shrinkage is dependent on water evaporation and hence always entails a moisture exchange with the concrete's surroundings, Figure 2.1.

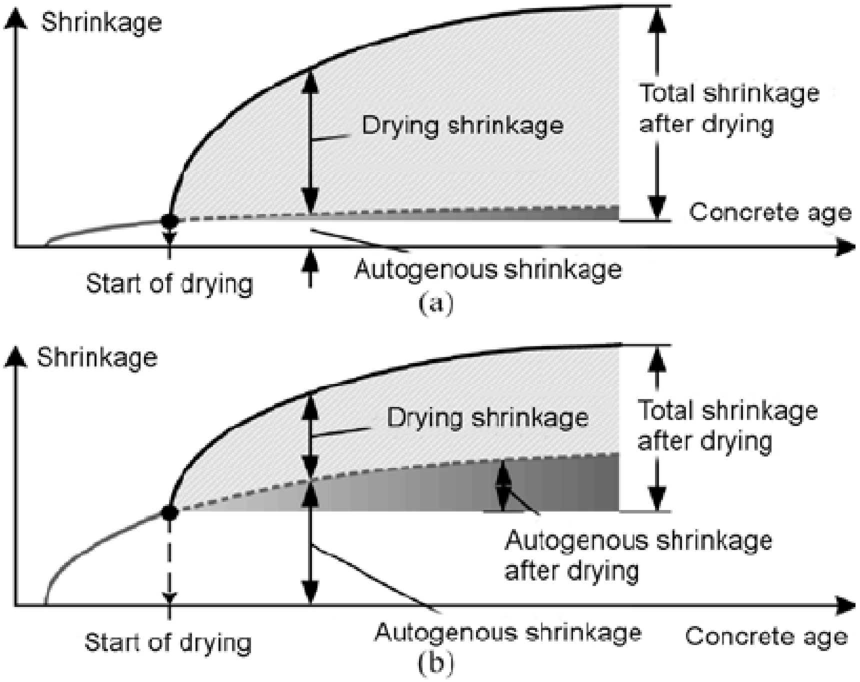


FIGURE 2.1: Shrinkage strain components in (a) normal-strength and (b) high-strength concrete (Gribniak et al., 2008)

The drying process in concrete doesn't begin until the formwork is removed – except for the exposed side, which is another important reason for curing. At first, *free water* from the pores evaporates, causing little or no shrinkage. As drying proceeds, *adsorbed water* is removed and the volumetric change of unrestrained hydrated cement paste in this phase is approximately equal to the loss of a water layer one molecule thick, from the surface of gel particles (Neville, 1995). The thickness of a water molecule is ca. 1% of the gel particle's size, upon complete drying a *drying shrinkage strain*, ε_{cds}, of 10‰ could theoretically be expected; values up to 4‰ have been observed on cement paste, but 0.2–0.6‰ are most common apparent values for concrete(Neville, 1995; Acker and Ulm, 2001). The specific mechanism of the structural changes occurring in the pores is very complex. Sometimes the pores aren't thick enough to fully develop adsorbed layers of water, causing large disjoining pressures (Bažant et al., 1997) exerted by the hindered adsorbed layers on pore walls; other times a removal of *intercristallyine water* also occurs.

The relation between water loss and drying shrinkage depends highly on the 'neatness' of the cement paste. The more porous the cement paste, the higher the content of free water that can evaporate causing no shrinkage. Drying shrinkage is also a process that depends on the size of the specimen since at each point drying is related to the distance of that point from the nearest surface (where moisture exchange takes place). The transport of water is described by diffusion theory and it is usually assumed that the rate of diffusion of vapor is proportional to the square root of time elapsed (Mensi and Acker, 1988). In other words, what happens in a cylinder of diameter D_1 after time t_1 also happens in a cylinder of diameter kD_1 after time $k^2 t_1$. However, the presence of edges further complicates this relation. The times for drying to finish (drying *is* a finite process because there is a finite amount of water in concrete) can be very long – 10 years for a specimen 160 mm in diameter, but 300 years for 1 m of concrete (Acker and Ulm, 2001).

The explanations so far have been in regard to cement paste – the higher the *w/c* ratio, the higher the shrinkage (since there is more evaporable water). Aggregates, their amount and stiffness, have the highest influence in restraining the shrinkage of cement paste. The ratio of shrinkage of concrete S_c to the shrinkage of the cement paste S_p, depends on the aggregate content a and is

$$S_c = S_p \cdot (1-a)^n \tag{2.1}$$

where experimental values of n vary between 1.2 and 1.7 (L'Hermite, 1960). The variations are partly due to the wide range of aggregate properties and the restraint they offer, some of them even showing shrinkage themselves (some dolerites and basalts, whereas granite, limestone and quartzite are non-shrinking).

The chemical composition of cement (excluding blended cements) is believed not to be a significant influence on shrinkage, while particle size can affect it through faster and more complete hydration of finer particles.

2.2.5 Differential Shrinkage

The discussion so far has been about free or unrestrained shrinkage. However, in structural members several sources of restraint exist. Beside the aggregate in concrete, other restraints are the non-shrinking reinforcement and the boundary or support conditions of the structural member. Since drying takes place at the surface of a concrete element, shrinkage varies with the size and shape of the element and is a function of the surface/volume ratio called the *notional size*, h_0, of a concrete member

$$h_0 = 2 \cdot A_c / u \tag{2.2}$$

where A_c is the cross-sectional area and u the perimeter of the part exposed to drying. The notional size is linearly related to the logarithm of shrinkage and to the logarithm of the time required for half the shrinkage to be completed (Neville, 1995).

The stresses induced by restrained shrinkage are partly relieved by relaxation and creep. However, when drying occurs rapidly *shrinkage cracking* can occur. It is exactly this shrinkage cracking that is of main concern when designing concrete structures. As stated earlier, the *w/c* ratio has one of the most important impacts on shrinkage. When it is large it increases shrinkage and reduces strength, making concrete more prone to cracking. An increase in the cement content also increases shrinkage, but strength as well. The stresses induced by shrinkage are through time relieved by creep and by the increase of strength (but not of the modulus of elasticity in the case of restrained shrinkage, as it increases stress). Cracking can only be avoided if the stress induced by free shrinkage and reduced by creep at all times remains lower than the tensile strength of concrete. It can be seen that there is a complex interplay of time-dependent processes that determines whether shrinkage cracking will occur.

2.3 Creep

2.3.1 Introduction

In concrete, the relation between stress and strain is a function of time. This is schematically shown in Figure 2.2. It can be seen that there is an increase in strain under sustained stress in excess of the initial strain at the time the stress is applied and the shrinkage strain that also increases during this period. Since this increase can be several times as large as the instantaneous strain at loading, creep can be of considerable importance when analysing concrete structures.

Under normal loading conditions, the instantaneous strain depends on the speed of load application and includes an initial, elastic part, $\varepsilon_{ci}(t_0)$, and a plastic part, $\varepsilon_{pl}(t_0)$, where t_0 denotes the time of stress application. Since load application can only theoretically be truly *instantaneous*, this strain also includes some creep strain (hence the importance in achieving as short a load application as possible in experiments). After the application of stress $\sigma(t_0)$, the shrinkage strain, ε_{cs}, continues to develop as shown by the dashed line in Figure 2.2. At any time t, the strain in excess of the instantaneous strain, $\varepsilon_{ci}(t_0) + \varepsilon_{pl}(t_0)$, and the shrinkage strain, $\varepsilon_{cs}(t)$ is called the creep strain, $\varepsilon_{cc}(t)$. If the stress is removed at a time t_1, a new instantaneous strain, $\varepsilon_{ci}(t_1)$, and a delayed *reversible strain*, ε_r, will be realized. This new instantaneous unloading strain will generally be lower than the instantaneous strain caused by loading because of the increase of the modulus of elasticity from t_0 to t_1. The creep strain will now develop in the opposite direction, in time decreasing the overall strain towards an asymptotic value (always greater than the shrinkage strain).

As stated previously, the creep strain at the end of loading may be three to four times the instantaneous strain, which is 'truly exceptional for a mineral' (Acker and Ulm, 2001). As with shrinkage, the role of water is of primary importance. Creep under conditions of no moisture exchange with the environment is called *basic creep*, ε_{cbc}, whereas creep

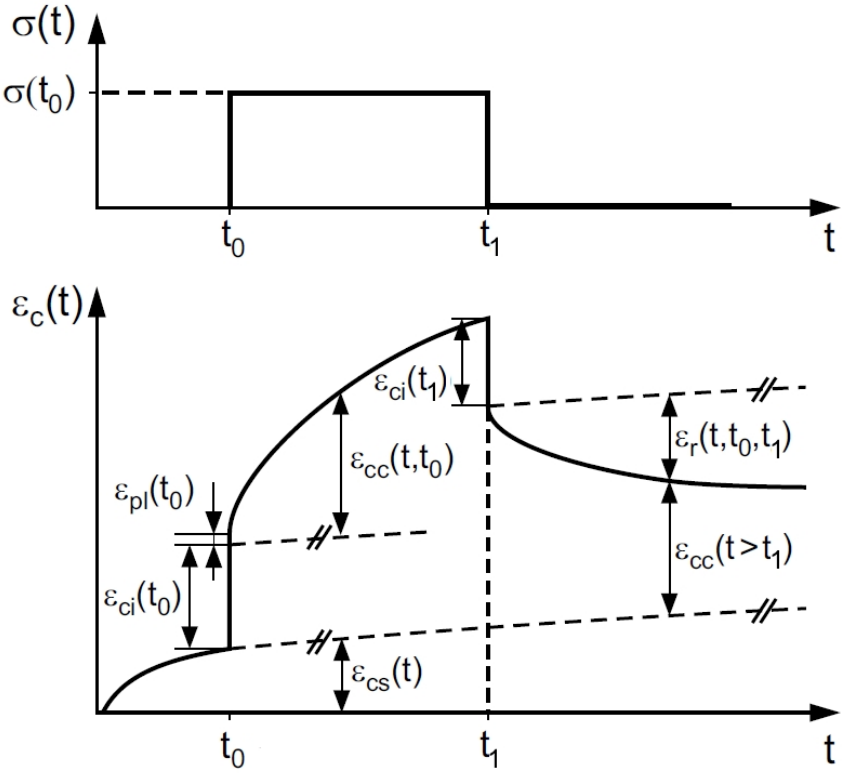


FIGURE 2.2: Deformation of concrete under a sustained stress for a fixed duration

under moisture exchange with the environment is called *drying creep*, ε_{cdc}. Beside being important, the role of water is also somewhat paradoxical: in cases with no exchange of water with the ambient (basic creep), the lower the evaporable water content in concrete, the lower the creep; however, with water exchange with the environment (drying creep), the greater the drying, the greater the creep (Acker and Ulm, 2001). In other words, creep is greater when there is water exchange with the environment (drying creep in excess of basic creep). This was first pointed out by Pickett (1942).

2.3.2 Nature of Creep

Creep of concrete was probably first observed at the beginning of the twentieth century (Hatt, 1907). At that stage, beside empirical macroscale observations, it wasn't possible to offer physically meaningful interpretations of creep. However, by the middle of the century it was known that the process depended on the adsorption and desorption of water and that 'an analysis based on thermodynamics is especially instructive'(Powers, 1968).

In the meantime, with the development of testing equipment, it became possible to study the phenomenon of creep on ever smaller scales. So far, perhaps the most detailed study is that by Vandamme and Ulm (2009). In it, the authors explain the nanogranular origin of creep. Since in concrete, it is the hydrated cement paste that displays creep behaviour—the aggregates mostly offer restraint—the authors decided to perform nanoindentation tests of C-S-H since it is the major component contributing to the structure of the paste. The hypothesis was that C-S-H creep is 'likely due to the rearrangement of nanoscale particles around limit packing densities following the free-volume dynamics theory of granular physics' (Vandamme and Ulm, 2009).

In fact, by studying cement pastes produced using *w/c* ratios between 0.15 and 0.40, the authors noted three structurally distinct but compositionally similar C-S-H forms: low density, high density and ultra-high density. The low density C-S-H is produced in concretes with high *w/c* ratios whereas the high and ultra-high density C-S-H arises in concretes with low *w/c* ratios. Nanoindentation 'creep' tests, with a 180 s holding time of the indenter tip, were carried out to assess the creep compliance rate and creep compliance of C-S-H. The creep compliance, $J(t)$, one of the most important descriptions of creep, can be defined as the ratio of strain to stress at a certain time, i.e. $J(t) = \varepsilon(t)/\sigma$; the creep compliance rate is then the time derivative of the compliance. The results were promising in showing that nanoscale creep measurements during a short period are as exact as macroscopic creep tests carried out over years and that the most likely place for the creep deformation is the particle-to-particle contact of nanosized C-S-H.

Upscaling from the nano realm, another study with important experimental findings is the one by Zhang et al. (2014). The study consisted of minutes-long microindentation creep tests on cement paste (C-S-H particles are nanosized whereas the composite level of the cement paste is microsized), and years-long macroscopic creep tests on concrete. The study focused on basic creep, i.e. the samples were sealed to prevent desiccation. For both micro- and macroscale tests, the authors found that after a transient period, the creep function was well captured by a logarithmic function of time. The non-logarithmic part lasted for days in the macroscale tests but for seconds in the microscale tests. Since, as stated earlier, the creep of concrete is determined by the cement paste properties (its porosity and C-S-H properties), excellent agreement was found between microindentation tests on pastes and microscopic uniaxial tests on concrete, relating the uniaxial creep modulus to the contact creep modulus (the creep modulus is defined as the ratio of initial applied stress to *creep strain*). The authors also found that a 5 min long microindentation test can be useful in predicting the long-term logarithmic creep kinetics of a concrete sample. This approach potentially circumvents the problems of macroscale concrete creep tests – their length, the need to control many parameters over a long period as well as the need to run several experiments in parallel (compensating for shrinkage, decomposing shrinkage and creep into autogenous/basic and drying components). However, just how useful and applicable this procedure will be, taking into consideration the high price of micro- and nanoindentation equipment and the need for skilled handling of it, remains to be seen.

In order to take into account all of the afore-mentioned processes, a complex theory is needed, but one with a good, physical justification. One of the most successful attempts at doing this is the 'microprestress-solidification' theory, put forward by Bažant et al. (1997). The rationale behind the theory is that the justification for creep and the aging properties of concrete must be sought in changes in the microstructure. In the solidification theory, the process of cement hydration is modeled by the gradual deposition of non-aging layers of new hydration products on the walls of capillary pores in the hardened cement paste, i.e. a volume growth of the hydration products (Bažant et al., 1997). The result is an increased stiffness of the material and its macroscopic viscosity.

However, it was soon realized that the solidification theory cannot offer a complete explanation of concrete creep since the volume growth of hydration products is relatively short-lived whereas creep behaviour displays significant long-term aging. Hence, in (Bažant et al., 1997), the authors presented an improvement of the solidification theory in which the viscosity of the flow term of the compliance function was hypothesized to be 'a function of tensile microprestress carried by the bonds and bridges crossing the micropores (gel pores) in the hardened cement gel'. This microprestress is thought to be generated by the disjoining pressure of hindered adsorbed water in micropores and large, localized volume changes caused by hydration and drying. Long-term creep is then considered to be caused by shear slips between opposite walls of the micropores in which the bonds and bridges break and the tensile microprestress transverse to the slip plane gets released. This theory formed the basis of what would first become the B3 creep and shrinkage model (Bažant and Baweja, 1995a) and later the further improved B4 model (Wendner et al., 2013). These models are definitely one of the most advanced of their type and they will be analysed in more detail in section 2.5.

2.3.3 Factors Influencing Creep

Since a lot of the underlying processes concerning the hydrated cement paste are similar in both creep and shrinkage (autogenous/basic and drying), creep and shrinkage share the majority of their influencing factors. However, they are more numerous in the case of creep since it involves the presence of an external mechanical load.

As for aggregates, as stated earlier, they mostly just offer restraint to creep; their grading and porosity doesn't seem to present a significant influence. In the increasing order of the creep exhibited by concrete with the respective aggregates, they are basalt; quartz; gravel; marble and granite; and sandstone (Neville, 1995).

In the range of 'usual' stresses for a concrete structure, i.e. 0.4–0.6 of strength at time of loading, creep is proportional to stress. The upper limit of this 'linear creep' is reached when severe microcracking occurs. However, there is also a limit above which creep will produce *time failure*; this happens when it is loaded at stress levels above 0.8–0.9 of its strength (Neville, 1995). What is perhaps most important is that creep is inversely proportional to the strength at the time of loading. This means that it can be *normalized* and expressed in terms of a stress–strength ratio.

Cement influences creep only insofar as it influences strength development. If loaded with a same stress–strength ratio at the time of loading, creep will increase in the order of S, N, R classes of cement and, for the same applied stress, in the order R, N, S. These classes define the compressive strength development of cement with S, N, R being labels for slow, normal and rapid hardening cements, respectively (EN 197-1, 2000). The *pattern* of creep and creep recovery is, in principle, not affected by the addition of fly ash or slag. Nonetheless, these supplementary cementitious materials affect packing densities and hence permeability and diffusivity, possibly affecting drying creep. Because for a given mix strength and modulus of elasticity are related, that means that creep and modulus of elasticity are also related and inextricably connected (Neville, 1995).

One of the most important external factors is relative humidity. Generally, creep is higher the lower the relative humidity. It also increases with temperature (more drying and water desorption). Creep has been found to decrease with an increase in size of the specimen. It depends on the drying at the surface and is therefore greater at the surface than within the core of the specimen. As drying reaches the core the concrete ages and gains strength, reducing creep. In sealed concrete, no size-effect can be present (basic creep). The size-effect is also most easily expressed through the already mentioned notional size, h_0.

2.4 Deflections of Reinforced Concrete Beams

2.4.1 Introduction

Deflections are among the most complex limit states of reinforced concrete structures for modeling. The difficulty mostly arises from the difference between reinforced concrete and homogeneous materials such as steel for which well-known and simple formulae are easily applicable. Reinforced concrete is a composite material in which one material—concrete—displays time-dependent mechanical properties and the other—reinforcement—does not. Because of this, a redistribution of stresses occurs in the composite. Additionally, cracks are generally expected to open whenever the tensile strength of concrete is exceeded. The consequent reduction in stiffness of the member has a significant effect on its deflections.

The many factors influencing deflections of reinforced concrete members—which will be discussed in section 2.4.3—are mostly known and understood above the limit of practical applicability in the day-to-day design of reinforced concrete structures. In other words, the research of factors influencing deflections has overtaken the advance in producing calculation and prediction models capable of using this attained knowledge (Pecić, 2012).

The need for successfully calculating—for design purposes the more precise term would be 'predicting'—deflections is increasing. On the one hand, there is increasing use of high strength and ultra-high strength concretes for which the design requirements for serviceability limit states are generally ruling over the ones for ultimate limit states. On the other hand, there is (or should be) an increasing use of 'green' concretes, i.e. sustainable alternatives to traditional cement concrete produced using waste or recycled materials, for which serviceability is one of their lesser-known behavioural aspects.

2.4.2 Deflections of Cracked Members

The discussion in this section will be restricted only to non-prestressed reinforced concrete members under bending moments and no external axial forces.

Initially, the reinforced concrete cross-section resists the bending moment with its gross cross-section properties. However, as soon as the tensile strength of concrete is exceeded—in section 2.4.3 there will be further discussion on which tensile strength—cracking occurs. After cracking, the normal stresses in concrete below the crack tip cannot be tensile. Afterward, the internal forces in the cross-section must be resisted by the reinforcement and the uncracked part of the concrete. In other words, there is a redefinition of what the 'effective' cross-section actually is. There is a part of uncracked concrete which continues to be effective and is subjected to compression (and, in reality, some tension not exceeding the tensile strength of concrete) and there is the reinforcement below the crack tip subjected to tension, Figure 2.3 (Pecić, 2012). At sections away from cracks, concrete continues to contribute in tension and consequently, to the stiffness of the member.

From this follows that two distinct states of a reinforced concrete cross-section can exist. In state 1, the full area of the concrete cross-section is effective while in state 2 concrete in tension is ignored – the cross-section is composed of reinforcement in tension and concrete in compression and is said to be *fully cracked* (Ghali et al., 2002).

Some basic assumptions are necessary for the analysis of such cross-sections. Firstly, concrete in tension is ignored. Secondly, plane cross-sections are assumed to remain plane. Thirdly, strains in concrete and reinforcement are assumed to be compatible and finally, both materials are assumed to be ideally linear elastic. To facilitate analysis, a *transformed fully cracked section* is introduced, composed of A_c, the area of the compression zone and $\alpha_e \cdot A_s$, the transformed area of reinforcement, where $\alpha_e = E_s/E_c$ is the ratio of the reinforcement-to-concrete moduli of elasticity. If the bending moment acting on the cross-section is sustained, i.e. long-term, creep and shrinkage will produce changes in strains which are reflected as changes in A_c and E_c, i.e. the transformed fully cracked section is itself time-dependent.

In Figure 2.3 exactly such a transformed fully cracked section is shown. In it, the notation and sign convention that will be followed in the remainder of the thesis is given. A positive bending moment is a sagging one which produces compression in the top fibre. Both tensile strain in the reinforcement and compressive strain in concrete are taken as positive. A positive bending moment produces a positive curvature. Finally, when the axial force is zero, the neutral axis is at the centroid of the transformed fully cracked section (Ghali et al., 2002).

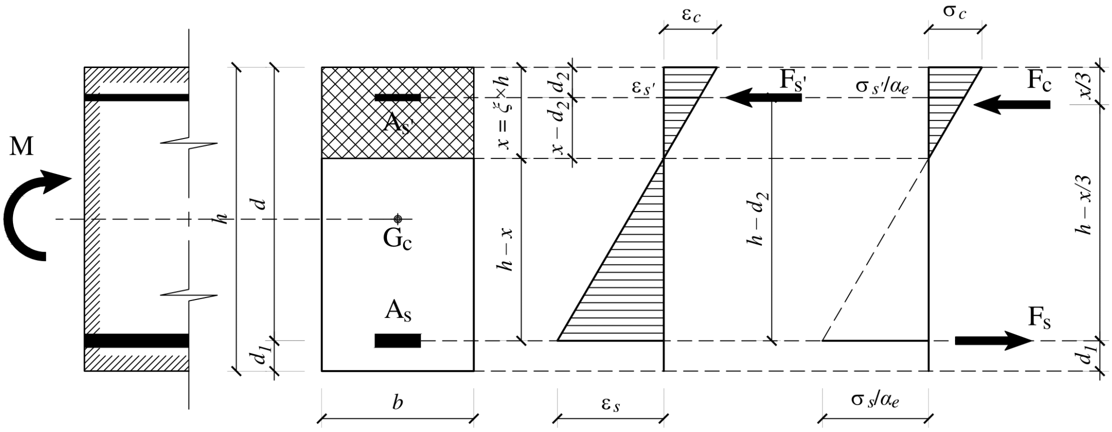


FIGURE 2.3: Stress and strain distribution in fully cracked cross-section in flexure

When calculating deflections of cracked reinforced concrete members using approximate methods, their stiffness has to be evaluated between the two extreme states mentioned earlier. Hence, a member's stiffness varies from a minimum value at the cracked section (state 2) and a maximum value midway between two cracks (state 1). The greatest difficulty in the calculation is accurately interpolating between these two states. Between two cracks, concrete restrains the elongation of steel and carries a part of the tensile force from the reinforcement. Thus, the strain in reinforcement, as stiffness, varies from a maximum value at the cracks to a minimum value midway between two cracks. This contribution to stiffness of concrete in the tension zone is called *tension stiffening* (Ghali et al., 2002). Ignoring its effect can lead to a serious overestimation of deflections.

A cracked reinforced concrete member, under a bending moment $M > M_{cr}$, is shown in Figure 2.4, where M_{cr} is the cracking moment of a reinforced concrete cross-section.

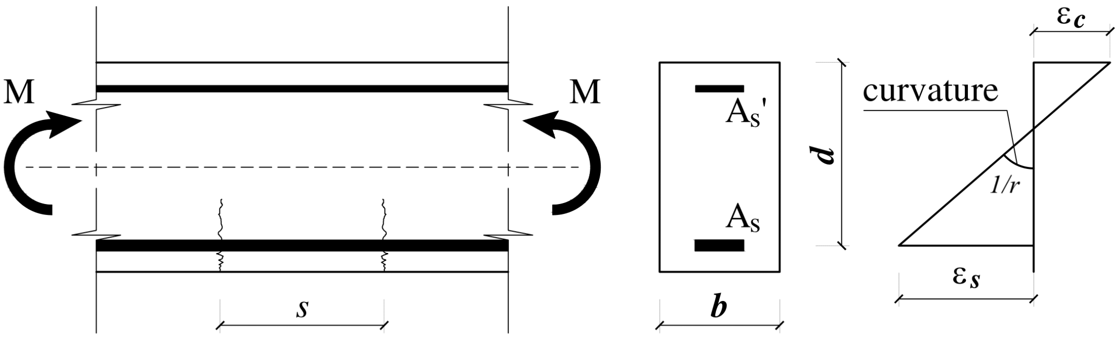


FIGURE 2.4: Cracked reinforced concrete member in flexure

The curvature at a cracked or uncracked section, $1/r$, can be expressed in two ways. In terms of the bending moment and flexural stiffness or in terms of strains.

$$1/r = \frac{M}{EI} \tag{2.3}$$

$$1/r = \frac{\varepsilon_c + \varepsilon_s}{d} \tag{2.4}$$

The reinforcement stress varies between two extremes – at the cracks, and midway between them. Assuming tension stiffening, the mean reinforcement strain can be considered to be

$$\varepsilon_{sm} = (1 - \zeta)\varepsilon_{s1} + \zeta\varepsilon_{s2} \tag{2.5}$$

where ε_{s1} and ε_{s2} are the reinforcement strains in states 1 and 2, respectively, and ζ is a distribution coefficient varying between 0 and 1, representing the extent of cracking. For the case of bending it can be represented as

$$\zeta = 1 - \beta_1\beta_2\left(\frac{M_{cr}}{M}\right)^2 \tag{2.6}$$

where, (at least in the European tradition) β_1 and β_2 are coefficients taking into account the bond properties of reinforcement and the duration of loading (FIB, 2013). It was earlier assumed that cracking has the same influence on curvature as on reinforcement strain. Hence, the mean curvature can be expressed as

$$(1/r)_m = (1-\zeta)\cdot(1/r)_1 + \zeta\cdot(1/r)_2 \tag{2.7}$$

where $(1/r)_1$ and $(1/r)_2$ are curvatures corresponding to states 1 and 2, respectively. The interpolation between these two curvatures is shown in Figure 2.5.

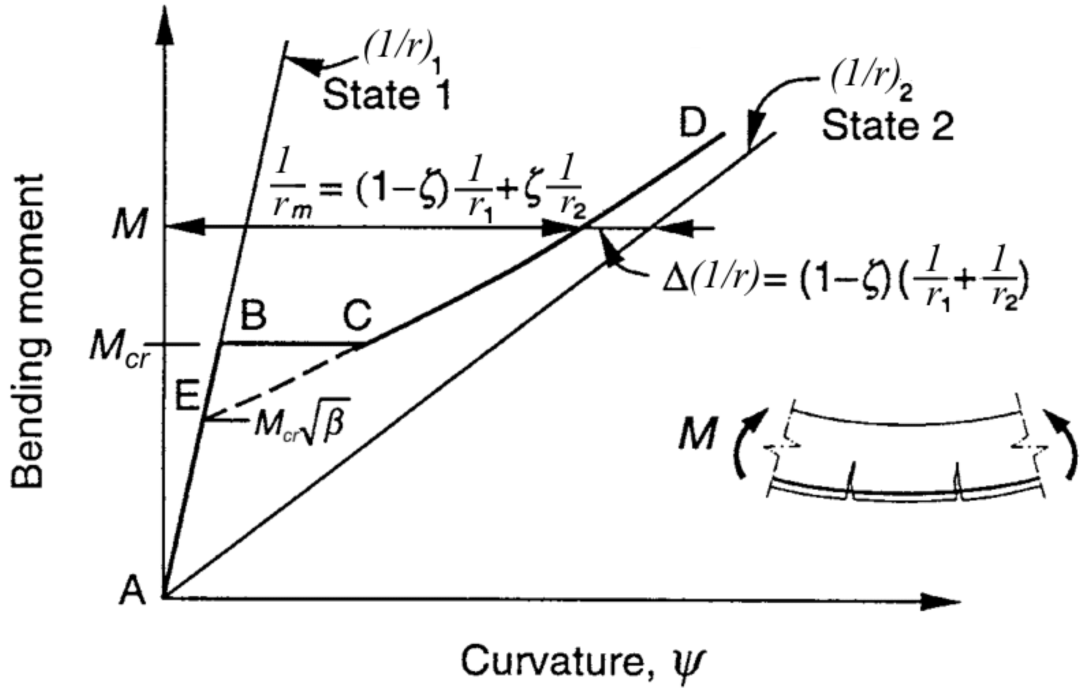

$(1/r)_1$
State 1
$(1/r)_2$
State 2
D
$\frac{1}{r_m} = (1-\zeta)\frac{1}{r_1} + \zeta\frac{1}{r_2}$
M
$\Delta(1/r) = (1-\zeta)(\frac{1}{r_1} + \frac{1}{r_2})$
B
C
M_{cr}
E
$M_{cr}\sqrt{\beta}$
M
A
Bending moment
Curvature, ψ

FIGURE 2.5: Moment–curvature relation in a cracked reinforced concrete member in flexure

The cracked member has a mean flexural stiffness

$$(EI)_m = \frac{M}{(1/r)_m} \tag{2.8}$$

and the curvatures $(1/r)_1$ and $(1/r)_2$ are given by

$$(1/r)_1 = \frac{M}{E_c I_1} \tag{2.9}$$

$$(1/r)_2 = \frac{M}{E_c I_2} \tag{2.10}$$

where I_1 and I_2 are the moments of inertia of transformed uncracked and fully cracked sections, respectively. The modulus of elasticity E_c is used as a reference for calculating the transformed sections (Ghali et al., 2002).

The behaviour of a reinforced concrete member in flexure, its moment–curvature relation, is given by lines ABCD in Figure 2.5. This is representative of a reinforced concrete loaded for the first time under short-term loading (Ghali et al., 2002). However, in other instances, the section EBC should be replaced by the section EC, an extension of the curve CD. This takes into consideration possible cracking caused by loads, shrinkage and temperature during construction, which happens under the reduced cracking moment $\sqrt{\beta}M_{cr}$, where $\beta = \beta_1\beta_2$.

In Figure 2.6 an example is given, showing the variation of curvature in a simply supported reinforced concrete beam under a distributed load. At the time of loading, t_0, the bending moment exceeds M_{cr} over the section 2a–3a. Sections 1–2a and 3a–4 remain uncracked, in state 1 and with a smaller corresponding curvature. The curvature of any cracked cross-section between points 2a and 3a corresponds to state 2 and is significantly larger than for state 1. However, the mean curvature, taking into account the tension stiffening effect is shown by the dashed line between curvatures for states 1 and 2. It can be seen that it is the closest to state 2 at midspan where the extent of cracking is the greatest. At time t, the overall curvatures for both states increase because of creep and shrinkage effects. However, the extent of the cracked zone also increases to the zone between points 2b–3b, even though the beam is under a constant load. This is also because of creep and shrinkage effects and is represented by the 'reduced' cracking moment value of $\sqrt{\beta}M_{cr}$ for time t in Figure 2.5.

Generally, from this point, two distinct approaches can be taken. One is typical for the European tradition and relies on the numerical integration of curvatures at various sections. In its simplest form, the curvature is calculated twice – for states 1 and 2, and the values are interpolated using ζ (FIB, 2013; EN 1992-1-1, 2004). The other approach is more characteristic for the North American tradition, and involves estimating an 'effective

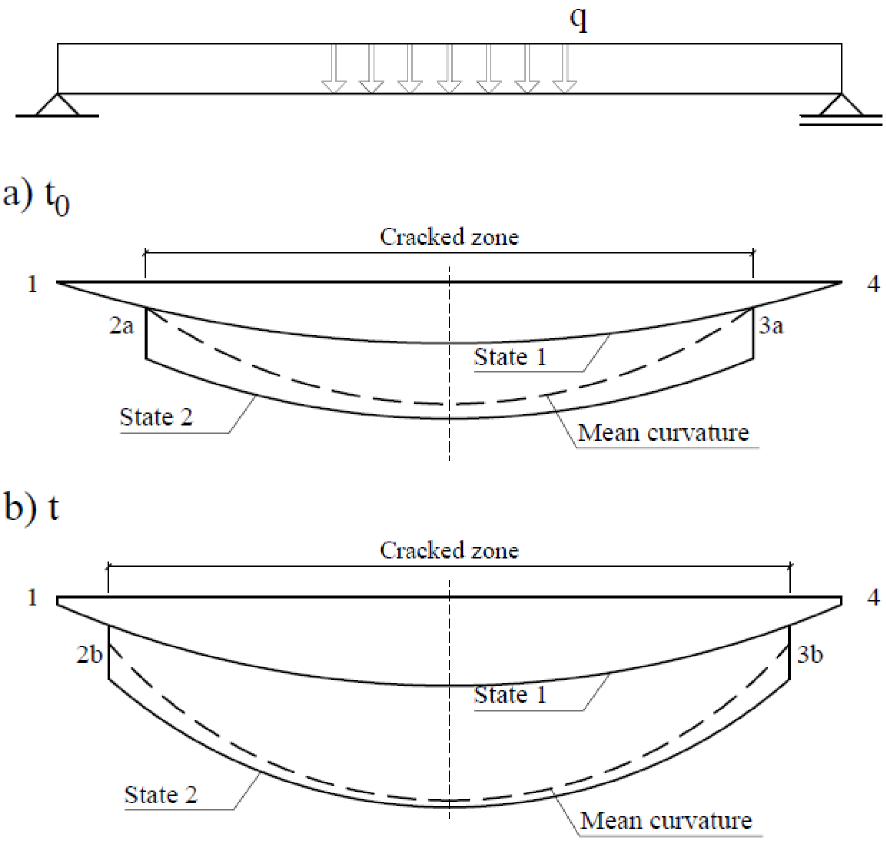


FIGURE 2.6: Curvature of a reinforced concrete beam a) at time t_0 and b) at time t. Adapted from (Ghali et al., 2002)

moment of inertia', I_e, to be used in deflection calculation. The most famous form of this approach is the empirical equation of Branson (ACI 318-11, 2011):

$$I_e = \left(\frac{M_{cr}}{M}\right)^m I_c + \left[1 - \left(\frac{M_{cr}}{M}\right)^m\right] I_2 \tag{2.11}$$

where $M \geq M_{cr}$ and $m = 3$ (or sometimes $m = 4$ when calculating the curvature of an individual section).

Both of the above-mentioned approaches will be explained in more detail in section 2.5.4.

2.4.3 Factors Influencing Deflections

In this section the most important factors that have an influence on the deflections of reinforced concrete members will be presented. In the general case, 11 factors can be distinguished (Pecić, 2012):

1. geometrical properties of the member (span, shape and size of cross-section);
2. moduli of elasticity of concrete and reinforcement;
3. concrete tensile strength
4. area and distribution of reinforcement in cross-sections;
5. load intensity and history;
6. stiffness reduction caused by cracking and tension stiffening;
7. member structural system (shape of bending moment diagram);
8. moment redistribution in statically indeterminate systems caused by stiffness reduction;
9. shrinkage;
10. creep;
11. moment redistribution in statically indeterminate systems caused by shrinkage and creep.

Geometrical properties of the member

The geometrical properties of a reinforced concrete member are its span(s), shape and size of its cross-sections. These properties determine the member's stiffness and, through it, influence deflections. Within the experimental programme of this thesis, only simply supported beams with a rectangular cross-section are analysed.

Moduli of elasticity of concrete and reinforcement

In the case of reinforcement, the modulus of elasticity is considered constant under usual conditions for structural members, i.e. normal temperature.

In the case of concrete, describing the modulus of elasticity is more complicated. First of all, since concrete is a composite, its modulus of elasticity depends on the stiffness of its components – paste and aggregate, and their respective amounts. Generally, both paste and aggregates behave linearly under stress, however, because of the presence of the aggregate–paste interface transition zone (ITZ), concrete does not (Neville, 1995; Müller et al., 2013).

Another important influence on the modulus of elasticity is the speed of load application. When the load is applied rapidly (<0.01 s), the recorded strains decrease significantly. If the load is applied during 5 s to 2 min, the strains steadily increase. However, for a load application duration longer than 2 min there is no further significant increase (Neville, 1995). The moisture conditions during testing also play an important role.The time development of the modulus of elasticity is much less pronounced than the development of compressive strength.

There is also a distinction between different moduli for the same concrete, Figure 2.7. The most common definition is that of the tangent modulus ($E_{ci} = E_{cm}$ in Figure 2.7) at the origin of the stress–strain diagram. It is approximately equal to the slope of the secant of the unloading branch for rapid unloading. For calculating deflections, however, some codes recommend a reduced value (by approximately 15%) – E_c in Figure 2.7, (Pecić, 2012).

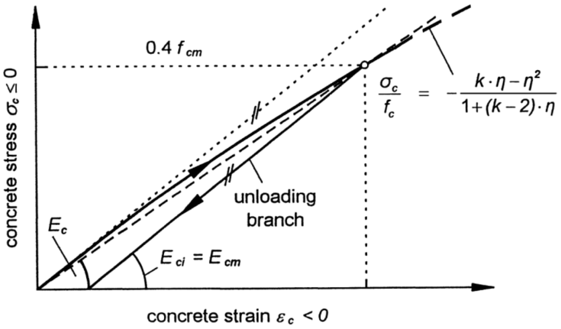

0.4 f_{cm}
concrete stress $\sigma_c \leq 0$
$\frac{\sigma_c}{f_c} = -\frac{k \cdot \eta - \eta^2}{1+(k-2)\cdot\eta}$
unloading branch
E_c
$E_{ci} = E_{cm}$
concrete strain $\varepsilon_c < 0$

FIGURE 2.7: Definition of different moduli of elasticity (FIB, 2013)

Concrete tensile strength

The tensile strength of concrete is important for deflections because it defines the cracking moment M_{cr} and subsequently the cracked region of the member where the interpolation between states 1 and 2 is necessary.

Cracking is usually considered to occur when the *flexural strength of concrete*, $f_{ctm,fl}$, is exceeded. This flexural strength is actually a numerically transformed tensile strength, f_{ctm}, but greater than f_{ctm}. The fact that $f_{ctm,fl} > f_{ctm}$ is explained by a 'size effect' by which it is increasing in relation to the cross-section height. In reality, it is the shape of tensile stresses before cracking that is behind this effect. Below the neutral axis and prior to cracking, the tensile stress diagram is not linear but slightly parabolic and convex. Thus, the cracking moment is not equal to $W f_{ctm}$, but to a slightly larger value and this is taken into account by transforming the tensile strength into the flexural strength (Pecić, 2012).

However, in time, in reinforced concrete members shrinkage causes tensile stresses on the more heavily reinforced side (usually the one that will be in tension under load) and reduces or 'eats away' part of the flexural strength. Hence, in calculations it is useful to use a *reduced flexural strength*, $f_{ctm,fl,red}$, which can for simplicity be taken as f_{ctm} (Pecić, 2012).

The actual tensile strength defined in codes is the *axial tensile strength*, considered to be a true material property. Since testing it properly requires sophisticated testing machines, it is usually approximated by the *splitting tensile strength*, $f_{ctm,sp}$. The splitting tensile strength can be taken as equal to the axial tensile strength since it isn't subject to a size effect, moisture conditions don't affect it significantly and cracking is initiated in the middle of the specimen, not on the edges (Müller et al., 2013).

Tensile strength does not increase in proportion to the compressive strength since paste is more brittle for higher strengths and it depends crucially on the bond between the paste and aggregates. An important characteristic of concrete tensile strength is its large scatter. The lower and upper bound values (5% and 95% percentiles) are approximately 30% from the mean value and care should be taken when choosing between the characteristic or mean values (Müller et al., 2013).

Area and distribution of reinforcement in cross-sections

The area and distribution of reinforcement in a concrete member influence the transformed section's stiffness and restrain shrinkage and creep of concrete.

Load intensity and history

Load influences deflections through the bending moments it induces in the member which in turn determine the member's stresses, strains and curvature. Although the load history is an important factor when calculating deflections of a cracked member, it is not studied in this thesis, i.e. a single constant load is adopted during over the entire duration of the experiment.

Stiffness reduction caused by cracking and tension stiffening

The influence of stiffness reduction caused by cracking and the effects of tension stiffening have already been discussed in section 2.4.2 in terms of interpolations between states 1 (uncracked section) and 2 (fully cracked cross-section).

Member structural system

The main influence of the structural system—simply supported beam, cantilever, etc.—on deflections is through the shape of the bending moment diagram. In the experimental programme of this thesis only simply supported beams were studied.

Moment redistribution in statically indeterminate systems caused by stiffness reduction

Reinforced concrete structures are usually loaded sequentially and thus, cracking occurs stepwise in the most stressed regions. In statically indeterminate systems, this leads to a certain redistribution of internal forces. The redistributed moments change the curvature of the member compared with the elastic solution and produce different deflections. Since only simply supported beams are studied in this thesis, this factor wasn't considered for further analysis.

Shrinkage and creep

Shrinkage and creep are the most important factors influencing the time evolution of deflections in reinforced concrete members. Since shrinkage is restrained by reinforcement, it produces curvature in the case of non-symetrically reinforced cross-sections (which is usually the case). The effect of creep is to further increase curvature through the increase of compressive strains in concrete. This increase can be significant in reinforced concrete structures since a large part of their load is dead load, because of their large self-weight.

Shrinkage and creep were discussed in sections 2.2 and 2.3, respectively, and their effect on curvature in section 2.4.2.

Moment redistribution in statically indeterminate systems caused by shrinkage and creep

In time, shrinkage and creep increase the curvature of reinforced concrete members in flexure. In statically indeterminate systems this increase is usually incompatible with the 'statically redundant' supports because of the restraining effect of reinforcement. The induced 'secondary' reactions cause bending moments which change the final bending moment diagram and curvature. As stated earlier, since only simply supported beams are studied in this thesis, this factor wasn't considered for further analysis.

2.5 Models for Calculating Shrinkage, Creep and Deflections of Reinforced Concrete Beams

2.5.1 Introduction

The knowledge and understanding of all of the phenomena described in the previous sections is only valuable if it is useful to engineers in practice. It was already mentioned that the current understanding exceeds the calculation tools and time necessary to perform them, currently at the disposal of practicing engineers. If however, these complex models, e.g. finite element analyses, progress to a point where they truly become 'practical, every-day tools for design office engineers' (FIB Task Group 4.4, 2008), these engineers will be required to understand the background and operation of such models.

One way to reach this kind of understanding is through literature reviews and state-of-the-art reports. One such review is given in this section. The aim of the section is to present models available for calculating or 'predicting' shrinkage and creep of concrete and deflections of reinforced concrete beams.

First, in the following section, two types of experimental research are presented. The first type are long-term tests on plain concrete specimens (loaded and not loaded). Through these tests it is possible to validate and calibrate shrinkage and creep behaviour of different concretes. The largest database compiled for this purpose, at the Northwestern University's Infrastructure Technology Institute, the 'NU-ITI database on concrete creep and shrinkage' is presented (Bažant and Li, 2013). A discussion of relevant features of the results contained in the database is offered and some implications are discussed.

The second type of experimental research discussed in section 2.5.2 are sustained loading tests on reinforced concrete beams. The database of these tests, compiled by Espion (1988), is presented. In it, the author presents a brief but useful discussion of each experimental investigation that entered the database. However, in this section, beside a global overview, only selected individual experiments will be presented in more detail.

In section 2.5.3 individual models for predicting shrinkage and creep are presented and explained. The models are the following:

- the B4 model (Bažant et al., 2015),
- the MC10 model (FIB, 2013),
- the EC2 model (EN 1992-1-1, 2004),
- the ACI 209R-92 model (ACI 209R-92, 1992), and
- the GL2000 model (Gardner and Lockman, 2001).

Finally, section 2.5.4 provides an overview of models for predicting the deflections of reinforced concrete members. The models are divided into two distinct groups, depending on the approach taken in interpolating the curvatures of members between states 1 and 2 (see section 2.4.2):

- the European tradition, best exemplified by (FIB, 2013) and (EN 1992-1-1, 2004), and

- the North American tradition, best exemplified by (ACI 318-11, 2011) and (ACI 435R-95, 2003).

2.5.2 Experimental Research

Experimental research on the material level

The first part of this section presents an overview of the 'NU-ITI database on concrete creep and shrinkage', available for free download at http://iti.northwestern.edu (Bažant and Li, 2013). The database itself, its historical background, use and statistical justification are presented in more detail in (Bažant and Li, 2008; Hubler et al., 2015a; Wendner et al., 2015b) and used as sources for this section.

Databases of results of concrete shrinkage and creep now have a 50 year-old tradition. The first one was prepared in the 1960s for the first CEB-FIP Model Code and its shrinkage and creep model (CEB-FIP, 1978). Afterward, another one was compiled for the 1971 ACI 209 model. These efforts were continued in the 1970s at the Northwestern University within the work on the BP model (Bažant and Panula, 1978). The work was expanded through a subcommittee of the RILEM Committee TC107, chaired by professor Harald S. Müller. This led to the creation of the RILEM-ACI 209 Database in 1992, subsequently expanded in 2008 and 2010 (Hubler et al., 2015a).

The most recent version of the database, the 'NU-ITI database on concrete creep and shrinkage' was assembled in 2010–2013 at the Northwestern University's Infrastructure Technology Institute, mainly by the support from the U.S. Department of Transportation. The information in this database was mostly extracted from numerous journal articles, conference proceedings and reports. In its newest form, the database also attempts to fill the gap of missing information on the behavior of high performance concretes with very low *w/c* ratios which rely heavily on cement replacement and admixtures (all concretes that are significantly affected by chemical reactions other than cement hydration, i.e. high strength, SCC, and green concretes). Information is now also provided about the admixtures content and the mineralogical composition of aggregates. (Hubler et al., 2015a).

The NU-ITI database contains 1751 shrinkage curve (1217 'total', 417 autogenous and 117 drying shrinkage curves) and 1370 creep curves (734 'total' and 636 basic creep curves). Of these, approximately 800 creep and 1050 shrinkage curves are for concretes containing admixtures. A large majority of the concretes (68% of the creep curves and 80% of the shrinkage curves) were made with regular cement (type R or equivalent) and the remainder is equally distributed between concretes with rapid or slow hardening cements. Also importantly, all the creep data in the database was obtained for sustained uniaxial compressive stress lower than 40% of the compressive strength.

Since both shrinkage and creep are phenomena that evolve over several decades, it is precisely multi-decade tests and loading which are of interest for calibrating prediction models. Unfortunately, most of the data in the database is crowded into short load durations, into short drying times, and also into short ages at loading. Additionally, most of the tested specimens are crowded into small thicknesses. Unedited, the database is 'unsuitable for statistical regression because the conditional coefficient of variation (CoV) of compliance data shows them to be strongly heteroscedastic', i.e. containing sub-populations that have different variabilities from others (Bažant and Li, 2008).

Of all the data, 96% is from tests not exceeding 6 years and only two sets extend beyond 12 years. To somehow alleviate this deficiency, data was included on the multi-decade deflections (most of them excessive) of 69 large-span (>80 m) prestressed bridges. Such bridges are useful, if they have deflected excessively, because they are highly sensitive to creep, their multi-decade deflections are mainly caused by creep under self-weight and after 3 years since the span closing the deflection evolves approximately proportionally to the compliance function (Hubler et al., 2015a). Their deflections are useful for optimizing the parameters that control the terminal slope of the compliance function in the logarithmic time scale (Bažant and Li, 2008).

Further on the topic of data variability in the database, it is dominated by differences in concrete composition, aggregate type, and admixture effects, and is many times higher than the scatter in individual laboratory tests of one and the same concrete (Hubler et al., 2015a). Hence, in addition to global statistics of the database, the individual tests must be used when trying to evaluate the shape of predicted individual curves.

Discussing the database, Hubler et al. (2015a) offer several important guidelines for using and interpreting it, as well as for carrying out future experiments. The authors cite which individual studies from the database should be used to assess the time shape of drying shrinkage and creep curves (these include the longest tests from the database, 5–18 years long) and check shrinkage and creep influencing factors (age at exposure/loading, relative humidity, specimen size and ambient temperature). Notably, when checking the shape of the shrinkage curves in a logarithmic plot, an asymptotic value must be observed as well as an initial evolution following a straight line of slope 1/2, dictated by diffusion theory (Hubler et al., 2015a; Wittmann et al., 1987). This follows from the smoothing formula for shrinkage, given by Wittmann et al. (1987) as:

$$\varepsilon_{sh} = \varepsilon_{\infty} \cdot \left[1 + \left(\frac{\tau_{sh}}{t}\right)^{r}\right]^{-\frac{1}{2}r} \tag{2.12}$$

where ε_{sh} is the shrinkage strain, ε_{∞} is the final shrinkage strain, τ_{sh} is the shrinkage half-time, t is the duration of drying and r is a constant, usually taken as 0.4 or 1.0. From Equation 2.12 it can be seen that for short drying times t, shrinkage strain is proportional to $\sqrt{t}$:

$$\varepsilon_{sh} \propto \sqrt{t} \tag{2.13}$$

When the logarithm is taken of both sides, the equation becomes

$$log(\varepsilon_{sh}) \propto log(t)^{1/2} \tag{2.14}$$

$$log(\varepsilon_{sh}) \propto (1/2) \cdot log(t) \tag{2.15}$$

The distribution of input parameters for shrinkage and creep in the NU-ITI database covers a wide range of *w/c* ratios between 0.3 and 0.7; however, this does not correspond to a similar distribution of compressive strength. The 28-day compressive strength are concentrated around two ranges: at values around 45–50 MPa typical for normal concretes, and at high values near 100 MPa typical of concretes with modern cements. For creep, the mean test duration is only 240 days and for shrinkage 180 days. Interestingly, data from different countries was shown to correlate differently to input parameters (Hubler et al., 2015a).

Also very useful, Hubler et al. (2015a) provide examples of testing and reporting deficiencies, as shown in Figure 2.8: (a) change of relative humidity, (b) change in temperature, (c) insufficient environmental controls, (d) omitted initial response, (e) measurement begun before initial setting, (f) possible digitization error, (g) initial drying shrinkage measurement not following diffusion theory (delayed measurement start), (h) initial creep strain does not follow asymptotic creep trend (delayed measurement start) and (i) retrofitting of the structure.

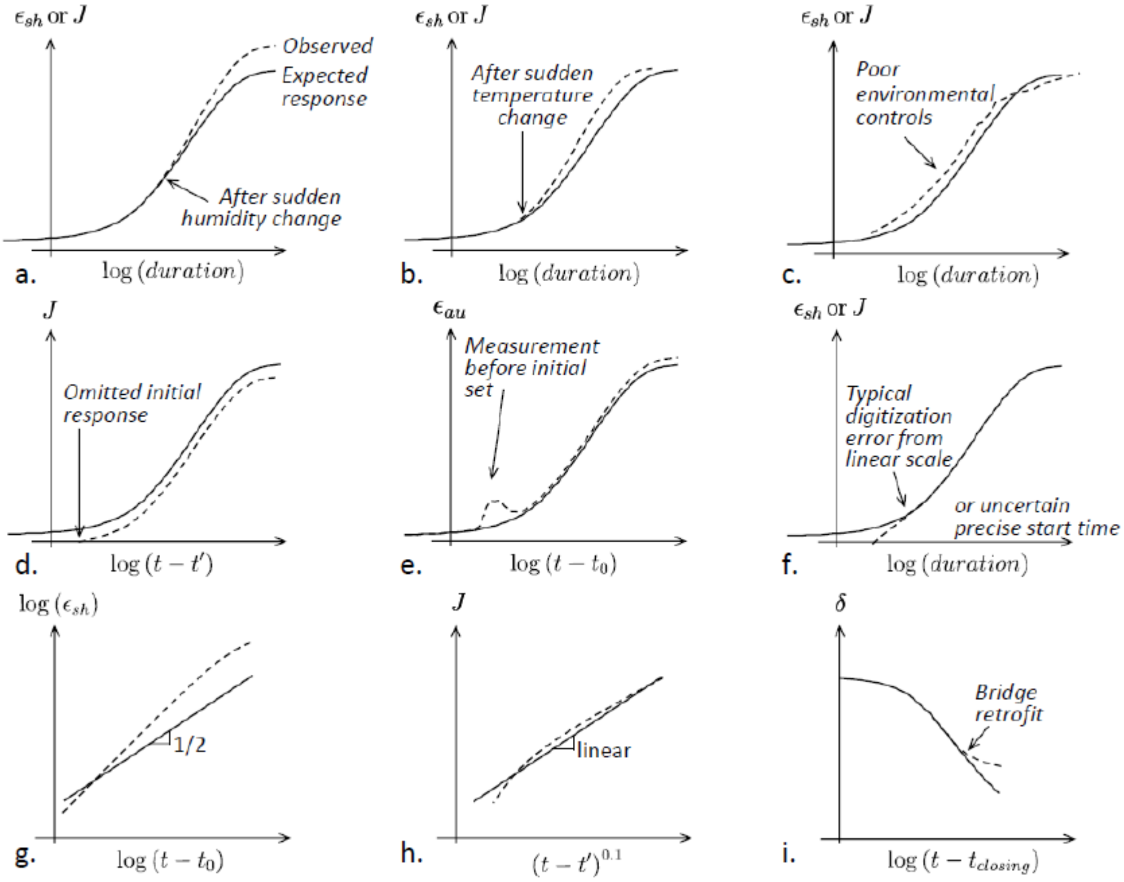


FIGURE 2.8: Examples of deviations in data curves caused by testing procedures or reporting (Hubler et al., 2015a)

As a conclusion of the discussion on the database, important guidelines for carrying out and reporting future tests are provided by Hubler et al. (2015a). Some of the most important ones are given in the following:

- the specimen dimensions, a detailed description of the test setup, and testing procedure should be provided; the sensor type, location, and gauge length should always be reported;
- the temperature and relative humidity of environment should be monitored automatically, along with the deformation data, for the entire test duration;
- the concrete composition should be specified precisely; beside the class of cement used, the mix proportions, admixtures, and the type of aggregate should also be mentioned; the particle size distribution and the mineralogic composition are useful; companion tests of strength and modulus of elasticity should be reported;
- since the shrinkage strain distribution near the specimen ends is highly nonuniform, it is important to use long specimens and the distance of the gauge contact points from the specimen ends should not be less than two diameters;
- for creep tests, the rate or duration of load application at the beginning of creep tests is essential information and should always be reported; all the measurements should start before the load is applied and the short-term deformation during the load application must be included;
- if the stress–strength ratios are reported, the reference strength value must be specified, too; if the strains are normalized by strength, the strength at the time of load application should be used and reported;
- the measurements of creep should not be reported in terms of the creep coefficient, but directly as the compliance, since this avoids uncertainty regarding the modulus of elasticity that was used to convert the measured strains into the creep coefficient;
- the creep compliance curves should always be plotted against the logarithm of load duration (a linear scale can show clearly only the part of response corresponding to only one decade in the logarithm of duration, while the values of shorter times cannot be distinguished and the values for longer times lie outside the diagram);

- the reported data should always include the total deformation, including the initial value upon load application;
- if anything other than raw data is presented, the methods of data preparation should always be explained; and
- multiple specimens for shrinkage and creep tests should always be used; from these, both the mean curve and the envelope of measurements or confidence limits should be plotted, and outlier curves identified; if some individual tests show conflicting trends, the individual test curves rather than just their average should be published.

Experimental research on the structural level

The second type of database and experimental research discussed in this section are sustained loading tests on simply supported reinforced concrete beams.

The most comprehensive database of such tests is the one compiled by Espion (1988) for the purpose of the 1990 paper by Espion and Halleux (1990) discussing the variability of predictions of deflections made with the ACI and CEB-FIP models.

In the database, the author conducted a survey of 397 results from 45 experimental programmes. An important distinction was made straight away between test carried out in North America (123 results from 18 research programmes) as opposed to those carried out in the rest of the world. This distinction was made based on the fact that North American tests were, when the environmental conditions were in fact controlled, carried out under RH $< 50\%$ whereas in the rest of the world more damp conditions were used (RH $> 50\%$).

From the initial set of results, 180 were eliminated based on various reasons:

- lack of essential data,
- not being truly sustained load tests (sequential loading, unloading, etc.),
- beams remaining uncracked during the experiment,
- continuous beams, and
- other.

The final database contained 217 results from 29 experimental programmes. Within the database 83.4% of the results are on beams with rectangular cross-sections (117 beams and 64 slabs), while the rest are T-sections, inverted T-sections or hollow sections. The relative humidity of the environment was 'dry' in 34.5% of the cases, uncontrolled in 22.1% and 'damp' in the rest.

A very useful tabular presentation of the data of all the results entering the database is given by Espion (1988). Briefly, the range of the most important parameters is shown in Table 2.1.

TABLE 2.1: Range of the most important parameters, (Espion, 1988)

Span:	1000–7925 mm
Depth:	75–350 mm
Span/depth:	7.5–69
f_{cm}:	9.9–45.7 MPa
ρ:	0.3–3.9 %
ρ':	0–1.67%
t_0:	7–232 days
$t-t_0$:	60–3101 days

The database actually contains results dating back to the probably first observation of concrete creep in 1907 (Hatt, 1907). However, these early experimental programmes were more qualitative than anything else and the first 'usable' results are the ones from 1927 (Faber, 1928) while the first ones to carry out tests under controlled environmental conditions were Glanville and Thomas (1939).

When analysing the results in the final database and when designing new experiments, several important factors should be taken into account. All of them account for the difficulties in executing proper and 'realistic' sustained loading tests on reinforced concrete beams (Pecić, 2012).

One of the factors is the size effect that is often introduced into experiments through the use of smaller cross-sections than are common in engineering practice. They are usually the consequence of equipment and laboratory restraints; however, they lead to an increased effect of shrinkage, any deviation of the reinforcement position has a large influence and the ratio of uncracked-to-cracked sections of the member can differ compared with full-scale members (Pecić, 2012).

The use of smaller cross-sections often leads to the beams being more heavily reinforced than 'realistic' members – deflections are mostly a problem of slabs which are mainly lightly reinforced. Larger reinforcement ratios also lead to a greater restraint of shrinkage. The overly reinforced sections can lead to high stresses in concrete, even at moderate stress levels in the reinforcement (Pecić, 2012).

Another important factor is the 'speed' of measuring deflections. The loading process is usually gradual and incremental and can last for some time; measuring the 'initial' deflection can be delayed for several hours even, meaning that it will contain an unknown portion of creep. Jaccoud and Favre (1982) measured deflections 'instantly' after loading and after 5 min, observing a 10% increase in that time, whereas in some cases it took Washa and Fluck (1952) up to eight hours to perform the first measurement.

In view of the diversity of concretes existing today, types of admixtures, use of recycled and waste materials, the data provided in the database can seem scarce. For example, only compressive strength is reported for each result, taking the approach to determine all other properties based on code expressions. In effect, this implies testing a complete range of a code's predictive capabilities, not just deflections. Other information, such as mixture proportion, cement type or *w/c* ratio, are unavailable. Also, for deflections, their complete time curves aren't provided but only the final measurements. As with the 'NU-ITI database on concrete creep and shrinkage', here also there is a bias toward shorter testing times with the longest experimental programme lasting just over eight years (Espion, 1988). Furthermore, some errors in data entry have been noticed when comparing database results with original papers, e.g. compressive strengths of series C slabs in (Jaccoud and Favre, 1982); hence, care should be taken when analyzing data which is only reported in the database without having access to the original material.

Taking all of this into account, only four studies stand out as exemplars of excellent experimental design and a thoroughly methodological approach (Pecić, 2012). Comparative to their scope they are the ones that enable the most conclusions to be made and offer best practice examples for future studies. They are

1. the experiments carried out by Washa and Fluck (1952),
2. the research campaign by Corley and Sozen (1966),
3. experiments by Bakoss et al. (1983), and
4. the campaign by Jaccoud and Favre (1982).

’Effect of compressive reinforcement on the plastic flow of reinforced concrete beams’ (Washa and Fluck, 1952)

Washa and Fluck started their first experimental campaign in 1947 on reinforced concrete slabs. However, their most famous experiment is the one on simply supported reinforced concrete beams, from 1952. The experiment was designed to test the influence of compressive reinforcement on deflections, the effect of which was noticed even by Faber (1928).

In total, 34 beams were tested. They had four types of cross-sections, with widths 152–305 mm and depths 76–305 mm and spans 3.81–6.10 m (span/depth ratios 20, 30, 50 and 70). In effect, they simulated both beams and slabs. However, for those beams with the lowest depth any variation in reinforcement position could have had significant effects. All of them were loaded after 14 days and deflections were measured for 2.5 years under uncontrolled environmental conditions. The important thing is that within each cross-section type there was a pair of beams with only tensile reinforcement, and pairs of beams with compressive reinforcement equal to half and full area of tensile reinforcement. This large number of results is the greatest quality of this experiment, especially the fact that each beam type was produced in pairs, meaning that strain values were actually averages of four, and deflections were averages of two measurements.

The beams were heavily reinforced ($\rho = 1.58$–1.68%) because they were designed as balanced sections. Hence, the load level is substantial as are the effects of shrinkage and creep.

The mixture was designed for a target compressive strength of 24 MPa, but the measured values after 28 days ranged from 20.7 to 29.3 MPa. Importantly, the modulus of elasticity had unusually low values, well below code predictions – after 28 days, it was between 19.1 and 23.9 GPa (Washa and Fluck, 1952). The concrete tensile strength was not measured.

The beams were cast in wooden formworks 75 mm above their final position and cured for five days with wet canvas or burlap. After 14 days, they were raised on supports with hydraulic jacks. The supports were made of steel pipe sections, resting on concrete blocks. The beams were loaded with a distributed load consisting of concrete block and bricks. However, the loading procedure was time-consuming and in some instances the first readings were taken hours after loading was completed.

For measuring deflections, brass plugs were cast onto the top of each beam along the longitudinal center line, one over each support and one at mid-length, i.e. three point leveling was used and in this way the authors attempted to also measure the deflections from self-weight (which was actually the only load in series E). Plugs were also cast on the sides of the beams at the level of tensile and compressive reinforcement and strains were measured using a Berry strain gauge of undisclosed gauge length. However, in (Washa and Fluck, 1956), the same authors provide important information about strain measurements. In this experiment, which tested continuous beams—and the results of which won't be considered in this thesis—strains were measured in three ways. Using the same method of brass plugs cast into the sides of the beams at the level of tensile and compression reinforcement; measuring strains directly on exposed bars (wooden blocks were cast into the sides and later chipped out to reveal the bars); and using SR-4 electrical strain gauges. The measurements by the Barry strain gauge (with 250 and 500 mm gauge lengths) showed a close match between the ones on the concrete surface and directly on the reinforcement. However, there were erratic differences between them and the SR-4 strain gauges, possibly because the SR-4 strain gauges measured strains on a smaller gauge length with poor bond between the bars and concrete (caused by the waterproofing of the strain gauges).

In (Washa and Fluck, 1952), the authors also tested shrinkage and creep on prisms. The specimens for testing creep were loaded by a stress equal to the compressive stress in the top fibre of the beams. The creep coefficient measured on the prisms was 4.6 after 2.5 years, and the shrinkage strain was 0.75‰.

The results of the experiment highlighted the important effect of compressive reinforcement on the long-term deflection behaviour of reinforced concrete members. The authors presented immediate deflections of the beams (A) and the increase in deflections after 2.5

years (B). The ratio of these two values (B/A) ranged from 0.76 to 2.27. More importantly, among each group of beams with the same geometry, the beams with full compression reinforcement averaged only 46% of the increase in deflections compared with the corresponding beams with no compression reinforcement; in the case of beams with half compression reinforcement, this was 62%. A similar trend was found when analysing strain at the level of compression reinforcement, the increase in strain (caused by shrinkage and creep) was 37% and 58% for beams with full and half compression reinforcement, respectively, compared with beams with only tensile reinforcement.

The results of this study were, and still are, among the most valuable to researchers studying the long-term behaviour of reinforced concrete members. These results were among the few selected by ACI Committee 435 on which the original 1972 ACI method for deflection control was calibrated (Espion and Halleux, 1990).

’Time-dependent deflections of reinforced concrete beams’ (Corley and Sozen, 1966)

This is another well-known and often referenced experimental programme comprising four simply supported reinforced concrete beams. The beams had 76.2/109.5 and 76.2/152.4 mm cross-sections and a 1.83 m span. The variable was the reinforcement ratio – 1.37%, 2.02% and 3.03%, moderate to very high. One of the beams was loaded and immediately unloaded (not under sustained load). The concrete had a compressive strength of 24.13 MPa while other mechanical properties were not measured.

The beams were cast in wooden formworks and cured with wet burlap for 24 hours. After curing and during the test the beams and all test specimens were under controlled environmental conditions (RH = 50%).

Deflection were measured using dial indicators on the top side of the beam and strains were measured on Whittemore gauge points (with a 250 mm gauge length Whittemore strain gauge) installed in holes on the beams’ sides, left after chipping out 10 mm long Plexiglas rods cast into the sides. Each beam had three sets of five gauge lines on each side, enabling the measurement of strain distribution across the cross-section height.

The load was applied at quarter points of the beams using steel springs and maintained for 700 days (Corley and Sozen, 1966). The springs were calibrated using an extensometer, and loading each beam lasted approximately 15 min. Each time a reading was performed, the springs were adjusted to return the load level to its initial value, however only very small drops were observed.

The creep coefficient measured on test cylinders was approximately 3 after 700 days, while the shrinkage strain was 0.3‰. The increase in deflections cannot be compared directly between beams since they had different dimensions, reinforcement ratios and load levels, but for all three of them, the ratio of long-term–to–initial deflections was between 2.19 and 2.54.

Also importantly, from the strain measurements, the authors found agreement with a linear strain distribution along the height of the cross-section in the cracked section of the beams (despite some local deviations). Additionally, they observed the formation of new cracks in a period of up to 60 days after loading and in the later stages of the tests they noted that 'the neutral axis moved to a position below the top of the cracks' and that 'the upper portions of the cracks were observed to close as this happened' (Corley and Sozen, 1966).

'Long-term tests on reinforced concrete beams' (Bakoss et al., 1983)

This campaign consisted of long-term tests on two simply supported and two continuous reinforced concrete beams. The beams had a 100/150 mm cross-section and a 3.75 m span (span/depth ratio of 25). The simply supported beams had a 1.69% reinforcement ratio. After being moist-cured for 14 days, they were transported to a laboratory with RH varying between 35% and 75%. After 28 days, the beams were loaded in third points and the load was kept for 500 days on one beam (1B2) and immediately removed from the other (1B1).

The 28-day concrete compressive strength was 39 MPa and the modulus of elasticity was 31.2 GPa. The measured creep coefficient and shrinkage strain are only provided graphically but, after 528 days, they are approximately 2.4 and 0.65‰ respectively. The initial deflection of beam 1B2 was 8.94 mm and after 500 days, 25.02 mm (a ratio of 2.8).

'Fleche des structures en béton armé: Verification experimentale d'une methode de calcul' (Jaccoud and Favre, 1982)

This is probably the most famous and well-designed experimental programme. It was carried out at EPFL in Switzerland by the very researchers responsible for the CEB bilinear model for calculating deflections of reinforced concrete members.

The experimental campaign consisted of four series of tests—A, B, C and D—on reinforced concrete one-way and two-way slabs. One of the greatest advantages of these tests is the fact that they are very well designed in terms of reinforcement ratios and span/depth ratios, the scale factor does not exceed two (Pecić, 2012). Because of this, and the richness in number of results, this experimental programme enabled the researchers and anyone interpreting the results after them to make a large number of reliable conclusions.

Series B and D were two-way slabs and since these types of members are not of direct interest for this thesis, their setup and results will not be discussed here. Series A were slabs tested after 15 days with a load level equal to 40% of their ultimate load for one year. The variable was the curing regime for each of the five slabs in this series.

By far the most interesting and relevant series was series C, comprising 11 one-way slabs. All of the slabs were identical in geometry and reinforcement – 750/160 mm cross-section, 3.1 m span, reinforced with 5⌀12 bars. The series was separated into two groups – C1–C3 and C11–C22, with C0 being a trial slab.

The slabs C1–C3 were loaded with 60% of their ultimate load (i.e. full service load) but at different speeds: 12 seconds, 10 min and 10 hours, after which rapid cycles of loading and unloading followed. As with series A, B and D, these slabs are not of particular interest for this thesis.

The seven slabs in the group C11–C22 were loaded at five different load levels: 0.2, 0.3, 0.4, 0.5 and 0.6 of their ultimate load. Slab C11, loaded at 20% of its ultimate load, remained uncracked; slabs C12 and C22, loaded at 30% of their ultimate load, were practically at the cracking load level; and the remainder of the slabs were fully cracked.

The slabs were loaded in four point bending, at points 1 m from the supports, after 28 days, for a period of 510 days (some of them only 1 year). The environmental conditions were controlled with an average RH = 60%.

Deflections were measured with dial indicators 'instantly' after loading, after 5 min, 1 h, every day up to 28 days, 6 months, 1 year and 510 days. The deflections measured after 5 min were adopted as 'initial' but importantly, there was up to a 15% increase between the 'instantaneous' deflections and these nominally 'initial' ones after 5 min.

Strains were measured with a mechanical Huggenberger strain gauge with a 100 mm gauge length and using pins glued directly to the concrete surface. Immediately after loading, the crack pattern wasn't fully developed; it was completed only after two to three weeks in the flexural span and only after three to four months on the whole slab. The crack spacing was noticed to be roughly equal to the stirrup spacing.

Alongside the slabs, specimens were tested for mechanical properties and shrinkage and creep was measured on accompanying prisms.

The 15-day compressive strength of series A was approximately 25.2 MPa for slabs A1–3 and 40.35 MPa for slabs A4–5. The modulus of elasticity was 23.35 and 33.25 GPa for slabs A1–3 and A4–5, respectively. For series C, the 28-day compressive strength was between 28.8 and 32 MPa, and the modulus of elasticity between 28.3 and 30.9 GPa. Interestingly, for tensile strength, the authors actually measured the flexural tensile strength (modulus of rupture) but reported it as pure tensile strength taken as 50% of the measured flexural strength value. The creep coefficient measured on prisms was 2.52 for slabs A1–3, 2.24 for slabs A4–5 and 2.31 for series C. The measured shrinkage strain was 0.52‰ for slabs A1–3, 0.39‰ for slabs A4–5 and 0.35‰ for series C.

After a one year period, the slabs from series A had a final-to-initial deflection ratio between 2.15 and 2.84 for slabs A1–3 and 3.1 and 3.6 for slabs A4–5. For slabs in series C, after 538 days, this ratio decreased with increasing load levels, from 4.38 for slab C12 (loaded to 0.2 of ultimate load), to 2.08 for slab C15 (loaded to 0.6 of ultimate load). With the results from series C, the authors captured a wide range of load-deflection behaviour of reinforced concrete members, as shown on Figure 2.5.

The period after 1988

After the database by Espion (1988), there have not been many experimental programmes studying long-term behaviour of reinforced concrete members similar to the ones compiled in the database (simply supported beams, normal-strength concrete, rectangular cross-sections, etc.) There have been some, but most others have dealt with very specific topics.

Some examples are studies on the influence of repeated or variable loading (Arangjelovski et al., 2012; Criel et al., 2014), high load levels (0.7, 0.8, 0.9 of ultimate load) (Reybrouck et al., 2015) and different deterioration mechanisms such as freeze-thaw action or chloride-induced corrosion (Gao et al., 2016; Duan et al., 2016).

The reason for this is perhaps a lowered interest for the 'ordinary' problem of long-term deflections of reinforced concrete members which was considered 'solved' after the introduction of CEB and ACI deflection prediction models in the 1970s. The attention then turned to problems of beams with special load conditions, concrete composition, etc. The attention of the scientific community turned to other things, and perhaps as a consequence, one of the rare 'ordinary' experimental programmes on long-term behaviour of reinforced concrete members under sustained loads was published only as a report and not as a peer-reviewed article.

'An experimental study on flexural cracking in reinforced concrete members under sustained loads' (Gilbert and Nejadi, 2004)

This experimental programme is one of many carried out at the University of South Wales, Australia. One of them entered into Espion's database – Bakoss et al. (1983).

Within the scope of this new programme, six beams and six slabs were cast and moist cured for 14 days after which they were exposed to sustained loads. All specimens were simply supported with a 3.5 m span and loaded for 400 days. The six beams were loaded in four point bending and the six slabs were loaded uniformly by a distributed load. Deflections at mid-span, crack patterns and widths, steel and concrete strains were measured. Concrete compressive and tensile strength as well as the modulus of elasticity were measured at different times.

The parameters varied in the tests were the tensile reinforcement, concrete cover and load level. For both the beams and the slabs, two identical specimens were made for each combination of reinforcement and cover. One was loaded to about 50% of its ultimate load (type 'a') and the other to around 30% of its ultimate load (type 'b').

The beams had either a 250/340 mm or a 250/325 mm cross-section with an effective depth of 300 mm in all cases—the concrete cover was 40 or 25 mm (the L/d ratio was

11.67). The reinforcement ratio were 0.54% and 0.80% with no compression reinforcement. The beams were loaded to load levels 25–45% of their ultimate load (reinforcement stress 128–226 MPa).

The slabs had a 400/155 mm cross-section (130 mm effective depth, L/d = 26.92) and reinforcement ratios of 0.44%, 0.65% and 0.87% with no compression reinforcement. The slabs were loaded to levels 32–50% of their ultimate load (reinforcement stress 159–252 MPa).

On the beams and slabs, steel strains were measured using 13 electronic strain gauges attached to one of the main reinforcement bars. For measuring concrete surface strains, a DEMEC strain gauge with a 250 mm base length was used and 11 target points were distributed in the critical moment region. A microscope with a magnification factor of 40 was used for measuring crack widths. The development, propagation, extent and width of cracking were observed and recorded throughout the test. Dial gauges were used to measure the deflection at the middle of each specimen.

Companion specimens for measuring mechanical properties and creep and shrinkage were also cast. Cylinders 150 and 100 mm in diameter and 300 and 200 mm in height were used, 100/100/500 mm prisms and 600/600/160 mm blocks (for drying shrinkage). The specimens were cured and kept under same conditions as the beams and slabs (3 days of moist curing and covering with wet hessian until the 14th day).

The concrete had a 28-day compressive strength of 24.8 MPa (with values also reported for 7, 14 and 21 days), a splitting tensile strength of 2.8 MPa and a flexural strength of 5.6 MPa; the modulus of elasticity was 24.95 GPa. The creep coefficient measured on prisms was 1.71 after 394 days and the shrinkage strain was 0.83‰.

The initial deflections were between 2 and 5.8 mm for beams and 3.7 and 11.8 mm for slabs, whereas the final deflections after 400 days were 7.4–13.3 mm for beams and 19.9–32.5 mm for slabs – the final-to-initial deflection ratio was between 2.5 and 4 for beams and 2.8 and 5.4 for slabs.

Crack widths and spacing was an important part of the study and so, a lot of results were reported about them. Since the concrete cover was also varied among identically reinforced beams, after loading, the beam with the larger cover had larger crack widths, as expected. However, long-term crack widths were similar for both covers. Crack widths ranged from 0.03 to 0.15 mm after loading and from 0.03 to 0.38 mm after 400 days. However, they were measured at the bottom concrete fibre and not at the level of reinforcement. The crack widths increased linearly with reinforcement stress. Initial crack spacing was 200-–300 mm for beams and 130-–190 mm for slabs and after 400 days 130-–200 mm for beams and 95—130 mm for slabs, i.e. new cracks appeared.

The authors also provided comprehensive annexes to the report with practically all measurements as raw data which is extremely useful for analysis, predictions and reproduction. It is precisely these reports which raise certain questions about the reliability of the results. Namely, when the initial deflections reported in Table 10 in (Gilbert and Nejadi, 2004) are compared with the raw data measurements in the annexes, it can be seen that, e.g. the results for slabs S2-a and S3-a are ’switched’ and that the initial deflection for slab S1-b is not 3.7 but 2.72 mm. Furthermore, in the case of identically reinforced slabs such as S1-a and S1-b (differing only in the load level) the slab with a higher initial deflection, S1-a, shows a drastically lower long-term increase of deflections compared with slab S1-b which is under a smaller load – the final-to-initial deflection ratios are 3.5 and 5.4, respectively. This is also seen in the case of slabs S2-a and S2-b as well as S3-a and S3-b, which raises the question of the accuracy of measuring initial deflections.

Further still, when an attempt is made to convert mechanical strain gauge readings provided in the annexes into strains, the reported results cannot be obtained in most cases. Hence, serious care should be taken whether these results are reliable for use in any type of analysis.

2.5.3 Models for Calculating Shrinkage and Creep

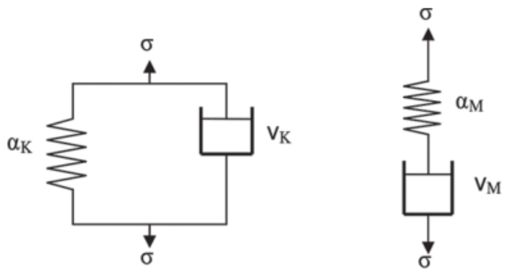
Initially, shrinkage and creep models were purely empirical, calibrated on experimental data that actually didn’t cover the entire range of practical interest for all parameters. These basic models comprised combinations of idealized springs and dashpots representing the elastic and viscous behaviour of concrete. They had a mechanistic basis for the observed instantaneous and time-dependent deformations of concrete under sustained load.

Most famous among them are the Maxwell and Kelvin models Figure 2.9, governed by simple relations describing the viscoelastic response of materials under sustained uniaxial stress given by eqs. (2.16) and (2.17), respectively:

$$\varepsilon(t) = \sigma\left[\frac{1}{E(t_0)} + \frac{A}{\nu_M L}(t-t_0)\right] \tag{2.16}$$

$$\varepsilon(t) = \frac{\sigma A \alpha_k}{L}\left[1 - e^{\frac{-(t-t_0)}{\alpha_K \nu_K}}\right] \tag{2.17}$$

where $\varepsilon(t)$ is the total strain at time t, σ is the sustained stress, $E(t_0)$ is the modulus of elasticity of the spring at time of loading t_0, α_k is a spring constant, ν_M and ν_K are dashpot viscosity-dependent constants (for the Maxwell and Kelvin models, respectively) and L and A are the characteristic length and area used to define the spring stiffness.



(a) Kelvin Model (b) Maxwell Model

FIGURE 2.9: Basic rheological models (Fathifazl and Razaqpur, 2013)

In the Maxwell Model, the creep rate is constant, which does not agree with the observed decrease in concrete creep rate with time whereas in the Kelvin Model, the elastic deformation component evolves exponentially while, in reality, it is reached practically instantly. All of these limitations have prompted researchers and engineers to develop more complex models. Some of the more important ones were the Kelvin-Voigt (KV) and Dischinger (D) models (Mola and Pellegrini, 2012).

In 1995, the B3 model was published by Bažant and Baweja (Bažant and Baweja, 1995a). It was a result of several advances that included a vast expansion of the experimental database on concrete shrinkage and creep (as discussed earlier), the compilation of a computerized data bank, the development of computerized statistical procedures and optimizations for data fitting and comparison and an improved understanding of the physical processes underlying shrinkage and creep (ageing, diffusion processes, thermally activated processes and microcracking and their mathematical modelling).

The model was an improvement of previous models developed at Northwestern University: the BP and BP-KX models. The justification and refinements of the model were also presented to the scientific community and heavily discussed: the statistics, sensitivity, updating and theoretical basis of the model (Bažant and Baweja, 1995b,c).

The B4 model

Sadly, it was the disastrous experience of the Koror-Babeldaob bridge collapse in Palau in 1996 that provided a strong impulse for the latest advance in shrinkage and creep prediction models. The collapse of this bridge, caused by an unsuccessful retrofit, shed light on another problem – excessive creep deflections, which reached 1.61 m (compared with the design camber), and a prestress loss of almost 50%. This disastrous experience led to the creation of the RILEM Committee TC-MDC (Multi-Decade Creep) (Bažant et al., 2015).

The final result of the commission's work was the B4 model, a major improvement upon the previous B3 model and the fourth in a series of progressively improved models developed at Northwestern University since 1978. Since the general mathematical form of the B3 model was theoretically supported by the solidification theory, theory of microprestress relaxation in the nanostructure, activation energy concepts, moisture diffusion theory and damage models for microcracking, the same mathematical form was retained in the B4 model, except for autogenous shrinkage. However, formulas giving the dependence of the creep and shrinkage parameters on the concrete strength, mix composition, cement and aggregate types, and curing procedure were revised and refined to include the effects of admixtures such as fly ash, silica fume, water reducers and superplasticizers. These dependencies were captured with optimized parameters, as were the effects of different cement types and aggregate types (Wendner et al., 2013).

Along with the model, the authors presented a thorough discussion on the optimization methods used for the model (Wendner et al., 2015a) and gave detailed statistical justifications for multi-decade creep and autogenous shrinkage of concrete (Wendner et al., 2015b; Hubler et al., 2015b).

The B4 model was calibrated for the following range of its parameters (original notation is used):

$$0.22 \leq w/c \leq 0.87, \quad 1.0 \leq a/c \leq 13.2 \tag{2.18}$$

$$15MPa \leq \overline{f}_c \leq 70MPa, \quad 200kg/m^3 \leq c \leq 1500kg/m^3 \tag{2.19}$$

$$-25°C \leq T \leq 75°C \tag{2.20}$$

$$20°C \leq T_{cur} \leq 30°C \tag{2.21}$$

$$12 \leq V/S \leq 120 \tag{2.22}$$

where a/c is the aggregate-cement ratio, $\overline{f}_c$ is the mean cylinder compressive strength (f_{cm}), c is the cement content, T is the ambient temperature, T_{cur} is the curing temperature and V/S is the volume-surface ratio (for members with a constant cross-section this is equal to half the notional size, i.e. $0.5h_0$).

The model B4 assumes the relation in Equation 2.23 for total concrete strain ε at time t under a constant stress σ applied at age t'. Within the service stress range (up to approximately $0.45\overline{f}_c$ creep is considered to depend linearly on stress (and any other nonlinearity is caused by cracking).

$$\varepsilon(t) = J(\hat{t},\hat{t}') \cdot \sigma + \varepsilon_{sh,total}(\tilde{t},\tilde{t}_0) + \alpha_T \cdot \Delta T \tag{2.23}$$

in which $J(\hat{t},\hat{t}')$ is the creep compliance function, $\varepsilon_{sh,total}(\tilde{t},\tilde{t}_0)$ is the total shrinkage strain (negative for a decrease in volume), $\Delta T(t)$ is the temperature difference from the reference temperature at time t and α_T is the thermal coefficient of expansion.

The times $\hat{t}$, $\hat{t}'$, $\tilde{t}$ and $\tilde{t}_0$ are transformed and temperature-adjusted ages t, t', $t-t_0$ and t_0, respectively (current age, age at loading, duration of exposure to environmental conditions and start of environmental exposure, respectively).

$$\tilde{t}_0 = t_0\beta_{Th}, \quad \beta_{Th} = exp\left[\frac{U_h}{R}\left(\frac{1}{293} - \frac{1}{T_{cur}+273}\right)\right] \tag{2.24}$$

$$\tilde{t} = (t-t_0)\beta_{Ts}, \quad \beta_{Ts} = exp\left[\frac{U_s}{R}\left(\frac{1}{293} - \frac{1}{T_{cur}+273}\right)\right] \tag{2.25}$$

$$\hat{t}' = t_0\beta_{Th} + (t'-t_0)\beta_{Ts}, \; \hat{t} = \hat{t}' + (t-t')\beta_{Tc}, \; \beta_{Tc} = exp\left[\frac{U_c}{R}\left(\frac{1}{293} - \frac{1}{T_{cur}+273}\right)\right] \tag{2.26}$$

where U_h, U_s and U_c are activation energies of hydration, moisture diffusion and creep, respectively and R is the gas constant. In absence of data, $U_h/R = U_s/R = U_c/R = 4000$ K can be adopted.

An additional important insight from Equation 2.23 is that the B4 model doesn't use the creep coefficient ϕ which most engineers are used to. However, the B4 model does define it as

$$\phi(t,t') = E(t') \cdot J(t,t') - 1 \tag{2.27}$$

As stated in (Bažant et al., 2015), the creep coefficient should always be calculated this way. The modulus of elasticity $E(t')$ should be calculated from the short-duration compliance $J(t,t')$ for $\Delta = t - t'$, typically around 1.5 min. This is highly important since various combinations of ϕ and E corresponding to any chosen Δ-value between 0.1 s and 2 h yield the same compliance. Hence, using incompatible E-values (e.g. from code expressions) with an experimentally reported creep coefficient can cause significant errors (Bažant et al., 2015).

From Equation 2.23, the total shrinkage strain is defined as a non-interactive sum of autogenous shrinkage, ε_{au} and drying shrinkage ε_{sh}:

$$\varepsilon_{sh,total}(\tilde{t},\tilde{t}_0) = \varepsilon_{sh}(\tilde{t},\tilde{t}_0) + \varepsilon_{au}(\tilde{t},\tilde{t}_0) \tag{2.28}$$

Drying shrinkage is defined by

$$\varepsilon_{sh}(\tilde{t},\tilde{t}_0) = \varepsilon_{sh\infty}(\tilde{t}_0) \cdot k_h \cdot S(\tilde{t}) \tag{2.29}$$

where $\varepsilon_{sh\infty}(\tilde{t}_0)$ is the age-corrected final drying shrinkage, k_h is the humidity dependence of drying shrinkage and $S(\tilde{t})$ is the drying shrinkage time curve.

$$\varepsilon_{sh\infty}(\tilde{t}_0) = -\varepsilon_0 k_{\varepsilon a} \frac{E(7\beta_{Th} + 600\beta_{Ts})}{E(\tilde{t}_0 + \tau_{sh}\beta_{Ts})} \tag{2.30}$$

$$\varepsilon_0 = \varepsilon_{cem}\left(\frac{a/c}{6}\right)^{p_{\varepsilon a}}\left(\frac{w/c}{0.38}\right)^{p_{\varepsilon w}}\left(\frac{6.5c}{\rho}\right)^{p_{\varepsilon c}}, \quad \rho = 2350\,kg/m^3 \tag{2.31}$$

For eqs. (2.30) and (2.31), ε_{cem}, $p_{\varepsilon a}$, $p_{\varepsilon w}$ and $p_{\varepsilon c}$ should be taken from Table 1 and $k_{\varepsilon a}$ from Table 6 in (Bažant et al., 2015).

The modulus of elasticity at any time t can be determined from the modulus of elasticity after 28 days—E_{28} in model B4 or E_{cm} in Eurocode 2 (EN 1992-1-1, 2004)—which in turn, can be determined from code-based expressions.

$$E(t) = E_{28}\sqrt{\frac{t}{4\,days + (6/7)t}} \tag{2.32}$$

while Bažant et al. (2015) recommend

$$E_{28} = 4734\,MPa\sqrt{\frac{\overline{f}_c}{MPa}} \tag{2.33}$$

The humidity dependence k_h is defined according to relative humidity h as

$$k_h = \begin{cases} 1 - h^3 & h \leq 0.98 \\ 12.94(1-h) - 0.2 & 0.98 \leq h \leq 1 \end{cases} \tag{2.34}$$

Finally, in drying shrinkage, the time curve is given by

$$S(\tilde{t}) = tanh\sqrt{\frac{\tilde{t}}{\tau_{sh}}} \tag{2.35}$$

with the shrinkage 'halftime' τ_{sh} being

$$\tau_{sh} = \tau_0 k_{\tau a}\left(k_s \frac{2V/S}{1\,mm}\right)^2 \tag{2.36}$$

and

$$\tau_0 = \tau_{cem}\left(\frac{a/c}{6}\right)^{p_{\tau a}}\left(\frac{w/c}{0.38}\right)^{p_{\tau w}}\left(\frac{6.5c}{\rho}\right)^{p_{\tau c}}, \quad \rho = 2350\,kg/m^3 \tag{2.37}$$

The correction factor for the aggregate type, $k_{\tau a}$, the cement type-dependent parameter τ_{cem} and exponents $p_{\tau a}$, $p_{\tau w}$ and $p_{\tau c}$ are given in Table 6 and Table 1 in (Bažant et al., 2015), respectively. The shape parameter k_s takes into account the specimen geometry:

$$k_s = \begin{cases} 1.00 & \text{infinite slab} \\ 1.15 & \text{infinite cylinder} \\ 1.25 & \text{infinite square prism} \\ 1.30 & \text{sphere} \\ 1.55 & \text{cube} \end{cases} \tag{2.38}$$

Autogenous shrinkage is one of the major improvements of the B4 model in comparison with the B3 model. The autogenous shrinkage strain ε_{au} is calculated as

$$\varepsilon_{au}(\tilde{t},\tilde{t}_0) = \varepsilon_{au\infty}\left[1+\left(\frac{\tau_{au}}{\tilde{t}+\tilde{t}_0}\right)^{\alpha}\right]^{r_t}, \quad \alpha = r_\alpha(\frac{w/c}{0.38}) \tag{2.39}$$

The final autogenous shrinkage strain is given by

$$\varepsilon_{au\infty} = -\varepsilon_{au,cem}\left(\frac{a/c}{6}\right)^{r_{\varepsilon a}}\left(\frac{w/c}{0.38}\right)^{r_{\varepsilon w}} \tag{2.40}$$

and the autogenous shrinkage 'halftime' as

$$\tau_{au} = \tau_{au,cem}\left(\frac{w/c}{0.38}\right)^{r_{\tau w}} \tag{2.41}$$

The values of parameters $\varepsilon_{au,cem}$, $\tau_{au,cem}$ and r_α and the exponents $r_{\varepsilon a}$, $r_{\varepsilon w}$, $r_{\tau w}$ and r_t are provided in Table 2 in (Bažant et al., 2015).

As for the creep compliance function, it is given in the following format

$$J(\hat{t},\hat{t}') = q_1 + R_T \cdot C_0(\hat{t},\hat{t}') + C_d(\hat{t},\hat{t}',\tilde{t}_0) \tag{2.42}$$

The creep compliance is decomposed into the instantaneous compliance q_1 which is extrapolated from compliance curves between 0.1 s and 1 h to zero load duration (approximately independent of loading age t'), the basic creep compliance C_0 and the drying creep compliance C_d.

$$q_1 = \frac{1}{E_0} = \frac{p_1}{E_{28}} \tag{2.43}$$

where p_1 is a cement type dependent factor given in Table 3 of (Bažant et al., 2015).

Temperature effects are taken into account by 'horizontal scaling' (time transformations) and 'vertical scaling' using the factor R_T:

$$R_T = exp\left[\frac{U_c}{R}\left(\frac{1}{293} - \frac{1}{T+273}\right)\right] \tag{2.44}$$

The basic creep compliance is defined via its time rate, i.e. its time derivative:

$$\dot{C}_0(t,t') = \frac{n(q_2 t^{-m} + q_3)}{(t-t') + (t-t')^{1-n}} + \frac{q_4}{t}, \quad (m = 0.5, n = 0.1) \tag{2.45}$$

Parameters q_2, q_3 and q_4 represent aging viscoelastic creep, non-aging viscoelastic creep and flow, respectively.

$$q_2 = \frac{p_2}{1\,GPa}\left(\frac{w/c}{0.38}\right)^{p_{2w}} \tag{2.46}$$

$$q_3 = p_3 q_2 \left(\frac{a/c}{6}\right)^{p_{3a}}\left(\frac{w/c}{0.38}\right)^{p_{3w}} \tag{2.47}$$

$$q_4 = \frac{p_4}{1\,GPa}\left(\frac{a/c}{6}\right)^{p_{4a}}\left(\frac{w/c}{0.38}\right)^{p_{4w}} \tag{2.48}$$

Parameters p_2, p_3 and p_4 and exponents p_{2w}, p_{3a}, p_{3w}, p_{4a} and p_{4w} are given in Table 3 in (Bažant et al., 2015).

Finally, the drying creep compliance is defined as

$$C_d(\hat{t},\hat{t}',\tilde{t}_0) = q_t \left\langle exp[-p_{5H} \cdot H(\hat{t},\tilde{t}_0)] - exp[-p_{5H} \cdot H_c(\tilde{t}_0',\tilde{t}_0)]\right\rangle^{0.5} \tag{2.49}$$

where $\hat{t}_0' = max(\hat{t}',\tilde{t}_0)$ if $\hat{t} \geq \hat{t}_0'$; otherwise $C_d(\hat{t},\hat{t}',\tilde{t}_0) = 0$.

The drying creep parameter q_5 is

$$q_5 = \frac{p_5}{1\,GPa}\left(\frac{a/c}{6}\right)^{p_{5a}}\left(\frac{w/c}{0.38}\right)^{p_{5w}} |k_h \cdot \varepsilon_{sh\infty}(\tilde{t}_0)|^{p_{5\varepsilon}} \tag{2.50}$$

with parameter p_5 and exponents p_{5a}, p_{5w} and $p_{5\varepsilon}$ given in Table 3 in (Bažant et al., 2015).

Lastly,

$$H(\hat{t},\tilde{t}_0) = 1-(1-h)tanh\sqrt{\frac{\hat{t}-\tilde{t}_0}{\tau_{sh}}} \tag{2.51}$$

$$H_c(\hat{t}'_0,\tilde{t}_0) = 1-(1-h)tanh\sqrt{\frac{\hat{t}'_0-\tilde{t}_0}{\tau_{sh}}} \tag{2.52}$$

Since the B4 model uses as its input parameters the characteristics of the concrete mix, it is not always applicable in practice, since in most situations the designer knows only the required compressive strength of the concrete; in fact, all other models except the B4 model are formulated based only on compressive strength. Therefore, a simplified version of the B4 model is also proposed, called ’B4s’, which uses the mean compressive strength f_{cm} as its single input parameter. Several equations of the full B4 model are replaced with simplified ones in the B4s.

Shrinkage:

$$\varepsilon_0 = \varepsilon_{s,cem}\cdot\left(\frac{f_{cm}}{40MPa}\right)^{s_{\varepsilon f}} \tag{2.53}$$

Drying shrinkage halftime:

$$\tau_0 = \tau_{s,cem}\cdot\left(\frac{f_{cm}}{40MPa}\right)^{s_{\tau f}} \tag{2.54}$$

Autogenous shrinkage:

$$\varepsilon_{au}(\tilde{t},\tilde{t}_0 = \varepsilon_{au\infty}\cdot\left[1+\left(\frac{\tau_{au}}{\tilde{t}+\tilde{t}_0}\right)^{\alpha_s}\right]^{r_t} \tag{2.55}$$

Final autogenous shrinkage:

$$\varepsilon_{au\infty} = -\varepsilon_{au,cem}\cdot\left(\frac{f_{cm}}{40MPa}\right)^{r_{\varepsilon f}} \tag{2.56}$$

Autogenous shrinkage halftime:

$$\tau_{au} = \tau_{au,cem} \cdot \left(\frac{f_{cm}}{40MPa}\right)^{r_{\tau f}} \tag{2.57}$$

Aging viscoealstic creep:

$$q_2 = \frac{s_2}{1GPa} \cdot \left(\frac{f_{cm}}{40MPa}\right)^{s_{2f}} \tag{2.58}$$

Non-aging viscoelastic creep:

$$q_3 = s_3 \cdot q_2 \cdot \left(\frac{f_{cm}}{40MPa}\right)^{s_{3f}} \tag{2.59}$$

Flow:

$$q_4 = \frac{s_4}{1GPa} \cdot \left(\frac{f_{cm}}{40MPa}\right)^{s_{4f}} \tag{2.60}$$

Drying creep:

$$q_5 = \frac{s_5}{1GPa} \cdot \left(\frac{f_{cm}}{40MPa}\right)^{s_{5f}} |k_h \cdot \varepsilon_{sh\infty}|^{p_{5\varepsilon}} \tag{2.61}$$

All of the parameters for the model B4s are provided in Tables 7, 8 and 9 in (Bažant et al., 2015).

The MC10 model

Coming from a long, mostly European tradition, the MC10 is the latest in a series of *fib* Model Code shrinkage and creep models (FIB, 2013). The first model was published in the CEB-FIP Model Code 1978 (MC78) (CEB-FIP, 1978). The MC78 model represented a generalisation of the (KV) and (D) models and treated the creep coefficient as a sum of a 'sudden creep deformation at time of loading', a developing non-aging and a developing aging part of creep (Mola and Pellegrini, 2012).

A major improvement over the shortcomings of the MC78 model was the CEB-FIP Model Code 1990 (MC90) (CEB-FIP, 1991). In it, the creep coefficient was a product function with components for taking into account various influencing factors. The model eliminated the problems of the 'sudden creep deformation' of MC78. Importantly, the model assumed the influence of relative humidity and member notional size on all creep components meaning that creep is purely regarded as drying creep and thus has a final value (Mola and Pellegrini, 2012). Furthermore, it was found that the model displayed strange behaviour in some cases. For example, after unloading, the model displays a decreasing and then increasing creep compliance, i.e. a negative delayed elasticity—violating the principles of thermodynamics (Mola and Pellegrini, 2012)!

This was the background of the *fib* Model Code 2010 (MC10) model which it had to overcome (FIB, 2013). The model carries several major changes. Most importantly shrinkage and creep are both separated into their constituent components: autogenous and drying shrinkage; and basic and drying creep. For the creep model, the creep coefficient is a sum of the basic and drying creep coefficients, both product functions expressing influencing factors. In MC10, the basic creep function is not limited, expressing the still-unresolved question of whether basic creep actually ever reaches a final value; the drying creep function remains limited (Mola and Pellegrini, 2012).

The MC10 defines the total strain $\varepsilon_c(t)$ at time t of a concrete member uniaxially loaded at time t_0 under a constant stress $\sigma_c(t_0)$ as

$$\varepsilon_c(t) = \varepsilon_{ci}(t_0) + \varepsilon_{cc}(t) + \varepsilon_{cs}(t) + \varepsilon_{cT}(t) \tag{2.62}$$

or

$$\varepsilon_c(t) = \varepsilon_{c\sigma}(t, t_0) + \varepsilon_{cn}(t) \tag{2.63}$$

where $\varepsilon_{ci}(t_0)$ is the initial strain at loading, $\varepsilon_{cc}(t)$ is the creep strain at time $t > t_0$, $\varepsilon_{cs}(t)$ is the shrinkage strain, $\varepsilon_{cT}(t)$ is the thermal strain, $\varepsilon_{c\sigma}(t)$ is the stress-dependent strain (initial and creep strain) and $\varepsilon_{cn}(t)$ is the stress-independent strain (shrinkage and thermal strain).

The MC10 model is considered to be applicable in the following parameter range:

$$20MPa \leq f_{cm} \leq 130MPa, \tag{2.64}$$

$$5^{\circ}C \leq T \leq 30^{\circ}C \tag{2.65}$$

$$40\% \leq RH \leq 100\% \tag{2.66}$$

Within the service stress range ($\sigma_c \leq 0.4f_{cm}$), creep is assumed to be linearly dependent on stress. For a constant stress $\sigma_c(t_0)$ applied at t_0:

$$\varepsilon_{c\sigma}(t,t_0) = \sigma_c(t_0) \cdot \left[\frac{1}{E_{ci}(t_0)} + \frac{\phi(t,t_0)}{E_{ci}}\right] = \sigma_c(t_0) \cdot J(t,t_0) \tag{2.67}$$

where $J(t,t_0)$ is the creep compliance function and $E_{ci}(t_0)$ is the modulus of elasticity at the time of loading ($E_{ci} = E_{cm}$ is the 28-day modulus of elasticity). Additionally, MC10 offers the possibility of adjusting any time (e.g. t or t_0) to take into account temperature effects:

$$t_T = \sum_{i=1}^{n} \Delta t_i \cdot exp\left[13.65 - \frac{4000}{273 + T(\Delta t_i)}\right] \tag{2.68}$$

where t_T is the temperature-adjusted age of concrete and δt_i is the number of days when a temperature T prevails.

The effect of cement type on the creep coefficient can be taken into account by modifying the age at loading using the following expression:

$$t_{0,adj} = t_{0,T}\left[\frac{9}{2 + t_{0,T}^{1.2}} + 1\right]^{\alpha} \tag{2.69}$$

where $t_{0,T}$ is time t_0 adjusted according to Equation 2.68 and α is a coefficient dependent on the type of cement.

$$\alpha = \begin{cases} -1 & \text{for cement class 32.5N} \\ 0 & \text{for cement classes 32.5R and 42.5N} \\ 1 & \text{for cement classes 42.5R, 52.5N and 52.5R} \end{cases} \tag{2.70}$$

The creep coefficient $\phi(t,t_0)$ is given as

$$\phi(t,t_0) = \phi_{bc}(t,t_0) + \phi_{dc}(t,t_0) \tag{2.71}$$

with $\phi_{bc}(t,t_0)$ representing basic creep and $\phi_{dc}(t,t_0)$ representing drying creep.

The basic creep coefficient is calculated as

$$\phi_{bc}(t,t_0) = \beta_{bc}(f_{cm}) \cdot \beta_{bc}(t,t_0) \tag{2.72}$$

$$\beta_{bc}(f_{cm}) = \frac{1.8}{(f_{cm})^{0.7}} \tag{2.73}$$

$$\beta_{bc}(t,t_0) = ln\left[\left(\frac{30}{t_{0,adj}} + 0.035\right)^2 \cdot (t - t_0) + 1\right] \tag{2.74}$$

The drying creep coefficient is calculated as

$$\phi_{dc}(t,t_0) = \beta_{dc}(f_{cm}) \cdot \beta(RH) \cdot \beta_{dc}(t_0) \cdot \beta_{dc}(t,t_0) \tag{2.75}$$

$$\beta_{dc}(f_{cm}) = \frac{412}{(f_{cm})^{1.4}} \tag{2.76}$$

$$\beta(RH) = \frac{1 - \frac{RH}{100}}{\sqrt[3]{0.1\frac{h_0}{100}}} \tag{2.77}$$

$$\beta_{dc}(t_0) = \frac{1}{0.1 + t_{0,adj}^{0.2}} \tag{2.78}$$

$$\beta_{dc}(t,t_0) = \left[\frac{(t - t_0)}{\beta_h + (t - t_0)}\right]^{\gamma(t_0)} \tag{2.79}$$

$$\gamma(t_0) = \frac{1}{2.3 + \frac{3.5}{\sqrt{t_{0,adj}}}} \tag{2.80}$$

$$\beta_h = 1.5h_0 + 250\alpha_{f_{cm}} \leq 1500\alpha_{f_{cm}} \tag{2.81}$$

$$\alpha_{f_{cm}} = \left(\frac{35}{f_{cm}}\right)^{0.5} \tag{2.82}$$

where RH is relative humidity in % and h_0 is the member notional size (in mm).

MC10 also offers the possibility of extending the applicability range of its creep model to stresses in the range of $0.4f_{cm}(t_0) \leq \sigma_c \leq 0.6f_{cm}(t_0)$ transforming the creep coefficient $\phi(t,t_0)$ into the nonlinear creep coefficient $\phi_\sigma(t,t_0)$.

$$\phi_\sigma(t,t_0) = \phi(t,t_0) \cdot exp[1.5(k_\sigma - 0.4)], \quad \text{for } 0.4 < k_\sigma < 0.6 \tag{2.83}$$

where $k_\sigma = \sigma_c / f_{cm}(t_0)$ is the stress–strength ratio.

As for shrinkage, the total shrinkage strain at time t after the start of drying at time t_s, $\varepsilon_{cs}(t,t_s)$ is decomposed into an autogenous shrinkage strain ε_{cas} and a drying shrinkage strain ε_{cds}.

$$\varepsilon_{cs}(t,t_s) = \varepsilon_{cas}(t) + \varepsilon_{cds}(t,t_s) \tag{2.84}$$

Autogenous shrinkage is modeled as

$$\varepsilon_{cas}(t) = \varepsilon_{cas0}(f_{cm}) \cdot \beta_{as}(t) \tag{2.85}$$

and drying shrinkage as

$$\varepsilon_{cds}(t,t_s) = \varepsilon_{cds0}(f_{cm}) \cdot \beta_{RH} \cdot \beta_{ds}(t-t_s) \tag{2.86}$$

with

$$\varepsilon_{cas0}(f_{cm}) = -\alpha_{as}\left(\frac{f_{cm}/10}{6+f_{cm}/10}\right)^{2.5} \cdot 10^{-6} \tag{2.87}$$

$$\beta_{as}(t) = 1 - exp(-0.2\sqrt{t}) \tag{2.88}$$

$$\varepsilon_{cds0}(f_{cm}) = [(220+110\alpha_{ds1}) \cdot exp(-\alpha_{ds2} f_{cm})] \cdot 10^{-6} \tag{2.89}$$

$$\beta_{RH} = \begin{cases} -1.55\left[1-\left(\frac{RH}{100}\right)^3\right] & \text{for } 40\% \leq RH \leq 99\% \cdot \beta_{s1} \\ 0.25 & \text{for } RH \geq 99\% \cdot \beta_{s1} \end{cases} \tag{2.90}$$

$$\beta_{ds}(t-t_s) = \left(\frac{(t-t_s)}{0.035h_0^2+(t-t_s)}\right)^{0.5} \tag{2.91}$$

$$\beta_{s1} = \left(\frac{35}{f_{cm}}\right)^{0.1} \leq 1.0 \tag{2.92}$$

Coefficients α_{as}, α_{ds1} and α_{ds2} are given in Table 2.2.

TABLE 2.2: Coefficients α_i (FIB, 2013)

Strength class of cement	α_{as}	α_{ds1}	α_{ds2}
32.5N	800	3	0.013
32.5R, 42.5N	700	4	0.012
42.5R, 52.5N, 52.5R	600	6	0.012

The EC2 model

Between the time Model Code 1990 and 2010 were published, in 2004 Eurocode 2 was adopted by CEN and its member states (EN 1992-1-1, 2004). Relying heavily on MC90, Eurocode 2 offered a very similar model for creep and shrinkage (EC2). In defining the creep compliance and creep coefficient, EC2 is basically equal to MC90 (except for a few coefficients in the equations). This carries with it all of the before-mentioned shortcomings (treating creep as a purely drying phenomenon). An improvement exists in the definition of shrinkage since MC90 does not recognize autogenous from drying shrinkage whereas EC2 does. Nonetheless, EC2 is the ruling code of design in most of Europe and consequently, its shrinkage and creep models are as well.

EC2 considers that creep is linearly related to stress up to stress levels of $0.45 f_{ck}(t_0)$ where t_0 is the concrete age at loading. However, the creep coefficient $\phi(t,t_0)$ is related to the *tangent* modulus of elasticity $E_c = 1.05E_{cm}$, rather than simply E_{cm}. All concrete ages can be transformed to take into account the effects of cement type and temperature using the same expressions as in MC10, i.e. eqs. (2.68) and (2.69).

EC2 gives the following expression for the creep strain:

$$\varepsilon_{cc}(t,t_0) = \phi(t,t_0) \cdot \left(\frac{\sigma_c}{E_c}\right) \tag{2.93}$$

The total stress-dependent strain can then be calculated as

$$\varepsilon_{c\sigma}(t,t_0) = \sigma_c(t_0) \cdot \left[\frac{1}{E_c(t_0)} + \frac{\phi(t,t_0)}{E_c}\right] = \sigma_c(t_0) \cdot J(t,t_0) \tag{2.94}$$

Identically to MC10 (and in fact MC90), EC2 allows the correction of the creep coefficient for stress levels above $0.45 f_{ck}(t_0)$ using the same expression, i.e. Equation 2.83.

EC2 does not explicitly prescribe equations for calculating $\phi(t,t_0)$, rather provides nomograms for its visual assessment. A detailed analytical method is given only in the 'informative' Annex B (EN 1992-1-1, 2004).

From Annex B, the creep coefficient can be determined as

$$\phi(t,t_0) = \phi_0 \cdot \beta_c(t,t_0) \tag{2.95}$$

where ϕ_0 is the notional creep coefficient which can be estimated from

$$\phi_0 = \phi_{RH} \cdot \beta(f_{cm}) \cdot \beta(t_0) \tag{2.96}$$

$$\phi_{RH} = \begin{cases} 1 + \frac{1-RH/100}{0.1\sqrt[3]{h_0}} & \text{for } f_{cm} \leq 35\,MPa \\ \left[1 + \frac{1-RH/100}{0.1\sqrt[3]{h_0}} \cdot \alpha_1\right] \cdot \alpha_2 & \text{for } f_{cm} > 35\,MPa \end{cases} \tag{2.97}$$

$$\beta(f_{cm}) = \frac{16.8}{\sqrt{f_{cm}}} \tag{2.98}$$

$\beta(t_0)$ is equal to MC10's $\beta_{dc}(t_0)$ and can be calculated using Equation 2.78.

The development of creep in Equation 2.95 is described in the same way as in MC10, using Equation 2.79 except that in EC2, $\gamma(t_0) = 0.3$ and β_h is defined as

$$\beta_h = \begin{cases} 1.5[1 + (0.012RH)^{18}]h_0 + 250 \leq 1500 & \text{for } f_{cm} \leq 35\,MPa \\ 1.5[1 + (0.012RH)^{18}]h_0 + 250\alpha_3 \leq 1500\alpha_3 & \text{for } f_{cm} \geq 35\,MPa \end{cases} \tag{2.99}$$

The coefficients α_1, α_2 and α_3 in eqs. (2.97) and (2.99) are given by

$$\alpha_1 = \left[\frac{35}{f_{cm}}\right]^{0.7} \quad \alpha_2 = \left[\frac{35}{f_{cm}}\right]^{0.2} \quad \alpha_3 = \left[\frac{35}{f_{cm}}\right]^{0.5} \tag{2.100}$$

On the other hand, shrinkage is defined in more detail in the main body of Eurocode 2, with the total concrete shrinkage strain ε_{cs} equal to the sum of the autogenous shrinkage strain, ε_{ca}, and the drying shrinkage strain, ε_{cd}.

The autogenous shrinkage strain is expressed as

$$\varepsilon_{ca}(t) = \beta_{as}(t) \cdot \varepsilon_{ca}(\infty) \tag{2.101}$$

where

$$\beta_{as}(t) = 1 - exp(-0.2t^{0.5}) \tag{2.102}$$

$$\varepsilon_{ca}(\infty) = 2.5(f_{ck} - 10) \cdot 10^{-6} \tag{2.103}$$

Importantly, in Equation 2.103 the characteristic strength $f_{ck} = f_{cm} - 8$ must be used.

The drying shrinkage strain is described as

$$\varepsilon_{cd}(t) = \beta_{ds}(t,t_s) \cdot k_h \cdot \varepsilon_{cd,0} \tag{2.104}$$

where $\beta_{ds}(t,t_s)$ represents the time evolution of drying shrinkage from the beginning of drying at time t_s until time t, k_h is a notional size dependent coefficient and $\varepsilon_{cd,0}$ is the nominal unrestrained drying shrinkage (tabulated in the main body of Eurocode 2 or calculated using expressions in Annex B).

$$\beta_{ds}(t,t_s) = \frac{(t-t_s)}{(t-t_s)+0.04h_0^{1.5}} \tag{2.105}$$

$$k_h = \begin{cases} 1.0 & \text{for } h_0 = 100\,mm \\ 0.85 & \text{for } h_0 = 200\,mm \\ 0.75 & \text{for } h_0 = 300\,mm \\ 0.70 & \text{for } h_0 \geq 500\,mm \end{cases} \tag{2.106}$$

$$\varepsilon_{cd,0} = 0.85\Big[(220+110\alpha_{ds1}) \cdot exp\Big(-\alpha_{ds2}\frac{f_{cm}}{f_{cmo}}\Big)\Big] \cdot 10^{-6} \cdot \beta_{RH} \tag{2.107}$$

where f_{cmo} = 10 MPa, coefficients α_{ds1} and α_{ds2} are cement type dependent and are given in Table 2.3.

$$\beta_{RH} = 1.55\Big[1-\Big(\frac{RH}{100}\Big)^3\Big] \tag{2.108}$$

TABLE 2.3: Coefficients α_{dsi} in Equation 2.107

Strength class of cement	α_{ds1}	α_{ds2}
S	3	0.13
N	4	0.12
R	6	0.11

The ACI 209R-92 model

The ACI 209R-92 model probably has the longest history of all the shrinkage and creep models currently in use and since it is codified by the American Concrete Institute (ACI 209R-92, 1992) it is still widely used in North America. Its history dates back to 1971 when ACI Committee 209 recommended a model developed by Branson and Crhistiason (ACI 209.2R-08, 2008). The model was later slightly modified in 1982 and again in 1992. The model is relatively simple and purely empirical, hence, it does not actually model shrinkage and creep phenomena. It captures basic influencing factors on an empirical basis: concrete age (at loading, at end of curing), relative humidity, notional member size and cement type.

Both shrinkage and creep are modeled with hyperbolic curves tending to an asymptotic value. This final value is then modified by the time development function and its shape can be corrected to take into account basic influencing factors (ACI 209.2R-08, 2008).

The shrinkage strain $\varepsilon(t,t_c)$ at time t measured from the end of curing (start of drying), t_c, is calculated as

$$\varepsilon(t,t_c) = \frac{(t-t_c)^{\alpha}}{f+(t-t_c)^{\alpha}} \cdot \varepsilon_{shu} \tag{2.109}$$

where f (in days) and α are parameters taking into account member shape and size. ACI 209.2R-08 (2008) recommends using $\alpha = 1$ and calculating f using the volume-surface ratio (V/S) as

$$f = 26 \cdot exp[1.42 \cdot 10^{-2} \cdot (V/S)] \tag{2.110}$$

The ultimate shrinkage strain ε_{shu} is given as

$$\varepsilon_{shu} = 780 \cdot \gamma_{sh} \cdot 10^{-6}\ mm/mm \tag{2.111}$$

with γ_{sh} being a product function of seven factors influencing shrinkage:

$$\gamma_{sh} = \gamma_{sh,tc} \cdot \gamma_{sh,RH} \cdot \gamma_{sh,vs} \cdot \gamma_{sh,s} \cdot \gamma_{sh,\psi} \cdot \gamma_{sh,c} \cdot \gamma_{sh,\alpha} \tag{2.112}$$

$\gamma_{sh,tc}$ takes into account the duration of moist curing,

$$\gamma_{sh,tc} = 1.202 - 0.2337 log(t_c) \tag{2.113}$$

$\gamma_{sh,RH}$ takes into account relative humidity h (in decimals),

$$\gamma_{sh,RH} = \begin{cases} 1.4 - 1.02h & \text{for } 0.40 \leq h \leq 0.80 \\ 3.00 - 3.0h & \text{for } 0.80 \leq h \leq 1.00 \end{cases} \tag{2.114}$$

$\gamma_{sh,vs}$ takes into account the member size,

$$\gamma_{sh,vs} = 1.2 \cdot exp[-0.00472(V/S)] \tag{2.115}$$

$\gamma_{sh,s}$ takes into account the slump s of fresh concrete,

$$\gamma_{sh,s} = 0.89 + 0.00161 \cdot s \tag{2.116}$$

$\gamma_{sh,\psi}$ takes into account the weight ratio of fine-to-coarse aggregate ψ,

$$\gamma_{sh,\psi} = \begin{cases} 0.30 + 0.014 \cdot \psi & \text{for } \psi \leq 50\% \\ 0.90 + 0.002 \cdot \psi & \text{for } \psi > 50\% \end{cases} \tag{2.117}$$

$\gamma_{sh,c}$ takes into account the cement content c in kg/m^3,

$$\gamma_{sh,c} = 0.75 + 0.00061 \cdot c \tag{2.118}$$

and finally, $\gamma_{sh,\alpha}$ takes into account the air content α (in percent).

$$\gamma_{sh,\alpha} = 0.95 + 0.008 \cdot \alpha \ \geq \ 1.0 \tag{2.119}$$

The creep compliance function at time t after loading at time t_0 is defined as

$$J(t,t_0) = \frac{1 + \phi(t,t_0)}{E_{cm}(t_0)} \tag{2.120}$$

where $E_{cm}(t_0)$ is the modulus of elasticity at time t_0 and $\phi(t,t_0)$ the creep coefficient at t_0.

The modulus of elasticity at time t_0 can be calculated from the compressive strength at t_0, $f_{cm}(t_0)$ (in MPa) and concrete density γ_c (in kg/m^3):

$$E_{cm}(t_0) = 0.043 \cdot \gamma_c^{1.5} \sqrt{f_{cm}(t_0)} \tag{2.121}$$

or simply as

$$E_{cm}(t_0) = 5000 \cdot \sqrt{f_{cm}(t_0)} \tag{2.122}$$

The time development of compressive strength is given in relation to its 28-day value, f_{cm}:

$$f_{cm}(t) = \left[\frac{t}{a + b \cdot t}\right] \cdot f_{cm} \tag{2.123}$$

where constants a and b are functions of curing type and cement type. For moist-cured concrete a is 4.0 and 2.3 for cement types I and III, respectively, whereas b is 0.85 and 0.92. Cement types I and III can roughly be approximated to European N and R cements (ACI 209.2R-08, 2008).

The creep coefficient is a product of the ultimate creep coefficient and a time-development function:

$$\phi(t, t_0) = \frac{(t - t_0)^{\psi}}{d + (t - t_0)^{\psi}} \cdot \phi_u \tag{2.124}$$

The shape and size effects can be taken into account by adopting $\psi = 1$ and calculating $d = f$ according to Equation 2.110.

The ultimate creep coefficient ϕ_u is a product function of six factors influencing creep:

$$\phi_u = 2.35 \cdot \gamma_c \tag{2.125}$$

$$\gamma_c = \gamma_{c,to} \cdot \gamma_{c,RH} \cdot \gamma_{c,vs} \cdot \gamma_{c,s} \cdot \gamma_{c,\psi} \cdot \gamma_{c,\alpha} \tag{2.126}$$

$\gamma_{c,t0}$ takes into account loading ages greater than seven days for moist-cured concrete,

$$\gamma_{c,t0} = 1.25 \cdot t_0^{-0.118} \tag{2.127}$$

$\gamma_{c,RH}$ takes into account relative humidity h (in decimals),

$$\gamma_{c,RH} = 1.27 - 0.67h \quad \text{for } h \geq 0.40 \tag{2.128}$$

$\gamma_{c,vs}$ takes into account the member size,

$$\gamma_{c,vs} = \frac{2}{3} \cdot \left\{1 + 1.13 \cdot exp[-0.0213(V/S)]\right\} \tag{2.129}$$

$\gamma_{c,s}$ takes into account the slump s of fresh concrete,

$$\gamma_{c,s} = 0.82 + 0.00264 \cdot s \tag{2.130}$$

$\gamma_{c,\psi}$ takes into account the weight ratio of fine-to-coarse aggregate ψ,

$$\gamma_{c,\psi} = 0.88 + 0.0024 \cdot \psi \tag{2.131}$$

and finally, $\gamma_{c,\alpha}$ takes into account the air content α (in percent).

$$\gamma_{c,\alpha} = 0.46 + 0.09 \cdot \alpha \ \geq \ 1.0 \tag{2.132}$$

The GL2000 model

The GL2000 model was developed by Gardner and Lockman (2001) as a modification of a previous 'Atlanta 97' model from 1993 (ACI 209.2R-08, 2008). It is a simple model, intended to be mostly used by design-office engineers and hence, based on input parameters known at the design stage: compressive strength, age at loading, size and relative humidity. According to the authors, the model can be used regardless of what chemical admixtures or mineral by-products are used in the concrete, casting temperature or curing regime.

The shrinkage strain $\varepsilon_{sh}(t,t_c)$ at time t, measured from the end of curing t_c is defined as

$$\varepsilon_{sh}(t,t_c) = \varepsilon_{shu} \cdot \beta(h) \cdot \beta(t-t_c) \tag{2.133}$$

where ε_{shu} is the ultimate shrinkage strain, $\beta(h)$ is a correction factor for the effect of relative humidity and $\beta(t-t_c)$ is the time development of drying.

$$\varepsilon_{shu} = 900 \cdot k \cdot \left(\frac{30}{f_{cm}}\right)^{0.5} \cdot 10^{-6} \tag{2.134}$$

with k being a cement type dependent coefficient equal to 1.0, 0.75 and 1.15 for cement types I, II and III, respectively.

$$\beta(h) = (1 - 1.18 \cdot h^4) \tag{2.135}$$

$$\beta(t - t_c) = \left[\frac{(t - t_c)}{(t - t_c) + 0.12(V/S)^2}\right] \tag{2.136}$$

The creep compliance is composed of the elastic and creep strains. The elastic strain is related to the modulus of elasticity at the time of loading t_0 – $E_{cm}(t_0)$. The creep strain is related to the 28-day creep coefficient $\phi_{28}(t, t_0)$ and the 28-day modulus of elasticity – E_{cm} (hence the name '28-day creep coefficient').

$$J(t, t_0) = \frac{1}{E_{cm}(t_0)} + \frac{\phi_{28}(t, t_0)}{E_{cm}} \tag{2.137}$$

$\phi_{28}(t, t_0)$ includes three terms: the first two represent basic creep and the third one drying creep.

$$\begin{aligned}\phi_{28}(t, t_0) = \Phi(t_c) \cdot \Bigg[2 \cdot \frac{(t - t_0)^{0.3}}{(t - t_0)^{0.3} + 14} + \left(\frac{7}{t_0}\right)^{0.5} \cdot \left(\frac{(t - t_0)}{(t - t_0) + 7}\right)^{0.5} + \\ +2.5 \cdot (1 - 1.086 \cdot h^2) \cdot \left(\frac{(t - t_0)}{(t - t_0) + 0.12 \cdot (V/S)^2}\right)^2 \Bigg]\end{aligned} \tag{2.138}$$

$$\Phi(t_c) = \begin{cases} 1 & \text{if } t_0 = t_c \\ \left[1 - \left(\frac{(t_0 - t_c)}{(t_0 - t_c) + 0.12 \cdot (V/S)^2}\right)^{0.5}\right]^{0.5} & \text{if } t_0 > t_c \end{cases} \tag{2.139}$$

Comparison of different models

The statistical comparison of the presented models is a very complex and somewhat controversial task. A detailed investigation into this problem falls outside the scope of this thesis. However, few important insight will be presented in brief.

First of all, there is in fact no consensus on how to actually compare the models, at what level and using what indicators. Some of the more commonly used methods for determining a model's deviation from test data include (ACI 209.2R-08, 2008):

- Comparison of individual prediction curves to individual sets of test data, requiring a case-by-case evaluation;
- Comparison of test data and calculated values using linear regression;
- Evaluation of residuals (if there is a trend in the data, this method may be biased); and
- Calculation of a coefficient of variation or standard error of regression normalized by the data centroid.

Some of the statistical descriptors used so far to compare different models have been the $\overline{\omega}_{BP}$ coefficient of variation developed by Bažant and Panula (1978); this method involves weighting data points according to which time decade they belong to.

The 'CEB statistical indicators' are the coefficient of variation V_{CEB}, mean square error F_{CEB} and mean deviation M_{CEB}, developed in 1990 by the CEB General Task Group 9 headed by Müller and Hilsdorf (ACI 209.2R-08, 2008).

The Gardner coefficient of variation, ω_G, developed by Gardner (2004) also calculates the mean observed value and root mean square of the difference between calculated and observed values in half-logarithmic scale for several time intervals. A coefficient of variation is obtained by dividing the average root mean square normalized by the average value.

Importantly, not all studies conducting such tests reach the same conclusions, further signaling the lack of consensus on the approach required for this subject.

In (ACI 209.2R-08, 2008), a comparison is made between the ACI 209R-92, GL2000, B3 (previous version of the B4) and MC90-99 (improved version of MC90) models.

Two sets of input information were used from RILEM data sets. The first set of inputs consisted only of measured 28-day compressive strength with all other concrete properties derived from it; the second set used all available measured properties for each mix. The duration after drying was divided into seven half-log decades. Then, the root mean square was calculated for all comparisons in each half-log decade and the coefficient of variation was the average root mean square divided by the average experimental value for the same half-log decade.

The analysis showed that for shrinkage strain prediction, the B3 and GL2000 models provided the best results whereas for creep compliance the GL2000, MC90-99 and B3 models all gave acceptable predictions. Except for the ACI 209R-92 model, using more directly measured properties improved the quality of predictions (ACI 209.2R-08, 2008).

Al-Manaseer and Prado (2015) carried out a comparison of the ACI 209R-92, B3, GL2000, MC90-99, MC10 and AASHTO 2012 models. The authors observed the CEB coefficient of variation, the CEB mean square error, the CEB mean deviation and a modified coefficient of variation (with different statistical weighting of data points).

Three 'plans', i.e. increasingly strict data selection criteria were used to select data from the RILEM and NU-ITI databases. As a result, the authors found that for shrinkage, ACI 209R-92 showed the best overall performance (followed by B3, MC90-99, MC10, GL2000 and AASHTO 2012); for creep ACI 209R-92 was also the best performer (followed by B3, GL2000, MC90-99, MC10 and AASHTO 2012). However, the authors do note that data selection criteria, used database and selected statistical method can influence model ranking (Al-Manaseer and Prado, 2015).

Finally, Hubler et al. (2015b) and Wendner et al. (2015b) provide statistical justification of the B4 model for shrinkage and creep, respectively, and compare it with the ACI 209R-92, B3, GL2000, MC10 and MC90-99 models using the NU-ITI laboratory and bridge databases.

The authors tried not rely strictly on scatter plots of measured vs. predicted values since this does not reflect statistical trends and the statistics become dominated by short-term measurements and old data and the scatter due composition variability masks the scatter in the shape of time evolution curves (Hubler et al., 2015b).In both studies, the authors first validated the B4 model on selected individual time curves and then performed a comparison with complete database values.

For shrinkage, the B4 and B4s models provided the best overall fit, followed by the MC90-99, MC10, B3 and GL2000 models. The ACI 209R-92 model can be refitted to represent the initial shape quite well, second only to the B4 model (Hubler et al., 2015b). Looking at the time development of residuals, the B4 and B4s models are overall conservative with the least underestimation through all half-decades while maintaining a relatively narrow scatter band. In comparison, the residuals of MC10 increase in time, whereas the ACI

209R-92 model shows the most inconsistent behavior (in the beginning, the shrinkage is underestimated, between 30 and 1000 days it is overestimated, and ultimately tends to underestimations again).

As for creep, similar conclusions were reached. The CoV of residuals for short-term laboratory creep test data was found to be the lowest for the B4 and GL200 models. The models MC90-99 and ACI 209R-92 which have a wrong functional form (horizontal asymptote) are clearly shown as inadequate by the multi-decade bridge data. The GL2000 model is an exception since its functional form corresponds to MC90-99 but is calibrated in such a way that it approaches a horizontal asymptote only long after the longest measurement times, thus mimicking a terminal slope of the creep compliance in logarithmic time (Wendner et al., 2015b). When both laboratory and bridge databases are combined, the best behaviour is shown by the B4 and B4s models, followed by the B3, MC10 and GL2000 models.

2.5.4 Models for Calculating Deflections

As mentioned in section 2.5.1, two distinct traditions—or ’families’ of models—for calculating deflections will be presented here: the European and North American traditions. The general philosophy behind each of them has been presented in section 2.4.2.

The European tradition has traditionally been tied to calculating curvatures—or, directly, deflections—of reinforced concrete members in states 1 and 2 and then interpolating between them, whereas the North American tradition has been to interpolate on the level of the sectional moment of inertia rather than curvature which depends on it.

Even though in recent years there has been significant advance in the availability and practicability of nonlinear finite element method (FEM) software (DIANA, Abaqus, Ansys, etc.) that can be used to analyse deflections of reinforced concrete members (employing different ’smeared’ or ’discrete’ cracking models to more accurately capture the cracking behaviour of reinforced concrete), the two approaches presented herein are still most easily used by design-office engineers and can be sufficiently accurate for this purpose.

The European tradition

Among European countries, organized around the CEB (Comité Européen du Béton, later: Comité Euro-international du Béton), and after 1998, the *fib*, there is a long-lasting tradition of calculating deflections of reinforced concrete structures in a certain way. The first codification of their unified approach was given in the Model Code 1978 and its final installment is in the Model Code 2010, while preparations are ongoing for the new Model Code 2020 (in the meantime, there was the Model Code 1990). The latest installment of the official design code of most European countries is, of course, the Eurocode 2 (EN 1992-1-1, 2004) which uses a method which can be assessed as intermediate between the Model Codes 1990 and 2010.

In this section, the method outlined in Eurocode 2 will be presented in detail but the historic background and context to its origin through the previous Model Codes will also be given.

The foundation of all European models has been the realization that the load–deflection (or moment–curvature) behaviour of all reinforced concrete elements lies between two limits given by states 1 (uncracked) and 2 (fully cracked), as shown in Figure 2.5. The main task of a design method is then, to find the most appropriate way to interpolate between these two states.

Starting from an analysis of a member in pure tension (CEB, 1985), (Figure 2.10) it was shown that a mathematical formulation for the 'average' steel strain in a cracked member, ε_{sm} can be given by the following expression:

$$\varepsilon_{sm} = (1-\zeta)\cdot\varepsilon_{s1} + \zeta\cdot\varepsilon_{s2} \tag{2.140}$$

where ε_{s1} and ε_{s2} are reinforcement strains for state 1 and 2, respectively and ζ is the distribution coefficient between states 1 and 2, originally given by the following relation:

$$\zeta = 1 - \frac{\sigma_{sr}^2}{\sigma_s^2} \tag{2.141}$$

where σ_{sr} is the reinforcement stress, calculated on the basis of a cracked section, under a load combination causing a maximum stress in concrete in tension equal to its tensile

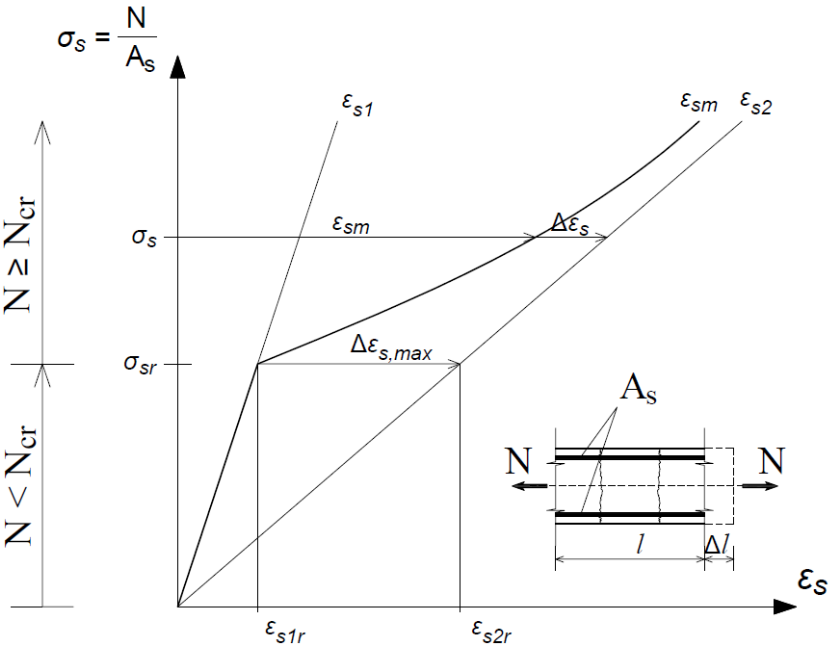


FIGURE 2.10: Reinforcement strain in a reinforced concrete member under pure tension

strength f_{ct} (suggested as f_{ctm} or $f_{ctk,0.05}$ by (CEB, 1985)) and σ_s is the reinforcement stress at a cracked section under the considered load combination.

In order to take into account bond quality of the reinforcement and the influence of load duration or repetition, two coefficients were originally introduced – β_1 and β_2:

$$\zeta = \begin{cases} 1 - \beta_1 \cdot \beta_2 \cdot \left(\frac{\sigma_{sr}}{\sigma_s}\right)^2 & \text{for } \sigma_s \geq \sqrt{\beta_1 \cdot \beta_2} \cdot \sigma_{sr} \\ 0 & \text{for } \sigma_s < \sqrt{\beta_1 \cdot \beta_2} \cdot \sigma_{sr} \end{cases} \tag{2.142}$$

where β_1 was 1 for deformed bars and 0.5 for smooth bars and β_2 was 1 for first loading and 0.5 for long-term or repetitive loading (CEB-FIP, 1978).

Moving from pure tension to pure flexure, the same approach is assumed to be valid. However, now the stresses can be replaced with moments (since both are calculated with the fully-cracked transformed section modulus $W_{2,i}$):

$$\zeta = \begin{cases} 1 - \beta_1 \cdot \beta_2 \cdot \left(\frac{M_{cr}}{M}\right)^2 & \text{for } M \geq \sqrt{\beta_1 \cdot \beta_2} \cdot M_{cr} \\ 0 & \text{for } M < \sqrt{\beta_1 \cdot \beta_2} \cdot M_{cr} \end{cases} \tag{2.143}$$

The authors of (CEB, 1985) were explicit that M_{cr} should be calculated as

$$M_{cr} = W_{1,i} \cdot f_{ct} \approx W_c \cdot f_{ct} \tag{2.144}$$

where $W_{1,i}$ is the section modulus of the uncracked transformed section, W_c the section modulus of the gross concrete cross-section and f_{ct} should be taken either as $f_{ctk,0.05}$ (5% fractile) if the calculation is a matter of avoiding damage or as f_{ctm} if it is a matter of calculating deflections.

Several important points stand out in the discussion so far. First of all, since the first Model Code was introduced in 1978, the β_1 coefficient has become obsolete with smooth bars not being allowed by current Eurocode 2 or Model Code 2010 standards. However, a 'controversy' around the choice of the β_2 coefficient (later, simply β), and its physical meaning, remains.

It can actually be seen that the cracked zone of a member is given not by M_{cr} but by $\sqrt{\beta} \cdot M_{cr}$. The idea behind the coefficient β (henceforth this symbol will be used when referring to the original β_2 coefficient) is to roughly reduce the cracking moment, or more precisely tensile strength, in order to take into account several phenomena such as the effects of restrained shrinkage, cracking caused by previous loading and creep, see Figure 2.5. In this sense, $\beta = 1$ is only appropriate for first loading of a completely uncracked member. For long-term effects, $\beta = 0.5$ was shown to be adequate (Gilbert and Ranzi, 2011); this value reduces the importance and effect of properly selecting the tensile strength by basically reducing f_{ctm} by approximately 30%.

However, whether $\beta = 1$ is appropriate for short-term and first loading is questionable. In (CEB-FIP, 1991) the value $\beta = 0.8$ was given and even $\beta = 0.7$ is sometimes recommended for early loading ages (Gilbert and Ranzi, 2011).Nonetheless, Eurocode 2 and Model Code 2010 have reverted back to $\beta = 1$ for calculating initial deflections.

Even so, the original expressions Equation 2.142 and Equation 2.143 delimited the cracked zone simply by comparing σ_s to σ_{sr}, i.e. M to M_{cr}. No doubt this was the source of much confusion that developed later around the procedure.

The question surrounding the proper choice of M_{cr} is made even more questionable after it is realized that the tensile strength for calculating M_{cr} has already been reduced by using f_{ctm} instead of the 'natural' choice of flexural strength $f_{ct,fl}$ ((ACI 318-11, 2011) indeed still uses f_r, i.e. the modulus of rupture). This only further raises concern whether the distribution coefficient ζ is in fact properly formulated—a concern voiced even in (CEB, 1985).

Moving past this discussion, the procedure given in Eurocode 2, section 7.4, will be presented in detail (EN 1992-1-1, 2004).

The general format for predicting a cracked reinforced concrete member's behaviour is given as

$$\alpha = \zeta \cdot \alpha_2 + (1 - \zeta) \cdot \alpha_1 \tag{2.145}$$

where α is any deformation parameter (curvature, rotation or deflection). The distribution coefficient is given by

$$\zeta = \begin{cases} 1 - \beta \cdot \left(\frac{\sigma_{sr}}{\sigma_s}\right)^2 & \text{for } \sigma_s \geq \sqrt{\beta} \cdot \sigma_{sr} \\ 0 & \text{for } \sigma_s < \sqrt{\beta} \cdot \sigma_{sr} \end{cases} \tag{2.146}$$

for the general case and by

$$\zeta = \begin{cases} 1 - \beta \cdot \left(\frac{M_{cr}}{M}\right)^2 & \text{for } M \geq \sqrt{\beta} \cdot M_{cr} \\ 0 & \text{for } M < \sqrt{\beta} \cdot M_{cr} \end{cases} \tag{2.147}$$

for the case of pure bending. As said previously, β is 1 for a single short-term load and 0.5 for long-term or repeated load. It must be pointed out that the inequalities for which ζ is not equal to zero are *not* stated explicitly in Eurocode 2. This has the potential of causing confusion especially when β is smaller than one, since the reduction of the cracking moment by $\sqrt{\beta}$ can easily be overlooked.

The most general approach is based on calculating curvatures under the assumption that curvatures from different effects can be superimposed and that, in that case, the total curvature $(1/r)(t)$ at time t is equal to the sum of the curvature caused by load, $(1/r)_l$ and curvature caused by shrinkage $(1/r)_{cs}$.

$$(1/r)(t) = (1/r)_l + (1/r)_{cs} \tag{2.148}$$

Each of the terms in Equation 2.148 is then calculated for both states 1 and 2 and interpolated using Equation 5.30. The most rigorous approach is to calculate curvatures for states 1 and 2 in numerous sections along the member, interpolate them and perform a double numerical integration. The process is more complex and time-consuming, however, for sufficient accuracy, 10 section are usually adequate (FIB Bulletin 52, 2010).

The assumed evolution of curvature in different states, as a function of the bending moment M, and for different times $t = t_0$ and $t = t$, is given in Figure 2.11.

Curvatures caused by loading, if the assumption is made that the material is linear elastic, can be calculated according to Equation 2.3. The question then only remains, what values for E and I should be taken for states 1 and 2 and for times $t = t_0$ and $t = t$?

For initial deflections, E_{cm} should be taken along with $I_{1,i}$ (moment of inertia of the transformed uncracked section).

For long-term deflection, $I_{2,i}$ (moment of inertia of the transformed fully-cracked section) should be taken and for the modulus of elasticity, the *effective modulus* should be taken as

$$E_{c,eff}(t,t_0) = \frac{E_c}{1+\phi(t,t_0)} \tag{2.149}$$

It should be noted that in Equation 2.149, the *tangent* modulus ($E_c = 1.05 \cdot E_{cm}$) should be used, since in Eurocode 2 the creep coefficient is related to it and not to E_{cm} (even though this is in contrast to clause 7.4.3(5) of Eurocode 2). The effective modulus method—actually the inverse of the compliance function—is one the oldest approximate methods for taking creep into account in long-term deflection calculations (Jirásek and Bažant, 2001).

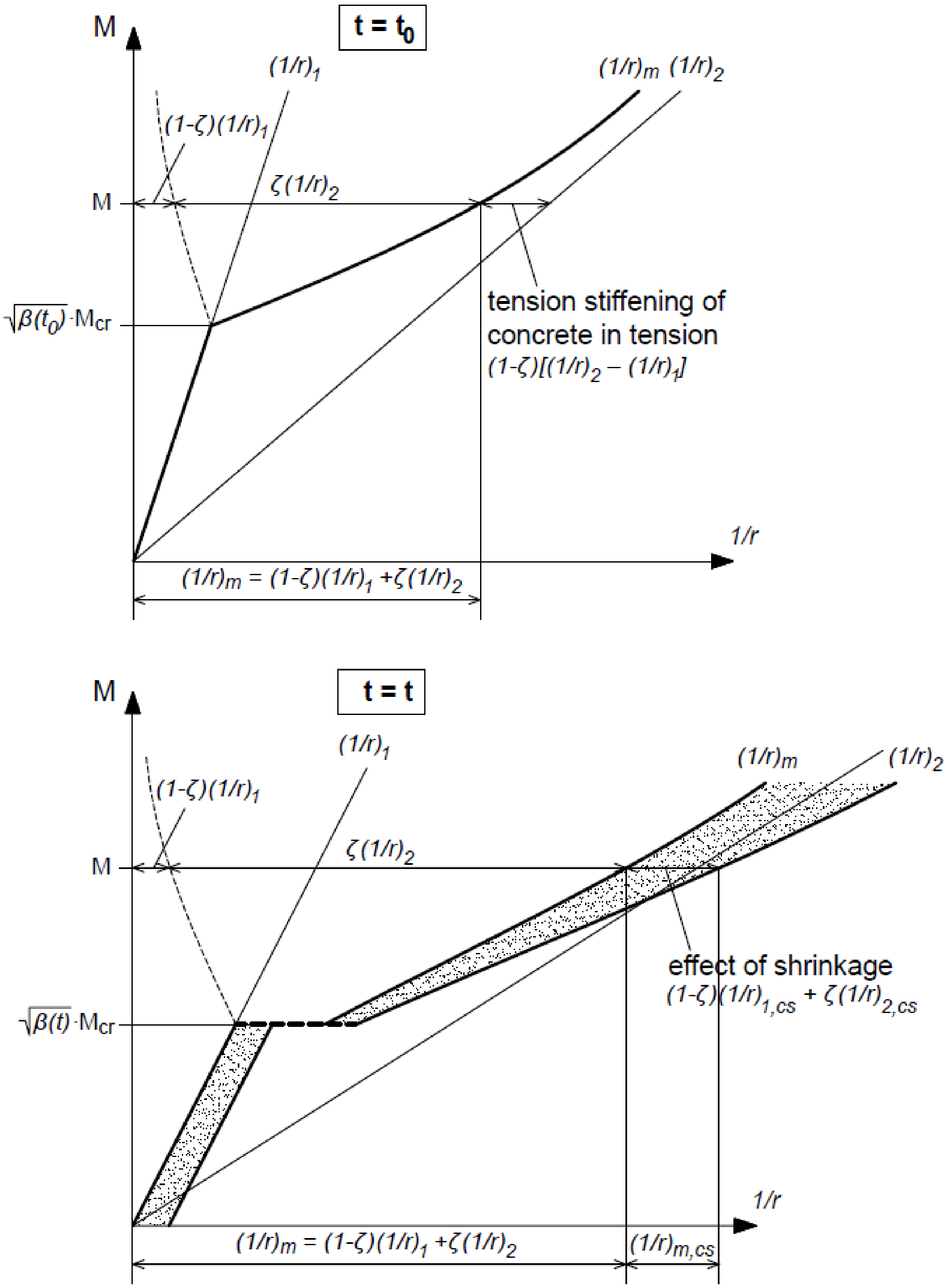

t = t$_0$
M
$(1/r)_1$
$(1/r)_m$ $(1/r)_2$
$(1-\zeta)(1/r)_1$
$\zeta(1/r)_2$
M
$\sqrt{\beta(t_0)}\cdot M_{cr}$
tension stiffening of concrete in tension
$(1-\zeta)[(1/r)_2 - (1/r)_1]$
1/r
$(1/r)_m = (1-\zeta)(1/r)_1 + \zeta(1/r)_2$
t = t
M
$(1/r)_1$
$(1-\zeta)(1/r)_1$
$(1/r)_m$
$(1/r)_2$
$\zeta(1/r)_2$
M
$\sqrt{\beta(t)}\cdot M_{cr}$
effect of shrinkage
$(1-\zeta)(1/r)_{1,cs} + \zeta(1/r)_{2,cs}$
1/r
$(1/r)_m = (1-\zeta)(1/r)_1 + \zeta(1/r)_2$
$(1/r)_{m,cs}$

FIGURE 2.11: Moment–curvature diagrams for pure bending

The effective modulus method is only valid for single-step (constant) loads. For more complex loading histories, the *age-adjusted effective modulus method* can be used in which

$$E_{c,eff}(t,t_0) = \frac{E_c}{1+\chi(t,t_0)\phi(t,t_0)} \tag{2.150}$$

in which $\chi(t,t_0)$ represents the so-called aging coefficient which is actually

$$\chi(t,t_0) = \frac{E_c}{E_c - R(t,t_0)} - \frac{1}{\phi(t,t_0)} \tag{2.151}$$

where $R(t,t_0)$ is the *relaxation function* (describing stress development for a constant strain). The advantage of this approach is that the aging coefficient varies very little (from 0.5 to 1), with 0.8 being the most common value (Jirásek and Bažant, 2001).

Alternatively to the age-adjusted modulus method, the *effective creep coefficient*, ϕ_{eff} can be used. For several loads, e.g. q_1, q_2 and q_3, applied at ages t_1, t_2 and t_3, respectively, ϕ_{eff} can be defined as

$$\phi_{eff}(t) = \frac{q_1 \cdot \phi(t,t_1) + q_2 \cdot \phi(t,t_2) + q_3 \cdot \phi(t,t_3)}{q_1 + q_2 + q_3} \tag{2.152}$$

and then used in Equation 2.149.

Finally, curvatures caused by load, on the level of an individual cross-section, can be obtained by

$$(1/r)_{1,l} = \begin{cases} \frac{M}{E_{cm} \cdot I_{1,i}} & \text{for } t \ = \ t_0 \\ \frac{M}{E_{c,eff} \cdot I_{1,i}} & \text{for } t \ = \ t \end{cases} \tag{2.153}$$

for state 1, and using

$$(1/r)_{2,l} = \begin{cases} \frac{M}{E_{cm} \cdot I_{2,i}} & \text{for } t = t_0 \\ \frac{M}{E_{c,eff} \cdot I_{2,i}} & \text{for } t = t \end{cases} \tag{2.154}$$

for state 2. In the end, they are interpolated using Equation 5.30.

For shrinkage effects, Eurocode 2 provides the following expression for calculating curvatures caused by shrinkage:

$$(1/r)_{i,cs} = \varepsilon_{cs} \cdot \alpha_e \frac{S_{i,i}}{I_{i,i}} \tag{2.155}$$

where i stands for states 1 or 2, ε_{cs} is the free shrinkage strain, α_e is the modular ratio ($E_s/E_{c,eff}$), $S_{i,i}$ is the first moment of area of the reinforcement about the transformed section's centroid (cracked or uncracked) and $I_{i,i}$ is, of course, the transformed section's moment of inertia (also cracked or uncracked).

Just like curvatures caused by load, curvatures caused by shrinkage are calculated for states 1 and 2 as $(1/r)_{1,cs}$ and $(1/r)_{2,cs}$ and interpolated using Equation 5.30.

Some useful examples of numerical integration of curvatures using Excel-based spreadsheets are given in (FIB Bulletin 52, 2010; Beeby and Narayanan, 2005).

The question of the accuracy of calculating deflections is a very important one and it has influenced different methods significantly. Some of the most important sources of uncertainty, according to Beeby and Narayanan (2005), are

- actual load level compared with design load level,
- variability of concrete tensile strength,
- variability of concrete modulus of elasticity,
- variability of creep and shrinkage,
- behaviour of cracked tension zone,
- temperature effects and

- age of loading and load history.

Although in laboratory conditions, where most, if not all, effects are known, an accuracy of around ±20% is achievable; in practice, it is likely far worse (Beeby and Narayanan, 2005). Simply the scatter of tensile strength for a given compressive strength, which is around ±30% (FIB Bulletin 52, 2010), can have profound influences on deflection predictions, especially for load levels close to the cracking load and for small reinforcement ratios. For example, a simple analysis of a simply supported beam with a 0.4% reinforcement ratio and a low load level, showed that using $f_{ctk,0.05}$ for calculating M_{cr} gave predictions 121% above the ones obtained when using f_{ctm} and when using $f_{ctk,0.95}$, the predictions were only 43% of those obtained using f_{ctm}.

The differences are lower for larger reinforcement ratios and load levels but still, such uncertainties can make a complex procedure like numerical integration pointless if the results can oscillate so much. This is why, ever since Model Code 1978, there was a search for simplified procedures which would be simple enough for manual calculation but still provide similar accuracy as numerical integration.

One of the earliest and most famous ones, was the *bilinear* method, proposed by Jaccoud and Favre, on the basis of their experimental programme presented in (Jaccoud and Favre, 1982). It was then elaborated in (CEB, 1985). The idea behind the bilinear method was to calculate the deflection from load only twice—once for the uncracked condition and once for the cracked condition—using the following expressions

$$a_{i,l} = K \cdot \frac{M_{max} \cdot l^2}{E \cdot I_{i,i}} \tag{2.156}$$

where a_i are the deflections in states 1 and 2 (a_1 and a_2, respectively), K is a coefficient dependent on the shape of the bending moment diagram (e.g. for a simply supported beam and uniformly distributed load $K = 0.104$), M_{max} is the critical bending moment, usually the largest moment in a beam's span (or the support moment of a console), E is the appropriate modulus of elasticity for states 1 and 2 (E_{cm} and $E_{c,eff}$, respectively) and $I_{i,i}$ the transformed section's moment of inertia for states 1 and 2.

For long-term deflections, the shrinkage deflection for states 1 and 2 should be calculated as

$$a_{i,cs} = \delta_{cs} \cdot \varepsilon_{cs} \frac{S_i \cdot l^2}{I_{i,i} \cdot 8} \tag{2.157}$$

where δ_{cs} is a coefficient dependent on the member's support conditions (e.g. 1 for a simply supported beam).

The question is then how to interpolate only once, using which value for ζ? In other words, which value should M take in Equation 2.147? The solution proposed by Jaccoud nad Favre was to take the geometric mean of moments M_{cr} and M_{max}, i.e. $\sqrt{M_{cr} \cdot M_{max}}$. Substituting this into Equation 2.147 leads to the following expression:

$$\zeta = \begin{cases} 1 - \beta \cdot \frac{M_{cr}}{M_{max}} & \text{for } M_{max} \geq \sqrt{\beta} \cdot M_{cr} \\ 0 & \text{for } M_{max} < \sqrt{\beta} \cdot M_{cr} \end{cases} \tag{2.158}$$

This solution yielded a bilinear moment–deflection diagram (excluding shrinkage), i.e. the moment–deflection relationship remained linear after cracking.

The method was in use for a long time, however, its solutions were not on the safe side. This was famously shown by Espion and Halleux (1990). In this paper, the authors compared the simplified approaches of CEB and ACI on their compiled database of 217 results (Espion, 1988). While the comparison is explained in more detail after presenting the ACI method, for now it is sufficient to say that the mean value of predictions using the bilinear method was 0.968 for initial deflections and 0.905 for long-term deflections (with a standard deviation of 0.313 and 0.215, respectively). The results were even worse when the authors restricted the database to the 21 results from the 1950s used for calibrating the ACI procedure (mean values were close to 0.8 for both initial and long-term deflections). This clearly demonstrated that the bilinear method was not on the safe side (sometimes by a large margin) and that the geometric averaging of moments was too low (this can even be seen from original diagrams in (Jaccoud and Favre, 1982), e.g. Figure 28).

In order to remain on the safe side, but also maintain a simplified procedure, the approach taken in Eurocode 2 and later in Model Code 2010 was to simply substitute M_{max} for M in Equation 2.147 so that the distribution coefficient becomes

$$\zeta = \begin{cases} 1 - \beta \cdot \left(\frac{M_{cr}}{M_{max}}\right)^2 & \text{for } M_{max} \geq \sqrt{\beta} \cdot M_{cr} \\ 0 & \text{for } M_{max} < \sqrt{\beta} \cdot M_{cr} \end{cases} \tag{2.159}$$

This is recommended by numerous authors Gilbert and Ranzi (2011); Beeby and Narayanan (2005); FIB Bulletin 52 (2010). The results can differ from numerical integration, usually not more than 10%, but they are always on the safe side. While Eurocode 2 is not explicit about this (clause 7.4.3.(7) simply states that 'in most cases it will be acceptable to compute the deflection twice, assuming the whole member to be in the uncracked and fully cracked condition in turn, and then interpolate'), Model Code 2010 is explicit in saying that the distribution coefficient ζ should be calculated at the 'most unfavourable section'.

The shortcomings of the current approach seem to have been recognized by the *fib* since, in (FIB, 2013), there is a proposal of an alternative to interpolating curvatures (or deflections) and it is actually similar to the ACI approach – finding an equivalent stiffness:

$$(EI)_{eff} = \frac{(EI)_1 \cdot (EI)_2}{\zeta \cdot (EI)_1 + (1 - \zeta) \cdot (EI)_2} \tag{2.160}$$

A very useful instruction on the application of the presented methods can be found in more detail in (CEB, 1985; FIB Bulletin 52, 2010; Gilbert and Ranzi, 2011).

The North American tradition

The traditional approach to calculating deflections in North America (USA and Canada, but also Australia), is the effective moment of inertia method, based on work done by Branson in the 1970s. In the USA, it is codified in (ACI 318-11, 2011) and (ACI 435R-95, 2003).

Unlike in the European tradition, here, the interpolation between states 1 and 2 is performed at the level of the moment of inertia using Equation 2.11.

The rigorous procedure for calculating deflections involves determining the curvature in numerous sections along the member length and performing a double numerical integration. A simplified procedure, suitable for manual calculation, is to assume uniform cross-section properties along the entire member's length (according to the section with the maximum bending moment). The code ACI 435R-95 (2003) prescribes as the exponent in Equation 2.11 $m = 3$ with no distinction between the rigorous and simplified approaches. Only in Annex B of (ACI 435R-95, 2003) is it mentioned that Branson originally calibrated the exponent as $m = 4$ in Equation 2.11 for individual cross-sections when calculating curvatures.

Again, the distinction between the uncracked and cracked regions of a reinforced concrete member given by the M_{cr} value is highly important. (ACI 318-11, 2011) explicitly states that the cracking moment should be calculated using the gross concrete section modulus W_c and the modulus of rupture (flexural tensile strength) f_r. However, to adequately take into account shrinkage effects, Scanlon and Bischoff (2008) found that a reduction of the cracking moment is necessary, and proposed a reduced value of the modulus of rupture $(2/3 \cdot f_r)$. Nonetheless, this approach is known to overestimate stiffness after cracking for members with relatively small reinforcement ratios (Gilbert and Ranzi, 2011).

The simplest form of this procedure is

$$a_{LT} = a_L + \lambda_t \cdot a_{sus} \tag{2.161}$$

where a_{LT} is the long-term deflection, a_{sus} the deflection under sustained loads (both determined using the effective moment of inertia) and λ_t is a time-dependent multiplier for time t. As can be seen, the approach is based on the simple multiplication of the sustained load deflection calculated as

$$a_{sus} = K \cdot \frac{M_{sus} l^2}{E_c(t_0) I_e} \tag{2.162}$$

using the effective moment of inertia I_e (2.11) but also the modulus of elasticity at the time of loading t_0 and not the effective modulus as in the European approach. Further, the coefficient λ_t is given by

$$\lambda_t = \frac{\xi}{1 + 50 \cdot \rho'} \tag{2.163}$$

In Equation 2.163, ρ' is the reinforcement ratio of compressive reinforcement and ξ is a time-dependent factor given graphically in (ACI 435R-95, 2003) and equal to

$$\xi = \begin{cases} 1.0 & \text{for 3 months} \\ 1.2 & \text{for 6 months} \\ 1.4 & \text{for 12 months} \\ 2.0 & \text{for 5 years or more} \end{cases} \tag{2.164}$$

Another, modified method is offered in (ACI 435R-95, 2003) for calculating creep (a_{cr}) and shrinkage (a_{sh}) deflections separately.

$$a_{cr} = \lambda_c \cdot a_{sus} \tag{2.165}$$

$$a_{sh} = k_{sh} \cdot \left(A_{sh} \cdot \frac{|\varepsilon_{cs}|(t)}{h} \right) \cdot l^2 \tag{2.166}$$

$$\lambda_c = \frac{0.85 \cdot C_t}{1 + 50 \cdot \rho'} \tag{2.167}$$

where C_t is the creep coefficient at time t ($\phi(t, t_0)$),

$$A_{sh} = \begin{cases} 0.7 \cdot (\rho - \rho')^{1/3} \cdot (\frac{\rho - \rho'}{\rho})^{1/2} & \text{for } \rho - \rho' \leq 3\% \\ 0.7 \cdot \rho^{1/3} & \text{for } \rho' = 0 \\ 1.0 & \text{for } \rho - \rho' > 3\% \end{cases} \tag{2.168}$$

and k_{sh} is a statical system dependent factor (= 0.125 for simply supported beams).

Comparison of the methods

It is fairly obvious that the effective moment of inertia method as proposed by ACI is simpler than the European methods and accounts for less factors. The ACI method was calibrated on a small number of regionally specific results (Espion and Halleux, 1990) and when compared with European methods on a larger, unbiased database its performance is significantly poorer (Espion and Halleux, 1990). On the database compiled by Espion (1988), the authors compared the ACI simplified approach with the CEB bilinear method. When predicting initial deflections, the ACI simplified procedure and the CEB bilinear method demonstrate mean values of 0.988 and 0.968, respectively, with standard deviations of 0.310 and 0.313, respectively. However, when predicting the long-term deflection values (last reported values of each study in the database), the CEB bilinear method has a mean value of 0.905 and standard deviation of 0.215 (90% confidence interval is 0.552–1.258), whereas the ACI simplified procedure has a mean value of 1.114 and standard deviation of 0.375 (90% confidence interval is 0.499–1.729) (Espion and Halleux, 1990). Also importantly, and as expected, the prediction ability of both models is the most imprecise when the load level is around the cracking load level (Espion and Halleux, 1990). As stated before, this study was very indicative at the time and important in practically abandoning the CEB bilinear methods in future installments of the Model Code and subsequently, Eurocode 2; nonetheless, it did not produce a similar change in the ACI approach.

2.6 Recycled Aggregate Concrete

2.6.1 Introduction

Section 1.1 presented some basic background to the sustainability problems of concrete production worldwide. One of them was the problem of landfilling large amounts of CDW. Studies on how to utilize this waste were started several decades ago (Nixon, 1978) and are carried out today in increasing numbers.

One of the main strategies of treating CDW is to extract from it parts which can be recycled into aggregates for concrete production. This can be done with several materials such as plain or reinforced concrete and masonry. The focus of this section, and this thesis in general, will be on the aggregates obtained by crushing plain or reinforced concrete waste. The final product of this process are aggregates called recycled concrete aggregates or RCA, and any new concrete produced with them is called recycled aggregate concrete or RAC.

The problems that recycling of CDW tries to solve are the depletion of natural resources (river or crushed stone aggregates) and the use of large land areas for landfilling. Following from this, the countries with the largest interest in recycling CDW and which, in fact, use it most intensively, are those with scarce sources of natural materials or with limited land available for landfilling. Such are Japan, the Netherlands and Denmark, and indeed, they recycle the most: 98%, 90% and 81%, respectively (Ignjatović, 2009). Most other countries, in Europe and around the world are lagging far behind.

Because of its growing use, many standards and organizations have finally started to produce guidelines and classifications of products obtained from CDW recycling. In Europe, EN 12620 (2010) categorizes crushed concrete aggregates as R_c according to the percentage of pure RCA in the product (which can also include mortar and masonry units). The standard recognizes three classes of R_c: R_{c90}, R_{c70} and R_{c50} if the aggregates contain more than 90%, 70% and 50% of crushed concrete, respectively. Other aggregates classified by EN 12620 (2010) include unbound or hydraulically bound aggregates R_u, recycled masonry products R_b, recycled bitumen materials R_a and others, as well as combinations of them.

Recycling of concrete waste is itself a process not unlike the one used to produce crushed stone aggregate (the main difference being the presence of potential impurities and contaminants and reinforcement). It can be carried out in mobile or stationary recycling facilities. Schematics of such facilities are given in figs. 2.12 and 2.13, respectively. As can be seen, both usually involve a one- or two-stage crushing and sieving process using jaw crushers, horizontal and vertical impact crushers, cone crushers (the choice of which depends on the size of the input waste and determines the size and quality of the output), magnetic separators and sieves.

The choice between using a mobile or stationary facility depends on many factors including the availability of the process equipment, the desired quality of the final product, the

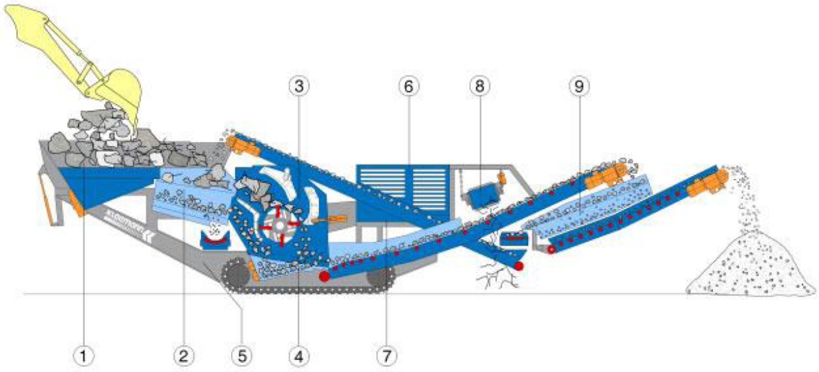


FIGURE 2.12: Example of a mobile crusher, (Ignjatović, 2009): (1) loading tray, (2) primary sieves, (3) crusher, (4) conveyor belt, (5) machine chassis, (6) engine, (7) command board, (8) magnetic separator and (9) secondary sieves)

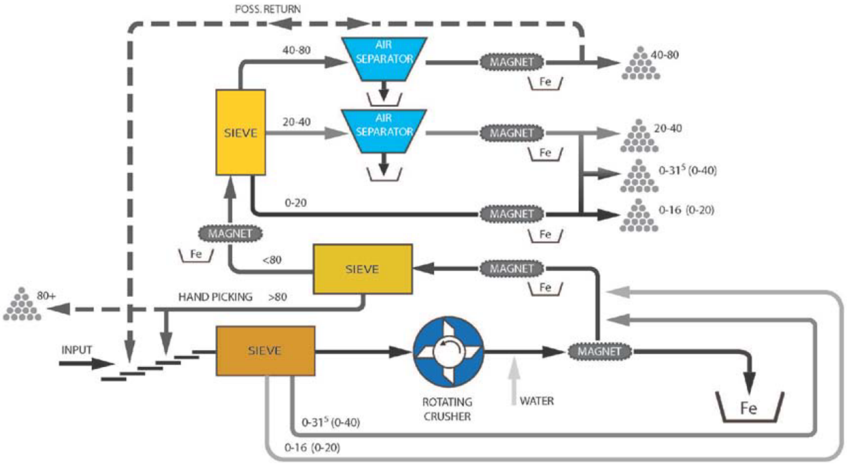


FIGURE 2.13: Schematic of a process in a stationary recycling facility, provided by Recycling Kombinatie REKO BV, the Netherlands

space and time available on the demolition site, the transport distance between the demolition site and the nearest recycling plant (Silva, 2015). Much has been written on the economic feasibility of recycling plants (Duran et al., 2006; Nunes et al., 2007; Coelho and De Brito, 2013a,b) and the conclusion is that they can be sustainable and profitable investments; however, sometimes certain stimulating policies are necessary such as increasing taxes on landfilling or the consumption of natural aggregates and subsidizing the recycling industry.

Since concrete is composed of natural aggregates bound by hardened cement mortar, after crushing concrete waste, the final product, RCA, is composed of natural aggregate particles with some 'residual cement paste' bound to them, i.e. the product is a two-phase material, Figure 2.14.

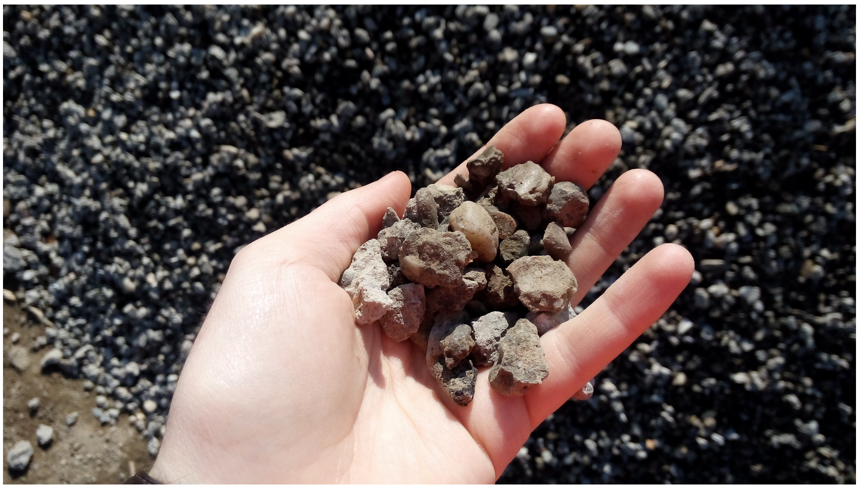


FIGURE 2.14: Recycled concrete aggregate particles

This 'residual cement paste' is one of the defining characteristics of RCA and it influences most of its properties. It, in turn, depends on the quality of the original concrete that was recycled, something that is most often unknown when producing RCA. Since cement paste is more porous, less dense and has greater water absorption than natural aggregates, so does RCA have lower density, higher porosity and greater water absorption compared with natural (both river and crushed stone) aggregates. Most of the studies on RCA have actually focused on two properties: density and water absorption, being the easiest to measure and having the greatest importance when producing RAC. Just as an example, the 'final' water absorption of natural aggregates is rarely above 1% by mass, whereas for RCA it can be 3.5–10% in the case of coarse RCA (particle size > 4 mm) (Xiao et al., 2005; Rahal, 2007) and even 5.5–13% in the case of fine RCA (particle size < 4 mm) (Evangelista and de Brito, 2007). This large water absorption of fine RCA has lead to it mostly being avoided (or forbidden) when producing RAC (leaving another problem of unused fines left after recycling) (RILEM TC 121-DRG, 1994).

This large water absorption poses many challenges to designing RAC mixtures for a target strength and especially workability. In this regards, many approaches can be taken. Usually, the aggregates are used in an oven-dry condition and additional water is added to compensate for RCA absorption (usually not for the 'final' absorption, but, e.g. for the 1 h or 2 h absorption). However, many underlying processes that occur during mixing and hardening remain unclear. RCA display different absorption kinetics compared with natural aggregates, with most absorption occurring very rapidly (Belin et al., 2014). The role of the absorbed water on the ITZ between the new cement paste and RCA (in this case two ITZs exist: new cement paste–natural aggregate and new cement paste–residual cement paste) is also unclear; some researchers point to it being weakened and porous (Poon et al., 2004) whereas others point to a potential internal curing effect of the absorbed water in RCA (Seara-Paz et al., 2016). Even the usual method of determining water absorption of aggregates using EN 1097-6 (2000) can lead to possibly erroneous results in the case of RCA as heating RCA at 110°C can lead to the evaporation of not only free water but chemically bound water as well (Tam et al., 2008). Their weaker properties often end up leading to more cement used in mixture design to achieve the same compressive strength as the companion NAC (Marinković et al., 2010).

Beside all of this, water absorption and density remain the most useful characteristics for the classification of RCA and recently a simple and straight-forward approach was proposed by Silva et al. (2014). The authors classified all recycled products (RCA, recycled masonry aggregates and mixed recycled aggregates) according to water absorption, oven-dry density and the Los Angeles coefficient value (EN 1097-2, 2010) into four categories (A, B, C and D) each with three subcategories (I, II and III). The authors carried out an extensive literature review and analyzed the probabilities of a recycled aggregate falling into each category given according to its properties (e.g. according to literature there is a 77.7% chance that coarse RCA will fall into category B with an oven-dry (OD) density 2100–2300 kg/m^3, water absorption 5–8.5% and Los Angeles coefficient < 45).

Another important aspect to keep in mind regarding RCA is their potential contamination with different contaminants to which the original concrete is exposed to (chlorides, sulphates, etc.). Although significant contamination is not common in concrete structures, this highlights the importance of properly screening, processing and categorizing waste coming into the recycling facility (Silva et al., 2014). There is though, one process that is otherwise considered deleterious to concrete which can in fact be beneficial in the case of RCA and that is carbonation. The residual cement paste on RCA particles can be carbonated and through this process the properties of RCA can be improved (decreased water absorption) and also a certain amount of CO_2 can be absorbed (Thiery et al., 2013; Tam et al., 2016). However, questions remain on how much carbonation is possible under atmospheric conditions and what is the true RCA CO_2 sequestration potential (Habert et al., 2017).

In his doctoral dissertation Silva (2015) comprehensively studied existing literature to draw conclusions about different influences RCA has on main mechanical, time-dependent and durability-related properties of concrete. A similar analysis with similar conclusions was carried out by Ignjatović (2013), also in his doctoral dissertation. These two studies will be mostly relied upon to present general conclusions about mechanical properties of RAC compared with companion NAC. This was done because both studies contain comprehensive literature reviews and analysis of collected data. In this way, their conclusions are very robust and reliable, especially because in both studies they are practically the same. For later sections, when analyses are carried out, the use of specific studies will be necessary, but for this section, where only general conclusions are needed, these reviews are the best source of data.

For compressive strength, Silva (2015) studied the influence of the RCA replacement level, RCA moisture content, quality of the original concrete from which RCA was produced, *w/c* ratio, chemical admixtures and additions. A comprehensive statistical analysis revealed that for example, a 100% coarse RCA content can lead to approximately 20% higher or 40% lower compressive strengths compared with companion NAC (produced with a same *w/c* ratio), practically the same conclusions are reached by Ignjatović (2013). But generally, for a given *w/c* ratio, there will be an increase in strength loss with a decrease in RCA quality and for an increasing replacement ratio. The influence of chemical admixtures was not detected and the use of additions (such as fly ash) has a similar effect on RAC and NAC. Importantly, RAC was sometimes observed to display a larger strength gain after 28 days compared with NAC (possible internal curing effects of RCA or delayed hydration of the unhydrated part of the residual cement paste in RCA). Importantly for design and codes, no significant increase in the scatter of compressive strength results was observed for RAC.

For tensile strength, Silva (2015) studied the influences of the RCA replacement level, mixing procedure, chemical admixtures and additions, and found that tensile strength decreases with increasing RCA content; an increase of up to 10% and decrease of up to 20% was found by Ignjatović (2013). Again, the strength development of RAC seemed to be more pronounced than for NAC. Concerning the use of Eurocode 2, the author noted that the relationship between tensile and compressive strength was unaffected by RCA or mineral additions, (Silva, 2015). However, for both NAC and RAC, the author found that the time development of tensile strength should be corrected since there was an increasing skewness in predictions with increasing age (tensile strength tended to get increasingly underestimated), (Silva, 2015). Hence, a new relationship was proposed:

$$f_{ctm}(t) = \left(e^{\{a[1-(\frac{28}{t})^{b}]\}}\right)^{c} \cdot f_{ctm} \tag{2.169}$$

where a is a coefficient that depends on curing (10 for water curing and 9 for air curing), $b = 0.0025$ and $c = 3$.

One of the properties in which RAC differs from NAC the most—and one which is of great importance for calculating deflections—is the modulus of elasticity. The modulus of elasticity, as was said before, depends on the stiffness of both the cement paste and aggregates and the ITZ between them; these are all aspects in which RAC significantly differs from NAC. Although the modulus of elasticity depends on these many factors, modern design codes mostly relate it only to compressive strength, i.e. in (EN 1992-1-1, 2004) using the following expression:

$$E_{cm} = 22 \cdot \left(\frac{f_{cm}}{10}\right)^{0.3} \tag{2.170}$$

This is mostly the case because in the design stage it is still unknown which aggregates will be used in concrete production. The influence of aggregates is recognized in Eurocode 2 by offering a correction coefficient to multiply Equation 2.170 if the type of aggregates are known: 0.7, 0.9, 1.0 and 1.2 for sandstone, limestone, quartzite and basalt aggregates, respectively.

With serviceability limit states increasingly governing design, it is probable to expect the prediction of the modulus of elasticity to become more complex in the future.

As for RAC, a lot of research has been done so far and it has been successfully compiled and analysed in (Silva, 2015; Ignjatović, 2013). Again, these two reviews are useful as they analyse a large number of data, unlike other research dealing with the modulus of elasticity of RAC which provide predicting equations but only based on own or limited data and usually not as a function of RCA percentage (Li, 2009; Corinaldesi, 2010).

Unsurprisingly, both reviews found that the modulus of elasticity decreases with increasing RCA percentage and decreasing RCA quality. Compensation of RCA water absorption was found to be paramount in achieving a good ITZ and consequently, a modulus of elasticity comparable with NAC. The use of chemical admixtures and mineral additions was found to have the same effect on NAC and RAC.

Silva (2015) and Ignjatović (2013) thoroughly analysed the relationship between the modulus of elasticity and compressive strength of RAC and reached very similar conclusions. Ignjatović (2013) found that for a 100% coarse RCA content, the modulus of elasticity can be expected to fall within 110% and 60% of the modulus of companion NAC (produced with a same *w/c* ratio); for RAC with a 50% coarse RCA content, this range was between 110% and 80%. Similarly, for 588 concrete mixes with both fine and coarse RCA, Silva (2015) found that 95% of results were above the prediction made by Eurocode 2 for sandstone aggregates (correction coefficient of 0.7).

This is in line with other findings, e.g. by the Standing Committee of Concrete of Spain which in 2004 suggested a correction coefficient of 0.8 for RAC with 100% coarse RCA, or the relationship proposed by Seara-Paz (2015)

$$E_{cm} = 22 \cdot \left(\frac{f_{cm}}{10}\right)^{0.3} \cdot (1 - 0.0024 \cdot \%RCA) \tag{2.171}$$

which leads to correction coefficients of 0.76 and 0.88 for RAC with 100% and 50% of coarse RCA, respectively. Furthermore, the Chinese RAC standard DG/TJ07-008 proposes the following equation for the modulus of elasticity of RAC with 100% coarse RCA:

$$E_c = \frac{10^5}{2.8 + (40.1/f_{cu})} \tag{2.172}$$

which produces a 20% reduction compared with the predictions for NAC in Chinese code GB50010-2002 (Li, 2009):

$$E_c = \frac{10^5}{2.2 + (34.7/f_{cu})} \tag{2.173}$$

Another comprehensive review was conducted by (Lye et al., 2016a) in which the authors also compiled a comprehensive database of NAC and RAC moduli of elasticity. The cited conclusions of other researchers and organizations point to reductions of the modulus of elasticity between 5% and 40% for RAC with 100% coarse RCA. The authors also prepared a useful diagram which determines the relative modulus of elasticity of RAC compared with NAC depending on the coarse RCA content and compressive strength of concrete (Lye et al., 2016a). For example, for a 30 MPa compressive strength and a 100% coarse RCA content, the reduction in modulus is 20% and decreases with increasing strength (but not significantly).

Taking all of these finding into account, if existing correction coefficients in Eurocode 2 are to be used, a recommendation could be made to use the correction coefficient of 0.9 (limestone aggregates) for RAC with 50% of coarse RCA and 0.7 (for sandstone aggregates) for RAC with 100% of coarse RCA.

As for other mechanical properties such as bond strength and bond behaviour, most research has found it to be practically identical to companion NAC (produced with a same *w/c* ratio) (Ignjatović, 2013).

Durability-related properties such as carbonation resistance, chloride ion penetration and freeze-thaw resistance have also been studied extensively, but are not the topic of this thesis. In general, RAC produced with the same compressive strength as NAC will have a lower carbonation resistance and greater chloride ion penetration Silva (2015).

Even though only around 25% of concrete produced globally is reinforced concrete (Scrivener et al., 2016), the use of RCA is of paramount importance. If structural concrete is recycled and then RCA used in lower-grade applications such as road base and sub-base (as it is in most cases) then what we actually have is not recycling but ’down-cycling’ because natural resources are still needed for new structural-grade concrete. However, so far only a negligible portion of available RCA has been used in structural applications. The questions regarding mixture design are definitely among the existing problems but also the lack of standards and regulations and, more importantly, design codes that treat structural RAC members.

Fortunately, there exist truly numerous tests on RAC structural members. These tests range from reinforced concrete beams tested in shear and flexure—a database of 217 results from 16 studies was compiled by Tošić et al. (2016)—to RAC frames (Xiao et al., 2006), pushover (Pacheco et al., 2015) and shake-table (Xiao et al., 2012) tests of RAC structures. The conclusions of all these studies are very encouraging: if RAC is produced with the same strength as NAC, their structural behaviour (mainly ultimate strength) will be practically identical regardless of coarse RCA percentage in the mix. Silva et al. (2016) and Tošić et al. (2016) have studied the possibility of designing reinforced concrete beams in flexure and shear using Eurocode 2 provisions. The results are encouraging and point to a clear applicability of existing design codes for determining the ultimate flexural and shear strength of this type of RAC structural members.

2.6.2 Shrinkage and Creep of RAC

On a material level, shrinkage and creep of RAC have been relatively extensively studied, though not systematically and with widely varying approaches. The aim of researchers has been to identify ways in which RCA affects shrinkage and creep of RAC. One way this is achieved is through the stiffness of RCA since aggregate stiffness provides the major source of restraint to shrinkage and creep. Another important factor however, is the residual cement paste on RCA particles, part of which can be unhydrated. It can have a complex influence on these phenomena through its porousness, volume fraction, quality, etc.

Although shrinkage and creep, like other RAC properties, have not yet been codified, there exists a sufficient number of experimental results for a meaningful statistical analysis.

Shrinkage of RAC

Silva (2015) collected results on RAC shrinkage from 77 studies that included both fine and coarse RCA use. Generally, as with other mechanical properties, a RCA content lower than 30% had insignificant influence on shrinkage; but, when 100% coarse RCA was used, shrinkage of RAC was 10–110% greater relative to NAC (produced with a same *w/c* ratio) (Silva, 2015).

However, an important problem exists with all of these studies, and that is their duration. The problem of results being skewed toward shorter times is pronounced for NAC, as discussed in section 2.5.2, but even more so for RAC. In his analysis, Silva (2015) had to rely on measurements after only 90 days, which is insufficient to reach the 'leveling-off' of the shrinkage curve.

As expected, the use of dry RCA and absorption compensation was shown to produce better results than using pre-saturated aggregates (Leite, 2001; Ferreira et al., 2011).

An important study was carried out by Ajdukiewicz and Kliszczewicz (2002) in which the influence of parent concrete (used for producing RCA) was studied. Although a general increase in shrinkage of 10–30% compared with NAC was observed, no significant influence of parent concrete quality was detected. It should be noted however, that the parent concrete was a laboratory produced concrete, crushed at a relatively early age.

Also, not many studies have tested shrinkage and creep of RAC by separating them into their components – autogenous and drying shrinkage, and basic and drying creep. One notable exception are two studies (Gómez-Soberón, 2002; Goméz-Soberón, 2002) in which measurements were carried out for 270 days on sealed and unsealed specimens. Importantly, both components of shrinkage and creep were greater in RAC than companion NAC (produced with a same *w/c* ratio).

Silva (2015) also carried out a comparison of RAC shrinkage results with predictions by several models: EC2, ACI 209R-92, B3 (the previous version of the B4 model), MC99 (an intermediate between MC90 and MC10) and GL2000. As expected, all models displayed a degree of correlation to the results (R^2 between 0.55 and 0.66) with ACI 209R-92 providing the best fit of experimental data ($R^2 = 0.66$). Because the results initially couldn't provide information on whether their scatter was larger compared with NAC, the data was broken up into several ranges of RCA content (0–25%, 25–50%, 50–75% and 75–100%). Again, ACI 209R-92 was the most accurate.

Importantly though, all existing models were *more precise* in estimating RAC shrinkage than NAC shrinkage. An interesting explanation was offered by Silva (2015): since the existing models were calibrated on databases containing concretes as far back as 1953, 'it is possible that they were modeled after concrete materials exhibiting a worse shrinkage behaviour than that of present concrete mixtures'. Since RAC generally has greater creep than (modern) NAC, then the models are better at predicting RAC than NAC shrinkage. However, Silva (2015) also noted an 'increasing divergence and spread of data with time as comparison is made between the actual shrinkage data with that of a model's prediction'. This is the side of the story related to short measurement times. Existing models have been calibrated on databases with results from much longer measurement times (and weighted them accordingly) and hence, tend to be equally precise in predicting both short- and long-term shrinkage. The fact of the matter is that these models may predict short-term shrinkage of RAC better, but not long-term, which can be actually more important.

Another, recently published, comprehensive review of RAC shrinkage was carried out by Lye et al. (2016c). In it, the authors carried out a similar study to the one they did for the modulus of elasticity (Lye et al., 2016a). They first identified current conclusions and recommendations about RAC shrinkage by researchers and organizations and found that generally they estimate a 10–50% increase in shrinkage for RAC with 100% coarse RCA relative to companion NAC. After this, they carried out their own analysis and for results from 199 publications from 29 countries since 1978, found the average increase in shrinkage of RAC with 100% coarse RCA to be 33% relative to companion NAC; for a 20% coarse RCA content, the increase was 10% signifying RCA's importance even at low replacement levels (Lye et al., 2016c).

The authors then produced a useful diagram for an easy assessment of relative shrinkage of RAC with respect to NAC as a function of RCA content and compressive strength. The diagram is primarily intended for correcting Eurocode 2 shrinkage predictions. So, for example, for a 30 MPa compressive strength and a 100% coarse RCA content, the increase is almost 50% and it decreases with decreasing RCA content and increasing compressive strength (it is much more sensitive to RCA content) (Lye et al., 2016c).

Creep of RAC

The situation with existing results on RAC creep is relatively similar to shrinkage. Silva (2015) identified 11 studies dealing with this phenomenon and a wide variety of test conditions, loading ages and duration, specimen sizes, etc. Again, as with shrinkage, most of the time only unsealed specimens were tested. A further unknown and unexplained influence with RAC creep is the residual cement mortar – how much creep the parent concrete underwent during its service life can have an effect on the creep properties of RAC (Fathifazl and Razaqpur, 2013).

Because of the expected increase in creep with increasing RCA content, Silva (2015) studied the expected increase in RAC creep relative to companion NAC (produced with a same *w/c* ratio). According to his analysis, for RAC with 100% coarse RCA, the 95% upper confidence limit for increase in creep compliance (which is the most objective measure) relative to NAC was 81%; when looking at the creep coefficient and creep strain, this increase was 82% and 91%, respectively. From this, Silva (2015) proposed creep coefficient correction factors of 1.2, 1.4 and 1.8 for RAC with 20%, 50% and 100% of coarse RCA, respectively. These corrections are significantly greater than those proposed by RILEM (RILEM TC 121-DRG, 1994) which are 1.0 and 1.25 for RAC with up to 20% and 100% coarse RCA, respectively.

Just like the analysis of RAC shrinkage, Silva (2015) carried out comparison of RAC creep results with predictions made by EC2, ACI 209R-92, B3 , MC99 and GL2000 models. As with shrinkage, ACI 209R-92 showed the best accuracy of predictions, even after separating the data according to RCA content. The same explanation was offered: since the existing models were calibrated on data going back as far as 1936, 'it is possible that they were modeled after concrete materials exhibiting a worse creep behaviour than that of present concrete mixes'. Since RAC generally has greater shrinkage than (modern) NAC, then the models are better at predicting RAC than NAC creep (Silva, 2015). But, as for shrinkage, the explanation possibly has another side: existing models have been calibrated on databases with results from much longer measurement times (and weighted them accordingly) and hence, tend to be equally precise in predicting both short- and long-term shrinkage. Since existing RAC creep measurements are usually much shorter, it is possible that the models are indeed better at predicting short-term RAC creep, but not long-term creep.

Just like for RAC modulus of elasticity and shrinkage, Lye et al. (2016b) carried out a similar review of RAC creep. The authors first found current conclusions and recommendations about RAC creep by researchers and organizations and found that generally they estimate a 15–60% increase in creep for RAC with 100% coarse RCA relative to companion NAC whereas for low replacement percentages, e.g. 20%, no corrections are recommended. Then, they performed their own analysis and for results from 27 countries since 1984, found the average increase in creep of RAC with 100% coarse RCA to be 32% relative to companion NAC; for a 20% coarse RCA content, the increase was 20%, contrary to prior findings (Lye et al., 2016b).

The authors also made a diagram for an easy assessment of the necessary creep correction factor for RAC with respect to NAC as a function of RCA content and compressive strength. The diagram is primarily intended for correcting Eurocode 2 creep coefficient predictions. For example, for a 30 MPa compressive strength and a 100% coarse RCA content, the creep correction factor is approximately 1.4 and it decreases with decreasing RCA content and increasing compressive strength (Lye et al., 2016b).

As for modeling RAC creep, only a few authors had attempted to tackle this problem. Fan et al. (2014) presented a possible model for predicting the increase in RAC creep relative to companion NAC. The authors used the model presented by Neville (1995) and based on Equation 2.1, substituting shrinkage for creep. However, the authors' model is very intricate and has a downside of being based on companion NAC properties; hence, it is not a true 'design' model for RAC and won't be presented here in detail.

A more successful attempt, at least in the author's opinion, is the correction of the ACI 209R-92 model proposed by Fathifazl and Razaqpur (2013). In their proposal, the authors begin with eqs. (2.125) and (2.126) and introduce a new correction coefficient multiplying the ultimate creep coefficient: the RCA coefficient K_{RCA}.

The derivation of this coefficient starts from the fact that RCA has several influences on RAC creep: it increases the fines and air content of RAC and its residual cement paste has creep properties. Hence, 'the creep of RAC is a function of its residual mortar content and the extent of recoverable creep in that mortar' (Fathifazl and Razaqpur, 2013). Hence, the authors hypothesize that the coefficient K_{RCA} is comprised of two other coefficients representing the influences of these two parameters.

$$K_{RCA} = K_{RM} \cdot K_{RC} \tag{2.174}$$

In Equation 2.174, K_{RM} is the residual mortar coefficient and K_{RC} is the recoverable creep coefficient. The first coefficient is defined as

$$K_{RM} = \frac{\left[1 - V_{RCA} \cdot (-RMC + 1 + R)\right]^{\frac{2.4}{1.2+0.6\cdot\frac{E_{RAC}}{E_{NAC}}}}}{\left[1 - V_{RCA}\right]^{1.33}} \tag{2.175}$$

where V_{RCA} is the volume of coarse RCA in RAC, R is the volumetric ratio of fresh coarse natural aggregate to coarse RCA in RAC, E_{RAC} and E_{NAC} are the elastic moduli of RAC and NAC, respectively, and RMC is the residual mortar content of RCA defined as percent weight of residual mortar to the total weight of RCA.

The recoverable creep coefficient is given

$$K_{RC} = 1 - \beta \cdot K_t \cdot \left(\frac{V_{RCA} \cdot RMC}{1 - V_{RCA} \cdot (1+R)}\right)^{1.33} \tag{2.176}$$

where β is a coefficient between 0 and 1, corresponding to 100% and zero recoverable creep, and

$$K_t = \frac{t^{0.6}}{10 + t^{0.6}} \tag{2.177}$$

where t is the time in days after the application of sustained load.

The proposed approach was used by the authors to test the long-term behaviour of own cylindrical specimens of RAC, but produced with a different mixture proportioning method – the Equivalent Mortar Volume (EMV) method, based on targeting the same total mortar volume in NAC (only new mortar) and RAC (new and residual mortar) (Fathifazl et al., 2009). The results, although on a small number of results, showed that the K_{RCA} coefficient could be used to improve creep behaviour predictions of existing models.

2.6.3 Deflections of reinforced RAC beams

The deflections of full-scale reinforced RAC beams *per se* have not been the subject of many investigations. The study of their long-term behaviour under sustained loads has been identified by the author as the topic in only six experimental programmes (the results of which have been presented in more than six publications): (Maruyama et al., 2005; Sato et al., 2007; Ajdukiewicz and Kliszczewicz, 2011; Choi and Yun, 2013; Knaack and Kurama, 2015; Seara-Paz et al., 2016; Seara-Paz, 2015; Łapko and Grygo, 2010). The studies cover a period of approximately 10 years and, within them, 44 beams in total were tested. As a number of tests, 44 is not insignificant. However, as will be seen after briefly presenting these experiments, because of the sheer number of possible parameters that can be varied and the way in which tests can be designed and carried out, of these 44 tests, very few can be compared across different experimental programmes.

In order to complement these results, certain conclusions can be drawn from studies in which short-term flexural behaviour of reinforced RAC beams was studied. It was previously mentioned that a database of these results was compiled by Tošić et al. (2016). In some of the studies in the database, comments were made on cracking behaviour and cracking patterns, as well as short-term deflections under what the authors labeled as 'service load' (usually equal to approximately 40% of the beam's ultimate load).

The general conclusion of these studies on the short-term behaviour of RAC beams(Sato et al., 2007; Ajdukiewicz and Kliszczewicz, 2007; Ignjatović, 2013; Ignjatović et al., 2013), is that the crack spacing and crack widths of reinforced RAC beams are greater than in companion NAC beams, up to 30% and 70% in (Sato et al., 2007). Deflections under a short-term 'service load' level were found to be greater in RAC beams than in companion NAC beams in a wide range from 20% to 100% Ajdukiewicz and Kliszczewicz (2007). However, it is important to distinguish what is meant by 'companion NAC' in each experimental programme. Namely, in (Sato et al., 2007; Ajdukiewicz and Kliszczewicz, 2007) companion NAC is NAC produced with the same *w/c* ratio as RAC whereas in (Ignjatović, 2013; Ignjatović et al., 2013) companion NAC is NAC which has the same strength and workability as RAC.

Code predicted short-term 'service load' deflections (EC2 and ACI 209R-92) were within 10% of the measured deflections for both RAC and NAC beams (when the 'service load' bending moment is greater than the cracking moment) (Ignjatović, 2013). All of these results are indicative of the influence of RCA quality on the ITZ zone (for cracking) and their stiffness on the modulus of elasticity of RAC (for deflections).

’Time-dependent behaviour of reinforced recycled concrete beams’ (Maruyama et al., 2005)

This is the first experimental programme dealing with long-term behaviour of reinforced RAC beams under sustained loads. It was part of a broader study on the flexural behaviour of reinforced recycled beams, published by Sato et al. (2007).

In their experiment, the authors compared two NAC beams (’VC’) with two RAC beam made from both coarse and fine RCA (’CFRC’). The RCA itself was produced by crushing old laboratory concrete of known quality (made with *w/c* ratios of 0.45 and 0.63). The produced NAC and RAC (with a 0.6 *w/c* ratio) had significantly different 28-day compressive strengths: 36.4 and 21.4 MPa, respectively. The moduli of elasticity were also quite different but also generally low: 24.4 and 18.1 GPa for NAC and RAC, respectively.

A peculiar characteristic of the experiment was the second varied parameter, beside the concrete type – the ’curing’ type. Namely, two beams were stored and loaded under ’wet’ conditions, i.e. they were sealed with saturated paper at room temperature (it is unclear how often the paper was rewet), and the other two under ’dry’ conditions, i.e. they were exposed to room temperature after one week of wet curing.

The beams had a 150/200 mm cross-section and a 2800 mm span. They were loaded in four-point bending with a flexural span of 800 mm. The reinforcement ratio was 1.05% consisting of two ⊘13 mm bars with a yield stress of approximately 340 MPa. The experimental setup is shown in Figure 2.15.

The NAC and RAC beams were loaded after at the ’temperature adjusted concrete age’ of 21 and 25 days, respectively. The external force was applied using a tendon with screwing nuts. The load was equal to a force necessary for inducing a 100 MPa stress in reinforcement (as calculated for a cracked section) and it was monitored using a load cell and maintained for 380 days.

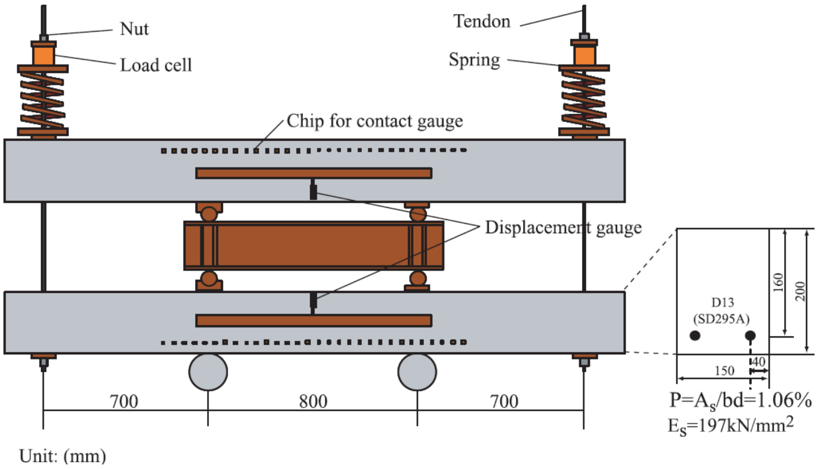


FIGURE 2.15: Setup for sustained loading test, (Sato et al., 2007)

Deflections and crack widths were measured. Deflection at midspan was measured using a displacement transducer with a 1/1000 mm precision. Chips for contact gauges, at intervals of 40 mm, were attached on the sides of beams at the same depth as the reinforcement in order to measure the crack width.

Rather than deflections, the authors plotted curvature determined from midspan deflection. For beams under 'wet' curing, there was practically no increase in curvature after loading whereas the beams under 'dry' conditions experienced an increase in curvature with the RAC beam's curvature being 1.8 times greater than the NAC beam's. Larger crack widths and smaller crack spacing was reported for RAC beams.

Overall, this experiment has an interesting concept of testing drying conditions. However, the execution of curing and the experiment overall, doesn't allow full interpretation or replication of the results. Also, basing the imposed load on reinforcement rather than concrete stress for concretes of different strengths, doesn't allow an easy comparison of results since the stress-to–strength-at-loading ratio ($\sigma_c/f_{cm}(t_0)$) will differ.

'Long term deformations of recycled aggregate concrete (RAC) beams made of recycled concrete' (Łapko and Grygo, 2010)

The results of this study were published in a conference proceeding and hence, do not offer much detail.

As part of a wider experimental campaign, Łapko and Grygo (2010) tested two reinforced concrete beams (one RAC and one NAC, of similar compressive strengths) as simply supported beams in four point bending under a constant load for 15 weeks.

The beams had a 120/200 mm cross-section and a 3200 mm span. The longitudinal tensile reinforcement consisted of 3⊘12 mm bars, the longitudinal compressive reinforcement of 2⊘10 mm bars and stirrups were ⊘6 mm bars. The constant value of the load was applied in the form of two concentrate forces located at the third-points of the span and kept for 15 weeks Figure 2.16.

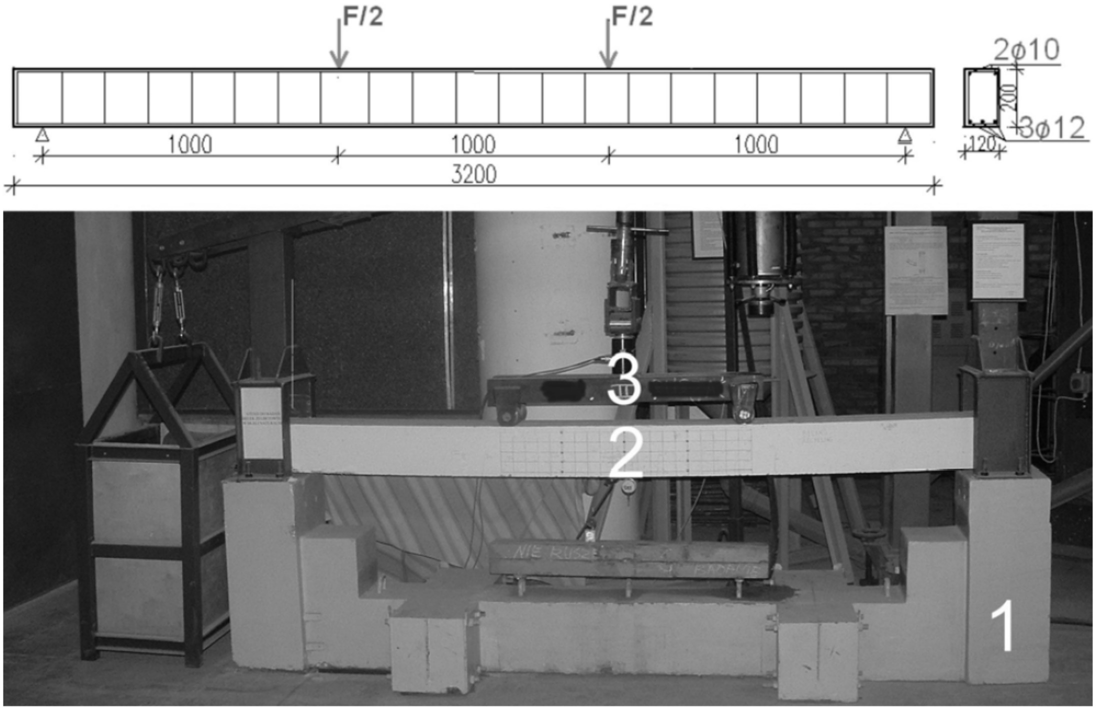


FIGURE 2.16: The view of the test stand showing the method of loading beams in natural scale: (1 – test stand, 2 – beam R-LT made of recycled aggregates, 3 – actuator loading the beam), (Łapko and Grygo, 2010)

Beside a graph plotting the results, only one comment is given that 'the differences between deflections of the two beams after 15 weeks of testing were about 20%' (Łapko and Grygo, 2010).

'Long-term behaviour of reinforced-concrete beams and columns made of recycled aggregate concrete' (Ajdukiewicz and Kliszczewicz, 2011)

The reinforced RAC beams tested under sustained loads by Ajdukiewicz and Kliszczewicz (2011) were a part of a wider programme (Ajdukiewicz and Kliszczewicz, 2002). The most important characteristic of it was the study of RCA quality influence on RAC properties. The authors first produced concrete from quartzite, granite and basalt natural aggregates; then, they crushed these concretes to produce coarse and fine RCA. Finally, nine concrete mixtures (and eventually beams) were designed, divided into three groups: (1) NAC with quartzite aggregates and RAC with only coarse, and fine and coarse RCA from original quartzite NAC (QNN, QRN and QRR, respectively); (2) NAC with granite aggregates and RAC with only coarse, and fine and coarse RCA from original granite NAC (GNN, GRN and GRR, respectively); and (3) NAC with basalt aggregates and RAC with only coarse, and fine and coarse RCA from original basalt NAC (BNN, BRN and BRR, respectively).

The QNN, QRN and QRR concretes had a compressive strength of around 43 MPa, the GNN, GRN and GRR concretes around 53 MPa and the BNN, BRN and BNN concretes around 100 MPa (within the three groups the strengths were very similar).

In the experimental phase, nine reinforced concrete beams were produced with a reinforcement layout shown in Figure 2.17. The sustained load was applied in third points of the beams with an intensity equal to 1/3 of each beams calculated flexural capacity. The beams were loaded with concrete blocks and the load was controlled using dynamometers. The load was sustained for 400 days when the beams were unloaded and monitored up to 480 days.

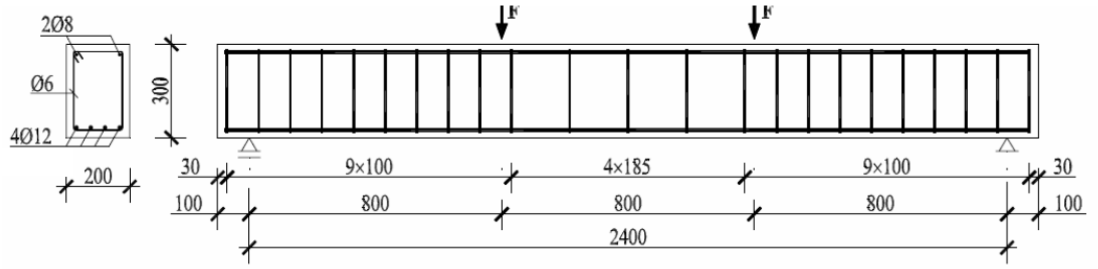


FIGURE 2.17: Dimensions, reinforcement and loading scheme of the beams in long-term tests, (Ajdukiewicz and Kliszczewicz, 2011)

The publication in which these results were published was a conference proceeding and hence, not much more information on the execution of the programme was provided.

Additionally, there are no numerical values of the measured deflections, only diagrams shown in Figure 2.18.

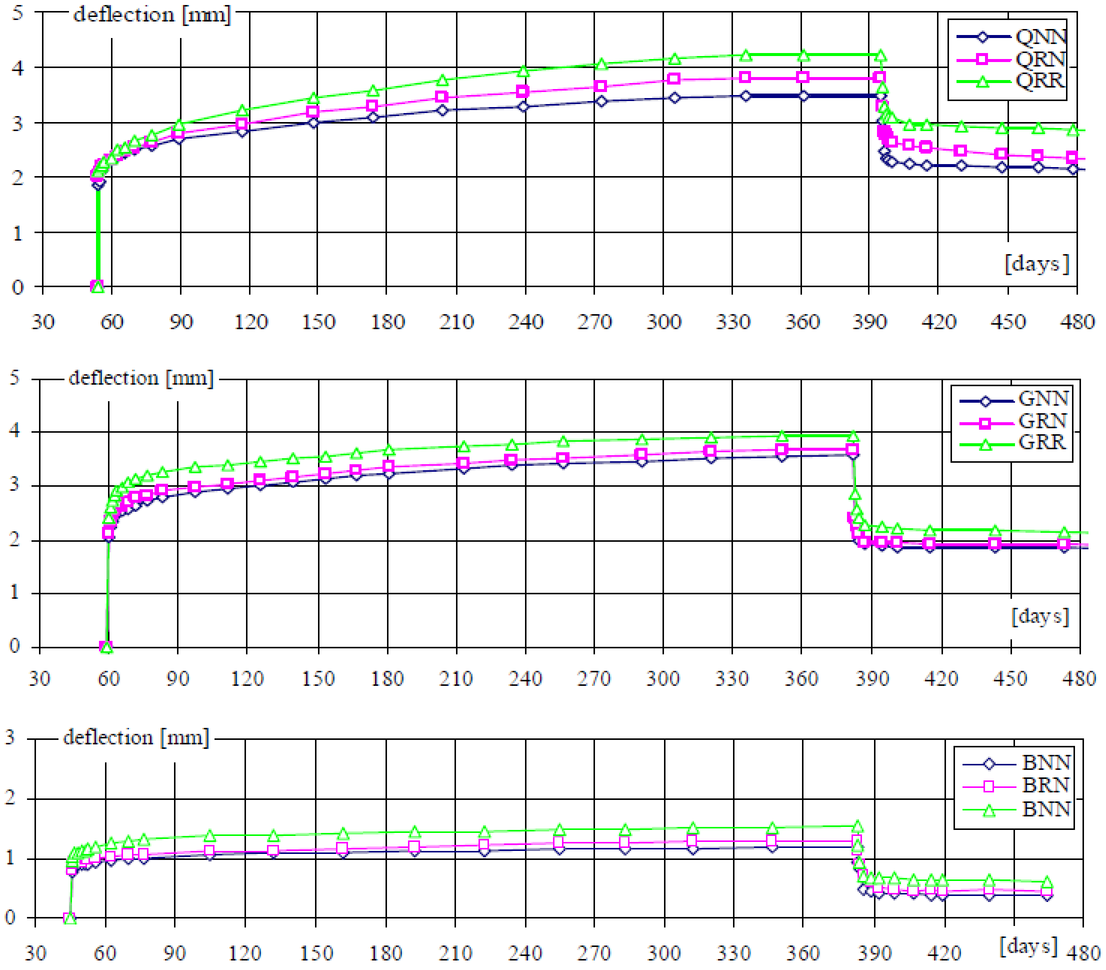


FIGURE 2.18: Results of long-term tests of beams with different contribution of recycled aggregate, (Ajdukiewicz and Kliszczewicz, 2011)

What little can be inferred from the diagrams is that for all three groups of concretes, deflections increase in the order of NAC, RAC with only coarse RCA and RAC with both coarse and fine RCA. Also importantly, the shapes of time curves are identical for all concretes, even though they are plotted in linear time scale.

’Long-term deflection and flexural behavior of reinforced concrete beams with recycled aggregate’ (Choi and Yun, 2013)

In this study from 2013, the authors used both fine and coarse RCA from demolished concrete structures in Daejeon, South Korea. Based on the water absorption results, the RCA was of great quality with coarse RCA having water absorption of 1.86% and fine RCA of 3.64%.

In total, three beams were tested: one NAC beam (C30-0.5ω), one RAC beam with coarse RCA (RL30-0.5ω) and one RAC beam with fine RCA (RH30-0.5ω). All concretes were produced for a target compressive strength f_{cm} = 30 MPa. C30-0.5ω and RL30-0.5ω beams were prepared with *w/c* = 0.45 and the RH30-0.5ω beam with *w/c* = 0.5. However, the achieved compressive strengths were 31.61 MPa for C30-0.5ω, 39.66 MPa for RL30-0.5ω and 36.10 MPa for RH30-0.5ω. The modulus of elasticity is reported as 26.25, 28.48 and 27.53 GPa for C30-0.5ω, RL30-0.5ω and RH30-0.5ω, respectively; unfortunately, no information about concrete tensile strength is given. Also, no information was given on the state in which RCA was used however, from the mix designe it can be seen that actually the water content was constant in all three mixes and the cement content varied.

The tested beams had a 170/200 mm cross-section and a 2000 mm span. They were reinforced with a 0.5% reinforcement ratio comprising 2$\oslash$10 mm bars in the tension zone. Compressive reinforcement consisted of 2$\oslash$6 mm bars and $\oslash$6 mm stirrups were used, spaced at 100 mm.

The beams were loaded to 50% of their ultimate load capacity for approximately one year (the loading age is unclear), Figure 2.19. The loading process lasted 2 h and after it was completed initial deflections and strains due to the superimposed load were recorded at the mid-span of each beam and monitored using linear variable differential transducers (LVDTs) and an electrical strain gauge installed at the mid-span to measure the tensile strain in reinforcement and compressive strain in concrete. The deflection and strains were monitored every day by a data logger and automatic data acquisition system. The crack length was measured and recorded simultaneously.

Important to note is that there were very large temperature variations during testing as the temperature even went below zero degrees Celsius (for almost 100 days) and up to 30°C. After approximately one year, the beams were unloaded and tested until failure in a universal testing machine.

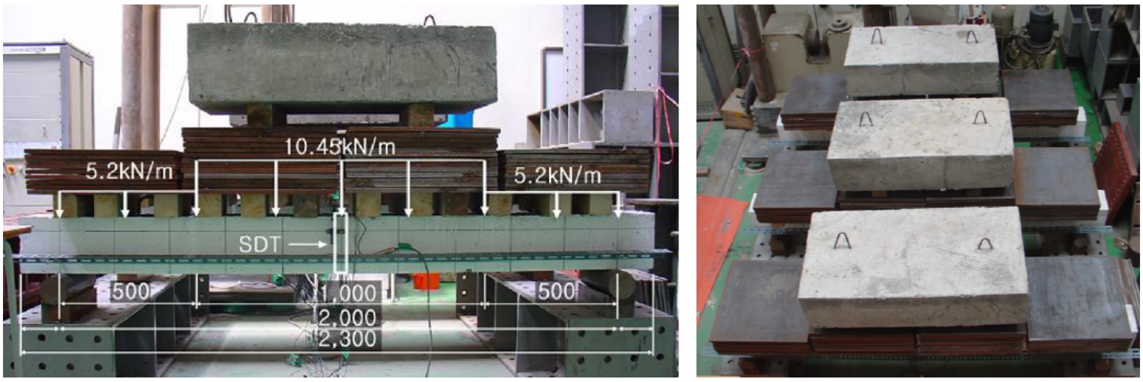


FIGURE 2.19: Schematic test set-up for sustained loading, (Choi and Yun, 2013)

As for the results, fewer cracks were observed in the C30-0.5ω beam but instantly after loading only one crack was visible in C30-0.5ω and two in RL30-0.5ω and RH30-0.5ω beams. Also, very small deflections were reached after 380 days: maximum for RH30-0.5ω was 2.29 mm from an instantaneous deflection of 1.18 mm; 2.10 mm for C30-0.5ω from 1.01 mm; 1.80 mm for RL30-0.5ω from 0.91 mm).

As for compressive strains in concrete (20 mm from beam top) and tensile strains in reinforcement, strange trends are observed with both strains simply linearly increasing with time in a linear time plot.

One of the major drawbacks of this experimental programme is definitely the uncontrolled temperature change and a low level of cracking observed in the beams. The 'strange' reinforcement strain results (their linear increase with time) and very poor agreement with ACI 209R-92 predictions (completely wrong shape of time curve) draw serious doubt upon the use value of these results for further analysis.

'Sustained service load behavior of concrete beams with recycled concrete aggregates' (Knaack and Kurama, 2015)

The experimental campaign by Knaack and Kurama (2015) is the most abundant one in results. In total, 18 reinforced beams were tested under sustained loads – 6 NAC and 12 RAC beams.

Only coarse RCA was used to replace 0, 50 and 100% of natural aggregate. RCA was sourced from a demolished concrete foundation of a late 1920s manufacturing plant in

South Bend, IN, USA. The water absorption of RCA was 6.06% and the residual mortar content 30.4%.

The three concretes (basically NAC, RAC50 and RAC100) were produced with a *w/c* ratio equal to 0.44, for a target compressive strength f_{cm} = 40 MPa, slump of 125±25 mm and air content 5.0±1.5%. Importantly, during mixing, over-saturated RCA was used and the excess water measured and taken into account. An air-entraining agent and high-range water reducing admixture were used as well.

The compressive strength of all the concretes varied relatively widely with f_{cm} for NAC between 33 and 50 MPa, for RAC50 between 38 and 50 MPa and for RAC100 between 36 and 49 MPa.

The 18 beams that were produced had a 150/230 mm cross-section and a 3700 mm span. There were two reinforcement layouts: the UT series had only tensile reinforcement and the UC and CC series also had compressive reinforcement and stirrups. The tensile reinforcement was the same for all series and consisted of 2⊘16 mm Grade 420 bars, while the compressive and transverse reinforcement in series UC and CC consisted of 2⊘10 mm Grade 420 bars and ⊘10 mm stirrups spaced at 95 mm, respectively. Six beams were cast in each series.

The cause for a distinction between series was the fact that series UT and UC were loaded with an imposed load that was designed not to induce immediate cracking, whereas the CC series was loaded with an imposed load such that there was immediate cracking of the beams. The beams were moist-cured under plastic sheeting for two days, and then removed from their forms to be stored inside the laboratory until testing.

Each beam was subjected to four-point bending using concrete blocks to simulate superimposed service loads for a period of at least 119 days, Figure 2.20. The weight of the concrete blocks was determined so that it corresponded to 75% of the cracking load for the UT and UC series and to 65% of the predicted linear creep limit load (ruled by $0.45 f_{cm}$) for the CC series. To apply the load, the blocks were first placed on four screw jacks, which were then lowered slowly and uniformly until the block touched down on the beam with little impact.

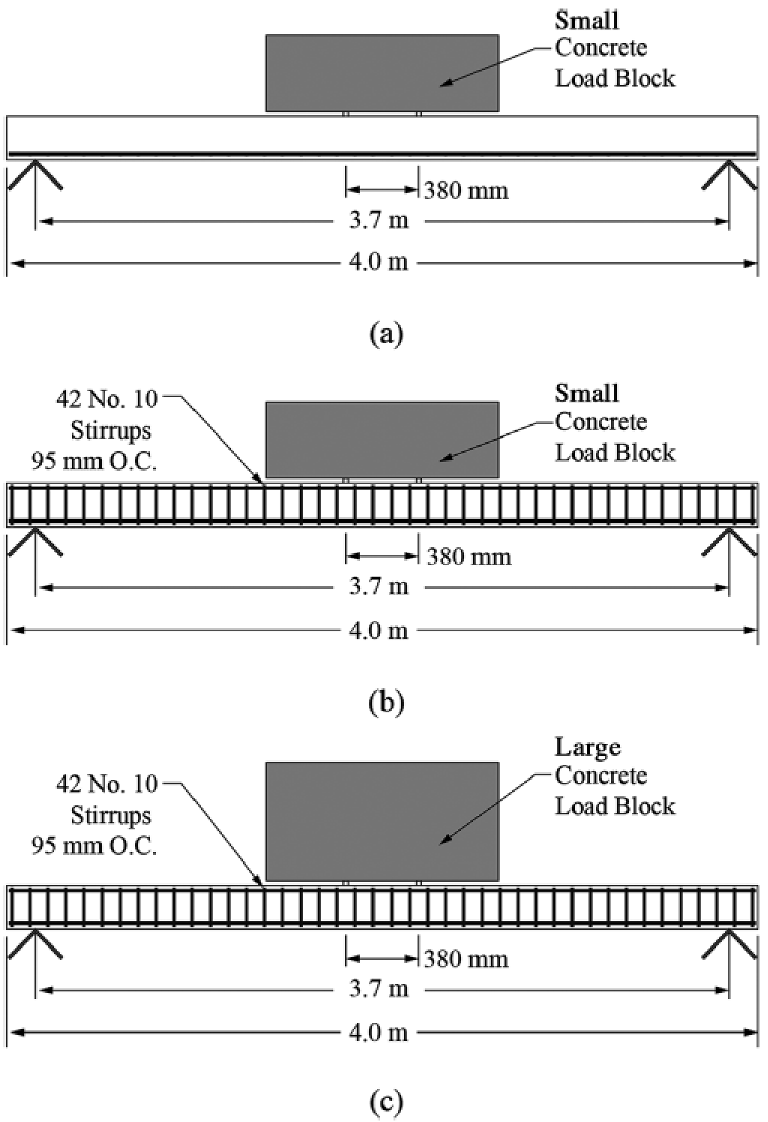


FIGURE 2.20: Beam test elevation: (a) UT series beams; (b) UC series beams; and (c) CC series beams, (Knaack and Kurama, 2015)

The testing was organized in three cycles with six beams being tested in each cycle: two NAC, RAC50 and RAC100 beams, one tested after 7 and the other after 28 days. These loading ages were selected since they are 'generally considered as standard for concrete testing' (Knaack and Kurama, 2015). The first two rounds of six beams were loaded for 119 days (approximately 4 months), and the last round of six beams was loaded for 170 and 226 days (approximately 5.5 and 7.5 months beginning at ages of t_0 = 28 days and 7 days, respectively).

The authors state that since the beams were stored indoors, only minor changes in temperature occurred and because all the beams from one set were tested simultaneously, they were under the same conditions and thus, comparisons are possible.

The beam midspan deflection was measured and recorded using a string potentiometer and a data logger. Strain readings were taken with a mechanical strain gauge with a gauge length of 152 mm on brass inserts which were placed along two vertical lines over the depth of the beam and spaced ±76 mm from the midspan. Each line consisted of eight brass inserts, with the top and bottom inserts placed 25 mm from the top and bottom of the beam, respectively, and 25 mm on center between adjacent inserts.

As for the results of this experimental programme, it was designed and executed in such a way that many conclusions can be drawn. The main drawback however, is the fact that the loading of two series of beams (UT and UC) was chosen so that it didn't induce immediate cracking in the beams but cracks did occur over time. This makes for a very difficult situation when predicting deflections using any model and isn't very representative of loading conditions of many reinforced concrete members. Another drawback is the relatively short period during which measurements were taken.

Nonetheless, what is observed is that an increase in the RCA content leads to increases in both the instantaneous and long-term deflections. This increase is greater for the 'uncracked' series (69% from NAC to RAC100) than for 'fully cracked' series (21%) because of the greater role of concrete in the transformed section.

The effects of compression reinforcement and loading age seem to be identical in NAC and RAC beams. The shape of the deflection time curves is identical and strain distribution is linear in all beams. Finally, a significant lowering of the neutral axis was observed over time. This lowering was more pronounced for higher RCA contents and it was smaller for beams loaded after 28 days.

'Time-dependent behaviour of structural concrete made with recycled coarse aggregates. Creep and shrinkage' (Seara-Paz et al., 2016)

This investigation belongs to the third phase of a long research project, whose main objective was to carry out a full study of structural recycled concrete (Seara-Paz, 2015). For the production of RAC, coarse RCA was obtained from the demolished concrete structures, with water absorption equal to 5.4%. Two series of concretes were produced with *w/c* ratios of 0.50 and 0.65, named H50 and H65, respectively. Each series comprised four types of concretes made with different replacement percentages of virgin coarse aggregate with RCA (20%, 50% and 100%); and NAC (0% replacement). Hence, eight mixtures were made: H50-0, H50-20, H50-50, H50-100, H65-0, H65-20, H65-50 and H65-100. It should be noted that RCA was saturated for 10 min prior to mixing to compensate for an estimated 80% of its water absorption. The achieved compressive strengths ranged from 60 to 43 MPa for H50 concretes (H50-0 to H50-100) and from 47 to 32 MPa for H65 concrete (H65-0 to H65-100).

In this experimental campaign, eight simply supported reinforced beams were tested. The beams had a 200/300 mm cross-section and were 3600 mm in length. The beams were loaded in four-point bending (the clear span was 3400 mm and the flexural span 850 mm) at the age of 42 days and the load was sustained for 1000 days. The beams were reinforced with 2⌀16 mm bars in the tension zone (reinforcement ratio 0.8%), 2⌀8 mm bars in the compression zone and ⌀8 mm stirrups spaced at 180 mm.

The beams were cured under wet burlap for 48 h and afterward stored in laboratory conditions. Temperature and relative humidity were monitored for the entirety of the test; mean temperature was 15°C and mean relative humidity 75% (relatively high, with maximum values of up to 90%.

The load was applied using a clever lever mechanism that allowed for a constant load, Figure 2.21. The load intensity was determined according to the concrete compressive strength and modulus of elasticity with an aim of obtaining a maximum compressive stress of $0.4 f_{cm}(t)$.

Simultaneously with beams, cylindrical specimens were tested for shrinkage and creep. The creep strains observed on the beams were lower than on cylinders because of the restraining effect of reinforcement; therefore 'it can be considered that beam strains are mainly attributed to creep effect, while shrinkage can be neglected' (Seara-Paz et al., 2016). While concrete prisms made with 20% and 50% of RCA showed an increase of 9–26%, those made of RAC with 100% replacement developed a specific creep (creep strain per unit of stress, $\varepsilon_{cr}/\sigma_c$) that is 51–84% higher than that of NAC. Higher creep

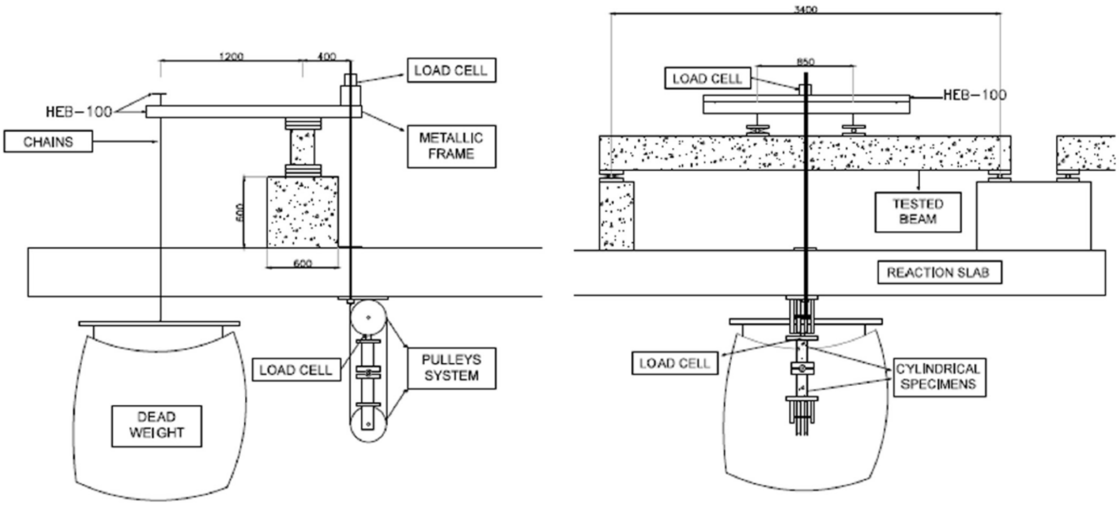


FIGURE 2.21: Test equipment under sustained load, (Seara-Paz et al., 2016)

is observed in RAC at early ages compared with NAC. As for deflections, *normalized* deflections (deflection at time *t* divided by the instantaneous deflection) increase with increasing RCA content. For NAC this increase after 1000 days is around 60–70% of the initial deflection while for RAC100 it is 120–150%. However, it should be kept in mind that because NAC and RAC were produced with the same *w/c* ratio, their moduli of elasticity were different – the modulus of elasticity of RAC100 was approximately 30% smaller than that of NAC.

2.7 High-volume Fly Ash Concrete

2.7.1 Introduction

According to World Bank data for 2013, 41.3% of electricity produced worldwide came from coal burning sources World Bank (2016); unfortunately, in Serbia this figure was 73.1%. After coal combustion in thermal power plants, a fine micron-sized powder remains, called fly ash, Figure 2.22; this residue is collected from the combustion gases before it is released into the atmosphere. Following from this, huge amounts of fly ash are generated worldwide. In Serbia for instance, there are six coal-burning power plants producing 6 million tons of fly ash every year with 200 million tons already landfilled. Global production of fly ash is estimated at approximately 900 megatons per year (Scrivener et al., 2016) and currently only one third is being used, mostly because of its very variable quality (since it is a waste material).

As can be seen from Figure 2.22, most of the fly ash particles are solid or hollow spheres. Their size can vary from less than one μm up to more than 100 μm, with a typical size of around 20 μm (Rashad, 2015); the specific gravity of fly ash can vary between 1900 and 2800 kg/m^3.

Fly ash mostly consists of silicon, aluminium, iron and calcium oxides with magnesium, sulphur, sodium, potassium and carbon being minor constituents (Rashad, 2015). Fly ash is typically classified as so-called class C or class F according to (ASTM-C618-12a, 2012). The classification is based on the sum of silicon, aluminium and iron oxide percentages with a minimum 70% for class F and 50% for class C. Class F fly ash is also called low-calcium with CaO contents under 10%. In Europe, the standard to which fly ash must conform—when used in concrete—is (EN 450-1, 2012).

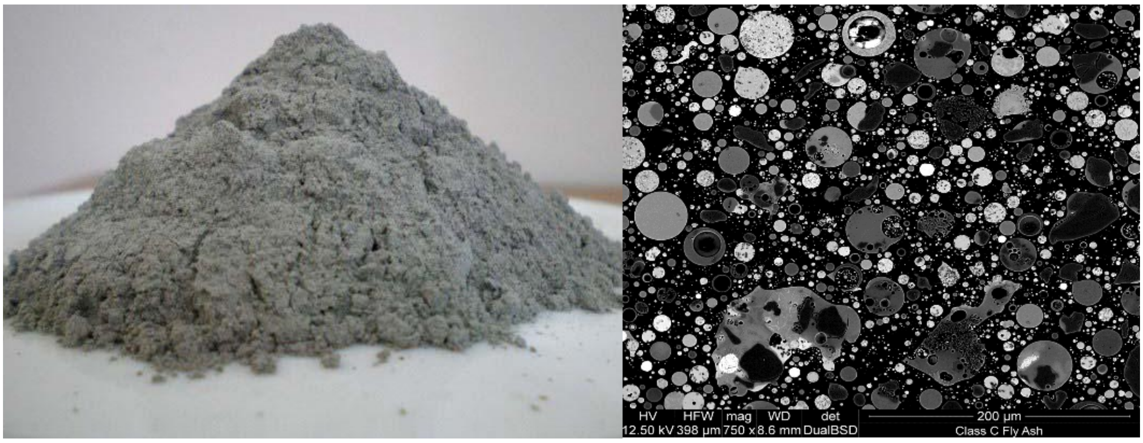


FIGURE 2.22: Fly ash sample (left) and scanning electron microscopy (SEM) image (right)

Dating back to the 1930s, fly ash had been used as a partial replacement of clinker in Portland cement, or as an addition in concrete to improve its durability, while also limiting the amount of early heat generation (Dragaš et al., 2016). A current trend is to attempt to replace high percentages of cement in concrete with supplementary cementitious materials, of which fly ash is the most abundant one globally. As explained earlier, concrete in which more than 30% of the total cementitious material is fly ash is called high-volume fly ash concrete or HVFAC. Research on HVFAC has generally taken one of three approaches starting from a reference NAC (Dragaš et al., 2016): (i) partial cement replacement, with the same water/cementitious material (*w/cm*) ratio in HVFAC as in the companion NAC, (ii) partial cement replacement, with a lower *w/cm* ratio in HVFAC than in NAC and (iii) partial aggregate replacement.

The high contents of fly ash in these concretes influence both the chemical reaction of cement hydration and its kinetics. As a pozzolan, fly ash influences cement hydration through the so-called pozzolanic reaction which occurs when fly ash is mixed with water, together with cement. In it, the glass phase silica (SiO_2) and alumina (Al_2O_3) progressively react with $Ca(OH)_2$ formed by cement hydration (mullite and quartz are ineffective), forming hydrates of calcium silicate (C-S-H):

$$Ca(OH)_2 + [SiO_2 + Al_2O_3] \longrightarrow \begin{cases} 3CaO \cdot 2SiO_2 \cdot 3H_2O \\ 3CaO \cdot Al_2O_3 \cdot 6H_2O \\ 3CaO \cdot Al_2O_3 \cdot 3CaSO_4 \cdot 32H_2O \end{cases} \tag{2.178}$$

This reaction reduces the $Ca(OH)_2$ content, which is deleterious for compressive strength, while at the same time, it increases the C-S-H gel which is responsible for the formation of the structure of the hardened cement. Therefore, in concrete containing fly ash, the hydration of cement forms the hardened structure, and the pozzolanic reaction of fly ash improves the structure, ensuring strength development for a long time (Hwang et al., 2004). The hydration products of the fly ash–cement mix are practically the same as those of Portland cement, under normal curing conditions, only the development of hydration products is much slower for low-calcium (class F) fly ash; for high-calcium (class C) fly ash it is about the same as in Portland cement under normal curing conditions (Wesche, 2004). For the effect of fly ash on C_3S hydration, there have been conflicting reports in literature (both acceleration and delay of hydration has been found), whereas for its effect on C_3A and C_4AF hydration, fly ash was generally found to slow down the reaction (Wesche, 2004).

The fineness of fly as is considered to be more important than its chemical composition in determining its reactivity and improving strength characteristics of mortars and concretes – finer material will dissolve and react faster in the liquid phase of the hydrating system; it has also been suggested that the reactivity of fly ash depends on the temperature at which the coal is burned rather than on the quality of coal (Wesche, 2004).

Stimulating the use of fly ash in concrete has its downsides as well. Burning coal to produce electricity is by far the largest source of anthropogenic CO_2 and in some countries coal fired electricity production is being phased out (Scrivener et al., 2016). Also, since fly ash is a by-product/waste, its availability varies regionally. Originally, they were sold at a low price, thereby reducing the cost of cement. This is now changing in many regions due to heightened demand (Scrivener et al., 2016). They also were considered to be CO_2 free, but allocation of environmental loads is now under discussion. This could be detrimental for stimulating its increased use (Marinković et al., 2016).

As for how much cement can actually be replaced with fly ash, there is no prescribed limit. However, (EN 206-1, 2000) does introduce a limit as to how much fly ash can be taken into account for the 'binder potential' of HVFAC. This is done through the 'k-value' concept which limits the 'active' fly ash in HVFAC to 33% of the cement amount (EN 206-1, 2000).The k-value concept is used to replace the *w/c* ratio with the water/(cement+k·fly ash) ratio, where the k-value depends on the cement type (Dragaš et al., 2016). The minimum cement content is corrected by taking into account the fly ash content needed to give the required durability. As a result, the amount of fly ash used as a direct replacement of cement is generally around 25-–30%. Research has shown that with these cement replacement levels, the compressive strength at all ages is similar to or slightly lower than that of the companion NAC (Dragaš et al., 2016).

Because of its widely varying availability and properties, although many studies on HVFAC have been carried out, systematising, analysing and comparing all of this research is a difficult, if not impossible task. Rashad (2015) carried out a comprehensive literature review on some of the most important mechanical and durability-related properties of HVFAC. However, all that was possible through this kind of review was a listing of studies and short commentary on the results; no deeper analysis was possible. Nonetheless, such a literature review is valuable.

The main characteristic of HVFAC is caused by the pozzolanic properties of fly ash and its speed compared with cement hydration: 45–55% of fly ash in paste (fly ash + cement + water) mixtures causes a lower degree of reaction (almost 80% of fly ash particles don't react in the first 90 days) (Rashad, 2015); HVFAC will exhibit lower early-age strengths compared with companion NAC (Dragaš et al., 2016); however, a lower heat of hydration is an advantage of HVFAC.

Studying compressive strength, Rashad (2015) divided HVFAC into three categories: 45–55% of fly ash, <60% and <70% of fly ash in the total cementitious materials. There was a definite reduction in compressive strength compared with companion NAC (produced with the same **w/cm** ratio) and it reached 25–55% after 7 days and 8–20% after 90 days for HVFAC with 45–55% of fly ash in the total cementitious materials; around 40% after 28 days and 25–30% after 90 days for HVFAC with < 60% of fly ash in the total cementitious materials; and 50–60% after 28–90 days for HVFAC with < 70% of fly ash in the total cementitious materials.

One of the ways to obtain higher compressive strengths is to reduce the *w/cm* ratio of HVFAC compared with the companion NAC. Research has shown that similar or higher compressive strength of HVFAC can be achieved by decreasing the *w/cm* ratio and through the use of superplasticizers which is necessary in the range of 0.2–3.0% of total cementitious materials (Dragaš et al., 2016).

Similar to compressive strength, reductions in HVFAC tensile strength compared with companion NAC produced with the same **w/cm** ratio, both flexural and splitting, and modulus of elasticity were also found (Rashad, 2015). For tensile strength they were in the range of 35–45% after 28 days for HVFAC with 45–55% of fly ash and reduced to 20–35% after 90 days. The decrease of the modulus of elasticity was found to be between 10% (after 90 days and for lower fly ash contents) and 60% (after seven days and higher fly ash contents).

Finally, another very interesting possibility for using fly ash in concrete is a partial replacement of fine aggregate. In many experimental investigations this was shown to benefit practically all HVFAC mechanical properties, mostly because of a finer packing density (Dragaš et al., 2016).

However, a very important parameter in the development of HVFAC mechanical properties is the curing regime. This is evidenced by a study carried out by Ramezanianpour and Malhotra (1995), in which four different curing regimes were applied to several concrete mixes containing, among others, NAC and HVFAC and compressive strength was monitored until 180 days. One curing regime was standard moist curing after demoulding, the second was curing at room temperature after demoulding, the third was curing at room temperature after two days of moist curing and the fourth was curing at 38°C and 65% RH.

The NAC (RA1 in the experiment) had 372 kg/m^3 of cement and a 0.5 *w/c* ratio, one HVFAC (RA4) had 92 kg/m^3 of fly ash and 280 kg/m^3 of cement and a 0.5 *w/c* ratio and another HVFAC (RA5) had 216 kg/m^3 of fly ash and 156 kg/m^3 of cement and a 0.35 *w/c* ratio. For practical purposes, the differences between the first three curing regimes are of interest.

Compared with the first curing regime of moist curing, the NAC had a 17% and 5% lower 28-day compressive strength under the second and third curing regime, respectively. For HVFAC with less fly ash (RA4), these percentages were 27% and 5% respectively, and for the HVFAC with more fly ash 35% and 14%. Even more importantly, for NAC the increase in compressive strength between 28 and 180 days was 25% for moist curing but only 10% and 7% under the second and third curing regime, respectively. For HVFAC with less fly ash and under standard curing this increase was 41% but only 9% and 11% under the second and third curing regime, respectively. For HVFAC with more fly ash and under standard curing this increase was 38% but -8% and 6% under the second and third curing regime, respectively! These kind of results have prompted researchers to recommend at least seven days of moist curing when high amounts of fly ash are used (Thomas, 2007).

As for durability-related properties, fewer studies are available. Nonetheless, a decreased carbonation resistance can be noticed in HVFAC with increasing fly ash contents (Rashad, 2015). For chloride ion permeability, there seems to be a positive effect of the presence of fly ash in the paste matrix. This reduction in permeability can cause an improvement in long-term durability and resistance to various forms of deterioration. The addition of fly ash also results in considerable pore refinement (Rashad, 2015). Finally, for freezing and thawing, according to available studies it can be concluded that there is no apparent difference between HVFAC and companion NAC (Rashad, 2015).

2.7.2 Shrinkage and Creep of HVFAC

Although a relatively large number of studies on shrinkage and creep of HVFAC had been carried out in the past, until recently there was little work on trying to model its long-term behaviour. As with other mechanical properties, so too for shrinkage and creep, the large variability of fly ash leads to difficulties in comparing results from different experimental campaigns. Another potential problem is that often, not only HVFAC is investigated but also concretes with other supplementary cementitious materials such as slag, and sometimes even ternary mixtures (cement + fly ash + slag). Hence, the focus can often be on a more general 'high-volume supplementary cementitious material concrete' rather than simply HVFAC.

Some general conclusions can however be drawn from the available literature. From the literature review in (Rashad, 2015), the author studied drying shrinkage and generally found a decrease in free drying shrinkage with the increase of fly ash content – up to a 50% decrease for a 50% fly ash content. The author posits that the inclusion of high volumes of fly ash in the matrix reduced the water demand of HVFAC, and produced a finer paste structure, and as a result the loss of pore water within the paste system was restricted and consequently the drying shrinkage reduced (Rashad, 2015).The lower shrinkage of HVFAC compared with companion NAC was also explained as a result of reduced cement paste content and a lower amount of hydrated paste (caused by the slower pozzolanic reaction) (Atiş, 2003).

As for creep, similar trends are expected. However, complex interactions with a different compressive strength development compared with NAC can be expected, e.g. when comparing HVFAC and companion NAC proportioned to have the same strength *at the time of loading*, HVFAC will exhibit lower creep due to the larger increase in compressive strength (ACI Committe 232, 1986). Comparing creep behaviour with code predictions, e.g. for HVFAC with 50% of fly ash loaded after 28 days and sustained under load for 180 days, significant underestimation of creep behaviour using the EC2 model has been reported (Dragaš et al., 2016). This is in line with previous studies and has led Chen et al. (2017) to formulate a correction of the EC2 model for 'concretes with high volumes of supplementary cementitious materials' or SCM concretes.

The authors were primarily interested in concrete-filled steel tube (CFT) columns which are an interesting application for HVFAC because they successfully solve the problem of lower early strengths (Chen et al., 2017). In order to develop a full improvement of the EC2 model, the authors also introduced corrections into equations predicting the time development of compressive strength and the modulus of elasticity. The models were validated using a database of experimental results and two full-scale CFT columns with SCM concrete that were tested under sustained loading. After this, a parametric study was conducted. One of the major factors influencing SCM concrete creep was identified as the 'binder ratio': $C/(S+A)$ or $CaO/(SiO_2+Al_2O_3)$ (taken as the total amount in fly ash and cement). The results of the final parametric study indicated that SCM concretes with a $C/(S+A)$ ratio greater than 0.5 behaved similarly to NAC (Chen et al., 2017).

The database compiled by Chen et al. (2017) contains results from 18 experimental programmes with SCM concretes (13 of which are purely HVFAC studies) and includes the following main parameters:

- sealed and unsealed specimens,
- cement replacement levels between 0 and 60% with fly ash,
- cement replacement levels between 0 and 80% with slag,
- cement replacement levels between 0 and 90% of cement with blended fly ash and slag,
- water-cementitious material (*w/cm*) ratios ranging from 0.21 to 0.66,
- age at loading (t_0) from 7 to 149 days, and
- initial load normalized by (28-day or initial) strength (n_c) ranging from 0.20 to 0.60.

As a first step, the authors evaluated the modulus of elasticity of SCM concretes using the default EC2 equation to test results from nine studies:

$$E_c(t) = \beta_{cc}^{0.3}(t) \cdot E_{cm} \tag{2.179}$$

with $\beta_{cc}(t)$ being the compressive strength time development coefficient given by

$$\beta_{cc}(t) = exp\left[s\cdot\left(1-\sqrt{\frac{28}{t}}\right)\right] \tag{2.180}$$

where s is a coefficient dependent on the cement type.

$$s = \begin{cases} 0.20 & \text{for cement classes CEM 42.5R, CEM 52.5N and CEM 52.5R} \\ 0.25 & \text{for cement classes CEM 32.5R and CEM 42.5N} \\ 0.38 & \text{for cement class CEM 32.5N} \end{cases} \tag{2.181}$$

Comparing the EC2 predictions for $E_c(t)$ with the database results, Chen et al. (2017) found that 80% of the results fell within ±20% of the EC2 predictions. Building upon the known importance of the $C/(S+A)$ ratio for the rate of the pozzolanic reaction, the authors proposed a correction of the EC2 predictions in the following form:

$$E_c(t) = \beta_E(t)\cdot E_{cm} \tag{2.182}$$

with $\beta_E(t)$ now being a completely new time development coefficient for the modulus of elasticity.

$$\beta_E(t) = \left\{exp\left[s\cdot\left(1-\sqrt{\frac{28}{t}}\right)\left(-1.60\cdot\frac{C}{S+A}+5.26\right)\right]\right\}^{0.3} \tag{2.183}$$

A new comparison made using Equation 2.182 showed an improved accuracy of the predictions with a mean value of 0.99 and a coefficient of variation of 0.14 (Chen et al., 2017).

Compressive strength was evaluated using results from five studies and the default EC2 prediction:

$$f_c(t) = \beta_{cc}(t)\cdot f_{cm} \tag{2.184}$$

with $\beta_{cc}(t)$ given by Equation 2.180.

The authors investigated the correlation between compressive strength and the $C/(S+A)$ ratio and found that $\beta_{cc}(t)$ decreased with increasing $C/(S+A)$ ratios for ages under 28 days and increased with increasing $C/(S+A)$ ratios for ages over 28 days (Chen et al., 2017). Hence, an improved formula was proposed:

$$f_c(t) = \beta_C(t) \cdot f_{cm} \tag{2.185}$$

with $\beta_C(t)$ being a new time development coefficient for compressive strength.

$$\beta_C(t) = exp\left[s \cdot \left(1 - \sqrt{\frac{28}{t}}\right)\beta_{cc}\left(\frac{C}{S+A}\right)\right] \tag{2.186}$$

where $\beta_{cc}\left(\frac{C}{S+A}\right)$ is given by

$$\beta_{cc}\left(\frac{C}{S+A}\right) = \begin{cases} -0.38 \cdot \frac{C}{S+A} + 2.12 & t \; < \; 28\,days \\ -1.15 \cdot \frac{C}{S+A} + 3.7 & t \; > \; 28\,days \end{cases} \tag{2.187}$$

The accuracy of the new equations was tested on data that wasn't used for their calibration. The mean value of the predicted results divided by the measured was 1.00 and the coefficient of variation was 0.15 (Chen et al., 2017).

Finally, creep was evaluated on 69 results from seven studies. The experimentally studied variables included sealed and unsealed curing conditions, compressive strength (22–62 MPa), age at first loading (t_0) (7–90 days), and initial stress levels (n_c) (0.23–0.34). The replacement ratios were 12–58% with fly ash, 4.5–68% of slag and up to 50% of slag plus fly ash. Comparison with EC2 predictions showed that the EC2 model tended to overestimate the creep of SCM concretes since over 60% of the calculated values exceed the ±30% limit (Chen et al., 2017).

As a result, the authors modified the EC2 model and again compared them to the database results. The starting point for the modifications was the study of the influence of the $C/(S+A)$ ratio and *w/cm* ratio on SCM concrete creep; previous studies revealed that a lower *w/cm* ratio results in a more compact ITZ between SCMs and cement paste, which decreases the creep of SCM concretes (Chen et al., 2017). Plotting relationships ϕ_{test}/ϕ_{EC2} to $C/(S+A)$ and to the *w/cm* ratio led to the following modifications of eqs. (2.95) and (2.96):

$$\phi(t,t_0) = \phi_{RH} \cdot \beta(f_{cm}) \cdot \beta(t_0) \cdot \beta\left(\frac{C}{S+A}\right) \cdot \beta\left(\frac{w}{cm}\right) \cdot \beta_c(t,t_0) \tag{2.188}$$

$$\beta\left(\frac{C}{S+A}\right) = 0.17 \cdot \frac{C}{S+A} + 0.87 \tag{2.189}$$

$$\beta\left(\frac{w}{cm}\right) = 0.74 \cdot \frac{w}{cm} + 0.37 \tag{2.190}$$

When looking at the modified predictions, for all the results, a mean value of the predicted results divided by the measured results was 0.99 and the coefficient of variation was 0.16 (Chen et al., 2017).

The obtained results are a promising indication that the long-term behaviour of SCM concretes—at least on the material level—can be successfully predicted using existing models.

2.7.3 Deflections of reinforced HVFAC beams

Research on the deflection and long-term behaviour of reinforced HVFAC is probably the most lacking in the field of structural HVFAC application. So far, research has mostly concentrated on short-term flexural and shear strength. In a few of those investigations, observations have been made about the cracking and deflection behaviour of these beams.

Arezoumandi et al. (2013) investigated, in a very large experimental programme, the shear strength of reinforced HVFAC beams made with class C fly ash that represented 70% of the total cementitious materials in two different concretes. Eight beams were made from each of these two concretes and they were tested in shear with varying transverse and longitudinal reinforcement ratios.

A comment was made by the authors that 'in terms of crack morphology, crack progression, and load–deflection response, the behaviour of the both the HVFAC-H and HVFAC-L (the two concrete types) beams was virtually identical' (Arezoumandi et al., 2013).

Soman and Sobha (2014) tested the flexural behaviour of reinforced HVFAC beams with 50% of class F fly ash. The mix contained 200 kg/m^3 of cement and 200 kg/m^3 of fly ash. HVFAC and companion NAC both had a compressive strength of around 47 MPa after 28 days and similar moduli of elasticity and splitting tensile strengths.

The beams had a 100/150 mm cross-section and a 1200 mm and so, can't really be considered to be full-scale (making conclusions about anything related with a size effect very difficult). The beams were tested in four-point bending until failure. The authors noted smaller deflections for HVFAC beams at all load levels, smaller crack spacings and smaller crack widths (Soman and Sobha, 2014).

Yoo et al. (2015) tested a series of reinforced concrete beams in flexure with 0%, 35% and 50% of fly ash, various tensile reinforcement ratios and different compressive strengths. The authors observed that 'the deflection, strain, crack load, yield load and ultimate load observed in the members were seen to be practically indifferent to the content in fly ash since the structural behavior of the test members with fly ash replacement ratio of 35% and 50% was quasi-similar to that of the members without fly ash' (Yoo et al., 2015). A slight increase in deflections of HVFAC beams was explained by the fact that because of its smaller density, HVFAC has a smaller modulus of elasticity and hence, slightly larger deflections.

As for long-term tests of reinforced HVFAC beams under sustained loads, the author of this thesis could identify only two studies: (Luo et al., 2006) and (Liu et al., 2008).

Unfortunately, (Luo et al., 2006) is in Chinese and was not available to the author, except for the abstract which is given in its entirety:

Using the construction of the railway between Luoyan and Zhanjiang as background, based upon the experimental results of shrinkage and creep of eight non-glued concrete beams with different mixtures of high-performance fly ash, the shrinkage, creep and camber of beams with different mixtures of high-performance fly ash concrete under long-term loadings are investigated. The effects of the environmental factors such as temperature, humidity are also explored, the experimental results over 300 days indicate that the non-glued concrete beams with 20–40% high performance fly ash not only have better workability and mechanical properties, but also exhibit better long-term performance. Compared with concrete beams of same strength but without fly ash, they have higher late-stage strength and compressive elastic modulus, lower shrinkage and less creep with desirable social and economic profitability.

The other study, (Liu et al., 2008), is in English, however, its results are not in fact very useful. The experimental programme carried out by the authors included six self-compacting reinforced concrete (SCC) beams and three 'normally vibrated' reinforced concrete beams. All of the mixtures contained 396 kg/m^3 of cement and 180 kg/m^3 of fly ash (31% of total cementitious material). Ultra-pulverized fly ash produced by the Electric Plant of Xiangtan city in Hunan province was used. Out of the six SCC beams, three were simply supported, two were ’shrinkage’ beams and one was a two-span continuous beams. Out of the three ’vibrated’ beams, two were simply supported and one was a ’shrinkage’ beam. Unfortunately, in all of the beams the reinforcement ratio was also varied.

The test setup is shown in Figure 2.23. The deflections at midspan and support of the beams were measured by a dial gauge with a precision of 0.01 mm and the concrete strain at the level of reinforcement was measured by a dial gauge with a higher precision of 0.001 mm (Liu et al., 2008). Relative humidity was kept constant by a dehumidifying machine. The test was started on January 26, 2005 and lasted for 540 days. The temperature in the laboratory however, varied between 5°C and 35°C.

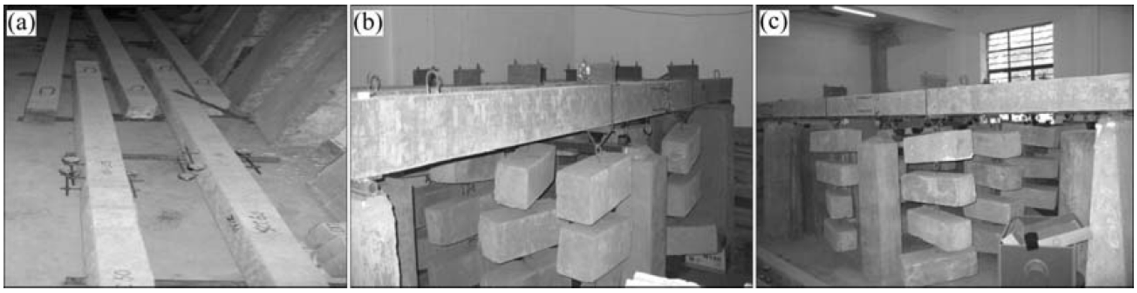


FIGURE 2.23: Test setup of long-term experiment: (a) Shrinkage beam; (b) Simply supported beam; and (c) Continuous beam, (Liu et al., 2008)

As can be seen from such a description, there were simply too many parameters varied in nine beams (’vibration type’, reinforcement, statical system, etc.). Additionally, no companion NAC was produced nor were code comparisons made. Hence, the presented results are of little value for further investigation.

2.8 Summary

This chapter presented a review of current knowledge and understanding of several phenomena important for long-term behaviour of reinforced concrete members under sustained loads.

First, two properties specific to concrete—shrinkage and creep—were briefly presented. Both processes were shown to be tied to microstructural changes in concrete over time and to the movement of water within concrete. Other influencing factors such as aggregate stiffness and ambient conditions were briefly mentioned. Additionally, newest research and findings on these topics, such as nanoindentation tests on C-S-H, were also presented.

Deflections of reinforced concrete members and approaches to their calculation were discussed afterward. The changes in members' stiffness caused by cracking were presented and European and North American traditions in estimating their curvatures were explained. Other influencing factors on deflections of reinforced concrete members were also introduced, such as the geometrical properties of the member, moduli of elasticity of concrete and reinforcement, concrete tensile strength, shrinkage and creep.

Next, models currently available for shrinkage, creep and deflection calculation were presented. First, databases on concrete shrinkage and creep and on long-term behaviour of reinforced concrete beams under sustained loads were discussed. It was explained how these two databases were compiled, what information they contain and what are some of their drawbacks, e.g. bias toward shorter testing times. Second, models for calculating and predicting concrete shrinkage and creep were given. These were the B4, MC10, EC2, ACI 209R-92 and GL2000 models. Their formulation, advantages and drawbacks were presented. Finally, two families of models for calculating and predicting deflections of reinforced concrete members were given: the European tradition of models (with the latest installments being MC10 and EC2) and the North American tradition of models (with the latest installments being ACI 318 and ACI 435R).

In the following section, a literature review was elaborated on RCA and RAC. The main reasons in favour of CDW recycling were given and some important properties of RCA presented. A review on the observed influence of RCA on basic mechanical RAC properties was laid out. A discussion on the shrinkage and creep of RAC was presented in more detail with a special look on proposed corrections of existing prediction models. Finally, experimental programmes dealing with the long-term behaviour of reinforced RAC beams under sustained loads was presented. Test setups and concepts as well as results were discussed.

In the last section of this chapter, HVFAC was studied. First, an overview of global fly ash production and use was given and then its use in HVFAC was discussed. From a literature review, the main properties of HVFAC and differences compared with NAC were presented. For a more in-depth analysis, a newly proposed model for creep prediction of HVFAC was outlined. In the end, some results from short- and long-term tests on reinforced HVFAC beams were presented.

Chapter 3

Experimental Programme – Long-term Behaviour of Reinforced Concrete Beams Under Sustained Loads

3.1 Scope of the Experimental Programme

In this thesis, the long-term behaviour of reinforced concrete beams made from recycled and waste materials, under sustained loads, was tested and compared with beams made from traditional NAC. The recycled materials used were coarse RCA and the waste material was fly ash.

Three concrete mixtures were prepared—NAC, RAC with 100% coarse RCA and HVFAC with a 1:1 cement:fly ash ratio. First, the material properties of the component materials were determined. This included assessing aggregate, fly ash and cement properties such as density and water absorption.

Second, all three mixtures were designed and their rheological and mechanical properties were verified experimentally. The mixtures were proportioned in such a way as to possess approximately the same workability and compressive strength. For workability, an initial slump of 100–150 mm and a slump of 50–90 mm after 30 min were targeted. As for compressive strength, the aim was a mean value of 35 MPa after 28 days on a 100 mm cubic sample.

Finally, six 3.2 m-span simply supported reinforced concrete beams were made from all three concrete mixtures and loaded in four-point bending with a sustained load at ages of 7 and 28 days (two beams made from each concrete mixture).

The load was applied for 450 days and it was determined by adopting a fixed stress–to–strength-at-loading ratio ($\sigma_c/f_{cm}(t_0)$) for all beams loaded at the same age. This ratio was chosen to be 0.45 in the case of beams loaded after 28 days; this is the limit provided by Eurocode 2, below which the linear theory of creep is assumed to apply (EN 1992-1-1, 2004). For the beams loaded after seven days, this ratio was chosen as 0.60; this value is provided by MC10 as the upper value for which the effect of high stresses on creep can be accounted for by its model (FIB, 2013). Additionally, although the beams loaded after seven days would initially display non-linearity in creep behaviour, the increase in compressive strength from 7 to 28 days and creep itself would gradually decrease the $\sigma_c/f_{cm}(t)$ ratio; using Eurocode 2 relations for the time evolution of compressive strength and creep, it was calculated that after 28 days the $\sigma_c/f_{cm}(t)$ ratio would decrease to approximately 0.45.

On all the beams, deflections, concrete and reinforcement strains were measured. Accompanying specimens for mechanical properties, as well as shrinkage and creep were also prepared and tested.

3.2 Material Properties of Component Materials

3.2.1 Natural Aggregate

The natural aggregate (NA) used in this experiment was a commercially available river aggregate—both sand and gravel—’Dunavac’ aggregate from an excavation site on the Danube river in the vicinity of Belgrade. The aggregate was purchased from Gradient d.o.o., Belgrade.

The aggregate was obtained in three distinct particle sizes:

- fraction I (0/4 mm) – sand
- fraction II (4/8 mm) – gravel
- fraction III (8/16 mm) – gravel

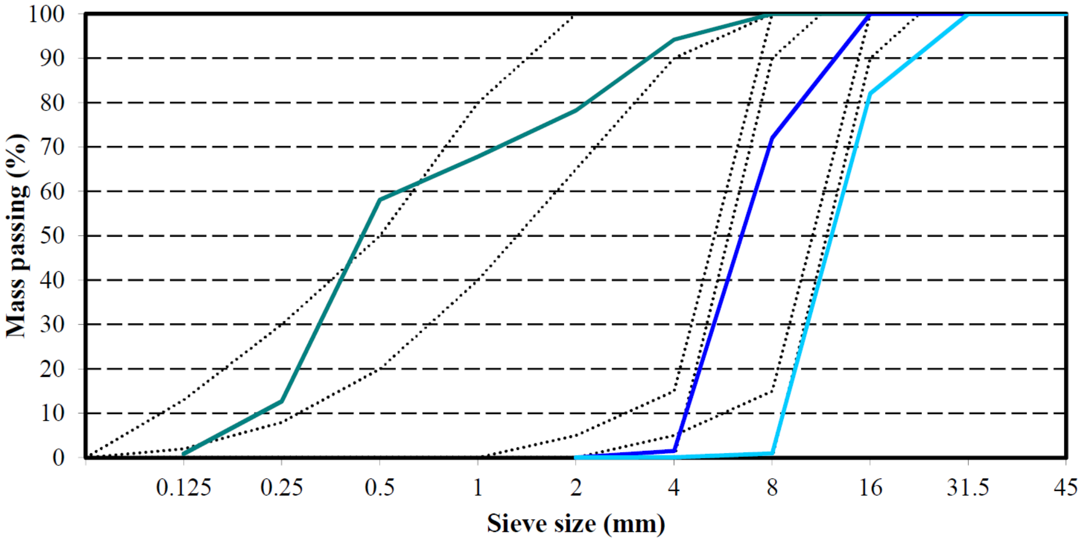
The aggregate was stored on an open-air storage site for 18 months before being used. From the storage site it was transported to the Faculty of Civil Engineering where the following properties were tested:

- particle size distribution,
- water absorption,
- density,
- aggregate crushing value,
- aggregate shape index and
- aggregate flakiness index.

The particle size distribution was determined using the dry sieving procedure given in (EN 933-1, 1997). The results are represented in Figure 3.1. Also plotted on the figure are reference areas for each fraction (dotted lines).

As can be seen, sand is slightly above the limit on the 0.5 mm sieve (58% passing, with a limit of 50%); the particle size distribution of the sand is skewed toward smaller particle sizes. Fractions II and III (gravel) are somewhat skewed toward larger particle sizes. For fraction II the percentage of particles passing through sieve size 8 mm is 72% whereas the lower limit is 90%; for fraction III the percentage of particles passing through sieve size 16 mm is 82% and the lower limit 90%.

Although the separate fractions are not completely within the reference areas for each fraction separately, when the concrete mixes were designed care was taken to ensure that the particle size distribution of the mixed aggregates (0–16 mm) was within recommended limits (SRPS U.M1.057, 1984).



Fraction	Mass percentage passing through sieve size (%/mm)											
mm	0.063	0.125	0.250	0.500	1	2	4	8	16	22.4	31.5	45
0-4		1	13	58	68	78	94	100	100	100	100	100
4-8						0	2	72	100	100	100	100
8-16						0	0	1	82	100	100	100

FIGURE 3.1: Particle size distribution of NA – sand and gravel

Physical and mechanical properties of the aggregate fractions are given in Table 3.1. The OD and saturated-surface dry (SSD) densities of the aggregates were determined according to the methods given in (EN 1097-6, 2000) and water absorption according to (EN 1097-6, 2000).

The aggregate crushing value for the coarse aggregates was determined by crushing the samples in a cylinder as per (SRPS B.B8.033, 1994). This test was deemed to be an indication of the aggregates' stiffness which is an important factor affecting concrete properties such as the modulus of elasticity, creep and shrinkage. The test was carried out on both gravel fractions (II and III) and the results are below the limit set by (SRPS B.B2.009, 1986) for use of aggregates in concrete—a crushing value below 30%.

The aggregate shape index was determined according to (SRPS B.B8.049, 1984) and the aggregate flakiness index according to (SRPS B.B8.048, 1984). The results are below the limit set by (SRPS B.B2.009, 1986) for use of aggregates in concrete—a shape index lower than 0.18.

TABLE 3.1: Physical and mechanical properties of NA and RCA

Aggregate	OD density (kg/m^3)	SSD density (kg/m^3)	Water absorption 30 min (%)	Water absorption 24 h (%)	Crushing value (%)	Shape index (–)	Flakiness index (%)
NA I	2573	2604	–	1.20	–	–	–
NA II	2548	2580	–	1.24	13.22	0.123	31.0
NA III	2591	2618	–	1.04	18.23	0.164	34.0
RCA II	2390	2478	3.01	3.67	16.29	0.108	19.2
RCA III	2359	2545	3.55	4.05	21.64	0.118	33.8

3.2.2 Recycled Concrete Aggregate – RCA

The RCA used in the experimental programme was obtained by demolishing an existing 40 year old highway bridge in the vicinity of Belgrade, Serbia, Figure 3.2. The aggregate was obtained by crushing columns and the deck of the bridge in a GIPO GISLER POWER construction site mobile crusher, Figure 3.3. The demolition and crushing were carried out by Planum AD, Belgrade.

The demolished structure was relatively clean from impurities as the asphalt had been scraped of the deck prior to demolition. The aggregates were sieved into two grain sizes for testing: II (4/8 mm) and III (8/16 mm).

FIGURE 3.2: Demolition of a highway bridge

FIGURE 3.3: Mobile recycling machine

Since very little was known about the original structure, ⌀100/100 mm cores were taken from the columns and the deck and compressive strength (f_{cm}) and carbonation depth (d_k) were tested (EN 14630, 2006) and the results are shown in Figure 3.4 and in Table 3.2. As can be seen from the results, the parent concrete was presumably made with a high *w/c* ratio and natural river gravel which is consistent with the majority of the types of concrete produced in that period in Serbia. It should also be noted that at the time of its construction blended cements were extensively used in Serbia.

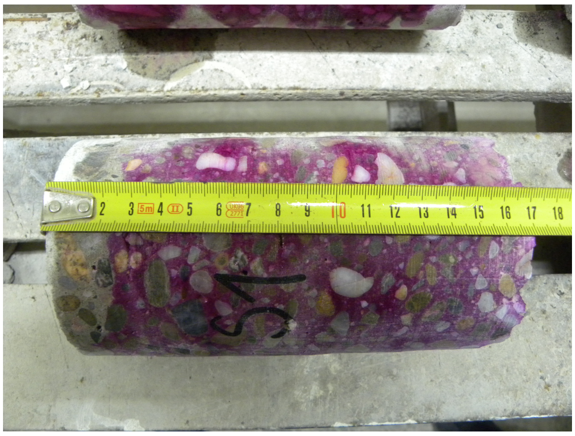


FIGURE 3.4: Column core carbonation

The demolition and crushing were carried out in July 2014. The resulting concrete waste was a mixture of demolished columns and segments of the bridge deck, in an unknown proportion. After sieving by Gradient d.o.o., Belgrade, the aggregate was stored on an

TABLE 3.2: Properties of the parent concrete

	f_{cm} (MPa)	d_k (mm)
Column	23	25
Deck	35	0

open-air storage site for 18 months before being used. During stockpiling, RCA was covered with plastic sheets in order to decrease the rate of carbonation, Figure 3.5. From the storage site it was transported to the Faculty of Civil Engineering where the following properties were tested:

- particle size distribution,
- water absorption,
- density,
- aggregate crushing value,
- aggregate resistance to fragmentation,
- aggregate shape index and
- aggregate flakiness index.

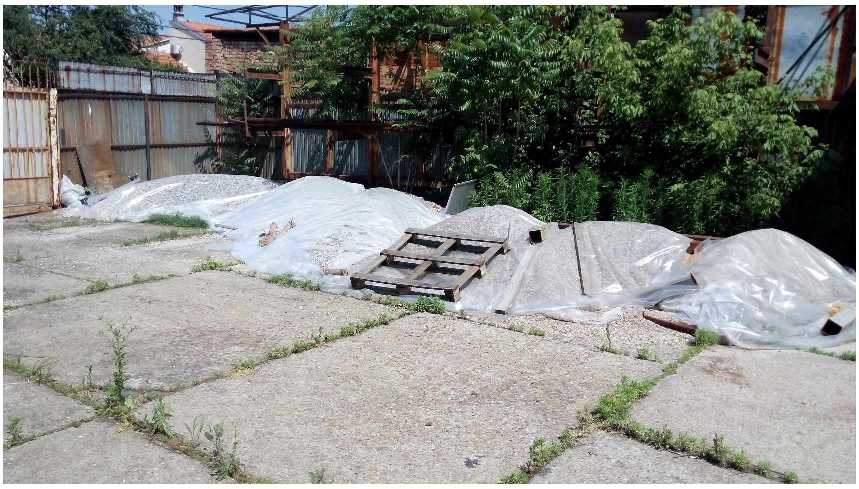
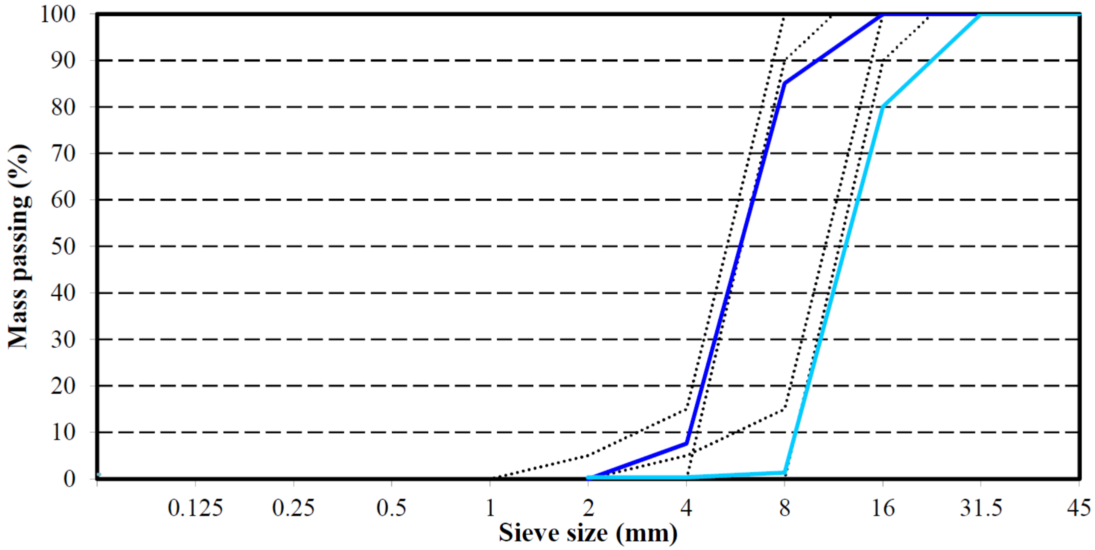


FIGURE 3.5: Stockpiling of RCA

The particle size distribution was determined using the dry sieving procedure given in (EN 933-1, 1997). The results are shown in Figure 3.6. Also plotted on the Figure are reference areas for each fraction (dotted lines).



Fraction	Mass percentage passing through sieve size (%/mm)											
mm	0.063	0.125	0.250	0.500	1	2	4	8	16	22.4	31.5	45
4-8						0	8	85	100	100	100	100
8-16						0	0	1	80	100	100	100

FIGURE 3.6: Particle size distribution of coarse RCA

As can be seen, both fractions II and III have slightly smaller passing percentages than the minimum values on the larger sieve sizes, which means they are skewed toward larger particle sizes. Although the separate fractions are not completely within the reference areas for each fraction separately, when the concrete mixes were designed care was taken to ensure that the particle size distribution of the mixed aggregates (NA and RCA, 0–16 mm) was within recommended limits (SRPS U.M1.057, 1984).

Physical and mechanical properties of RCA are given in Table 3.1. The same standards were used as for NA. The final (24 h) water absorption values of 3.67% and 4.05% for fractions II and III, respectively, are common for RCA made only from concrete waste. Together with OD density values (which are about 10% lower compared with NA), this aggregate can be classified as class B-I according to the classification proposed by Silva et al. (2014); this is actually a relatively lower quality for recycled aggregates made only from concrete waste but still does not prevent them from being used in the production of RAC.

Additionally, water absorption after 30 min was also determined for RCA. This was considered important as it represents a typical transport scenario for ready-mixed concrete in Serbia and a period during which concrete workability should be maintained. The 30 min water absorption values were 3.01% for fraction II and 3.55% for fraction III; ca. 83–87% of absorption occurred within the first 30 min. The crushing value for RCA is also approximately 10% lower compared with NA. The shape and flakiness indices of RCA are comparable or even superior to that of NA.

Only for RCA, the resistance to fragmentation was determined according to (EN 1097-2, 2010) for fractions 4/8 mm and 8/11.2 mm—which is an intermediate fraction prescribed by the standard. The obtained values of the Los Angeles coefficient were 23.8% and 27.5%, respectively. These values can be used as an indicator of the amount of residual cement paste attached to the original aggregates in NA. The values are relatively good and comparable to natural limestone aggregates. These results are below the limit set by (SRPS B.B2.009, 1986) for use of aggregates in concrete – a crushing value below 30% and a Los Angeles coefficient lower than 30.

3.2.3 Fly Ash

The fly ash used in this study was obtained from the Nikola Tesla B power plant in Obrenovac, Serbia. In 2010, a new fly ash separation and transportation system was installed which enabled the collection of fly ash from four separate locations, each with an increasingly smaller particle size, Figure 3.7.

For this study, fly ash was collected from the final hopper as it was assumed to have the smallest mean particle size. The particle size distribution was performed using a Malvern Instruments Mastersizer 2000 and the results are presented in Figure 3.8. The mean particle size of the sample was 8.53 μm which signifies a very fine fly ash; such a small mean particle size is a very important parameter as it can have significant influence on concrete properties. The specific density of fly ash was determined using a Le Chatelier flask as 2075 kg/m^3 (ASTM C188-15, 2015).

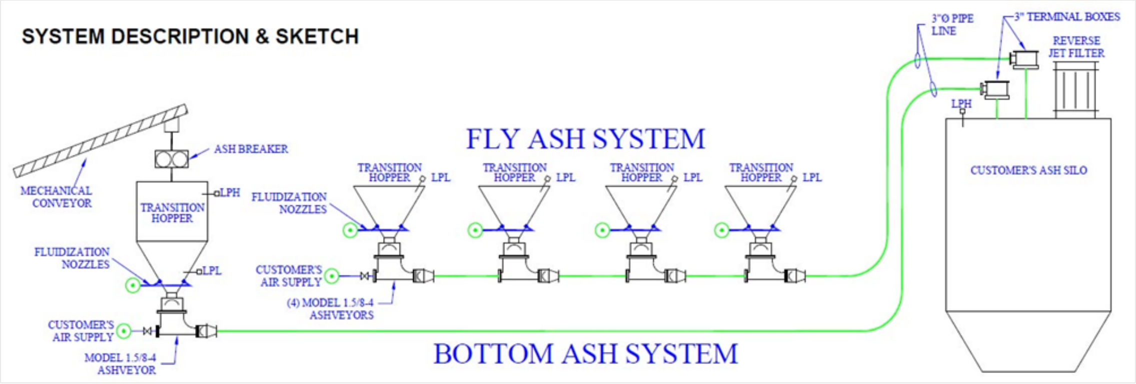


FIGURE 3.7: Fly ash collection system

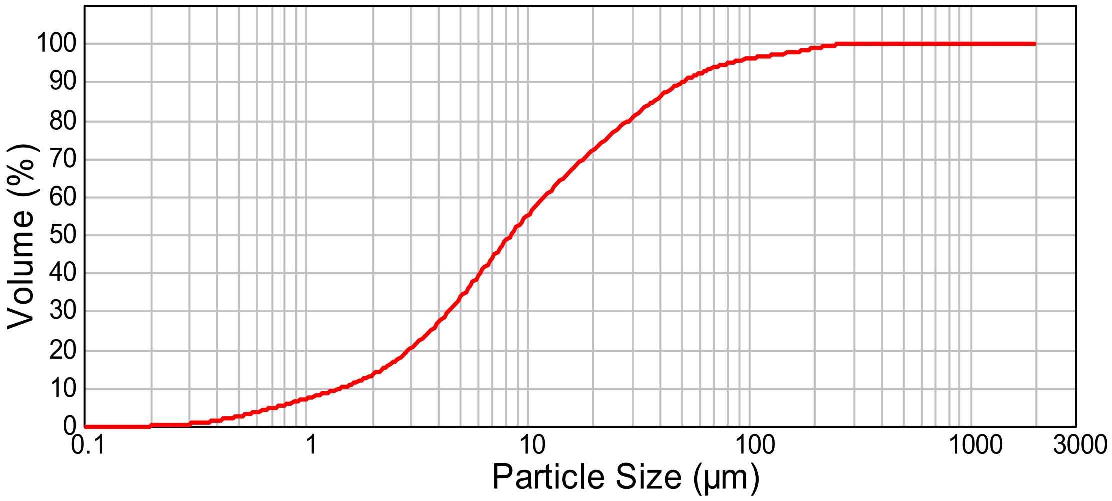


FIGURE 3.8: Fly ash particle size distribution

The chemical composition and physical properties were assessed by X-ray fluorescence (XRF) analysis and the results are given in Table 3.3.

As can be seen, the tested sample meets all of the (EN 450-1, 2012) criteria and according to the loss on ignition (LOI) it would be classified as category A fly ash. As for the (ASTM-C618-12a, 2012) criteria, according to them, this sample would be classified as class F fly ash, which is a far more common fly ash type (low-calcium fly ash) than class C.

TABLE 3.3: Chemical and physical properties of fly ash

Property	Cement CEM II/ A-M(S-L)42.5R	Fly ash	EN 450-1:2012 requirement (%)
SiO_2 (%)	21.04	58.24	–
Al_2O_3 (%)	5.33	20.23	–
Fe_2O_3 (%)	2.37	5.33	–
$SiO_2 + Al_2O_3 + Fe_2O_3$(%)	–	83.80	>70
TiO_2 (%)	–	0.45	–
CaO (%)	60.43	7.62	–
MgO (%)	2.43	2.01	<4
P_2O_5 (%)	–	0.00	<5
SO_3 (%)	3.55	2.21	<3
Na_2O (%)	0.22	0.52	<5
K_2O (%)	0.70	1.51	–
MnO (%)	–	0.03	–
LOI (%)	3.53	2.10	<5
Fineness (>45 μm) (%)	–	11.71	<12

3.2.4 Cement

The cement used in this study was commercially available CEM II Portland-composite cement produced by Lafarge in Beočin, Serbia. The cement type was CEM II/A-M(S-L)42.5R according to (EN 197-1, 2000).

The composition of this cement is 80–94% Portland cement clinker, 6–20% ground slag and limestone and 0–5% gypsum and mineral fillers, Table 3.3. The specific density of the cement is 3050–3150 kg/m^3.

3.2.5 Reinforcement

The reinforcement was provided by Deneza M, Belgrade. The ⌀10 mm ribbed bars were grade B500C (yield stress f_{yl} = 574–600 MPa, ultimate strain ε_{uk} = 10.4–12.6%) while the ⌀6 mm plain bars were grade SAE1108 (yield stress f_{yl} = 395 MPa, ultimate strain ε_{uk} = 32%).

3.3 Mixture Design of Concretes

3.3.1 Mixture Design Methodology

As stated in the introduction, the mixture proportioning of all the concretes was carried out with two goals in mind: workability and compressive strength. These two goals or criteria are considered to be simple and understandable when choosing or designing ready-mixed concrete and still sufficiently informative about the desired behaviour and properties of concrete. Workability addresses the question of how and using which technology can concrete be placed as well as its durability, indirectly through placing and compacting. Compressive strength is an indicator of both physical–mechanical properties as well as durability-related properties.

For this experimental programme, three criteria were set:

- initial slump 100–150 mm,
- 50–90 mm slump after 30 min and
- 28-day compressive strength of 35 MPa (water cured 100 mm cubic samples).

The chosen slump values mean an initial slump class S3 and a slump class S2 after 30 min (EN 206-1, 2000). These slump classes enable such concretes to be pumped—after an initially high slump, after 30 min (when casting can be expected, at the earliest) slump is sufficient for pumping.

When converted to a ⌀150/300 mm cylinder, the target mean compressive strength (f_{cm}) is 35·0.75 = 26.25 MPa. Instead of simply subtracting 8 MPa from the mean compressive strength to obtain the characteristic compressive strength (f_{ck}), i.e. the concrete class, a more precise approach was adopted. Since the concretes would be cast in laboratory conditions, a smaller scatter of the results can be expected and a CoV of not more than 10%. Hence, the characteristic compressive strength can be assessed as a 5%-fractile, 26.25 - 1.645·0.1·25.5 = 21.93 MPa. Such a characteristic compressive strength would classify this concrete as class C20/25. This class of concretes is suitable for environments with a low risk of carbonation-induced corrosion (XC1) and no risk of damage to concrete

(X0). Practically this means it is suitable for casting indoor members such as slabs and beams—members in which the behaviour under long-term loading is of particular interest.

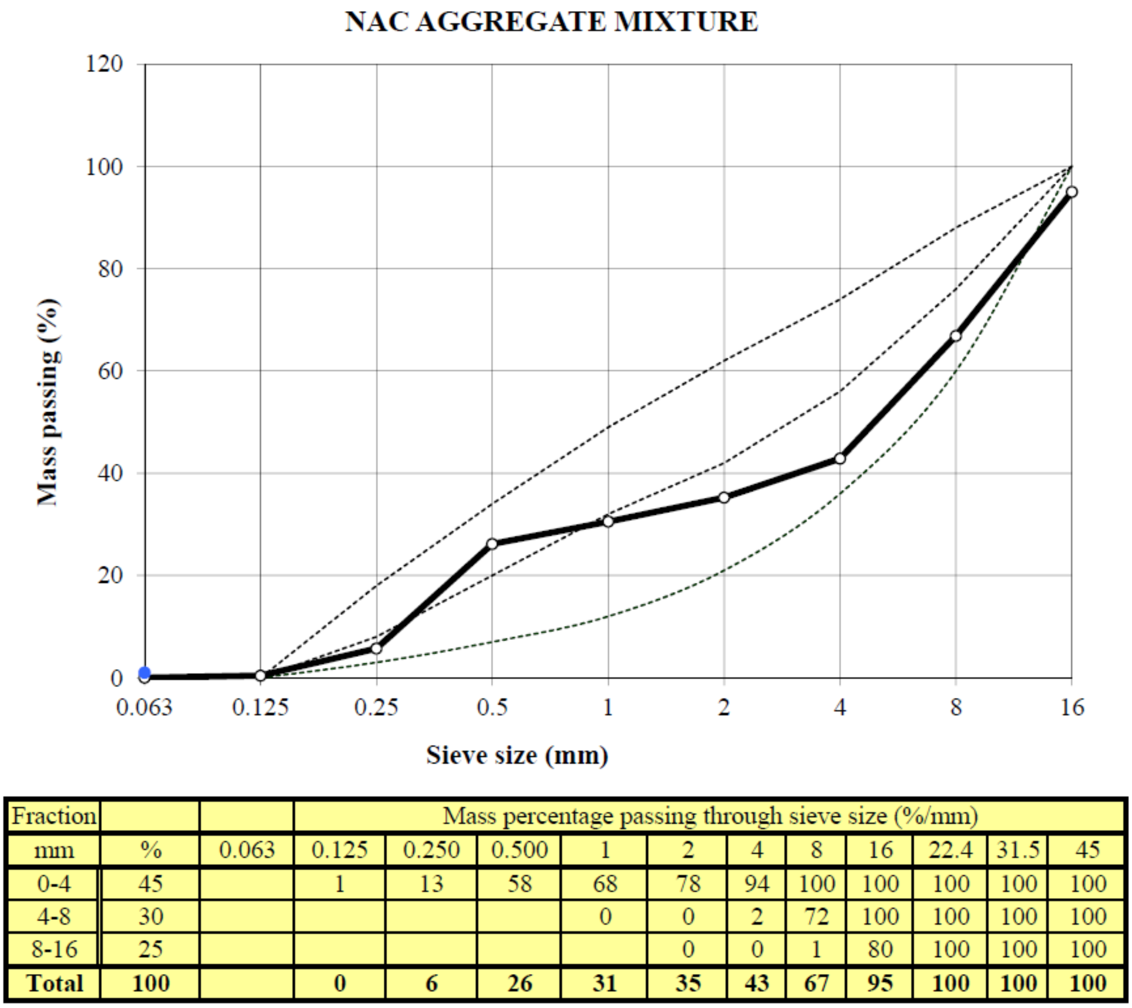
All this is not to say that higher compressive strengths can't be produced from the recycled and waste materials used in this study, but taking into account the constraints imposed by the equipment, technology and experience, this choice was considered to be the most appropriate. Additionally, all of the produced mixtures were very similar to concretes produced in the past by the same research team (Ignjatović, 2013; Dragaš et al., 2016). This meant that there existed significant experience in producing the targeted compressive strengths and workability. For an experiment which required so much careful planning and precision, as this one, the choice was made to use mixtures with which the research team was familiar.

3.3.2 Natural Aggregate Concrete – NAC

The mixture proportioning procedure for NAC relied heavily on previous experiences at the University of Belgrade's Faculty of Civil Engineering. The experimental programme carried out within the scope of a previous PhD thesis (Ignjatović, 2013), consisted of designing a NAC with a 36 MPa mean compressive strength (albeit on a 150 mm cubic sample). Starting from this mixture and taking into account new aggregate properties, trial mixes were cast to test both workability and compressive strength. Since a lower compressive strength was targeted, the amount of cement was decreased and the *w/c* ratio increased, all assessed through trial mixtures.

First, a particle size distribution for the aggregate mixture was chosen, so as to conform with the limits given in (SRPS U.M1.057, 1984). The mass percentages in the aggregate mixture were 45%, 30% and 25% for fractions I, II and III, respectively, Figure 3.9. Secondly, through the volumetric equation (Equation 3.1), the total amount of aggregate (used in the OD condition) was determined and then divided into fractions from the particle size distribution. The percentage of entrained air was determined as 2.5% by testing trial mixtures. No admixtures were used.

$$\frac{m_c}{\gamma_c}+\frac{m_w}{\gamma_w}+\frac{m_{NA,I}}{\gamma_{NA,I}}+\frac{m_{NA,II}}{\gamma_{NA,II}}+\frac{m_{NA,III}}{\gamma_{NA,III}}+V_a=1 \tag{3.1}$$



Fraction			Mass percentage passing through sieve size (%/mm)										
mm	%	0.063	0.125	0.250	0.500	1	2	4	8	16	22.4	31.5	45
0-4	45		1	13	58	68	78	94	100	100	100	100	100
4-8	30					0	0	2	72	100	100	100	100
8-16	25						0	0	1	80	100	100	100
Total	**100**		**0**	**6**	**26**	**31**	**35**	**43**	**67**	**95**	**100**	**100**	**100**

FIGURE 3.9: Aggregate mixture distribution for NAC

where γ_c was taken as 3150 kg/m^3 and γ_w as 1000 kg/m^3.

The final mixture proportions are given in Table 3.4.

TABLE 3.4: Mixture proportions of NAC

Concrete	m_c (kg/m^3)	m_w (kg/m^3)	w/c (–)	Natural aggregate $m_{NA,I}$ (kg/m^3)	Natural aggregate $m_{NA,II}$ (kg/m^3)	Natural aggregate $m_{NA,III}$ (kg/m^3)	V_a (%)
NAC	285	175	0.614	815	543	453	2.5

The mixing procedure began with mixing sand and coarse aggregate in the mixing pan for approximately 1 min. After this, cement was added and everything was mixed together for another minute. Finally, water was added during the next 30 s and the mixing continued for approximately another 2.5 min – meaning an overall mixing time of 5 min.

3.3.3 Recycled Aggregate Concrete – RAC

Similar to NAC, as explained in section 3.3.2, the mixture proportions for RAC were determined by relying primarily on experience gained within the scope of a previously completed PhD thesis (Ignjatović, 2013).

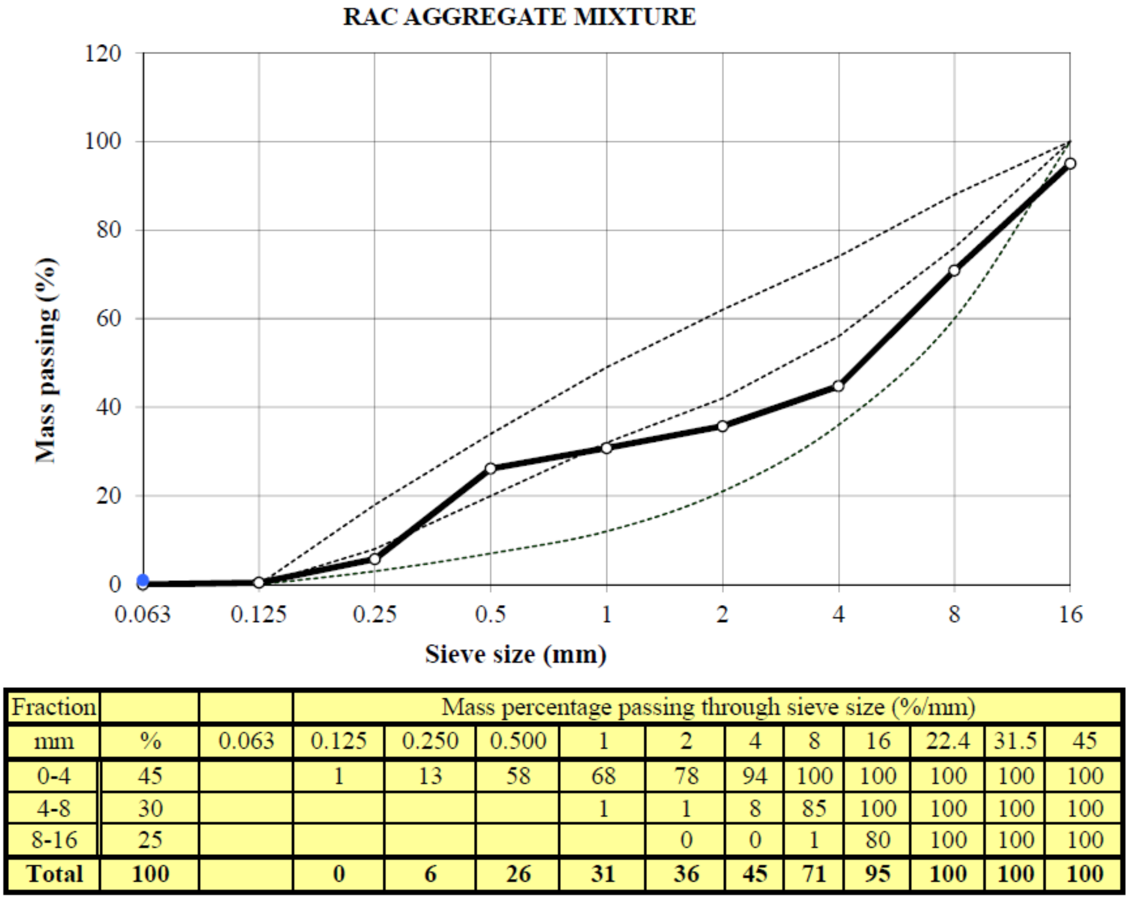
As with NAC, first a particle size distribution of the aggregate mixture was calculated. The mass percentages in the aggregate mixture were 45%, 30% and 25% for fractions I, II and III, respectively, Figure 3.10.

Again, through the volumetric equation (Equation 3.2), the total amount of aggregate (used in the OD condition) was determined and then divided into fractions from the particle size distribution. The percentage of entrained air was determined as 4% by testing trial mixtures. No admixtures were used.

$$\frac{m_c}{\gamma_c}+\frac{m_w}{\gamma_w}+\frac{m_{NA,I}}{\gamma_{NA,I}}+\frac{m_{RCA,II}}{\gamma_{RCA,II}}+\frac{m_{RCA,III}}{\gamma_{RCA,III}}+V_a=1 \tag{3.2}$$

As for additional water Δm_w necessary for RCA water absorption, initially it was taken according to RCA absorption after 30 min, i.e. 3.05% and 3.55% for fractions II and III, respectively. Taking into account the mixture proportions in Table 3.5, this would have amounted to 30.7 kg/m^3 of additional water. However, trial mixtures showed that their slump was excessive and hard to control. Hence, using new trial mixtures, a reduced amount of additional water was determined as Δm_w = 21.5 kg/m^3. The final mixture proportions are given in Table 3.5. The $(w/c)_{eff}$ ratio denotes the *effective* water-cement ratio, i.e. not taking additional water into account.

The mixing procedure was identical to that of NAC; it began with mixing sand and coarse aggregate in the mixing pan for approximately 1 min. After this, cement was added and



Fraction			Mass percentage passing through sieve size (%/mm)										
mm	%	0.063	0.125	0.250	0.500	1	2	4	8	16	22.4	31.5	45
0-4	45		1	13	58	68	78	94	100	100	100	100	100
4-8	30					1	1	8	85	100	100	100	100
8-16	25						0	0	1	80	100	100	100
Total	**100**		**0**	**6**	**26**	**31**	**36**	**45**	**71**	**95**	**100**	**100**	**100**

FIGURE 3.10: Aggregate mixture distribution for RAC

TABLE 3.5: Mixture proportions of RAC

Concrete	m_c (kg/m^3)	m_w (kg/m^3)	Δm_w (kg/m^3)	$(w/c)_{eff}$ (–)	Natural sand $m_{NA,I}$ (kg/m^3)	RCA $m_{RCA,II}$ (kg/m^3)	RCA $m_{RCA,III}$ (kg/m^3)	V_a (%)
RAC	285	175	21.5	0.614	767	511	426	4.0

everything was mixed together for another minute. Finally, water was added during the next 30 s and the mixing continued for approximately another 2.5 min – meaning an overall mixing time of 5 min.

3.3.4 High-volume Fly Ash Concrete – HVFAC

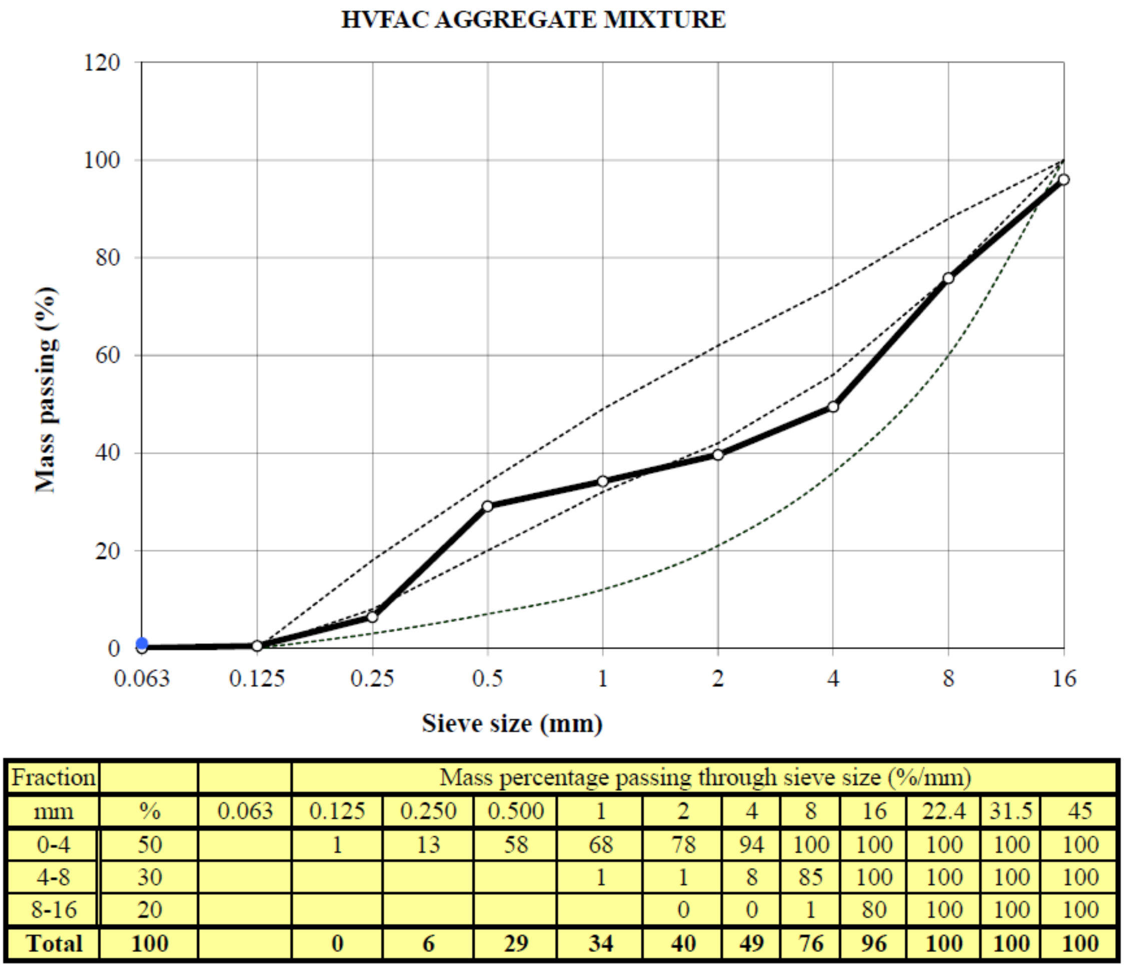
The mixture design of HVFAC for this experimental programme was based on previous knowledge gained through joint work on a PhD thesis dealing with the flexural and shear behaviour of HVFAC beams with colleague Jelena Dragaš.

The methodology through which the mixture used in this study was arrived at is described in detail in (Dragaš et al., 2016). In that study, a comprehensive two-phase investigation into different HVFAC mixtures was carried out. The goals aimed for, when proportioning HVFAC mixtures were (1) a 28-day compressive strength similar to the ’control’ NAC mixture (suitable for structural applications), (2) a suitable early (3- or 7-day compressive strength) and (3) a workability that enables easy casting.

Dragaš et al. (2016) tested mixtures with different cement and fly ash amounts, but also, in some mixtures, replaced part of the sand with fly ash. In the final phase of their programme, the authors produced concretes with 200 kg/m^3 of cement and 200–400 kg/m^3 of fly ash (in 50 kg/m^3 increments), as well as concretes with 150 kg/m^3 of cement and 150–350 kg/m^3 of fly ash (in 50 kg/m^3 increments). It’s important to note that in all other mixtures, except the ones with 150 and 200 kg/m^3 of both cement and fly ash, a part of the sand was replaced with fly ash—the coarse aggregate was kept constant and sand was decreased as much as it was allowed by the particle size distribution limits.

For this experimental programme, one of the above mentioned mixtures had to be chosen. The concretes with 150 kg/m^3 of cement did not achieve high enough 28-day compressive strengths (all were lower than 30 MPa on a 100 mm cubic sample). Within the concretes with 200 kg/m^3 of cement, only the mixtures with 200 and 250 kg/m^3 of fly ash had a suitable workability (slump > 100 mm). From these two, the mixture with 200 kg/m^3 of fly ash was chosen since it did not have sand replacement with fly ash—which would have potentially introduced a new and insufficiently known influence into the research—and it did not require the use of superplasticizers (which neither NAC nor RAC required).

Determining the mixture proportions, as with NAC, first a particle size distribution of the aggregate mixture was calculated. The mass percentages in the aggregate mixture were 50%, 30% and 20% for fractions I, II and III, respectively, Figure 3.11.



Fraction			Mass percentage passing through sieve size (%/mm)										
mm	%	0.063	0.125	0.250	0.500	1	2	4	8	16	22.4	31.5	45
0-4	50		1	13	58	68	78	94	100	100	100	100	100
4-8	30					1	1	8	85	100	100	100	100
8-16	20						0	0	1	80	100	100	100
Total	**100**		**0**	**6**	**29**	**34**	**40**	**49**	**76**	**96**	**100**	**100**	**100**

FIGURE 3.11: Aggregate mixture distribution for HVFAC

Again, through the volumetric equation (Equation 3.3), the total amount of aggregate (used in the OD condition) was determined and then divided into fractions from the particle size distribution. The percentage of entrained air was determined as 1.5% by testing trial mixtures. No admixtures were used.

$$\frac{m_c}{\gamma_c} + \frac{m_{FA}}{\gamma_{FA}} + \frac{m_w}{\gamma_w} + \frac{m_{NA,I}}{\gamma_{NA,I}} + \frac{m_{NA,II}}{\gamma_{NA,II}} + \frac{m_{NA,III}}{\gamma_{NA,III}} + V_a = 1 \qquad (3.3)$$

where γ_{FA} was taken as 2075 kg/m^3.

The final mixture proportions are given in Table 3.6.

TABLE 3.6: Mixture proportions of HVFAC

Concrete	m_c (kg/m^3)	m_{FA} (kg/m^3)	m_w (kg/m^3)	$w/(c+FA)$ (–)	Natural aggregate $m_{NA,I}$ (kg/m^3)	 $m_{NA,II}$ (kg/m^3)	 $m_{NA,III}$ (kg/m^3)	V_a (%)
HVFAC	200	200	195	0.488	810	486	324	1.5

As with NAC and RAC, the mixing procedure began with mixing sand and coarse aggregate in the mixing pan for approximately 1 min. After this, cement and fly ash were both added and everything was mixed together for another minute. Finally, water was added during the next 30 s and the mixing continued for approximately another 2.5 min—giving an overall mixing time of 5 min.

3.4 Reinforced Concrete Beams

3.4.1 Beam Design and Specifications

This was the main experimental phase of the research. After determining properties of the component materials and their suitability for concrete production and after verifying the concrete mix designs, reinforced concrete beams were cast in order to test their long-term behaviour under sustained loading.

For this purpose, the following experimental programme, explained in detail below, was carried out. The decision was made to test reinforced concrete beams in four-point bending, as this type of loading causes only bending moments in the part of the span between the applied loads, thus eliminating any influence of shear stresses, Figure 3.12. This makes it easier to analyse the effects of creep and shrinkage.

Upon consideration of the previously published studies, taking into account the most usual dimensions of the tested specimens, a choice was made to produce beams with a 3.2 m span and a b/h = 160/200 mm cross-section (Espion, 1988). This meant a span-to-height ratio $l/h = 20$. Although this value may be more representative of slabs than beams, it was retained; it was chosen as sufficient to provide measurable deflections, achievable with the

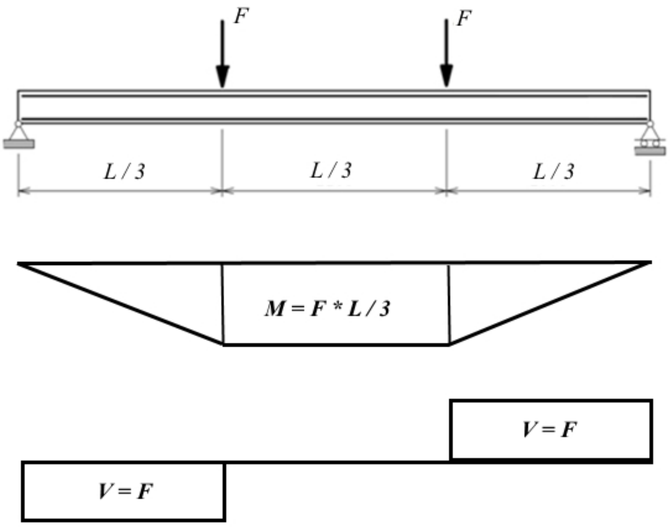


FIGURE 3.12: Schematic representation of a four-point bending test

available loading equipment. The actual wooden formwork designed for the beams had a length of 3.5 m; with a 3.2 m span, a 150 mm overhang was provided on each side for adequate reinforcement anchorage.

The beams were reinforced with 2⌀10 mm bars as bottom reinforcement (a reinforcement ratio of ρ = 0.58%) and 2⌀6 mm bars as top reinforcement (a reinforcement ratio of ρ' = 0.21%). For transverse reinforcement, ⌀6 mm stirrups were adopted and spaced at 100 mm in the shear spans and 200 mm between the applied loads. The concrete cover was 20 mm. A reinforcement plan of the beams is shown in Figure 3.13 and the reinforcement in the formwork in Figure 3.14.

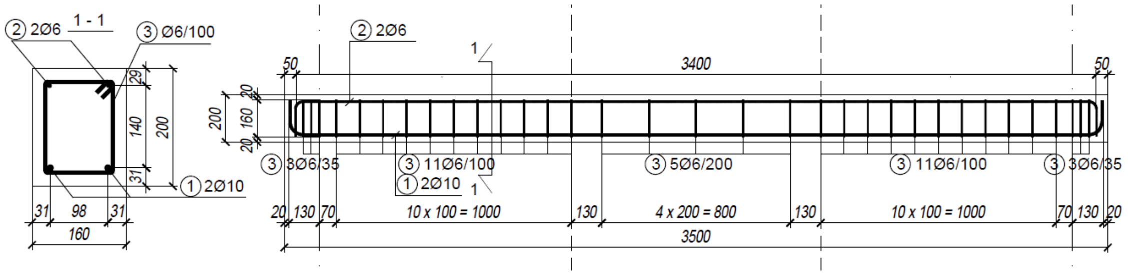


FIGURE 3.13: Reinforcement layout of the beams

From the stated properties of the beams and the target compressive strength of the concretes, it was possible to calculate the flexural strength (ultimate bending moment M_{ult}) of the beams from the following equation—assuming a parabola–rectangle stress–strain

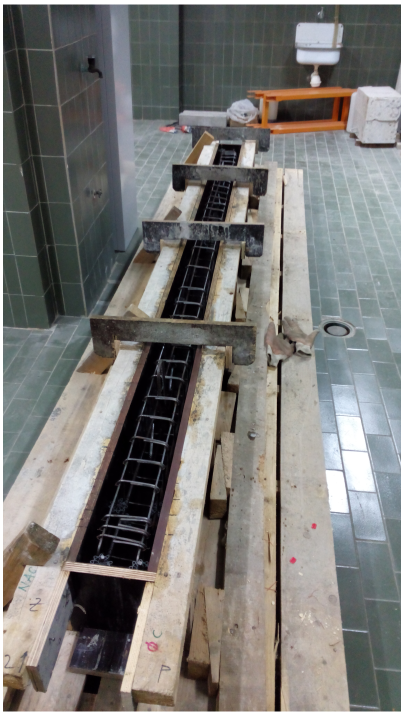


FIGURE 3.14: Reinforcement in the formwork

relation for concrete and a bi-linear stress–strain relation for reinforcement, with a horizontal top branch

$$M_{ult} = A_{sl} f_{yl} d (1 - 0.513 \frac{A_{sl} f_{yl}}{b d f_{cm}}) \tag{3.4}$$

where A_{sl} is the area of the longitudinal tensile reinforcement, f_{yl} is the reinforcement yield stress, d is the cross-section effective depth, b is the cross-section width and f_{cm} is the mean concrete compressive strength.

$$M_{ult} = 157 \cdot 574 \cdot 169 \cdot (1 - 0.513 \cdot \frac{157 \cdot 574}{160 \cdot 169 \cdot 26.25}) \cdot 10^{-6} = 14.24\, kNm \tag{3.5}$$

It was also possible to calculate the cracking moment M_{cr} of the beams by using the predicted value of the reduced flexural tensile strength of the concretes—taking into account the size effect on tensile strength and the reduction due to shrinkage—equal to the mean axial tensile strength, as recommended in (Pecić, 2012).

$$f_{ctm} = 0.3 \cdot (f_{cm} - 8)^{\frac{2}{3}} = 0.3 \cdot (26.25 - 8)^{\frac{2}{3}} = 2.08\, MPa \tag{3.6}$$

$$M_{cr} = W_c \cdot f_{ctm} = \frac{160 \cdot 200^2}{6} \cdot 2.08 \cdot 10^{-6} = 2.21\, kNm \tag{3.7}$$

where W_c is the section modulus of the gross concrete cross-section.

Both of these moments should be taken as first approximations, with real values expected to vary. However, knowing them enables the calculation of an appropriate long-term load. By 'appropriate load', what is meant is a load that satisfies several criteria simultaneously (the most important one being whether it is achievable using available equipment).

First, the bending moment induced by that load should not exceed ca. $0.6 \cdot M_{ult}$, or the so-called 'service load'. Second, this bending moment should be sufficiently greater than the cracking moment so that a developed cracked state of the beam is produced, at least in the middle part of the span. Finally, and in connection with this, certain target initial strains and stresses in both concrete and tensile reinforcement need to be met. The initial strain in the tensile reinforcement should be in the range of 1.0–1.5‰ so that, with a modulus of elasticity E_s of 210 GPa, the stress is in the range of 210–315 MPa. This would ensure a developed cracked state and initial crack-widths in the order of 0.08–0.1 mm.

At the same time, the compressive stress in the top fibre of the section must be below the adopted $\sigma_c / f_{cm}(t_0)$ ratio. A final constraint to keep in mind is the availability of the applied load and the limits imposed by the test setup design—the space requirements.

The stresses and strains in the cracked cross-section were calculated assuming plane sections, no contribution of concrete in tension and linear elastic material properties.

If the internal forces consist of a concrete compressive force, a top reinforcement compressive force and a bottom reinforcement tensile force, then, from moment and axial force equilibrium conditions, the neutral axis position can be calculated.

$$\xi^2 + 2 \cdot \alpha_e \cdot (\rho + \rho') \cdot \xi - 2 \cdot \alpha_e \cdot \left(\rho + \rho' \cdot \frac{d_2}{d}\right) = 0 \tag{3.8}$$

Where ξ is the neutral axis position coefficient, α_e is the modular ratio (ratio of steel-to-concrete moduli of elasticity), ρ is the longitudinal tensile reinforcement ratio, ρ' is the longitudinal compressive reinforcement ratio, d_2 is the distance of the center of gravity of the compression reinforcement to the top compressed fibre of the cross-section and d is the beam effective depth.

The modulus of elasticity is estimated using Eurocode 2 provisions (EN 1992-1-1, 2004) as

$$E_{cm} = 22 \cdot (f_{cm}/10)^{0.3} = 22 \cdot 26.25^{0.3} = 29.39\,GPa \tag{3.9}$$

With an effective depth of 169 mm and a compressive reinforcement centre of gravity 29 mm from the top of the beam, the neutral axis position can be calculated as

$$\xi^2 + 2 \cdot \frac{210}{29.39} \cdot (0.58 + 0.21) \cdot 10^{-2} \cdot \xi - 2 \cdot \frac{210}{29.39} \cdot \left(0.58 + 0.21 \cdot \frac{29}{169}\right) \cdot 10^{-2} = 0 \tag{3.10}$$

Solving Equation 3.10 yields a result ξ = 0.246 and a compressive zone depth of 0.246 · 169 = 41.6 mm. Then, the compressive stress in the top fibre is given by

$$\sigma_c = \frac{M}{b \cdot d^2} \cdot \frac{\xi}{\frac{\xi^2}{2} \cdot (1 - \frac{\xi}{3}) + \alpha_e \cdot \rho' \cdot (\xi - \frac{d_2}{d}) \cdot (1 - \frac{d_2}{d})} \tag{3.11}$$

From the prescribed $\sigma_c/f_{cm}(t_0)$ ratios, the maximum bending moment in the beam can be calculated.

In the case of beams loaded after 28 days, this ratio is 0.45 and the maximum compressive stress is 0.45·26.25 = 11.81 MPa. The maximum bending moment $M(28)$ is then calculated as 6.28 kNm. Since the beam self-weight is approximately 0.16·0.2·25 = 0.8 kN/m, the imposed force acting at the thirds of the span, is

$$G(28) = \frac{M(28) - g \cdot l^2/8}{a} = \frac{6.28 - 0.8 \cdot 3.2^2/8}{1.07} = 4.92\,kN \tag{3.12}$$

where $G(28)$ is the imposed force applied at thirds of the beam span at a concrete age of 28 days.

The total imposed load is 2·4.92 = 9.84 kN or ca. 984 kg. The stresses and strains are

$$\sigma_c = 0.45 \cdot 26.25 = 11.8\,MPa \tag{3.13}$$

$$\sigma_{s,t} = \alpha_e \cdot \sigma_c \cdot \frac{1-\xi}{\xi} = \frac{210}{29.39} \cdot 11.8 \cdot \frac{1 - 0.249}{0.249} = 258.9\,MPa \tag{3.14}$$

$$\sigma_{s,c} = \alpha_e \cdot \sigma_c \cdot \frac{\xi - d_2/d}{d_2/d} = \frac{210}{29.39} \cdot 11.8 \cdot \frac{0.249 - 29/169}{29/169} = 25.4 MPa \tag{3.15}$$

$$\varepsilon_c = \sigma_c / E_{cm} = 11.8/29390 = 0.4‰ \tag{3.16}$$

$$\varepsilon_{s,t} = \sigma_{s,t} / E_s = 258.9/210000 = 1.23‰ \tag{3.17}$$

$$\varepsilon_{s,c} = \sigma_{s,c} / E_s = 25.4/210000 = 0.12‰ \tag{3.18}$$

The tensile reinforcement strains and stresses are in the targeted range. The imposed bending moment-to-cracking moment ratio is $M(28)/M_{cr}$ = 6.28/2.21 = 2.84 and the imposed bending moment-to-flexural strength is $M(28)/M_{ult}$ = 6.28/14.24 = 0.44. These ratios and the values of strains and stresses are promising in terms of an expected developed cracked state. The mean value of crack widths can be predicted according to Eurocode 2 provisions. Since the Eurocode 2 procedure calculates the characteristic crack widths w_k, to obtain the mean value w_m, w_k must be divided by 1.7.

$$w_m = \frac{s_{r,max}}{1.7} \cdot (\varepsilon_{sm} - \varepsilon_{cm}) \tag{3.19}$$

where $s_{r,max}$ is the maximum crack spacing, ε_{sm} is the mean tensile strain in the bottom reinforcement and ε_{cm} is the mean compressive strain in the concrete between cracks.

$$s_{r,max} = k_3 \cdot c + k_1 \cdot k_2 \cdot k_4 \cdot \oslash / \rho_{p,eff} \tag{3.20}$$

where k_3 = 3.4, c is the cover to the longitudinal reinforcement, k_1 is a coefficient taking into account bond properties (=0.8 for high-bond bars), k_2 is a coefficient taking into account the strain distribution (=0.5 for bending), k_4 = 0.425, $\oslash$ is the longitudinal reinforcement diameter and $\rho_{p,eff}$ is the effective reinforcement ratio.

$$\rho_{p,eff} = A_{sl}/A_{c,eff} = A_{sl}/(b \cdot h_{c,ef}) \tag{3.21}$$

where $A_{c,eff}$ is the effective area of the concrete in tensions surrounding the reinforcement and $h_{c,ef}$ is the lesser of 2.5·$(h-d)$, $(h-x)/3$ or $h/2$

$$\rho_{p,eff} = 157/[160 \cdot (200 - 0.246 \cdot 169)/3] = 1.86\% \tag{3.22}$$

$$s_{r,max} = 3.4 \cdot 26 + 0.8 \cdot 0.5 \cdot 0.425 \cdot 10/0.0186 = 179.8\,mm \tag{3.23}$$

$$\varepsilon_{sm} - \varepsilon_{cm} = \frac{\sigma_{s,t} - k_t \cdot \frac{f_{ct,eff}}{\rho_{p,eff}} \cdot (1 + \alpha_e \cdot \rho_{p,eff})}{E_s} \tag{3.24}$$

where k_t is a factor dependent on the duration of the load (=0.6 for short-term loading) and $f_{ct,eff}$ is the mean concrete axial tensile strength at first crack occurrence (=f_{ctm}).

$$\varepsilon_{sm} - \varepsilon_{cm} = \frac{258.9 - 0.6 \cdot \frac{2.08}{0.0186} \cdot (1 + 7.34 \cdot 0.0186)}{210} = 0.8‰ \tag{3.25}$$

Finally, the mean crack width is

$$w_{m,28} = \frac{179.8}{1.7} \cdot 0.00087 = 0.09\,mm \tag{3.26}$$

This value is within the predicted and desired range.

In a similar manner, the calculations can be performed for the beams loaded after seven days, keeping in mind that the targeted $\sigma_c/f_{cm}(7)$ ratio is 0.60. Using Eurocode 2 formulae for predicting mechanical properties at ages other than 28 days, the procedure can be repeated.

$$f_{cm}(t) = \beta_{cc}(t) \cdot f_{cm} \tag{3.27}$$

$$f_{ctm}(t) = (\beta_{cc}(t))^{\alpha} \cdot f_{ctm} \tag{3.28}$$

$$E_{cm}(t) = (f_{cm}(t)/f_{cm})^{0.3} \cdot E_{cm} = (\beta_{cc}(t))^{0.3} \cdot E_{cm} \tag{3.29}$$

$$\beta_{cc} = exp\left\{s\left[1 - \left(\frac{28}{t}\right)^{\frac{1}{2}}\right]\right\} = 0.818 \tag{3.30}$$

where the coefficient $\alpha = 1$ for a concrete age $t < 28$ days and s is dependent on the cement type (=0.2 for class CEM 42.5R).

Hence, the mechanical properties after seven days are

$$f_{cm}(7) = 0.818 \cdot 26.25 = 21.47\,MPa \tag{3.31}$$

$$f_{ctm}(7) = (0.818)^1 \cdot 2.08 = 1.70\,MPa \tag{3.32}$$

$$E_{cm}(t) = (0.818)^{0.3} \cdot 29.39 = 27.65\,GPa \tag{3.33}$$

$$\xi^2+2\cdot\frac{210}{27.65}\cdot(0.58+0.21)\cdot10^{-2}\cdot\xi-2\cdot\frac{210}{27.65}\cdot\left(0.58+0.21\cdot\frac{29}{169}\right)\cdot10^{-2}=0 \quad (3.34)$$

The neutral axis position is calculated as ξ = 0.252 using Equation 3.34 and the compressive zone depth is 0.252·169 = 42.6 mm.

By limiting the compressive stress to 0.6·21.47 = 12.88 MPa, the required imposed bending moment is calculated from Equation 3.11 as $M(7)$ = 7.01 kNm. Since the beam self-weight is approximately 0.16·0.2·25 = 0.8 kN/m, the imposed force acting at the thirds of the span, is calculated as

$$G(7)=\frac{M(7)-g\cdot l^2/8}{a}=\frac{7.01-0.8\cdot3.2^2/8}{1.07}=5.60\,kN \quad (3.35)$$

The total imposed load is then 2·5.6 = 11.2 kN or ca. 1120 kg. The stresses and strains are

$$\sigma_c=0.60\cdot21.47=12.9\,MPa \quad (3.36)$$

$$\sigma_{s,t}=\frac{210}{27.65}\cdot12.9\cdot\frac{1-0.252}{0.252}=290\,MPa \quad (3.37)$$

$$\sigma_{s,c}=\frac{210}{27.65}\cdot12.9\cdot\frac{0.252-29/169}{29/169}=31.1\,MPa \quad (3.38)$$

$$\varepsilon_c=12.9/27650=0.46‰ \quad (3.39)$$

$$\varepsilon_{s,t}=290/210000=1.38‰ \quad (3.40)$$

$$\varepsilon_{s,c}=31.1/210000=0.15‰ \quad (3.41)$$

Again, the tensile reinforcement strains and stresses are in the targeted range. The imposed bending moment-to-cracking moment ratio is $M(7)/M_{cr}$ = 7.01/1.8 = 3.88 and the imposed bending moment-to-flexural strength is $M(7)/M_{ult}$ = 7.01/14.24 = 0.49.

Finally, the crack widths are calculated as

$$\rho_{p,eff}=157/[160\cdot(200-0.252\cdot169)/3]=1.88\% \quad (3.42)$$

$$s_{r,max}=3.4\cdot26+0.8\cdot0.5\cdot0.425\cdot10/0.0188=178.8\,mm \quad (3.43)$$

$$\varepsilon_{sm}-\varepsilon_{cm}=\frac{290-0.6\cdot\frac{1.70}{0.0188}\cdot(1+7.8\cdot0.0188)}{210}=1.08‰ \quad (3.44)$$

$$w_{m,7} = \frac{178.8}{1.7} \cdot 0.00108 = 0.11\,mm \tag{3.45}$$

As can be seen, the initial stress, strain and crack width values for beams loaded after 7 days are very close to those for the beam loaded after 28 days, even slightly higher. This is because of the higher $\sigma_c/f_{cm}(t_0)$ ratio. In the case of the beam loaded after seven days, if we calculate the $\sigma_c(7)/f_{cm}$ ratio as 12.8/26.25 = 0.49 it can be seen that through compressive strength increase—from 21.47 to 26.25 MPa—the $\sigma_c/f_{cm}(t_0)$ ratio will drop to 0.49 by the 28th day. Creep will further decrease the concrete compressive stress, to a value very close to 0.45. This means that all six beams will have a $\sigma_c(28)/f_{cm}$ ratio equal to 0.45.

3.4.2 Beam Casting

In the experimental phase, two beams were cast from each concrete, one to be loaded after 7 days and the other after 28 days. These loading ages were selected as being representative of 'early' and 'standard' loading ages of typical reinforced concrete structures, e.g. buildings.

Depending on the concrete and loading age, the beams were named **NAC7**, **NAC28**, **RAC7**, **RAC28**, **HVFAC7** and **HVFAC28**. The beams were cast in the Faculty of Civil Engineering's Laboratory for Concrete and Rheology in the following sequence—NAC beams on January 25, RAC beams on February 2 and HVFAC beams on February 10, 2016. A vertical-axis Controls pan mixer with a 70 l capacity was used, Figure 3.15. One

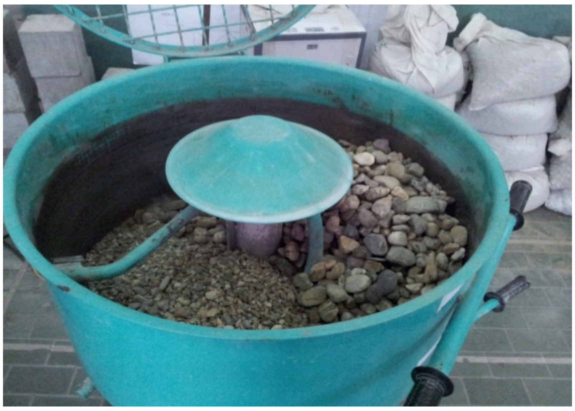


FIGURE 3.15: Vertical-axis pan mixer

day prior to casting, two formworks were prepared by placing the previously delivered reinforcement cage—provided and prepared by Deneza M, Belgrade. The formworks were lubricated by commercially available formwork oil, Oplatonal. The volume of each beam was 0.16·0.2·3.5 = 0.112 m^3 and the pan mixer was loaded up to 40 l in each mixing. This means that the beams were cast in approximately four batches each. To aid placing, a 50 mm diameter vibrator was used to homogenize the concrete and release entrapped air, Figure 3.16. After casting, the beams were cured for 24 h. During this period, they were covered with jute matting which was kept wet and above which plastic sheets were placed. After 24 h, one side of the formwork was opened and the beams were slightly moved to separate them from the other side of the formwork; thus, they were left lying on the bottom side of the formwork, drying under laboratory conditions. The accompanying test specimens (described in section 3.4.3) were cured in the same way.

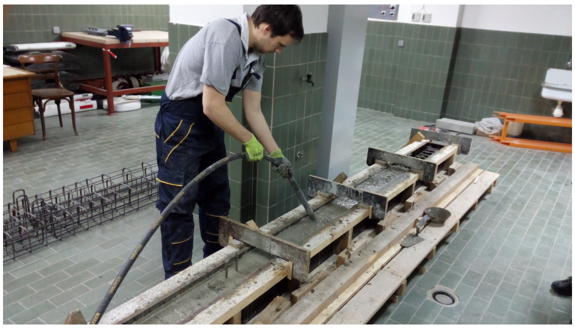


FIGURE 3.16: Placing concrete in the formwork

Strictly speaking, this curing regime is not in accordance with the Serbian design code for reinforced concrete structures (Ivković and Pakvor, 1989) which prescribes curing of concrete for at least seven days or until 60% of the characteristic compressive strength is reached. Since there was no testing of compressive strength after one day, the curing regime cannot be said to comply with these provisions. Nonetheless, curing concrete for only one day is standard practice in the Serbian construction industry, at least for the majority of structures such as buildings, and the aim was to simulate this in the experiment. From the insights of previous research, it was expected that this curing regime would have an impact on the evolution of mechanical properties of the concretes, especially HVFAC.

The laboratory in which the experiment was conducted is situated in the basement of the Faculty of Civil Engineering. The laboratory is 8.2·12.7 m with one corner being occupied by steel frames for testing creep, which will be explained in the subsequent section. The fact that the laboratory is situated underground and has no windows makes controlling temperature and humidity easier. The room is equipped with a Mitsubishi air-conditioning unit capable of controlling temperature. However, there is no option for directly maintaining a set RH. Prior testing of the AC unit showed that when the temperature is set at 21°C, RH will oscillate around $50 \pm 10\%$. This was deemed satisfactory and sufficiently representative of realistic conditions for indoor structural elements, and for the entire duration of the experiment the AC units were set to maintain a temperature of 21°C. Both temperature and RH were recorded with a EasyLog USB measuring device.

3.4.3 Accompanying Concrete Test Specimens

In this section, the casting and testing of accompanying concrete specimens is explained. Alongside the reinforced concrete beams, concrete specimens were necessary in order to measure and track the development of important mechanical properties of each concrete.

The mechanical properties selected for measurement were concrete compressive strength (f_c), tensile splitting ($f_{ct,sp}$) and flexural strengths ($f_{ct,fl}$) and the modulus of elasticity (E_c). For concrete compressive strength, 100/100/100 mm cubes were selected and tested according to (ISO 4012, 1978). This was considered to be the most practical option, requiring the least amount of concrete and it was possible since the maximum aggregate size used was $d_{max} = 16$ mm. For testing splitting tensile strength, ⌀150/150 mm cylinders were used and for flexural tensile strength, 120/120/360 mm prisms; tests were carried out according to (ISO 4108, 1980) and (ISO 4013, 1978), respectively. The modulus of elasticity was determined using ⌀150/300 mm cylinders according to (ISO 6784, 1982).

Beside mechanical properties, it was essential to measure long-term properties of the concretes – creep and shrinkage. For this purpose, 120/120/360 mm prisms were used.

Since the evolution of concrete properties was of interest, a large number of specimens were necessary. For all mechanical properties, a measurement at a certain age (e.g., 28 days) consisted of testing three specimens; the value reported for the property is the mean value of these three results.

Concrete compressive strength was tested at six ages: 7, 28, 90, 240 and 450 days. Since all the specimens were kept in the same laboratory as the reinforced concrete beams, it was decided to determine compressive strength after 28 days for standard water curing conditions as well (in order to enable comparability with other results and codes). In total, this meant six instances of compressive strength measurements for each concrete. With three cubes necessary for each occasion, this amounted to 21 cubes cast for testing compressive strength of each concrete.

Tensile and flexural strengths were measured after 7 and 28 days—coinciding with the days when the beams were loaded—which meant six ⌀150/150 mm cylinders and six 120/120/360 mm prisms for these properties were necessary.

The modulus of elasticity was measured at the same ages as compressive strength: 7, 28, 90, 240 and 450 days. Since these were non-destructive tests, only three large cylinders were necessary per concrete.

The specimens were cast in steel moulds on the same day as the beams. Good placing was ensured by vibrating the specimens on a vibrating table. They were cured in the same manner – 24 h curing with wet jute matting. After this, the specimens were unmoulded and kept in the Laboratory for Concrete and Rheology alongside the beams until testing, except for the three cubes cured in a water tank for 28 days, Figure 3.17. All of the tests of mechanical properties were carried out at the Faculty of Civil Engineering's Laboratory for Testing Materials. Compressive and tensile strengths were determined on a 600 kN Amsler hydraulic press, Figures 3.18 to 3.20. The modulus of elasticity was measured using a 2500 kN Amsler hydraulic press and a Controls measuring ring with a dial indicator, Figure 3.21. Creep and shrinkage were measured on three prisms each, with creep being measured for the same loading ages as the beams: 7 and 28 days. The specimens were cast and afterward cured together with the cubes and cylinders, i.e. one day of wet curing and consequent storage in the Laboratory for Concrete and Rheology under controlled environmental conditions (as explained in section 3.4.2). The strain measurements were carried out by an INSIZE mechanical strain gauge with a 100 mm base, Figure 3.22. In order to be able to start shrinkage measurements as soon as possible, immediately after the end of the curing period—24 h after casting—the specimens' surface was dried with an electric fan and steel pins for strain measurements were glued using HBM's X60 two-component fast-curing adhesive, which enabled measurements after just 15 min. For

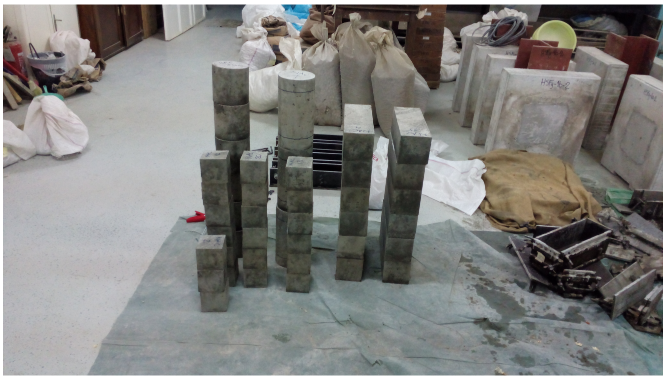


FIGURE 3.17: Concrete test specimens

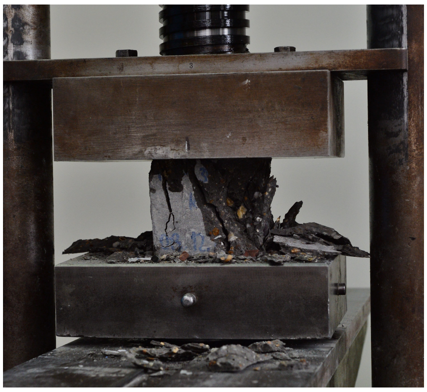


FIGURE 3.18: Compressive strength testing

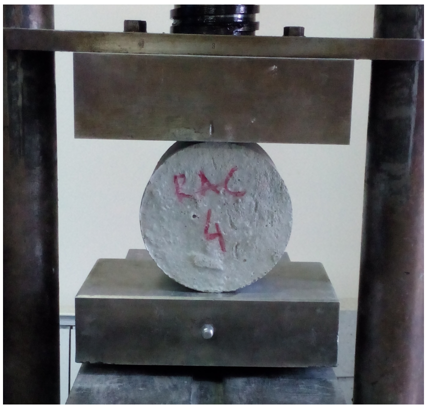


FIGURE 3.19: Splitting tensile strength testing

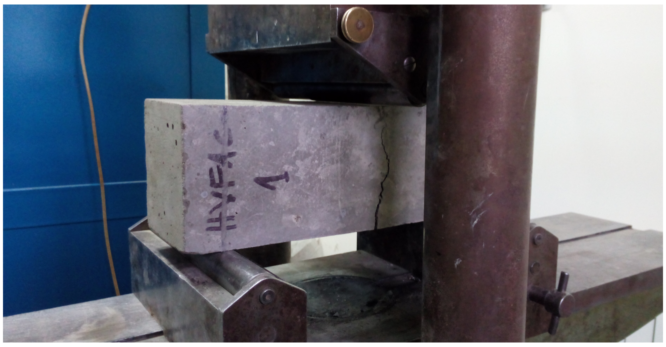


FIGURE 3.20: Flexural tensile strength testing

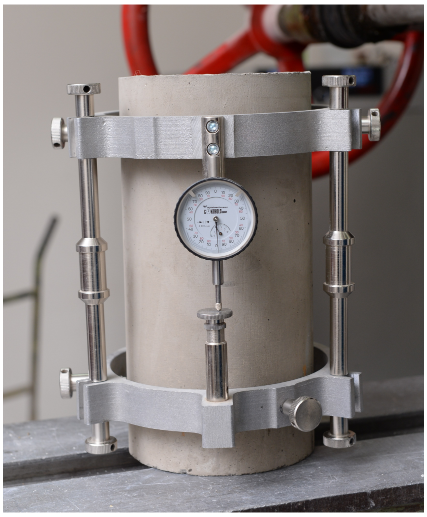


FIGURE 3.21: Modulus of elasticity testing

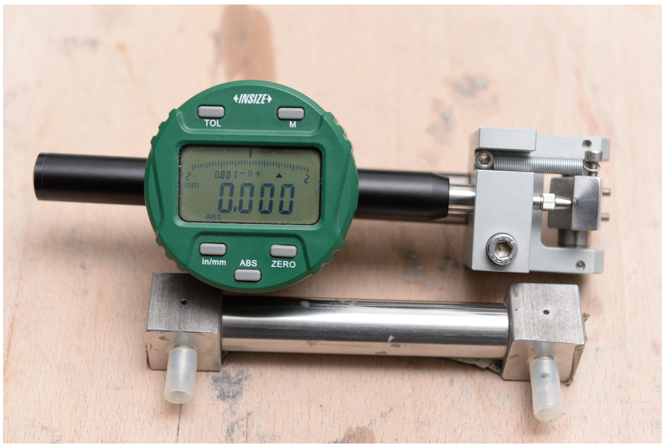


FIGURE 3.22: Mechanical strain gauge

shrinkage, the steel pins were positioned in the middle of two opposite sides of each prism. In this way, it was possible to start shrinkage measurements 24 h after casting, i.e. almost immediately after the end of the curing period. During the entire experiment, the prisms for measuring shrinkage were held in the upright position, Figure 3.23. Creep was tested in special steel frames, using a lever arm mechanism to multiply the weight of the applied load, Figure 3.24. Each frame allows for three prisms to be placed inside, with the rotatable steel plates above them ensuring axial load application, as much as possible.

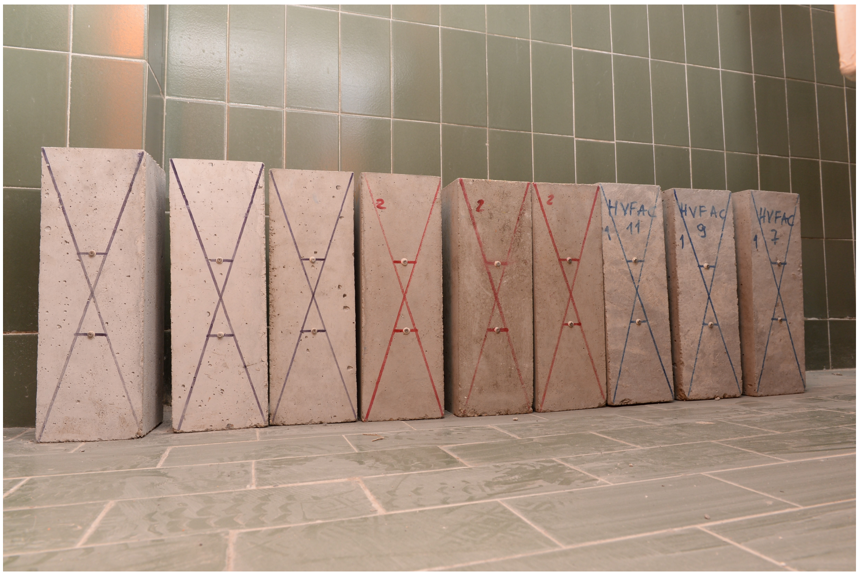


FIGURE 3.23: Prisms for measuring shrinkage

One important constraint existed in the case of steel frames. Only four frames were functional and usable in the laboratory and six were necessary – three concretes and two loading ages. Because of this, creep tests were not performed on NAC, only shrinkage. This enabled the complete testing of RAC and HVFAC for both loading ages. Omitting NAC from creep tests was chosen as the least bad option since there are already relatively abundant results for NAC creep (for this range of compressive strengths, loading ages and other relevant conditions) which are in most cases successfully predicted by existing models (Al-Manaseer and Prado, 2015; Bažant and Baweja, 1995c; Wendner et al., 2015b). Here also, it was considered that creep of this NAC will be successfully predicted by existing models and to a certain degree deduced from strain results on reinforced concrete beams. To assess the multiplication factor of the frames, a trial test was carried out on each frame. Concrete prisms were set in the frame and a load cell was placed on top of

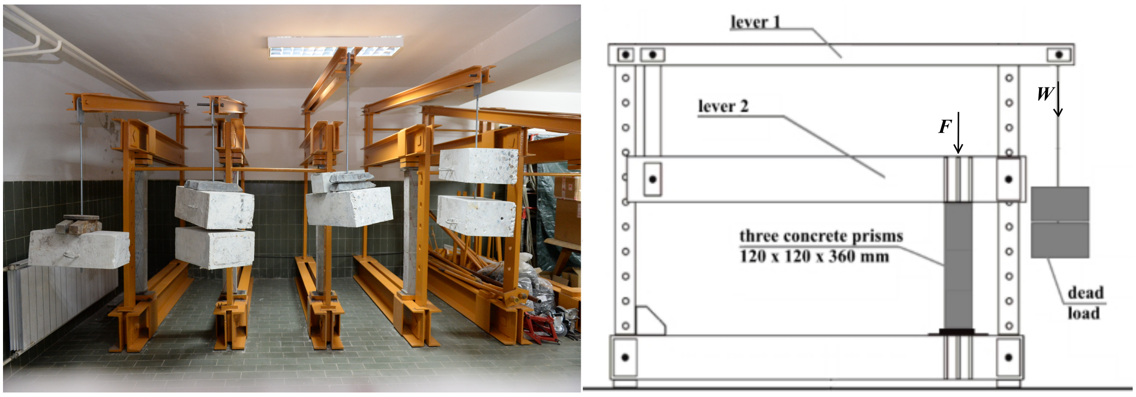


FIGURE 3.24: Steel frames for testing creep – in the laboratory (left) and scheme (right)

them to electronically record the force acting on the prisms. Before hanging any load to the frame, a force of 40.6 kN was recorded on the load cell, simply from the self-weight of the frame. Afterward, measured weights were hung on the frame and the force recorded for each step of loading as well as unloading. In this way the following equation was derived for the force in the frame, valid for all frames

$$F = 0.99 \cdot W + 40.6 \tag{3.46}$$

where F is the force acting on the prisms in the frame (kN) and W is the weight of the load hung on the frame (kN).

Steel pins for measuring strains were glued on all four sides of the specimens, similar to the specimens for shrinkage. In this case, SikaDur 31 two-component adhesive was used since it has a 24 h setting time and there was no time constraint – the first measurements were seven days after casting. Also, groups of three prisms were glued together using the same adhesive, controlling for their verticality.

On the day of loading—after 7 and 28 days—compressive strength, tensile strength and the modulus of elasticity were tested. From the compressive strength and the desired $\sigma_c/f_{cm}(t_0)$ ratio (whose precise determination will be explained in the following section) the necessary force acting on the prisms was calculated. From this value and Equation 3.46 the required weight of load was determined. For the specimens loaded after 7 days, with a 14400 mm^2 specimen area and a 12.88 MPa stress limit (calculated in section 3.4.1), a 185.5 kN force would be necessary. From Equation 3.46, an imposed load of 146 kg can be determined. The specimens loaded after 28 days had a 11.81 MPa stress limit (calculated in section 3.4.1) and a 170 kN force would be required. From Equation 3.46, an imposed load of 130.7 kg can be determined. For loading, lead weights were used in combination with 200/300/800 mm segments of reinforced concrete beams (left over after the previous experiment in (Ignjatović, 2013).

First, the block of three glued prisms was placed in the frame. The upper steel beams were then raised and held in that position until the prisms were positioned, centred and the remaining gap between the upper steel plate and the prisms filled by wedging additional steel plates, Figure 3.25. Before lowering the steel beams the initial or ’zero’ measurement was read. Then, the steel beams were lowered and the previously chosen and measured load hung onto the frame. The first reading was taken after 5 min, regarded as the elastic deformation of the specimens. Subsequently, measurements were taken after 1 h and 6 h on the first day, every day during the first week, every seven days during the first month and every 30 days until 450 days.

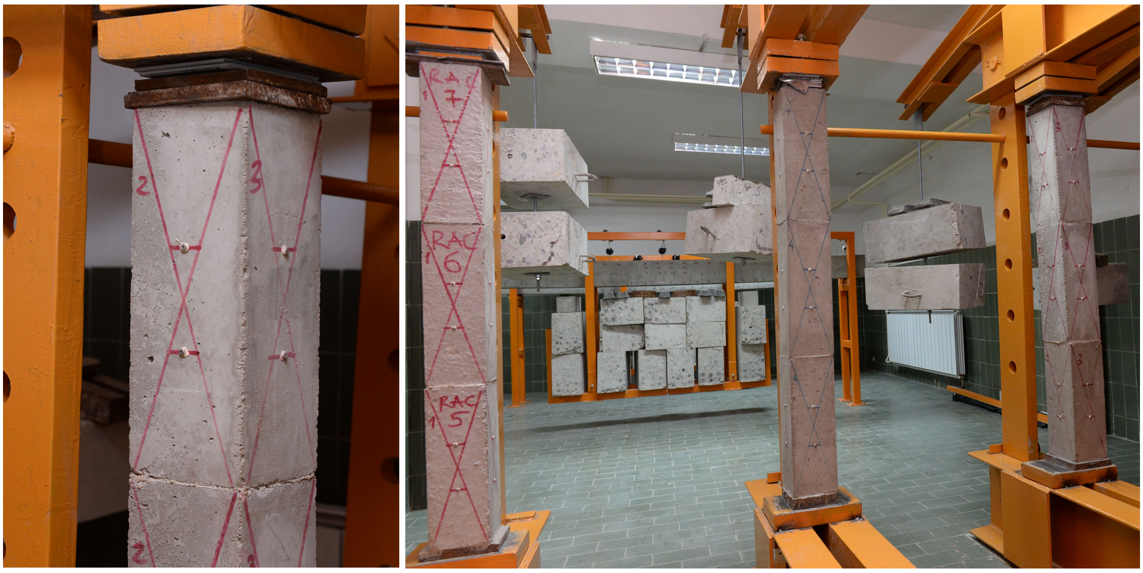


FIGURE 3.25: Prisms positioned in the frame

Given the information and methods described above, it is clear that the creep and shrinkage measurements were not fully compliant with existing standard procedures and recommendations (Acker et al., 1998; C512/512M-10, 2010; SRPS U.M1.027:1983, 1983; SRPS U.M1.029:1983, 1983). The experimental programme deviates from some standards in specimen size and shape, loading device, measurement base length and curing and storing conditions. However, the standards themselves vary widely in these aspects and the main points of importance have been achieved in this experiment: controlled environmental conditions for storing the specimens (the same as the beams which they accompany), a base of measurements in the middle third of the specimens (an equally distributed stress state and avoidance of edge effects), allowed unrestrained shrinkage for shrinkage specimens and a constantly applied axial compression force for creep specimens.

3.4.4 Beam Loading Procedure and Measurements

As stated in section 3.4.1 the beams were cured for 24 h. After this period, one side of the formwork was opened and the equipping of the beam with measuring devices began. In order to continue, it is first necessary to set out an explanation and justification of the experiment disposition and of the chosen measurement procedures.

First, the experiments disposition: a four-point bending test with sustained loads. It was necessary to design a test setup that would overcome as many of the deficiencies of previous experiments as possible. The most important characteristic that was desired was instantaneous loading of the beams. This was observed to be a major deficiency in previous experiments, in some of which, the period between loading and first measurements lasted up to 8 h (Washa and Fluck, 1952). Beside this, the test setup had to enable the application of sufficient loading that would cause a developed state of cracks in the beam with an easily observable and measurable deflection. Since the load would consist of 200/300/800 mm segments of reinforced concrete beams (left over after the previous experiment in (Ignjatović, 2013)), this would need to be taken into account when designing the test setup, Figure 3.26. The following design was adopted: for each beam, a steel support structure was designed and constructed by Čelikinvest d.o.o., Belgrade, Figure 3.27. As can be seen, each one consisted of two Vierendeel columns constructed from 80/80/3 mm rectangular steel tubes, connected by a longitudinal beam, a 80/40/3 mm rectangular steel tube. The height of the columns was chosen so that measurements on the beam could be made from a comfortable standing position; hence, the supports were positioned 1100 mm above the floor.

The supports were designed so that one would be fixed and the other free. To enable rotation, they were made from ⌀51/3.5 mm steel tubes—with strengthening inside—either

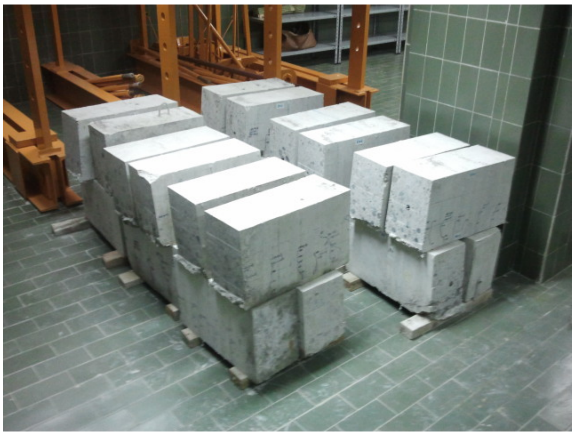


FIGURE 3.26: Load for beams

fixed or free to roll, Figure 3.28. The role of the longitudinal beam was to prevent differential movement of the columns and to enable the placement of dial indicators for deflection measurements. The load application was designed in the following manner.

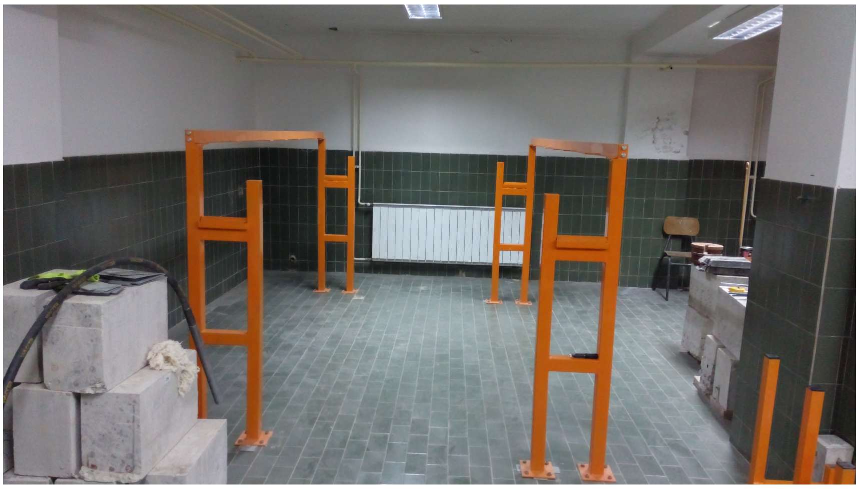


FIGURE 3.27: Steel support structure

After manually raising the beams onto the supports—usually 4–5 persons, using steel rods and reinforcement loops in the beams, Figure 3.29—two pairs of 'Π' shaped steel 'hands' were placed over the beam—dividing the span into three parts (107–106–107 cm), Figure 3.30. The 'hands' were made from 60/60/3 mm rectangular steel tubes with steel plates on their ends with drilled ⌀13 mm holes.

For each beam, a steel cart was designed for placing the load, Figure 3.31. The cart was made from 60/60/3 mm and 40/40/2 mm rectangular steel tubes. The weight of the

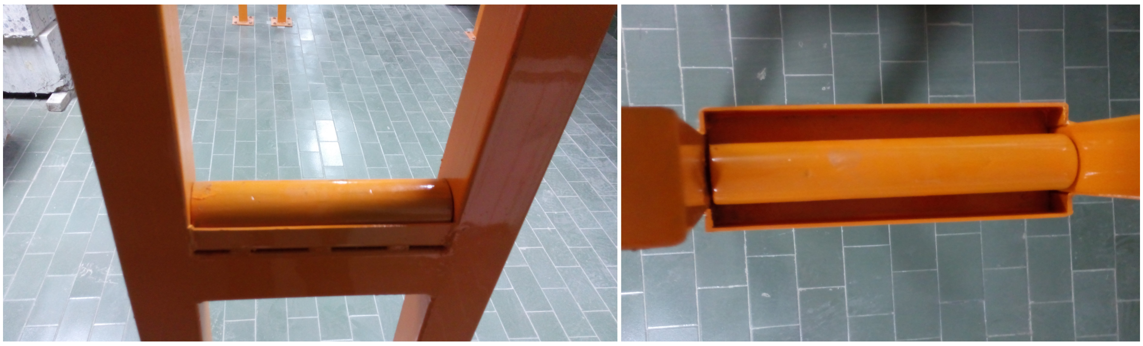


FIGURE 3.28: Steel support roller – fixed (left) and free (right)

steel cart and 'hands' was 60 kg; this was taken into account when the applied load was calculated. It also had vertical steel plates welded to its upper side and horizontal steel plates welded to its bottom side, all with drilled ⌀13 mm holes. The purpose of the horizontal plates was to enable the placement and removal of wheels. The wheels would be mounted on the cart; the cart would be loaded by placing pre-measured concrete beam segments; the cart would be driven underneath the beams and the vertical plates on the cart aligned with the vertical plates on the end of the steel 'hands', Figure 3.32 (photo is from the workshop, before painting). The steel cart would then be raised by four manual car-jacks in each corner of the cart; bolts would be screwed to connect the 'hands' with the cart; the wheels would be removed from the cart, Figure 3.33. Finally, a 'zero' reading of strains and deflections would be made (more on this later) and the car-jacks would be released simultaneously; thus, an instant application of the load would be achieved, Figure 3.34. The method for the precise determination of the applied loads is given in section 3.4.1. Precise values for each beam are given in section 4.3.1. Deflections were

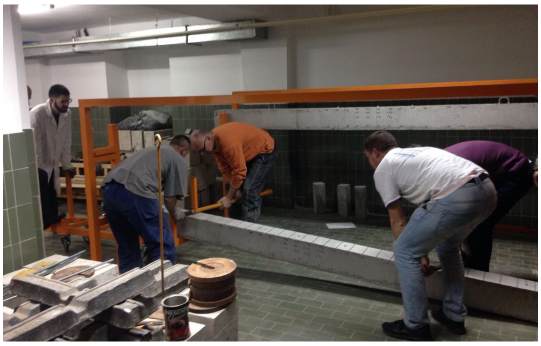


FIGURE 3.29: Raising beams onto supports

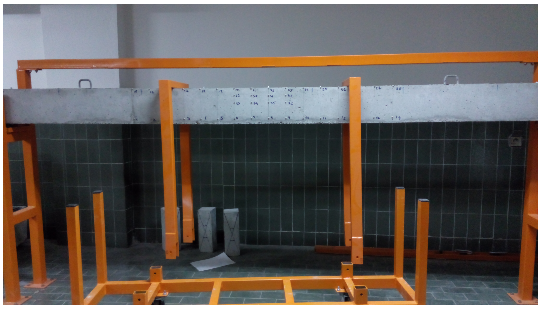


FIGURE 3.30: Steel 'hands' on beams

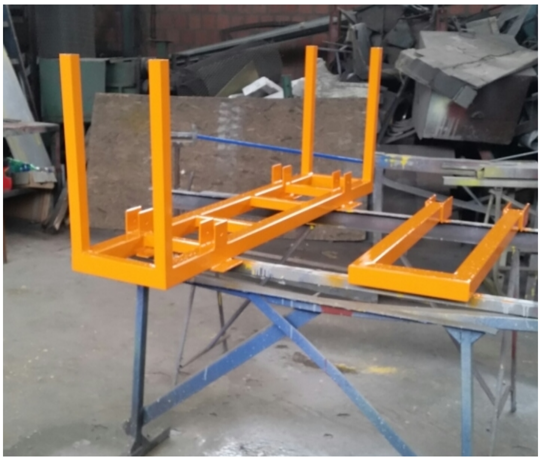


FIGURE 3.31: Steel cart

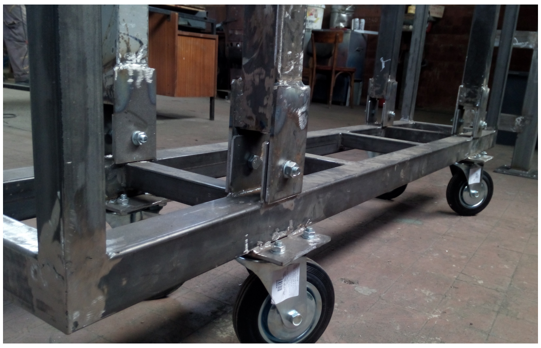


FIGURE 3.32: Steel cart aligned with steel 'hands'

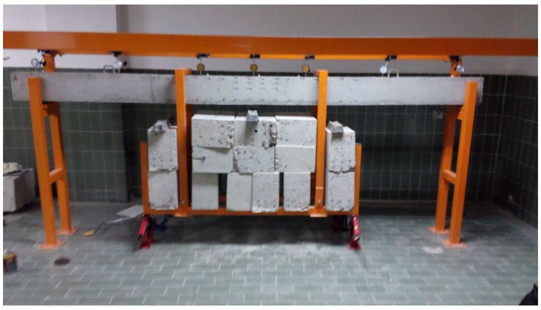


FIGURE 3.33: Raising the steel cart

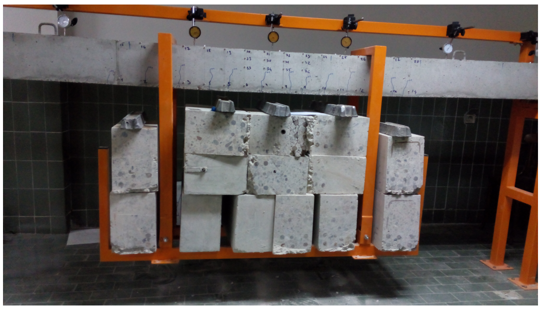


FIGURE 3.34: After releasing the car-jacks

measured in two ways. First, the deflections after applying the load were measured with dial indicators. Seven dial indicators were positioned above each beam. They were held with magnetic holders placed on the longitudinal steel beam and were in contact with a small steel plate glued on the top surface of the beams, Figure 3.35. The position of the dial indicators, relative to one support axis, is given in Table 3.7 for each beam.

The indicators above the supports and in the shear span were generic commercially available indicators with 0.01 mm precision and a 10 mm range; the three indicators in the middle span were SZOMET CZ indicators with 0.01 mm precision with a 30 mm range. Prior to their use, the indicators were calibrated, Figure 3.36. The first or 'zero' reading on the indicators was taken after positioning and bolting the cart below the beam, but before releasing the car-jacks. The first measurement was taken 5 min after loading and subsequently after 1 h and 6 h on the first day, every day during the first week, every seven days during the first month and every 30 days until 450 days. However, this way of measuring deflections obviously cannot measure the deflection of the beams from self-weight since its ’zero’ reading is only made after raising the beams on supports. Indeed, with dial indicators it is impossible. To overcome this, a method using geodetic measurements was devised. Although the self-weight of the beams should not crack the beams—and a deflection of only approximately 0.4 mm was expected (calculated as an elastic deflection of the uncracked section under distributed self-weight) i.e. 4–7% of the initial deflection due to the applied load—it was important to measure this deflection. One reason is the verification of the elastic deflection prediction of the uncracked beams and the other is the verification that the beams remained uncracked until loading—premature cracking of the beams would be detected through suspiciously large deflections from self-weight.

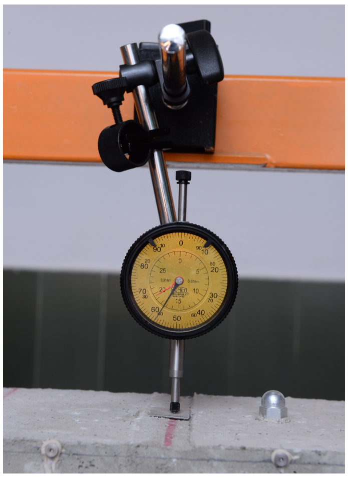


FIGURE 3.35: Dial indicator

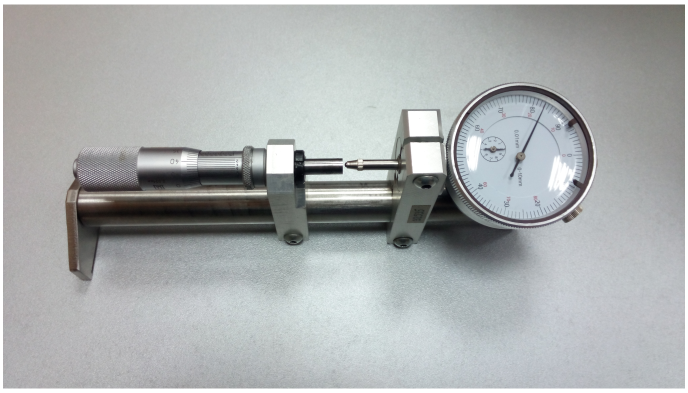


FIGURE 3.36: Calibration of dial indicator

TABLE 3.7: Position of dial indicators

Beam	Position relative to support (mm)						
	I_1	I_2	I_3	I_4	I_5	I_6	I_7
NAC7	-25	570	1170	1570	1970	2580	3170
NAC28	0	600	1200	1600	1940	2600	3200
RAC7	10	610	1210	1610	2000	2600	3200
RAC28	-10	595	1200	1590	1990	2590	3190
HVFAC7	5	600	1200	1590	2000	2600	3200
HVFAC28	-5	595	1195	1595	1990	2590	3185

This new method was as follows: after the curing period of the beam i.e. 24 h, five steel caps were glued onto the upper surface of each beam. The exact position of each cap relative to one support is given in Table 3.8. Some differences between their positions on each beam are noticeable. The aim was to position them close to supports, force application positions and the middle of the span; however, some deviations were unavoidable.

TABLE 3.8: Position of steel caps for geodetic measurements

Beam	Position relative to support (mm)				
	C_1	C_2	C_3	C_4	C_5
NAC7	20	1230	1610	1930	3120
NAC28	50	1260	1640	2000	3150
RAC7	60	1260	1560	1960	3160
RAC28	40	1240	1640	1940	3140
HVFAC7	50	1250	1650	1950	3150
HVFAC28	50	1250	1650	1940	3140

The measurements were performed with a precise self-adjusting level instrument Zeiss 007 KONI and a vertical ruler with a millimeter graduation and spherical level hangs up on it, Figures 3.37 and 3.38. The accuracy of these measurements was assessed as 0.1 mm. A leveling benchmark was positioned on one of the columns in the laboratory. First, two days after casting the beams, while still in the formwork i.e. prior to any movement, the

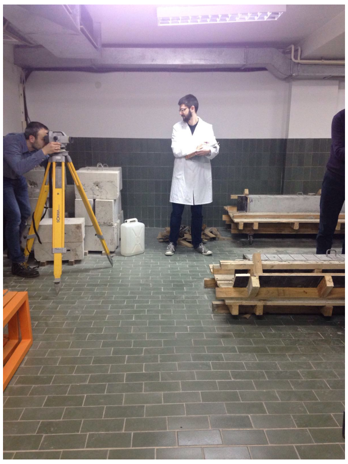


FIGURE 3.37: Precise self-adjusting level instrument

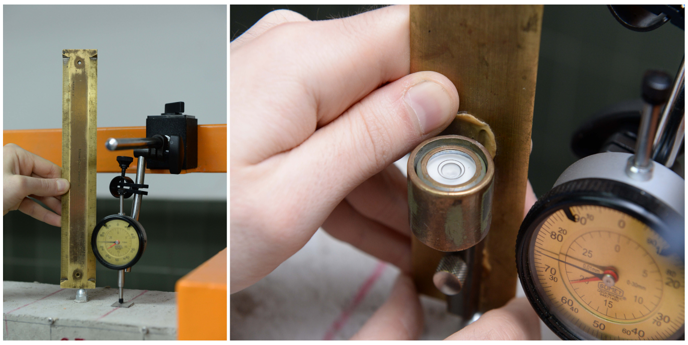


FIGURE 3.38: Ruler on a steel cap next to a dial indicator

initial reading was taken. Second, immediately after raising the beam onto the supports the second reading was taken. With the first measurement in the formwork, an initial diagram of the relative vertical position of all the steel caps could be obtained i.e. an initial 'centre-line' of the beam. After the second reading a new 'centre-line' could be drawn, consisting of the deflection from self-weight, but superimposed on the initial 'centre-line'. Hence, after deducting the relative positions of the first reading from the second, the final value of deflections from self-weight could be calculated, Figure 3.39. After these two measurements, additional ones were performed after 28, 90, 180, 365 and 450 days, as a control of the dial indicator measurements.

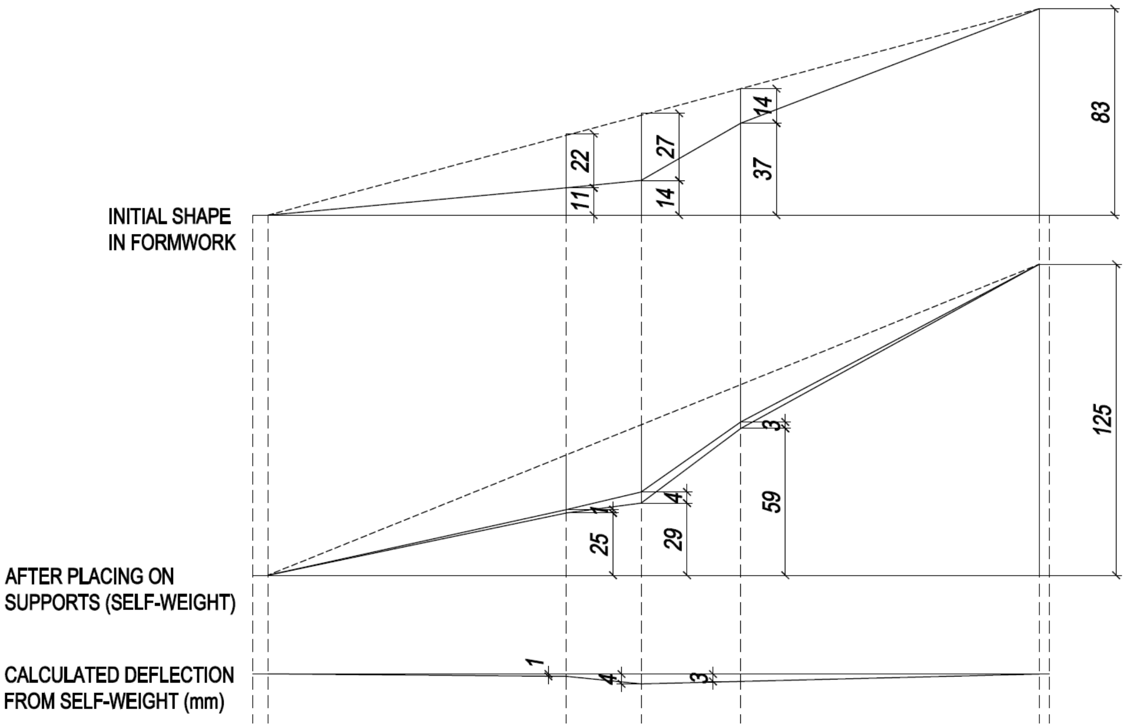

INITIAL SHAPE IN FORMWORK
22
11
27
14
14
37
83
AFTER PLACING ON SUPPORTS (SELF-WEIGHT)
1
25
4
29
3
59
125
CALCULATED DEFLECTION FROM SELF-WEIGHT (mm)
1
4
3

FIGURE 3.39: Representation of self-weight deflection calculation

Strains were measured using the same INSIZE mechanical strain gauge with a 100 mm base, as for creep and shrinkage prisms, Figure 3.22. Of interest were tensile strains in the bottom reinforcement and the compressive strains in the concrete. This type of strain gauge requires special steel pins and their position on the beam is given in Figure 3.40. Pins were present on both sides of each beam.

Since the four-point bending test provides a constant bending moment in the span between the applied forces, strain readings were concentrated in this area; only one reading position was placed adjacent to the load application position, in the shear spans.

To measure tensile strains in the bottom reinforcement, the pins were placed at the height of the bottom bars, 31 mm from the bottom of the beam. These pins were glued directly onto the concrete surface using the SikaDur 31 two-component adhesive. Through prior literature review (Cottingham et al., 1961; Jaccoud and Favre, 1982; Washa and Fluck, 1956) and a trial beam test, this type of pin position was determined to give sufficiently similar results as when the pins were placed 'directly' on the reinforcement.

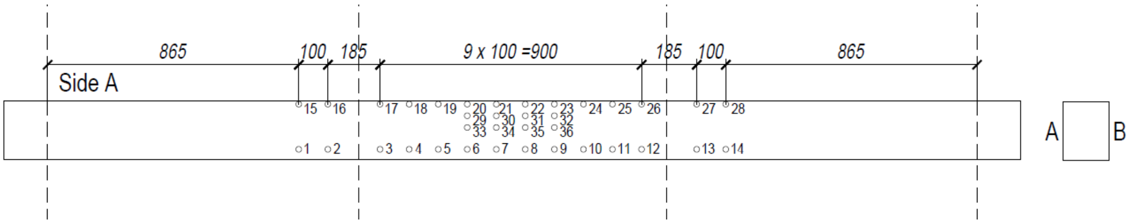


FIGURE 3.40: Layout of steel pins for strain measurements

For the top reinforcement, measuring strains 'directly' was never on option since the perpendicular steel bars necessary for this type of measurement would decrease the compressive zone of concrete. Since the accent of this experiment was not placed on the compressive reinforcement as a variable parameter, these strains were not measured; rather, they were calculated from the strain distribution in the cross-section. In all sections, beside the pins at the height of the bottom reinforcement, pins were positioned as near to the top of the beam as possible, 5 mm from the top. To obtain a strain distribution, in the middle of the beam, in three sections (Figure 3.40) steel pins were positioned along the height of the beam: at heights of 31, 115, 155 and 197 mm. In this way, the change in the position of the neutral axis could be monitored more precisely.

Finally, cracks were monitored, viz. crack widths and crack propagation. This was especially important for several reasons. First, the aim was to assess the physical implications of deflection calculations – the lowering of the neutral axis due to creep (Ghali et al., 2002; Pecić, 2012). This would be enabled by coupling the crack propagation measurements with strain measurements. Second, the aim was also to assess whether there exist differences in the cracking behaviour between NAC, RAC and HVFAC beams, already investigated under short-term loading by previous studies (Arezoumandi et al., 2015; Ignjatović et al., 2013; Kang et al., 2014).

A first inspection of each beam was performed after raising it on supports. Subsequently, 1 h after loading, cracks were measured in detail; their position and lengths were identified and highlighted with a marker and their widths were measured, Figure 3.41. All measurements were performed under a flash light and crack widths were measured with a commercially available crack gauge, Figure 3.42. Further measurements were performed 7, 28, 90, 180, 365 and 450 days after loading.

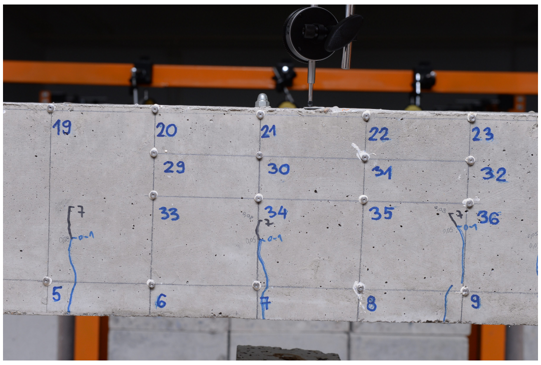


FIGURE 3.41: Marking crack lengths and widths

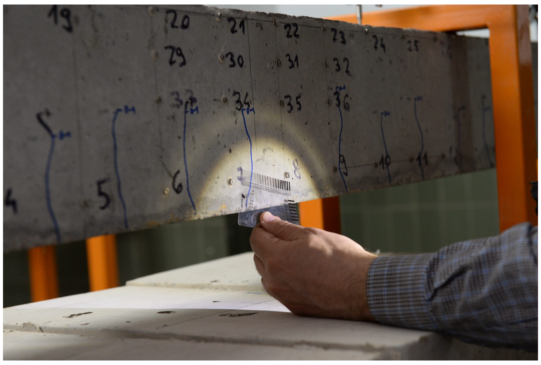


FIGURE 3.42: Measuring crack widths with a crack gauge

A detailed listing of all measurements, in raw data form, are provided in Appendix A.

Finally, since the majority of the measurements in this experimental programme were manual, it was especially important to keep the measurement error and uncertainty at a minimum. One way of doing so is to have the same type of measurement be taken always under the same conditions (time of day, reading position, etc.) and by the same person. Hence, every testing of mechanical properties of concrete was carried out by a (at the time) fellow PhD student, teaching assistant and colleague – Aleksandar Radević. The geodetic measurements were performed by professor Branislav Bajat and (at the time) teaching assistant Milutin Pejović, also from the University of Belgrade's Faculty of Civil Engineering. The majority of crack measurements were performed by a fellow PhD student, teaching assistant and colleague—Vedran Carević; some early measurements were performed by assistant professor Ivan Ignjatović, also from the University of Belgrade's Faculty of Civil Engineering. Finally, all of the readings on dial indicators and using the mechanical strain gauge (on prisms and beams) were carried out by the author of this thesis, Nikola Tošić.

3.5 Summary

In this section, the experimental programme of the thesis was described. The main goal was to design an experiment testing the long-term behaviour of reinforced concrete beams made from recycled and waste materials, under sustained loads.

The recycled materials used were coarse RCA and the waste material was fly ash. Material properties of the component materials were determined. This included assessing aggregate, fly ash and cement properties such as density and water absorption.

Three types of concretes were prepared: NAC, RAC and HVFAC. Mixtures of all three concretes were designed and their rheological and mechanical properties were verified experimentally. The mixtures were proportioned so as to have approximately the same workability and compressive strength. An initial slump of 100–150 mm and a slump of 50–90 mm after 30 min were targeted. The aim was also a 28-day mean compressive strength of 35 MPa (on a 100 mm cubic sample).

The main part of the experiment consisted of casting six 3.2 m-span simply supported reinforced concrete beams loaded in four-point bending with a sustained load at ages of 7 and 28 days (two beams made from each concrete). The load was applied for 450 days and it was determined by adopting a fixed $\sigma_c/f_{cm}(t_0)$ for all beams loaded at the same age. On all the beams, deflections, concrete and reinforcement strains were measured. Accompanying specimens for mechanical properties, as well as shrinkage and creep were also prepared and tested.

Chapter 4

Results of the Experimental Programme

4.1 Introduction

This chapter presents the results of the experimental programme described in Chapter 3.

It is divided into two major parts – material properties of concretes and results on reinforced concrete beams. The first part presents the results on the material level of the studied concretes – NAC, RAC and HVFAC. Their physical and mechanical properties are presented: workability, fresh and hardened density, compressive and tensile strength, modulus of elasticity, shrinkage and creep. The results are presented in graphical and numerical/tabular form and briefly commented on in the text. However, a deeper analysis of the results is reserved for section 5.2.

In the second part of this chapter, the results obtained on the six reinforced concrete beams are presented. This first includes a detailed description of how the load was calculated and applied to each particular beam, depending on the measured mechanical properties of the concrete. The load was different in each case because, as explained earlier, the aim was to achieve equal $\sigma_c/f_{cm}(t_0)$ ratios in beams loaded at the same age (7 and 28 days). In section 4.3.2, the deflections of the beams are presented in full detail. In section 4.3.3, crack spacing and crack width measurements are presented. Finally, section 4.3.4 describes the measurement results of strains in the beams.

4.2 Material Properties of Concretes

4.2.1 Workability

The workability of the concrete mixes was determined through a slump test, carried out in accordance with (EN 12350-2, 2010). As was stated in section 3.1, the mixes were produced targeting an initial slump of 100–150 mm, and a slump of 50–90 mm after 30 min. These values correspond to slump classes S3 and S2, respectively, as defined in (EN 206-1, 2000), Table 4.1.

TABLE 4.1: Slump classes according to (EN 206-1, 2000)

Class	Slump in mm
S1	10 to 40
S2	50 to 90
S3	100 to 150
S4	160 to 210
S5	≥ 220

In section 3.4.2 it was explained that the volume of the concrete mixer was such that approximately 4–5 batches were necessary for each beam and a further 6–7 for the accompanying specimens. Hence, initial slump was controlled for several batches; for the slump after 30 min, one batch was chosen (usually the last one) and after measuring its initial slump, the concrete was returned into the mixer, left to rest, covered with a plastic sheet and only remixed for 10 sec every 5 min.

In accordance with (EN 12350-2, 2010), the slump type was also checked – whether it is a ’true’ or ’shear’ slump, i.e. whether ’the concrete remains substantially intact and symmetrical’, Figure 4.1. The test is only valid if it yields a true slump.

The results of the slump test on all the mixes are given in Table 4.2. As per (EN 12350-2, 2010), the results are rounded to the nearest 10 mm.

The results in italic are for the shear slump measurements which are not valid according to (EN 12350-2, 2010). Unfortunately, slump after 30 min was not measured for HVFAC

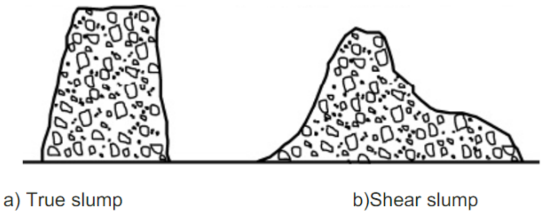


FIGURE 4.1: Forms of slump, (EN 12350-2, 2010)

TABLE 4.2: Slump test results

Batch No.	Time (min)	Slump form	Slump (mm)	Slump class
NAC 1	5	True	60	S2
NAC 4	5	Shear	*150*	*S3*
NAC 4	30	True	90	S2
NAC 5	5	Shear	*130*	*S3*
RAC 1	5	Shear	*190*	*S4*
RAC 2	5	Shear	*180*	*S4*
RAC 3	5	True	180	S4
RAC 8	5	True	70	S2
RAC 12	5	True	80	S2
RAC 12	30	True	50	S2
HVFAC 1	5	True	70	S2
HVFAC 7	5	True	100	S3
HVFAC 12	5	True	30	S1

because the last batch had an initial slump of 30 mm and it was expected it would have no slump after 30 min.

From Table 4.2 it can be seen that the target slump values were only partially achieved. Initial slump was difficult to control and it varied between batches of the same concrete; shear slump can be associated with higher slump values (above 130–150 mm) – in these cases it is sometimes difficult to distinguish between true and shear slump. Initial slump was more easily controlled in the case of NAC and HVFAC although the workability of HVFAC was generally poorer than for the other concretes. However, initial slump was problematic in the case of RAC where it exceeded the target slump class S3. This can be related to the water absorption of the aggregates and its kinetics. The initial absorption is probably overestimated with the used water amount which leads to higher slump values.

Importantly, however, the 30 min slump was (barely) achieved. The 30 min slump was also achieved in the case of NAC but not in the case of HVFAC.

Nonetheless, the differences between concretes are comparable with or even smaller than the differences between different batches of the same concrete. In the end, all concretes were sufficiently workable for placement—at least in laboratory conditions—and the results were accepted as such.

The pictures of the slump measurements are shown in Figures 4.2 to 4.4.

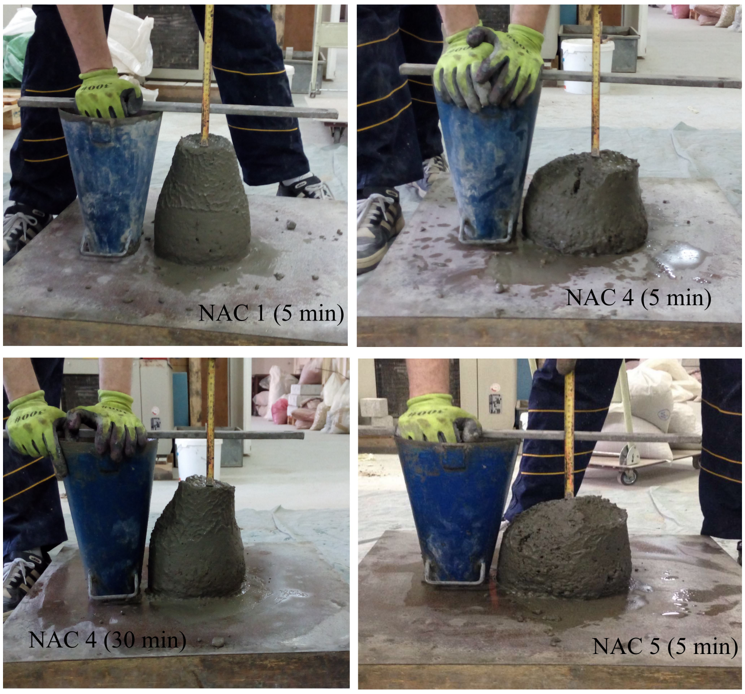


FIGURE 4.2: Slump measurements – NAC

4.2.2 Fresh and Hardened Density

The fresh density, γ_{fresh} of the mixes was determined immediately after casting, by first measuring the weight of empty molds for accompanying specimens (cubes, cylinders and prisms), then measuring their weight with concrete inside, subtracting the weights and dividing by the volume of the mold.

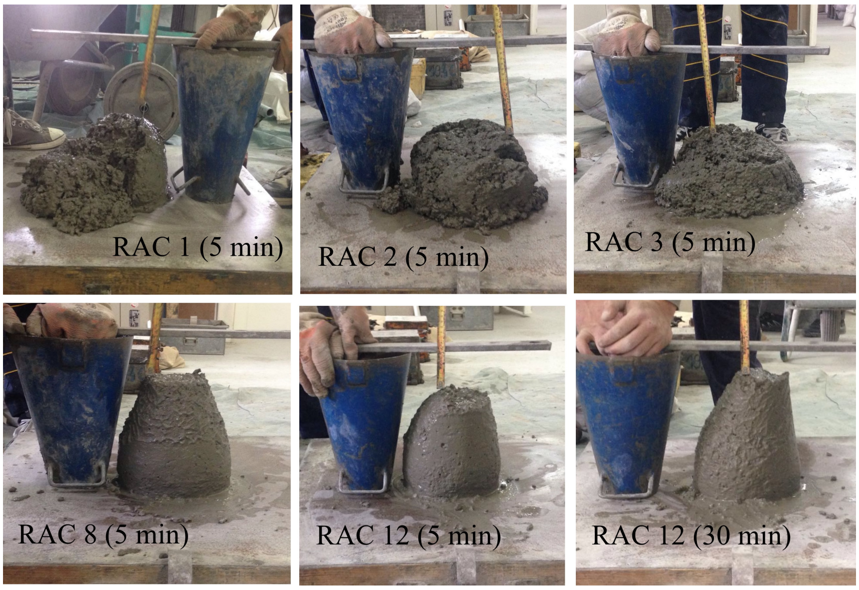


FIGURE 4.3: Slump measurements – RAC

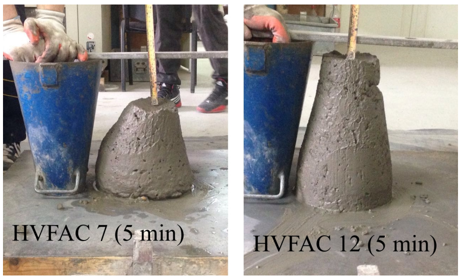


FIGURE 4.4: Slump measurements – HVFAC

The hardened densities were determined after demoulding all the specimens (45 in total for each concrete), $\gamma_{hard,1}$ and after 28 days on three 100 mm cubes used for testing compressive strength (kept in the laboratory alongside the beams), $\gamma_{hard,28}$.

The results are presented in Table 4.3, with the mean value μ rounded to the nearest 10 kg/m^3 and the CoV given in percentages.

As expected, both fresh and hardened densities are in the decreasing order of NAC, RAC, HVFAC. The CoVs of measurements for all concretes are very small and the ratio of fresh-to-hardened densities is also very similar for all concrete and equal to approximately 1.04, i.e. there is a 4% reduction in density between the fresh and hardened states (after 28 days). Also, the HVFAC's hardened density is relatively low, 2200 kg/m^3, but still

TABLE 4.3: Fresh and hardened densities of the concretes

	γ_{fresh}		$\gamma_{hard,1}$		$\gamma_{hard,28}$	
Concrete	μ (kg/m^3)	CoV (%)	μ (kg/m^3)	CoV (%)	μ (kg/m^3)	CoV (%)
NAC	2430	2.67	2390	1.61	2340	1.67
RAC	2340	1.54	2310	1.01	2240	0.75
HVFAC	2300	1.27	2280	1.20	2200	1.90

well-above the threshold for normal-weight concrete of 2000 kg/m^3 defined in (EN 206-1, 2000).

4.2.3 Compressive Strength

One of the two main targets when designing the concrete mixtures was the compressive strength. As explained in section 3.1, the target was a mean value of 35 MPa after 28 days on a 100 mm cubic sample. Compressive strength was tested after 7, 28, 90, 240 and 450 days on cubes kept in the laboratory alongside the beams and after 28 days on water-cured cubes. All reported measurements are average values from three cubes and the CoV within any three cubes tested on the same day, never exceeded 10%.

The results are presented in Table 4.4. The values in parentheses given in bold are 28-day compressive strengths of water-cured samples. In Table 4.5, the cube compressive strengths were converted to standard cylindrical specimens using a conversion factor of 0.75.

TABLE 4.4: Cube compressive strengths of the concretes

Concrete	$f_{cm,cube}(7)$ (MPa)	$f_{cm,cube}(28)$ (MPa)	$f_{cm,cube}(90)$ (MPa)	$f_{cm,cube}(240)$ (MPa)	$f_{cm,cube}(450)$ (MPa)
NAC	32.9	40.7 (**33.9**)	40.7	45.2	43.7
RAC	32.2	37.4 (**33.3**)	38.8	39.2	43.7
HVFAC	21.8	30.1 (**30.6**)	34.5	33.0	34.1

As can be seen from the results, the target cube compressive strength of 35 MPa was overshot in the case of NAC, approximately achieved in the case of RAC and undershot

TABLE 4.5: Compressive strengths of the concretes converted to standard cylinder strength

Concrete	$f_{cm}(7)$ (MPa)	$f_{cm}(28)$ (MPa)	$f_{cm}(90)$ (MPa)	$f_{cm}(240)$ (MPa)	$f_{cm}(450)$ (MPa)
NAC	24.7	30.5 (**25.5**)	30.5	33.9	32.8
RAC	24.2	28.1 (**25.0**)	29.1	29.4	32.8
HVFAC	16.4	22.6 (**23.0**)	25.9	24.8	25.6

by about 15% in the case of HVFAC. If water-cured samples are looked at, then the target is approximately achieved for both NAC and RAC, and again undershot by about 15% in the case of HVFAC. One potential solution to the problem could have been the use of superplasticizers in the case of HVFAC – this would enable a decrease of the *w/b* ratio and hence higher compressive strength (and probably greater slump). However, it was chosen not to use superplasticizers in this study in order not to introduce further uncertainties into the experiment.

An interesting effect can be noticed when looking at the ratio of compressive strengths of samples kept in the laboratory versus the water-cured ones. For both NAC and RAC, there is a significant (17% and 11%, respectively) reduction of compressive strength for water-cured samples, whereas the effect is not present in HVFAC. This is probably a combined effect of water availability and cement hydration kinetics in these concretes (i.e. the effect of the pozzolanic reaction of HVFAC).

The time evolution of compressive strength and a comparative view of different concretes is given in Figure 4.5 alongside error bars representing highest and lowest values measured on individual specimens.

From Figure 4.5 several interesting things can be observed. Firstly, the time evolution of compressive strength is most pronounced for HVFAC, with $f_{cm}(t)/f_{cm}(28)$ ratios of 0.73, 1.15, 1.10 and 1.13 for 7, 90, 240 and 450 days, respectively. The time evolution of compressive strength is low for this type of concrete, if usual research results are taken as a benchmark. An identical mixture was previously produced with the same fly ash (Dragaš et al., 2016); the mix had 7, 28 and 90-day cube strengths of 22.7, 34.2 and 44.2 MPa. The 7-day strengths are practically identical but the 28 and 90-day values are now

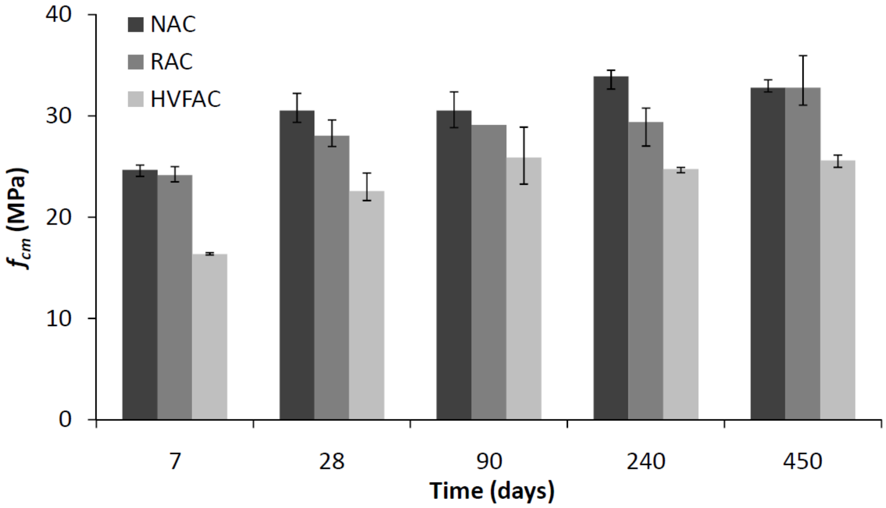


FIGURE 4.5: Time evolution and comparison of compressive strengths

13% and 28% lower; the $f_{cm}(t)/f_{cm}(28)$ ratios for 7 and 90 days were 0.66 and 1.29 respectively. However, there exists a significant difference between these two series of results – the curing regime. In (Dragaš et al., 2016), the cubes were cured in water until testing, whereas here they were air cured after demoulding. This effect should be viewed in conjunction with the results from Ramezanianpour and Malhotra (1995) explained in section 2.7.1: in this particular case, one day of wet curing slowed down and decreased the development of compressive strength, mostly after 28 days. Nonetheless, this curing regime is more realistic and similar to construction practice in Serbia.

As for NAC, the $f_{cm}(t)/f_{cm}(28)$ ratios are 0.81, 1.00, 1.11 and 1.07, and for RAC 0.86, 1.04, 1.05, 1.17. In accordance with earlier findings, the time evolution of RAC strength was slightly more pronounced than for NAC.

For all three concretes there were certain variations in compressive strength over time, for example, the NAC 90-day strength was the same as the 28-day strength; but these are mean values and it can be seen that the scatter of results overlaps significantly.

4.2.4 Tensile Strength

As explained in section 3.4.3, splitting tensile strength $f_{ct,sp}$ and flexural tensile strength $f_{ct,fl}$ (on 120/120/360 mm prisms) were determined for all concretes at the age of 7 and

28 days.

The results are presented in Table 4.6. All of the reported values are averages of three tested specimens. Not surprisingly, the CoV for splitting tensile was larger than for compressive strength: between 12% and 25%; however, the CoV for flexural tensile strength was lower: between 3% and 10%.

TABLE 4.6: Splitting and flexural tensile strengths of the concretes

Concrete	$f_{ct,sp}(7)$ (MPa)	$f_{ct,sp}(28)$ (MPa)	$f_{ct,fl}(7)$ (MPa)	$f_{ct,fl}(28)$ (MPa)
NAC	2.0	2.4	5.6	6.7
RAC	2.0	2.5	5.4	6.4
HVFAC	1.2	2.1	4.3	5.2

The results show that NAC and RAC have practically the same tensile strengths (both splitting and flexural) and a practically identical time evolution of those strengths. For NAC, the increase in splitting and flexural tensile strength from 7 to 28 days is 17% and 16% respectively, whereas it is 20% and 15% for RAC. HVFAC has lower tensile strengths, especially the splitting tensile strength after 7 days (only 60% of the NAC and RAC splitting tensile strength); after 28 days it catches up to 86%.

Among all the concretes, there is a relatively uniform ratio of splitting-to-flexural tensile strength. For NAC, this ratio is 2.83 and 2.77 after 7 and 28 days, respectively; for RAC 2.75 and 2.59; and for HVFAC 3.65 and 2.51.

4.2.5 Modulus of Elasticity

Measuring the modulus of elasticity E_{cm}, although extremely important for this study, proved to be in some ways difficult and problematic, precisely for RAC for which it is the most important. As stated in section 3.4.3, the measurements were made on cylinders at the ages of 7, 28, 90, 240 and 450 days. The measurements were always made on the same three cylinders throughout the entire experiment. When the measurements were successful, the CoV between the three samples never exceeded 15%.

However, for RAC after 7 days, one result was detected as an outlier (its value was only 60% of the other two); hence, it was discarded and $E_{cm}(7)$ for RAC is the average of two values. At the age of 28 days, when RAC was being tested, there was a malfunction of the measuring equipment after the first measurement and the remaining two could not be measured at all. Hence, the reported value of $E_{cm}(28)$ for RAC is a single value. Unfortunately, 7 and 28 days were the most critical because load calculation for the beams depended on them. The values obtained in this way were sufficiently in line with expectations and they were accepted. Later analysis will show whether this was fully justified.

The values are given numerically in Table 4.7 and graphically in Figure 4.6 with error bars representing highest and lowest measured values on individual cylinders.

TABLE 4.7: Modulus of elasticity of the concretes

Concrete	$E_{cm}(7)$ (GPa)	$E_{cm}(28)$ (GPa)	$E_{cm}(90)$ (GPa)	$E_{cm}(240)$ (GPa)	$E_{cm}(450)$ (GPa)
NAC	30.1	32.2	32.4	33.2	34.5
RAC	26.2	30.8	25.3	26.4	28.6
HVFAC	25.2	28.7	27.7	29.7	30.2

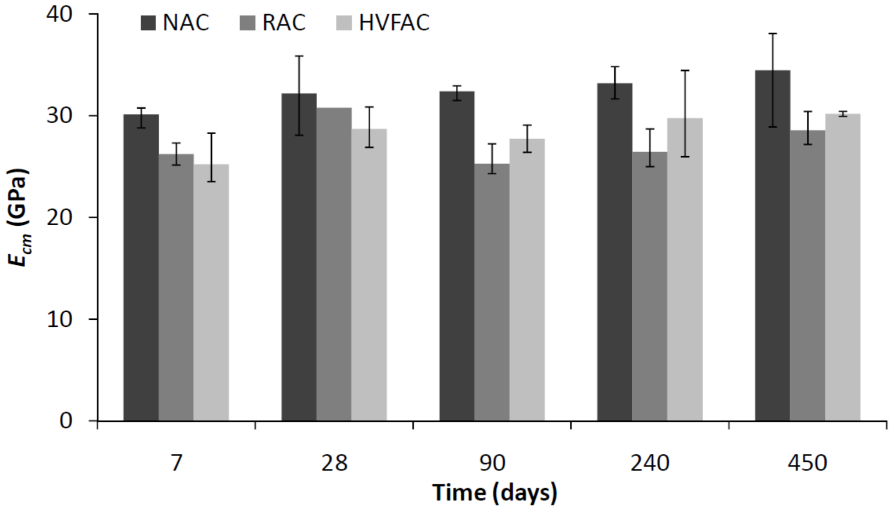


FIGURE 4.6: Time evolution and comparison of the modulus of elasticity

The first thing that can be noticed is that NAC has the highest modulus of elasticity at all ages, and around a value which is to be expected for this strength class (ca. 30 GPa), but also the highest scatter of results. Both RAC and HVFAC have 10–15% lower values at all times, with HVFAC having a slightly larger modulus of elasticity. The value which stands out is $E_{cm}(28)$ for RAC—the single measured value—it clearly doesn't fit the trend for RAC and the average value would probably have been lower.

The time evolution of the modulus of elasticity for all the concretes is barely noticeable (this is expected, the time evolution of the modulus of elasticity is much slower than for compressive strength). As with compressive strength, there are some variations over time with the modulus of elasticity seemingly decreasing; however, these are mean values and when looking at the scatter it can be seen that it overlaps significantly between consecutive measurements.

4.2.6 Shrinkage

It was explained in section 3.4.3 that shrinkage was measured on 120/120/360 mm prisms with three prisms for each concrete; as outlined, the measurements were performed with a mechanical strain gauge and steel pins glued to two sides of each prisms. Hence, the obtained shrinkage strain values for each concrete are averages of six measurements.

The first important thing to note are the environmental conditions in the laboratory during the experiment. The changes in temperature and humidity are shown in Figure 4.7. It can be seen that temperature indeed remained relatively constant during the entire period oscillating between 18°C and 25°C. Humidity, on the other hand, displays much larger variations between 28% and 68% with an average value of 48.5%. However, some long-term changes and trends are observable: in the period January–October 2016 humidity was higher, between 45% and 60%. Then, in the period November 2016–January 2017 it dropped to an average of 32.9% and started increasing again until May 2017 in which it averaged 54%. Temperature and humidity monthly averages are given in Table 4.8.

Table 4.9 presents the shrinkage measurements for NAC, RAC and HVFAC. The results show a relatively large shrinkage strain for all concretes after 477 days of drying. The results are shown graphically in figs. 4.8 and 4.9 in linear and logarithmic time scales, respectively.

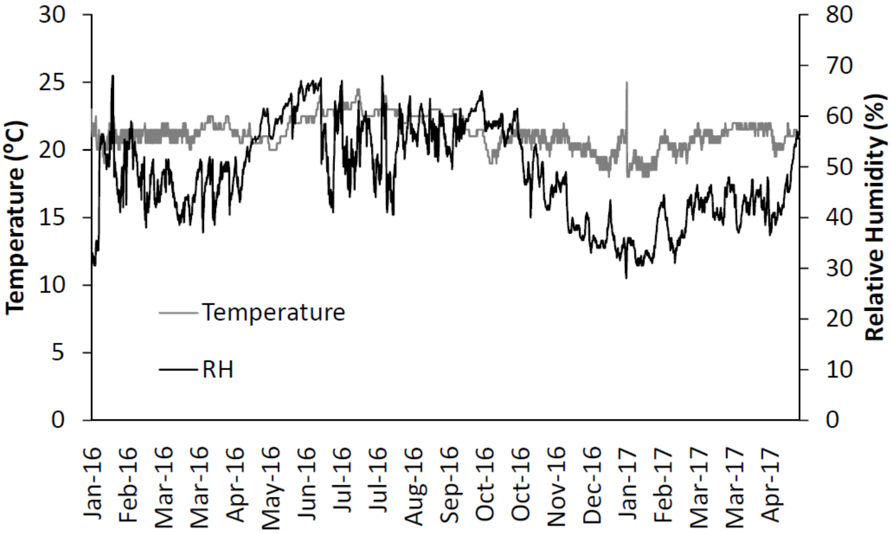


FIGURE 4.7: Temperature and humidity in the laboratory during the experiment

TABLE 4.8: Temperature and humidity monthly averages

Month	Temperature (°C)	RH (%)
January 2016	20.8	44.1
February 2016	21.2	49.9
March 2016	21.2	44.7
April 2016	21.6	47.1
May 2016	20.9	58.2
June 2016	22.6	59.9
July 2016	23.2	54.5
August 2016	22.6	55.0
September 2016	22.3	57.5
October 2016	20.7	58.0
November 2016	21.0	46.3
December 2016	19.8	36.6
January 2017	19.5	32.9
February 2017	20.4	39.0
March 2017	21.3	42.6
April 2017	21.2	42.7
May 2017	21.2	53.6

TABLE 4.9: Measured shrinkage strains

	$\varepsilon_{cs}(t,t_s)(‰)$				
	7 d	28 d	96 d	186 d	477 d
NAC	-0.143	-0.342	-0.540	-0.557	-0.645
RAC	-0.155	-0.385	-0.583	-0.660	-0.782
HVFAC	-0.125	-0.315	-0.410	-0.492	-0.597

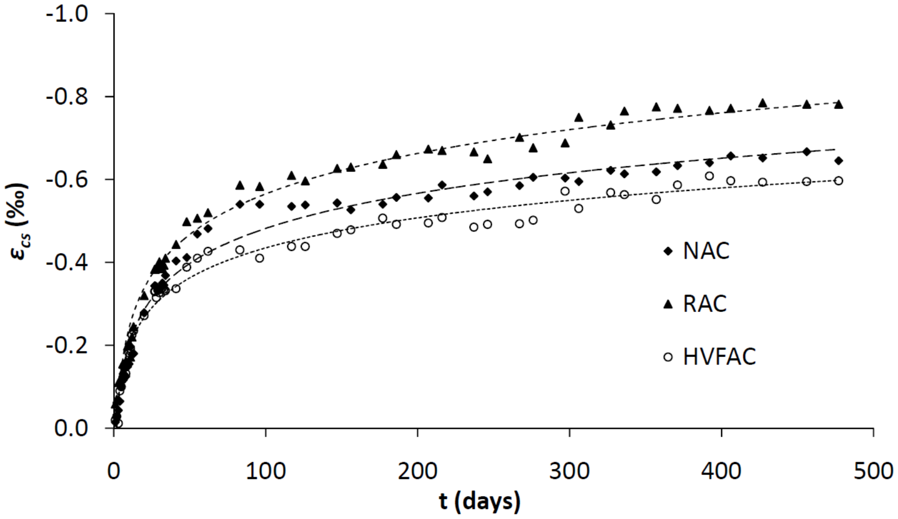


FIGURE 4.8: Time evolution of shrinkage strain, linear time scale

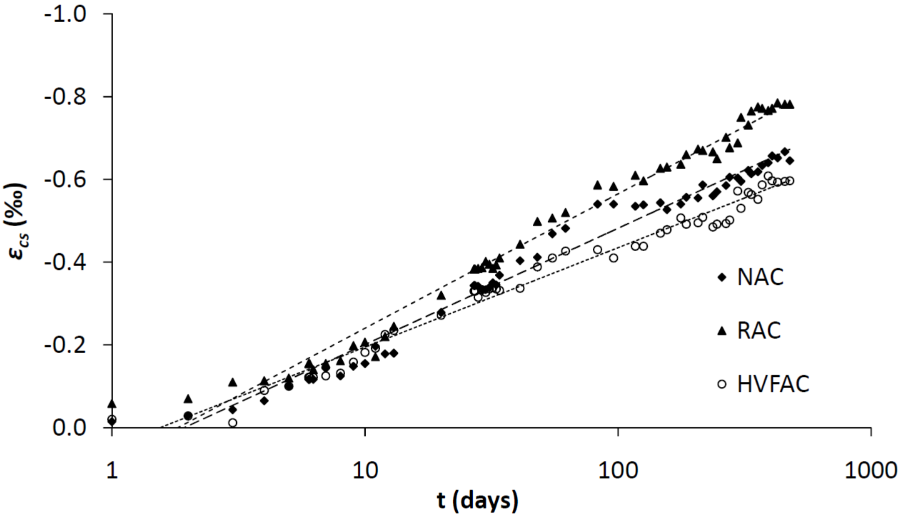


FIGURE 4.9: Time evolution of shrinkage strain, logarithmic time scale

It should be noted that the measurements on NAC prisms displayed swelling during the first two days of measurements, up to +0.1‰ and then started decreasing, reaching a final measured value of -0.545‰. However, the observed swelling is probably a consequence of the surface layer of concrete being too wet and influencing the adhesive with which steel pins for measurements were glued. Hence, all NAC measurements were scaled by a negative strain of 0.1‰ thus obtaining the final value of -0.645‰.

NAC showed the largest scatter of results until it stabilized after 28 days at a CoV of 15%; for RAC and HVFAC the CoV stabilized at around 20% and 12% after 28 days, respectively, however, no swelling was measured. From the figures it can be seen that shrinkage follows a logarithmic function very nicely, but the slopes of the function are clearly different, as can be seen in Figure 4.9 – the slopes decrease in the order of RAC, NAC and HVFAC, indicating decreasing shrinkage trends. The time development of shrinkage is such that after 7, 28, 96 and 186 days, NAC reaches 22%, 53%, 84% and 86% of the value after 477 days, respectively; for RAC these percentages are 20%, 49%, 75% and 84%; for HVFAC, they are 21%, 49%, 75% and 84%.

After 477 days, RAC and HVFAC respectively have a 21% larger and 7% smaller shrinkage strain compared with NAC.

4.2.7 Creep

As described in section 3.4.3, creep was measured only for RAC and HVFAC in steel frames in which three prisms of each concrete were loaded after 7 and 28 days, Figure 3.25. As explained earlier, strains were measured using a mechanical strain gauge and pins glued to all four sides of the prism. Unfortunately, during the measurements, on several prisms the steel pins fell off and on those prisms, measurements weren't taken on all four sides (it was never less than three sides). However, upon closer examination of the measurements, a large scatter was observed (40% and 20% for RAC loaded after 7 and 28 days, respectively and 40% and 35% for HVFAC loaded after 7 and 28 days, respectively). This indicated that the load was not ideally axially applied but that there was a certain eccentricity present. However, the results were nonetheless averaged (a few clear outliers were eliminated) and taken into account.

First, in Table 4.10, the overall results are presented. The total strain 450 days after loading is given as $\varepsilon_c(450)$, the initial strain is $\varepsilon_{ci}(t_0)$; also given is the shrinkage strain ε_{cs} and the creep strain ε_{cc} obtained after subtracting the initial and shrinkage strains from the total strain. From this creep strain, the *experimental creep coefficient* ϕ_{exp} is calculated as

$$\phi_{exp}(t) = \frac{\varepsilon_{cc}(t)}{\varepsilon_{ci}(t_0)} \tag{4.1}$$

Finally, the stress to which the prisms were loaded is given ($\sigma_c(t_0)$ and the $\sigma_c/f_{cm}(t_0)$ ratios which confirm that the target ratios were achived.

TABLE 4.10: Results obtained on prisms for creep measurements

	$\varepsilon_c(450)$ (‰)	$\varepsilon_{ci}(t_0)$ (‰)	$\varepsilon_{cs}(450)$ (‰)	$\varepsilon_{cc}(450)$ (‰)	$\phi_{exp}(450)$ (-)	$\sigma_c(t_0)$ (MPa)	$\sigma_c/f_{cm}(t_0)$ (-)
RAC7	-3.413	-0.775	-0.782	-1.856	2.395	14.50	0.60
RAC28	-2.849	-0.594	-0.782	-1.473	2.480	12.78	0.45
HVFAC7	-2.345	-0.664	-0.595	-1.086	1.634	9.84	0.60
HVFAC28	-1.857	-0.493	-0.597	-0.767	1.554	10.20	0.45

First, when the initial strain $\varepsilon_{ci}(t_0)$ is looked at in more detail, it can be seen that, when the corresponding modulus of elasticity is calculated from the initial strain and stress $\sigma_c(t_0)$, 30–40% lower values are calculated compared with experimental results on the modulus of elasticity; this can primarily be attributed to different loading speeds between creep and modulus of elasticity measurements and the fact that the first reading on prisms was taken 5 min after loading.

Secondly and most interestingly, practically the same experimental creep coefficient is obtained for both loading ages for both RAC and HVFAC, even though the prisms loaded after 7 days are loaded up to a level that is supposed to be in the region of non-linear creep; in the case of RAC, a slightly larger creep coefficient is obtained for a loading age of 28 days and a lower $\sigma_c/f_{cm}(t_0)$ ratio! Because of the scatter of measurements, the creep coefficients for different loading ages can be considered to be the same.

Probably the most important results to analyse are the stress-dependent strains $\varepsilon_{c\sigma}(t,t_0) = \varepsilon_{ci}(t_0) + \varepsilon_{cc}(t)$ (given by Equation 2.67), shown in figs. 4.10 and 4.11. A clear logarithmic time evolution of stress-dependent strain can be seen from the figures. For HVFAC, the lines for the two loading ages are parallel, reflected in the practically identical creep coefficients in Table 4.10. However, for RAC, the gap between the lines slowly decreases, also reflected by the creep coefficient being slightly larger for the loading age of 28 days, Table 4.10.

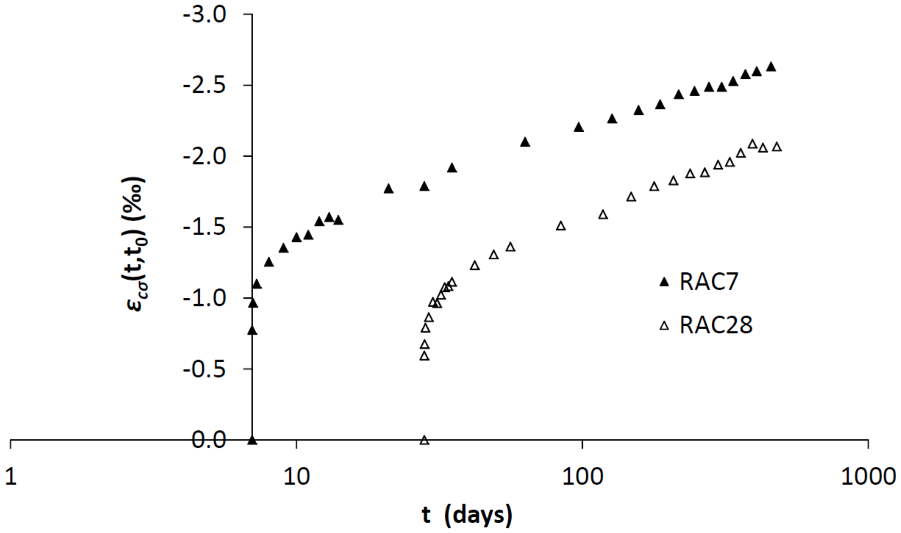


FIGURE 4.10: Stress-dependent strain for RAC prisms

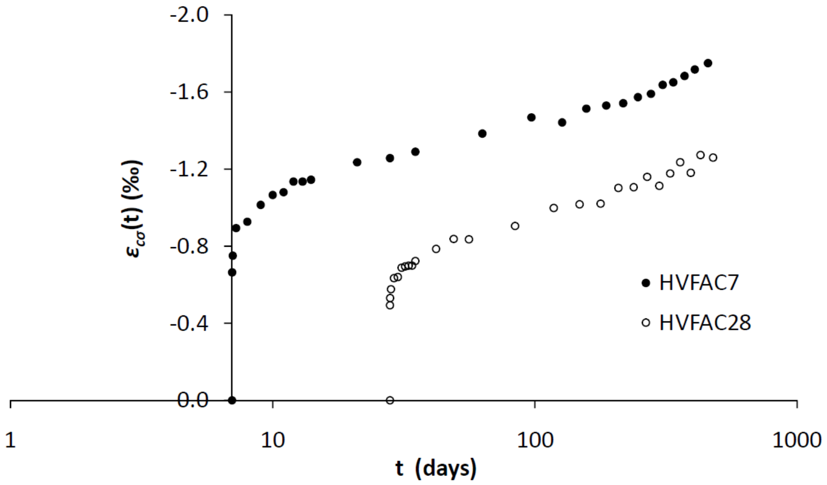


FIGURE 4.11: Stress-dependent strain for HVFAC prisms

From the stress-dependent strain and initial stress, the creep compliance $J(t,t_0)$ can be calculated using Equation 2.67. The compliances for RAC and HVFAC and both loading ages, are given in Figure 4.12 and Table 4.11. RAC and HVFAC loaded after 7 days practically represent the same line, as would be expected for prisms loaded to the same $\sigma_c/f_{cm}(t_0)$ ratio; however, for the loading age of 28 days, HVFAC has a significantly smaller value of the compliance function.

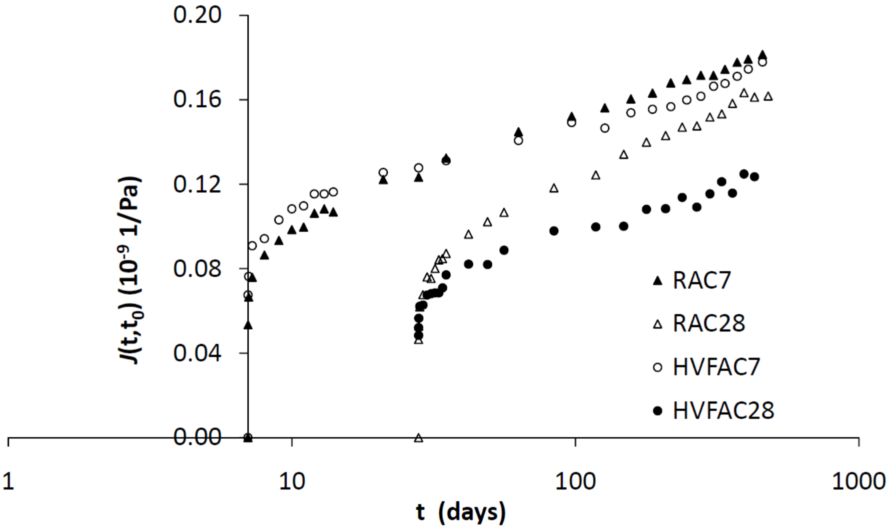


FIGURE 4.12: Creep compliance curves for RAC and HVFAC

TABLE 4.11: Compliance function values for RAC and HVFAC

	$J(t,t_0)(10^{-9}$ 1/Pa)					
	5 min	7 d	28 d	90 d	180 d	450 d
RAC7	0.053	0.107	0.132	0.152	0.163	0.181
RAC28	0.046	0.087	0.107	0.124	0.143	0.162
HVFAC7	0.068	0.116	0.131	0.149	0.155	0.178
HVFAC28	0.048	0.071	0.082	0.098	0.108	0.124

Further analysing the results, the creep strain for RAC and HVFAC is shown in Figure 4.13 and Figure 4.14, respectively. Here, again, the logarithmic evolution of the creep strain can be seen as well and the parallelness of lines representing different loading ages investigated. In Figure 4.15, the 'specific creep strain' is presented (creep strain divided by stress). As can be seen, for RAC there is practically no non-linear creep effect (lines for both loading ages, i.e. for both $\sigma_c/f_{cm}(t_0)$ ratios are very similar), whereas for HVFAC this effect is very visible.

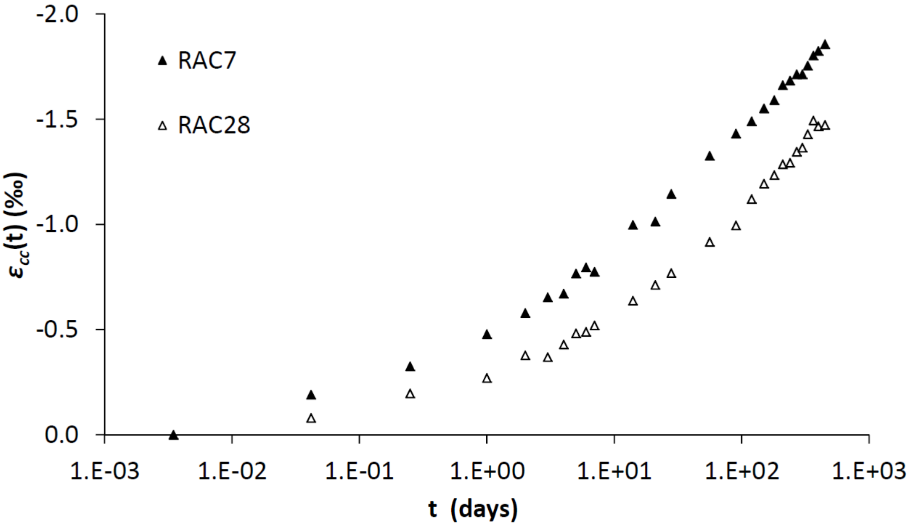


FIGURE 4.13: Creep strain of RAC

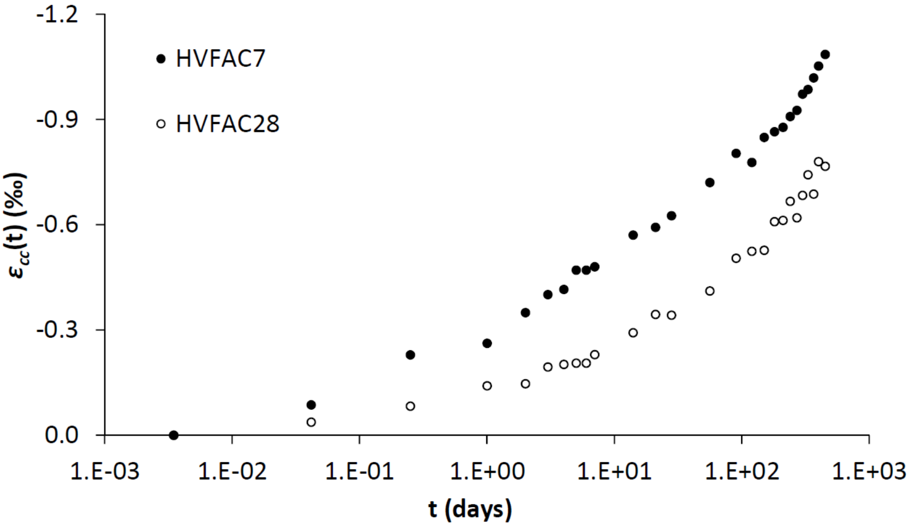


FIGURE 4.14: Creep strain of HVFAC

From the creep strain of RAC and HVFAC, the experimental creep coefficient is calculated according to Equation 4.1 and its time evolution is given in Table 4.12. After 7, 28, 90 and 180 days, ϕ_{exp} of RAC loaded at 7 days reaches 42%, 62%, 71% and 86% of its value after 450 days; for RAC loaded at 28 days these percentages are 35%, 52%, 68% and 84%. As for HVFAC, for a loading age of 7 days, after 7, 28, 90 and 180 days, ϕ_{exp} reaches 44%,

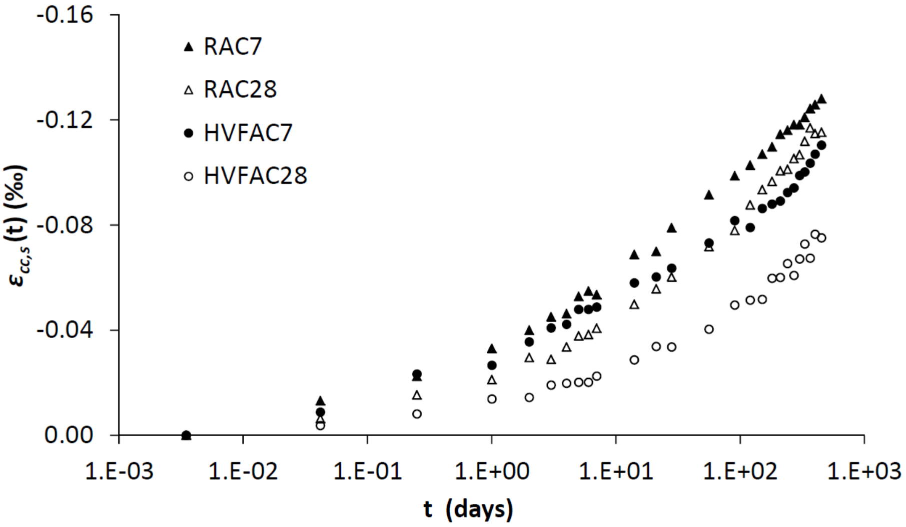


FIGURE 4.15: Specific creep strain for RAC and HVFAC

58%, 74% and 80% of its value after 450 days, and for a loading age of 28 days these percentages are 30%, 45%, 66% and 80%.

TABLE 4.12: Time evolution of experimental creep coefficient

	$\phi_{exp}(t,t_0)$				
	7 d	28 d	90 d	180 d	450 d
RAC7	1.000	1.477	1.846	2.053	2.395
RAC28	0.877	1.295	1.676	2.077	2.480
HVFAC7	0.723	0.942	1.210	1.303	1.634
HVFAC28	0.466	0.694	1.024	1.235	1.554

4.3 Results on Reinforced Concrete Beams

4.3.1 Load Calculation and Applications

The general outline of the beam design, load calculation and method of application was provided in 3.4.1. In that section, the initial design of a 'target' beam was shown and the procedure outlined. Then, after the mechanical properties of the concrete were determined experimentally, it was possible to precisely calculate the necessary load for each beam in order to achieve the target $\sigma_c/f_{cm}(t_0)$ ratio.

Following the procedure from section 3.4.1 and taking into account all experimental results (density, compressive and tensile strength and modulus of elasticity), load values were calculated. The distributed self-weight and additional dead load are given in Table 4.13 along with the bending moments these loads produce.

TABLE 4.13: Applied load and bending moments

Beam	g (kN/m)	2·G (kN)	M_g (Nm)	M_G (Nm)	M_{tot} (Nm)
NAC7	0.77	12.42	983	6645	7628
NAC28	0.77	10.94	983	5853	6836
RAC7	0.74	12.94	942	6923	7865
RAC28	0.74	10.12	942	5414	6356
HVFAC7	0.72	8.54	922	4569	5491
HVFAC28	0.72	8.28	922	4430	5352

Because of their similar measured compressive strength and modulus of elasticity, NAC and RAC are loaded to similar bending moments in both loading ages, whereas HVFAC is loaded to a lower bending moment.

The ratio of the total imposed-to-cracking moment and total imposed-to-ultimate moment are given in Table 4.14. The cracking moment is calculated as

$$M_{cr} = W_i \cdot f_{ctm} \tag{4.2}$$

where W_i is the section modulus of the transformed cross-section and f_{ctm} is taken as $0.9 \cdot f_{ct,sp}$, as per (EN 1992-1-1, 2004). The ultimate bending moment is calculated according to Equation 3.4.

In section 3.4.1 it was shown that for 28 days, the ratios were expected to be 2.84 and 0.44 for M_{tot}/M_{cr} and M_{tot}/M_{ult}, respectively, and for 7 days 3.88 and 0.49. Looking at the values in Table 4.14 it can be seen that, again, for NAC and RAC the targets are almost completely achieved (except that M_{tot}/M_{ult} is slightly overshot for 28 days); on the other hand, for HVFAC the load level necessary to achieve the target $\sigma_c/f_{cm}(t_0)$ ratios is overall lower.

TABLE 4.14: Ratios between the total imposed, cracking and ultimate bending moments

Beam	M_{tot} (Nm)	M_{cr} (Nm)	M_{tot}/M_{cr}	M_{ult} (Nm)	M_{tot}/M_{ult}
NAC7	7628	2071	3.68	14178	0.54
NAC28	6836	2473	2.76	14379	0.48
RAC7	7865	2093	3.76	14155	0.56
RAC28	6356	2584	2.46	14304	0.44
HVFAC7	5491	1260	4.36	13642	0.40
HVFAC28	5352	2182	2.45	14080	0.38

Table 4.15 presents the calculated initial stresses in concrete, tensile and compression reinforcement, along with compressed zone depth and achieved $\sigma_c/f_{cm}(t_0)$ ratio. Finally, Table 4.16 presents the calculated initial strains in concrete, tensile and compression reinforcement, obtained by dividing the stresses in Table 4.15 by the measured moduli of elasticity, provided in Table 4.7.

TABLE 4.15: Calculated initial stresses in the beams

Beam	x (mm)	σ_c (MPa)	σ_{s1} (MPa)	σ_{s2} (MPa)	$\sigma_c/f_{cm}(t_0)$
NAC7	40.3	14.8	313.1	27.5	0.60
NAC28	39.2	13.6	280.0	22.0	0.45
RAC7	42.6	14.4	324.7	35.0	0.59
RAC28	40.0	12.4	260.8	22.1	0.44
HVFAC7	43.3	9.9	227.1	25.9	0.60
HVFAC28	41.1	10.2	220.0	20.9	0.45

4.3.2 Deflections

The procedure for measuring deflections was elaborated in section 3.4.4. Since these data are the most important results of the experimental programme, special care was taken to obtain properly measured values. For that purpose, an attempt was made to measure deflections from self-weight using geodetic readings, as outlined in section 3.4.4.

TABLE 4.16: Calculated initial strains in the beams

Beam	ε_c (‰)	ε_{s1} (‰) (MPa)	ε_{s2} (‰)
NAC7	-0.49	1.57	0.14
NAC28	-0.42	1.40	0.11
RAC7	-0.55	1.62	0.18
RAC28	-0.40	1.30	0.11
HVFAC7	-0.39	1.14	0.13
HVFAC28	-0.35	1.10	0.10

After performing a geodetic reading when the beams were still in the formwork, the next measurements were taken immediately after raising the beams onto supports. Knowing the precise density of the concretes, i.e. the self-weight of the beams (Table 4.13), and the span of 3.2 m, the deflection from self-weight could be calculated. Since M_g is always smaller than M_{cr}, the deflection from self-weight was calculated for state 1, i.e. uncracked state of the beam:

$$a_{sw,1} = 0.104 \cdot \frac{M_g \cdot l^2}{E_{cm} \cdot I_{i,1}} \tag{4.3}$$

where $I_{i,I}$ is the moment of inertia of the transformed cross-section in state 1.

In this way, the experimental and calculated deflections from self-weight are given in Table 4.17. Generally, the expected deflections from self-weight are around 0.3 mm. The measured values, on the other hand, match the calculated ones in only three cases: NAC7, NAC28 and RAC7 (the precision of the instrumentation was 0.1 mm). The higher values for RAC28 and HVFAC28 could potentially point to the presence of several cracks in the beams. However, the result for HVFAC7 casts a doubt over these measurements. It is in fact very possible that a lot of the measured deflection from self-weight was actually the 'straightening out' of the beams which were, to a certain degree, warped in the framework (this is especially true for HVFAC7). In this case, since there was only one steel cap for geodetic measurements along the center line on top of the beam (Figure 3.38) it could be that the results for RAC28, HVFAC7 and HVFAC28 in fact represent this phenomenon and not the presence of cracks – the beams were visually inspected prior to loading and no cracks were visible. It is for this reason that these results should not be taken into account in the analysis.

TABLE 4.17: Measured and calculated deflections from self-weight

Beam	$a_{sw,exp}(t_0)$ (mm)	$a_{sw,calc}(t_0)$ (mm)
NAC7	0.23	0.31
NAC28	0.39	0.29
RAC7	0.50	0.33
RAC28	1.16	0.29
HVFAC7	-0.41	0.34
HVFAC28	0.99	0.30

The results obtained with dial indicators (not including deflections until the application of the imposed load, in other words, not including deflections from self-weight) are given in Table 4.18. It can be seen that for all the beams except HVFAC28 the deflection limit of $L/250$ (12.8 mm) is surpassed after 450 days (but not immediately after loading). A direct comparison of these values is not very meaningful since the beams were loaded to different load levels and had different moduli of elasticity. More interesting would be to consider the time evolution of the 'normalized deflection', i.e. $a(t-t_0)/a(t_0)$, given in Table 4.19.

TABLE 4.18: Time evolution of mid-span deflection of the beams

Beam	$a(t_0)$ (mm)	$a(7)$ (mm)	$a(28)$ (mm)	$a(90)$ (mm)	$a(180)$ (mm)	$a(450)$ (mm)
NAC7	9.17	12.44	14.42	16.35	17.23	18.94
NAC28	8.11	10.92	12.52	13.85	14.92	16.51
RAC7	10.89	14.43	16.90	19.12	20.39	22.47
RAC28	6.23	8.76	10.36	11.65	12.91	14.69
HVFAC7	6.13	8.75	10.04	10.79	11.33	12.45
HVFAC28	4.04	5.22	6.01	6.61	7.33	8.72

Table 4.19 shows a very similar time evolution of normalized deflections for all the beams except RAC28 and HVFAC28. This is shown visually in figs. 4.16 and 4.17. All three beams loaded after 7 days display a practically identical time evolution, whereas for the beams loaded after 28 days, RAC28 has a much more pronounced time evolution reaching

TABLE 4.19: Time evolution of normalized mid-span deflection of the beams

	$a(t-t_0)/a(t_0)$				
Beam	7 d	28 d	90 d	180 d	450 d
NAC7	1.36	1.57	1.76	1.88	2.07
NAC28	1.35	1.54	1.71	1.84	2.04
RAC7	1.33	1.55	1.76	1.87	2.06
RAC28	1.41	1.66	1.87	2.07	2.36
HVFAC7	1.43	1.64	1.76	1.85	2.03
HVFAC28	1.29	1.49	1.64	1.81	2.16

a ratio of 2.36 after 450 days and HVFAC28 seems to start more slowly than NAC28 and RAC28 but increases the rate of its time evolution towards the end, reaching a ratio of 2.16. While the results for beam RAC28 are in agreement with the results for creep obtained on prisms (in which creep of prisms loaded after 28 days seemed to be more pronounced and catching up with those loaded after 7 days), the results for beam HVFAC28 are surprising since prisms loaded after 28 days showed a much smaller compliance compared with prisms loaded after 7 days, Figure 4.12. This points to a possible variation of actual mechanical properties of RAC and HVFAC after 28 days which could have led to the application of a different load than was intended, but this point will be discussed in the following chapter.

So far, the results were for mid-span deflections, but also useful are the deflections along the length of the beam. The time evolution of these deflections for NAC7 and NAC28, RAC7 and RAC28, and HVFAC7 and HVFAC28 is given in Figure 4.18, Figure 4.19 and Figure 4.20, respectively. Only on beams RAC7 and HVFAC7 the deflections seem to be somewhat unsymmetrical; a still-significant increase can be observed between 180 and 450 days. Also, the lower load level of beams loaded after 28 days is observable through their lower deflections compared with beams loaded after 7 days but this effect is more pronounce in RAC and HVFAC beams than in NAC beams.

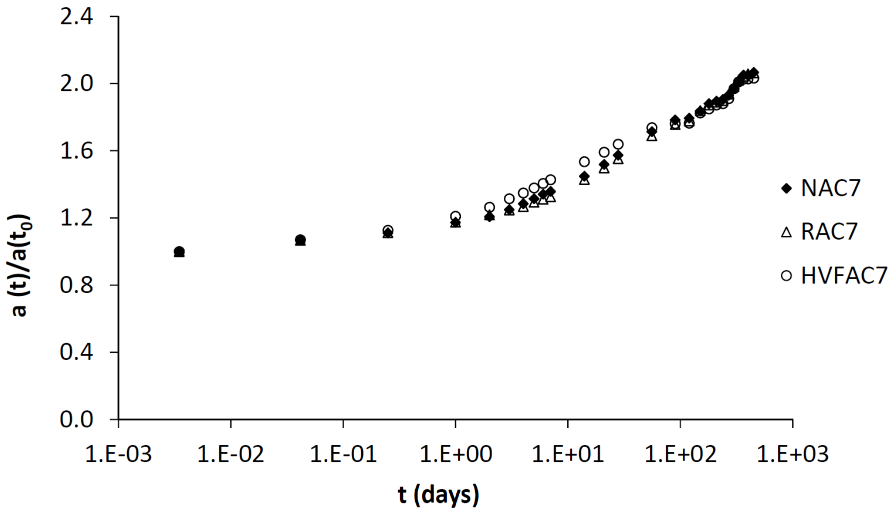


FIGURE 4.16: Time evolution of normalized mid-span deflections for beams loaded after 7 days

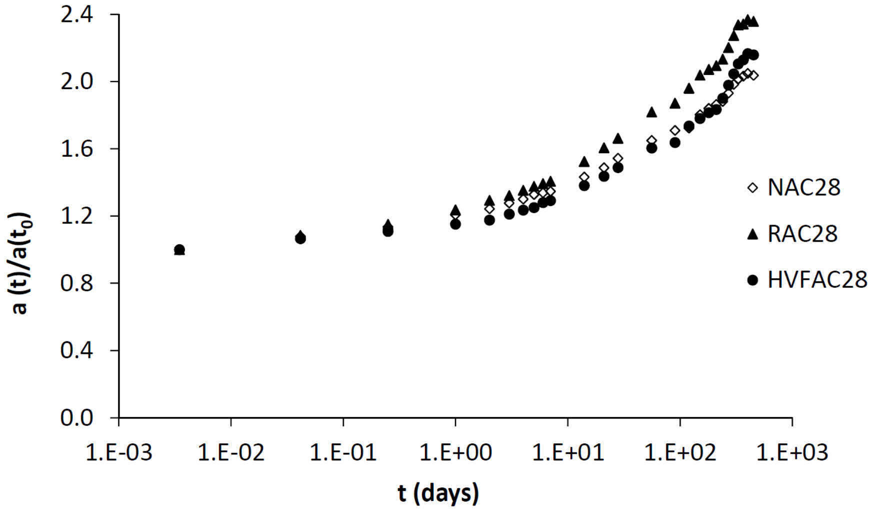


FIGURE 4.17: Time evolution of normalized mid-span deflections for beams loaded after 28 days

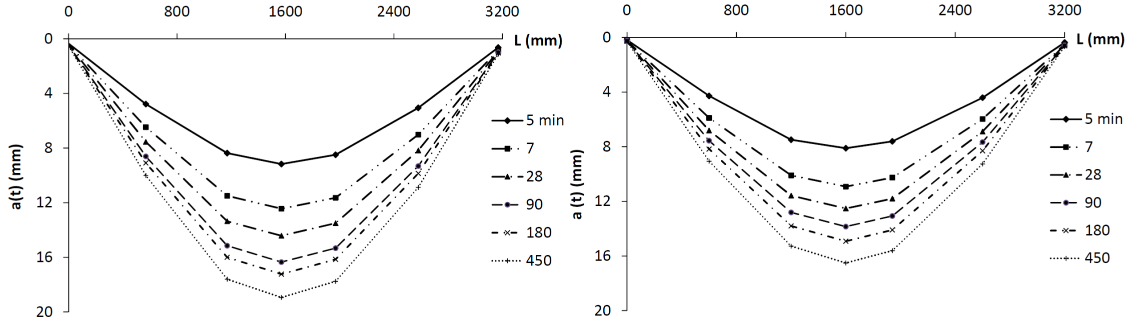


FIGURE 4.18: Time evolution of deflections along the length of beam NAC7 (left) and NAC28 (right)

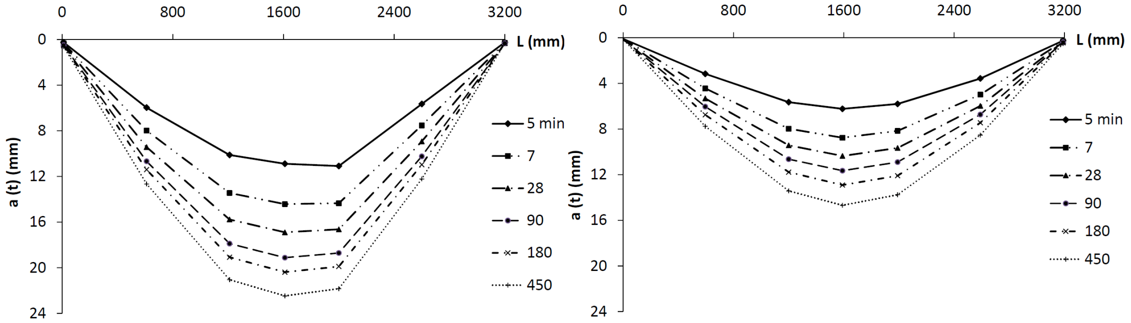


FIGURE 4.19: Time evolution of deflections along the length of beam RAC7 (left) and RAC28 (right)

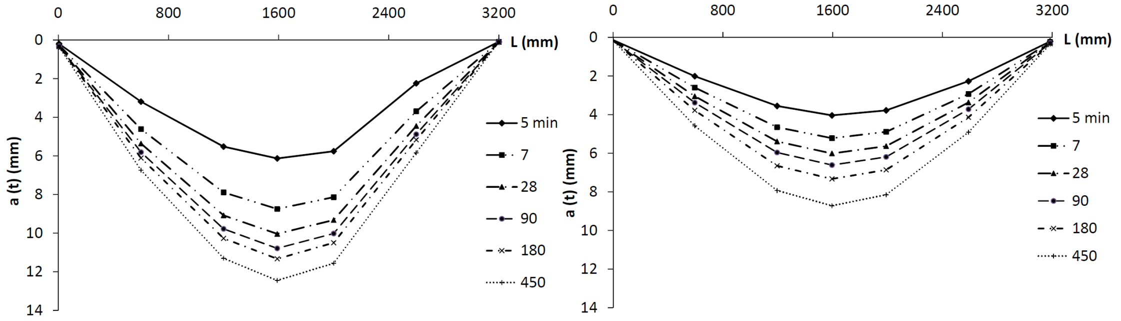


FIGURE 4.20: Time evolution of deflections along the length of beam HVFAC7 (left) and HVFAC28 (right)

4.3.3 Crack Spacing and Crack Widths

Cracks were monitored on all beams throughout the experiment. As outlined in section 3.4.4, this consisted of marking the height and width of cracks as well as noting whether new cracks appeared during the experiment.

After raising the beams onto supports and before applying the superimposed dead load, all of them were checked for pre-existing cracks and none were found on any of the beams. After the beams were loaded, the first measurement of cracks was performed after 1 h, then subsequently after 7, 28, 90, 180, 365 and 450 days. Here, crack patterns are shown for all beams at times t_0 (measured 1 h after loading) and 450 days, figs. 4.21 to 4.26. The patterns are shown for both sides of the beams, one above the other, to avoid overlapping on one image.

Looking at the figures, several things can be noticed. First, as expected, the crack pattern is much more developed in NAC and RAC than in HVFAC beams as they are loaded to a larger M_{tot}/M_{ult} ratio, i.e. a higher tensile steel stress. Within NAC and RAC beams, those loaded after 7 days have more pronounced crack patterns than those loaded after 28 days, again because of the higher tensile steel stress. Second, there is an increase in the width of the cracked zone between t_0 and 450 days – new cracks appeared, both outside the initial cracked zone and between existing cracks; this is the confirmation of the 'reduction' of the cracking moment, i.e. the reduction of tensile strength caused by shrinkage.

Finally, a certain asymmetry can be observed in the crack patterns – the number of cracks on sides A and B does not always match and some cracks are not perpendicular to the beam's longitudinal axis. For example, in Figure 4.21, at time t_0 the crack on side A between steel pins 6 and 7 has no matching crack between steel pins 9 and 8 on side B; rather, its counterpart is the crack between steel pins 8 and 7 on side B. Beside natural deviation of crack planes caused by the distribution of aggregate grains in the concrete, this asymmetry can also be caused by warping of the beams. This problem was already mentioned when deflections from self-weight were discussed. This fact means that averaging of strains on sides A and B must be done carefully, taking into account which cracks correspond to each other on both sides, this will be done in section 4.3.4.

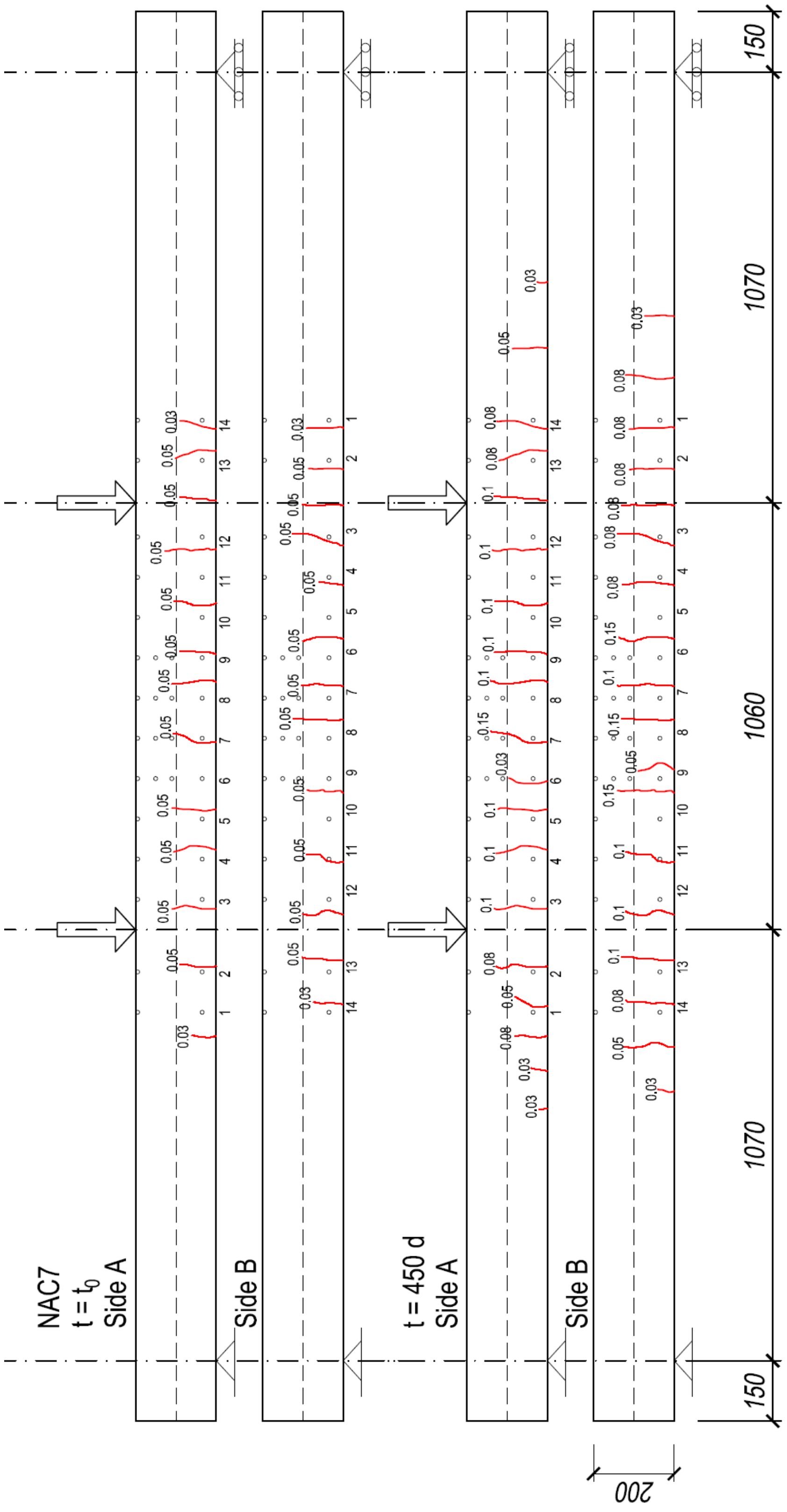


FIGURE 4.21: Crack pattern for beam NAC7 at t_0 and 450 d

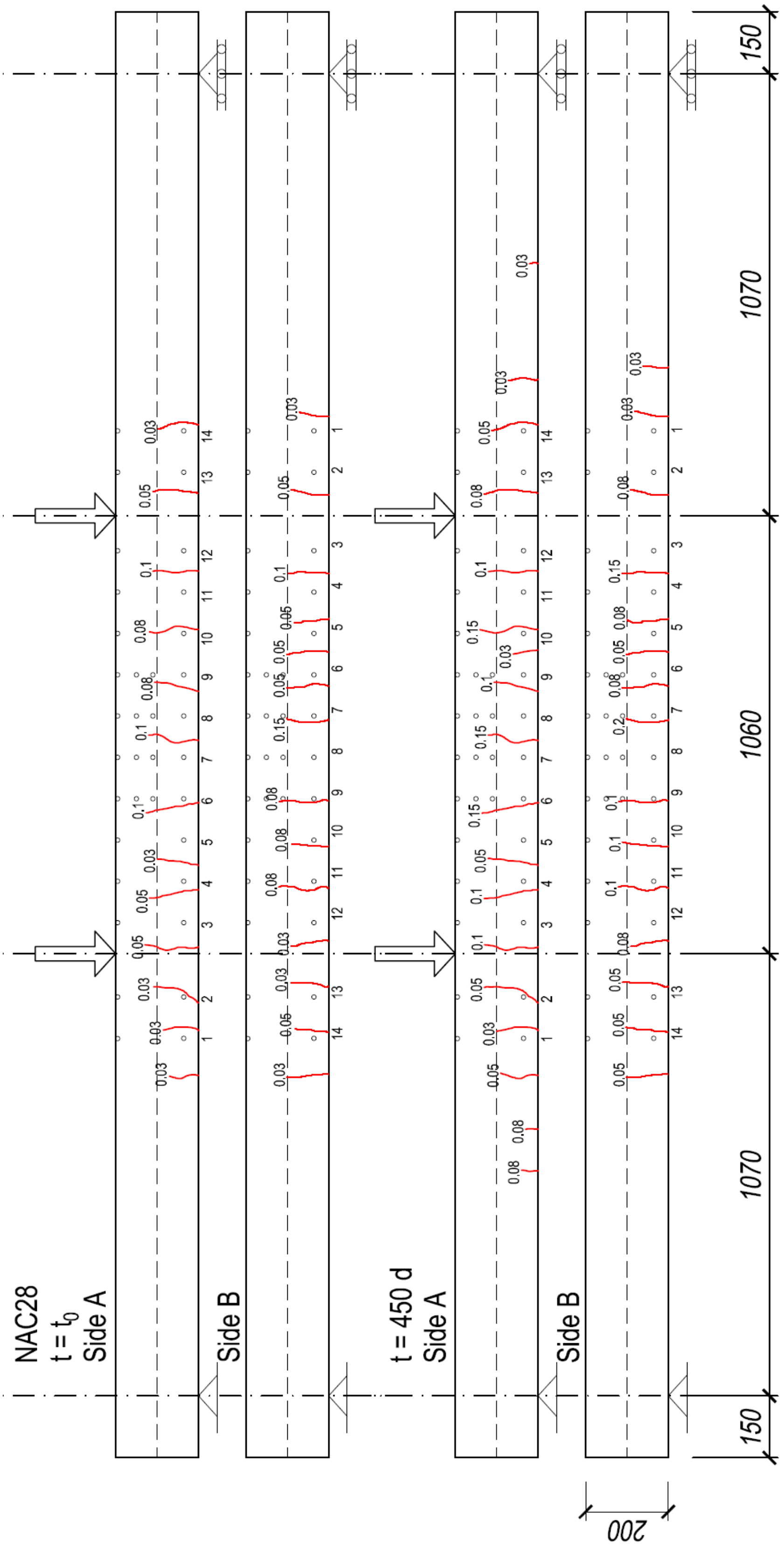


FIGURE 4.22: Crack pattern for beam NAC28 at t_0 and 450 d

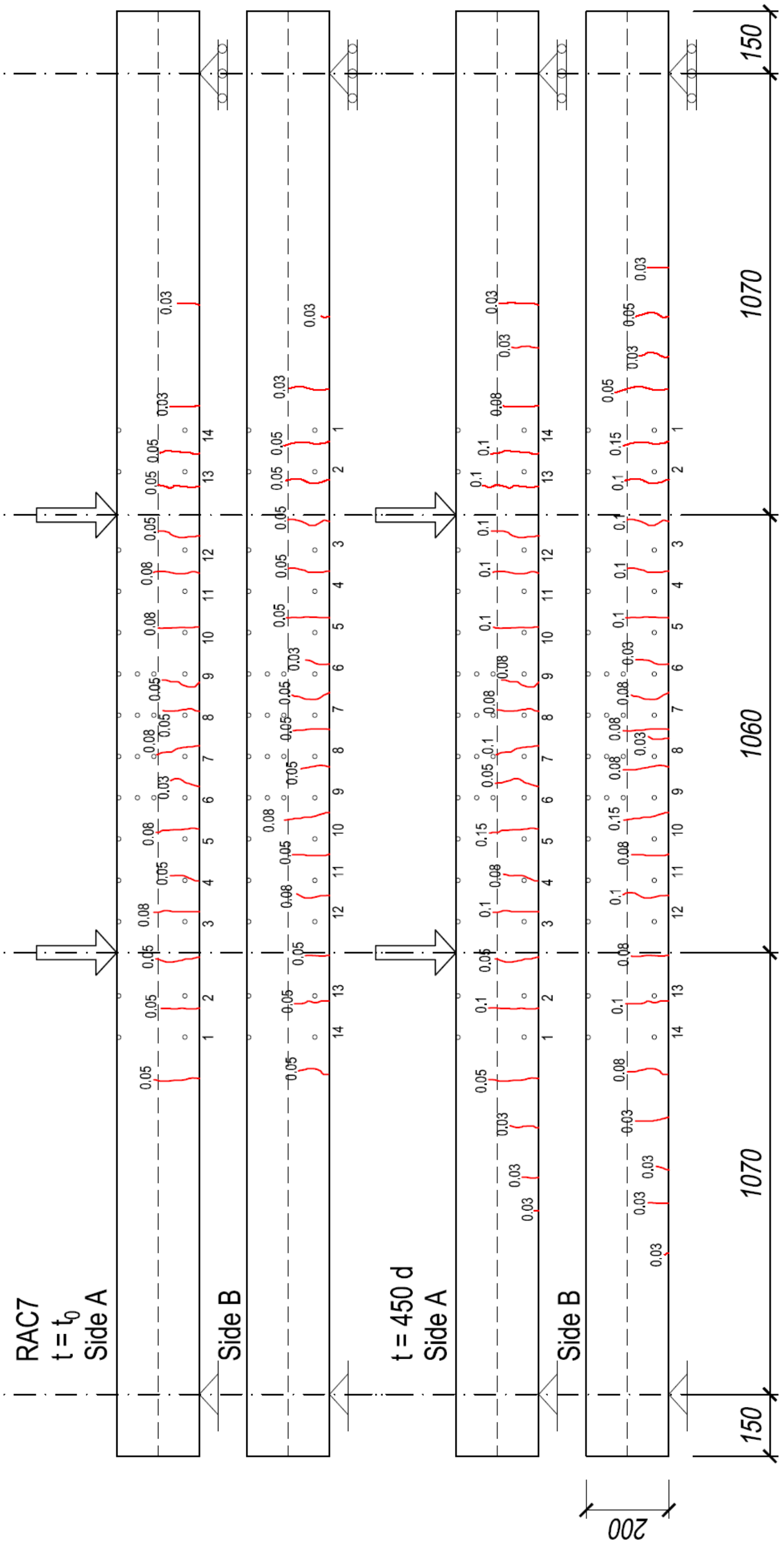


FIGURE 4.23: Crack pattern for beam RAC7 at t_0 and 450 d

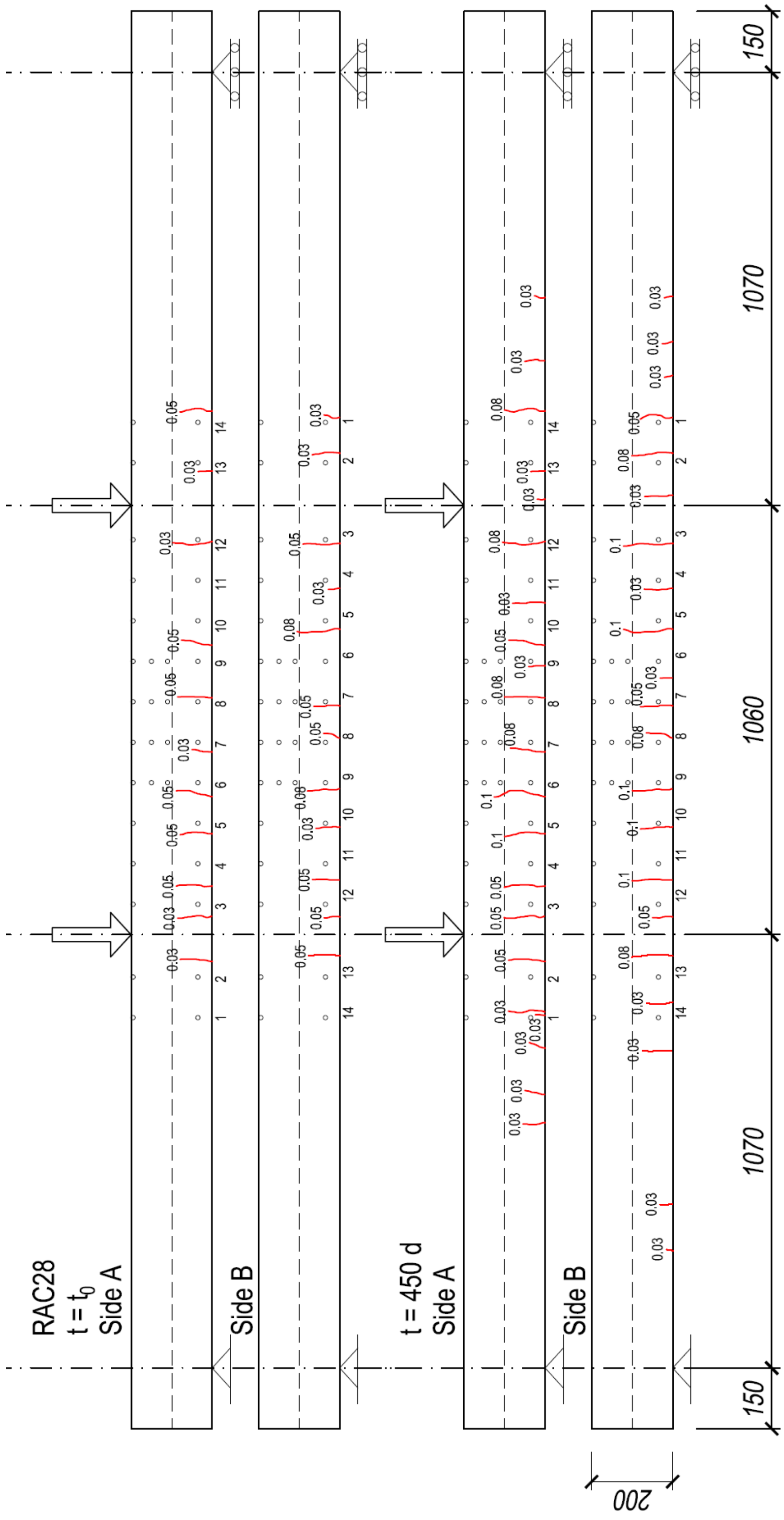


FIGURE 4.24: Crack pattern for beam RAC28 at t_0 and 450 d

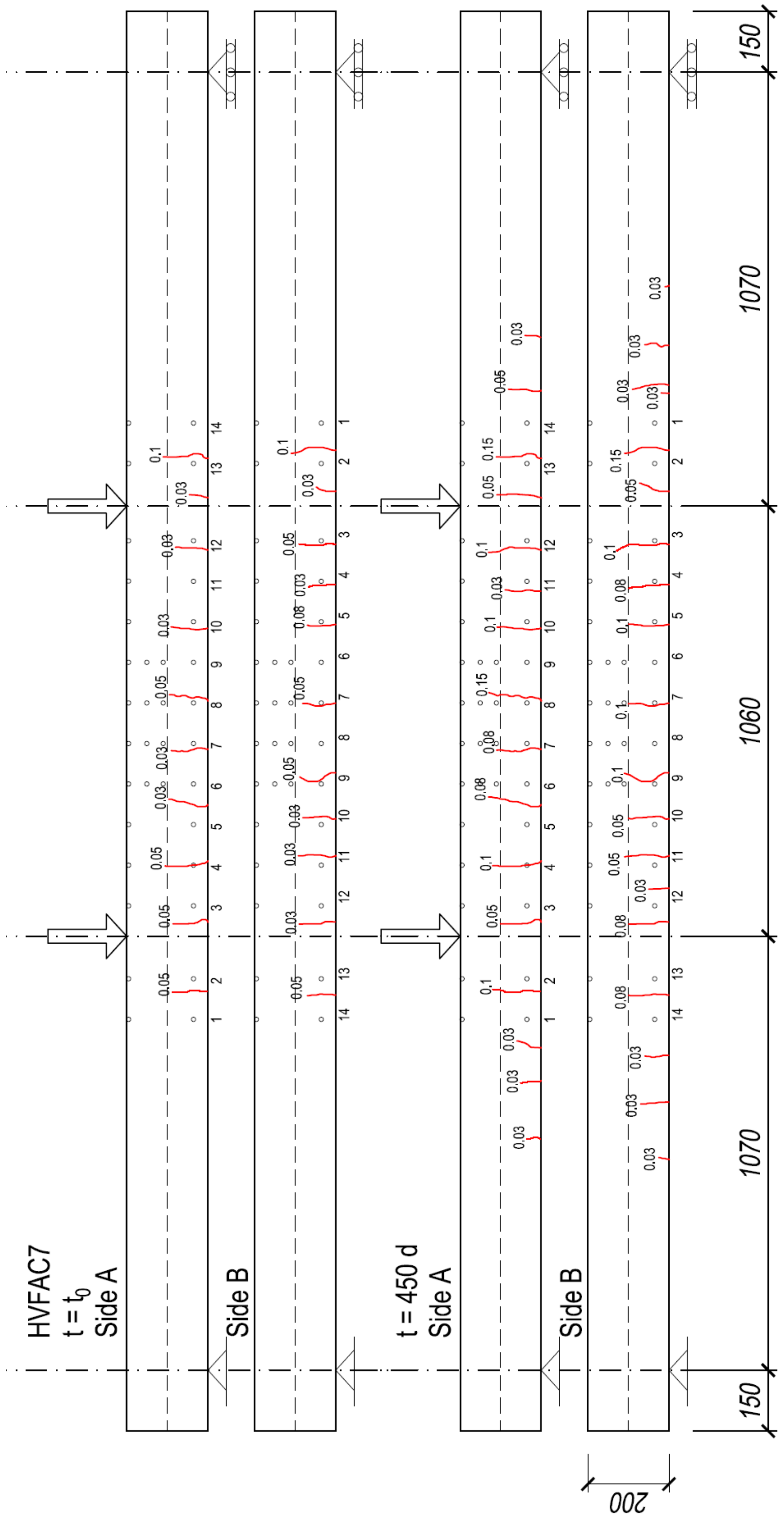


FIGURE 4.25: Crack pattern for beam HVFAC7 at t_0 and 450 d

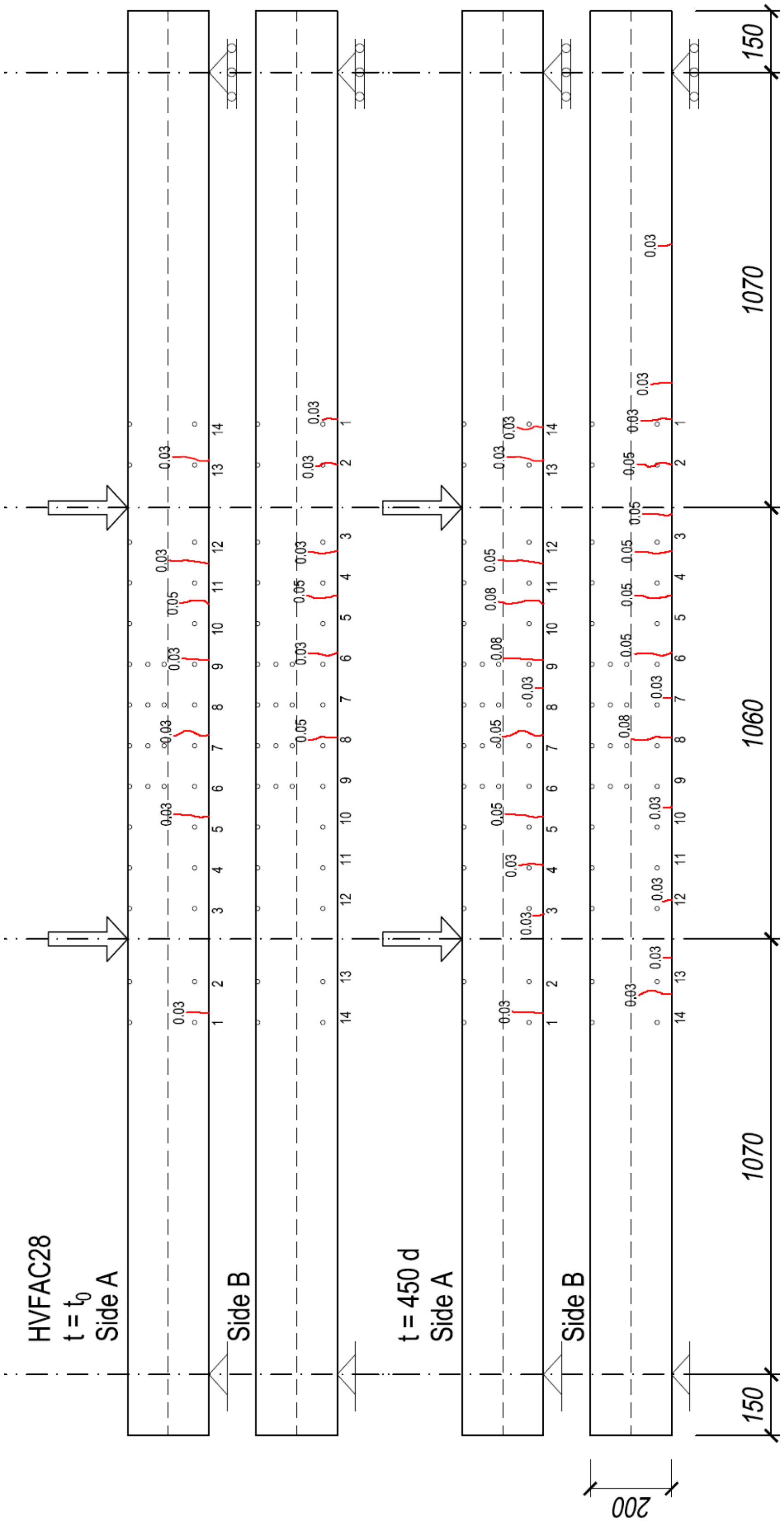


FIGURE 4.26: Crack pattern for beam HVFAC28 at t_0 and 450 d

Also important to note is that the cracks generally propagated over the beam's height, sometimes by as much as 100 mm, but mostly by 10–30 mm. Although the crack patterns are shown only for t_0 and 450 days, this propagation—as well as the increase in crack width—mostly occurred at earlier times – between 7 and 90 days. Between this period new cracks appeared between existing cracks; however, the widening of the cracked zone, i.e. the cracks outside the initial cracked zone, generally appeared much later, between 365 and 450 days, only when shrinkage could sufficiently reduce the cracking moment.

The four-point bending test chosen for this experiment is useful for analysing cracks since the entire flexural span of the beam is under a constant bending moment with no shear forces. Consequently, crack widths and spacings will be analysed only for this region. The average (mean) crack spacing s_m and crack width w_m, minimum and maximum crack widths (w_{min} and w_{max}) are given in Table 4.20 for times t_0 and 450 days; in the table they are also related to the calculated tensile steel stress.

TABLE 4.20: Crack spacing and crack widths for the beams

Beam	σ_{s1} (MPa)	t_0 s_m (mm)	t_0 w_m (mm)	t_0 w_{min}–w_{max} (mm)	450 days s_m (mm)	450 days w_m (mm)	450 days w_{min}–w_{max} (mm)
NAC7	313.1	134.3	0.05	0.05-0.05	115.8	0.10	0.03-0.15
NAC28	280.0	119.5	0.08	0.03-0.15	110.4	0.11	0.03-0.20
RAC7	324.7	102.0	0.06	0.03-0.08	97.4	0.09	0.03-0.15
RAC28	260.8	123.6	0.05	0.03-0.08	102.5	0.07	0.03-0.10
HVFAC7	227.1	145.4	0.04	0.03-0.08	125.9	0.08	0.03-0.15
HVFAC28	220.0	153.1	0.04	0.03-0.05	128.9	0.05	0.03-0.08

From Table 4.20 the negative correlation between the tensile steel stress and crack spacing, and the positive correlation between the tensile steel stress and crack width can be seen; the only outlier seems to be beam NAC28 which has a smaller crack spacing and larger crack widths compared with beam NAC7 even though its tensile steel stress is 10% lower. RAC beams—under similar tensile steel stress as NAC beams—have smaller or similar crack spacing and somewhat smaller crack widths, contradictory to some previous findings in literature, see section 2.6.3. HVFAC beams, in this experiment, under markedly lower tensile steel stress levels, show significantly larger crack spacing and smaller crack widths. Interestingly, the range of crack widths (minimum–maximum) is much wider in

NAC and RAC beams compared with HVFAC beams in which the crack widths are more uniform. In all of the beams, the $s_m(450)/s_m(t_0)$ crack spacing ratio was between 0.83 and 0.95, indicating that the beams were loaded to such a load level that an almost completely developed crack pattern was achieved at t_0, only one or two new cracks appeared in the flexural span over 450 days.

It should also be said that crack widths were measured in discrete values of 0.03, 0.05, 0.08, 0.10, 0.15 and 0.20 mm, as was possible using the crack gauge, Figure 3.42.

4.3.4 Strains

Strains were measured in the manner described in section 3.4.4. Since the first measurements were taken 5 min after applying the superimposed dead load, the total strains obtained in this way *do not include* shrinkage strain up to loading nor mechanical strain caused by self-weight of the beam (in state 1).

Analysing the strains in the flexural span, special consideration was given to the crack pattern, figs. 4.21 to 4.26. Since measurements were taken on both sides, averaging had to be done very carefully, by looking at the position of each crack on both sides (see the example given in section 4.3.3). The expected values of total strain, calculated on the basis of a cracked cross-section (in state 2), are given in Table 4.16. Values which deviated significantly from these values were disregarded (e.g. some tensile steel strains were negative); these cases mostly turned out to be cases where the crack didn't appear immediately or didn't cross the level of tensile reinforcement.

The compressive concrete (measured 3 mm from the top concrete surface) and tensile steel strains for beam NAC7 are tabulated in Table 4.21 and Table 4.22, respectively and shown graphically in Figure 4.27 and Figure 4.28, respectively. In both the tables and figures, the position of the strain is denoted by the number of steel pins on side A, while the values are actually averages of side A and corresponding side B (selected after considering the crack pattern).

As can be seen, the total compressive concrete strain follows a logarithmic time evolution, and after 450 days reaches values 3.29–3.63 times larger than those 5 min after loading.

TABLE 4.21: Compressive concrete strain in beam NAC7

	ε_c (‰)				
Beam	A6-7	A8-9	A9-10	A10-11	A11-12
5 min	-0.57	-0.59	-0.46	-0.48	-0.59
28 d	-1.27	-1.34	-1.05	-1.14	-1.27
90 d	-1.57	-1.63	-1.32	-1.40	-1.57
180 d	-1.73	-1.79	-1.45	-1.53	-1.73
450 d	-1.95	-2.01	-1.63	-1.74	-1.94

TABLE 4.22: Tensile steel strain in beam NAC7

	ε_{s1} (‰)				
Beam	A6-7	A8-9	A9-10	A10-11	A11-12
5 min	1.59	1.07	1.40	1.42	1.51
28 d	1.97	1.33	1.72	1.82	1.89
90 d	2.08	1.39	1.76	1.92	1.97
180 d	2.08	1.37	1.75	1.87	1.95
450 d	2.17	1.43	1.83	1.95	2.05

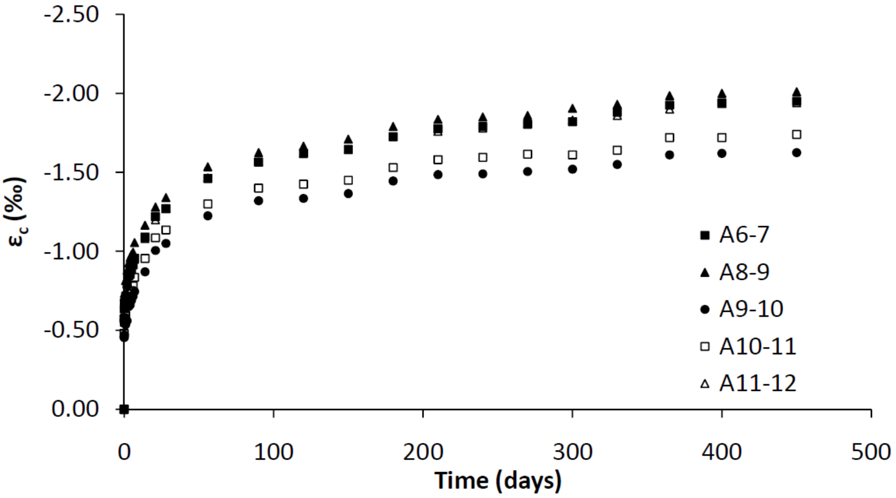


FIGURE 4.27: Time evolution of compressive concrete strain in beam NAC7

Meanwhile, the total tensile steel strain follows a mild linear increase in time, and after 450 days reaches values 1.31–1.37 times larger than those 5 min after loading. Although, theoretically there should be practically no increase in tensile steel strain over time, its

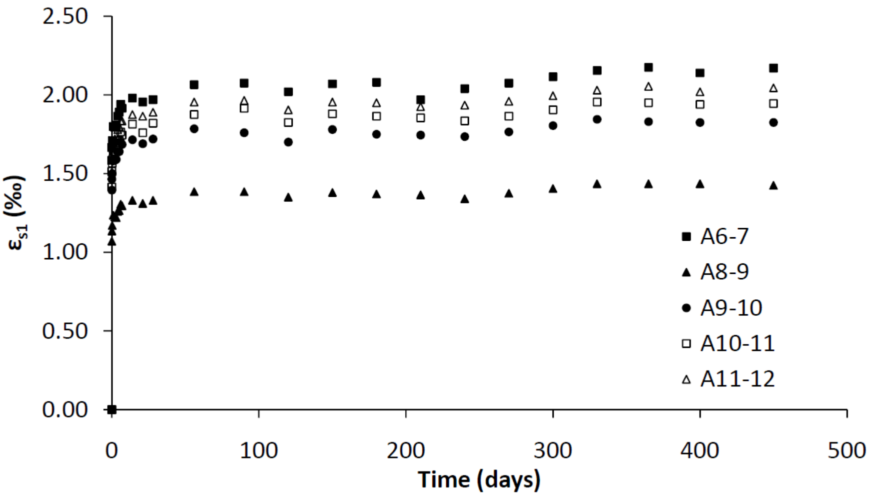


FIGURE 4.28: Time evolution of tensile steel strain in beam NAC7

presence here is the consequence of the measurement method. In fact, strain was measured on the concrete surface *at the level of tensile reinforcement*; hence, the increase in strain over time can be explained by the loss of concrete tension stiffening between two measurement points. Nonetheless, the values are, on average, close to the predicted values in Table 4.16, notwithstanding that the measured values omitted part of the shrinkage and mechanical strain from self-weight and were taken 3 mm below the top surface; still, the values agreed within 10–20%.

As noted in section 3.4.4, three cross-sections in the middle of the beam were equipped with steel pins along the beam height in order to measure the strain distribution across the cross-section height. From the crack pattern in Figure 4.21 it was seen that two cross-sections contained cracks: A6-7 (and B7-8) and A8-9 (and B6-7), Figure 4.29.

For these two cross-sections, the strain distribution along their height is shown for 5 min, 90 and 450 days after loading, in figs. 4.30 and 4.31.

From the figures, it can be seen that the strains are distributed linearly, as shown by the drawn trendlines. The lowering of the neutral axis is also clearly visible. From the trendline equations, the increase in the compressed zone depth was calculated as 56.1 to 89.9 mm for section A6-7 and 58.7 to 98.8 mm for section A8-9.

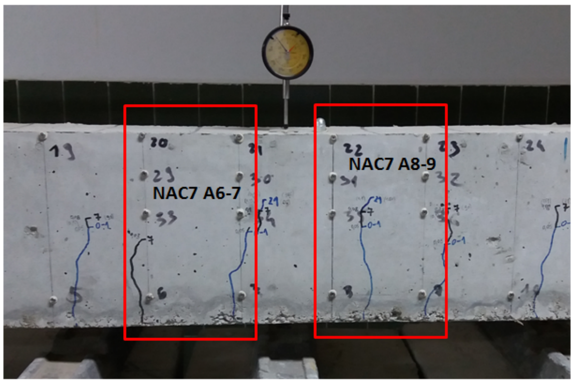


FIGURE 4.29: Close view of middle cross-sections of beam NAC7

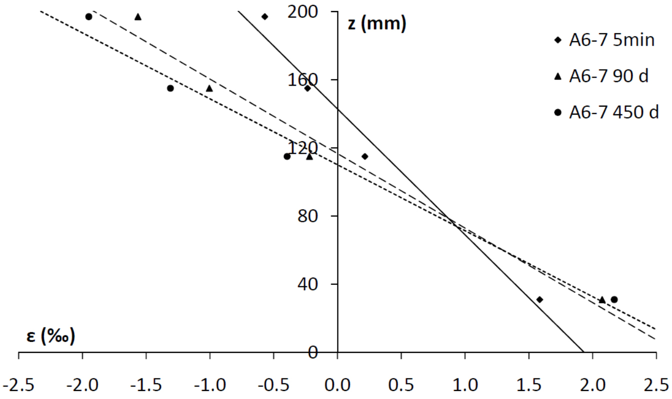


FIGURE 4.30: Strain distribution of cross-section A6-7 in beam NAC7

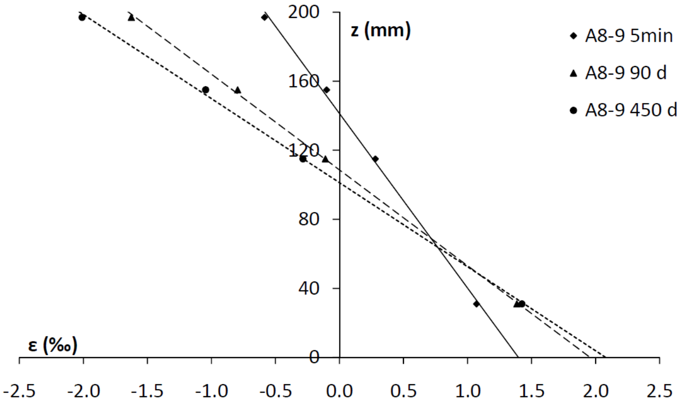


FIGURE 4.31: Strain distribution of cross-section A8-9 in beam NAC7

The compressive concrete and tensile steel strains for beam NAC28 are tabulated in Table 4.23 and Table 4.24, respectively and shown graphically in Figure 4.32 and Figure 4.33, respectively.

TABLE 4.23: Compressive concrete strain in beam NAC28

	ε_c (‰)						
Beam	A3-4	A4-5	A5-6	A7-8	A8-9	A10-11	A11-12
5 min	-0.65	-0.42	-0.49	-0.45	-0.48	-0.39	-0.52
28 d	-1.08	-0.83	-0.89	-0.85	-0.91	-0.82	-0.94
90 d	-1.23	-1.02	-1.02	-0.99	-1.10	-0.98	-1.13
180 d	-1.36	-1.13	-1.16	-1.14	-1.26	-1.15	-1.27
450 d	-1.53	-1.33	-1.31	-1.29	-1.45	-1.34	-1.46

TABLE 4.24: Tensile steel strain in beam NAC28

	ε_{s1} (‰)						
Beam	A3-4	A4-5	A5-6	A7-8	A8-9	A10-11	A11-12
5 min	1.36	1.10	1.69	1.18	1.23	1.29	1.65
28 d	1.74	1.40	2.13	1.67	1.56	1.66	2.24
90 d	1.80	1.44	2.20	1.73	1.61	1.66	2.32
180 d	1.84	1.44	2.26	1.80	1.63	1.66	2.38
450 d	1.86	1.47	2.38	1.93	1.69	1.73	2.50

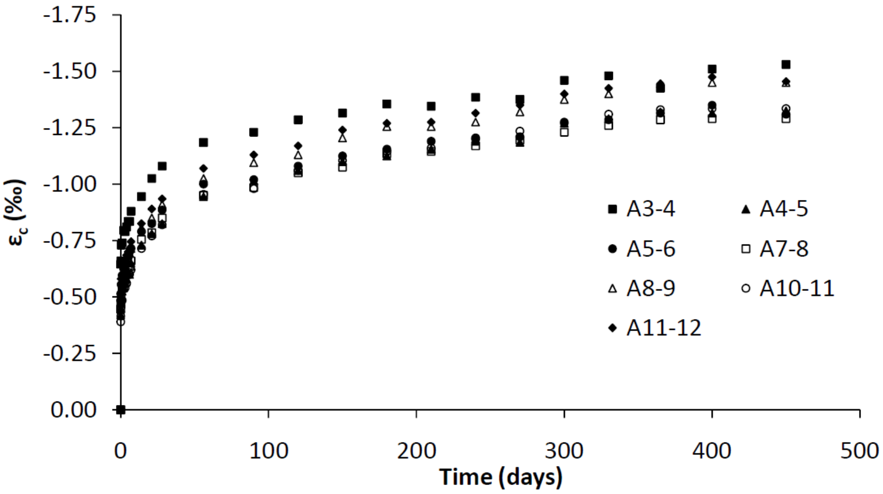


FIGURE 4.32: Time evolution of compressive concrete strain in beam NAC28

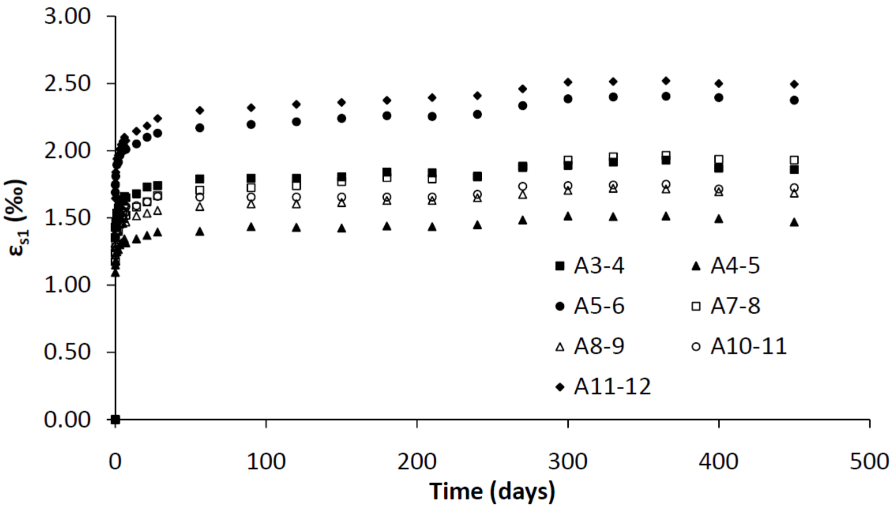


FIGURE 4.33: Time evolution of tensile steel strain in beam NAC28

The shape of the time curves of the strains are similar to those in the case of beam NAC7. However, in beam NAC28 the steel strain increases 1.34–1.64 times its initial value, a greater increase than in beam NAC7; at the same time, the compressive concrete strain increased 2.37–3.15 times its initial value, a less pronounced increase than in the case of beam NAC7. The smaller increase in compressive strain is expected, since the beam is under a smaller $\sigma_c/f_{cm}(t_0)$ ratio, but the larger increase in tensile steel strain is not. The results is, nonetheless, in concordance with the measured larger crack widths and smaller crack spacing in beam NAC28.

The measured initial compressive concrete strain is, on average 23% greater than calculated, the measured tensile steel strain is only 4% lower than calculated. The variation between strains measured in different cross-sections does not seem much wider than in the case of beam NAC7.

There are two possible explanations for the observed phenomenon: (1) the measured modulus of elasticity is not correct and is, in fact, smaller – this explains the underestimated compressive concrete strain, but not so much the increase in steel strain and larger crack widths; or (2) there was some deviation in the position of the tensile reinforcement, i.e. the effective depth is smaller than designed – this would mean a larger tensile steel stress and larger crack widths.

Again, from the crack pattern in Figure 4.22, it was found that two cross-sections contained cracks: A7-8 (and B7-8) and A8-9 (and B6-7), Figure 4.34. For these two cross-sections, the strain distribution along their height is shown for 5 min, 90 and 450 days after loading, in figs. 4.35 and 4.36. The strains follow a clear linear distribution and the lowering of the neutral axis is observable. From the trendline equations, the increase in the compressed zone depth was determined as 51.2 to 73.1 mm for section A7-8 and 51.8 to 82.9 mm for section A8-9.

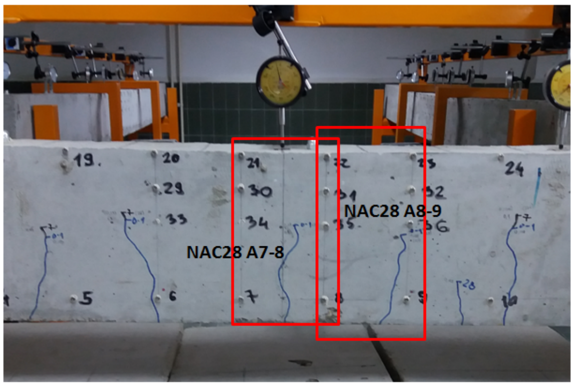


FIGURE 4.34: Close view of middle cross-sections of beam NAC28

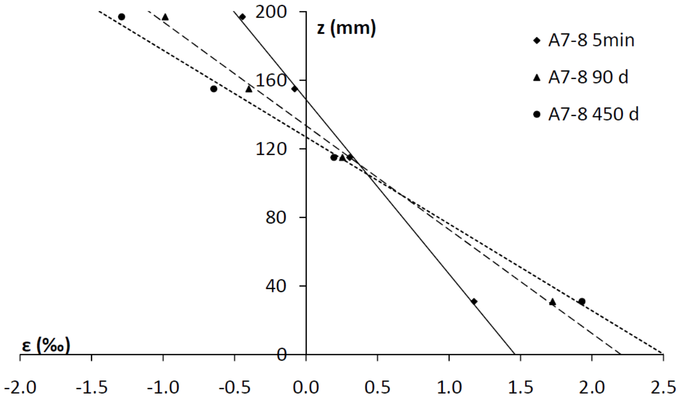


FIGURE 4.35: Strain distribution of cross-section A7-8 in beam NAC28

These were the results on the two NAC beams.

For beam RAC7, the compressive concrete and tensile steel strains are tabulated in Table 4.25 and Table 4.26, respectively and shown graphically in Figure 4.37 and Figure 4.38, respectively.

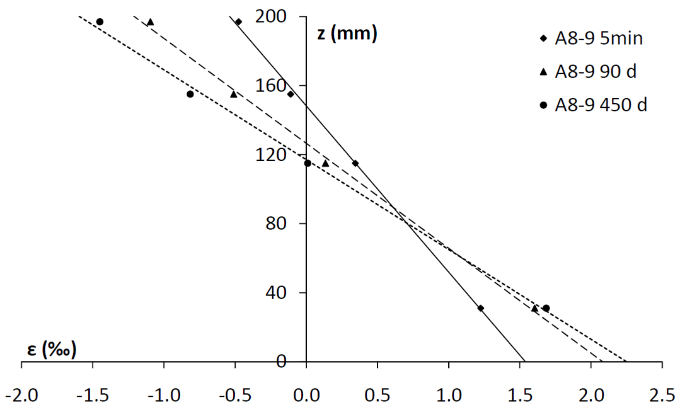


FIGURE 4.36: Strain distribution of cross-section A8-9 in beam NAC28

TABLE 4.25: Compressive concrete strain in beam RAC7

	ε_c (‰)							
Beam	A3-4	A4-5	A5-6	A6-7	A7-8	A8-9	A10-11	A11-12
5 min	-0.65	-0.55	-0.75	-0.48	-0.90	-0.61	-0.44	-0.73
28 d	-1.42	-1.26	-1.45	-1.30	-1.62	-1.37	-1.23	-1.52
90 d	-1.74	-1.57	-1.76	-1.58	-1.98	-1.70	-1.50	-1.83
180 d	-1.90	-1.75	-1.90	-1.75	-2.13	-1.87	-1.70	-2.00
450 d	-2.21	-2.02	-2.13	-2.00	-2.40	-2.16	-1.94	-2.24

TABLE 4.26: Tensile steel strain in beam RAC7

	ε_{s1} (‰)							
Beam	A3-4	A4-5	A5-6	A6-7	A7-8	A8-9	A10-11	A11-12
5 min	1.72	0.79	1.89	0.91	1.68	1.80	1.54	1.67
28 d	2.02	0.93	2.24	1.01	1.85	2.16	1.82	1.94
90 d	2.11	0.94	2.34	1.07	1.91	2.21	1.84	2.05
180 d	2.17	0.94	2.41	1.07	1.95	2.25	1.84	2.08
450 d	2.22	0.91	2.46	1.06	1.95	2.29	1.83	2.13

Since the beams RAC7 and NAC7 are loaded to practically identical $\sigma_c/f_{cm}(t_0)$ and M_{tot}/M_{ult} ratios, similar increases in concrete and steel strains would be expected. Indeed, the concrete compressive strain increased 2.68–4.21 times its initial value in beam RAC7 compared with 3.29–3.63 in beam NAC7. The steel tensile strain increased 1.16–1.30 times its initial value in beam RAC7 compared with 1.31–1.37 in beam NAC7; the

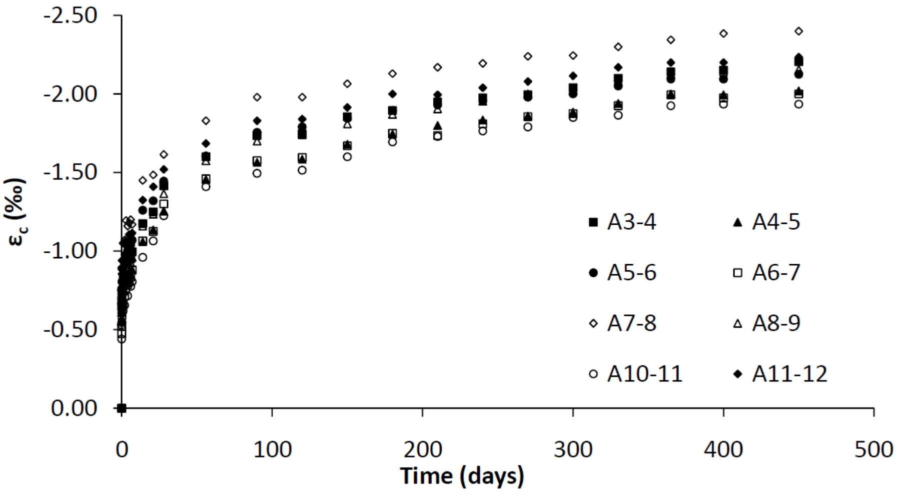


FIGURE 4.37: Time evolution of compressive concrete strain in beam RAC7

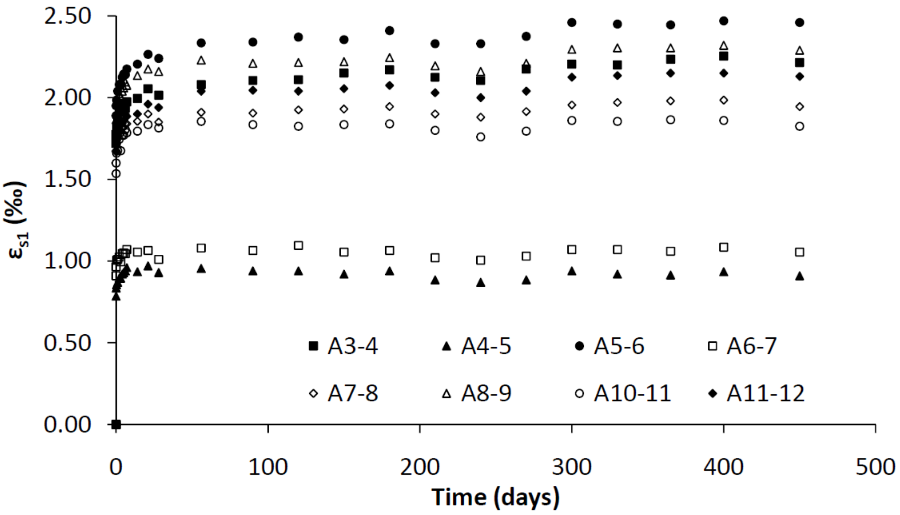


FIGURE 4.38: Time evolution of tensile steel strain in beam RAC7

effects of shrinkage and creep in RAC7 seem to be more pronounced. Compared with predicted strain values, the concrete compressive strain was underestimated by as much as 25%, again pointing to a possibly different modulus of elasticity than the one measured.

In beam RAC7 the crack pattern is developed the most of all the beams, in all three cross-sections with steel pins along the beam height (A6-7 and B8-9; A7-8 and B7-8; and A8-9 and B6-7) cracks were observed on both sides and thus strain distributions in all three cross-sections were possible, Figure 4.39.

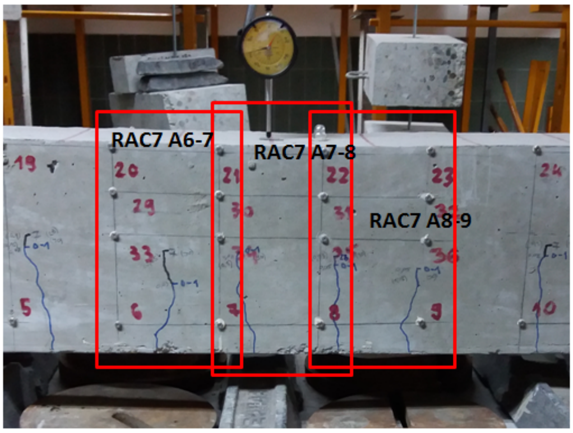


FIGURE 4.39: Close view of middle cross-sections of beam RAC7

They are shown for 5 min, 90 and 450 days after loading, in figs. 4.40 to 4.42. As in NAC beams, the strains follow a linear distribution and the lowering of the neutral axis is clear. From the trendline equations, the increase in the compressed zone depth was determined as 63.6 to 109.0 mm for section A6-7, 59.9 to 84.6 mm for section A7-8 and 53.8 to 88.8 mm for section A8-9.

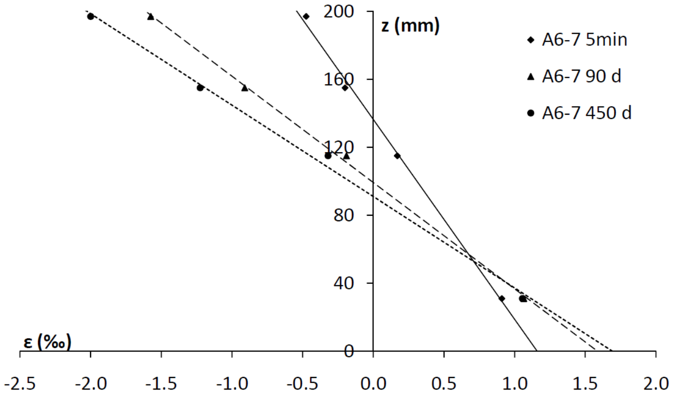


FIGURE 4.40: Strain distribution of cross-section A6-7 in beam RAC7

For beam RAC28, the compressive concrete and tensile steel strains are tabulated in Table 4.27 and Table 4.28, respectively and plotted in Figure 4.43 and Figure 4.44, respectively.

Since the beams RAC28 and NAC28 are also loaded to identical $\sigma_c/f_{cm}(t_0)$ ratios and very similar M_{tot}/M_{ult} ratios, increases in concrete and steel strains can be expected to be similar. The concrete compressive strain increased 3.19–3.63 times its initial value

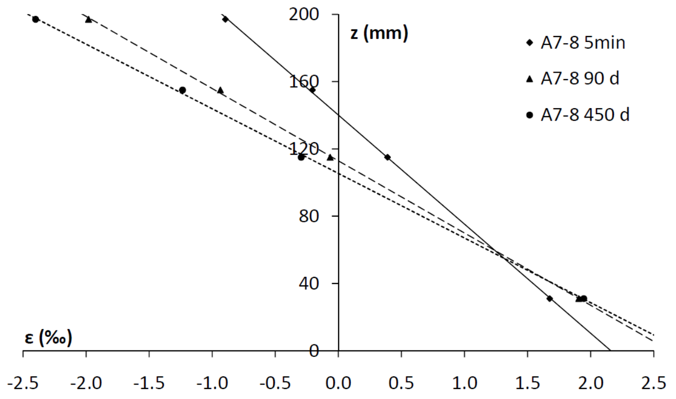


FIGURE 4.41: Strain distribution of cross-section A7-8 in beam RAC7

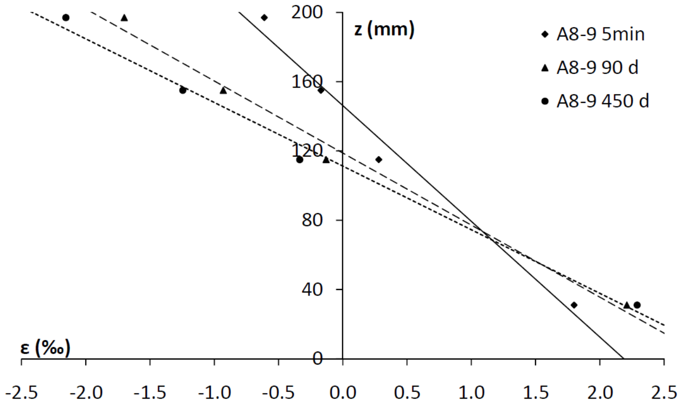


FIGURE 4.42: Strain distribution of cross-section A8-9 in beam RAC7

TABLE 4.27: Compressive concrete strain in beam RAC28

	ε_c (‰)					
Beam	A3-4	A4-5	A5-6	A8-9	A9-10	A11-12
5 min	-0.43	-0.38	-0.39	-0.40	-0.39	-0.43
28 d	-0.84	-0.81	-0.82	-0.86	-0.80	-0.83
90 d	-1.02	-0.98	-1.01	-1.04	-1.00	-1.03
180 d	-1.19	-1.17	-1.18	-1.22	-1.16	-1.16
450 d	-1.37	-1.38	-1.36	-1.45	-1.36	-1.38

TABLE 4.28: Tensile steel strain in beam RAC28

	ε_{s1} (‰)					
Beam	A3-4	A4-5	A5-6	A8-9	A9-10	A11-12
5 min	0.98	0.81	1.05	1.48	1.01	1.18
28 d	1.29	1.14	1.41	2.12	1.33	1.56
90 d	1.31	1.11	1.42	2.15	1.33	1.57
180 d	1.37	1.15	1.48	2.27	1.42	1.64
450 d	1.50	1.24	1.57	2.44	1.51	1.72

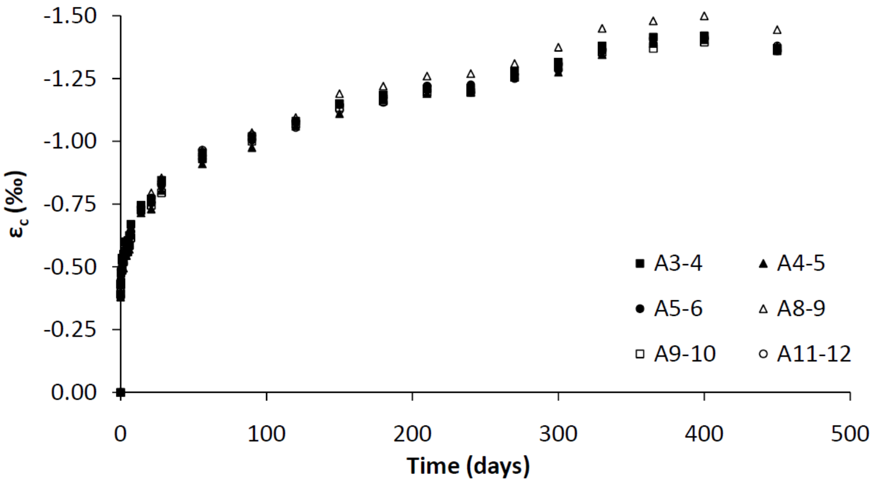


FIGURE 4.43: Time evolution of compressive concrete strain in beam RAC28

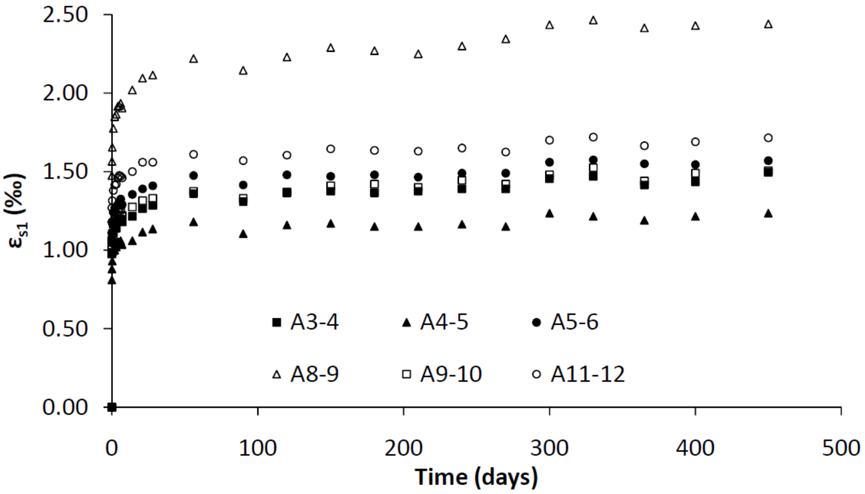


FIGURE 4.44: Time evolution of tensile steel strain in beam RAC28

in beam RAC28 compared with 2.37–3.15 in beam NAC28. The steel tensile strain increased 1.45–1.65 times its initial value in beam RAC28 compared with 1.34–1.64 in beam NAC28. Again, the effects of shrinkage and creep in RAC seem to be more pronounced than in NAC; interestingly, both beams loaded after 28 days show higher increases in tensile steel strain compared with beams loaded after 7 days. Compared with predicted strain values, the concrete compressive strain was underestimated by only 10% on average.

In beam RAC28 the crack pattern is less developed and a crack was observed in only one cross-section with steel pins along the beam height on both sides, namely section A8-9 (and B7-8), Figure 4.39.

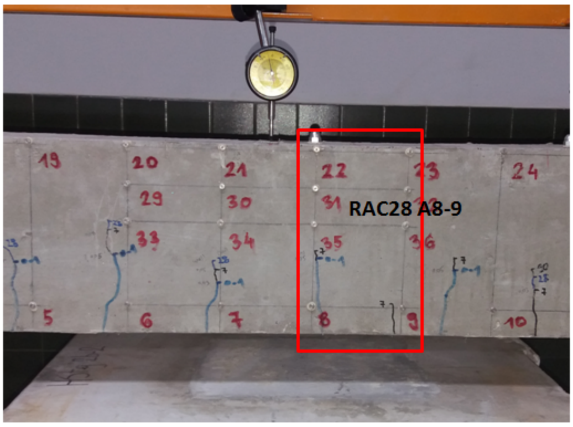


FIGURE 4.45: Close view of middle cross-sections of beam RAC28

The strain distribution for this section is shown for 5 min, 90 and 450 days after loading, in Figure 4.46. As before, the strains follow a linear distribution and the neutral axis moves downward over time. From the trendline equations, the increase in the compressed zone depth was determined as 52.4 to 76.5 mm.

These were the results on the two RAC beams. The two HVFAC beams, although loaded to identical $\sigma_c/f_{cm}(t_0)$ ratios as NAC and RAC beams, were, at the same time, loaded to lower M_{tot}/M_{ult} ratios, Table 4.14. This led to HVFAC beams having a less developed crack pattern, smaller crack widths and lower tensile steel and compressive concrete strains.

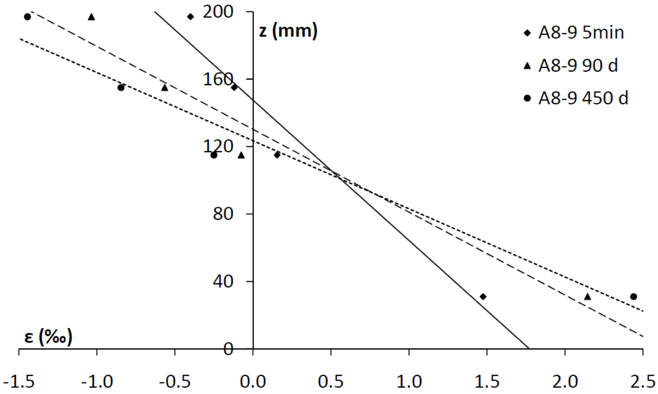


FIGURE 4.46: Strain distribution of cross-section A8-9 in beam RAC28

The compressive concrete and tensile steel strains for beam HVFAC7 are given in numerical form in Table 4.29 and Table 4.30, respectively and in graphical form in Figure 4.47 and Figure 4.48, respectively.

TABLE 4.29: Compressive concrete strain in beam HVFAC7

	ε_c (‰)			
Beam	A3-4	A5-6	A7-8	A9-10
5 min	-0.41	-0.38	-0.38	-0.41
28 d	-0.83	-0.85	-0.88	-0.87
90 d	-0.98	-0.93	-1.00	-0.99
180 d	-1.09	-1.05	-1.13	-1.11
450 d	-1.25	-1.19	-1.30	-1.29

TABLE 4.30: Tensile steel strain in beam HVFAC7

	ε_{s1} (‰)			
Beam	A3-4	A5-6	A7-8	A9-10
5 min	1.00	0.85	1.21	1.14
28 d	1.32	1.05	1.65	1.48
90 d	1.31	1.04	1.66	1.44
180 d	1.26	1.01	1.63	1.42
450 d	1.32	1.06	1.65	1.49

The increase in compressive concrete strain for beam HVFAC7 is 3.04–3.41 times its initial value, about 10% less than in the case of beam NAC7. The increase in tensile

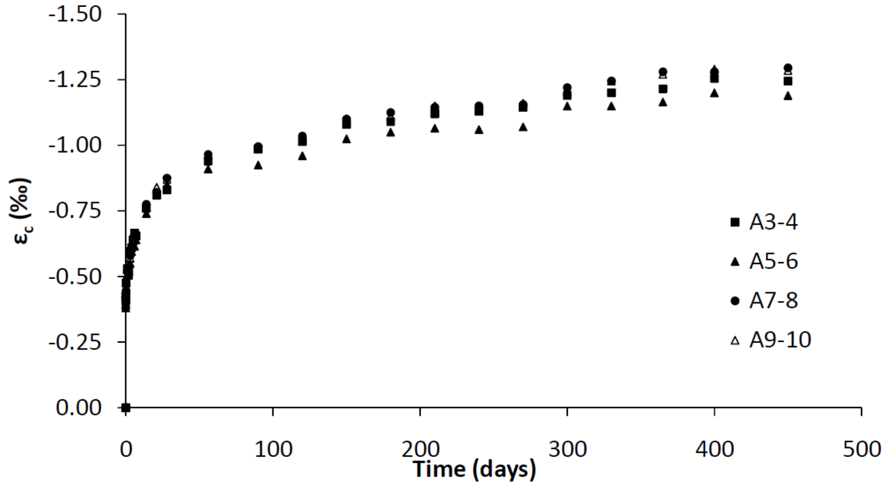


FIGURE 4.47: Time evolution of compressive concrete strain in beam HVFAC7

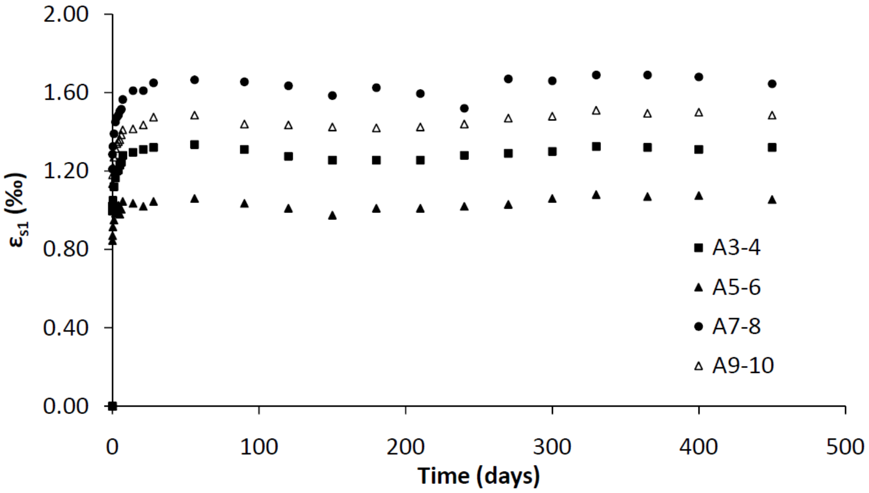


FIGURE 4.48: Time evolution of tensile steel strain in beam HVFAC7

steel strain is 1.25–1.36 times its initial value, practically identical to beam NAC7. This points to a less pronounced effect of shrinkage and creep in beam HVFAC7 compared with NAC7. Also important is that predicted strain values (both compressive and tensile) are within 10% of measured values.

Because of the aforementioned less developed crack pattern, only one cross-section with pins along the beam height was suitable for analysing the strain distribution – section A8-9 (and B7-8), Figure 4.49.

The strain distribution for this section is shown for 5 min, 90 and 450 days after loading,

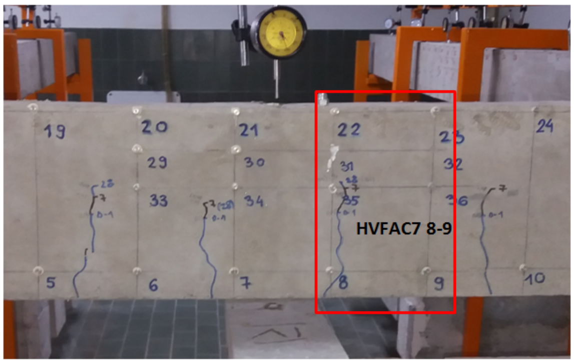


FIGURE 4.49: Close view of middle cross-sections of beam HVFAC7

in Figure 4.50. As before, the strains follow a linear distribution and the neutral axis moves downward over time. From the trendline equations, the increase in the compressed zone depth was determined as 50.6 to 75.6 mm.

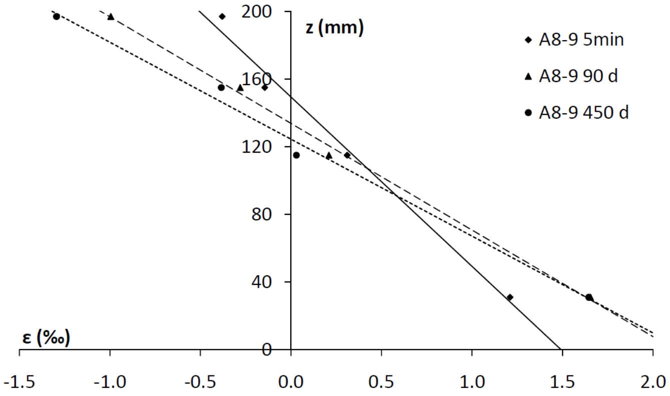


FIGURE 4.50: Strain distribution of cross-section A8-9 in beam HVFAC7

Finally, for beam HVFAC28, the compressive concrete and tensile steel strains are given in numerical form in Table 4.31 and Table 4.32, respectively and in graphical form in Figure 4.51 and Figure 4.52, respectively.

The increase in compressive concrete strain over 450 days for beam HVFAC28 was 2.95–3.02 of its initial value, mostly in the middle of the range for NAC28 (2.37–3.42). The increase in tensile steel strain for beam HVFAC28 was 1.36–1.56 times its initial value, practically identical to beam NAC28 (1.34–1.64). As with NAC28 compared with NAC7 and RAC28 compared with RAC7, so too for HVFAC28, the increase in tensile steel strain is greater than for HVFAC7. Compared with predicted strain values, the measured

TABLE 4.31: Compressive concrete strain in beam HVFAC28

	ε_c (‰)		
Beam	A7-8	A9-10	A10-11
5 min	-0.30	-0.29	-0.30
28 d	-0.53	-0.50	-0.55
90 d	-0.61	-0.58	-0.63
180 d	-0.77	-0.73	-0.77
450 d	-0.90	-0.86	-0.90

TABLE 4.32: Tensile steel strain in beam HVFAC28

	ε_{s1} (‰)		
Beam	A7-8	A9-10	A10-11
5 min	0.77	0.71	0.75
28 d	1.00	0.88	1.09
90 d	1.04	0.90	1.10
180 d	1.02	0.87	1.07
450 d	1.16	0.97	1.16

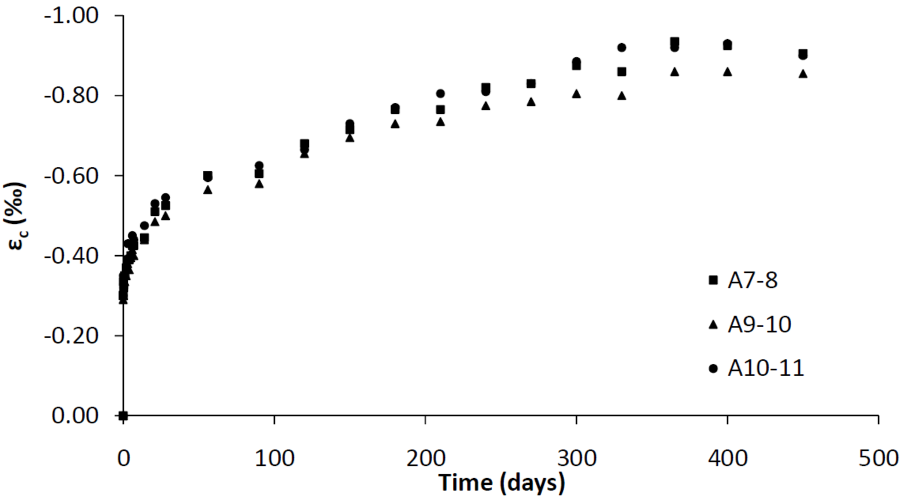


FIGURE 4.51: Time evolution of compressive concrete strain in beam HVFAC28

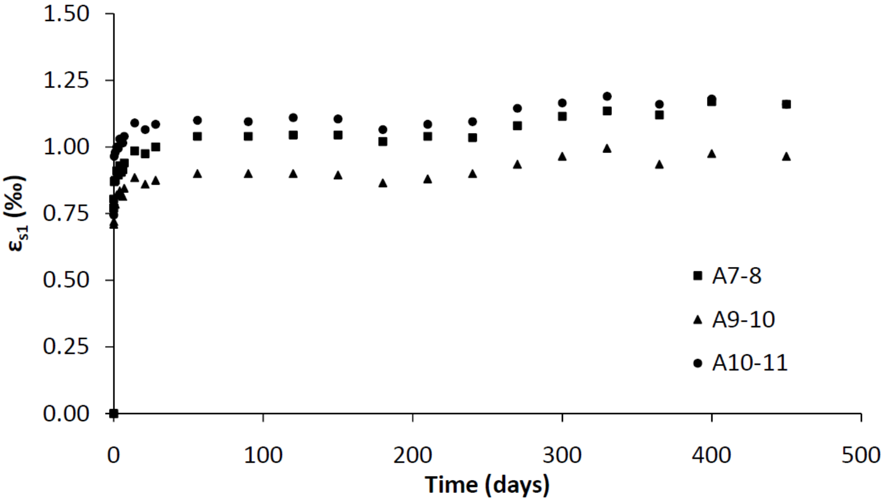


FIGURE 4.52: Time evolution of tensile steel strain in beam HVFAC28

compressive strain was within 10%; however, the measured tensile steel strain was almost 30% lower, on average, than the predicted value – looking at the underdeveloped crack pattern of beam HVFAC28, this possibly points to a much smaller tensile steel stress than targeted.

As for beam HVFAC7, only one cross-section with pins along the beam height was suitable for analysing the strain distribution in beam HVFAC28 – section A7-8 (and B7-8), Figure 4.53.

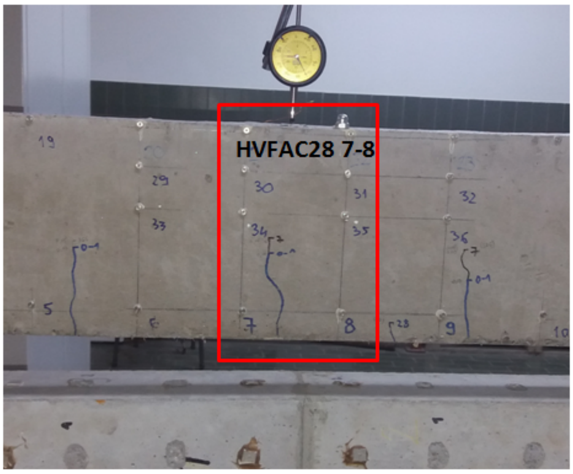


FIGURE 4.53: Close view of middle cross-sections of beam HVFAC28

The strain distribution for this section is shown for 5 min, 90 and 450 days after loading, in Figure 4.54. As before, the strains follow a linear distribution and the neutral axis moves downward over time. From the trendline equations, the increase in the compressed zone depth was determined as 50.6 to 79.1 mm.

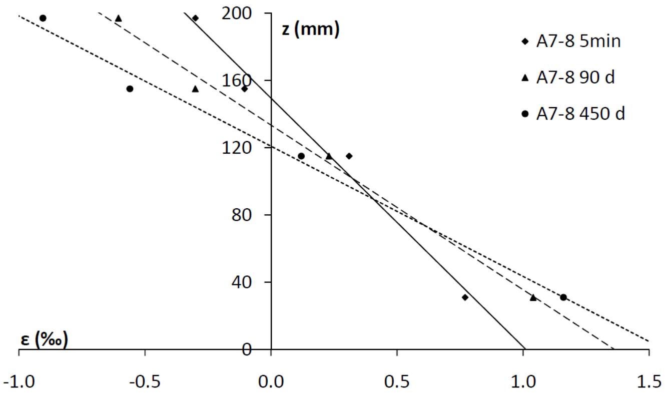


FIGURE 4.54: Strain distribution of cross-section A7-8 in beam HVFAC28

4.4 Summary

This chapter presented the results of the experimental programme in detail. All results concerning fresh and hardened concrete properties, obtained on accompanying test specimens, were presented, as well as the main experimental results obtained on reinforced concrete beams.

Material Properties of Concretes

The workability of the concretes proved somewhat hard to consistently control, varying by ± one slump class from the target class S3 (measured after 5 min). The target slump after 30 min of class S2 was achieved for NAC and RAC, but not for HVFAC.

The densities of the concretes decreased in the order of NAC, RAC, HVFAC, with 28-day hardened densities of 2340, 2240 and 2200 kg/m^3, respectively.

The target 28-day compressive strength of 35 MPa on a 100 mm cube was achieved for NAC and RAC (with an overshot of 5–10%) but not in the case of HVFAC which missed the target by 5 MPa. The time evolution of compressive strength showed a slowing down and even decrease after 240 days.

The tensile splitting and flexural strengths were measured after 7 and 28 days. NAC and RAC had practically the same tensile strengths at both times: splitting tensile strengths of 2 MPa after 7 days and 2.4 (NAC) and 2.5 (RAC) after 28 days. HVFAC had a much lower 7-day splitting strength of 1.2 MPa, rising to 2.1 MPa after 28 days.

The 28-day moduli of elasticity for NAC, RAC and HVFAC were 32.2, 30.8 and 28.7 GPa, respectively. There time evolution was almost negligible, not more than 20% between 7 and 450 days.

The shrinkage strain after 450 days for NAC, RAC and HVFAC was -0.645, -0.782 and -0.597 ‰. The time evolution of shrinkage followed a logarithmic function.

Creep was measured only on RAC and HVFAC prisms, loaded after 7 and 28 days. The experimental creep coefficients for RAC loaded after 7 and 28 days were 2.395 and 2.480, respectively, and for HVFAC loaded after 7 and 28 days, 1.634 and 1.554, respectively. Taking all the measurement imprecision and scatter into account, these creep coefficients basically represent the same values (for RAC and HVFAC), showing no effect of higher stress levels (non-linear creep) to which specimens loaded after 7 days were exposed to. While creep compliance for RAC7, RAC28 and HVFAC7 prisms are very similar, the creep compliance for HVFAC28 prisms is significantly smaller.

Results on Reinforced Concrete Beams

Starting from target $\sigma_c/f_{cm}(t_0)$ ratios of 0.6 and 0.45 for beams loaded after 7 and 28 days, respectively, taking into account measured mechanical properties of the beams (modulus of elasticity and compressive strength), the superimposed dead load was calculated for each beam. In the end, beams NAC7 and RAC7 were loaded to 0.54 and 0.56 of their ultimate strengths, respectively, beams NAC28 and RAC28 to 0.48 and 0.44 of their ultimate strengths, respectively, and beams HVFAC7 and HVFAC28 to 0.40 and 0.38 of their ultimate strengths, respectively. This meant that beams NAC7 and RAC7 had similar tensile steel stresses, as well as beams NAC28 and RAC28, and beams HVFAC7 and HVFAC28.

The deflections of the beams from self-weight could not be successfully measured using geodetic readings. While some results showed good agreement with theoretical values, the warping of other beams meant that those readings were useless for this purpose. The dial gauge readings showed that mid-span deflections increased very similarly for all six beams: the ratios of final-to-initial deflections were in a narrow range of 2.03–2.16 with only RAC28 having a larger ratio of 2.36. Over time, the deflections developed following a clear logarithmic trend.

Crack patterns, spacings and widths were analysed for all beams. Generally, the beams loaded after 7 days had a more developed crack pattern compared with beams loaded after 28 days. Over the course of 450 days the width of the cracks increased, the cracked zone widened and new cracks opened between existing cracks, reducing the average crack spacing by approximately 15%.

The strains in the beams showed a relatively good agreement with predicted values, with an average variation of around 15–20% for compressive concrete strains. The compressive concrete strains increased logarithmically, by roughly 2.5–3.5 times their initial value; higher increases were in beams loaded after 7 days. The tensile steel strains increased linearly by roughly 1.2-1.6 times their initial value; higher increases were in beams loaded after 28 days. The strain distribution in mid-span cross-sections was linear along the height of the beam and the neutral axis was observed to move downward in the cross-section, increasing the depth of the compressed zone.

Chapter 5

Analysis, Discussion and Implications of the Results

5.1 Aim of the Analysis of the Results

Beside Chapter 3, the current chapter is the most important one in this thesis. It is primarily concerned with analyses of the obtained experimental results. The conducted analyses serve to verify the adequacy and proper execution of the experimental programme itself, but also to provide new insight into the studied phenomena. In line with section 1.3, the main objective of this chapter is to 'reach accurate and precise methods for predicting the behaviour of NAC, RAC and HVFAC beams under sustained loads'.

The chapter begins with the analyses of the mechanical properties of the produced concrete mixes, section 5.2. Although the results of this part of the experiment were not numerous (compressive and tensile strengths, modulus of elasticity), and a lot of systematic research on this topic exists (sections 2.6 and 2.7), it was still important to verify the obtained results. This is especially important taking into consideration certain problems with measurements (e.g. modulus of elasticity of RAC, section 4.2.5), which are bound to happen in any experimental programme. Hence, the primary goal of this section was to establish a reliable *range* of mechanical properties of the produced concretes for the analyses in subsequent sections.

The second section of this chapter, 5.3, presents analyses of shrinkage and creep results obtained on accompanying prisms. The section contains comparisons with predictions provided by the models presented in section 2.5.3: model B4, MC10, EC2, ACI 209R-92 and GL2000 models. The experimental results are analysed in comparison with model predictions and relative to each other, i.e. differences between NAC, RAC and HVFAC are studied. The general 'fit' of the results to model predictions is discussed.

The third section, 5.4 is central to this chapter, providing analyses of beam deflection results which were presented in section 4.3.2. In order to achieve the objective of reaching accurate and precise methods for predicting the behaviour of NAC, RAC and HVFAC beams under sustained loads, two families of models for predicting deflections were studied, originating from the European and North American traditions, section 2.5.4. First, for both families of models, the rigorous approach based on numerical integration was studied and compared with selected reliable experimental results presented in section 2.5.2. Through this comparison, it was determined whether corrections are necessary in the rigorous form of the models. Second, the rigorous form of the models was compared with their respective simplified versions and necessary calibrations were performed in order to achieve the same accuracy and precision on the previously selected experimental results. Third, the models were applied to existing results on RAC and HVFAC beams and conclusions about their applicability to them were reached.

5.2 Analysis of the Mechanical Properties of Concretes

5.2.1 Compressive Strength

Compressive strength of the concretes (converted from cubes to cylinders) was given in Table 4.5 and Figure 4.5. In section 4.2.3 the obtained results were presented and commented on. It was stated that the presented values were averages of three measurements (with a CoV generally not exceeding 10% on any particular test). It was noted also that there were some peculiar results such as a relative decrease in the mean strength between two test dates in some instances as well as the unexpectedly low time evolution of compressive strength for HVFAC.

Since the compressive strength was one of the targets when designing concrete mixes and a ruling criterion in the experimental setup design—through the $\sigma_c/f_{cm}(t_0)$ ratio—it is important to establish reasonable *ranges* within which the compressive strength of each concrete actually lies. This is also important since all the presented models for calculating shrinkage, creep or deflections use compressive strength as an input parameter (with the exception of the B4 model). Whether using measured experimental data for input mechanical properties or deriving them from code expressions based on compressive strength, it is useful to have a range within which the actual results fit reasonably well.

Hence, this section will assess what is the range within which compressive strength lies, specifically at the ages of 7 and 28 days since these were the loading ages for the beams. The range will be defined by the following values:

- $f_{c,inf}$ – lower 'characteristic' value of compressive strength;
- f_{cm} – mean value of compressive strength;
- $f_{c,sup}$ – upper 'characteristic' value of compressive strength.

Since all code expressions predict other mechanical properties from the 28-day compressive strength (as well as the time evolution of compressive strength itself), the measured mean $f_{cm,exp}$ values were taken as a starting point (30.5, 28.1 and 22.6 MPa for NAC, RAC and HVFAC, respectively). From these values, using a maximum observed CoV of 10%, the lower and upper 'characteristic' values were obtained by adding, i.e. subtracting, $1.65 \cdot 0.1 \cdot f_{cm,exp}$ – representing, in fact, 5 and 95 percentile values of a normal distribution with mean $f_{cm,exp}$. Hence, $f_{c,inf}(28)$ and $f_{c,inf}(28)$ were obtained; these value represent a reasonable range within which the actual value of the 28-day concrete compressive strength lies.

Since compressive strength was measured after 7, 28, 90, 240 and 450 days, the next step was to assess how well code expressions predict the development of compressive strength for each concrete. For this purpose, the code expressions given in Eurocode 2 (EN 1992-1-1, 2004) and ACI 318-11 (ACI 318-11, 2011) were tested (the Model Code 2010 expressions is identical to Eurocode 2 and models B4 and GL2000 use the ACI 318-11 formula).

According to EC2, mean compressive strength at time t, $f_{cm}(t)$, is derived from the 28-day mean compressive strength:

$$f_{cm}(t) = \beta_{cc}(t) \cdot f_{cm} \tag{5.1}$$

where β_{cc} is the time evolution function given in Equation 2.180 with a cement type-dependent coefficient s defined in Equation 2.181. As outlined in section 3.2.4, cement type 42.5 R S-L was used for which $s = 0.2$.

According to ACI 318-11, the time evolution of compressive strength is given by Equation 2.123 taking coefficients a and b as 4 and 0.85, respectively.

For all three concretes, the time evolution of compressive strength was calculated from three values: $f_{c,inf}(28)$, $f_{cm,exp}$ and $f_{c,sup}(28)$, according to Eurocode 2 and ACI 318-11. For NAC, $f_{cm} = 30.5$ MPa; $f_{c,inf}(28) = 30.5 - 1.65 \cdot 0.1 \cdot 30.5 = 25.5$ MPa and $f_{c,sup}(28) = 30.5 + 1.65 \cdot 0.1 \cdot 30.5 = 35.6$. The results are given in Table 5.1 and Figure 5.1.

TABLE 5.1: Predictions of NAC compressive strength

		Eurocode			ACI		
Time (days)	$f_{cm,exp}$ (MPa)	$f_{c,inf}$ (MPa)	f_{cm} (MPa)	$f_{c,sup}$ (MPa)	$f_{c,inf}$ (MPa)	f_{cm} (MPa)	$f_{c,sup}$ (MPa)
7	24.7	20.9	25.0	29.1	17.9	21.5	25.0
28	**30.5**	**25.5**	**30.5**	**35.6**	**25.5**	**30.5**	**35.6**
90	30.5	27.9	33.4	38.9	28.5	34.1	39.8
240	33.9	29.1	34.8	40.6	29.4	35.2	41.0
450	32.8	29.6	35.5	41.3	29.7	35.6	41.4

In Table 5.1, the values in bold are the 28-day lower-bound, mean and upper-bound compressive strengths, which were the input for both code predictions, calculated from $f_{cm,exp}$. Conclusions are perhaps easier to make by looking at Figure 5.1; in it, Eurocode 2 predictions are given by full lines and ACI 318-11 predictions by the dotted lines. It can be seen that experimentally obtained values lie comfortably within the range predicted from upper- and lower-bound values (except for 7-day strength which is underestimated by ACI

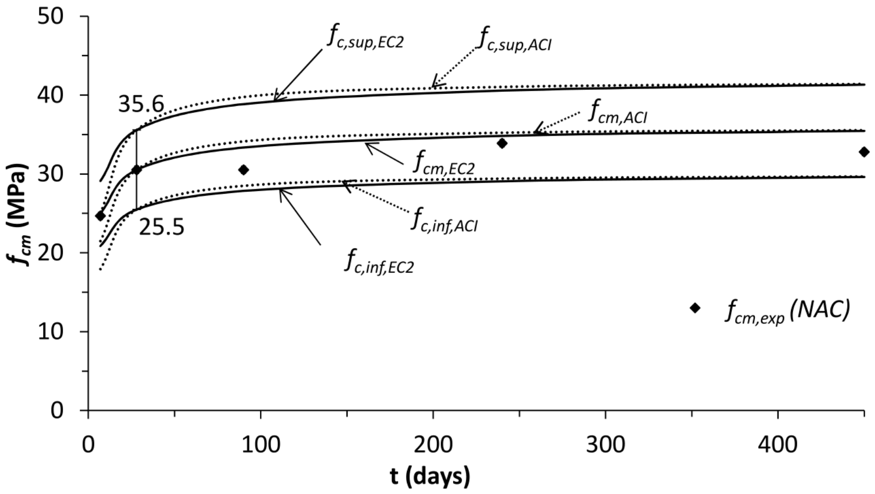


FIGURE 5.1: Predictions of NAC compressive strength time evolution

318-11, probably because it doesn't account for the rapid-hardening cement type). Also, the measured values lie closest to the line calculated from $f_{cm,exp}$ (although 240 and 450-day strengths are somewhat below this line). This is important for the reliability of the measurements. Hence, the ranges provided in Table 5.1 can be used in further analyses, e.g. the 7-day compressive strength will be considered to lie between 20.9 and 29.1 MPa, with a 'most probable' value of 25.0 MPa.

The same was performed for RAC and HVFAC. The results for RAC are given in Table 5.2 and Figure 5.2.

TABLE 5.2: Predictions of RAC compressive strength

		Eurocode			ACI		
Time (days)	$f_{cm,exp}$ (MPa)	$f_{c,inf}$ (MPa)	f_{cm} (MPa)	$f_{c,sup}$ (MPa)	$f_{c,inf}$ (MPa)	f_{cm} (MPa)	$f_{c,sup}$ (MPa)
7	24.2	19.2	23.0	26.8	16.5	19.7	23.0
28	**28.1**	**23.4**	**28.1**	**32.7**	**23.4**	**28.1**	**32.7**
90	29.1	25.6	30.6	35.7	26.2	31.4	36.5
240	29.4	26.7	32.0	37.3	27.0	32.4	37.7
450	32.8	27.2	32.6	38.0	27.3	32.7	38.1

As with NAC, the measured values, $f_{cm,exp}(t)$, lie within the range predicted from the upper- and lower-bound compressive strengths, close to the predictions from $f_{cm,exp}$.

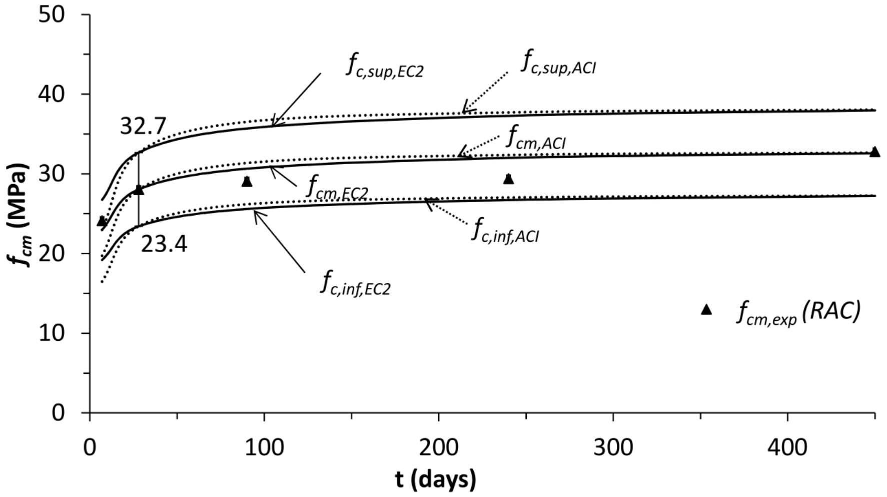


FIGURE 5.2: Predictions of RAC compressive strength time evolution

However, the 90 and 240-day strengths are somewhat below this middle line. Again, the analysis provides a reliable interval for RAC compressive strength.

For HVFAC, beside the Eurocode 2 and ACI 318-11 predictions, the expression proposed by (Chen et al., 2017) was also used to predict compressive strength from $f_{cm,exp}$. The equation is given in Equation 2.185 and is actually a modification of the $\beta_{cc}(t)$ function with the introduction of the $C/(S+A)$ ratio, Equation 2.186. For the specific HVFAC mixture used in this experiment, the $C/(S+A)$ ratio can be calculated from the chemical composition of cement and fly ash, Table 3.3. Since the amounts of cement and fly ash are equal per m^3, the ratio can be calculated as

$$\frac{C}{S+A} = \frac{60.43+7.62}{(21.04+58.24)+(5.33+20.33)} = 0.649 \tag{5.2}$$

The results of the compressive strength predictions are given in Table 5.3 and Figure 5.3.

As with NAC and RAC, the measured values line within the range of predictions from the upper- and lower-bound values, very close to the mean line. However, what is noticeable is the extreme discrepancy between the measured values and predictions using the expression proposed by Chen et al. (2017). This slow evolution of HVFAC compressive strength was mentioned previously in section 4.2.3 and attributed mostly to the curing regime – the fly ash reacted much less with cement and the pozzolanic reaction was of

TABLE 5.3: Predictions of HVFAC compressive strength

		Eurocode			ACI			Chen et al. (2017)
Time (days)	$f_{cm,exp}$ (MPa)	$f_{c,inf}$ (MPa)	f_{cm} (MPa)	$f_{c,sup}$ (MPa)	$f_{c,inf}$ (MPa)	f_{cm} (MPa)	$f_{c,sup}$ (MPa)	f_{cm} (MPa)
7	16.4	15.4	18.5	21.5	13.3	15.9	18.5	15.5
28	**22.6**	**18.9**	**22.6**	**26.3**	**18.9**	**22.6**	**26.3**	**22.6**
90	25.9	20.6	24.7	28.7	21.1	25.2	29.4	29.3
240	24.8	21.5	25.8	30.0	21.8	26.1	30.4	33.3
450	25.6	21.9	26.2	30.6	22.0	26.3	30.6	35.2

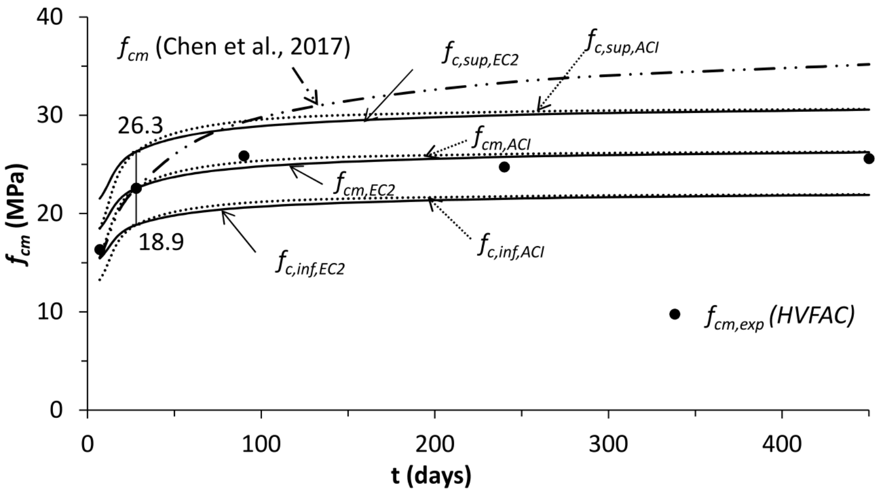


FIGURE 5.3: Predictions of HVFAC compressive strength time evolution

much lower intensity. In a way, this concrete is more like a concrete with 200 kg/m^3 of cement and filler (in the form of fly ash) than a typical HVFAC. Nonetheless, it is on the safe side to assume time evolution of compressive strength identical to NAC. Hence, the obtained ranges of compressive strength provide a reliable assessment of real compressive strength values. The result also serves as a reminder about the implications of predictions such as the one by Chen et al. (2017) – the preconditions for their validity are not always clear or explicitly stated.

5.2.2 Modulus of Elasticity

For the modulus of elasticity, an analysis similar to the one for compressive strength was carried out. The measurements of the modulus of elasticity were the most unreliable ones, with specific problems concerning the measurement of the RAC modulus of elasticity—as discussed in section 4.2.5. Hence, it was very important to first verify the experiment results, their validity and reliability.

For this purpose, a *range* of values within which the modulus of elasticity reasonably lies, was searched for. From the values measured after 28 days, $E_{cm,exp}$, upper and lower 'characteristic values, $E_{c,sup}(28)$ and $E_{c,inf}(28)$ were calculated as 5 and 95 percentile values by adding, i.e. subtracting, $1.65 \cdot 0.1 \cdot E_{cm,exp}$.

From these three values, the time evolution of the modulus of elasticity was predicted using Eurocode 2 (EN 1992-1-1, 2004), Model Code 2010 (FIB, 2013) and ACI 318-11 expressions (ACI 318-11, 2011).

Eurocode 2 and Model Code 2010 predict the time evolution of the modulus of elasticity using the same function β_{cc} as for compressive strength. However, since the observed increase in the modulus of elasticity over time is less pronounced, both codes use an exponential version of the β_{cc} function, only with different exponents; Eurocode 2 predicts a smaller increase in the modulus of elasticity.

The Eurocode 2 uses the following expression

$$E_c(t) = E_{cm} \cdot \beta_{cc}^{0.3} \tag{5.3}$$

whereas Model Code 2010 uses the following

$$E_c(t) = E_{cm} \cdot \beta_{cc}^{0.5} \tag{5.4}$$

Meanwhile, ACI 318-11 doesn't give an explicit function. However, since the modulus of elasticity is predicted form the square root of compressive strength at any time using equation Equation 2.122, it can be concluded that ACI 318-11 implies that the time evolution of the modulus of elasticity follows a function which is the square root of the function for compressive strength, i.e.

$$E_c(t) = E_{cm}\sqrt{\frac{t}{4+0.85\cdot t}} \tag{5.5}$$

Finally, from the three values at 28 days – $E_{c,sup}(28)$ and $E_{cm,exp}$ and $E_{c,sup}(28)$, the time evolution of the modulus of elasticity was calculated for ages 7, 90, 240 and 450 days. Values are given in Table 5.4 and in Figure 5.4. Values are given for Eurocode 2 and ACI 318-11 and not for Model Code 2010 since they are very similar to the values according to Eurocode 2, always within 10%.

TABLE 5.4: Time evolution of the NAC modulus of elasticity

		Eurocode			ACI		
Time (days)	$E_{cm,exp}$ (GPa)	$E_{c,inf}$ (GPa)	E_{cm} (GPa)	$E_{c,sup}$ (GPa)	$E_{c,inf}$ (GPa)	E_{cm} (GPa)	$E_{c,sup}$ (GPa)
7	30.1	25.3	30.3	35.3	22.5	27.0	31.5
28	**32.2**	**26.9**	**32.2**	**37.5**	**26.9**	**32.2**	**37.5**
90	32.4	27.6	33.1	38.5	28.4	34.0	39.7
240	33.2	28.0	33.5	39.0	28.9	34.6	40.3
450	34.5	28.1	33.7	39.2	29.0	34.7	40.5

It can be seen that the measured values of the modulus of elasticity all lie within the range obtained from the upper- and lower-bound values of E_{cm}. They practically all lie on the line which predicts the time evolution of the modulus of elasticity from its mean 28-day value. Notably, ACI 318-11 provides a slightly larger increase in the modulus after 28 days but also lower values at the age of 7 days.

This was the first step in the analysis, the verification of experimental results. The second step was to test the code expressions for predicting the modulus of elasticity from compressive strength.

The Eurocode 2 expression is given in Equation 2.170 and the ACI 318-11 expression in Equation 2.122. Model Code 2010 uses a similar expression to Eurocode 2, the only

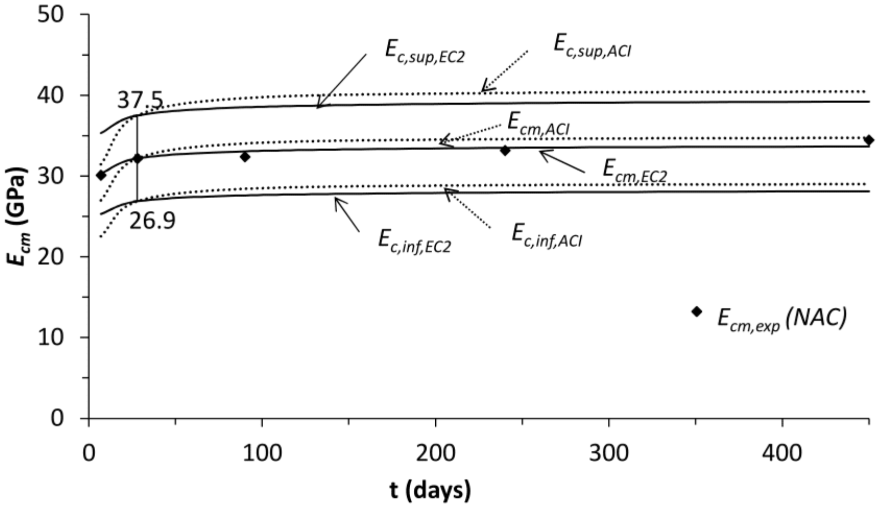


FIGURE 5.4: Time evolution of the NAC modulus of elasticity

difference being in the coefficient of the equation which is 22 for Eurocode 2 and 21.5 for Model Code 2010. This is an insignificant difference, so only the Eurocode 2 expression will be studied here.

The predicted values are given in Table 5.5 and Figure 5.5. The figure shows only lines obtained using the upper- and lower-bound values of compressive strength; this is because the ranges are relatively narrow and all three lines for both codes would make the figure illegible.

TABLE 5.5: Predictions of the NAC modulus of elasticity from compressive strength

		Eurocode			ACI		
Time (days)	$E_{cm,exp}$ (GPa)	$E_{c,inf,calc}$ (GPa)	$E_{cm,calc}$ (GPa)	$E_{c,sup,calc}$ (GPa)	$E_{c,inf,calc}$ (GPa)	$E_{cm,calc}$ (GPa)	$E_{c,sup,calc}$ (GPa)
7	30.1	27.4	29.0	30.3	21.2	23.2	25.0
28	32.2	29.1	30.8	32.2	25.3	27.6	29.8
90	32.4	29.9	31.6	33.1	26.7	29.2	31.5
240	33.2	30.3	32.0	33.5	27.1	29.7	32.0
450	34.5	30.5	32.2	33.7	27.2	29.8	32.2

Figure 5.5 clearly shows that both codes underestimate experimentally measured values. Eurocode 2 predicts them relatively well, most closely by using the upper-bound value of compressive strength $f_{c,sup}$, whereas ACI 318-11 underestimates the modulus of elasticity

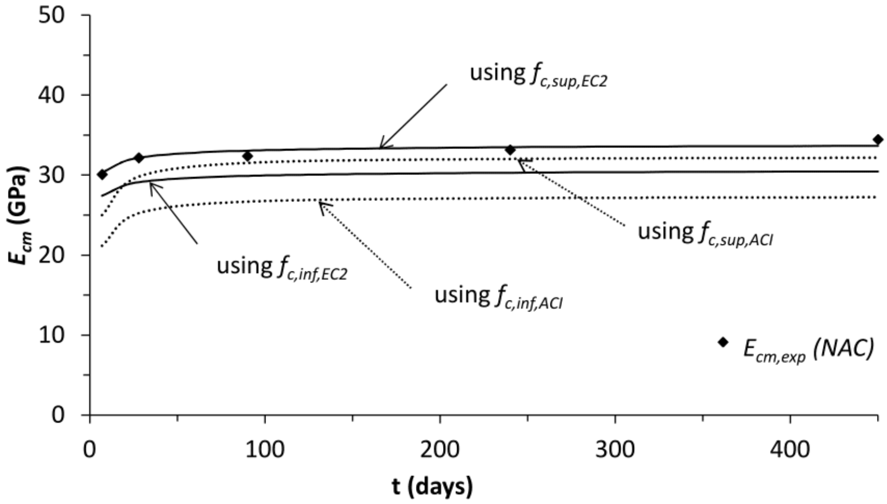


FIGURE 5.5: Predictions of the NAC modulus of elasticity from compressive strength

at all ages. If predictions using f_{cm} are considered, then for Eurocode 2, the modulus values after 7 and 28 days (important because of the loading ages of beams) are 96.3% and 95.6% of the measured values, respectively; for ACI 318-11, they are 77% and 85.7% for 7 and 28 days, respectively. Because of the importance of the modulus of elasticity in the experimental programme and setup, this conclusion has to borne in mind when carrying out further analyses.

RAC was the mixture for which the modulus of elasticity results are most unreliable, especially those at 7 and 28 days. It was explained previously that the 7-day value is the average of two measurements and the 28-day value is a single measurement, which seems to be nearer to the upper-bound limit of $E_c(t)$ values.

Because of this, a slightly different approach was taken for RAC: the 7-day value was taken as a starting point from which upper and lower 'characteristic' values, $E_{c,inf}(7)$ and $E_{c,sup}(7)$, were calculated. Then, from these three values, new E_{cm} values were determined and from them, the time evolution of the modulus of elasticity was predicted, Table 5.6 and Figure 5.6.

For Eurocode 2 predictions, all experimental values lie within the range between upper- and lower-bound values of E_{cm}; however, the scatter is significant. It is clear that the only value close to the upper-bound is the 28-day value (the single measurement), which points to the probability of the actual 28-day modulus value being lower than experimentally

TABLE 5.6: Time evolution of the RAC modulus of elasticity

		Eurocode			ACI		
Time (days)	$E_{cm,exp}$ (GPa)	$E_{c,inf}$ (GPa)	E_{cm} (GPa)	$E_{c,sup}$ (GPa)	$E_{c,inf}$ (GPa)	E_{cm} (GPa)	$E_{c,sup}$ (GPa)
7	**26.2**	**21.9**	**26.2**	**30.6**	**21.9**	**26.2**	**30.6**
28	30.8	23.3	27.9	32.5	26.1	31.3	36.4
90	25.3	23.9	28.6	33.3	27.6	33.1	38.5
240	26.4	24.2	29.0	33.8	28.0	33.6	39.1
450	28.6	24.3	29.1	33.9	28.2	33.7	39.3

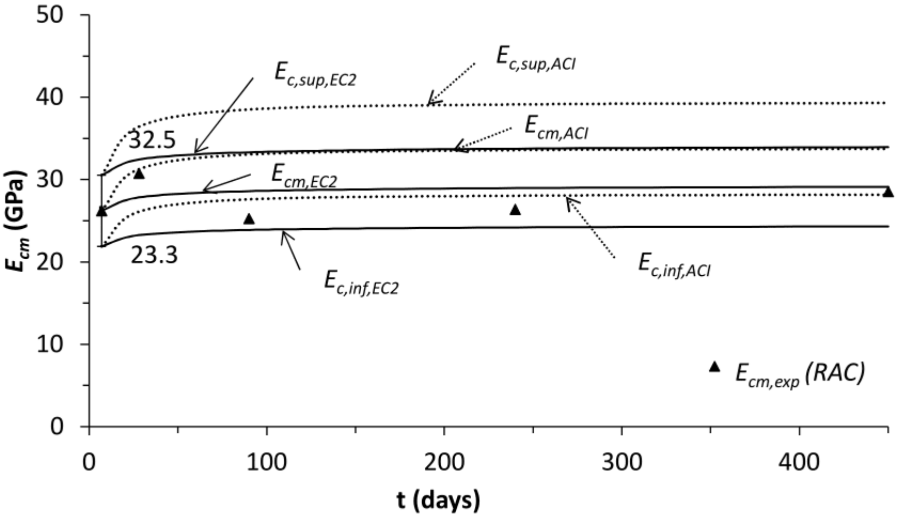


FIGURE 5.6: Time evolution of the RAC modulus of elasticity

determined. Meanwhile, the ACI 318-11 predictions are very imprecise and overestimate the modulus value at all ages except 28 days. This is because they were back-calculated from the 7-day value and the rate of increase in the ACI 318-11 formula is very large for early ages.

As for predictions from compressive strength, the results are given in Table 5.7 and Figure 5.7. *The Eurocode 2 predictions were determined using a correction coefficient of 0.9* in Equation 2.170, the correction coefficient recommended by EC2 for limestone aggregates. This was found to provide the best fit of results and is in line with conclusion of other researchers about the RAC modulus of elasticity being lower compared with NAC (see section 2.6.1), (Silva, 2015; Ignjatović, 2013; Lye et al., 2016a).

TABLE 5.7: Predictions of the RAC modulus of elasticity from compressive strength

		Eurocode			ACI		
Time (days)	$E_{cm,exp}$ (GPa)	$E_{c,inf,calc}$ (GPa)	$E_{cm,calc}$ (GPa)	$E_{c,sup,calc}$ (GPa)	$E_{c,inf,calc}$ (GPa)	$E_{cm,calc}$ (GPa)	$E_{c,sup,calc}$ (GPa)
7	26.2	24.1	25.4	26.6	20.3	22.2	24.0
28	30.8	25.6	27.0	28.3	24.2	26.5	28.6
90	25.3	26.3	27.7	29.0	25.6	28.0	30.2
240	26.4	26.6	28.1	29.4	26.0	28.5	30.7
450	28.6	26.7	28.2	29.6	26.1	28.6	30.8

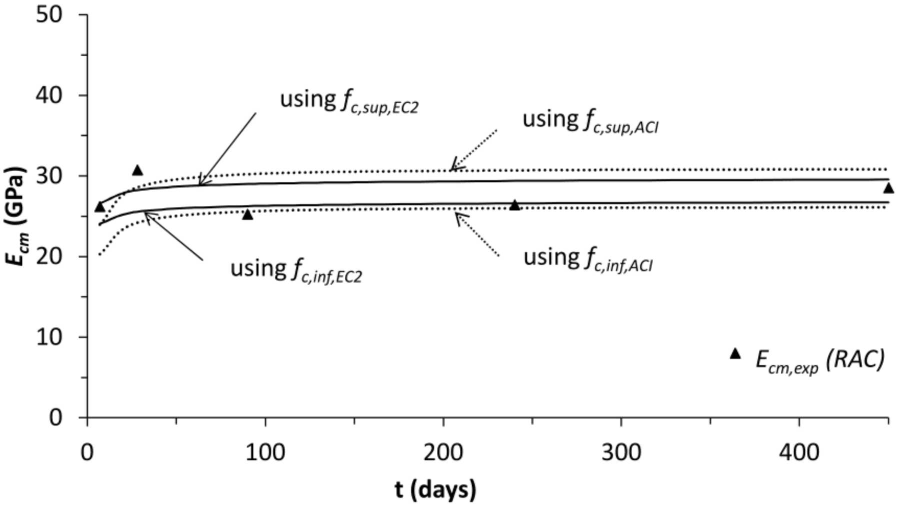


FIGURE 5.7: Predictions of the RAC modulus of elasticity from compressive strength

Both the Eurocode 2 and ACI 318-11 predictions, limited in Figure 5.7 by lines obtained from $f_{c,inf}(28)$ and $f_{c,sup}(28)$, pass between experimental values, which is mostly because of their large scatter. If the predictions from f_{cm} are analysed, then according to Eurocode 2, the predicted 7 and 28-day values are 96.9% and 87.7% of the measured results; for ACI 318-11 these percentages are 84.7% and 86% for 7 and 28 days, respectively. Again, special care should be taken when considering the proper value of E_{cm} in further analysis, however, the results obtained in this section present reasonable ranges for carrying out sensitivity analyses.

For HVFAC, the same procedure as for NAC was followed, i.e. upper and lower 'characteristic' values of E_{cm} were calculated from $E_{cm,exp}$ and from these values the time evolution of the modulus was predicted according to Eurocode 2 and ACI 318-11. Additionally, the expression proposed by (Chen et al., 2017) was also tested. The expression is a modification of the Eurocode 2 procedure and was outlined in section 2.7.2, eqs. (2.182) and (2.183). The results are given in Table 5.8 and Figure 5.8.

TABLE 5.8: Time evolution of the HVFAC modulus of elasticity

		Eurocode			ACI			Chen et al. (2017)
Time (days)	$E_{cm,exp}$ (GPa)	$E_{c,inf}$ (GPa)	E_{cm} (GPa)	$E_{c,sup}$ (GPa)	$E_{c,inf}$ (GPa)	E_{cm} (GPa)	$E_{c,sup}$ (GPa)	E_{cm} (GPa)
7	25.2	22.6	27.0	31.5	20.1	24.1	28.0	22.3
28	**28.7**	**24.0**	**28.7**	**33.4**	**24.0**	**28.7**	**33.4**	**28.7**
90	27.7	24.6	29.5	34.3	25.3	30.3	35.3	32.1
240	29.7	24.9	29.8	34.8	25.7	30.8	35.9	33.9
450	30.2	25.1	30.0	35.0	25.8	30.9	36.1	34.7

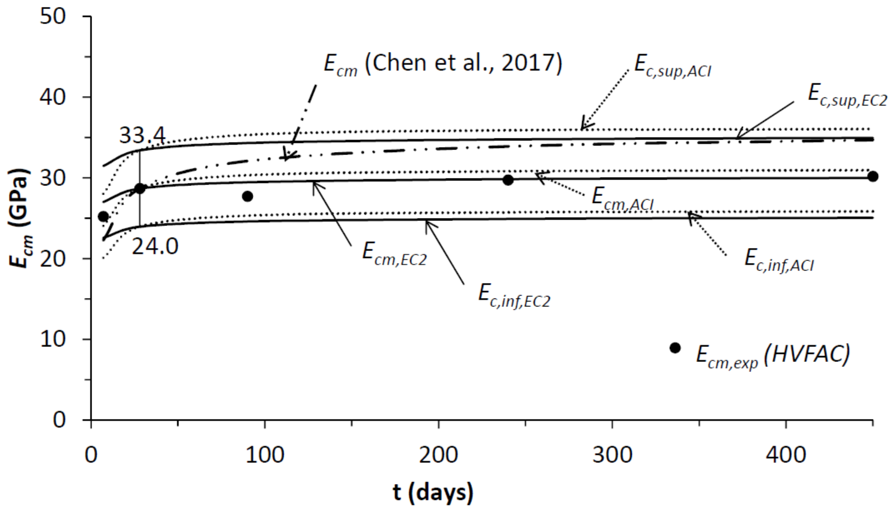


FIGURE 5.8: Time evolution of the HVFAC modulus of elasticity

The results show that the measured values fit well with predictions from E_{cm}, both for Eurocode 2 and ACI 318-11. It can also be seen that the increase in the modulus of elasticity is negligible after 28 days, standing in contrast to other findings and predictions by Chen et al. (2017), again pointing to the effect of curing regime. Nonetheless, experimental values seem validated and can be trusted in further analyses.

The values of the modulus of elasticity predicted from compressive strength are given in Table 5.9 and Figure 5.9. The results are similar to NAC: Eurocode 2 provides satisfying predictions with all measured values falling within the narrow range of predictions from $f_{c,inf}(28)$ and $f_{c,sup}(28)$; the ACI 318-11 predictions are, again, well below measured values, only approaching them when the upper-bound compressive strength is used. For Eurocode 2, the 7 and 28-day predicted values are 105.1% and 97.9% of measured moduli; for ACI 318-11, these percentages are 79% and 82.9% for 7 and 28 days, respectively. Once more, these results must be taken into account in further analyses when using the modulus of elasticity.

TABLE 5.9: Predictions of the HVFAC modulus of elasticity from compressive strength

		Eurocode			ACI		
Time (days)	$E_{cm,exp}$ (GPa)	$E_{c,inf,calc}$ (GPa)	$E_{cm,calc}$ (GPa)	$E_{c,sup,calc}$ (GPa)	$E_{c,inf,calc}$ (GPa)	$E_{cm,calc}$ (GPa)	$E_{c,sup,calc}$ (GPa)
7	25.2	25.1	26.5	27.7	18.2	19.9	21.5
28	28.7	26.6	28.1	29.4	21.7	23.8	25.6
90	27.7	27.3	28.9	30.2	23.0	25.1	27.1
240	29.7	27.7	29.2	30.6	23.3	25.5	27.6
450	30.2	27.8	29.4	30.8	23.4	25.6	27.7

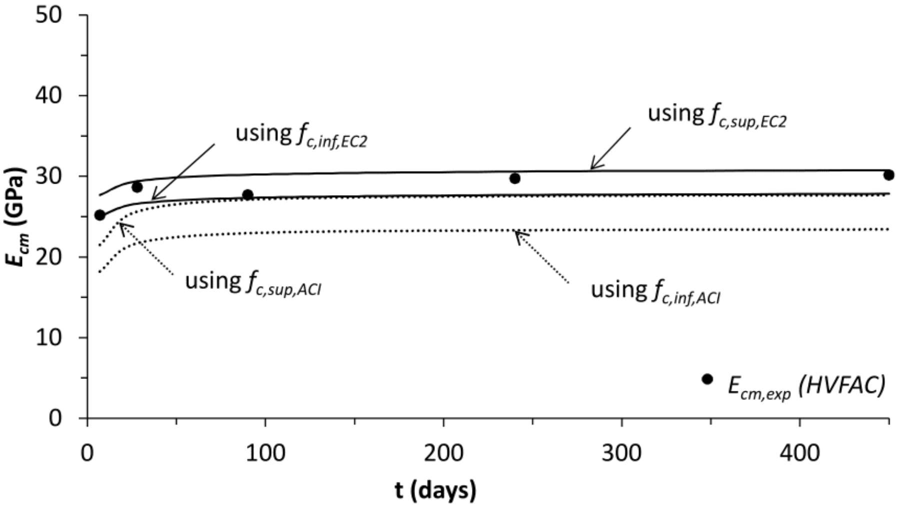


FIGURE 5.9: Predictions of the HVFAC modulus of elasticity from compressive strength

5.2.3 Tensile Strength

Unlike compressive strength and the modulus of elasticity, tensile strength was measured only at the ages of 7 and 28 days, section 4.2.4, in the form of splitting and flexural tensile strengths.

The tensile strength of concrete is an important parameter when calculating deflections of reinforced concrete structures as it directly determines the cracking moment and, indirectly, through the ratio of applied–to–cracking moment, the extent of cracking in the member. As was outlined in section 2.5.4, the European models (EC2 and MC10) are calibrated on cracking moments determined from axial tensile strength f_{ctm} whereas the North American models rely on the modulus of rupture f_r (flexural tensile strength) when calculating the cracking moment.

Since tensile strength was not measured after 28 days, analysing its time evolution was not possible. Hence, only code predictions of it were studied in this section. For Eurocode 2 and Model Code 2010 f_{ctm} is important and so, splitting tensile strength was converted to axial tensile strength according to code recommendations.

Eurocode 2 states that tensile strength may be taken as:

$$f_{ct} = 0.9 \cdot f_{ct,sp} \tag{5.6}$$

while Model Code 2010 recommends

$$f_{ct} = f_{ct,sp} \tag{5.7}$$

Hence, for these two codes $f_{ctm,exp}$ was calculated according to eqs. (5.6) and (5.7) using results from Table 4.6. The second step was to predict tensile strength values from compressive strength. For this purpose, both codes provide the following expression:

$$f_{ctm} = 0.3 \cdot f_{ck}^{(2/3)} = 0.3 \cdot \left(f_{cm} - 8\,MPa\right)^{(2/3)} \tag{5.8}$$

From $f_{c,inf}(28)$, f_{cm} and $f_{c,sup}(28)$, the lower 'characteristic, mean and upper 'characteristic' values of f_{ctm} were calculated. From each of them, using the expression for the time evolution of tensile strength, the 7-day value $f_{ctm}(7)$ was also predicted:

$$f_{ctm}(t) = f_{ctm} \cdot \beta_{cc}^{(2/3)} \text{ for } t \ \leq \ 7 \, days \tag{5.9}$$

where β_{cc} is the same function given by Equation 2.180.

The results for NAC are given in Table 5.10. It can be seen that the Model Code 2010 recommendation for taking splitting tensile strength equal to axial tensile strength is more precise in the case of NAC: both the 7 and 28-day predicted values show excellent agreement with measurements if the MC10 approach is adopted.

TABLE 5.10: Predictions of NAC tensile strength according to Eurocode 2 and Model Code 2010

Time (days)	$f_{ctm,exp,EC2}$ (MPa)	$f_{ctm,exp,MC10}$ (MPa)	$f_{ct,inf,calc}$ (MPa)	$f_{ctm,calc}$ (MPa)	$f_{ct,sup,calc}$ (MPa)
7	1.80	2.00	1.65	1.96	2.24
28	2.16	2.40	2.02	2.39	2.74

As for ACI 318-11, the modulus of rupture was predicted according to the following expression:

$$f_r(t) = 0.62 \cdot \sqrt{f_{cm}(t)} \tag{5.10}$$

It can be seen then, that the tensile strength follows the same time evolution function as the modulus of elasticity: the square root of the function for compressive strength. The modulus of rupture was calculated using the three compressive strength values, $f_{c,inf}(28)$, f_{cm} and $f_{c,sup}(28)$ and compared with the experimentally measured flexural tensile strength $f_{ct,fl}$.

The results for NAC are given in Table 5.11. It can be seen that the modulus of rupture predictions according to ACI 318-11 significantly underestimate experimental values even when predicted from $f_{c,sup}(28)$. This means that special care should be taken if experimentally determined values are used as input for deflection calculations.

TABLE 5.11: Predictions of NAC modulus of rupture according to ACI 318-11

Time (days)	$f_{ct,fl,exp}$ (MPa)	$f_{r,inf,calc}$ (MPa)	$f_{rm,calc}$ (MPa)	$f_{r,sup,calc}$ (MPa)
7	5.60	2.63	2.87	3.10
28	6.70	3.13	3.43	3.70

The same procedure was repeated for RAC and HVFAC. Additionally, for RAC, the modification of time evolution of tensile strength, as proposed by Silva (2015) (Equation 2.169), was also tested. The results for RAC are given in tables 5.12 and 5.13.

TABLE 5.12: Predictions of RAC tensile strength according to Eurocode 2 and Model Code 2010

			EC2/MC10			Silva (2015)
Time (days)	$f_{ctm,exp,EC2}$ (MPa)	$f_{ctm,exp,MC10}$ (MPa)	$f_{ct,inf,calc}$ (MPa)	$f_{ctm,calc}$ (MPa)	$f_{ct,sup,calc}$ (MPa)	f_{ctm} (MPa)
7	1.80	2.00	1.52	1.81	2.08	2.05
28	2.25	2.50	1.86	2.21	2.54	2.25

The predictions from mean compressive strength f_{cm} according to EC2 and MC10 are closer to $f_{ctm,exp}$ values when f_{ctm} is taken as $0.9 \cdot f_{ct,sp}$ as proposed by Eurocode 2. This is in contrast to NAC where the MC10 recommendation of $f_{ctm} = f_{ct,sp}$ provided better agreement with predictions. This points to a comparatively lower tensile strength of RAC relative to NAC, something which is in line with previous findings (Silva, 2015; Ignjatović, 2013).

The time evolution correction according to Equation 2.169 was calculated using $f_{ctm,exp,EC2}$ as a starting point. The obtained $f_{ctm}(7)$ value is higher than experimentally measured. Hence, in this case, the proposed equation does not improve Eurocode 2 predictions.

ACI 318-11 predictions of the RAC modulus of rupture again significantly underestimate measured values.

TABLE 5.13: Predictions of RAC modulus of rupture according to ACI 318-11

Time (days)	$f_{ct,fl,exp}$ (MPa)	$f_{r,inf,calc}$ (MPa)	$f_{rm,calc}$ (MPa)	$f_{r,sup,calc}$ (MPa)
7	5.40	2.52	2.75	2.97
28	6.40	3.00	3.28	3.54

The results for HVFAC are given in tables 5.14 and 5.15. In this case, EC2 and MC10 do not offer good predictions, neither of $f_{ctm,exp,EC2}$ nor $f_{ctm,exp,MC10}$ mostly because the increase in tensile strength between 7 and 28 days appears to be too big for these expressions to cover. The 28-day value is predicted relatively well from f_{cm} or $f_{c,sup}(28)$, but the 7-day value is too low and can't be reached by the current time evolution function. If the measurements can be trusted, than this points to a possibly different rate of tensile strength evolution in HVFAC compared with NAC. Similar to the corrections for the time evolution of compressive strength and modulus of elasticity, proposed by Chen et al. (2017), a relation should be found for the time evolution of HVFAC tensile strength. However, the currently available number of experimental results does not permit such an analysis.

TABLE 5.14: Predictions of HVFAC tensile strength according to Eurocode 2 and Model Code 2010

Time (days)	$f_{ctm,exp,EC2}$ (MPa)	$f_{ctm,exp,MC10}$ (MPa)	$f_{ct,inf,calc}$ (MPa)	$f_{ctm,calc}$ (MPa)	$f_{ct,sup,calc}$ (MPa)
7	1.08	1.20	1.20	1.47	1.70
28	1.89	2.10	1.47	1.79	2.08

As for ACI 318-11 predictions, they are again significantly below experimental values.

TABLE 5.15: Predictions of HVFAC modulus of rupture according to ACI 318-11

Time (days)	$f_{ct,fl,exp}$ (MPa)	$f_{r,inf,calc}$ (MPa)	$f_{rm,calc}$ (MPa)	$f_{r,sup,calc}$ (MPa)
7	4.30	2.26	2.47	2.67
28	5.20	2.69	2.95	3.18

5.3 Analysis of Shrinkage and Creep Results – Comparison with Existing Models

This section presents the analyses of the shrinkage and creep results obtained on prisms given in sections 4.2.6 and 4.2.7.

The results are analysed using the calculation models presented in section 2.5.3: B4, MC10, EC2, ACI 209R-92 and GL2000.

The aim of this section was to assess the ability of each model to capture the evolution of shrinkage and creep of the studied concrete mixes both quantitatively and qualitatively. This kind of assessment is important since these models are to be used later in the calculation of deflections; their results—shrinkage strain and creep coefficient—are important input parameters in the deflection calculation models.

For both shrinkage and creep, the procedure consisted of an initial calculation by the models using required input variables (compressive strength, mix characteristics) and default values of the models' 'free parameters', i.e. constants or variables in the models which cannot be predicted precisely or constrained by the model but have to be estimated theoretically or experimentally.

After an initial assessment of the overall agreement of the predictions with measured values, an optimal 'fit' or choice of the models' free parameters was found in order to improve predictions. The importance of this step lies in the verification of the general mathematical formulation of each model – how 'flexible' each model is in describing the shrinkage and creep processes of the studied concrete mixes. This means the testing of the *form* of each model's equations, regardless of the values of free parameters in them (which are optimized by fitting to experimental data); this is primarily a qualitative assessment of the shape of shrinkage and creep curves predicted by the models.

It is important to note that this was the only aim of this 'fitting' of free parameters – the calibrated shrinkage and creep models *were not* used in analyses of deflections.

5.3.1 Shrinkage

For shrinkage, all the concrete mixes were studied—NAC, RAC and HVFAC—since results were available for all of them.

An initial step carried out in the analyses was the identification of initial offset in shrinkage measurements, as explained in (Hubler et al., 2015b). Since according to diffusion theory the initial slope of the shrinkage curve is 1/2 in a log-log plot (Hubler et al., 2015a; Wittmann et al., 1987), early measurements were analysed and if found not to lie on such a line, a 'time offset' was applied to them in order to translate them into physically consistent results.

A diagram of how this was done for NAC is shown in Figure 5.10 resulting in an offset of two days for the first two measurements; the procedure was repeated for RAC (requiring no offset) and HVFAC (an offset of one day for the first three measurements).

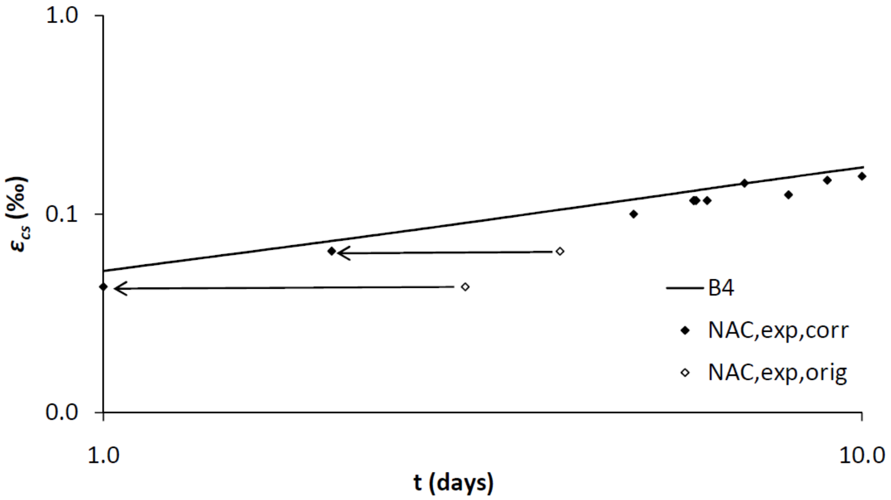


FIGURE 5.10: Determining the initial offset for NAC shrinkage measurements

After this, shrinkage strain curves were calculated according to the five models and compared with the experimentally obtained ones (corrected for the initial offset). In model B4, as an input for the type of aggregates, in the case of RAC sandstone was chosen since RCA is a softer aggregate and it was shown that modeling it with sandstone is a good estimate for predicting the modulus of elasticity (Silva et al., 2015); for NAC and HVFAC, quartzite was selected. Also in model B4, correction factors for fly ash were used given in Table 4 in (Bažant et al., 2015) (for a fly ash content greater than 30% of cement). A problem arises when using the B4 model for HVFAC: the model requires as input the *w/c* ratio, but always defined in terms of the mass of cement (not taking fly ash into account in any way). For the HVFAC mix in this study, this results in a *w/c* ratio of 0.975 which is well outside the range of input parameter values for which it was formulated (see Equation 2.18); hence, the results for HVFAC obtained using HVFAC must be interpreted taking this fact into account. Detailed calculations are given in Appendix B.

First, the comparison of shrinkage strain values after 477 days is given in Table 5.16.

TABLE 5.16: Comparison of calculated and measured shrinkage strain after 477 days

	$\varepsilon_{cs,calc}(477)/\varepsilon_{cs,exp}(477)$				
Concrete	B4	MC10	EC2	ACI 209R	GL2000
NAC	0.63	1.22	1.14	1.25	0.79
RAC	1.04	1.03	0.96	1.09	0.68
HVFAC	1.18	1.42	1.31	1.31	0.99

This information by itself does not tell much, except that the models mostly overestimate shrinkage after 477 days (except the GL2000 model for all mixes and the B4 model for NAC) and that, overall, the best predictions are for RAC. The obtained predictions are generally within the scatter of all the models: the CoV of all the models is 30–40%, (Hubler et al., 2015b).

The next step was the fitting of the models to the results by varying the models' free parameters. The B4 model states that its 'model parameters' (free parameters) must be considered as statistical variables (Bažant et al., 2015). The model parameters of model B4 (presented in section 2.5.3) are q_1, q_2, q_3, q_4, q_5, τ_{sh}, $\varepsilon_{sh\infty}$, τ_{au} and $\varepsilon_{au\infty}$ and Bažant et al. (2015) provide explicit 5% and 95% confidence limits for each parameter. Meanwhile, the other models do not state explicitly what are their free parameters or their confidence limits, this has to be deduced from the models' equations. Only the MC10 model provides 5% and 95% confidence limits for the total shrinkage strain and creep coefficient, i.e. for the calculation output rather than for model parameters; nonetheless, even this information is useful.

A brief overview of free parameters which were calibrated in each shrinkage model is given in Table 5.17 and the parameters are highlighted in Appendix B. The fitting/calibration procedure consisted of minimizing the mean value of the residuals (difference between calculated and measured values at each time t). It should be noted that more complex approaches exist, e.g. minimizing the CoV of the residuals and weighting them according to time decades, but they were not adopted herein.

TABLE 5.17: Shrinkage models' parameters which were calibrated

Model	Model parameter	Eq. with the parameter
B4	$k_{\varepsilon a}$; $k_{\tau a}$	Equation 2.30; Equation 2.36
MC10	α_{ds1}	Equation 2.89
EC2	α_{ds1}	Equation 2.107
ACI 209R	$780 \cdot 10^{-6}$	Equation 2.111
GL2000	$900 \cdot 10^{-6}$	Equation 2.134

The B4 model.

In figs. 5.11 to 5.13, the original and calibrated shrinkage curves according to models B4 for NAC, RAC and HVFAC are shown, respectively.

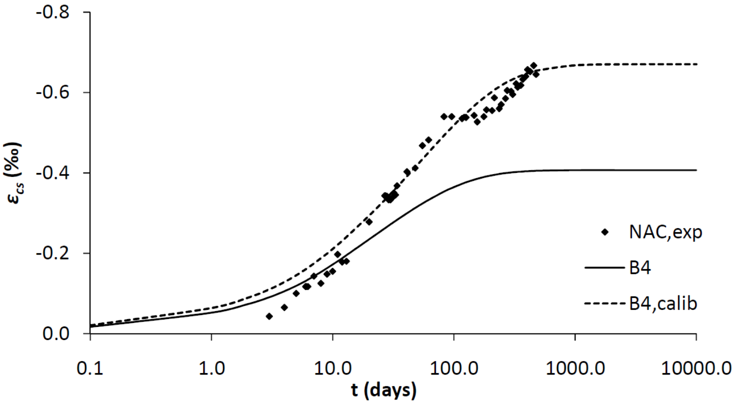


FIGURE 5.11: Original and calibrated NAC shrinkage curve according to model B4

First looking at NAC in Figure 5.11, in the experimental results, a horizontal shift in values around 100 days can be noticed. This can probably be attributed to changes in ambient conditions in the laboratory (mostly relative humidity, Figure 4.7), since this kind of horizontal shift is more or less also visible in RAC and HVFAC (where more

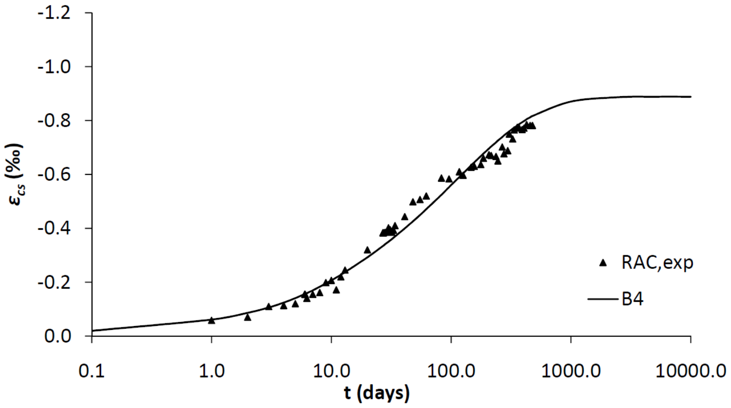


FIGURE 5.12: Original and calibrated RAC shrinkage curve according to model B4

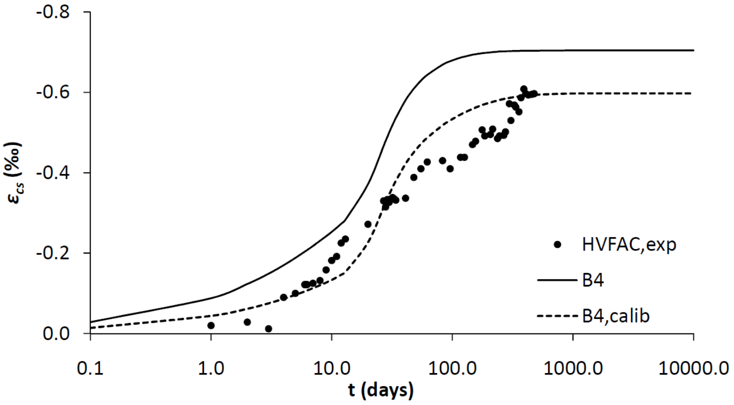


FIGURE 5.13: Original and calibrated HVFAC shrinkage curve according to model B4

than one is visible). It is therefore in question, how the evolution of shrinkage might have proceeded without this change in conditions. Nonetheless, the calculated values grossly underestimate the measured results; hence, the B4 model had to be fitted to the experimental NAC data and this was possible to a good degree. However, what cannot be inferred from the measurements is whether they are indeed approaching the leveling-off part of the curve or not; the measurement might in fact suggest that shrinkage will continue to increase.

As for RAC, shown in Figure 5.12, with the input of sandstone aggregates, the shrinkage curve shows very good agreement with measurements and hence, no fitting was necessary. On the other hand, for HVFAC, shown in Figure 5.13, the B4 model shows a very poor prediction, before and after fitting; the shrinkage curve shape is qualitatively inappropriate for the experimental results. This is most probably the result of inputting the very high *w/c* ratio of 0.975 into the model, for which it was not formulated. Hence, with the exception of HVFAC, the B4 model is able to capture the evolution of shrinkage of the studied concrete mixes by fitting its free parameters.

The MC10 model

The original and calibrated time curves according to MC10 are shown in figs. 5.14 to 5.16 for NAC, RAC and HVFAC, respectively.

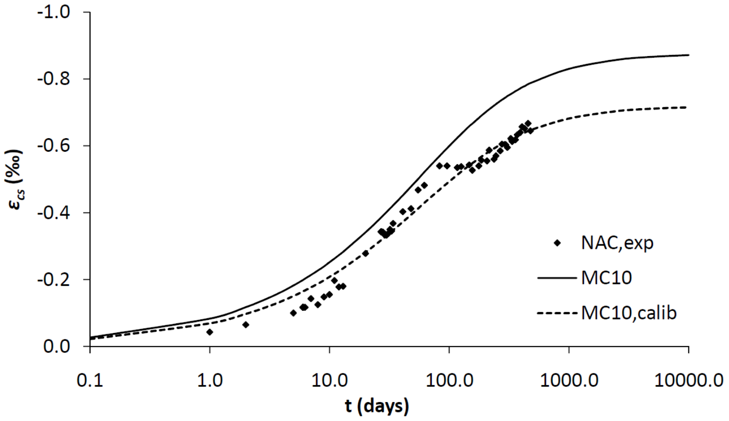


FIGURE 5.14: Original and calibrated NAC shrinkage curve according to model MC10

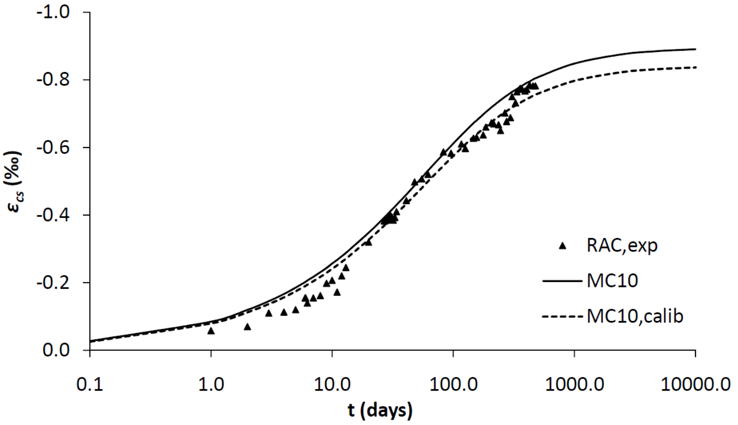


FIGURE 5.15: Original and calibrated RAC shrinkage curve according to model MC10

The results show an initial overestimation of the measured values, smallest in the case of RAC. After fitting the curves by varying the model's free parameters, the shrinkage of all three concretes is described very well (even HVFAC, unlike in the case of model B4). This flexible mathematical formulation of the MC10 model is very important for its future implementation in design codes. Again, from the diagrams it cannot be concluded

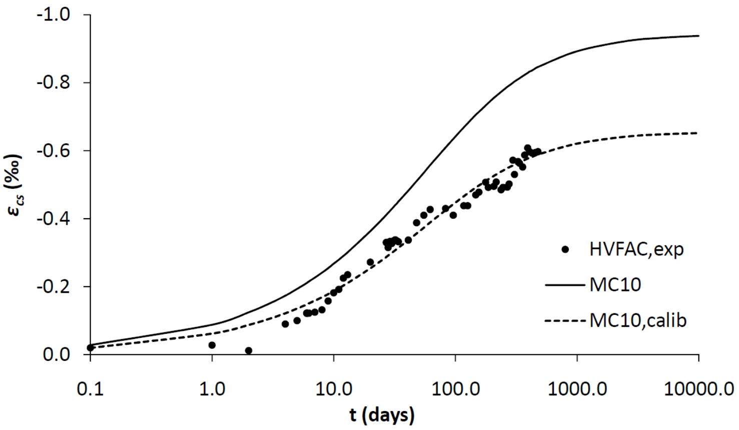


FIGURE 5.16: Original and calibrated HVFAC shrinkage curve according to model MC10

whether the leveling-off of the curve is actually being approached by measured values, probably another 500 days or even more are necessary.

The EC2 model

For EC2, original and calibrated time curves are shown in figs. 5.17 to 5.19 for NAC, RAC and HVFAC, respectively.

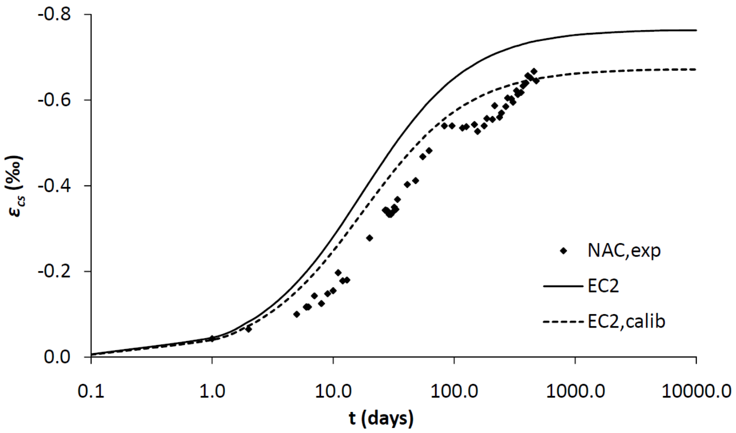


FIGURE 5.17: Original and calibrated NAC shrinkage curve according to model EC2

Just as MC10, uncalibrated EC2 shrinkage curves overestimate the measured values and fitting of the curves was necessary (except for RAC). However, the mathematical formulation of EC2 is not as flexible as that of MC10 and, as can be seen, the qualitative description of shrinkage evolution is not as good in this case. This kind of results is expected since the MC10's shrinkage model is an improvement of the EC2 model.

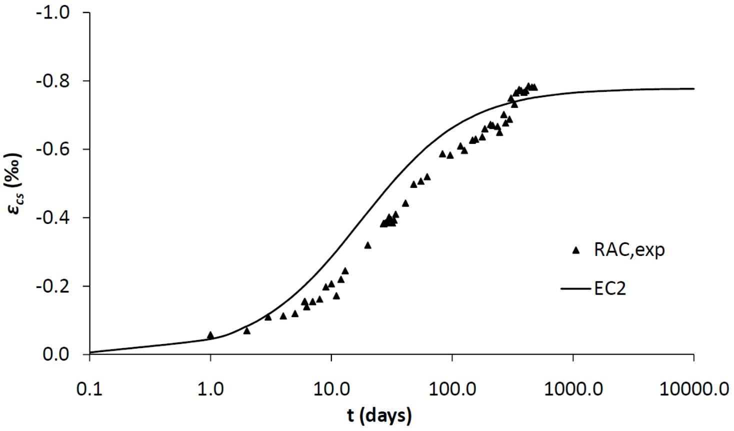


FIGURE 5.18: Original and calibrated RAC shrinkage curve according to model EC2

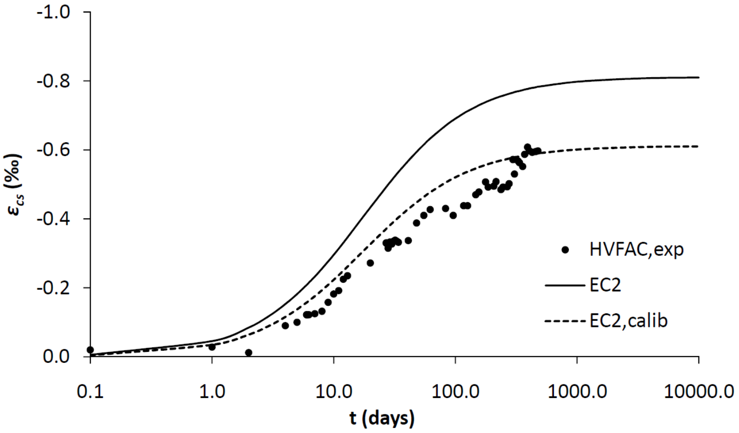


FIGURE 5.19: Original and calibrated HVFAC shrinkage curve according to model EC2

The ACI 209R model

Original and calibrated time curves according to ACI 209R-92 are shown in figs. 5.20 to 5.22 for NAC, RAC and HVFAC, respectively.

All of the shrinkage curves initially overestimate the measured values, but also show very good agreement for early shrinkage in three all cases. It is plausible that, if there was no horizontal shift in the measured values around 100 days, the curves would describe all three concrete mixes very well. Nonetheless, all curves were refitted to better match the experimental values. The model seems sufficiently capable of describing the shrinkage curves of the studied NAC, RAC and HVFAC mixes.

The GL2000 model

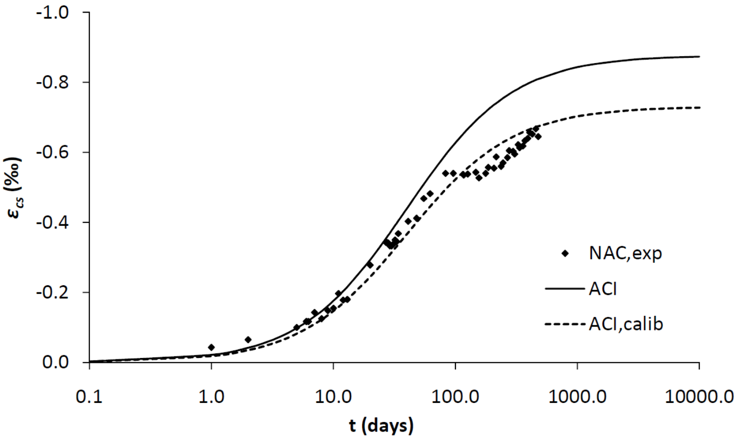


FIGURE 5.20: Original and calibrated NAC shrinkage curve according to model ACI 209R

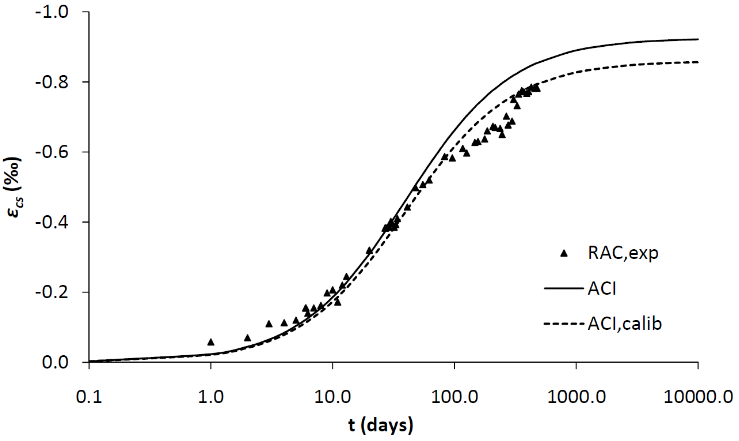


FIGURE 5.21: Original and calibrated RAC shrinkage curve according to model ACI 209R

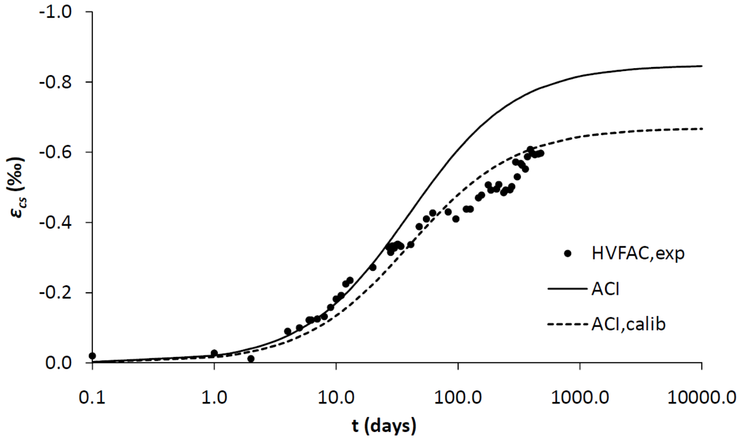


FIGURE 5.22: Original and calibrated HVFAC shrinkage curve according to model ACI 209R

Finally, for the GL2000 model, the original and calibrated time curves are shown in figs. 5.23 to 5.25 for NAC, RAC and HVFAC, respectively.

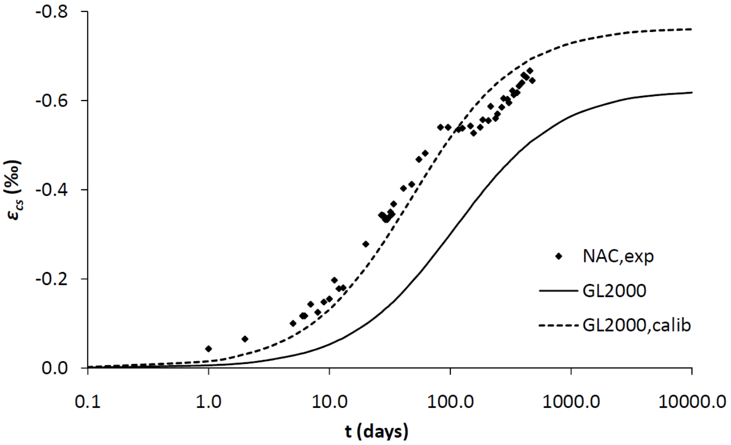


FIGURE 5.23: Original and calibrated NAC shrinkage curve according to model GL2000

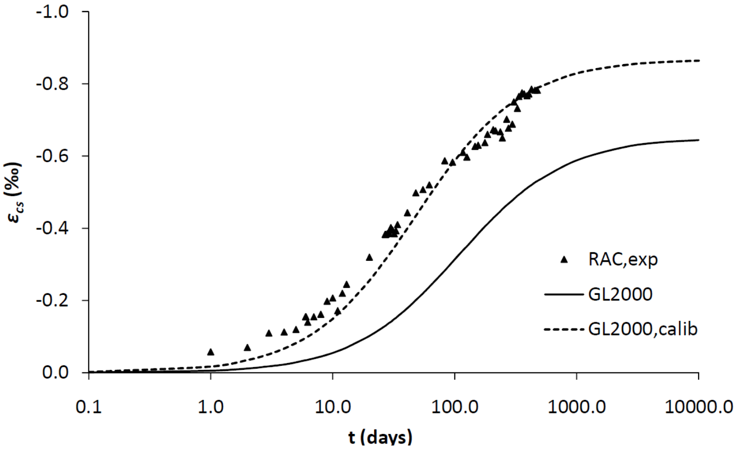


FIGURE 5.24: Original and calibrated RAC shrinkage curve according to model GL2000

The GL2000 model originally underestimated all three shrinkage curves (the best prediction of the final value was for HVFAC). After fitting, the experimentally obtained values were predicted reasonably well, both quantitatively and qualitatively.

In summary, all of the five analysed models predicted experimental shrinkage values within their generally established CoVs. The best predictions according to all models are for RAC, even not requiring any calibration for models B4 and EC2. The other models and other mixes (NAC and HVFAC) required the recalibration of models' free parameters to obtain better predictions. This was possible in all cases except for HVFAC using model B4, in which case the shape of shrinkage curve could not be matched to experimental

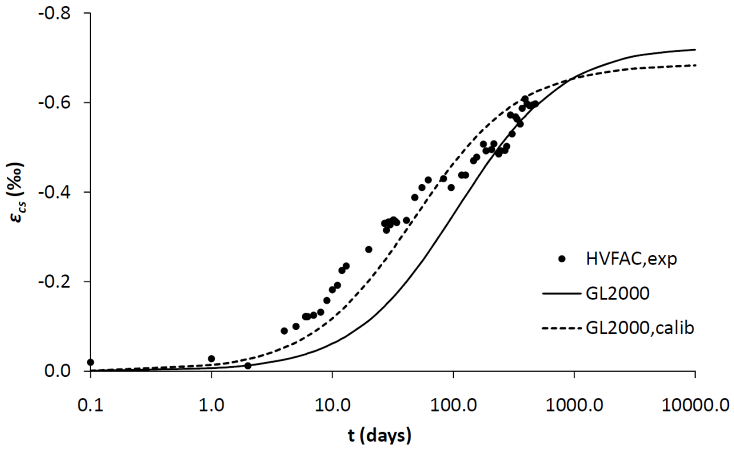


FIGURE 5.25: Original and calibrated HVFAC shrinkage curve according to model GL2000

values; the reason for this was the extremely high *w/c* ratio, as required by the model to be input as strictly water-to-cement.

5.3.2 Creep

Creep results were analysed for RAC and HVFAC prisms loaded after 7 and 28 days, comparing measured values with predictions obtained using models B4, MC10, EC2, ACI 209R and GL2000. An identical procedure was followed as in the case of shrinkage: creep compliance curves were calculated using default model settings and compared with the experimentally obtained compliances and, if necessary, the calculated curves were calibrated to better fit experimental ones by varying models' free parameters. The choice was made to analyse creep compliance curves rather than creep coefficients because of the possible incompatibility issues when calculating the creep coefficient using the wrong value of the modulus of elasticity (see section 2.5.3 and Equation 2.27).

A detailed presentation of input parameters and creep compliance calculation for all the models is given in the Appendix B, but some comment is also needed here. For model B4, the same problem arose in the case of HVFAC as for shrinkage: the necessary input of the *w/c* ratio as 0.975 meant that the specimens HVFAC7 and HVFAC28 (HVFAC loaded after 7 and 28 days, respectively) were outside the B4's range of applicability. Beside this, existing correction coefficients for fly ash were used. As an input for creep calculation, the B4 model also requires the shrinkage halftime and final shrinkage strain; these were taken as *calibrated* values obtained in 5.3.1.

In models MC10 and EC2, the non-linear creep coefficient was taken into account because of the $\sigma_c/f_{cm}(t_0)$ ratios of the prisms. Only the model B4 directly calculates the creep compliance $J(t,t_0)$, whereas in the case of other models, creep compliance was calculated from the creep coefficient and the appropriate moduli of elasticity prescribed by each code (see section 2.5.3).

A comparison of creep compliance values after 450 days is given in Table 5.18.

TABLE 5.18: Comparison of calculated and measured creep compliance after 450 days

	$J_{calc}(450,t_0)/J_{exp}(450,t_0)$				
Concrete	B4	MC10	EC2	ACI 209R	GL2000
RAC7	1.22	1.14	1.11	0.76	0.89
RAC28	1.02	0.84	0.86	0.64	0.74
HVFAC7	2.45	1.19	1.05	0.87	0.97
HVFAC28	2.64	1.25	1.17	0.93	1.04

The results in Table 5.18 show that the model B4 grossly overestimates the creep compliance of HVFAC, a consequence of the input of a *w/c* ratio outside the model's applicability range. This issue is probably something that should be dealt with in new versions of the model (the upcoming B5 model). As for all the other models—and B4 predictions for RAC—they are both greater and smaller than experimental values but mostly within the models' previously assessed CoVs which lie in the range of 15–40%, (Wendner et al., 2015b). Hence, no conclusion can be drawn about RAC and HVFAC relative to NAC.

An important insight from Table 5.18 is that models ACI 209R and GL2000 which do not have the capacity to take into account non-linear creep at higher stress–to–strength ratios, generally underestimated all creep compliances; meanwhile, MC10 and EC2, which do possess corrections for non-linear creep, overestimated creep compliance. The exception is RAC28 which is underestimated by all models except B4. The explanation behind this probably lies in the modulus of elasticity. Namely, when calculating creep compliance, the modulus of elasticity was calculated from compressive strength. In MC10 and EC2, the correction factor 0.9 was used (for limestone aggregates) whereas ACI 209R and GL2000 do not have any proposed correction factors; it seems that for RAC28 a lower correction factor is needed.

The next step consisted in evaluating the shape of individual creep compliance curves and their fit to experimental data. In the same manner as was done for shrinkage strain, the models' free parameters were calibrated by minimizing the mean value of the residuals. Again, the aim was the verification of the general mathematical formulation of each model – the testing of the *form* of each model's equations, regardless of the values of free parameters in them (which are optimized by fitting to experimental data). A brief overview of free parameters which were calibrated in each creep model is given in Table 5.19 and these parameters are highlighted in Appendix B.

TABLE 5.19: Creep models' parameters which were calibrated

Model	Model parameter	Eq. with the parameter
B4	p_1; p_{2w}	Equation 2.43; Equation 2.46
	p_{3a} and p_{3w}	Equation 2.47
	p_{4a} and p_{4w}	Equation 2.48
	p_{5a} and p_{5w}	Equation 2.50
MC10	1.8; 412	Equation 2.73; Equation 2.76
EC2	16.8; 1.5	Equation 2.98; Equation 2.99
ACI 209R	26 and $1.42 \cdot 10^{-2}$	Equation 2.110
	ψ; 2.35	Equation 2.124; Equation 2.125
GL2000	0.3, 0.5 and 2	Equation 2.138

The B4 model

Figure 5.26 presents the comparison between the uncalibrated and calibrated creep compliance curves for RAC7 and RAC28 according to B4 and experimental values.

A very good agreement can be seen for RAC28, practically requiring no calibration. Compliance was overestimated for RAC7, however. The model was easily able to fit the experimental curves after calibration. While their is currently a 'convergence' of RAC7 and RAC28 compliances, the model B4 predicts that the higher creep rate of RAC28 relative to RAC7 will slow down and that their compliances will remain parallel from around 1000 days onward.

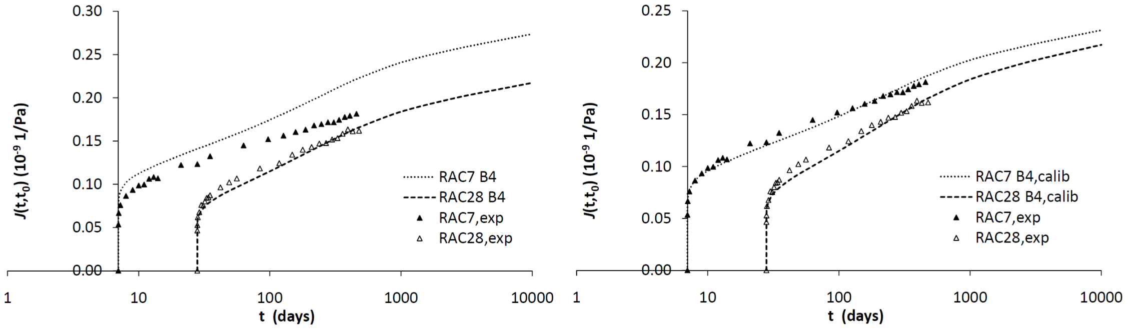


FIGURE 5.26: Original (left) and calibrated (right) creep compliance curves for RAC7 and RAC28 according to B4

Figure 5.27 shows the original and calibrated creep compliance curves for HVFAC7 and HVFAC28 as well as the experimental curves.

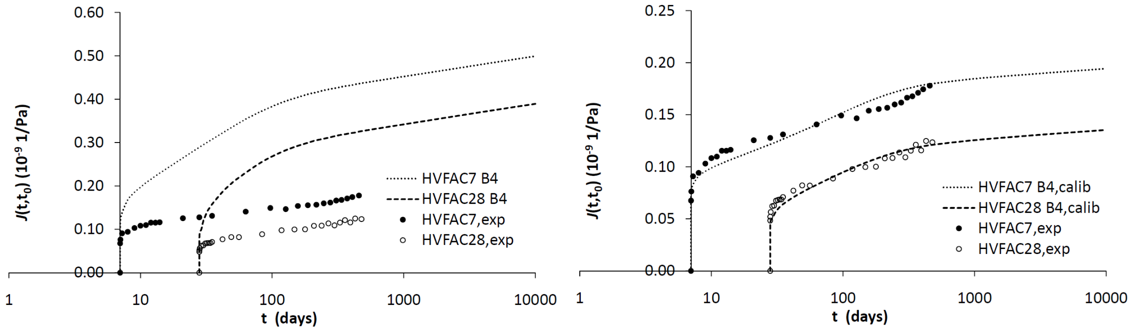


FIGURE 5.27: Original (left) and calibrated (right) creep compliance curves for HVFAC7 and HVFAC28 according to B4

The initially gross overestimation is, of course, due to the high *w/c* ratio input into the model. After calibration, the compliances fit the data very well, remaining parallel over time.

Thus, the B4 model can be adapted very well to fit the experimental data of RAC and HVFAC at both loading ages, which was expected as it is a very sophisticated and versatile model.

The MC10 model

Figure 5.28 presents the comparison between the uncalibrated and calibrated creep compliance curves for RAC7 and RAC28 according to MC10 and experimental values.

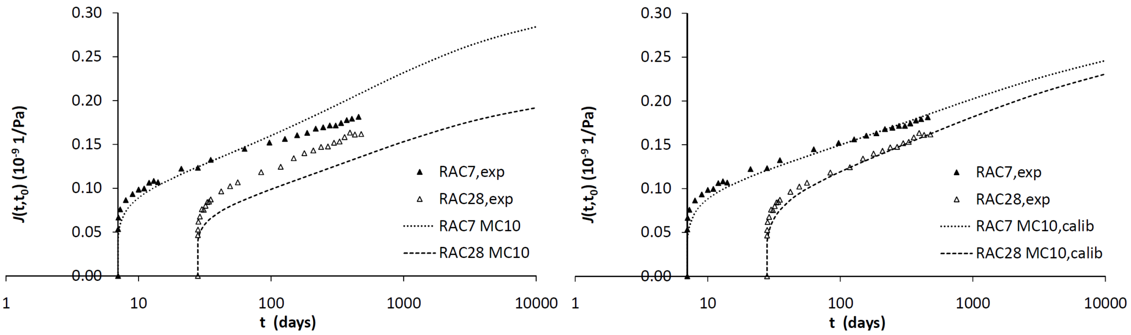


FIGURE 5.28: Original (left) and calibrated (right) creep compliance curves for RAC7 and RAC28 according to MC10

Figure 5.29 presents the comparison between the uncalibrated and calibrated creep compliance curves for HVAC7 and HVAC28 according to MC10 and experimental values.

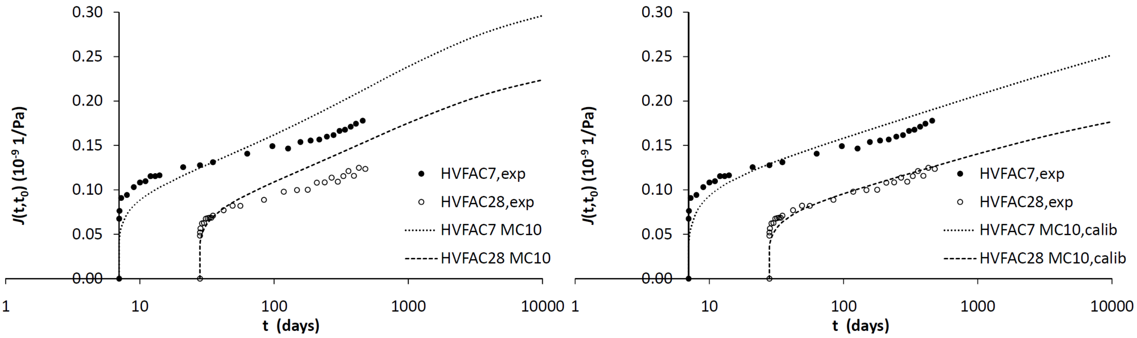


FIGURE 5.29: Original (left) and calibrated (right) creep compliance curves for HVFAC7 and HVFAC28 according to MC10

For both RAC and HVFAC there is an initial good match between predicted and measured values and with little calibration MC10 is able to capture the evolution of creep compliance of all four groups of specimens very well. This ability of MC10 is very important as it will be the foundation of design codes such as the new revision of Eurocode 2, and its creep and shrinkage models are an important part of it. The easiness of using MC10 compared with B4, along with their comparable flexibility, makes MC10 a good tool for practicing engineers.

The EC2 model

For EC2, the comparison between original and calibrated creep compliance curves and experimental values is shown in Figure 5.30 for RAC7 and RAC28 and in Figure 5.31 for HVFAC7 and HVFAC28.

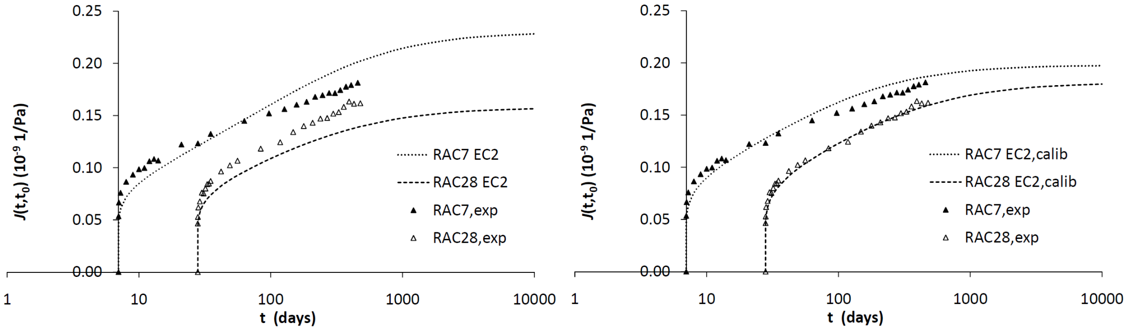


FIGURE 5.30: Original (left) and calibrated (right) creep compliance curves for RAC7 and RAC28 according to EC2

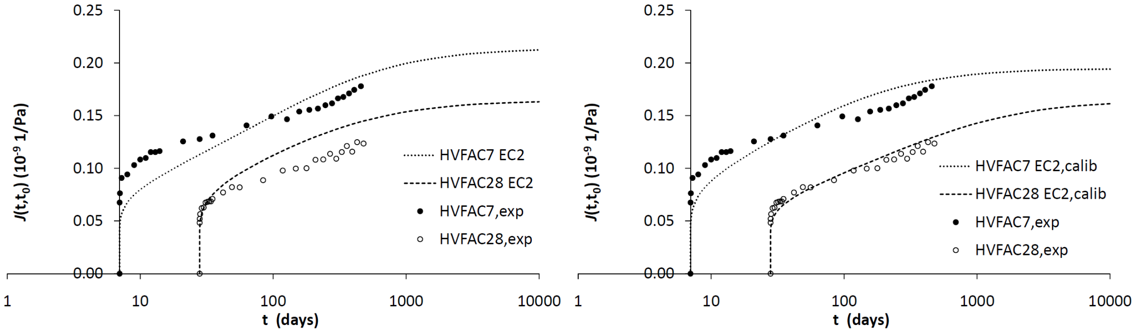


FIGURE 5.31: Original (left) and calibrated (right) creep compliance curves for HVFAC7 and HVFAC28 according to EC2

It is interesting to compare the calculated compliance curves according to EC2 and MC10 and observe the difference in shape. The new MC10 creep model, with a basic creep component without a final value, makes a clear difference compared with EC2's creep model which basically only has a drying part, reaching a final value fairly soon, between 1 000 and 10 000 days.

The EC2 model is still relatively able to capture the shape of experimental compliances (not so much that of HVFAC7), but the fit is clearly poorer compared with B4 and MC10.

The ACI 209R model

For ACI 209R, the comparison between original and calibrated creep compliance curves and experimental values is shown in Figure 5.32 for RAC7 and RAC28 and in Figure 5.33 for HVFAC7 and HVFAC28.

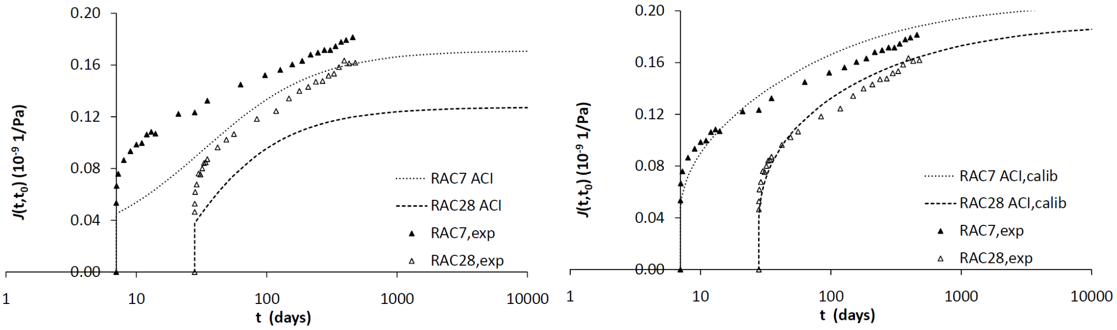


FIGURE 5.32: Original (left) and calibrated (right) creep compliance curves for RAC7 and RAC28 according to ACI 209R

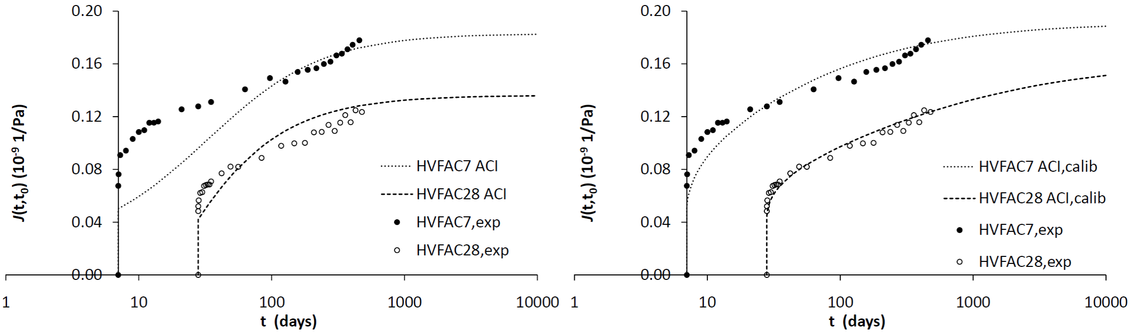


FIGURE 5.33: Original (left) and calibrated (right) creep compliance curves for HVFAC7 and HVFAC28 according to ACI 209R

Initially, the ACI 209R model provides a poor fit of experimental creep compliance for all groups of specimens, both qualitatively and quantitatively. Fitting the curves is possible but requires relatively heavier intervention in the model since it does not have many free parameters. Calibration is done by varying the ultimate creep coefficient of 2.35 in Equation 2.125, the exponent ψ in Equation 2.124 and the coefficient $d = f$ given by expression Equation 2.110.

However, even after calibration, the obtained fit is inferior to B4, MC10 and EC2, especially for RAC.

The GL2000 model

Finally, for model GL2000, the comparison between original and calibrated creep compliance curves and experimental values is shown in Figure 5.34 for RAC7 and RAC28 and in Figure 5.35 for HVFAC7 and HVFAC28.

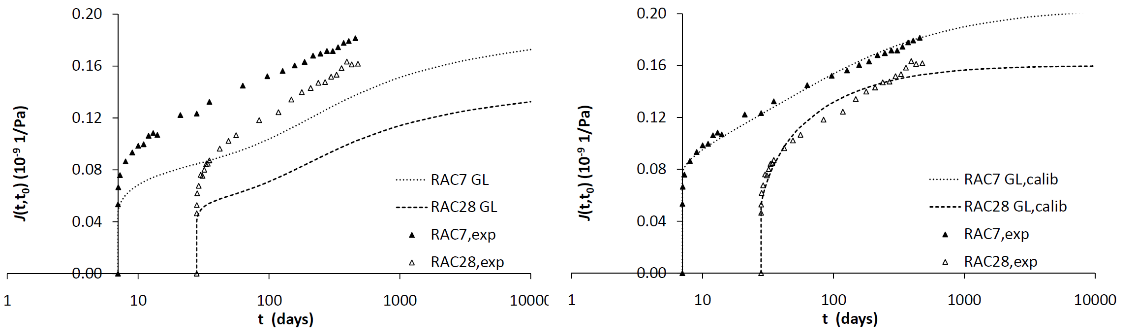


FIGURE 5.34: Original (left) and calibrated (right) creep compliance curves for RAC7 and RAC28 according to GL2000

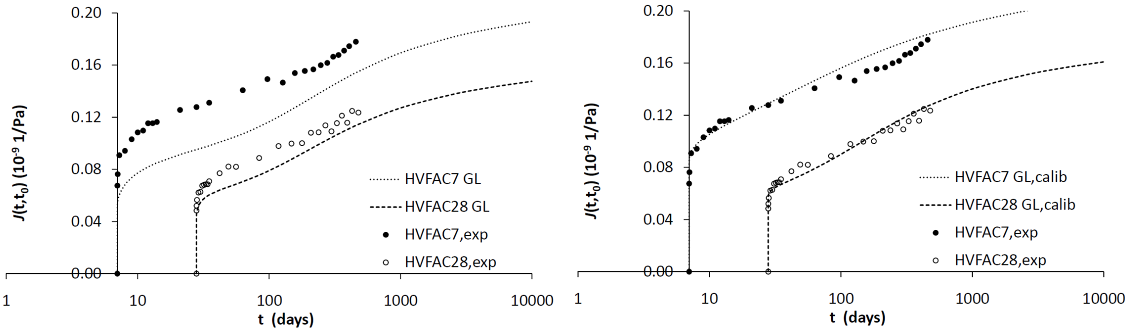


FIGURE 5.35: Original (left) and calibrated (right) creep compliance curves for HVFAC7 and HVFAC28 according to GL2000

The initial predictions by GL2000 for both RAC and HVFAC are not good (especially in the case of RAC) and, as in the case of ACI 209R, calibration is difficult because free parameters are not clearly identified. An intervention was possible in Equation 2.138 where the first two terms represent basic creep and the third term drying creep. Calibration was done by varying the exponents of each term related to time since loading $(t - t_0)$ (initially 0.3, 0.5 and 2.0 for the first, second and third component of Equation 2.138, respectively). Thus, the shape of the compliance curve could be changed as well as its time shift.

The calibrated compliances provide a relatively good fit of experimental data, except for RAC28 which could not be described well with GL2000.

In conclusion, of the five tested creep models, B4 and MC10 proved to be the most versatile and flexible, with MC10 being easier and more intuitive to use, at least from an engineer's perspective. The other models, EC2, ACI 209R and GL2000, could not describe the compliance curves qualitatively as well as B4 and MC10, with ACI 209R having showing the poorest performance. RAC and HVFAC did not seem to display any significant differences compared with NAC, outside the regular predictive ability of the studied models.

5.4 Analysis of Beam Deflection Results Using Existing Models

This section presents the main analytical part of this thesis. In it, the main results of the experimental programme, i.e. beam deflections, are analysed using existing, previously presented calculation models (see section 2.5.4).

Two existing models were analysed in-depth: Model Code 2010 (MC10) and ACI 435R (ACI). Within the 'European tradition', Eurocode 2 could also have been analysed; however, MC10 was chosen over it for two reasons: (1) the models are very similar, differing practically only in their respective shrinkage and creep models and (2) MC10 will form the basis of the new revision of Eurocode 2; hence, analysing it will provide valuable insight for this process, regarding serviceability limit states.

The general analysis procedure carried out in this section, for both models, was as follows.

First, an initial assessment of the basic mathematical formulation of each model was carried out on a small, selected set of experimental results; in this analysis all input variables are experimentally obtained values. This initial assessment is a qualitative test of the functional *form* of the basic mathematical expressions of the models, namely Equation 2.147 for MC10 and Equation 2.11 for ACI 318 and ACI 435R. These equations contain certain 'free parameters' (coefficient β and exponent 2 in MC10 and exponent m in ACI) but this step is not concerned with their 'default' values. Rather, this step means searching for *any* value of these free parameters for which the models provide a good fit of experimental data. In other words, a qualitative assessment of the shape of the predicted deflection curves is performed by comparing them with measured values.

Second, the precision and accuracy of each model was tested on a large database; in this analysis all input parameters are calculated according to code expressions, i.e. the overall capability of the codes is tested. Herein, accuracy is understood as the closeness of the model predictions to experimental values (closeness to a calculated–to–experimental ratio of 1.0) and precision is understood as the scatter of the results (CoV).

Third, the results are analysed in order to identify key parameters influencing models' precision and accuracy. Corrections are proposed for both models in terms of modifications of the models' free parameters or the functional form of mathematical expressions. The achieved improvements are presented.

Fourth, the applicability of corrected MC10 and ACI models to RAC and HVFAC beams is analysed on a new database of RAC, HVFAC and companion NAC beams, compiled using own and previously published existing results. A statistical analysis is used to demonstrate whether a significant difference exists between the models' performance on NAC and RAC beams. For HVFAC, due to a lack of data, only a qualitative assessment is given.

Each of the steps is elaborated upon in more detail in the following subsections.

5.4.1 Assessment and Correction of Existing Models for NAC

This subsection presents the assessment and subsequent improvement of the MC10 and ACI models for calculating deflections, based on analyses of NAC beams.

The first step was the validation of the core mathematical formulation of each model and its flexibility. As with shrinkage and creep models, this is a key feature of a model and cannot be inferred from an analysis of precision and accuracy on a large database. For this purpose, carefully selected individual deflection curves (containing a large number of values over a long time period) must be chosen. Then, using as input only measured values of mechanical properties, shrinkage and creep, deflections must be calculated and compared with measured values.

This kind of analysis allows for the assessment of the models' ability to fit individual deflection curves. The analyses are carried out using the models' rigorous methods, i.e. numerical integration of curvatures.

After this step, a larger database was compiled using results on NAC beams from literature, selected according to transparent criteria, outlined in the following subsection. In this case, results consisting of only initial and 'final' deflections are sufficient. Since the aim of this step is to determine the models' accuracy and precision, measured values are used only for basic input parameters, such as concrete compressive strength, and everything else is calculated using code expressions (modulus of elasticity, tensile strength, shrinkage and creep). This way, the overall predictive capability of the model is captured.

The results of this step allow for the identification of influencing parameters on the models' accuracy and precision and their eventual deficiencies. In the final step, corrections were proposed for both models and the possible improvements studied.

5.4.1.1 Assessment and Correction of Model Code 2010 Model

The first model that was analysed was MC10 (FIB, 2013). As outlined in section 2.5.4 it is the latest in the European tradition of models for calculating deflection, based on interpolating the stiffness of a reinforced concrete member between states 1 and 2 using the distribution coefficient ζ.

Creep effects on deflections are accounted for by the effective modulus method. Here, MC10 is somewhat inconsistent. Since the creep compliance function is defined by Equation 2.67, strictly speaking, the effective modulus should be taken as the inverse of the creep compliance function. This is precisely what is given in MC10 in equation (7.2-41) in section 7.2.4.10 on 'Approximate algebraic formulation for the constitutive relation: age-adjusted effective modulus (AAEM) method', (FIB, 2013):

$$E_{c,eff}(t,t_0) = \frac{1}{J(t,t_0)} = \frac{E_c(t_0)}{1+[E_c(t_0)/E_{ci}]\cdot\phi_{28}(t,t_0)} \tag{5.11}$$

However, in section 7.6.5.2 of MC10, 'Deformations due to bending with or without axial force', the effective modulus is given by equation (7.6-18), (FIB, 2013):

$$E_{c,eff} = \frac{E_{ci}}{1+\phi} \tag{5.12}$$

This definition of the effective modulus is also given in EC2, equation (7.20), (EN 1992-1-1, 2004). It can be argued that the difference between the effective modulus obtained using these two methods is negligible, indeed, for early enough loading ages (e.g. under 90 days), it is below 5–10%. However, for the sake of methodological consistency, in this thesis, the effective modulus was calculated as the inverse of the creep compliance function, i.e. according to Equation 5.11.

Expressions predicting mechanical properties from compressive strength are almost identical to EC2. There is a difference in tensile strength – EC2 recommends taking $f_{ctm} = 0.9 \cdot f_{ct,sp}$, whereas MC10 recommends $f_{ctm} = f_{ct,sp}$. A difference also exists in expressions for predicting the modulus of elasticity and its time evolution (discussed in 5.2.2) but the differences are not significant. The area where significant differences exist are the shrinkage and creep models, discussed in section 2.5.3. Again, the superiority of MC10's shrinkage and creep models and the fact that it will be the basis for the new revision of EC2 were the reasons for selecting it for this analysis.

For the first step, the validation of the model's mathematical formulation—in essence, the adequacy of the approach of using a distribution coefficient in the first place—had to be carried out on NAC beams for which entire deflection curves were available, over a sufficiently long period (close to 1000 days) and with all necessary mechanical properties experimentally measured (so as to only test the distribution coefficient). For this purpose, only one of the studies presented in section 2.5.2 was adequate – the study by Gilbert and Nejadi (2004).

The experimental programme of the study is given in section 2.5.2. The report of that study provides comprehensive raw data for all necessary input: mechanical properties, shrinkage, creep and deflections over a period of 380 days (measured in sufficiently small time intervals). Strictly speaking, the measured creep coefficient and shrinkage strain should not be applied directly in calculation of deflections since they were determined on prisms and not on beams or slabs – a different nominal thickness would cause slightly different results. However, this effect was consciously neglected. A detailed table with all input data is given in the Appendix C.

The study is very useful for this analysis as it contains both beams (larger reinforcement ratios and smaller L/d ratios) and slabs (smaller reinforcement ratios and larger L/d ratios), both loaded to lower and higher load levels; also, the compressive strength is that of ordinary structural grade concrete.

After entering all input data, deflections were calculated using numerical integration of curvatures in 50 cross-sections (an example of the Excel-based software used for this purpose is provided in the Appendix C). In this study, deflections from self-weight were not measured. If the beam does not crack under self-weight but cracks under imposed load, the measured deflection contains the deflections from imposed load and the increase in the deflection from self-weight that occurs when changing from state 1 to state 2. Hence, strictly speaking, when calculating the deflection, the deflection from self-weight in state 1 should be subtracted from the total calculated deflection (for self-weight + imposed load):

$$a_{calc,real} = a_{calc,tot} - a^{I}_{calc,sw} \tag{5.13}$$

The situation is even more complicated for beams which do crack under self-weight. In the end, *no correction of measured deflections for deflection from self-weight was taken into account* throughout the study for the following reasons: the magnitude of deflection from self-weight is usually very small compared with deflection from imposed load, the significance of this deflection decreases over time (as the long-term deflection increases) and many studies are not clear on the exact procedure of measuring deflections. A detailed listing of all calculated values is provided in Appendix C.

Although entire deflections curves were calculated, still the β coefficient in Equation 2.147 was taken as 1.0 for initial deflection and 0.5 for all points after that. This fact raises a particularly interesting point which will be discussed later and that is 'When should the β coefficient change from 1.0 to 0.5?'

Here, for easier discussion, the results for beams and slabs are shown graphically in Figure 5.36 and Figure 5.37, respectively.

The figures reveal a lot about the abilities MC10. When looking at all 12 members (6 beams and 6 slabs) a generally good agreement between calculated and measured deflections can be seen, at least qualitatively, which is precisely what is being assessed here.

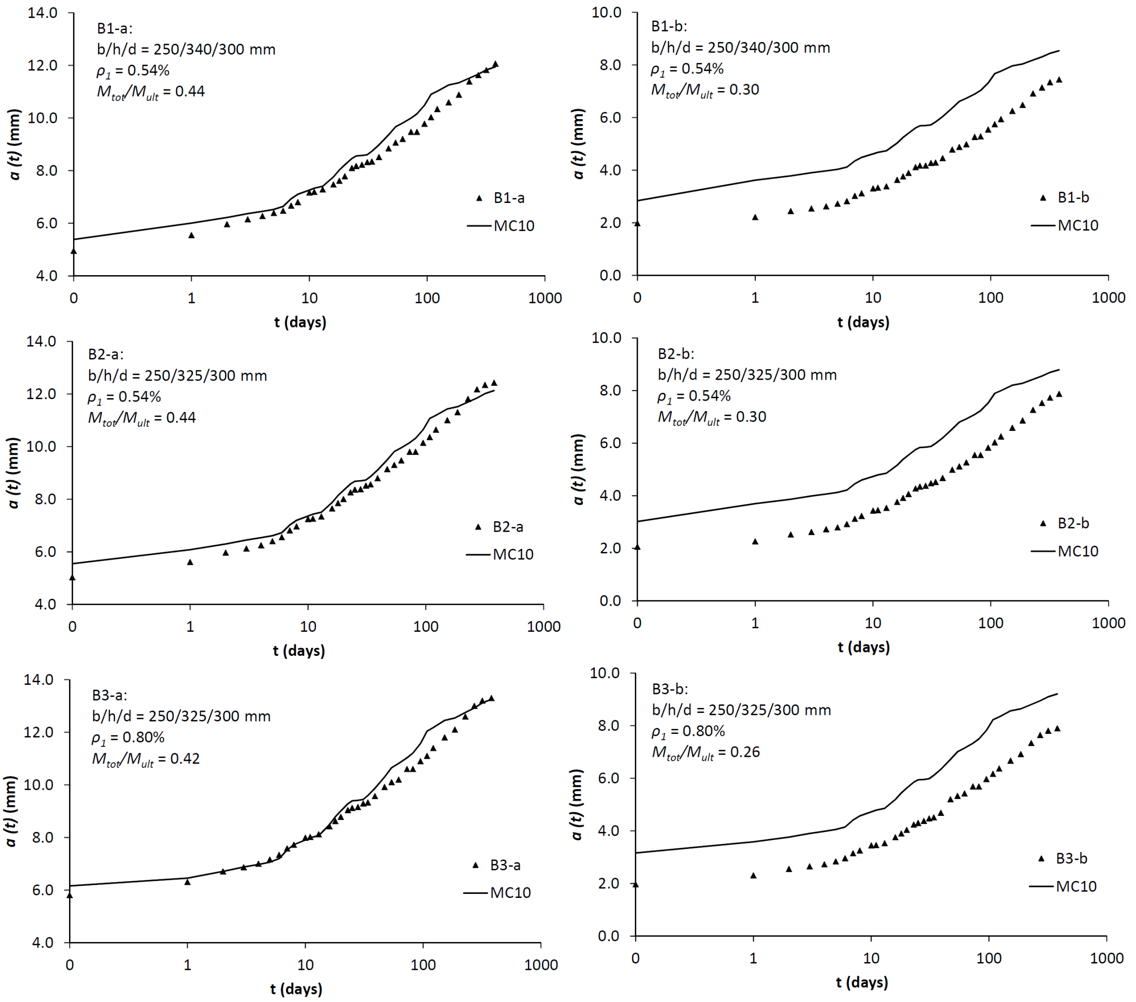


FIGURE 5.36: Assessment of deflection curves for beams from (Gilbert and Nejadi, 2004) according to MC10

On average, for all 12 specimens, the experimental values are overestimated by 19.8%, which, by itself is not bad. The calculated–to–experimental ratio varies from 0.94 to 2.52, and the CoV of the ratio is 15.5%. The situation is worse for initial deflections which are overestimated, on average, 51.3%. Final deflections (after 380 days) are overestimated by only 4.5% with a CoV of 6.5%.

Hence, the model performs much better for long-term deflections than for initial deflections (at least on this dataset, a general conclusion cannot be made based on it). This is expected, taking into account the larger significance of the modulus of elasticity and tensile strength for initial deflections – for both of these mechanical properties, the application of values measured on cylindrical specimens to beams or slabs is questionable at

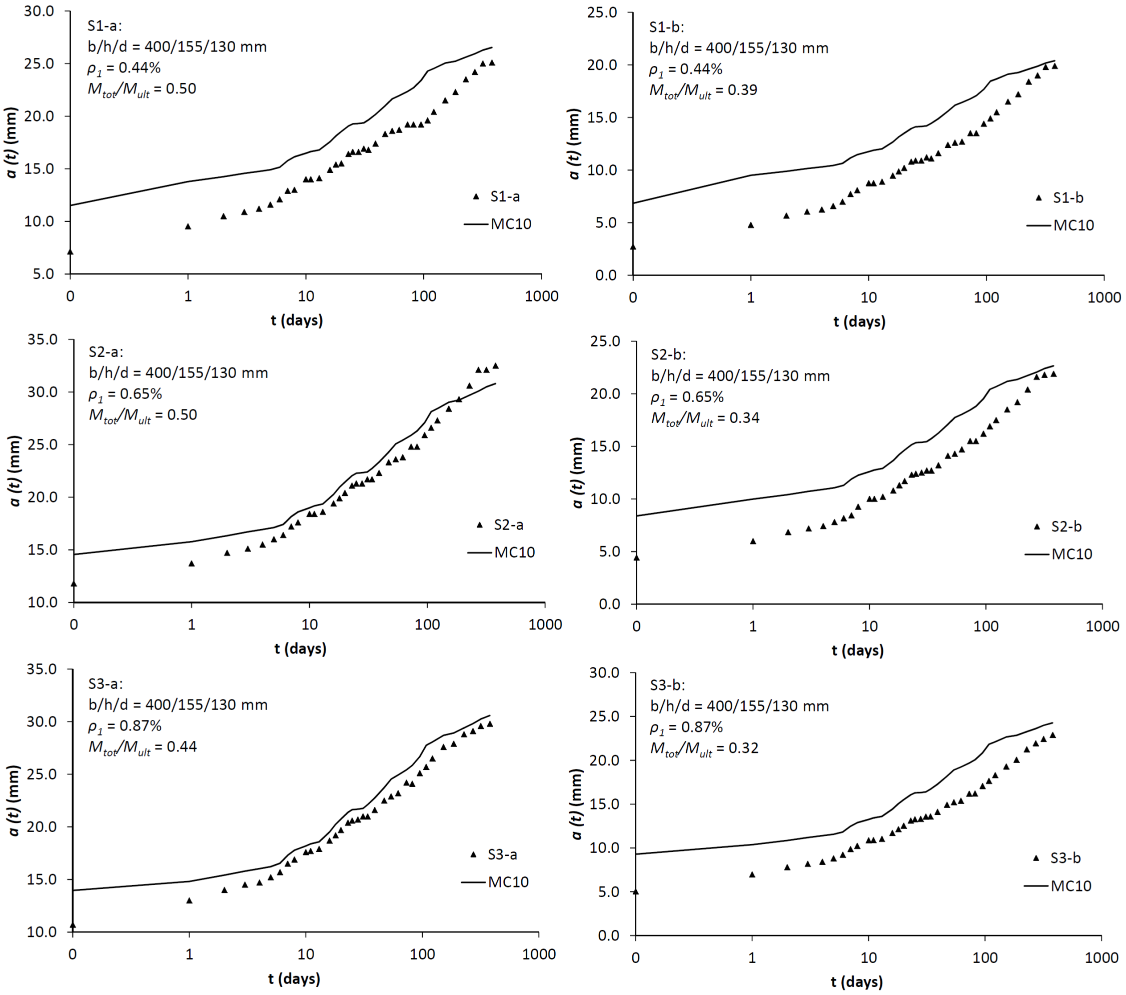


FIGURE 5.37: Assessment of deflection curves for slabs from (Gilbert and Nejadi, 2004) according to MC10

best; and both of these properties lose significance over time – tensile strength through the β coefficient, and the modulus of elasticity through the effective modulus method.

It should also be noted that the calculated curves are not smooth because of the experimental shrinkage and creep curves which are not smooth (probably because of uncontrolled ambient conditions).

An important fact which the figures reveal is that deflections of both beams and slabs loaded to higher load levels (left side of both figures, '-a' samples) were better predicted than for corresponding beams and slabs loaded to lower load levels (left side of both figures, '-b' samples). Also, calculated deflections of beams were generally in better agreement with experimental values than in the case of slabs, pointing to a possible effect of the reinforcement ratio or the L/d ratio.

Nonetheless, this short analysis validates the functional form of the mathematical expressions in MC10, leading to the next phase of the analysis.

First, criteria were selected based on which a large database of tests on NAC beams under sustained loads could be formed allowing a statistical analysis of the MC10 model. As explained in section 2.5.2, the largest existing database is the one compiled by Espion (1988). However, the database contains studies covering a large time span (more than 60 years) and some information in the database is missing (or assumed), e.g. relative humidity and ambient temperature. Therefore stricter criteria had to be applied, to reduce the number of results from (Espion, 1988) to a smaller but more reliable database.

The following criteria were set up:

- Studies carried out after 1945 (mostly because of construction technology and cement production);
- Reinforced concrete members with rectangular cross-sections;
- Deformed bars used;
- Four-point bending (4PB) or uniformly distributed load (UDL) tests (because of the similar shape of the bending moment diagram, most common in real members);
- The total imposed load caused cracking immediately after loading, i.e. beams were cracked throughout the entire experiment (this was considered most representative of realistic in-service behaviour of reinforced concrete members);
- Compressive strength between 20 and 50 MPa;
- Cross-section height greater than 100 mm;
- L/d ratio smaller than 40; and
- Loading age t_0 smaller than 90 days.

From the database in (Espion, 1988), only 12 studies complied with these criteria: beside the earlier presented studies (Washa and Fluck, 1952; Jaccoud and Favre, 1982; Bakoss et al., 1983), other selected studies were (P.C.A., 1950; Sattler, 1956; Hajnal-Konyi, 1963; Branson and Metz, 1963; Pauw and Meyers, 1964; Lutz et al., 1967; Dajung, 1984; Van Nieuwenburg, 1984; Clarke et al., 1988). These studies correspond to references [18], [11], [22], [23], [26], [29], [44], [45] and [46] in (Espion, 1988).

In addition, two more studies entered into the database: (Gilbert and Nejadi, 2004) and own experimental results from this thesis (NAC7 and NAC28). Thus, in total there were 14 studies in the database with exactly 70 reinforced concrete beams, yielding 140 data points (70 initial and 70 final deflections). All input data for the database is provided in Appendix C.

The range of the most important parameters in the database are given in Table 5.20 alongside the values of those parameters in own beams. From Table 5.20 it can be seen that own beams have relatively average values of geometric properties and compressive strength but a small reinforcement ratio. The loading age and load duration have usual values while the load intensity and increase of normalized deflection have values toward the lower end of the distribution in the database.

TABLE 5.20: Range of most important parameters in the database

	Database	Own experiment
Span:	1829–6400 mm	3200 mm
Depth:	120–340 mm	200 mm
Span/depth:	10.7–39.9	18.9
f_{cm}:	21.4–39.6 MPa	30.5 MPa
ρ:	0.44–3.53%	0.58%
ρ':	0–1.67%	0.21%
t_0:	7–53 days	7–28 days
$t-t_0$:	60–2025 days	450 days
M_{max}/M_{cr}:	1.12–11.00	2.51–3.35
I_I/I_{II}:	1.09–7.18	5.19–5.61
$a(t-t_0)/a(t_0)$	1.50–7.31	2.04–2.07

Unfortunately, for most studies relative humidity and temperature are not available and were taken as reported in (Espion, 1988). Shrinkage strain and creep coefficient were calculating using the MC10 model. Non-linear creep was taken into account in the following manner: in the first step, the regular creep coefficient was determined and using it, the effective modulus calculated – this reduces the initial $\sigma_c/f_{cm}(t_0)$ ratio; if it was still above 0.4, then the non-linear creep coefficient was calculated and applied. Shrinkage strain was taken as 0 for all initial deflections even if in some cases curing had stopped before the beam was loaded. The reason for this is that before laying the beam on supports, its bottom side is in the formwork and no evaporation of water can take place, hence, shrinkage does not cause curvature in the same way as it would if the beam was on supports.

In some studies, compressive strength was not measured after 28 days and had to be recalculated to f_{cm}. In these cases, unless known to be otherwise, cement was taken as 'class N', i.e. the coefficient s in Equation 2.181 was taken as 0.25. Also, the modulus of elasticity was always determined for quartzite aggregates (no correction coefficient was applied) since the information on aggregate type was not available.

After calculating all 140 deflections by numerical integration, the calculated–to–experimental ratio of deflections, a_{calc}/a_{exp} was determined. For all 140 values, the mean a_{calc}/a_{exp} ratio was 1.073 with a CoV of 25.3%. As a starting point, this is a very good result, at least in terms of mean value which is on the safe side; however, the CoV is on the upper bound of acceptable values for a useful prediction model. The range of values was 0.642–2.807, i.e. the distribution is skewed right and to a large degree. The plot of calculated vs. experimental values is shown in Figure 5.38.

Therefore, it serves to carry out a deeper analysis of the data. The first step is to separate initial from long-term (or 'final') deflections. Here, a question can be raised about the usefulness of calculating initial deflections in reinforced concrete members at all, when it is known that they will not be the highest value of deflections and, in the majority of cases, will not be critical in design. This is partly true only for standard reinforced concrete members in buildings, under 'usual' loads (dead and live loads); it is not true for other types of structures such as bridges and for specific types of loading, e.g. certain transient load situations for which short-term deflections are important. It is also the author's opinion that a good model must be able to capture the *entire* time evolution of a phenomenon, i.e. deflections, rather than just a part of it. It is noted that the model itself *is*

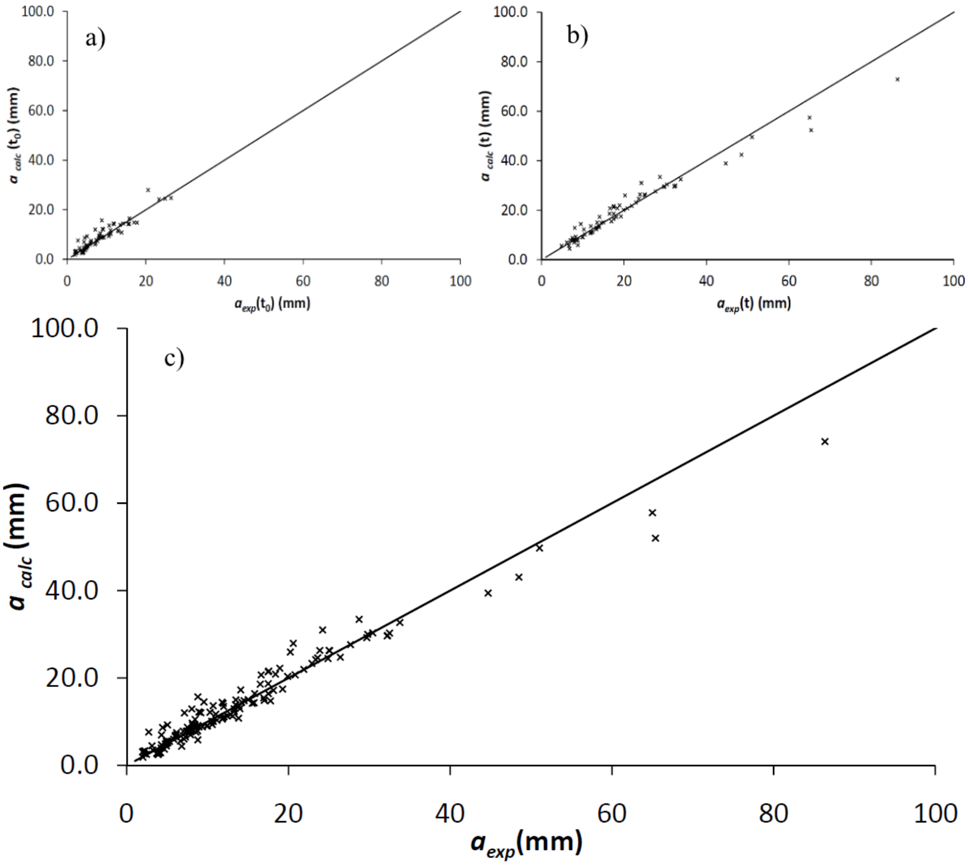


FIGURE 5.38: Calculated vs. experimental values of deflections, according to MC10: a) initial, b) final and c) initial and final deflections

somewhat different in the case of initial deflections (no shrinkage and creep, hence, strictly speaking no effective modulus. Also, any error that occurs when measuring deflections, e.g. caused by the imprecision of the instrumentation or arising from faulty manipulation (prolonged application of load, causing the initially measured deflection to contain creep effects), is relatively greater compared with initial deflections than compared with long-term deflections, since these will always be larger. Nonetheless, both initial and final deflections were analysed in this thesis.

For the 70 initial deflections, the mean a_{calc}/a_{exp} ratio was 1.127 and the CoV 30.5%. For the 70 final deflections, the mean was 1.020 and the CoV 15.5%. Now, a distinction between initial and final deflections is clearly visible. The model has a 10% higher mean and a twice(!) as large CoV for initial deflections. It behaves poorly for initial deflections but very good for final deflections (the CoV is reasonably low). The two most important reasons behind the worse performance of the model on initial deflections are: (1) the difficulty of measuring initial deflections precisely (a part of the error is on the side of experimental values) and (2) the underestimation of the cracking moment and modulus of elasticity (a part of the error is on the side of the model).

It is also possible that precisely because of reason (1), the overall distribution is skewed right and thus, leads to a wrong impression about the model's performance on initial deflections when the error is on the side of experimental values. Hence, a 'box and whiskers' procedure was performed to identify outliers in the distribution of a_{calc}/a_{exp} ratios. In short, the procedure consists of ranking all 140 values in increasing order; determining distribution quartile values: first a distribution is divided in two parts by its median (middle) value, then the upper and lower parts are also divided by their medians; the difference of the medians of the upper and lower parts (the upper and lower quartiles, Q_1 and Q_3 respectively), the so-called 'inter-quartile range' or *iqr* is multiplied by 1.5 and subtracted from the lower and added to the upper quartiles. These values ($Q_1 - 1.5 \cdot iqr$ and $Q_3 + 1.5 \cdot iqr$) are the new limits of the distribution, any value lying outside can be considered to be an outlier and can be disregarded from the distribution.

Doing this, the limits are determined as 0.582 and 1.474. This leaves out 12 outliers (all above 1.474), and importantly, 10 of them are initial deflections. The new sample of 128 values has a mean a_{calc}/a_{exp} ratio of 1.010 and a CoV of 14.9%. The 60 initial deflections have a mean ratio 1.017 and CoV 16.7% and the 68 final deflections have a mean 1.004 and CoV 13.0%. These are excellent values, the means are practically equal to 1.00 and the CoVs are below 15%.

There is one more phenomenon to consider. Namely, it is possible, using geometric characteristics of members in state 1 and 2, to calculate the deflections in state 1 and 2, i.e. the extremes between which real values lie. When this is done, it can be observed that some *experimental* values lie below the calculated deflection for state 1 or above the deflection for state 2. This means that they can never be 'reached' by interpolating between these two states using the distribution coefficient ζ. Out of the 128 'filtered' results, 49 are like this. Since these are results that cannot be calculated using the distribution coefficient, this means that the error lies elsewhere: in the expressions for predicting the tensile strength and modulus of elasticity, in the shrinkage and creep models (for final deflections) and again, in the precision of experimental measurements. The remaining 79 results are the ones on which ζ does have an influence. For them, the mean a_{calc}/a_{exp} ratio is 1.076 with a CoV of 11.6%. There are 41 initial deflections with a mean 1.088 and CoV 14.2% and 38 final deflections with a mean 1.062 and CoV 7.8%. It is noticeable that the means are now slightly higher but the CoVs are lower, even below 10% for final values.

All of the statistical parameters discussed in the previous paragraphs are given in Table 5.21.

TABLE 5.21: Statistical parameters for deflections according to MC10

Database	Deflections	n	μ	σ	CoV
Full database	all	140	1.073	0.272	0.253
	initial	70	1.127	0.344	0.305
	final	70	1.020	0.158	0.155
No outliers	all	128	1.010	0.150	0.149
	initial	60	1.017	0.170	0.167
	final	68	1.004	0.131	0.130
$a^{I}_{calc} < a_{exp} < a^{II}_{calc}$	all	79	1.076	0.125	0.116
	initial	41	1.088	0.154	0.142
	final	38	1.062	0.083	0.078

An initial idea can be to try and improve the shrinkage and creep part of MC10, e.g. by replacing MC10's shrinkage and creep model with that of B4s (B4s must be used instead of B4 because the only input can be compressive strength). This was done and the data is given in Appendix C. The creep coefficient was calculated from Equation 5.11 by inputing the creep compliance obtained by B4s.

Here, only a comparison with final deflections is meaningful. The mean a_{calc}/a_{exp} ratio for the 70 'MC10+B4s' final deflections is 1.167 with a CoV 19%. Hence, both the CoV and the mean are 10% higher compared with using MC10's creep and shrinkage model. As a consequence, this approach was not analysed further and only the MC10 model was used in its entirety.

Going back to the full database (excluding outliers), although the results are excellent, a search for potential influencing parameters is still worthwhile. This was done in the following.

In Figure 5.39 the influences of the M_{max}/M_{cr} ratio and compressive strength on the a_{calc}/a_{exp} ratio are given. Considering everything above 1.5 to be an outlier (as determined previously), no trend can be discerned except that, and this is potentially important, all of the outliers are in the region of $M_{max}/M_{cr} < 2.7$.

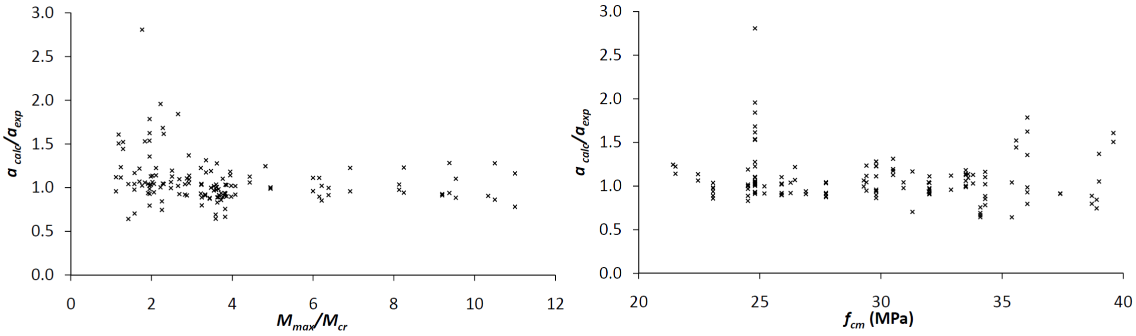


FIGURE 5.39: The influence of M_{max}/M_{cr} (left) and compressive strength (right) on a_{calc}/a_{exp}, MC10

Figure 5.40 displays the influences of the L/d ratio and time since loading $(t-t_0)$ on a_{calc}/a_{exp}. Again, excluding outliers above 1.5, no trends are observable. The high scatter of initial deflections (point $t-t_0=0$) is clearly visible.

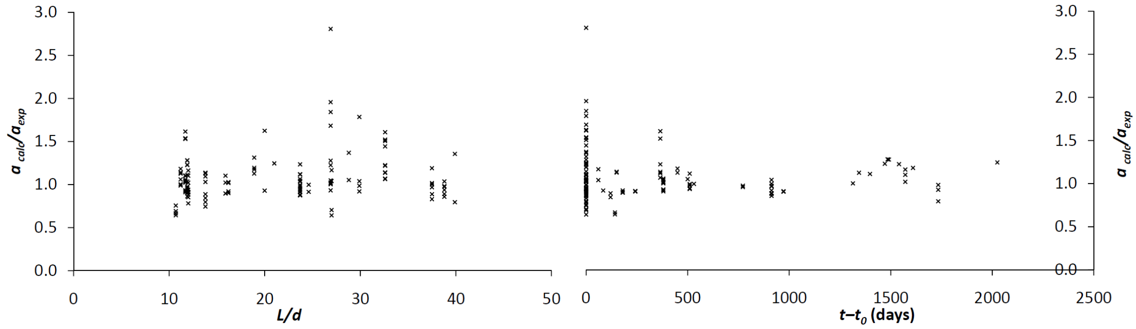


FIGURE 5.40: The influence of L/d (left) and $t-t_0$ (right) on a_{calc}/a_{exp}, MC10

Finally, Figure 5.41 shows the influences of the tensile and compressive reinforcement ratios ρ and ρ' on a_{calc}/a_{exp}. For the tensile reinforcement ratio ρ, as for M_{max}/M_{cr}, all the outliers are concentrated in an area of lower values, $\rho < 1\%$. Even disregarding outliers, there is a small downward trend in the data. As for ρ', the only observation that can be made is that practically all the variance in the data lies in the specimens with no compressive reinforcement. It can then be hypothesized that based on a single piece of information

– whether the member has compressive reinforcement – much can be concluded about the reliability of deflection predictions for that member.

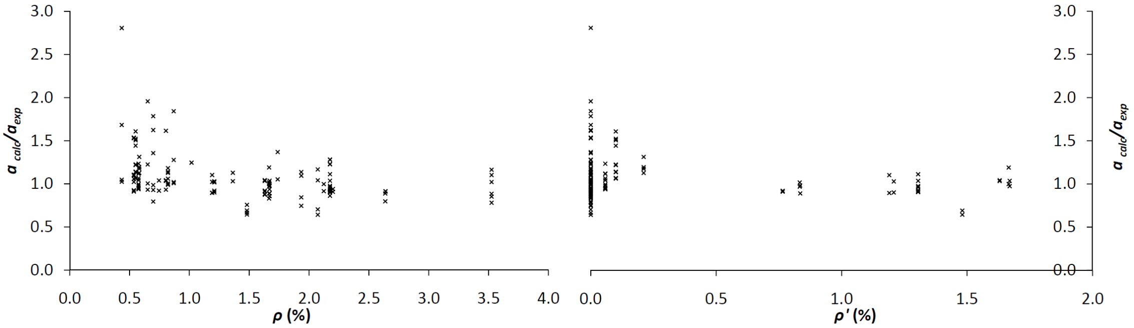


FIGURE 5.41: The influence of ρ (left) and ρ' (right) on a_{calc}/a_{exp}, MC10

There seems to exist an influence of load level and reinforcement ratio on the accuracy and precision of deflection predictions by MC10. Importantly, both of these parameters are actually proxy values for a more fundamental parameter which is the tensile stress in reinforcement. Lower tensile stress in reinforcement means a less cracked state of the member, closer to state 1 and a greater effect of the concrete part of the cross-section. Through this, all of the uncertainties regarding the expressions for mechanical properties, shrinkage and creep exert an influence on deflection predictions; it seems that the trend is toward conservative predictions in such cases.

Another open problem with the method, mentioned earlier is the β coefficient and its transition from 1.0 to 0.5 At what point in time should this change occur? After 5 minutes, 1 day, 10 days, 100 days? It is unclear. The current interpretation is that $\beta = 1$ should be used only for initial deflections *and* first loading, and $\beta = 0.5$ for all other cases.

The question of the β coefficient will be addressed first. Determining the β coefficient should involve two stages. The first stage is determining its dependence on the type of loading – first loading or repeated loading. The problem of repeated loading is not the subject of this thesis and for the purposes herein, β is recommended as 0.5 for repeated loading. As was stated in section 2.5.4 and by other researchers (Gilbert and Ranzi, 2011), such a value of β amounts to reducing f_{ctm} by approximately 30%, this reduction being mostly shrinkage-induced.

The other case is that of first loading. It is reasonable to believe that β should be 1.0 upon first loading and decrease after that. It is also reasonable to argue that its value should not be below 0.5. But how should it evolve over time? Indeed, if it amounts to a reduction of tensile strength by shrinkage, then its evolution should match the time evolution of shrinkage. And the time evolution of shrinkage is best described by a hyperbolic tangent function, as is done in model B4 (see Equation 2.35). Model B4 proposes Equation 2.35 as an expression for the shrinkage time curve, a hyperbolic tangent function of the square root of time, normalized by the so-called shrinkage half-time. From own and existing results it can be seen that the shrinkage curve reaches the leveling-off part around 1000 days; this time should then be taken as the moment when β should become 0.5.

Hence, the following expression is proposed for the β coefficient, for the case of first loading:

$$\beta = 1 - 0.5 \cdot tanh\sqrt{\frac{(t-t_0)}{50}} \geq 0.5 \tag{5.14}$$

The full definition of β should be:

$$\beta = \begin{cases} 1 - 0.5 \cdot tanh\sqrt{\frac{(t-t_0)}{50}} \ \geq \ 0.5 & \text{for first loading} \\ 0.5 & \text{for repeated loading} \end{cases} \tag{5.15}$$

The β function described by Equation 5.14 is shown in Figure 5.42. It can be seen that the function levels off very quickly, e.g. after 100 days its value is 0.556. Hence, the improvement in the quality of predictions cannot be expected to be significant. However, what it brings is a physical meaning to the β coefficient and a continuous function describing it.

The second correction of MC10 should aim for addressing the influence of the tensile stress in reinforcement, directly, or through one of its proxy values – M_{max}/M_{cr} or ρ. It is the author's opinion that the reinforcement ratio is the best choice as it is always directly available to the engineer in the design phase and is more robust than σ_{s1} which has to be calculated or M_{max}/M_{cr} in which M_{cr} depends on cross-section geometry (and reinforcement ratio!) and tensile strength.

Nonetheless, a brief discussion on the choice of the reinforcement ratio is in order because it needn't be clear straight away *which* reinforcement ratio should be used as a parameter.

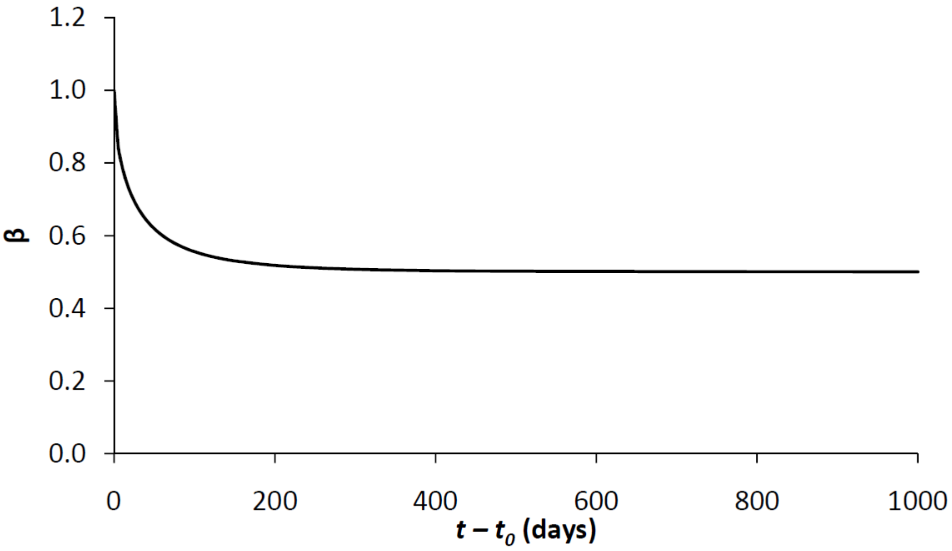


FIGURE 5.42: Proposed function for the β coefficient

There are actually two different types of reinforcement ratios that can be relevant for calculating deflections: (1) required reinforcement ratio (from ultimate limit state analysis) or adopted reinforcement ratio (equal to or greater than the required) and (2) reinforcement ratio in relation to the width of the compression or tension zone of the concrete cross-section. The combination of these gives four reinforcement ratios in total. In this study, the reinforcement ratio to be used as an input parameter was chosen as the adopted reinforcement ratio relative to the compression zone.

Unfortunately, with the available database of experimental results it is actually not possible to test which reinforcement ratio should be used. First, because practically all tested beams had the reinforcement required by ultimate limit state design, i.e. the adopted reinforcement ratio is equal to the required. Second, all of the beams in the analysed database had a rectangular cross-section (this was one of the selection criteria) for which the reinforcement ratio is the practically the same whether it is defined relative to the width of the compression or tension zone. The database by Espion (1988) does contain beams with different cross-section shapes (T, inverted T and rectangular hollow box sections), however their number relative to rectangular cross-sections is small – they comprise only 16.6% of the author's database and probably could not reveal which reinforcement ratio should be used.

After the choice of which reinforcement ratio should be used as input, the question is where can an intervention be made? The expression for the distribution coefficient ζ can be reformulated from Equation 2.147 to

$$\zeta = \begin{cases} 1 - \beta \cdot \left(\frac{M_{cr}}{M}\right)^{\alpha} & \text{for } M \geq \beta^{1/\alpha} \cdot M_{cr} \\ 0 & \text{for } M < \beta^{1/\alpha} \cdot M_{cr} \end{cases} \tag{5.16}$$

In other words, the exponent in Equation 5.16 needn't be equal to 2 (as it was not in the bilinear method). Decreasing α decreases the predicted deflection and this is what needs to happen in the area of small tensile reinforcement ratios or continuously with decreasing tensile reinforcement ratio. A similar idea has been laid out in by Zilch and Zehetmaier (2009). Here, an expression of the following form is proposed:

$$\alpha = \begin{cases} 1 & \text{for } \rho \ \leq \ 0.13\% \\ 0.175 \cdot \Big(ln(\rho) + 10\Big) & \text{for } 0.13\% \ < \ \rho \ \leq \ 4.0\% \\ 2 & \text{for } 4.0\% \ < \ \rho \end{cases} \tag{5.17}$$

where ρ is in %. The expression is limited by ρ = 0.13% and 4.0%, the current minimum and maximum reinforcement ratios according to EC2. Between these two values, α changes logarithmically between 1 and 2, Figure 5.43.

After these two proposed changes, deflections were calculated again using numerical integration on this 'corrected' MC10, called herein *MC10+*. The results are laid out in detail in Appendix C. Here, a table with statistical descriptors of the results, similar to Table 5.21 is given as Table 5.22.

Comparing Table 5.22 with Table 5.21 some differences, although definitely not statistically significant, can be seen. First, on the full database, both the mean value and CoV of a_{calc}/a_{exp} for initial deflections have been improved; this is completely thanks to the α coefficient. Also, for the database without outliers, all deflections (all, initial and final) have a mean value of a_{calc}/a_{exp} equal to 1.00 (considering three significant digits), with CoVs unchanged. There is also slight improvement in the $a^{I}_{calc} < a_{exp} < a^{II}_{calc}$ version of the database.

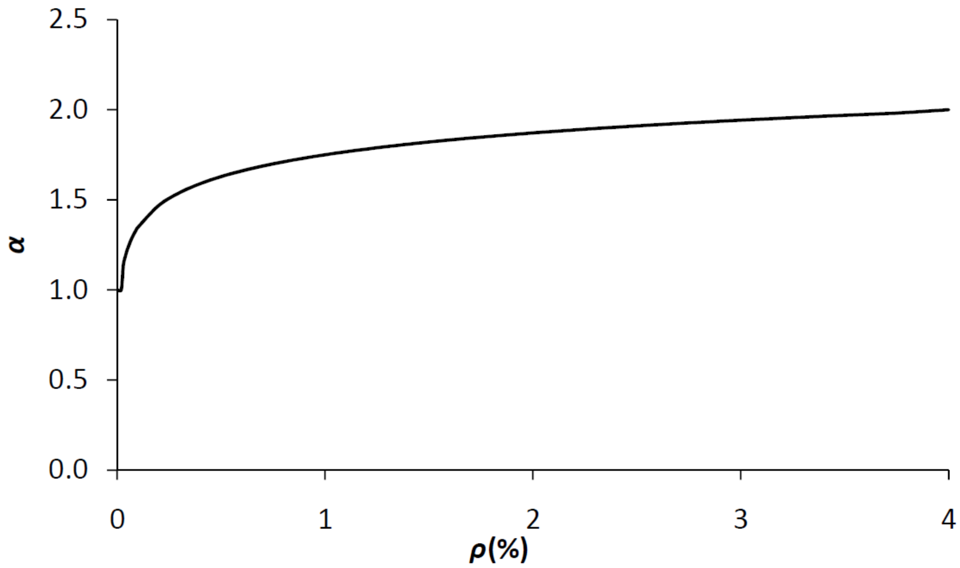


FIGURE 5.43: Proposed function for the exponent α

TABLE 5.22: Statistical parameters for deflections according to MC10+

Database	Deflections	n	μ	σ	CoV
Full database	all	140	1.045	0.244	0.233
	initial	70	1.083	0.304	0.281
	final	70	1.008	0.157	0.156
No outliers	all	130	0.996	0.148	0.149
	initial	62	0.999	0.167	0.167
	final	68	0.993	0.130	0.131
$a^{I}_{calc} < a_{exp} < a^{II}_{calc}$	all	81	1.055	0.127	0.120
	initial	43	1.062	0.157	0.148
	final	38	1.047	0.084	0.080

It is interesting now to look again at individual deflections curves from (Gilbert and Nejadi, 2004) and analyse the effect of the proposed 'MC10+' corrections. The comparison of MC10 and MC10+ is shown in Figure 5.44 for beams and Figure 5.45 for slabs.

Even if the database shows only a slight, statistically not significant, improvement, the individual deflection curves show a significant change in predictions. All of the calculated curves have shifted toward smaller deflections, but importantly, the shift has been the greatest for those members for which original predictions were most imprecise, namely, most of the slabs and beams loaded to lower load levels ('-b' specimens). More accurately,

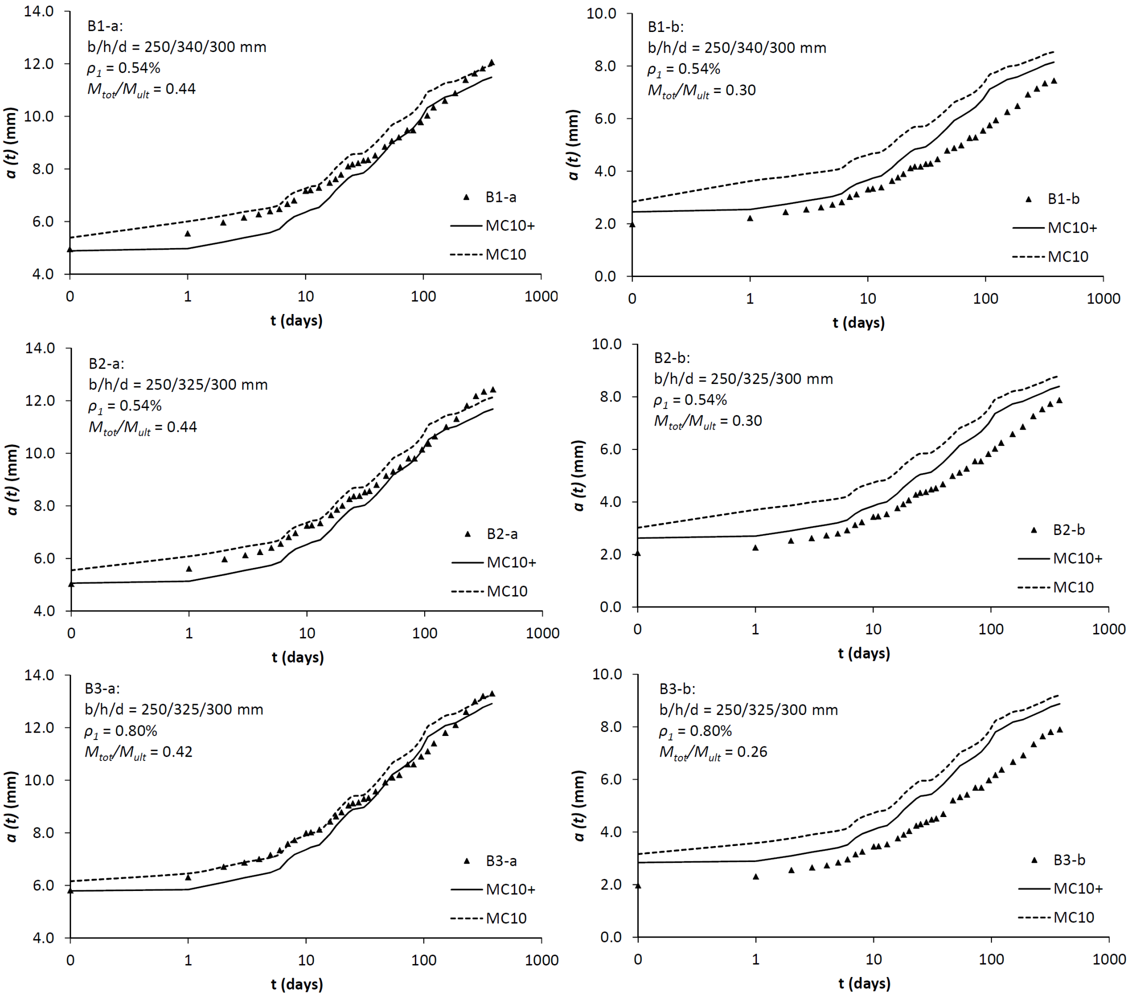


FIGURE 5.44: Deflection curves for beams from (Gilbert and Nejadi, 2004), comparison of MC10+ and MC10

while the original MC10 overestimated deflections in (Gilbert and Nejadi, 2004) by 19.8% on average (with a CoV of 15.5% and a range of a_{calc}/a_{exp} values of 0.94–2.52), the MC10+ overestimated deflections only 4.6% on average with a CoV of 11.2%; the range of a_{calc}/a_{exp} values is 0.87–1.95. Hence, a clear improvement is observable.

Overall, the proposed corrections lead to a more meaningful model, with improved performance and, hence, they will be retained for the remainder of the study.

All of the previous analyses were concerned with the MC10's rigorous method, i.e. numerical integration of curvatures. In practice, this process can be time-consuming and, in practice, is something not all design engineers are fully acquainted with (nor do they

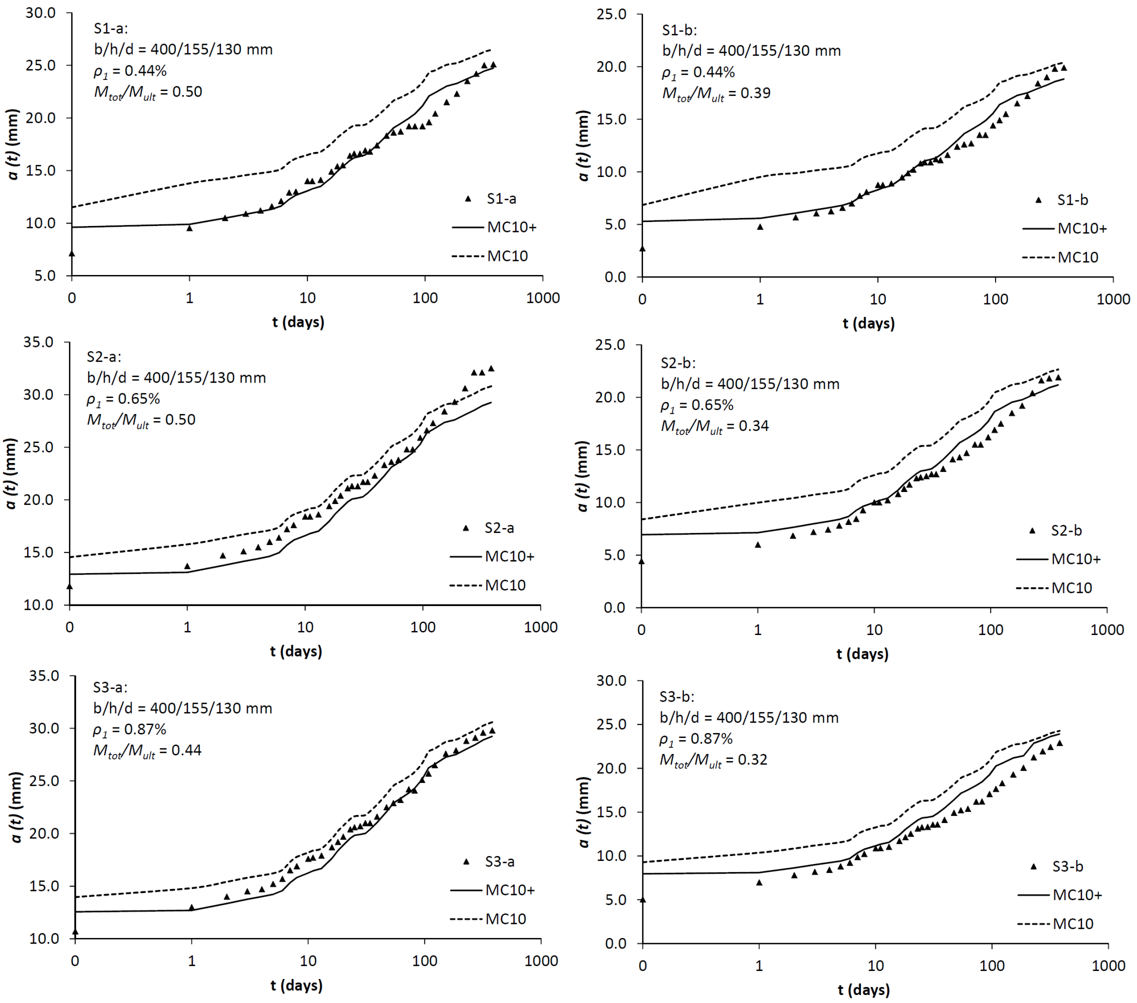


FIGURE 5.45: Deflection curves for slabs from (Gilbert and Nejadi, 2004), comparison of MC10+ and MC10

need to be). Because of this, ever since the European tradition of models for calculating deflections began, there was a search for a simplified procedure that would not require the use of numerical integration of curvatures.

The idea behind such an approach is formulated in both EC2 and MC10, and is expressed best by clause 7.4.3(7) of EC2: 'The most rigorous method of assessing deflections...is to compute the curvatures at frequent sections along the member and then calculate the deflection by numerical integration. In most cases it will be acceptable to compute the deflection twice, assuming the whole member to be in the uncracked and fully cracked condition in turn, and then interpolate...'. This means calculating the distribution coefficient ζ (Equation 2.147) only once. But using which value of M?

The first attempt at such a simplified procedure was the bilinear method, laid out in section 2.5.4 in which the geometric mean of M_{cr} and M_{max} (usually the maximum moment along the span) was entered into the equation whereby the exponent in Equation 2.147 was reduced to 1. However, as already discussed, this approach is not on the safe side, (Espion and Halleux, 1990).

Over time, the bilinear method was abandoned (perhaps even forgotten as it is never mentioned in newer literature on the subject). The current recommendation in practically all literature is to compute the ζ coefficient according to Equation 2.147 using as M the maximum bending moment along the span (FIB, 2013; Beeby and Narayanan, 2005; FIB Bulletin 52, 2010), and to assume that the shape of the curvature diagram is the same as the shape of the bending moment diagram. As stated by Beeby and Narayanan (2005) the error produced in this way is greater when the load level is close to the cracking load, but generally below 10%, and importantly, always on the safe side.

This is to be tested next. If a simplified procedure is to exist in MC10, as it definitely should, its accuracy should be as close as possible to the rigorous method. This kind of thinking has been behind previous attempts at proposing simplified methods which are equally accurate and precise as the rigorous one (Pecić, 2012; Pecić et al., 2017).

For this purpose, the simplified and rigorous methods must be compared in a parametric analysis, considering the $a_{simp}/a_{num.int.}$ ratio. This is most easily done in a dimensionless format which greatly reduces the number of parameters in the model.

For the rigorous method, a simply supported beam under uniformly distributed load is analysed using numerical integration of curvatures in 50 cross-sections. The MC10+ method is used. The simplified method uses only one value of the ζ coefficient over the entire span of the beam, i.e. the approach recommended by (FIB, 2013; Beeby and Narayanan, 2005).

It can be shown that a dimensionless analysis can be carried out and that the model can be reduced to only two free parameters: the load ratio given as M_{max}/M_{cr} and the cross-section geometry and reinforcement ratio given as I_I/I_{II} (the ratio of moments of inertia for states 1 and 2). This is true if shrinkage is disregarded in the analysis, as has been done here. The conclusions would not change significantly if it had been incorporated.

If we start from the expression for the deflection of a simply supported beam under uniformly distributed load:

$$a = \frac{5}{48} \cdot L^2 \cdot \left(\frac{1}{r}\right)_{eff} \tag{5.18}$$

and rearrange to

$$\frac{a}{L^2} = \frac{5}{48} \cdot \left(\frac{1}{r}\right)_{eff} \tag{5.19}$$

we can write $(1/r)_{eff}$ as

$$\left(\frac{1}{r}\right)_{eff} = (1-\zeta) \cdot \left(\frac{1}{r}\right)_1 + \zeta \cdot \left(\frac{1}{r}\right)_2 \tag{5.20}$$

and replace it in Equation 5.19 also replacing $(1/r)_1 = M_{max}/(E \cdot I_I)$ and $(1/r)_2 = M_{max}/(E \cdot I_{II})$

$$\frac{a}{L^2} = \frac{5}{48} \cdot \left[(1-\zeta) \cdot \frac{M_{max}}{E \cdot I_I} + \zeta \cdot \frac{M_{max}}{E \cdot I_{II}}\right] \tag{5.21}$$

Both sides can be multiplied by $E \cdot I_{II}/M_{cr}$ to obtain

$$\frac{a \cdot E \cdot I_{II}}{M_{cr} \cdot L^2} = \frac{5}{48} \cdot \left[(1-\zeta) \cdot \frac{M_{max}}{M_{cr}} \cdot \frac{I_{II}}{I_I} + \zeta \cdot \frac{M_{max}}{M_{cr}}\right] \tag{5.22}$$

which after reorganizing, finally gives

$$\frac{a \cdot E \cdot I_{II}}{M_{cr} \cdot L^2} = \frac{5}{48} \cdot \frac{M_{max}}{M_{cr}} \left[(1-\zeta) \cdot \frac{1}{I_I/I_{II}} + \zeta\right] \tag{5.23}$$

This way, the model is reduced to only two parameters. From this dimensionless form, deflection is obtained by multiplying the right-hand side of the equation by $M_{cr} \cdot L^2/(E \cdot I_{II})$.

The Excel-based spreadsheet in which the calculations were made is given in Appendix C. The parametric analysis was based by first adopting β and α coefficients. The β coefficient was taken as 0.5 or 1.0 and α as 1.0 or 2.0. The M_{max}/M_{cr} and I_I/I_{II} ratios were varied between 1.1 and 10.0 in 0.5 increments, while M_{max}/M_{cr} was varied in 0.1 increments between 1.1 and 1.5. Ratios equal to 1.0 were not considered as they correspond to an uncracked beam. After calculating the 'normalized' deflections according to both the simplified method and rigorous methods, their ratio, $a_{simp}/a_{num.int.}$, was determined. This resulted in four sets of tables with 1512 individual values which also given in Appendix C.

Here, for easier assessment, all four sets of data are visualized as a 3D surface in Figure 5.46.

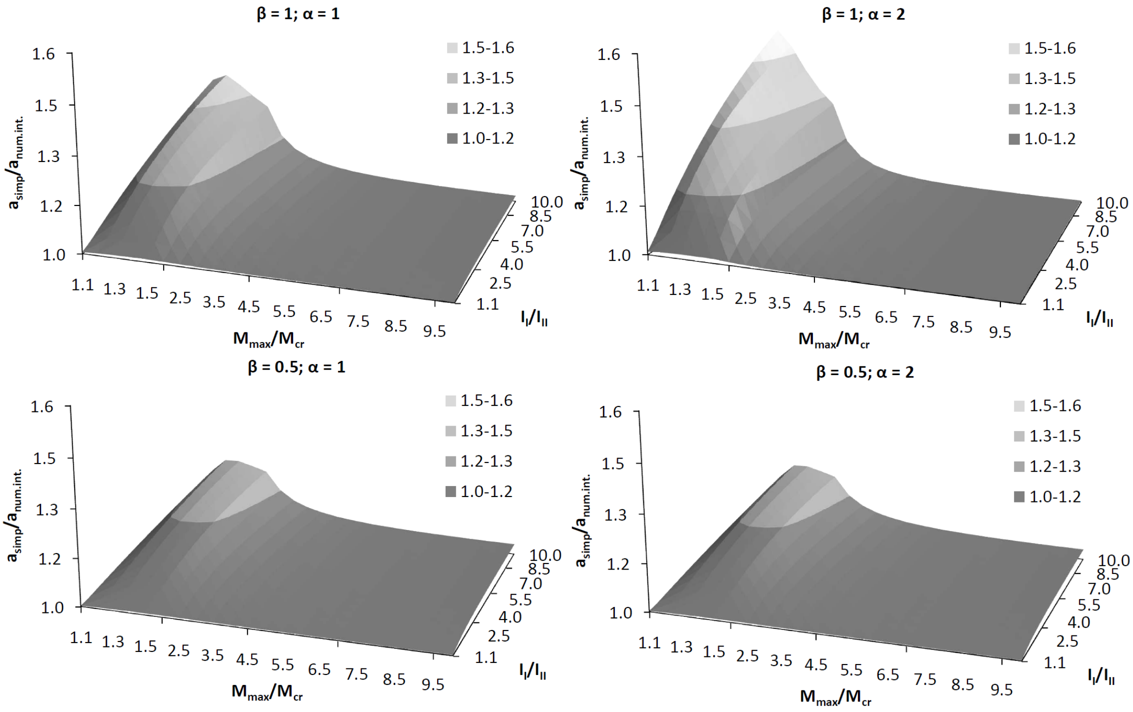


FIGURE 5.46: Initial parametric analysis and comparison of the simplified and rigorous MC10+ procedures

An interesting phenomenon can be observed. Precisely as Beeby and Narayanan (2005) stated, the simplified procedure is the most inaccurate for lower load levels. However, the inaccuracy is well above 10%. The 3D surface is mostly flat at a value of $a_{simp}/a_{num.int.}$ = 1. However, for M_{max}/M_{cr} ratios below 1.5 and practically for all I_I/I_{II} ratios in this region, the 3D surface starts rising sharply. This increase is less pronounced for β = 0.5 and for α = 1. As an extreme, for β = 1 and α = 2, I_I/I_{II} = 10 and M_{max}/M_{cr} = 1.1, $a_{simp}/a_{num.int.}$ = 1.529. Hence, the simplified method produces an error of 50%!

In order to correct this, an expression is necessary to reduce a_{simp} in this region. For practical purposes, a correction which would be bivariate, i.e. which would depend upon both M_{max}/M_{cr} and I_I/I_{II} would be too complicated. A much simpler approach would be to compensate only for the load level. Such an expression would have to target an 'average' compensation, leaving some parts of the 3D surface below 1 and others above.

In this study, a correction factor γ is proposed, to be applied directly to the calculated deflection using the simplified procedure, a_{simp}, to obtain a'_{simp}:

$$\gamma = \begin{cases} 0.4 \cdot \left(1 + \frac{M_{max}}{M_{cr}}\right) & \text{for } \frac{M_{max}}{M_{cr}} \leq 1.5 \\ 1 & \text{for } \frac{M_{max}}{M_{cr}} > 1.5 \end{cases} \tag{5.24}$$

Applying this equation to the four data sets in the parametric analysis, a new distribution is obtained in which the lowest value of the $a'_{simp}/a_{num.int.}$ ratio is now 0.842 whereas the highest is 1.297 (see Appendix C). Thus, the maximum error has been decreased to 30% which is acceptable, since it only occurs for a narrow range of M_{max}/M_{cr} and I_I/I_{II} values (between 1.1 and 1.5 and 8 and 10, respectively). The same is true for the ratios lower than 1: this is the case when both M_{max}/M_{cr} and I_I/I_{II} are between 1.1 and 1.5. Since the error is 15%, it can be accepted.

Finally, this correction of the simplified procedure was tested on the compiled database. Applying the same filters on the database, the calculated–to–experimental values are given in Table 5.23.

The proposed simplified method shows a slightly worse accuracy and precision compared with the rigorous MC10+ method; this is acceptable for a simplified procedure, considering that it is *always on the safe side*. In fact, in the entire database, there is only one beam for which the simplified procedure predicts a smaller deflection compared with the rigorous method and the difference in that case is 3%. There are 10 beams in the database for which M_{max}/M_{cr} is below 1.5, i.e. to which the proposed γ correction factor applies. Without the correction factor, the mean a_{simp}/a_{exp} ratio for these 10 beams would be 1.397

TABLE 5.23: Statistical parameters for deflections according to the MC10+ simplified procedure

Database	Deflections	n	μ	σ	CoV
Full database	all	140	1.094	0.289	0.264
	initial	70	1.155	0.368	0.319
	final	70	1.034	0.160	0.155
No outliers	all	127	1.022	0.148	0.145
	initial	59	1.027	0.165	0.161
	final	68	1.018	0.132	0.130
$a^{I}_{calc} < a_{exp} < a^{II}_{calc}$	all	78	1.091	0.117	0.107
	initial	40	1.101	0.144	0.131
	final	38	1.081	0.081	0.075

with a CoV of 27.5%. The use of γ lowers the mean to 1.254 and the CoV to 26.6%; at the same time, for the rigorous method, the mean of $a_{num.int.}/a_{exp}$ is 1.164 with a CoV of 24.6%. Hence, the simplified method is only 7% more conservative compared with the rigorous one.

A brief overview of the rigorous and simplified MC10+ methods, with a summary of the proposed corrections, is provided in Table 5.24.

TABLE 5.24: Summary of rigorous and simplified MC10+ methods

	Rigorous method	Simplified method
Level at which interpolation is performed	Curvature	Deflection
Basic formulation	$(1/r)_{eff} = (1-\zeta)(1/r)_I + \zeta(1/r)_{II}$	$a = \Big[(1-\zeta)a_I + \zeta \cdot a_{II}\Big] \cdot \gamma$
Distribution coefficient ζ	Equation 5.16	Equation 5.16
Moment M in Equation 5.16	Moment M in each cross-section	M_{max} over entire span
Cracking moment reduction factor β	Equation 5.15	Equation 5.15
Exponent α	Equation 5.17	Equation 5.17
Correction factor γ	n/a	Equation 5.24

This analysis proves the efficiency of the proposed corrections of the MC10 rigorous and simplified procedures and establishes the MC10+ proposal.

5.4.1.2 Assessment and Correction of the ACI 435R Model

After the assessment and correction of MC10 and the proposal of modifications in the form of model 'MC10+', the same approach was applied to the ACI 318 Building Code Requirements for Structural concrete and ACI 435R report by Committee 435 on the control of deflections in concrete structures, (ACI 318-11, 2011; ACI 435R-95, 2003). Herein, a greater emphasis is placed on the report ACI 435R-95 (2003) since it is strictly focused on the control of deflections, and its procedure for taking into account shrinkage and creep is more sophisticated compared with ACI 318-11 (2011).

Creep is taken into account by calculating the deflection increase caused by creep according to eqs. (2.165) and (2.167). This amounts to something alike the effective modulus method, at least for beams with no compression reinforcement. Deflection caused by shrinkage is calculated according to Equation 2.166. The drawback of this equation is that shrinkage deflection calculated according to it is not affected by the state of cracking of the member, nor by creep.

For the purposes of this study, when calculating the effective moment of inertia using Equation 2.11, the exponent $m = 3$ was adopted. As stated in section 2.5.4, the code mentions $m = 4$ citing Branson in Appendix B, however the $m = 3$ is the only prescribed value. As it will be shown later, the value $m = 3$ also fits experimental results much better (the higher the exponent, the closer the effective moment of inertia is to state 2, hence, the greater the deflection).

The first step was to check the mathematical formulation of the model itself, i.e. the equations for the effective moment of inertia and shrinkage and creep effects on deflections. Again, the study by Gilbert and Nejadi (2004) was used together with all experimentally determined values of mechanical properties, shrinkage and creep. For determining the cracking moment, the reported modulus of rupture f_r, was used. The input data and results of numerical integration in 50 cross-sections are given in Appendix D.

The comparison of experimental and calculated deflections curves are given in Figure 5.47 and Figure 5.48 for beams and slabs, respectively.

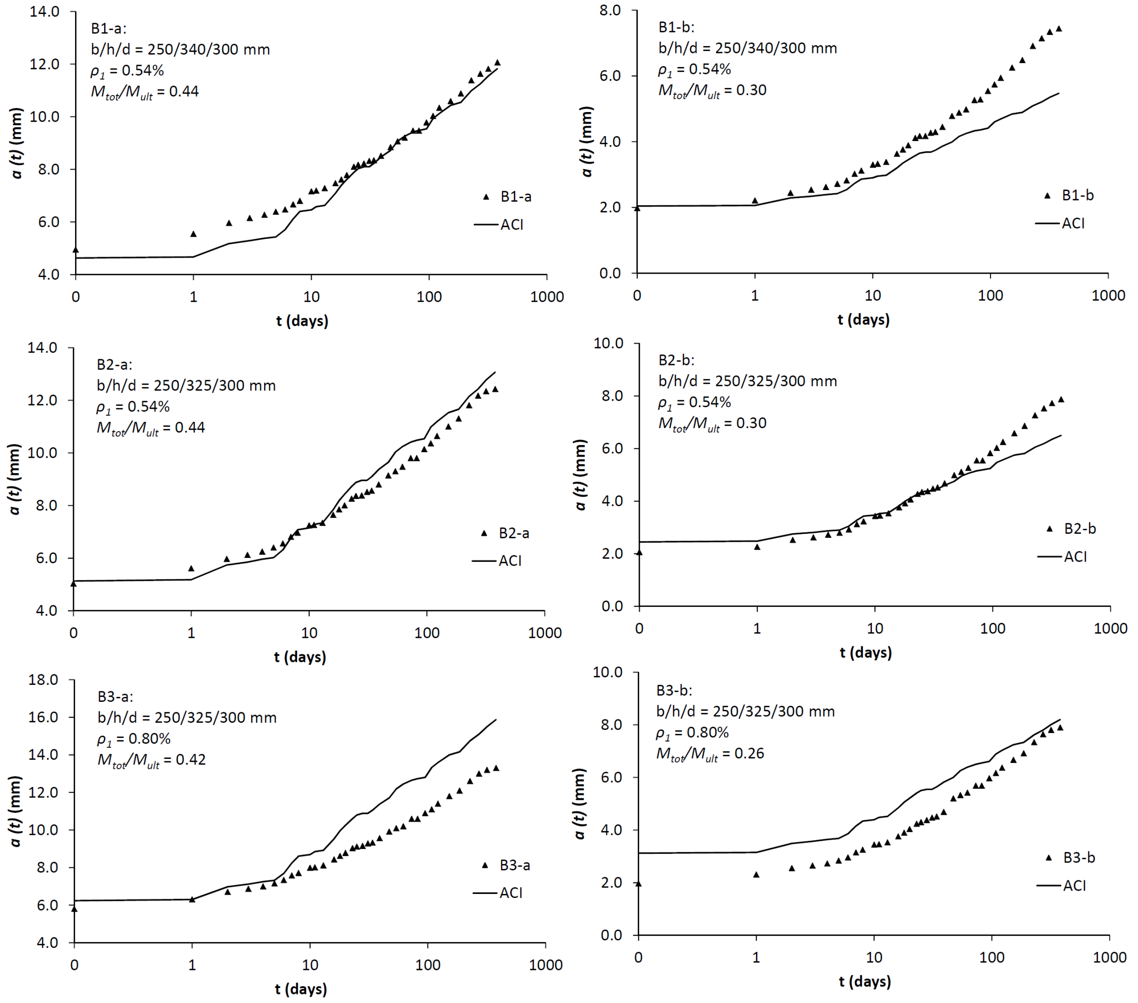


FIGURE 5.47: Assessment of deflection curves for beams from (Gilbert and Nejadi, 2004) according to ACI

The results in figs. 5.47 and 5.48 reveal a varying degree of matching between predictions and experimental results. Some calculated deflection curves fit experimental results very well, e.g. B2-a, S2-a; others overestimate deflections completely or increasingly over time, e.g. B3-b and B3-a; while others underestimate them, e.g. S1-a and S1-b.

This underestimation of deflections was not present in MC10 and here it is most pronounced for lightly reinforced members, i.e. slabs. This is something already mentioned by Gilbert and Ranzi (2011) as a deficiency of the model. Another important phenomenon

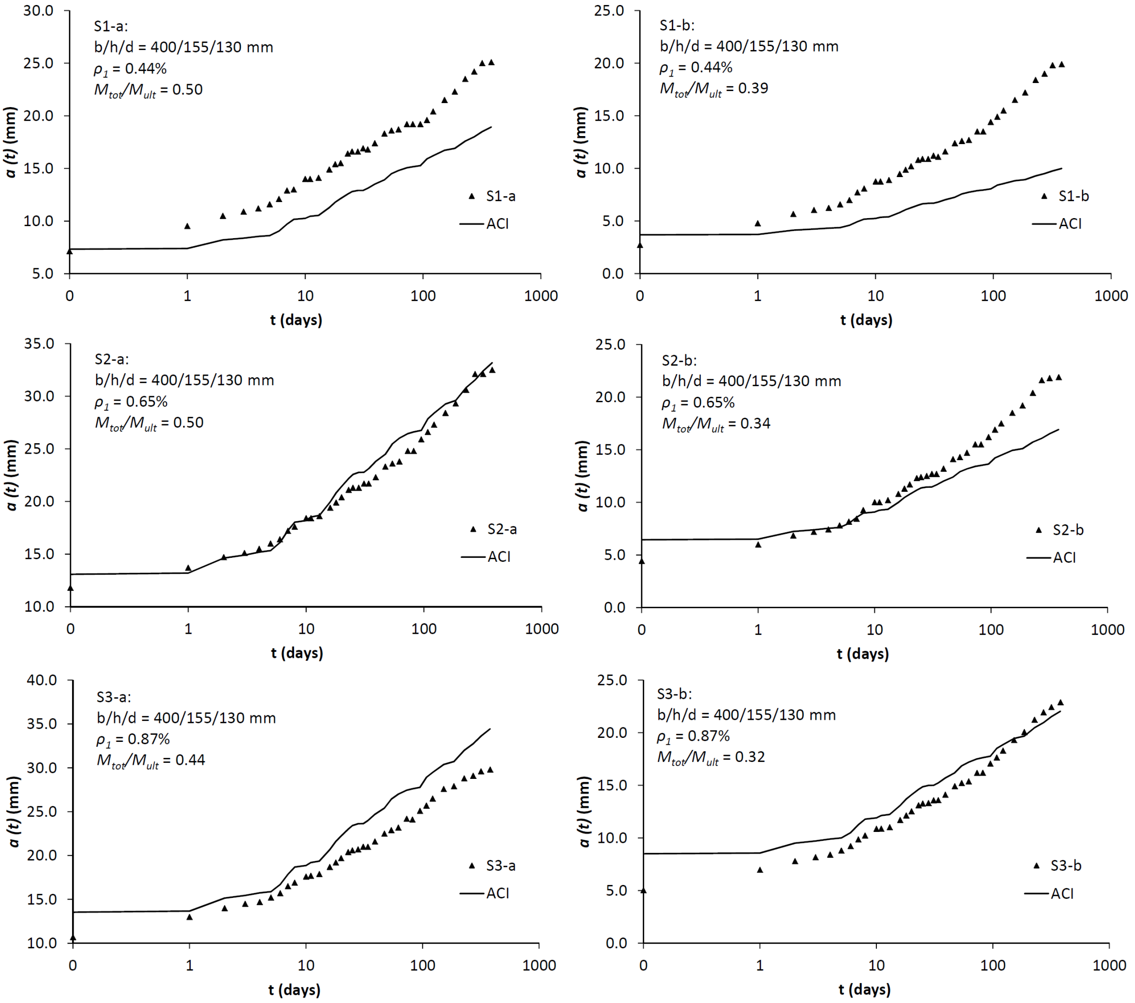


FIGURE 5.48: Assessment of deflection curves for slabs from (Gilbert and Nejadi, 2004) according to ACI

is the divergence of calculated and measured values, either to the side of under- or overestimating experimental values. This possibly points to the inadequate formulation of shrinkage and creep effects on deflection.

For all 12 specimens, the mean a_{calc}/a_{exp} ratio is 0.979 with a CoV of 18.8%; however, the range of values is 0.493–1.687, i.e. a less right skewed distribution compared with MC10. The 12 initial deflections are overestimated by 22.8% on average with a CoV of 19.9% and the 12 final deflections (after 380 days) are underestimated by 8.37% on average with a CoV of 21.9%. This means that the accuracy of the model decreases over time while its precision remains relatively the same.

It must be kept in mind that this is a qualitative assessment only, on the results from one study. As such, it cannot be the sole reason for any changes to the model before its overall accuracy and precision are tested on a larger database, the same one on which MC10 was tested. This time, as previously, all mechanical properties and shrinkage and creep are predicted by ACI 435R expressions and then deflections are calculated using numerical integration of curvatures.

The formation of the database was described in section 5.4.1.1 and, as explained, it contains 70 NAC beams with 140 results (70 initial and 70 'final' deflections). All input data and calculated deflections are given in Appendix D. When calculating shrinkage, the ACI model requires the input of curing time in days. For studies for which this information was available, the reported curing time was input. For other studies, 14 days was the input since it yield the $\gamma_{sh,tc}$ coefficient equal to 1.0 (this was done only if $t_0 > 14$ days. Also, since for most studies slump, fine–to–coarse aggregate ratio and air content were unknown, the corresponding coefficients in the ACI model were taken equal to 1.0.

For the entire database, the mean a_{calc}/a_{exp} ratio was determined as 1.104 with a CoV of 22.9% and a range of values 0.641–2.037. The plot of calculated vs. measured values is given in Figure 5.49. Compared with MC10, the mean is only slightly larger (1.104 compared with 1.073), the CoV is 10% lower and the range is significantly less right skewed (the lower value is the same whereas the highest value is 2.037 for ACI compared with 2.807 for MC10). This points to a more uniform prediction by ACI with less outlying results.

Separating the database into initial and final deflections gives the following results: a mean a_{calc}/a_{exp} of 1.135 and CoV of 24.8% for initial deflections and a mean of 1.072 and CoV of 20.2% for final deflections. As MC10, ACI better predicts final deflections. However, the differences are less pronounced for ACI.

The 'box and whiskers' technique identified lower and upper outlier values as 0.561 and 1.571, respectively, leaving out 10 results (all above the upper value, four of them final deflections). The filtered sample of 130 results now has a mean a_{calc}/a_{exp} ratio of 1.053 and a CoV of 16.9%. Separated into initial and final deflections the results are a mean of 1.069 and CoV of 17.2% for initial deflections and a mean of 1.038 and CoV of 16.5% for final deflections. The results are improved and with an acceptable accuracy and precision.

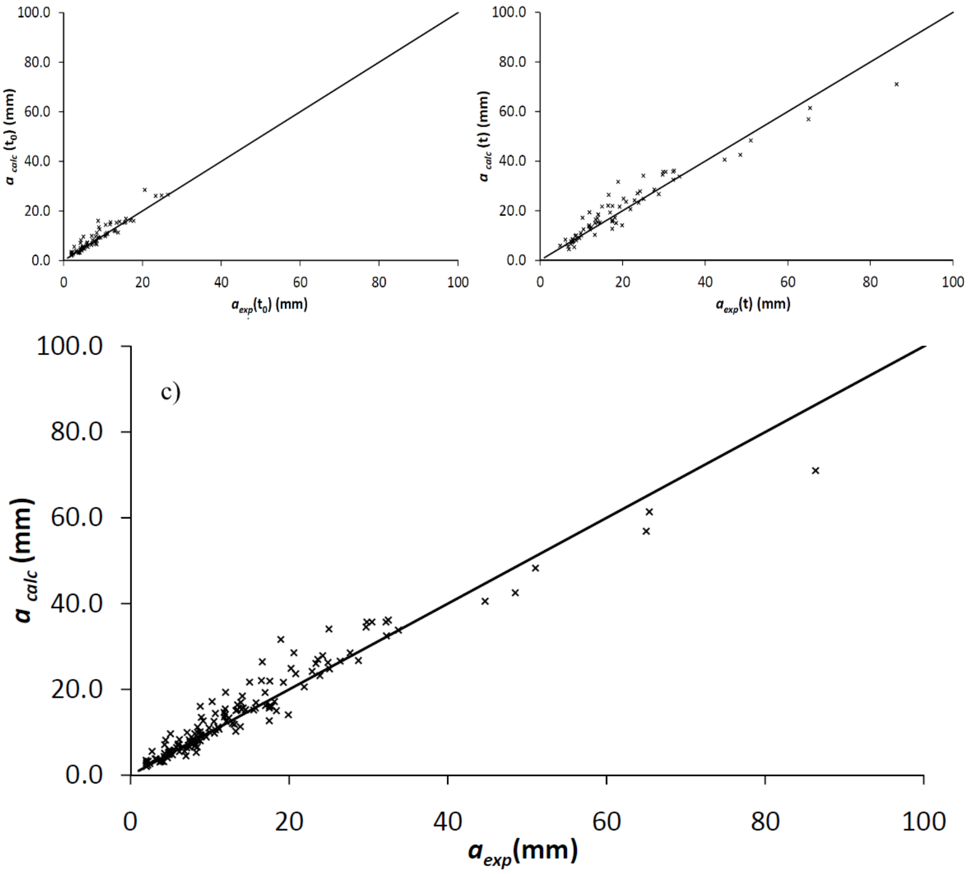


FIGURE 5.49: Calculated vs. experimental values of deflections, according to ACI: a) initial, b) final and c) initial and final deflections

Further filtering the database by eliminating experimental values below the deflection in state 1 or above the deflection in state 2 (the results which cannot be reached interpolating between the two states), reduces it to 105 results with a mean 1.089 and CoV 17.7%. Of these 105, 48 are initial deflections with a mean 1.124 and CoV 15.7% and 57 are final deflections with a mean 1.061 and CoV 16.3%. The results are the same for final deflections but worse for initial deflections.

All statistical parameters are given in Table 5.25.

The first improvement that was attempted was the replacement of ACI's shrinkage and creep models with B4s and GL2000. The input data and results for these analyses are given in Appendix D. Since the change only affects final deflections, only they will be discussed here.

TABLE 5.25: Statistical parameters for deflections according to ACI

Database	Deflections	n	μ	σ	CoV
Full database	all	140	1.104	0.253	0.229
	initial	70	1.135	0.282	0.248
	final	70	1.072	0.217	0.202
No outliers	all	130	1.053	0.178	0.169
	initial	64	1.069	0.184	0.172
	final	66	1.038	0.171	0.165
$a^{c}_{calc} < a_{exp} < a^{II}_{calc}$	all	105	1.089	0.177	0.163
	initial	48	1.124	0.177	0.157
	final	57	1.061	0.173	0.163

Replacing ACI's shrinkage and creep models with B4s lead to a mean a_{calc}/a_{exp} ratio for final deflections of 1.864 and a CoV of 36.4%. Clearly, the results have not improved but have deteriorated significantly. As for GL2000, the mean a_{calc}/a_{exp} ratio for final deflections is obtained as 1.188 with a CoV 26.1%. The model GL2000 provides approximately 10% higher predictions with an approximately 20% higher CoV. In conclusion, none of the two models are adequate to replace ACI's shrinkage and creep models and will not be considered in the remainder of the analysis.

After this, an attempt was made to identify influencing parameters. In Figure 5.50, the influences of load level (through the M_{max}/M_{cr} ratio) and compressive strength on a_{calc}/a_{exp} are given. There is no discernible trend in the data; even the outliers (data above 1.57) are relatively evenly spread out.

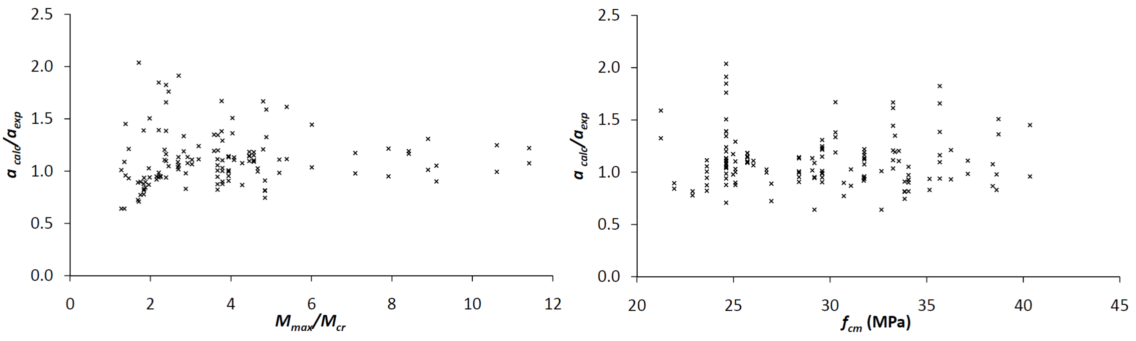


FIGURE 5.50: The influence of M_{max}/M_{cr} (left) and compressive strength (right) on a_{calc}/a_{exp}, ACI

In Figure 5.51, the influences of the L/d ratio and time under load $(t-t_0)$ on a_{calc}/a_{exp} are given. Again, no clear trend is identifiable. Finally, in Figure 5.52, the influences of tensile and compression reinforcement ratios on a_{calc}/a_{exp} are given.

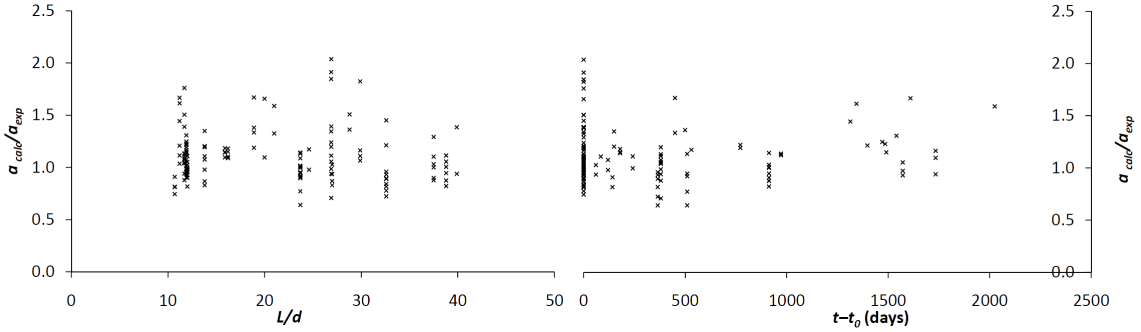


FIGURE 5.51: The influence of L/d (left) and $t-t_0$ (right) on a_{calc}/a_{exp}, ACI

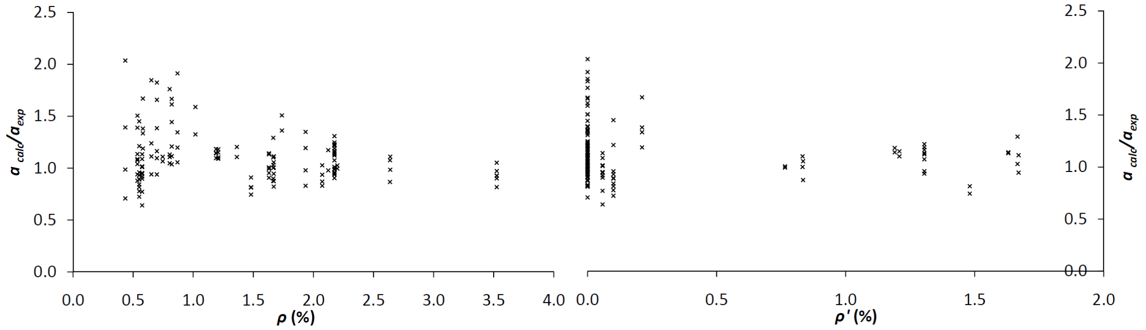


FIGURE 5.52: The influence of ρ (left) and ρ' (right) on a_{calc}/a_{exp}, ACI

Here, the outliers can be seen to lie mostly in the region of lower reinforcement ratios, but also a significant number of the values lower than 1.0 is in this region. This is in agreement with the comments by Gilbert and Ranzi (2011) that the ACI method can underestimate deflections of beams with low reinforcement ratios (generally below 0.5%); this is corroborated by the fitting of deflection curves from (Gilbert and Nejadi, 2004) (slabs S1-a and S1-b).

The ACI method seems to provide reasonably good results on the database, and some variability on individual deflection curves. Addressing the issue of individual curves would require reformulation of the model itself. What can be done without reformulating the model is to deal with the underestimation of deflections of lightly reinforced members. Similar to the recommendations made by Gilbert and Ranzi (2011), an upper bound to the effective moment of inertia, $I_{e,max}$, is proposed here. If the effective moment of inertia, I_e is calculated using Equation 2.11 with $m = 3$, then $I_{e,max}$ should be defined as

$$I_{e,max} = \begin{cases} max\{0.5 \cdot I_c, I_e\} & \text{for } \rho \leq 0.5\% \\ max\{\rho \cdot I_c, I_e\} & \text{for } 0.5\% < \rho \leq 1.0\% \\ max\{I_c, I_e\} & \text{for } 1.0\% < \rho \end{cases} \tag{5.25}$$

This equation sets the upper limit to the effective moment of inertia to 50% of the uncracked section's moment of inertia for reinforcement ratios lower than 0.5%, then linearly increases it to 100% of the uncracked section's moment of inertia for reinforcement ratios greater than 1.0% (ρ should be input in percentages).

By using this correction—this model can be called 'ACI+'—deflections are again calculated on the database. Detailed results are given in Appendix D while the statistical descriptors are given in Table 5.26. A slight increase in all values is seen compared with Table 5.25, but practically negligible. The range of data is now 0.701–2.147, indicating a slight shift toward higher values, which was the aim of the correction.

TABLE 5.26: Statistical parameters for deflections according to ACI+

Database	Deflections	n	μ	σ	CoV
Full database	all	140	1.115	0.256	0.230
	initial	70	1.149	0.293	0.255
	final	70	1.081	0.209	0.193
No outliers	all	129	1.060	0.173	0.163
	initial	63	1.073	0.184	0.171
	final	66	1.048	0.162	0.155
$a_{calc}^{c} < a_{exp} < a_{calc}^{II}$	all	104	1.098	0.169	0.154
	initial	47	1.131	0.175	0.155
	final	57	1.072	0.160	0.149

Applying this correction to the beams in (Gilbert and Nejadi, 2004) and again analysing the deflection curves, leads to figs. 5.53 and 5.54.

For some specimens there is no change, e.g. beams B3-a and B3-b and slabs S3-a and S3-b (the ones with the reinforcement ratios of 0.80% and 0.87%, respectively), whereas the greatest increase is precisely in the specimens with the lowest reinforcement ratio: S1-a and S2-b (ρ = 0.44%). The increase for slab S1-b is 26%, but still far below the experimental value. The effect is not ideal, but it is positive and in the right direction.

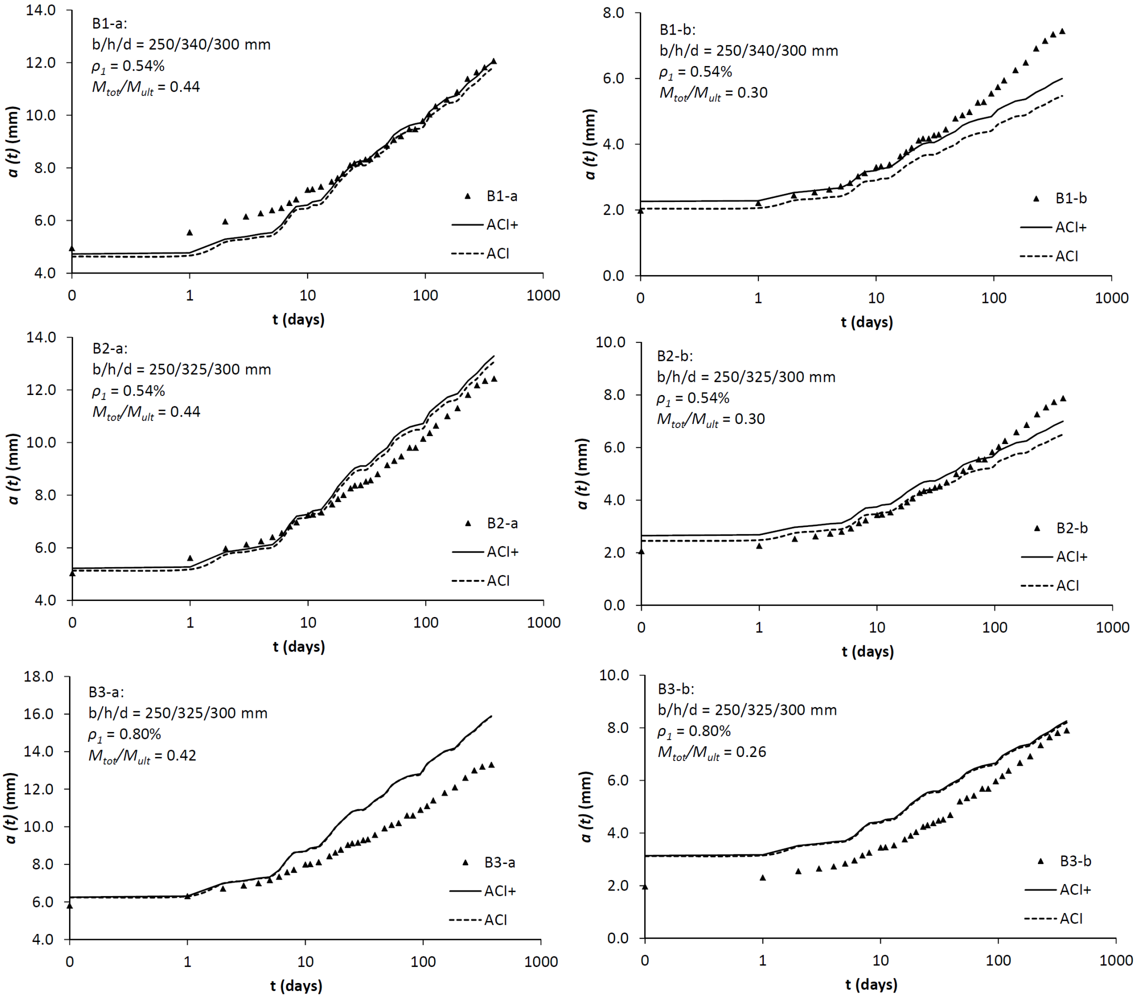


FIGURE 5.53: Deflection curves for beams from (Gilbert and Nejadi, 2004), comparison of ACI+ and ACI

Overall, the mean a_{calc}/a_{exp} ratio is now 1.102 with a CoV 15.5%; at the same time, the mean has increased to above 1.0 and the CoV has slightly decreased due to this correction. For initial deflections the mean is now 1.290 and CoV 21.2%, i.e. both have slightly increased. The final deflections are now underestimated by 5.27% on average with a CoV 17.7%, hence, this descriptor has improved. This demonstrates that this minor correction which is not difficult to implement in calculations definitely leads to more safe results overall.

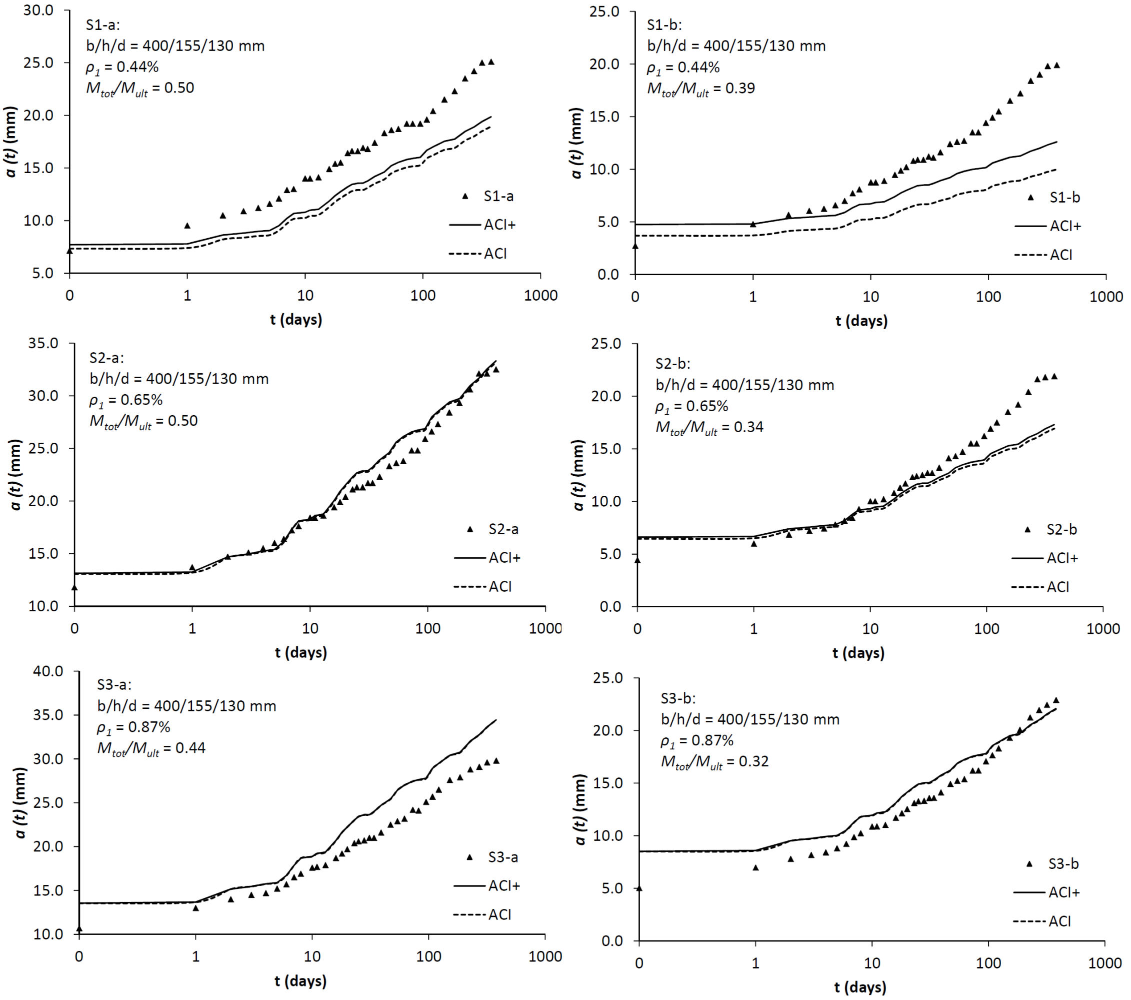


FIGURE 5.54: Deflection curves for slabs from (Gilbert and Nejadi, 2004), comparison of ACI+ and ACI

Just as MC10, so too does ACI have a simplified version of its method for calculating deflections. The simplified method consists of only calculating the effective moment of inertia once, for the cross-section under the maximum bending moment and assuming that these properties apply to the entire member. The next step in the analysis is to determine how accurate and precise is the ACI simplified approach compared with the rigorous method based on numerical integration of curvatures. The model can also be reduced to two independent variable – the load intensity, via the M_{max}/M_{cr} ratio, and the cross-section geometry and reinforcement ratio, via the I_c/I_{II} ratio.

Starting from the ACI equation for deflections of a simply supported beam under uniformly distributed load (not taking into account deflections caused by shrinkage)

$$a = \frac{5}{48} \cdot \frac{M_{max} \cdot L^2}{E \cdot I_e} \tag{5.26}$$

and multiplying it by $(E \cdot I_{II})/M_{cr}$, we obtain

$$\frac{a \cdot E \cdot I_{II}}{M_{cr} \cdot L^2} = \frac{5}{48} \cdot \frac{M_{max}}{M_{cr}} \cdot \frac{I_{II}}{I_e} \tag{5.27}$$

By changing I_e with Equation 2.11 with $m = 3$ and rearranging, the following expression is obtained:

$$\frac{a \cdot E \cdot I_{II}}{M_{cr} \cdot L^2} = \frac{5}{48} \cdot \frac{M_{max}}{M_{cr}} \cdot \frac{1}{\left(\frac{1}{M_{max}/M_{cr}}\right)^3 \cdot \frac{I_c}{I_{II}} + \left[1 - \left(\frac{1}{M_{max}/M_{cr}}\right)^3\right]} \tag{5.28}$$

The model is reduced to two dimensionless parameters. The deflection can be calculated by multiplying the right-hand side of Equation 5.28 by $M_{cr} \cdot L^2/(E \cdot I_{II})$. The effective moment of inertia can further be limited according to the correction proposed in Equation 5.25. An example calculation and comparison of the rigorous and simplified ACI methods is given in Appendix D.

Now the $a_{simp}/a_{num.int.}$ ratio, the ratio of simplified–to–rigorous method predictions, depends on ρ (because of the limitation to $I_{e,max}$), M_{max}/M_{cr} and I_c/I_{II}. A parametric analysis, similar to the one for MC10 was carried out, varying M_{max}/M_{cr} and I_c/I_{II} between 1.1 and 10.0 in 0.5 increments, while M_{max}/M_{cr} was varied in 0.1 increments between 1.1 and 1.5. The reinforcement ratio was taken as 0.5, 0.75 and 1.0. This generated three sets of data with 1254 data points in total, given in Appendix D. The three data sets are visualised in Figure 5.55.

The simplified procedure is always more conservative than the rigorous method, which is a good thing, but $a_{simp}/a_{num.int.}$ deviates from 1.0 significantly in the region of lower load levels ($M_{max}/M_{cr} < 3$) for almost all values of I_c/I_{II}. The highest value of $a_{simp}/a_{num.int.}$ is 1.329 (for $\rho > 1.0\%$ $M_{max}/M_{cr} = 1.4$ and $I_c/I_{II} = 10$). The shape of the 3D surface is irregular in this zone, with first rising, then falling $a_{simp}/a_{num.int.}$ values.

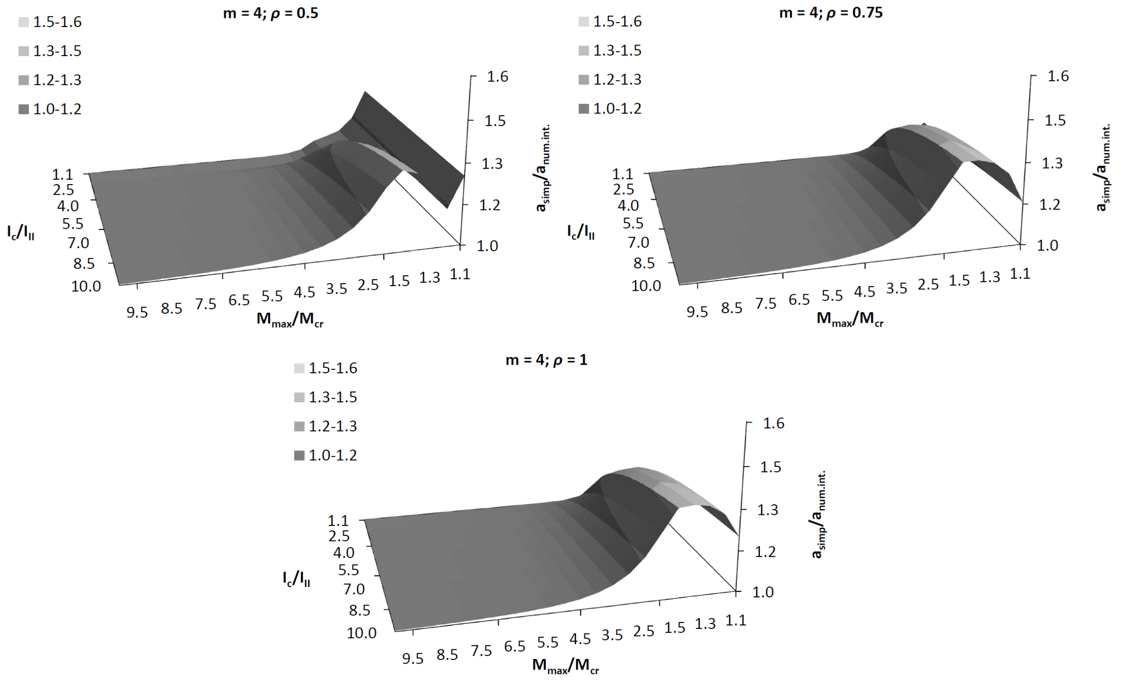


FIGURE 5.55: Initial parametric analysis and comparison of the simplified and rigorous ACI+ procedures

To correct for this behaviour analytically is extremely difficult, if at all possible. Hence, a simpler approach was adopted here. A correction factor γ is proposed which should multiply a_{simp} – the deflection calculated using the simplified procedure:

$$\gamma = \begin{cases} 0.9 & \text{for } M_{max}/M_{cr} \leq 3 \\ 1.0 & \text{for } M_{max}/M_{cr} > 3 \end{cases} \tag{5.29}$$

The deflection is simply reduced by 10% if the load level M_{max}/M_{cr} is below 3. This leads to a new set of data given also in Appendix D in which the highest value of $a_{simp}/a_{num.int.}$ is now 1.196 while the lowest value is 0.903. The underestimation by the simplified method is now 10% in the extreme case, which is acceptable (occurring at lower load levels and lower I_c/I_{II} ratios), while the highest value of $a_{simp}/a_{num.int.}$ is reduced from 1.329 to 1.196, i.e. the overestimation is 20% instead of 33%.

Finally, the proposed corrected simplified method is tested on the full database. Statistical descriptors of its performance are given in Table 5.27.

TABLE 5.27: Statistical parameters for deflections according to the ACI+ simplified procedure

Database	Deflections	n	μ	σ	CoV
Full database	all	140	1.121	0.259	0.231
	initial	70	1.155	0.291	0.252
	final	70	1.087	0.219	0.201
No outliers	all	129	1.066	0.178	0.167
	initial	63	1.081	0.187	0.173
	final	66	1.051	0.168	0.160
$a^{c}_{calc} < a_{exp} < a^{II}_{calc}$	all	104	1.103	0.175	0.159
	initial	47	1.139	0.178	0.156
	final	57	1.073	0.169	0.158

The proposed corrected simplified method provides practically identical predictions as the rigorous ACI+ method which is an excellent indication of its applicability. The previous analyses prove the efficiency of the proposed corrections of the ACI rigorous and simplified procedures and establish the ACI+ proposal.

A brief overview of the rigorous and simplified ACI+ methods, with a summary of the proposed corrections, is provided in Table 5.28.

TABLE 5.28: Summary of rigorous and simplified ACI+ methods

	Rigorous method	Simplified method
Effective moment of inertia, I_e	$I_e = \left(\frac{M_{cr}}{M}\right)^m I_c + \left[1 - \left(\frac{M_{cr}}{M}\right)^m\right] I_{II}$	
Moment M in I_e	Moment M in each cross-section	M_{max} over entire span
Exponent m in I_e	3	3
$I_{e,max}$	Equation 5.25	Equation 5.25
Deflection	$a = k \cdot \frac{M_{max}L^2}{E_c I_{e,max}}$	$a = \gamma \cdot k \cdot \frac{M_{max}L^2}{E_c I_{e,max}}$
Correction factor γ	n/a	Equation 5.29

5.4.2 Models for Calculating Deflections of reinforced RAC and HVFAC Members

After looking at the models for calculating deflections in detail, it is now time to analyse how they perform in predicting the short- and long-term deflections of reinforced concrete beams made with recycled and waste materials, in this case, RAC and HVFAC beams.

There are two questions which this section will attempt to answer.

The first one is ’Can the existing deflection calculation models qualitatively describe the time evolution of deflections of RAC and HVFAC beams as well as they can for NAC beams?’ The answer to this question lies in testing individual deflection curves of RAC and HVFAC beams, with all input data obtained experimentally, just as it was done for NAC beams when the general form of mathematical expressions of the MC10 and ACI models was tested. For this purpose, experimental results from own tests and those carried out by Seara-Paz (2015) will be used, since they provide the only detailed deflection curves with sufficient reported data for RAC and HVFAC beams available to the author (in fact, the only deflection curves for HVFAC beams available at all). The results of this analysis should point to whether the effect of tension stiffening is adequately captured for RAC and HVFAC beams using the MC10+ and ACI+ models.

After establishing an answer to the first question, this section will then try to answer whether the existing deflection calculation models (incorporating corrections proposed in this thesis) perform with the same accuracy and precision on a database of RAC and HVFAC beams as they do on companion NAC beams. In order to achieve this goal, another database will be compiled, consisting of as many results on RAC and HVFAC beams as possible. Unfortunately, as will be seen, this is not so many results; for HVFAC beams, own experimental results are the only results available. Hence, no statistical analysis is possible for HVFAC except for a broad qualitative assessment and recommendations for future research. The case for RAC beams is better, but will still require more work to be done at the material level, on models for calculating creep and shrinkage; a large drawback in previous research (reported in section 2.6.3 is that many studies only report results in graphical form (not allowing for the use of precise values in databases) or do not report sufficient additional information.

Nonetheless, conclusions and recommendations about calculating deflections of RAC and HVFAC beams will be drawn from these analyses. The significance of this research lies in the fact that (to the best of the author's knowledge) it is first of its kind for concretes made with recycled and waste materials.

5.4.2.1 Application of the Improved Model Code 2010 MC10+ Model

Although an argument could be made that the structural behaviour of reinforced RAC and HVFAC members is different than of companion NAC members, this does not yet warrant the introduction of new design expressions specifically for these members. Rather, the first thing that should be tested are existing models. This was the case in previous studies dealing with ultimate flexural and shear strength of reinforced RAC beams (Tošić et al., 2016) where design provisions of Eurocode 2 for flexural and shear strength were shown to be applicable to RAC beams.

The same approach will be used herein. The hypothesis to be tested is that any difference in the performance of deflection prediction models between RAC, HVFAC and NAC beams can be completely explained by taking into account differences in *mechanical* and *time-dependent* properties of these concretes. In other words, if the predictions of the RAC and HVFAC modulus of elasticity, tensile strength, shrinkage and creep are corrected, then the deflection prediction models will show the same accuracy and precision as they have for NAC beams – their *structural* behaviour is hypothesized to be identical.

In section 5.4.1.1, the performance of the MC10 model was assessed on NAC beams, through a validation of its mathematical form on individual deflection curves and through an assessment of its accuracy and precision on a database of NAC beams. Influencing parameters were analysed and corrections proposed in the form of the MC10+ model. In this section, the MC10+ model will be applied to predicting deflections of RAC and HVFAC beams, much in the same procedure as in section 5.4.1.1.

A first step will be to analyse individual deflection curves of RAC and HVFAC beams and check the behaviour of the model. The second step will be to assess its precision and accuracy on a new database of RAC and HVFAC beams.

For the first step, detailed results of long-term deflections of RAC and HVFAC beams are needed. Because this step entails only using the part of the MC10+ model for calculating deflections, all other mechanical properties must be experimentally measured values. Unfortunately, of all the literature reported in sections 2.6.3 and 2.7.3, only the experimental programme by Seara-Paz (2015) meets these demands. The author would here like to thank prof. Sindy Seara-Paz for the raw data provided in personal correspondence. Results from other experiments are either incompletely reported, with important data missing, or the deflections themselves are given in visual form, graphically; this way, precise values needed for the analysis cannot be extracted and using them as given would not be methodologically consistent (personal correspondence was also attempted in several cases but results could not be obtained).

Hence, for this step of the analysis, own experimental results were used together with results from (Seara-Paz, 2015). Deflection curves were analysed for six RAC beams: two RAC beams with 50% of coarse RCA, H50-50 and H65-50 from (Seara-Paz, 2015); and four RAC beams with 100% of coarse RCA, H50-100 and H65-100 from (Seara-Paz, 2015) and RAC7 and RAC28 from own experimental programme. As for HVFAC beams, only the two beams HVFAC7 and HVFAC28 from own experimental programme were available. The input data and calculation of deflections using the rigorous MC10+ method are given in Appendix E. The results are shown in Figure 5.56 for RAC beams and in Figure 5.57 for HVFAC beams.

First, let's take a look at RAC beams. Figure 5.56 can be looked at from several perspectives. Looking at all six beams, the mean value of the a_{calc}/a_{exp} ratio is 1.042 with a CoV of 14.5%, i.e. a very good results. Initial deflections are predicted with a mean of 1.179 and a CoV of 22.5% whereas final deflections have a mean a_{calc}/a_{exp} ratio of 1.039 and a CoV of 14.1%. Again, the model behaves much better when dealing with final deflections, although it should be noted that in (Seara-Paz, 2015), the time after loading when initial measurements were taken differed for different beams and could contribute to the scatter of results.

The next logical step would be to analyse separately beams with 50% and 100% of coarse RCA, i.e. beams H50-50 and H65-50 vs. beams H50-100, H65-100, RAC7 and RAC28. It seems that no conclusion can be drawn for beams with 50% of coarse RCA, they even show greater scatter than beams with 100% of coarse RCA. However, this is in accordance

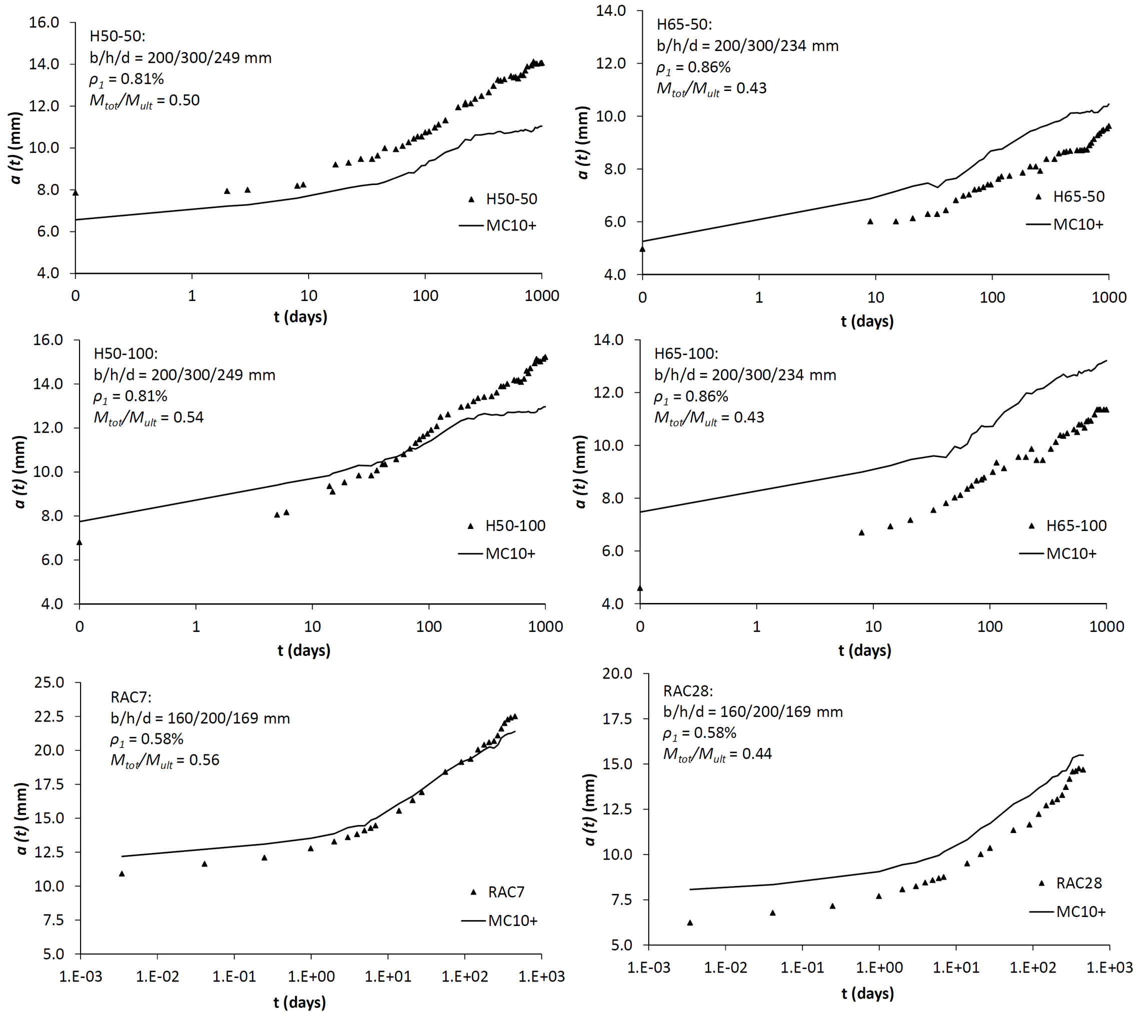


FIGURE 5.56: Assessment of deflection curves for RAC beams, MC10+

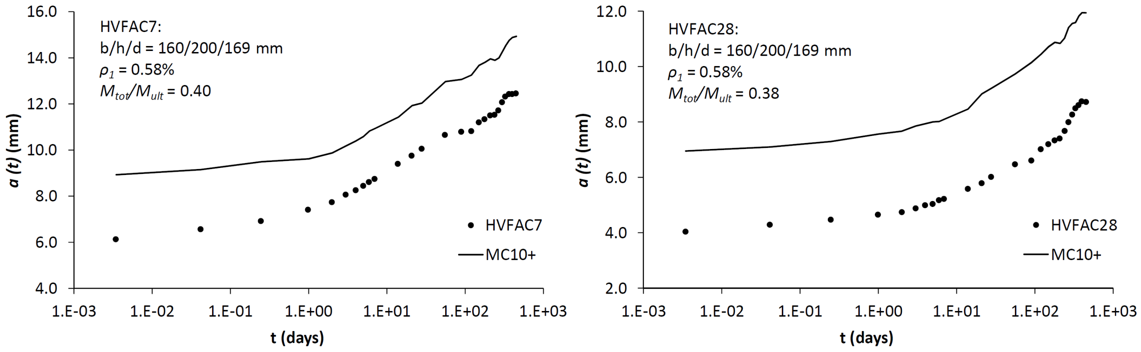


FIGURE 5.57: Assessment of deflection curves for HVFAC beams, MC10+

with findings by Tošić et al. (2016) who found that beams with 50% of coarse RCA had a higher scatter of flexural and shear strength than beams with 100% coarse RCA.

It can be noticed that three figures on the left side are beams loaded to a load level of 0.50–0.56 of ultimate load, whereas the three figures on the right are beams loaded to 0.43–0.44 of ultimate load. So one way of analysing the results is according to load level. This perspective is consistent with previous findings that the MC10+ behaves more conservatively for lower load levels.

Another way of looking at Figure 5.56 is according to compressive strength. Compressive strength of the concretes decreases in the order of H50-50, H50-100, H65-50, H65-100, RAC7/RAC28. If we separate them again into three figures on the left and right side (according to load level), we can see that in each ’column’ the predictions become more conservative with *decreasing* compressive strength – on the left side in the order of H50-50, H50-100, RAC7 and on the right side in the order of H65-50, H65-100 and RAC28. For beam H50-50 with a compressive strength of 53.1 MPa at loading, the predictions are unconservative as are for beam H50-100 after around 100 days (compressive strength of 45.3 MPa at loading). These two figures show a suspicious ’leveling-off’ of the predicted deflection curve after ca. 200 days which does not correspond to measurements. This is possibly caused by a change in the environmental conditions to which prisms for measuring creep were exposed; this is not reflected in beams since they were not on the same level in the laboratory (Seara-Paz, 2015).

Unfortunately, from Figure 5.56 nothing conclusive can be said about modeling tension stiffening in RAC beams using ζ according to Equation 5.16 or interpolating betweeen states 1 and 2 using Equation 5.30, since there are results which are conservative, unconservative and equal to experimental measurements. A clearer view can be gained after analysing a larger database of results and also using code expressions for predicting mechanical and time-dependent properties of RAC.

As for HVFAC, since HVFAC7 and HVFAC28 are the only results available, no ’larger database’ will be possible. The results in Figure 5.57 show an overestimation of deflections for both beams. For beam HVFAC7, the mean a_{calc}/a_{exp} ratio is 1.245 with a CoV of 5.5%; for beam HVFAC28 the mean a_{calc}/a_{exp} ratio is 1.516 with a CoV of 6.4%. The predicted deflection curves smoothly follow the experimental ones (as evidenced by the extremely low CoV) and systematically overestimate measured values (the overestimation slightly decreases over time). The HVFAC beams were loaded to 0.38–0.40 of their ultimate load; MC10+ does tend to somewhat overestimate deflections in this case, however not by this much (24.5% and 51.6%). This discrepancy can be explained by a larger tension stiffening effect in HVFAC beams compared with companion NAC beams.

Probably the simplest way to take this effect into account would be to multiply ζ with a reduction factor, e.g. c_{FA}, as $c_{FA} \cdot \zeta$. This kind of change of ζ was actually already envisioned in (CEB, 1985). Then, Equation 5.30 would take the following form:

$$\alpha = c_{FA} \cdot \zeta \cdot \alpha_2 + (1 - c_{FA} \cdot \zeta) \cdot \alpha_1 \tag{5.30}$$

where α is a deformation parameter; in the case of this analysis α is the curvature.

Looking at Figure 5.57, it would seem that c_{FA} should not be a constant value. But only from these two results it cannot be concluded on which parameters it depends. As an example, a fitting of c_{FA} was carried out for HVFAC7 and HVFAC28 and the results are shown in Figure 5.58; the appropriate value of c_{FA} was determined as 0.70 for beam HVFAC7 and 0.55 for beam HVFAC28. Perhaps an average value of c_{FA} should be (2/3), however more experiments are necessary.

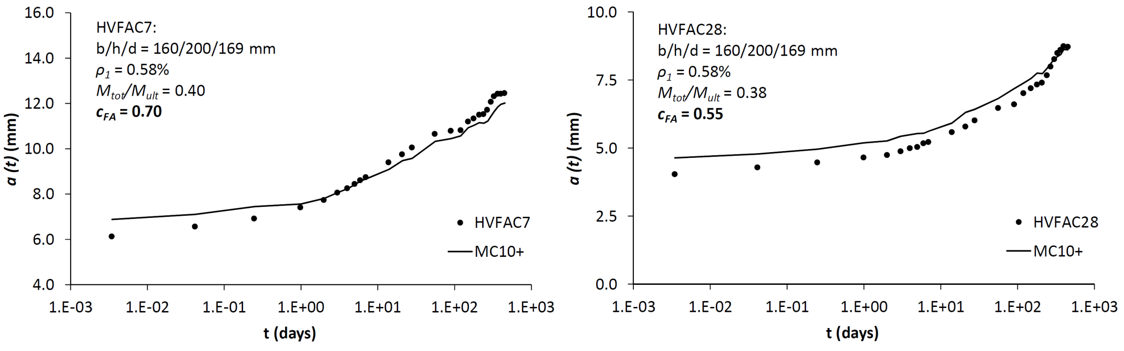


FIGURE 5.58: Calibration of deflection curves for HVFAC beams, MC10+

The next step in the analysis was to compile a database of RAC, HVFAC and companion NAC beams from the available literature. This step is analogous to the second step in section 5.4.1.1, i.e. it assesses the accuracy and precision of the MC10+ model when the only input is compressive strength and all other data is calculated by code expressions.

The only studies with usable results for RAC beams, beside own results, were studies by Knaack and Kurama (2015) and Seara-Paz (2015). In total, this gave a database with 30 beams: 10 NAC beams – two own, six from (Knaack and Kurama, 2015) and two from (Seara-Paz, 2015); eight RAC50 beams (beams with RAC in which 50% of coarse aggregate is RCA) – six from (Knaack and Kurama, 2015) and two from (Seara-Paz, 2015); 10 RAC100 beams (in which 100% of coarse aggregate is RCA) – two own, six from (Knaack and Kurama, 2015) and two from (Seara-Paz, 2015); and 2 HVFAC beams (own results). However, these 30 beams only allowed for 58 results: 30 initial and 28 'final' deflections. This is because for two beams in (Knaack and Kurama, 2015) final deflections are not reported. It is important to note that the water absorption of RCA from (Knaack and Kurama, 2015) and two from (Seara-Paz, 2015) is very similar: 6.06% and 5.4% respectively. Together with the water absorption between 3.67% and 4.05% for RCA used in own experimental programme, this means that any conclusions drawn in this study are only valid for RCA obtained by crushing concrete waste and having water absorption of 3.67–6.06% and density of 2320–2570 kg/m^3.

Another defficiency of the compiled database is the fact that out of the 18 beams tested by Knaack and Kurama (2015), 12 were designed not to crack immediately after loading but to do so over time. This is the worst situation for the model since wrongly predicting whether a beam is cracked or not leads to serious errors in calculated deflections. Since these beams account for 12 out of the total 30 (40%), the database is heavily skewed towards this type of very difficult situation for the model. Also, the duration of tests in (Knaack and Kurama, 2015) is only 119 days and these 18 beams (60% of the total 30) also heavily skew the database towards shorter load duration.

Additionally, Knaack and Kurama (2015) and Seara-Paz (2015) did carry out four-point bending tests, but the forces did not act in thirds of the span but at a closer distance. Thus, the shape of the bending moment diagram is somewhat different to the shape for which MC10+ was tested in section 5.4.1.1; nonetheless, this is not expected to have an influence on the analysis.

The database with all input data is given in Appendix E. The main parameters in the three studies are presented and compared in Table 5.29. It can be seen that the RCA used in own experiments had the lowest water absorption compared with those used by Knaack and Kurama (2015) and Seara-Paz (2015). The geometric properties of all the beams are very similar but compressive strengths in own experiments were the lowest among all tested beams, in the other two studies this parameter varied widely. Reinforcement ratios are also relatively similar with those used in own beams being the smallest. The duration of the tests varied widely with the experiment by Knaack and Kurama (2015) being the shortest, perhaps even too short. The load level was by far the greatest in own experiments leading to similar $a(t-t_0)/a(t_0)$ ratios for beams RAC7 and RAC28. As expected, since Knaack and Kurama (2015) tested a lot of beams very close to and even below cracking load (at t_0), this ratio is the highest for their experiment, going up to 7.40 (after only 119 days!).

TABLE 5.29: Comparison of parameters in the three studies on RAC beams

	Own experiment	Seara-Paz (2015)	Knaack and Kurama (2015)
RCA absorption:	3.67–4.05%	5.40%	6.06%
Span:	3200 mm	3400 mm	3700 mm
Depth:	200 mm	300 mm	230 mm
Span/depth:	18.9	13.7–14.5	18.5
f_{cm}:	28.1 MPa	33.6–53.7 MPa	35.7–49.6 MPa
ρ:	0.58%	0.81–0.86%	1.32%
ρ':	0.21%	0.20–0.22%	0.00–0.47%
t_0:	7 and 28 days	42 days	7 and 28 days
$t-t_0$:	450 days	1000 days	119 days
M_{max}/M_{cr}:	2.52–3.75	1.85–2.41	0.81–2.50
I_I/I_{II}:	5.08–5.49	5.03–5.67	2.69–3.21
$a(t-t_0)/a(t_0)$	2.06–2.36	1.78–2.47	2.40–7.40

For all the beams (NAC, RAC and HVFAC) mechanical properties were calculated using MC10 expressions, i.e. no corrections were applied to either RAC or HVFAC – they were treated the same as NAC. Also, some input data which was not available had to be assumed: in all NAC beams (and in the first step, in all RAC and HVFAC beams as well), for the prediction of the modulus of elasticity quartzite aggregates were assumed; unless known otherwise, cement class N was assumed (necessary for the time evolution function β_{cc}). The deflections were calculated by both the rigorous (numerical integration of curvatures in 50 cross-sections) and simplified MC10+ methods and the results are given in Appendix E.

The first step is to see how was the cracking state of beams from (Knaack and Kurama, 2015) predicted and to eliminate uncracked beams. Out of the 34 results from (Knaack and Kurama, 2015) which entered the database (18 initial and 16 final deflections), 12 were predicted to be uncracked. Out of these 12, 6 were final deflections – in reality these 6 beams did crack by the time they reached 119 days so this is an error by the model; the other 6 were initial deflections rightly predicted as uncracked beams. However, this means that 22 out of the 34 results were predicted as cracked beams. Among these 22, 11 are for the beams which were designed to crack immediately after loading (CC series). The other 11 results consisted of 5 final deflections of the UT and UC series, rightly predicted to be cracked after 119 days. But 6 were initial deflections of UT series beams, wrongly predicted as cracked initially whereas in the experiment they did not crack immediately after loading. These beams then have seriously overestimated deflection and a serious impact on the database. Such a situation can seriously warp the results of the database since they are over-represented in it (10% of the results); in reality, members that are in service loaded so close to the cracking load are mostly slabs, but they are usually two-way slabs for which deflection calculation differs. The reason why these six results will be retained in the database is that they are evenly distributed: two NAC, RAC50 and RAC100 beams. The final database contained 46 results; statistical descriptors are given in Table 5.30.

The reported 46 results all entered Table 5.30 since a 'box and whiskers' analysis didn't reveal any outliers among them.

The first impression after looking at Table 5.30 is the very large overestimation of HVFAC deflections in absolute value and relative to NAC and RAC beams. In the previous analysis of deflection curves, where all input values were taken as experimentally measured, the overestimation of deflection was, on average, 24.5% and 51.6% for HVFAC7 and HVFAC28, respectively. Now, the overestimation is 45.1% for HVFAC7 and 89.7% for HVFAC28. This means that new imprecision has been added through the introduction of code expressions for mechanical and time-dependent properties of HVFAC.

This is expected, since it was shown that MC10 overestimates the shrinkage and creep of the tested concretes, figs. 5.16 and 5.29. In section 5.3.1, MC10 was shown to overestimate shrinkage of this HVFAC mix by ca. 10% and in section 5.3.2 it was shown that MC10 overestimates creep of HVFAC7 by ca. 20% and of HVFAC28 by ca. 25%

TABLE 5.30: Statistical parameters for deflections of RAC, HVFAC and companion NAC beams, MC10+

Database	Deflections	n	Rigorous method			Simplified method		
			μ	σ	CoV	μ	σ	CoV
NAC	all	16	1.085	0.221	0.204	1.169	0.250	0.214
	initial	8	1.194	0.236	0.198	1.308	0.263	0.201
	final	8	0.975	0.148	0.152	1.029	0.143	0.139
RAC50	all	11	0.966	0.264	0.274	1.047	0.276	0.264
	initial	6	1.088	0.301	0.277	1.195	0.286	0.240
	final	5	0.820	0.111	0.136	0.869	0.127	0.146
RAC100	all	15	1.009	0.257	0.254	1.092	0.288	0.264
	initial	8	1.138	0.224	0.197	1.254	0.247	0.197
	final	7	0.862	0.219	0.254	0.907	0.218	0.240
HVFAC	all	4	1.674	0.263	0.157	1.748	0.288	0.165
	initial	2	1.629	0.332	0.204	1.723	0.376	0.218
	final	2	1.719	0.298	0.173	1.774	0.325	0.183

(these are, of course, predictions on prisms). When these differences compound together (tension stiffening, shrinkage, creep, mechanical properties) they get multiplied and the overestimation increases.

This means that, in order to calculate deflections of reinforced HVFAC members, the following work needs to be done in the future: (1) more experiments must be carried out, varying different parameters both on beams and concrete specimens; (2) code expressions for calculating the modulus of elasticity, tensile strength, shrinkage and creep need to be corrected, in them, special attention must be paid to the effect of the curing regime; and (3) after (1) and (2) is completed, the tension stiffening effect must be analysed and the distribution coefficient ζ corrected.

As for RAC and companion NAC beams, several trends appear. First of all, as for the large NAC database in section 5.4.1.1, accuracy and precision are better for final than for initial deflections. The NAC results in Table 5.30 should be compared with the 'no outliers' NAC database in Table 5.22. This smaller NAC database differs in mean values and CoVs from the larger one, mostly for initial deflections. The reason for this is certainly the over-representation of beams loaded very close to the cracking load in (Knaack and Kurama, 2015). Nonetheless, the aim in this section is to compare this smaller NAC database with companion RAC50 and RAC100 beams. What is important is whether there are statistically significant differences between these three data sets.

Looking at the data, what captures attention is the underestimation of final deflections for both RAC50 and RAC100 beams, in absolute terms and relative to companion NAC beams. Whether these differences are statistically significant or not, this underestimation points to several potential causes: (1) mechanical and time-dependent effects of RAC are not predicted well by MC10 (overestimation of the modulus of elasticity and underestimation of shrinkage and creep) and (2) tension stiffening is overestimated in RAC beams. But how can these two causes be distinguished?

It was seen earlier that Figure 5.56 could not reveal a definite conclusion about tension stiffening in RAC beams. Hence, a sequential approach will be taken. If there are indeed two causes of the model's underestimation of deflections of RAC beams, then, the first cause is connected with code expressions for f_{ctm}, E_{cm}, ε_{cs} and $\phi(t,t_0)$ while the second cause is in relation with the MC10+ expression for ζ. It is logical then, to first attempt a correction of code expressions for mechanical and time-dependent properties of RAC and check whether such a change can account for the entire deviation in the model's performance. If it can not, then a solution must be found in additional corrections of the distribution coefficient ζ, i.e. in changing the model for tension stiffening for RAC beams.

Correcting code expressions for each of the mentioned properties (f_{ctm}, E_{cm}, ε_{cs} and $\phi(t,t_0)$) is a difficult and complex task – a thesis can be dedicated to almost each of them separately. Hence, it is useful to try to rely on previously published review works on these topics, which do exist and were presented in section 2.6.2. In this thesis, previously published recommendations will be used for correcting mechanical and time-dependent properties of RAC. This does not preclude the necessity of making new comprehensive databases and literature reviews in order to overcome some of the deficiencies of the currently available studies which will be pointed out along the analysis. Recommendations for such future research along with guidelines will be presented in the end.

The first mechanical property of RAC which will be looked at is tensile strength f_{ctm}. The most comprehensive literature review on this topics was carried out by Silva (2015). In it, the author concluded that the Eurocode 2 expression for predicting tensile strength of RAC from compressive strength

$$f_{ctm} = 0.3 \cdot (f_{cm} - 8)^{2/3} \tag{5.31}$$

which is identical to the one in MC10, does not need to be altered for RAC. There was only a recommendation to alter the time evolution of tensile strength since it tended to underestimated for longer times, i.e. not changing the expression is on the safe side. In this thesis, *no changes* were implemented for RAC tensile strength.

This leaves the modulus of elasticity, shrinkage and creep. Silva (2015) analysed the Eurocode 2 expression for E_{cm}, Equation 2.170, which can be considered identical to MC10, the difference is in the coefficient – 22 vs. 21.5. The author proposed using a correction factor of 0.7 for the RAC modulus of elasticity, regardless of compressive strength or aggregate replacement ratio. This is a relatively crude recommendation and so it will not be used here.

An alternative was found in the previously presented work by Lye et al. (2016a). This study is a part of a three-part research into the elastic modulus, shrinkage, creep of RAC (Lye et al., 2016a,b,c). All three studies were carried out according to identical principles and have as an end-result useful, practical tools for correcting these properties of RAC. The concept of these studies will be explained in detail in the following.

Each of the three studies begins with a comprehensive literature review: 393 publications for the modulus of elasticity, 286 for shrinkage and 100 for creep. The studies then narrow this down to RAC produced with coarse RCA, i.e. aggregates derived from crushed concrete (no recycled masonry aggregates or mixed recycled aggregates) – 284 publications for the modulus of elasticity, 199 for shrinkage and 62 for creep. Unfortunately, the studies do not provide a range of water absorption or density for the RCA used in those studies; hence, the range of applicability of the authors' conclusions is not explicitly stated.

The basic variable analysed by the studies is the ratio of RAC-to-companion NAC for each property, e.g. $E_{cm,RAC}/E_{cm,NAC}$ (companion NAC is not explicitly defined as having the same *w/c* ratio). First, the data were separated according to the RCA replacement ratio and through a 'box and whiskers' technique outliers were eliminated. Additionaly, RAC-to-companion NAC ratios which were not on the 'safe side', i.e. ratios greater than

1 for the modulus of elasticity and smaller than 1 for shrinkage and creep, were also eliminated from the analyses. The authors tried to identify different influencing factors: RCA content, compressive strength, *w/c* ratio, curing (for shrinkage and creep), age at loading (for creep), etc. The authors concluded that RAC content and compressive strength were the two most significant influencing factors on all three properties.

Then, the authors tested the appropriateness of predicting E_{cm}, shrinkage and creep of RAC using *Eurocode 2* expressions. It is important to note that for studies which lacked certain necessary input data, *assumptions* were made for those parameters. Now, the basic variable considered is the RAC-to-'Eurocode 2 prediction for NAC' ratio for E_{cm}, shrinkage and creep. Since there were two independent variables in the data (RCA content and compressive strength), through a multiple regression, expressions were derived for the RAC-to-'Eurocode 2 prediction for NAC' ratio for each property, in the form of 'trendlines' or lines of best fit (unfortunately, analytic expressions were not provided).

The end result of all three studies, (Lye et al., 2016a,b,c), are bivariate diagrams which provide an estimate of relative increase/decrease of E_{cm}, shrinkage and creep of RAC compared with Eurocode 2 predictions for NAC on the vertical axis, one of the parameters (RCA content or compressive strength) on the horizontal axis and a family of lines for the other parameter. These diagrams are shown in figs. 5.59 to 5.61.

The use of these diagrams is straightforward. The authors provide the following example: 'using Eurocode 2, concrete made with CEM 42.5N cement and natural aggregate with characteristic cube strength of 37 MPa, having notional size of 820 mm, loading at 7 days in an environment of 50% RH, is estimated to have creep coefficient of 2.50. If 50% of the natural aggregate is replaced by RCA, a creep multiply factor of 1.275 would apply (Figure 5.61). Thus, the estimated creep coefficient of concrete made with 50% RCA would be 3.19 instead of 2.50 for concrete made with 100% NA' (Lye et al., 2016b).

These diagrams and the databases on which they are founded offer the possibility of analytically modifying MC10 shrinkage and creep models in future research and reaching a comprehensive design procedure for reinforced RAC members. However, for this thesis, the results in (Lye et al., 2016a,b,c) had to be used in the given graphical form. There was an obstacle to directly reading values from the diagrams – they were produced for use in conjunction with Eurocode 2 and in this section, MC10 is analysed.

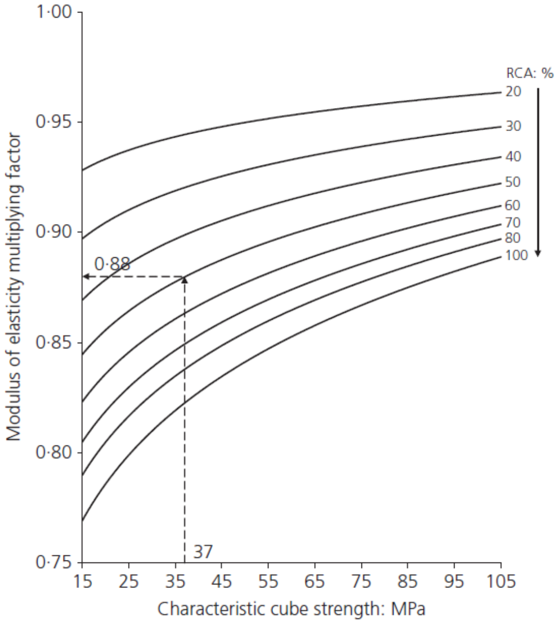


FIGURE 5.59: Proposed modulus of elasticity multiplying factors for RCA concretes of different characteristic cube strenghts, (Lye et al., 2016a)

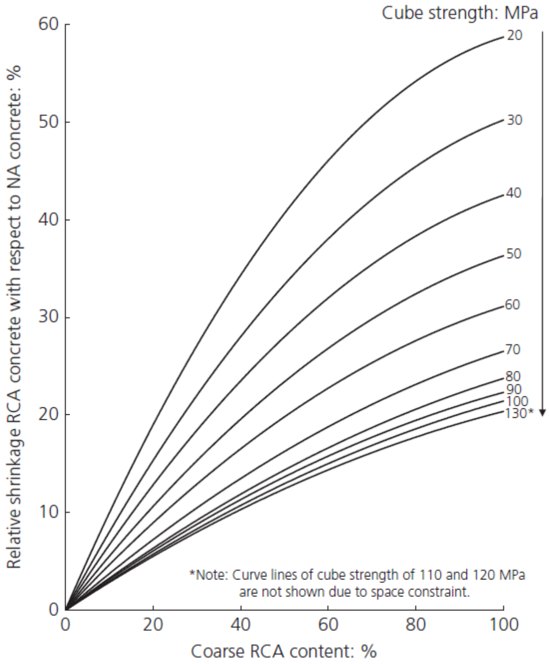


FIGURE 5.60: Compilation of relative *increase of* shrinkage of RCA concrete with respect to NA concrete at different strength grades, (Lye et al., 2016c). Note: text in italic added by author.

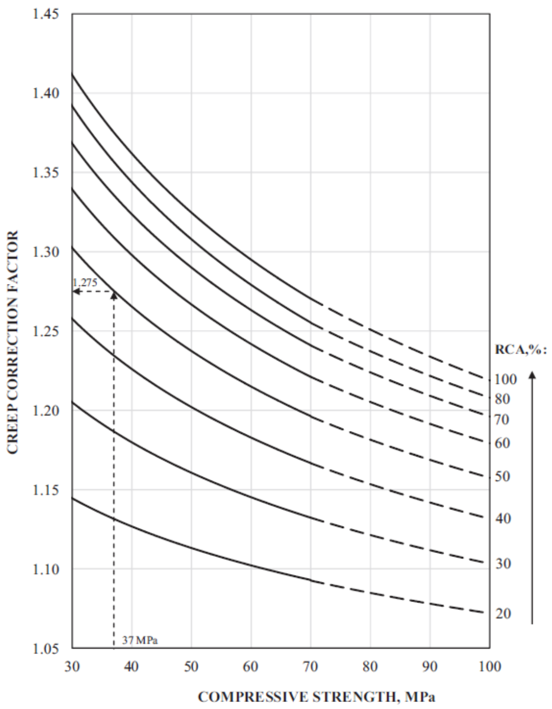


FIGURE 5.61: Proposed creep multiply factor of concrete made with different RCA content for various strength levels, (Lye et al., 2016b). Note: compressive strength is related to cube strength.

The way to overcoming this obstacle was in re-scaling the diagrams relative to MC10 predictions for NAC. In the example above, Eurocode 2 predicted a creep coefficient of 2.50 for NAC and a multiply factor of 1.275, i.e. a RAC creep coefficient of 3.19. The goal is to obtain 3.19 but through the multiplication of the MC10 prediction for NAC. For the given input, MC10 predicts a creep coefficient of 2.82 and thus, a multiplication factor of 1.127 is necessary. Mathematically, the transformation looks like this:

$$c_{EC2} \cdot \phi_{EC2} = c_{MC10} \cdot \phi_{MC10} \tag{5.32}$$

$$c_{MC10} = c_{EC2} \cdot \frac{\phi_{EC2}}{\phi_{MC10}} \tag{5.33}$$

where c_{EC2} and c_{MC10} are the correction factors for Eurocode 2 and MC10, respectively and ϕ_{EC2} and ϕ_{MC10} are Eurocode 2 and MC10 predictions for the NAC creep coefficient, respectively.

For the previously compiled database of deflections of RAC beams, first Eurocode 2 predictions were determined for E_{cm}, shrinkage and creep (for NAC of identical compressive strength). Then, the diagrams were imported into AutoCAD, scaled appropriately, and for each RAC compressive strength (converted from cylinder to cube using a 1.25 coefficient, according to Lye et al. (2016a)) the correction factors c_{EC2} for E_{cm}, shrinkage and creep were determined. Finally, MC10 predictions for E_{cm}, shrinkage and creep (for NAC of identical compressive strength) were calculated, and the new correction factor c_{MC10} was determined from Equation 5.33 (where ϕ is interchangeable with ε_{cs} or E_{cm}). It should be noted that there is no re-scaling for the modulus of elasticity since Eurocode 2 and MC10 predictions are within 2.5%.

The correction factor for the modulus of elasticity was in the range of 0.82–0.90 (lower values are generally for RAC100), for shrinkage strain the range was 1.05–1.52 (higher values are for RAC100) and for creep the range was 1.31–1.79 (higher values are for RAC100). This updated database, together with newly calculated deflections is reported in Appendix E.

The statistical descriptors of the new data set are given in Table 5.31. The results for NAC and HVFAC are unchanged but are repeated for clarity.

TABLE 5.31: Statistical parameters for deflections of RAC, HVFAC and companion NAC beams, MC10+ with corrections for RAC

Database	Deflections	n	Rigorous method			Simplified method		
			μ	σ	CoV	μ	σ	CoV
NAC	all	16	1.085	0.221	0.204	1.169	0.250	0.214
	initial	8	1.194	0.236	0.198	1.308	0.263	0.201
	final	8	0.975	0.148	0.152	1.029	0.143	0.139
RAC50	all	11	1.063	0.272	0.256	1.130	0.259	0.229
	initial	6	1.138	0.336	0.295	1.299	0.299	0.230
	final	5	0.973	0.160	0.164	1.013	0.154	0.152
RAC100	all	15	1.132	0.255	0.225	1.208	0.275	0.228
	initial	8	1.201	0.243	0.202	1.304	0.261	0.2
	final	7	1.053	0.263	0.250	1.098	0.267	0.243
HVFAC	all	4	1.674	0.263	0.157	1.748	0.288	0.165
	initial	2	1.629	0.332	0.204	1.723	0.376	0.218
	final	2	1.719	0.298	0.173	1.774	0.325	0.183

The results for RAC50 and RAC100 beams are now improved, most importantly, the final deflections are now much better predicted. The average values of the a_{calc}/a_{exp} ratio for both initial and final deflections are very similar to NAC for both RAC50 and RAC100 samples. Also seen from the table, is the similarity of the samples according to the simplified method as well as the fact that the simplified method remains 'on the safe side', with consistently conservative predictions compared with the rigorous one; however, its scatter is no worse than for the rigorous method.

In order to verify whether MC10+ now has statistically the same accuracy and precision for NAC and RAC beams, a set of t-tests were carried out on these small samples. The mean a_{calc}/a_{exp} ratios were compared and the following hypotheses were tested:

Null hypothesis H_0: $\mu_{NAC} = \mu_{RAC,i}$
Alternative hypothesis H_1: $\mu_{NAC} \neq \mu_{RAC,i}$
Level of significance: $\alpha = 0.05$

where μ_{NAC} is the mean a_{calc}/a_{exp} ratio for the NAC sample and $\mu_{RAC,i}$ is the mean a_{calc}/a_{exp} ratio for either RAC50 or RAC100. In other words, a two-tailed t-test was carried out to determine whether the difference between the means of RAC samples and the NAC sample are significantly different. The test statistic is the t score which is then compared with a critical t score dependent on the number of degrees of freedom of the samples and the level of significance. If the calculated t score is greater than the critical one, there is a statistically significant difference between the sample means, i.e. the null hypothesis should be rejected.

The t-test can also be reported in terms of the p-value which if smaller than 0.05 suggests the rejection of the null hypothesis. The p-value is the probability of getting a certain difference in means if the null hypothesis is true; e.g. a p-value of 0.03 for a certain difference in mean values means that *if the null hypothesis is true* then there is only a 3% chance of getting such a difference; a the level of significance of 0.05, every p-value below 0.05 means that the null hypothesis should be rejected.

The t-test was carried out comparing rows in Table 5.31: 1 vs. 4 and 7; 2 vs. 5 and 8; and 3 vs. 6 and 9. All of the obtained p-values were greater than 0.05: 0.820 and 0.583; 0.719 and 0.952; and 0.975 and 0.485, for the listed pairs, respectively. Hence, statistically, the MC10+ behaves the same on NAC and RAC beams *with corrected predictions for the modulus of elasticity, shrinkage and creep*. This means that all of the variation between NAC and RAC in Table 5.30 can be explained by the differences on the level of mechanical and time-dependent properties of RAC. Thus, there is no need to correct the modeling of tension stiffening for RAC beams, and the coefficient ζ can be used according to Equation 5.16.

This conclusion is in line with findings by Santana Rangel et al. (2017). In this study the authors tested the tension stiffening behaviour of RAC with 50% coarse aggregate replacement and for two concrete strengths (25 and 65 MPa) and found no effect of RCA presence when compared with a companion NAC of same compressive strength. Combined with their findings, the conclusion that for calculating deflections, tension stiffening can be taken to be the same in RAC as in NAC beams seems plausible: under usual serviceability load levels, steel stresses are such that bond properties of RAC and NAC do not differ significantly.

What is necessary, is further work on adapting MC10 shrinkage and creep models to RAC, not through diagrams as in (Lye et al., 2016a,b,c), but through analytic expressions incorporated directly into the models.

5.4.2.2 Application of the Improved ACI 435R ACI+ Model

Just as the applicability of MC10+ to RAC and HVFAC beams was described in the previous section, the applicability of the 'ACI+' model is tested in this one. The ACI 435R model with corrections proposed in section 5.4.1.2—the ACI+ model—is tested in the same way.

First, the mathematical form of the model is used to test deflection curves of own experimental results – RAC7, RAC28, HVFAC7 and HVFAC28 beams. Unfortunately, the beams tested by Seara-Paz (2015) could not be used here, since values for one parameter were missing – flexural tensile strength of concrete was not tested, only splitting tensile strength. The data for the four own beams are given in Appendix F together with calculated deflection curves. The results are shown in Figure 5.62.

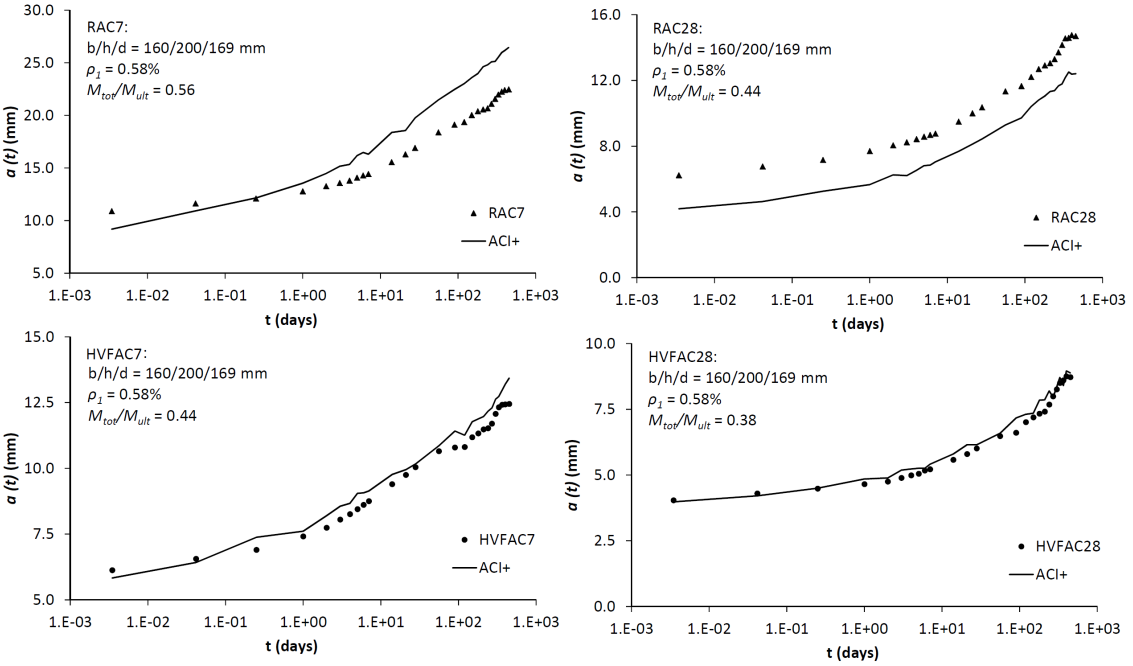


FIGURE 5.62: Assessment of deflection curves for beams from own experimental programme, ACI+

There are some unexpected outcomes of this analysis. The RAC deflections are predicted sufficiently well, taking into account how the model behaved on results from (Gilbert and Nejadi, 2004) shown in section 5.4.1.2. Nothing conclusive can be said about modeling tension stiffening. However, the HVFAC deflection curves are matched almost perfectly by the ACI+ model. The mean a_{calc}/a_{exp} ratio for RAC beams is 0.969 with a CoV of 18.4% (for RAC7 the mean is 1.113 and for RAC28 0.806); for HVFAC beams, the mean a_{calc}/a_{exp} ratio is 1.036 with a CoV of 2.7% (!) (for HVFAC7 the mean is 1.041 and for HVFAC28 1.030). It could of course be argued that these are only two results for HVFAC beams, and too much should not be read into them; nonetheless, they at least suggest that the effective moment of inertia approach, together with experimental values is capable of successfully describing HVFAC deflection curves. The inaccuracy of MC10+, hypothesized to be in connection with an underestimated tension stiffening effect present in HVFAC, disappears in ACI+ perhaps because of the use of the modulus of rupture (flexural tensile strength) instead of axial tensile strength. In fact, the cracking moments predicted by ACI+ are 2.21 and 1.52 times greater compared with MC10+ predictions for HVFAC7 and HVFAC28, respectively. This approach is probably better for concretes with a greater tensions stiffening effect, such as HVFAC.

In the next step, the ACI+ model was tested on the same database of NAC, RAC and HVFAC beams containing own experimental results and results by Knaack and Kurama (2015) and Seara-Paz (2015), as was MC10+, using only compressive strength as input and calculating mechanical properties, shrinkage and creep with code expressions. The input data and calculated deflections are given in Appendix F.

The first important thing to mention is that all of the 58 results in the database were calculated to be cracked beams. This means that the ACI+ model didn't recognize any of the UC and UT series' initial deflections as those of uncracked beams, i.e. the cracking moment is significantly underestimated. This would introduce extremely errors into the database since the deflection of such beams assessed as cracked (when they are in fact uncracked) can be overestimated by up to 300%! Also, there are 11 of such results, i.e. 19% of the total database; this would significantly warp statistical descriptors of the samples and render any meaningful analysis impossible.

But how is it possible that the ACI+ model which uses the modulus of rupture underestimates the cracking moments while MC10+ which uses axial tensile strength does not? The answer is twofold: (1) the modulus of rupture was predicted using the reduction factor (2/3) as recommended by Scanlon and Bischoff (2008) and (2)for calculating M_{cr}, ACI uses the gross section modulus W_c whereas MC10+ uses the transformed section modulus W_i. In the end, in many cases MC10+ ends up predicting a larger cracking moment than ACI+.

If the reduction factor of (2/3) for the modulus of rupture is abandoned, then, ACI would predict 16 beams to be uncracked. Among these 16, only half (8) would be rightly predicted to be uncracked (initial deflection of UC and UT series by Knaack and Kurama (2015)), the other 8 would be final deflections of these beams (which are cracked after 119 days). Looking at it from a design point of view, the use of the reduction factor (2/3) is preferable as it leads to results on the safe side, so it will be retained.

For further statistical analysis, these 11 results were removed from the database, for reasons mentioned above. The prediction of the cracking moment by the model is one aspect of its behaviour and the accuracy and precision of predicting deflections of cracked members is another. Hence, 47 results were retained. The statistical descriptors of the samples for the rigorous and simplified method are given in Table 5.32. For all the sample, a 'box and whiskers' analysis was performed to identify outliers and only one results was eliminated from the RAC100 sample.

TABLE 5.32: Statistical parameters for deflections of RAC, HVFAC and companion NAC beams, ACI+

Database	Deflections	n	Rigorous method			Simplified method		
			μ	σ	CoV	μ	σ	CoV
NAC	all	16	1.302	0.329	0.253	1.192	0.284	0.238
	initial	6	1.436	0.456	0.318	1.307	0.308	0.236
	final	10	1.222	0.213	0.174	1.124	0.260	0.231
RAC50	all	11	1.035	0.281	0.271	0.934	0.250	0.268
	initial	4	1.234	0.352	0.285	1.105	0.302	0.273
	final	7	0.922	0.183	0.198	0.836	0.168	0.201
RAC100	all	15	1.140	0.324	0.284	1.073	0.337	0.314
	initial	6	1.349	0.166	0.123	1.273	0.161	0.126
	final	9	1.000	0.334	0.334	0.940	0.364	0.387
HVFAC	all	4	1.828	0.229	0.125	1.841	0.180	0.098
	initial	2	1.709	0.289	0.169	1.719	0.195	0.113
	final	2	1.948	0.126	0.065	1.963	0.015	0.008

First, a brief discussion on the results for HVFAC beams. In Figure 5.62, using all measured input data, the ACI+ model predicted their deflections excellently. Now, when mechanical and time-dependent properties are calculated from code expressions, the model's performance is very poor. Not forgetting that there are only two HVFAC beams in the database, this results points to the need for correcting code expressions for calculating the modulus of elasticity, modulus of rupture, shrinkage and creep from compressive strength. However, much more experiments on HVFAC specimens and full-scale beams are necessary.

The performance of the ACI+ model on NAC beams is worse than on the database in Table 5.26, of course, because of the many beams loaded very close to cracking load from (Knaack and Kurama, 2015). However, since there are four such beams per sample (NAC, RAC50 and RAC100), the overall effect on the statistical descriptors of the samples should be the same, provided that the model behaves the same for NAC and RAC. Yet, it can be seen that RAC50 and RAC100 samples have lower a_{calc}/a_{exp} ratios, both for initial and final deflections, compared with NAC; the ratios for final deflections are especially important since they are smaller than or equal to 1.0. Also, because most of the beams are loaded close to their cracking load, the correction factor γ (Equation 5.29, for $M_{max}/M_{cr} < 3$) applies in the simplified procedure and leads to somewhat lower values of predictions compared with the rigorous method (as discussed earlier, this is up to 5–10% and is considered acceptable).

Just like when MC10+ was analysed, here also, the difference in the model's performance on RAC beams can be due to: (1) poor predictions of RAC mechanical and time-dependent properties by ACI code expressions and (2) incorrect modeling of tension stiffening for RAC beams. The way to distinguishing between these two causes is to eliminate them one by one. The same approach is taken for ACI+ as was for MC10+ – first, cause (1) is dealt with by correcting prediction models for the modulus of elasticity, shrinkage and creep. Again, the studies (Lye et al., 2016a,b,c) and the diagrams they produced, were used. The detailed description of the studies was given in the previous section.

In order to re-scale the diagrams in (Lye et al., 2016a,b,c) from Eurocode 2 to ACI, the same procedure was used as in section 5.4.2.1. First, the property (E_{cm}, shrinkage or creep) is calculated according to Eurocode 2. Then, the correction factor for Eurocode 2, c_{EC2} is determined using the diagrams in (Lye et al., 2016a,b,c) (importing them into AutoCAD, scaling and reading precise values). Then, the same property is calculated according to ACI and the correction factor for ACI, c_{ACI} is calculated as

$$c_{ACI} = c_{EC2} \cdot \frac{\phi_{EC2}}{\phi_{ACI}} \tag{5.34}$$

where ϕ is interchangeable with ε_{cs} or E_{cm}. All the data calculated this way, as well as corrected deflections of RAC beams are given in Appendix F. The correction factor for the modulus of elasticity was in the range of 0.89–0.97, for shrinkage strain in the range of 1.03–1.43 and for creep coefficient in the range of 1.23–2.35.

The statistical descriptors of the new data sets are given in Table 5.33. The results for NAC and HVFAC are unchanged but repeated for clarity.

The results for RAC50 and RAC100 samples are now better, all above one, and close to the values for NAC, although all samples still have relatively large CoVs. As in the case of MC10+, a set of *t*-tests was carried out to determine whether there are statistically

TABLE 5.33: Statistical parameters for deflections of RAC, HVFAC and companion NAC beams, ACI+ with corrections for RAC

Database	Deflections	n	Rigorous method			Simplified method		
			μ	σ	CoV	μ	σ	CoV
NAC	all	16	1.302	0.329	0.253	1.192	0.284	0.238
	initial	6	1.436	0.456	0.318	1.307	0.308	0.236
	final	10	1.222	0.213	0.174	1.124	0.260	0.231
RAC50	all	11	1.204	0.281	0.233	1.084	0.255	0.235
	initial	4	1.255	0.350	0.279	1.123	0.301	0.268
	final	7	1.174	0.259	0.221	1.062	0.248	0.234
RAC100	all	13	1.304	0.308	0.236	1.202	0.303	0.252
	initial	6	1.389	0.169	0.122	1.306	0.161	0.123
	final	7	1.231	0.390	0.317	1.114	0.377	0.338
HVFAC	all	4	1.828	0.229	0.125	1.841	0.180	0.098
	initial	2	1.709	0.289	0.169	1.719	0.195	0.113
	final	2	1.948	0.126	0.065	1.963	0.015	0.008

significant differences between corresponding samples in Table 5.33. The mean a_{calc}/a_{exp} ratios were compared and the following hypotheses were tested:

Null hypothesis H_0: $\mu_{NAC} = \mu_{RAC,i}$
Alternative hypothesis H_1: $\mu_{NAC} \neq \mu_{RAC,i}$
Level of significance: $\alpha = 0.05$

where μ_{NAC} is the mean a_{calc}/a_{exp} ratio for the NAC sample and $\mu_{RAC,i}$ is the mean a_{calc}/a_{exp} ratio for either RAC50 or RAC100. The results of the t-test are reported in terms of the p-value which if smaller than 0.05 suggests the rejection of the null hypothesis. The t-test was carried out comparing rows in Table 5.33: 1 vs. 4 and 7; 2 vs. 5 and 8; and 3 vs. 6 and 9. All of the obtained p-values were greater than 0.05: 0.427 and 0.986; 0.524 and 0.820; and 0.686 and 0.950, for the listed pairs, respectively.

Hence, statistically, the ACI+ behaves the same on NAC and RAC beams *with corrected predictions for the modulus of elasticity, shrinkage and creep*. This means that all of the variation between NAC and RAC in Table 5.32 can be explained by the differences on the level of mechanical and time-dependent properties of RAC. Thus, there is no need to correct the modeling of tension stiffening for RAC beams, but there is a need for modifying code expressions for the modulus of elasticity, shrinkage and creep.

5.5 Summary

In this Chapter, analyses of experimental results and existing shrinkage, creep and deflection prediction models were presented.

In section 5.2, mechanical properties obtained in the experimental programme were analysed. Experimentally measured compressive strength, tensile strength and modulus of elasticity were compared with code predictions by Eurocode 2 and ACI 318. These analyses established how well can these mechanical properties and their time evolution be predicted using code expressions.

The analysis showed that compressive strength and its time evolution for all three concrete mixtures (NAC, RAC and HVFAC) can be successfully predicted using both EC2 and ACI 318. However, other corrections for HVFAC proposed by Chen et al. (2017) are not applicable to HVFAC cured for only one day.

The modulus of elasticity could also be sufficiently well predicted for all three mixtures by EC2 and ACI318. The measured value for RAC after 28 days, $E_{cm,RAC}$, was determined to probably be an upper bound value, i.e. this measurement obtained from only one cylinder probably overestimated the true value of the modulus of elasticity at that time.

Splitting tensile strength could be predicted well for NAC and RAC by EC2 but not for HVFAC, whereas the modulus of rupture predictions by ACI 318 underestimated the measured flexural tensile strength for all three mixtures.

In section 5.3, shrinkage and creep results were analysed using existing prediction models B4, MC10, EC2, ACI 209R and GL2000. Calculated shrinkage and creep compliance curves were fitted to experimental data by varying model parameters in order to verify the mathematical form of each model and its capacity to describe the time evolution of shrinkage and creep of the NAC, RAC and HVFAC mixtures. This was done only to show the capabilities of each model and their applicability to RAC and HVFAC – the calibrated versions of the models were not used in further analysis. Further research and work is needed to globally calibrate and correct creep and shrinkage models on databases of RAC and HVFAC results.

In this study, for shrinkage, MC10 was found to be the most versatile model, fitting measured data very well after calibration. MC10 was followed by model B4 which only had problems describing the evolution of shrinkage of HVFAC because of the necessary input of a very high *w/c* ratio. The remaining models could not perform as well as these too.

For creep, again MC10 and B4 behaved similarly well with full capability of fitting experimental results of RAC and HVFAC, loaded after 7 and 28 days. The other models could not perform as well as MC10 and B4.

In the last section of this Chapter, section 5.4, existing models for calculating deflections (the MC10 and ACI 435R) were analysed and applied to own and already existing experimental results. First, both models were analysed on a comprehensive database of NAC beams and their accuracy and precision were tested. Through such an analysis, corrections were proposed in order to improve the performances of both models.

After this, the applicability of such corrected models (labeled as MC10+ and ACI+) on RAC and HVFAC beams was assessed. A new database was compiled, containing results on RAC, HVFAC and companion NAC beams. Analyses demonstrated that MC10+ can be used to predict deflections of RAC beams *if* corrections are applied when calculating the RAC modulus of elasticity, shrinkage and creep. In this study, such corrections were based on previously published results in literature, but more work is needed on a comprehensive analytic correction of MC10 and ACI models for the shrinkage and creep. With the corrections applied herein, both models possessed the same accuracy and precision for RAC beams as for NAC beams.

The available results for HVFAC, in the case of model MC10+ point to both a need to correct code expressions predicting mechanical and time-dependent properties *and* the need to correct the modeling of tension stiffening. In the case of the ACI+ model, the results suggest that only a correction of code expressions for mechanical and time-dependent properties is necessary.

Overall, this thesis provides easy-to-use corrections to existing models for calculating deflections, improving their observed deficiencies. Based on a database of 26 experimental results for RAC beams, this thesis has shown that existing models can be applied to them with no changes in the expressions concerning deflections, but with necessary changes in expressions predicting mechanical and time-dependent properties; the direction for further research is pointed out, in the field of analytic adaptations of shrinkage and creep models for RAC. For HVFAC beams, this thesis has provided first-ever results of the behaviour of such reinforced beams under sustained load. The analysis of own results from two HVFAC beams has revealed the need for a more comprehensive change of the models for calculating deflections – both tension stiffening and the modeling of shrinkage and creep need to be corrected. This insight provides guidance for further research which should enlarge the database of experimental results on HVFAC and reinforced HVFAC members.

Chapter 6

Conclusions

6.1 Conclusions from this Research

The research done within the scope of this thesis was motivated by the desire to promote the use of sustainable alternatives to traditional cement concrete in the form of RAC and HVFAC. In particular, the thesis addressed the problem of serviceability of reinforced members made from these concretes, specifically deflections of reinforced concrete beams. The increasing importance of serviceability criteria in design and the lack of experimental results on RAC and HVFAC in this field were the motivating factors for choosing this topic.

The experimental investigation carried out at the University of Belgrade's Faculty of Civil Engineering and described herein had the aim of shedding new light on the phenomenon of long-term deflections of reinforced RAC and HVFAC beams under sustained loads and formulating practical design procedures for the serviceability limit state of deflections for such members. Before the experiment could be conceptualized and carried out, extensive literature had to be reviewed in order to identify knowledge gaps in the state-of-art of the field. Through this work and all that was described in previous chapters, the following conclusions can be drawn in several areas.

From a comprehensive review of current knowledge on shrinkage, creep and deflections of reinforced concrete structures, as well as on the special features of these properties in RAC and HVFAC, the following conclusions are drawn:

1. The understanding of the phenomena of shrinkage and creep of concrete has reached considerable depth: both processes are now understood at the level of chemical and nano-mechanical changes in concrete's structure. However, the design practice of structural engineering has not kept pace with these developments. Most models for calculating shrinkage and creep of concrete are empirical and based on proxy variables as input parameters (e.g. compressive strength);

2. Deflections of reinforced concrete members are a serviceability limit state that has become increasingly important over the last several decades as stronger concretes have been developed for which the ultimate limit state is less and less critical. Deflections of reinforced concrete members depend on many parameters – material properties of concrete and steel, shrinkage and creep, geometric properties and reinforcement ratios of the member, loading and environmental conditions, etc. Together with cracking, all of this makes the calculation of deflections of reinforced concrete members a very complex task;

3. Shrinkage and creep of RAC are generally found to be greater than that of a companion NAC produced with the same *w/c* ratio. This relative increase depends on many factors, among them the compressive strength of RAC and the quality and content of RCA. In the broadest terms, the increase in both shrinkage and creep of RAC with 100% coarse RCA and a compressive strength 30–40 MPa can be up to 40% compared with companion NAC. For HVFAC, existing research and reviews suggest that HVFAC with an identical compressive strength to a companion NAC will display smaller shrinkage and creep strains;

4. Studies of the behaviour of reinforced RAC and HVFAC members under sustained loads are very scarce. Only six experimental campaigns were identified for RAC beams and none for HVFAC. The studies have found a general trend of greater deflections and greater increases of deflections over time for RAC beams compared with companion NAC beams.

Based on the experimental programme described in this thesis and its results, the following conclusions are drawn:

5. Out of the three concrete mixtures produced in this experiment—NAC, RAC and HVFAC—NAC and RAC had very similar mechanical properties: 28-day compressive strengths of 30.5 and 28.1 MPa, respectively; 28-day moduli of elasticity of 32.2 and 30.8 GPa, respectively; and a 28-day splitting tensile strength of 2.4 and 2.5 MPa, respectively. HVFAC on the other hand had a 28-day compressive strength of 22.6 MPa, a 28-day modulus of elasticity of 28.7 GPa and a 28-day splitting tensile strength of 2.1 MPa. The reason for the lower compressive strength of HVFAC lies in the curing regime consisting of only one day of wet curing;
6. After 477 days, the shrinkage strain was 0.645‰ for NAC 0.782‰ for RAC and 0.597‰ for HVFAC. The shrinkage of RAC was 22% greater and of HVFAC 8% smaller than that of NAC. The experimental creep coefficient was 2.395 and 2.480 for RAC loaded after 7 and 28 days, respectively; and 1.634 and 1.554 for HVFAC loaded after 7 and 28 days, respectively. There is practically no difference in the creep coefficient of specimens loaded after 7 and after 28 days even though specimens loaded after 7 days were loaded to a stress–to–strength at loading age ratio of 0.60 and those loaded after 28 days to a ratio of 0.45;
7. The normalized increase in deflections after 450 days was in the range of 2.03–2.36 for all six tested beams. This narrow range of results is caused by the relatively large load level (M_{tot}/M_{ult}) applied to the beams (0.38–0.56) which caused a significant extent of cracking and decreased the influence of shrinkage and creep on deflections through the smaller compressed zone in the members;

Based on the analyses performed on own and existing results from literature, concerning shrinkage and creep of RAC and HVFAC as well as deflections of reinforced RAC and HVFAC beams, the following conclusions are drawn:

8. Own experimental results in the form of measured mechanical properties of NAC, RAC and HVFAC (compressive and tensile strength and the modulus of elasticity) and their time evolution can be successfully described by code expressions in

EC2 and ACI 318. For predicting the RAC modulus of elasticity from compressive strength using the EC2 expression, a correction coefficient of 0.9 is necessary. Specific expression proposed by some researchers for HVFAC are not applicable in cases where the curing regime differs significantly from 28 days of wet curing;

9. Experimental shrinkage curves of NAC, RAC and HVFAC are best described by fitting models B4, MC10 and ACI 209R. Models EC2 and GL2000 show poorer performance. Model B4 is not successfully applicable to HVFAC when fly ash is not taken into account in determining *w/c*. Experimental creep compliance curves of RAC and HVFAC loaded after 7 and 28 days are best described by fitting models B4 and MC10. Models EC2, ACI 209R and GL2000 show poorer performance;

10. An analysis of the MC10 model for calculating deflections (the rigorous method of numerical integration of curvatures) on individual deflection curves and a large database of 140 results on NAC beams revealed the influence of the load level and reinforcement ratio on the accuracy and precision of the model. A correction was proposed by introducing an analytical expression for the β coefficient as well as for the exponent α used in calculating the distribution coefficient ζ. With these corrections, excellent accuracy and precision of the model were achieved. The simplified procedure for calculating deflections according to MC10 was compared with the rigorous approach and combinations of parameters in which it significantly overestimated deflections were identified. A simple correction coefficient was proposed that leads to very similar accuracy and precision of the rigorous and simplified MC10 methods;

11. An analysis of the ACI 435R model for calculating deflections (the rigorous method of numerical integration of curvatures) was also carried out on individual deflection curves and a large database of 140 results. The analysis revealed a need for introducing an upper bound to the effective moment of inertia calculated by the method, in the range of low reinforcement ratios. With this correction, the model's performance improved. The simplified version of the ACI 435R method was compared with the rigorous approach and a simple correction coefficient was introduced to correct for the significant overestimation that the simplified procedure displayed at lower load levels;

12. Based on a database of 16 results on NAC beams and 26 results on RAC beams from three experimental programmes (own and two previously published), the corrected MC10 model shows a greater variability on RAC beams compared with companion NAC beams. Previously published recommendations for the correction of Eurocode 2 predictions of the modulus of elasticity, shrinkage and creep were transformed into corrections for MC10. Using them, the corrected MC10 model for deflections shows no statistically significant difference in performance on RAC beams, compared with companion NAC beams. This means that all of the variance was in the code expressions for mechanical and time-dependent properties;

13. The corrected MC10 model was tested on own experimental results on HVFAC beams (only ones available) and, when all measured input data is used, the model significantly overestimates deflections (on average ca. 40%). This points to the need for correction the way in which tension stiffening is taken into account, possibly through a reduction of the distribution coefficient ζ. Unfortunately, only two values are not sufficient for determining this coefficient. When deflections are calculated using input data predicted from compressive strength using code expressions, the overestimation increases further. This means that these code expressions must be corrected as well;

14. Based on a database of 16 results on NAC beams and 26 results on RAC beams from three experimental programmes (own and two previously published), the corrected ACI 435R model also shows a greater variability on RAC beams compared with companion NAC beams. Previously published recommendations for the correction of Eurocode 2 predictions of the modulus of elasticity, shrinkage and creep were transformed into corrections for ACI 435R. Using them, the corrected ACI 435R model for deflections showed no statistically significant difference in performance on RAC beams, compared with companion NAC beams. This means that all of the variance was in the code expressions for mechanical and time-dependent properties;

15. The corrected ACI 435R model was also tested on own experimental results on HVFAC beams and, when all measured input data is used, the model estimates deflection excellently. This means that there is potentially no need to correct the expression for the effective moment of inertia. However, when deflections are calculated using input data predicted from compressive strength using code expressions, the

calculated values grossly overestimate experimental values. This means that these code expressions must be corrected as well.

6.2 Recommendations for Further Research

Usually, when an experiment is designed, at that time it can seem to the researcher that his ideas are 'air-tight' and it is easy to overlook things that could go wrong. This is what Richard Feynman famously warned about when he said 'The first principle is that you must not fool yourself – and you are the easiest person to fool.'

Only when the results of the experiment start coming in and are analysed, does the researcher realize in what ways could the experiment have been better or could have provided material for better conclusions. However, this is an illusion. Had the experiment been different, the problems to which it would have given rise would only have been different, not non-existent. So is the case with the experiment in this thesis.

Only after analysing the results, did the author of this thesis realize in which ways he could have done things differently. But this is good thing as it points to new unanswered questions in the field and provides a basis for future research and a continuation of work.

The results of this thesis allow the for the formulation of the following recommendations for future research:

- More experimental and theoretical work is needed on shrinkage and creep of RAC and HVFAC. For RAC, what is needed is the formulation of analytical expressions for shrinkage and creep which can be incorporated into existing prediction models. For HVFAC, first of all, much more experimental results are needed before any analytical expressions and code corrections can be proposed. What needs to be taken special care of in the case of HVFAC, are the curing conditions which profoundly influence the development of mechanical properties;
- Many more experiments are needed on RAC and HVFAC beams under sustained loads. In the case of RAC beams, these tests must incorporate different load levels and different reinforcement ratios and varying ambient and curing conditions. After

this, statically indeterminate beams should be tested. For HVFAC beams, beside the same tests described for RAC, additional studies on tension stiffening must be carried out in the form of tensile creep tests and axial tension tests on reinforced HVFAC ties.

Appendix A

Experimental Measurements

Experimental Measurements:

Density, Compressive Strength, Tensile Strength

NAC	**CASTING DATE**		**25-01-16**			**DEMOULDING DATE**		**26-01-16**				
	Cast sign	**Type**	**Base (mm)**	**Height (mm)**	**Volume (m^3)**	**Cast weight (g)**	**Specimen sign**	**Weight with specimen (g)**	**Weight with sample before demoulding (g)**	**Specimen after demoulding (g)**	**γ_{fresh} (kg/m^3)**	**$\gamma_{hard,1}$ (kg/m^3)**
1	C1	cube	100x100	100	0.001	3401	NAC 1	5814	5807	2389	2413	2389
2	C2	cube	100x100	100	0.001	3404	NAC 2	5855	5844	2398	2451	2398
3	C3	cube	100x100	100	0.001	3354	NAC 3	5887	5880	2452	2533	2452
4	C4	cube	100x100	100	0.001	3432	NAC 4	5921	5908	2427	2489	2427
5	C5	cube	100x100	100	0.001	3419	NAC 5	5880	5875	2421	2461	2421
6	C6	cube	100x100	100	0.001	3386	NAC 6	5877	5866	2426	2491	2426
7	C7	cube	100x100	100	0.001	3399	NAC 7	5836	5831	2412	2437	2412
8	C8	cube	100x100	100	0.001	3383	NAC 8	5851	5847	2425	2468	2425
9	C9	cube	100x100	100	0.001	3445	NAC 9	5844	5834	2381	2399	2381
10	C10	cube	100x100	100	0.001	3418	NAC 10	5814	5805	2380	2396	2380
11	C11	cube	100x100	100	0.001	3359	NAC 11	5747	5738	2369	2388	2369
12	C12	cube	100x100	100	0.001	3417	NAC 12	5828	5822	2391	2411	2391
13	C13	cube	100x100	100	0.001	3414	NAC 13	5929	5906	2433	2515	2433
14	C14	cube	100x100	100	0.001	3418	NAC 14	5782	5778	2353	2364	2353
15	C15	cube	100x100	100	0.001	3391	NAC 15	5789	5786	2383	2398	2383
16	C16	cube	100x100	100	0.001	4801	NAC 16	7185	7180	2364	2384	2364
17	C17	cube	100x100	100	0.001	4707	NAC 17	7050	7045	2332	2343	2332
18	C18	cube	100x100	100	0.001	4516	NAC 18	7185	7180	2355	2669	2355
19	C19	cube	100x100	100	0.003	18485	NAC 19	25880	25845	2394	2465	2394
20	C20	cube	100x100	100			NAC 20			2442		2442
21	C21	cube	100x100	100			NAC 21			2415		2415
22	LC1	cylinder	Ø150	300	0.0053	15320	NAC 1	27980	27955	12530	2388	2364
23	LC2	cylinder	Ø150	300	0.0053	15240	NAC 2	27940	27930	12615	2396	2380
24	LC3	cylinder	Ø150	300	0.0053	15295	NAC 3	27985	27970	12535	2394	2364
25	SC1	cylinder	Ø150	150	0.0027	6237	NAC 1	12705	12690	6369	2440	2403
26	SC2	cylinder	Ø150	150	0.0027	6408	NAC 2	12775	12765	6297	2402	2376
27	SC3	cylinder	Ø150	150	0.0027	6434	NAC 3	12810	12790	6299	2405	2376
28	SC4	cylinder	Ø150	150	0.0027	6524	NAC 4	12830	12800	6232	2379	2351
29	SC5	cylinder	Ø150	150	0.0027	6446	NAC 5	12745	12705	6216	2376	2345
30	SC6	cylinder	Ø150	150	0.0027	6403	NAC 6	12730	12755	6298	2387	2376
31	P1	prism	120x120	360	0.0052	18835	NAC 1	31030	30980	12090	2352	2332
32	P2	prism	120x120	360	0.0052	19315	NAC 2	31260	31205	11825	2304	2281
33	P3	prism	120x120	360	0.0052	21365	NAC 3	33845	33815	12385	2407	2389
34	P4	prism	120x120	360	0.0052	21015	NAC 4	33665	33585	12460	2440	2404
35	P5	prism	120x120	360	0.0052	21025	NAC 5	33480	33430	12340	2403	2380
36	P6	prism	120x120	360	0.0052	20845	NAC 6	33410	33370	12345	2424	2381
37	P7	prism	120x120	360	0.0052	20880	NAC 7	33250	33205	12210	2386	2355
38	P8	prism	120x120	360	0.0052	21460	NAC 8	33960	33985	12255	2411	2364
39	P9	prism	120x120	360	0.0052	20910	NAC 9	33180	33160	12140	2367	2342
40	P10	prism	120x120	360	0.0052	22660	NAC 10	36120	36100	13030	2596	2514
41	P11	prism	120x120	360	0.0052	21025	NAC 11	33710	33635	12475	2447	2406
42	P12	prism	120x120	360	0.0052	20690	NAC 12	33160	33120	12270	2405	2367
43	P13	prism	120x120	360	0.0052	21190	NAC 13	33790	33730	12450	2431	2402
44	P14	prism	120x120	360	0.0052	21130	NAC 14	33665	33695	12445	2418	2401
45	P15	prism	120x120	360	0.0052	22990	NAC 15	35660	35720	12610	2444	2432

NAC

COMPRESSIVE STRENGTH						
		P (kN)	***f_c (kN/cm^2)***	***AVG***	***DATE***	***m (g)***
7	*NAC15*	*335*	*3.35*	*3.29*	*01-02-16*	*2338*
	NAC11	*331*	*3.31*			*2319*
	NAC19	*320*	*3.2*			*2344*
28	*NAC21*	*430*	*4.3*	*4.07*	*22-02-16*	*2356*
	NAC18	*400*	*4.0*			*2295*
	NAC8	*392*	*3.92*			*2368*
90	*NAC9*	*385*	*3.85*	*4.07*	*24-04-16*	*2309*
	NAC16	*405*	*4.05*			*2304*
	NAC17	*432*	*4.32*			*2268*
240	*NAC5*	*460*	*4.6*	*4.52*	*21-09-16*	*2356*
	NAC6	*435*	*4.35*			*2358*
	NAC7	*460*	*4.6*			*2348*
450	*NAC4*	*432*	*4.32*	*4.38*	*19-04-17*	*n/a*
	NAC10	*433*	*4.33*			*n/a*
	NAC20	*448*	*4.48*			*n/a*

SPLITTING TENSILE STRENGTH						
		P (kN)	***f_t^{sp} (kN/cm^2)***	***AVG***	***DATE***	***m (g)***
7	*NAC4*	*80*	*0.23*	*0.20*	*01-02-16*	*6131*
	NAC2	*51*	*0.14*			*6214*
	NAC3	*80*	*0.23*			*6214*
28	*NAC1*	*74*	*0.21*	*0.24*	*22-02-16*	*6253*
	NAC5	*97*	*0.27*			*6120*
	NAC6	*84*	*0.24*			*6195*

FLEXURAL TENSILE STRENGTH						
		P (kN)	***f_t^{fl} (kN/cm^2)***	***AVG***	***DATE***	***m (g)***
7	*NAC13*	*16*	*0.50*	*0.56*	*01-02-16*	*12280*
	NAC14	*19*	*0.59*			*12260*
	NAC15	*19*	*0.59*			*12415*
28	*NAC9*	*22*	*0.69*	*0.67*	*22-02-16*	*11895*
	NAC5	*21*	*0.66*			*12090*
	NAC11	*21*	*0.66*			*12250*

RAC	CASTING DATE		02-02-16			DEMOULDING DATE		03-02-16				
	Cast sign	Type	Base (mm)	Height (mm)	Volume (m^3)	Cast weight (g)	Specimen sign	Weight with specimen (g)	Weight with sample before demoulding (g)	Specimen after demoulding (g)	γ_{fresh} (kg/m^3)	$\gamma_{hard,1}$ (kg/m^3)
1	C1	cube	100x100	100	0.001	3445	R1	5753	5742	2292	2308	2292
2	C2	cube	100x100	100	0.001	3423	R2	5756	5741	2311	2333	2311
3	C3	cube	100x100	100	0.001	3401	R3	5737	5727	2317	2336	2317
4	C4	cube	100x100	100	0.001	3405	R4	5754	5744	2329	2349	2329
5	C5	cube	100x100	100	0.001	4801	R5	7115	7095	2287	2314	2287
6	C6	cube	100x100	100	0.001	3416	R6	5780	5767	2328	2364	2328
7	C7	cube	100x100	100	0.001	3388	R7	5728	5711	2317	2340	2317
8	C8	cube	100x100	100	0.001	3423	R8	5759	5735	2301	2336	2301
9	C9	cube	100x100	100	0.001	3384	R9	5752	5743	2342	2368	2342
10	C10	cube	100x100	100	0.001	3402	R10	5773	5749	2326	2371	2326
11	C11	cube	100x100	100	0.001	3364	R11	5706	5690	2313	2342	2313
12	C12	cube	100x100	100	0.001	3347	R12	5692	5685	2332	2345	2332
13	C13	cube	100x100	100	0.001	3412	R13	5752	5735	2317	2340	2317
14	C14	cube	100x100	100	0.001	3422	R14	5720	5713	2290	2298	2290
15	C15	cube	100x100	100	0.001	3392	R15	5777	5768	2362	2385	2362
16	C16	cube	100x100	100	0.001	3429	R16	5765	5756	2317	2336	2317
17	C17	cube	100x100	100	0.001	4709	R17	7015	7000	2289	2306	2289
18	C18	cube	100x100	100	0.001	4821	R18	7095	7080	2255	2274	2255
19	C19	cube	100x100	100	0.003	18495	R19	25515	25485	2320	2340	2320
20	C20	cube	100x100	100			R20			2301		2301
21	C21	cube	100x100	100			R21			2325		2325
22	LC1	cylinder	Ø150	300	0.0053	15330	R1	27560	27520	12155	2307	2293
23	LC2	cylinder	Ø150	300	0.0053	15250	R2	27585	27535	12220	2327	2305
24	LC3	cylinder	Ø150	300	0.0053	15320	R3	27630	27565	12180	2322	2297
25	SC1	cylinder	Ø150	150	0.0027	6243	R1	12520	12305	6038	2368	2278
26	SC2	cylinder	Ø150	150	0.0027	6427	R2	12555	12500	6030	2312	2275
27	SC3	cylinder	Ø150	150	0.0027	6454	R3	12510	12495	6028	2285	2274
28	SC4	cylinder	Ø150	150	0.0027	6544	R4	12605	12595	6042	2287	2279
29	SC5	cylinder	Ø150	150	0.0027	6463	R5	12335	12505	6032	2215	2276
30	SC6	cylinder	Ø150	150	0.0027	6409	R6	12555	12535	6101	2319	2302
31	P1	prism	120x120	360	0.0052	18830	R1	30910	30835	11915	2330	2298
32	P2	prism	120x120	360	0.0052	19320	R2	31420	31340	11945	2334	2304
33	P3	prism	120x120	360	0.0052	20880	R3	33120	34560	12095	2361	2333
34	P4	prism	120x120	360	0.0052	21000	R4	33390	33010	11960	2390	2307
35	P5	prism	120x120	360	0.0052	21015	R5	33410	33325	12180	2391	2350
36	P6	prism	120x120	360	0.0052	21220	R6	33050	32985	12020	2282	2319
37	P7	prism	120x120	360	0.0052	21130	R7	33285	33230	12025	2345	2320
38	P8	prism	120x120	360	0.0052	23010	R8	35220	35160	12035	2355	2322
39	P9	prism	120x120	360	0.0052	21345	R9	33485	33420	11910	2342	2297
40	P10	prism	120x120	360	0.0052	22655	R10	34880	33230	12015	2358	2318
41	P11	prism	120x120	360	0.0052	21065	R11	33300	33065	12105	2360	2335
42	P12	prism	120x120	360	0.0052	21055	R12	33175	33130	11990	2338	2313
43	P13	prism	120x120	360	0.0052	21045	R13	33455	33375	12165	2394	2347
44	P14	prism	120x120	360	0.0052	20680	R14	33070	33000	12210	2390	2355
45	P15	prism	120x120	360	0.0052	20945	R15	33225	33110	12100	2369	2334

RAC

COMPRESSIVE STRENGTH						
		P (kN)	**f_c (kN/cm^2)**	**AVG**	**DATE**	**m (g)**
7	R16	333	3.33	3.22	09-02-16	2266
	R9	313	3.13			2287
	R6	319	3.19			2280
28	R2	395	3.95	3.74	01-03-16	2250
	R12	360	3.6			2219
	R8	368	3.68			2246
90	R1	388	3.88	3.88	02-05-16	2213
	R11	388	3.88			2238
	R14	388	3.88			2209
240	R3	405	4.05	3.92	29-09-16	2243
	R7	410	4.1			2244
	R17	360	3.6			2257
450	RAC1 C	480	4.80	4.38	27-04-17	n/a
	RAC2 C	415	4.15			n/a
	RAC3 C	419	4.19			n/a

SPLITTING TENSILE STRENGTH						
		P (kN)	**f_t^{sp} (kN/cm^2)**	**AVG**	**DATE**	**m (g)**
7	R1	74	0.21	0.20	09-02-16	5944
	R2	58	0.16			5928
	R6	77	0.22			5984
28	R4	67	0.19	0.25	01-03-16	5896
	R5	103	0.29			5885
	R6	90	0.25			5875

FLEXURAL TENSILE STRENGTH						
		P (kN)	**f_t^{fl} (kN/cm^2)**	**AVG**	**DATE**	**m (g)**
7	R14	17	0.53	0.54	09-02-16	11980
	R10	17	0.53			11780
	R9	18	0.56			11755
28	R8	20	0.63	0.64	01-03-16	11750
	R15	19	0.59			11825
	R3	22	0.69			11790

HVFAC	**CASTING DATE**		**10-02-16**			**DEMOULDING DATE**		**11-02-16**				
	Cast sign	**Type**	**Base (mm)**	**Height (mm)**	**Volume (m^3)**	**Cast weight (g)**	**Specimen sign**	**Weight with specimen (g)**	**Weight with sample before demoulding (g)**	**Specimen after demoulding (g)**	**γ_{fresh} (kg/m^3)**	**$\gamma_{hard,1}$ (kg/m^3)**
1	*C1*	*cube*	*100x100*	*100*	*0.001*	*3367*	*FA1*	*5666*	*5662*	*2288*	*2299*	*2288*
2	*C2*	*cube*	*100x100*	*100*	*0.001*	*3422*	*FA2*	*5740*	*5734*	*2298*	*2318*	*2298*
3	*C3*	*cube*	*100x100*	*100*	*0.001*	*4708*	*FA3*	*6952*	*6947*	*2232*	*2244*	*2232*
4	*C4*	*cube*	*100x100*	*100*	*0.001*	*3383*	*FA4*	*5691*	*5690*	*2299*	*2308*	*2299*
5	*C5*	*cube*	*100x100*	*100*	*0.001*	*3411*	*FA5*	*5737*	*5725*	*2299*	*2326*	*2299*
6	*C6*	*cube*	*100x100*	*100*	*0.001*	*3406*	*FA6*	*5707*	*5698*	*2286*	*2301*	*2286*
7	*C7*	*cube*	*100x100*	*100*	*0.001*	*3428*	*FA7*	*5735*	*5732*	*2299*	*2307*	*2299*
8	*C8*	*cube*	*100x100*	*100*	*0.001*	*3401*	*FA8*	*5675*	*5662*	*2254*	*2274*	*2254*
9	*C9*	*cube*	*100x100*	*100*	*0.001*	*3350*	*FA9*	*5676*	*5673*	*2318*	*2326*	*2318*
10	*C10*	*cube*	*100x100*	*100*	*0.001*	*4800*	*FA10*	*7055*	*7045*	*2237*	*2255*	*2237*
11	*C11*	*cube*	*100x100*	*100*	*0.001*	*3414*	*FA11*	*5694*	*5688*	*2269*	*2280*	*2269*
12	*C12*	*cube*	*100x100*	*100*	*0.001*	*4822*	*FA12*	*7075*	*7070*	*2244*	*2253*	*2244*
13	*C13*	*cube*	*100x100*	*100*	*0.001*	*3423*	*FA13*	*5694*	*5688*	*2254*	*2271*	*2254*
14	*C14*	*cube*	*100x100*	*100*	*0.001*	*3396*	*FA14*	*5744*	*5740*	*2336*	*2348*	*2336*
15	*C15*	*cube*	*100x100*	*100*	*0.001*	*3423*	*FA15*	*5730*	*5727*	*2299*	*2307*	*2299*
16	*C16*	*cube*	*100x100*	*100*	*0.001*	*3445*	*FA16*	*5738*	*5734*	*2283*	*2293*	*2283*
17	*C17*	*cube*	*100x100*	*100*	*0.001*	*3388*	*FA17*	*5659*	*5651*	*2258*	*2271*	*2258*
18	*C18*	*cube*	*100x100*	*100*	*0.001*	*3392*	*FA18*	*5680*	*5664*	*2266*	*2288*	*2266*
19	*C19*	*cube*	*100x100*	*100*	*0.003*	*18495*	*FA19*	*25410*	*25395*	*2284*	*2305*	*2284*
20	*C20*	*cube*	*100x100*	*100*			*FA20*			*2285*		*2285*
21	*C21*	*cube*	*100x100*	*100*			*FA21*			*2304*		*2304*
22	*LC1*	*cylinder*	*Ø150*	*300*	*0.0053*	*15220*	*FA1*	*27320*	*27290*	*12045*	*2282*	*2272*
23	*LC2*	*cylinder*	*Ø150*	*300*	*0.0053*	*15295*	*FA2*	*27515*	*27485*	*12140*	*2305*	*2290*
24	*LC3*	*cylinder*	*Ø150*	*300*	*0.0053*	*15320*	*FA3*	*27510*	*27450*	*12090*	*2299*	*2281*
25	*SC1*	*cylinder*	*Ø150*	*150*	*0.0027*	*6502*	*FA1*	*12575*	*12555*	*6027*	*2291*	*2274*
26	*SC2*	*cylinder*	*Ø150*	*150*	*0.0027*	*6396*	*FA2*	*12470*	*12460*	*6045*	*2291*	*2281*
27	*SC3*	*cylinder*	*Ø150*	*150*	*0.0027*	*6238*	*FA3*	*12325*	*12320*	*6068*	*2296*	*2289*
28	*SC4*	*cylinder*	*Ø150*	*150*	*0.0027*	*6407*	*FA4*	*12565*	*12520*	*6056*	*2323*	*2285*
29	*SC5*	*cylinder*	*Ø150*	*150*	*0.0027*	*6438*	*FA5*	*12505*	*12490*	*6038*	*2289*	*2278*
30	*SC6*	*cylinder*	*Ø150*	*150*	*0.0027*	*6532*	*FA6*	*12575*	*12555*	*6010*	*2280*	*2267*
31	*P1*	*prism*	*120x120*	*360*	*0.0052*	*23010*	*FA1*	*35000*	*35000*	*11990*	*2313*	*2313*
32	*P2*	*prism*	*120x120*	*360*	*0.0052*	*18835*	*FA2*	*30575*	*30575*	*11710*	*2265*	*2259*
33	*P3*	*prism*	*120x120*	*360*	*0.0052*	*19315*	*FA3*	*30935*	*30935*	*11615*	*2242*	*2241*
34	*P4*	*prism*	*120x120*	*360*	*0.0052*	*22655*	*FA4*	*35000*	*34940*	*12280*	*2381*	*2369*
35	*P5*	*prism*	*120x120*	*360*	*0.0052*	*21065*	*FA5*	*33180*	*33165*	*12050*	*2337*	*2324*
36	*P6*	*prism*	*120x120*	*360*	*0.0052*	*21315*	*FA6*	*33480*	*33470*	*12075*	*2347*	*2329*
37	*P7*	*prism*	*120x120*	*360*	*0.0052*	*21005*	*FA7*	*32680*	*32680*	*11665*	*2252*	*2250*
38	*P8*	*prism*	*120x120*	*360*	*0.0052*	*21055*	*FA8*	*33085*	*33085*	*11940*	*2321*	*2303*
39	*P9*	*prism*	*120x120*	*360*	*0.0052*	*20935*	*FA9*	*32960*	*32960*	*11985*	*2320*	*2312*
40	*P10*	*prism*	*120x120*	*360*	*0.0052*	*20675*	*FA10*	*32670*	*32670*	*11935*	*2314*	*2302*
41	*P11*	*prism*	*120x120*	*360*	*0.0052*	*20850*	*FA11*	*32770*	*32770*	*11875*	*2299*	*2291*
42	*P12*	*prism*	*120x120*	*360*	*0.0052*	*21130*	*FA12*	*32950*	*32950*	*11785*	*2280*	*2273*
43	*P13*	*prism*	*120x120*	*360*	*0.0052*	*21215*	*FA13*	*33020*	*33020*	*11765*	*2277*	*2269*
44	*P14*	*prism*	*120x120*	*360*	*0.0052*	*21045*	*FA14*	*32925*	*32925*	*11850*	*2292*	*2286*
45	*P15*	*prism*	*120x120*	*360*	*0.0052*	*21010*	*FA15*	*32795*	*32790*	*11755*	*2273*	*2268*

HVFAC

COMPRESSIVE STRENGTH						
		P (kN)	**f_c (kN/cm^2)**	**AVG**	**DATE**	**m (g)**
7	FA6	217	2.17	2.18	17-02-16	2204
	FA7	217	2.17			2222
	FA18	220	2.2			2192
28	FA15	325	3.25	3.01	09-03-16	2210
	FA9	289	2.89			2229
	FA	290	2.9			2149
90	FA10	310	3.1	3.45	10-05-16	2147
	FA5	385	3.85			2218
	FA2	339	3.39			2214
240	FA8	325	3.25	3.30	07-10-16	2165
	FA10	332	3.32			2146
	FA16	332	3.32			2192
450	HVFAC1 C	332	3.32	3.41	05-05-17	n/a
	HVFAC2 C	348	3.48			n/a
	HVFAC3 C	343	3.43			n/a

SPLITTING TENSILE STRENGTH						
		P (kN)	**f_t^{sp} (kN/cm^2)**	**AVG**	**DATE**	**m (g)**
7	FA4	50	0.14	0.12	17-02-16	5922
	FA5	44	0.12			5865
	FA1	30	0.08			5883
28	FA3	73	0.21	0.21	09-03-16	5852
	FA6	82	0.23			5831
	FA2	65	0.18			5836

FLEXURAL TENSILE STRENGTH						
		P (kN)	**f_t^{fl} (kN/cm^2)**	**AVG**	**DATE**	**m (g)**
7	FA1	14	0.44	0.43	17-02-16	11715
	FA4	13	0.41			11975
	FA15	14	0.44			11460
28	FA10	18	0.56	0.52	09-03-16	11550
	FA5	16	0.50			11655
	FA6	16	0.50			11660

Experimental Measurements:
Modulus of Elasticity

Specimen cylinder

d = 15 cm

h = 30 cm

A = 176.71 cm^2

Lo = 200 mm

σ_0 = 0.05 kN/cm^2

P_0 = 8.84 kN

σ_m = 0.842 kN/cm^2

P_m = 148.84 kN

σ_{incr} = 0.06 kN/cm^2

P_{incr} = 10.60 kN

$\pm\sigma_{incr}$ = 0.04 kN/cm^2

$\pm P_{incr}$ = 7.07 kN

m = 12370 g

Concrete	Specimen	Casting	Testing	Age	reading 1	reading 2	difference	ΔP	Δσ [Mpa]	strain	Elasticity modulus [GPa]
NAC	1	25-01-16	01-02-16	7	2815	2938	123	140.00	7.922		
					2835	2938	103			0.2575	30.767
						2938	103			0.2575	30.767
										average	**30.767**

m = 12440 g

Concrete	Specimen	Casting	Testing	Age	reading 1	reading 2	difference	ΔP	Δσ [Mpa]	strain	Elasticity modulus [GPa]
NAC	2	25-01-16	01-02-16	7	3018	3121	103	140.00	7.922	0.2575	30.767
					3021	3124	103			0.2575	30.767
					3021	3124	103			0.2575	30.767
										average	**30.767**

m = 12350 g

Concrete	Specimen	Casting	Testing	Age	reading 1	reading 2	difference	ΔP	Δσ [Mpa]	strain	Elasticity modulus [GPa]
NAC	3	25-01-16	01-02-16	7	1985	2108	123	140.00	7.922		
					2001	2111	110			0.2750	28.809
					2001	2111	110			0.2750	28.809
										average	**28.809**

Specimen cylinder

d = 15 cm

h = 30 cm

A = 176.71 cm^2

Lo = 200 mm

σ_0 = 0.05 kN/cm^2

P_0 = 8.84 kN

σ_m = 0.955 kN/cm^2

P_m = 168.84 kN

σ_{incr} = 0.06 kN/cm^2

P_{incr} = 10.60 kN

$\pm\sigma_{incr}$ = 0.04 kN/cm^2

$\pm P_{incr}$ = 7.07 kN

m = 12335 g

Concrete	Specimen	Casting	Testing	Age	reading 1	reading 2	difference	ΔP	Δσ [Mpa]	strain	Elasticity modulus [GPa]
NAC	1	25-01-16	22-02-16	28	3050	3161	111	160.00	9.054	0.2775	32.628
					3052	3163	111			0.2775	32.628

average **32.628**

m = 12370 g

Concrete	Specimen	Casting	Testing	Age	reading 1	reading 2	difference	ΔP	Δσ [Mpa]	strain	Elasticity modulus [GPa]
NAC	2	25-01-16	22-02-16	28	3254	3355	101	160.00	9.054	0.2525	35.858
					3254	3355	101			0.2525	35.858

average **35.858**

m = 12310 g

Concrete	Specimen	Casting	Testing	Age	reading 1	reading 2	difference	ΔP	Δσ [Mpa]	strain	Elasticity modulus [GPa]
NAC	3	25-01-16	22-02-16	28	2975	3104	129	160.00	9.054	0.3225	28.075
					2977	3106	129			0.3225	28.075

average **28.075**

Specimen cylinder

d = 15 cm

h = 30 cm

A = 176.71 cm^2

Lo = 200 mm

σ_0 = 0.05 kN/cm^2

P_0 = 8.84 kN

σ_m = 0.955 kN/cm^2

P_m = 168.84 kN

σ_{incr} = 0.06 kN/cm^2

P_{incr} = 10.60 kN

$\pm\sigma_{incr}$ = 0.04 kN/cm^2

$\pm P_{incr}$ = 7.07 kN

m = 12275 g

Concrete	Specimen	Casting	Testing	Age	reading 1	reading 2	difference	ΔP	Δσ [Mpa]	strain	Elasticity modulus [GPa]
NAC	1	25-01-16	24-04-16	90	2462	2585	123	160.00	9.054		
					2475	2586	111			0.2775	32.628
					2476		110			0.2750	32.924
										average	**32.776**

m = 12305 g

Concrete	Specimen	Casting	Testing	Age	reading 1	reading 2	difference	ΔP	Δσ [Mpa]	strain	Elasticity modulus [GPa]
NAC	2	25-01-16	24-04-16	90	2354	2476	122	160.00	9.054		
					2366	2476	110			0.2750	32.924
					2366		110			0.2750	32.924
										average	**32.924**

m = 12255 g

Concrete	Specimen	Casting	Testing	Age	reading 1	reading 2	difference	ΔP	Δσ [Mpa]	strain	Elasticity modulus [GPa]
NAC	3	25-01-16	24-04-16	90	2318	2445	127	160.00	9.054		
					2330	2445	115			0.2875	31.493
					2330		115			0.2875	31.493
										average	**31.493**

Specimen cylinder

d = 15 cm
h = 30 cm
A = 176.71 cm^2
Lo = 200 mm

σ_0 = 0.05 kN/cm^2
P_0 = 8.84 kN
σ_m = 1.182 kN/cm^2
P_m = 208.84 kN

σ_{incr} = 0.06 kN/cm^2
P_{incr} = 10.60 kN
$\pm\sigma_{incr}$ = 0.04 kN/cm^2
$\pm P_{incr}$ = 7.07 kN

m = 12255 g

Concrete	Specimen	Casting	Testing	Age	reading 1	reading 2	difference	ΔP	Δσ [Mpa]	strain	Elasticity modulus [GPa]
NAC	1	25-01-16	21-09-16	240	3165	3318	153	200.00	11.318		
					3172	3318	146				
					3175	3318	143			0.3575	31.658
					3175		143			0.3575	31.658
										average	**31.658**

m = 12285 g

Concrete	Specimen	Casting	Testing	Age	reading 1	reading 2	difference	ΔP	Δσ [Mpa]	strain	Elasticity modulus [GPa]
NAC	2	25-01-16	21-09-16	240	3140	3270	130	200.00	11.318	0.3250	34.824
							0				
										average	**34.824**

m = 12225 g

Concrete	Specimen	Casting	Testing	Age	reading 1	reading 2	difference	ΔP	Δσ [Mpa]	strain	Elasticity modulus [GPa]
NAC	3	25-01-16	21-09-16	240	3019	3156	137	200.00	11.318	0.3425	33.044
							0				
										average	**33.044**

Specimen cylinder

d = 15 cm

h = 30 cm

A = 176.71 cm^2

Lo = 200 mm

σ_0 = 0.05 kN/cm^2

P_0 = 8.84 kN

σ_m = 1.069 kN/cm^2

P_m = 188.84 kN

σ_{incr} = 0.06 kN/cm^2

P_{incr} = 10.60 kN

$\pm\sigma_{incr}$ = 0.04 kN/cm^2

$\pm P_{incr}$ = 7.07 kN

m = **g**

Concrete	Specimen	Casting	Testing	Age	reading 1	reading 2	difference	ΔP	Δσ [Mpa]	strain	Elasticity modulus [GPa]
NAC	1	25-01-16	19-04-17	450	2435	2550	115	180.00	10.186		
					2443	2550	107			0.2675	38.078
					2443	2550	107			0.2675	38.078
										average	**38.078**

m = **g**

Concrete	Specimen	Casting	Testing	Age	reading 1	reading 2	difference	ΔP	Δσ [Mpa]	strain	Elasticity modulus [GPa]
NAC	2	25-01-16	19-04-17	450	2372	2484	112	180.00	10.186		
					2371	2483	112			0.2800	36.378
										average	**36.378**

m = **g**

Concrete	Specimen	Casting	Testing	Age	reading 1	reading 2	difference	ΔP	Δσ [Mpa]	strain	Elasticity modulus [GPa]
NAC	3	25-01-16	19-04-17	450	2672	2823	151	180.00	10.186		
					2685	2825	140			0.3500	29.103
					2685	2827	142			0.3550	28.693
										average	**28.898**

Specimen cylinder

d = 15 cm

h = 30 cm

A = 176.71 cm^2

Lo = 200 mm

σ_0 = 0.05 kN/cm^2

P_0 = 8.84 kN

σ_m = 0.955 kN/cm^2

P_m = 168.84 kN

σ_{incr} = 0.06 kN/cm^2

P_{incr} = 10.60 kN

$\pm\sigma_{incr}$ = 0.04 kN/cm^2

$\pm P_{incr}$ = 7.07 kN

m = 11890 g

Concrete	Specimen	Casting	Testing	Age	reading 1	reading 2	difference	ΔP	Δσ [Mpa]	strain	Elasticity modulus [GPa]
RAC	1	02-02-16	09-02-16	7	2944	3100	156	160.00	9.054	0.3900	17.412
					2944	3100	156			0.3900	17.412

Classified as outlier!

average 17.412

m = 11970 g

Concrete	Specimen	Casting	Testing	Age	reading 1	reading 2	difference	ΔP	Δσ [Mpa]	strain	Elasticity modulus [GPa]
RAC	2	02-02-16	09-02-16	7	3306	3414	108	120.00	6.791	0.2700	25.150
					3306	3414	108	0.729		0.2700	25.150

average 25.150

m = 11930 g

Concrete	Specimen	Casting	Testing	Age	reading 1	reading 2	difference	ΔP	Δσ [Mpa]	strain	Elasticity modulus [GPa]
RAC	3	02-02-16	09-02-16	7	3279	3395	116	140.00	7.922	0.2900	27.319
					3279	3395	116	0.842		0.2900	27.319

average 27.319

Specimen cylinder

d = 15 cm

h = 30 cm

A = 176.71 cm^2

Lo = 200 mm

σ_0 = 0.05 kN/cm^2

P_0 = 8.84 kN

σ_m = 0.842 kN/cm^2

P_m = 148.84 kN

σ_{incr} = 0.06 kN/cm^2

P_{incr} = 10.60 kN

$\pm\sigma_{incr}$ = 0.04 kN/cm^2

$\pm P_{incr}$ = 7.07 kN

m = 11825 g

Concrete	Specimen	Casting	Testing	Age	reading 1	reading 2	difference	ΔP	Δσ [Mpa]	strain	Elasticity modulus [GPa]
RAC	1	02-02-16	01-03-16	28			0	140.00	7.922	0.0000	#DIV/0!
							0			0.0000	#DIV/0!

Unsuccessful test!

average #DIV/0!

m = 11905 g

Concrete	Specimen	Casting	Testing	Age	reading 1	reading 2	difference	ΔP	Δσ [Mpa]	strain	Elasticity modulus [GPa]
RAC	2	02-02-16	01-03-16	28	2764	2867	103	140.00	7.922	0.2575	30.767
					2764	2867	103			0.2575	30.767

average 30.767

m = 11855 g

Concrete	Specimen	Casting	Testing	Age	reading 1	reading 2	difference	ΔP	Δσ [Mpa]	strain	Elasticity modulus [GPa]
RAC	3	02-02-16	01-03-16	28			0	140.00	7.922	0.0000	#DIV/0!
							0			0.0000	#DIV/0!

Unsuccessful test!

average #DIV/0!

Specimen cylinder

d = 15 cm

h = 30 cm

A = 176.71 cm^2

Lo = 200 mm

σ_0 = 0.05 kN/cm^2

P_0 = 8.84 kN

σ_m = 0.955 kN/cm^2

P_m = 168.84 kN

σ_{incr} = 0.06 kN/cm^2

P_{incr} = 10.60 kN

$\pm\sigma_{incr}$ = 0.04 kN/cm^2

$\pm P_{incr}$ = 7.07 kN

m = 11755 g

Concrete	Specimen	Casting	Testing	Age	reading 1	reading 2	difference	ΔP	Δσ [Mpa]	strain	Elasticity modulus [GPa]
RAC	1	02-02-16	02-05-16	90	2100	2270	170	160.00	9.054		
					2121	2270	149			0.3725	24.306
					2121		149			0.3725	24.306
										average	**24.306**

m = 11845 g

Concrete	Specimen	Casting	Testing	Age	reading 1	reading 2	difference	ΔP	Δσ [Mpa]	strain	Elasticity modulus [GPa]
RAC	2	02-02-16	02-05-16	90	2138	2295	157	160.00	9.054		
					2149	2298	149			0.3725	24.306
					2149		149			0.3725	24.306
										average	**24.306**

m = 11975 g

Concrete	Specimen	Casting	Testing	Age	reading 1	reading 2	difference	ΔP	Δσ [Mpa]	strain	Elasticity modulus [GPa]
RAC	3	02-02-16	02-05-16	90	2030	2170	140	160.00	9.054		
					2037	2170	133			0.3325	27.231
					2037		133			0.3325	27.231
										average	**27.231**

Specimen cylinder

d = 15 cm

h = 30 cm

A = 176.71 cm^2

Lo = 200 mm

σ_0 = 0.05 kN/cm^2

P_0 = 8.84 kN

σ_m = 1.069 kN/cm^2

P_m = 188.84 kN

σ_{incr} = 0.06 kN/cm^2

P_{incr} = 10.60 kN

$\pm\sigma_{incr}$ = 0.04 kN/cm^2

$\pm P_{incr}$ = 7.07 kN

m = 11745 g

Concrete	Specimen	Casting	Testing	Age	reading 1	reading 2	difference	ΔP	Δσ [Mpa]	strain	Elasticity modulus [GPa]
RAC	1	02-02-16	29-09-16	240	2984	3143	159	180.00	10.186	0.3975	25.625
					2984	3143	159			0.3975	25.625

average 25.625

m = 11815 g

Concrete	Specimen	Casting	Testing	Age	reading 1	reading 2	difference	ΔP	Δσ [Mpa]	strain	Elasticity modulus [GPa]
RAC	2	02-02-16	29-09-16	240	2859	3022	163	180.00	10.186	0.4075	24.996
					2859	3022	163			0.4075	24.996

average 24.996

m = 11780 g

Concrete	Specimen	Casting	Testing	Age	reading 1	reading 2	difference	ΔP	Δσ [Mpa]	strain	Elasticity modulus [GPa]
RAC	3	02-02-16	29-09-16	240	2776	2918	142	180.00	10.186	0.3550	28.693
					2776	2918	142			0.3550	28.693

average 28.693

Specimen cylinder

d = 15 cm

h = 30 cm

A = 176.71 cm^2

Lo = 200 mm

σ_0 = 0.05 kN/cm^2

P_0 = 8.84 kN

σ_m = 1.069 kN/cm^2

P_m = 188.84 kN

σ_{incr} = 0.06 kN/cm^2

P_{incr} = 10.60 kN

$\pm\sigma_{incr}$ = 0.04 kN/cm^2

$\pm P_{incr}$ = 7.07 kN

m = **g**

Concrete	Specimen	Casting	Testing	Age	reading 1	reading 2	difference	ΔP	Δσ [Mpa]	strain	Elasticity modulus [GPa]
RAC	1	02-02-16	27-04-17	450	2758	2903	145	180.00	10.186	0.3625	28.099
					2758	2903	145			0.3625	28.099
										average	**28.099**

m = **g**

Concrete	Specimen	Casting	Testing	Age	reading 1	reading 2	difference	ΔP	Δσ [Mpa]	strain	Elasticity modulus [GPa]
RAC	2	02-02-16	27-04-17	450	2135	2285	150	180.00	10.186	0.3750	27.162
					2135	2285	150			0.3750	27.162
										average	**27.162**

m = **g**

Concrete	Specimen	Casting	Testing	Age	reading 1	reading 2	difference	ΔP	Δσ [Mpa]	strain	Elasticity modulus [GPa]
RAC	3	02-02-16	27-04-17	450	2853	2987	134	180.00	10.186	0.3350	30.406
					2853	2987	134			0.3350	30.406
										average	**30.406**

Specimen cylinder

d = 15 cm

h = 30 cm

A = 176.71 cm^2

Lo = 200 mm

σ_0 = 0.05 kN/cm^2

P_0 = 8.84 kN

σ_m = 0.503 kN/cm^2

P_m = 88.84 kN

σ_{incr} = 0.06 kN/cm^2

P_{incr} = 10.60 kN

$\pm\sigma_{incr}$ = 0.04 kN/cm^2

$\pm P_{incr}$ = 7.07 kN

m = 11750 g

Concrete	Specimen	Casting	Testing	Age	reading 1	reading 2	difference	ΔP	Δσ [Mpa]	strain	Elasticity modulus [GPa]
HVFAC	1	10-02-16	17-02-16	7	1881	1945	64	80.00	4.527	0.1600	28.294
					1881	1945	64			0.1600	28.294

average 28.294

m = 11825 g

Concrete	Specimen	Casting	Testing	Age	reading 1	reading 2	difference	ΔP	Δσ [Mpa]	strain	Elasticity modulus [GPa]
HVFAC	2	10-02-16	17-02-16	7	2620	2697	77	80.00	4.527	0.1925	23.517
					2620	2697	77			0.1925	23.517

average 23.517

m = 11795 g

Concrete	Specimen	Casting	Testing	Age	reading 1	reading 2	difference	ΔP	Δσ [Mpa]	strain	Elasticity modulus [GPa]
HVFAC	3	10-02-16	17-02-16	7	2940	3016	76	80.00	4.527	0.1900	23.827
					2941	3017	76			0.1900	23.827

average 23.827

Specimen cylinder

d = 15 cm

h = 30 cm

A = 176.71 cm^2

Lo = 200 mm

σ_0 = 0.05 kN/cm^2

P_0 = 8.84 kN

σ_m = 0.729 kN/cm^2

P_m = 128.84 kN

σ_{incr} = 0.06 kN/cm^2

P_{incr} = 10.60 kN

$\pm\sigma_{incr}$ = 0.04 kN/cm^2

$\pm P_{incr}$ = 7.07 kN

m = 11700 g

Concrete	Specimen	Casting	Testing	Age	reading 1	reading 2	difference	ΔP	Δσ [Mpa]	strain	Elasticity modulus [GPa]
HVFAC	1	10-02-16	09-03-16	28	2656	2744	88	120.00	6.791	0.2200	30.866
					2656	2744	88			0.2200	30.866
										average	**30.866**

m = 11760 g

Concrete	Specimen	Casting	Testing	Age	reading 1	reading 2	difference	ΔP	Δσ [Mpa]	strain	Elasticity modulus [GPa]
HVFAC	2	10-02-16	09-03-16	28	2235	2336	101	120.00	6.791	0.2525	26.894
					2235	2336	101			0.2525	26.894
										average	**26.894**

m = 11710 g

Concrete	Specimen	Casting	Testing	Age	reading 1	reading 2	difference	ΔP	Δσ [Mpa]	strain	Elasticity modulus [GPa]
HVFAC	3	10-02-16	09-03-16	28	2140	2236	96	120.00	6.791	0.2400	28.294
					2141	2237	96			0.2400	28.294
										average	**28.294**

Specimen cylinder

d = 15 cm

h = 30 cm

A = 176.71 cm^2

Lo = 200 mm

σ_0 = 0.05 kN/cm^2

P_0 = 8.84 kN

σ_m = 0.842 kN/cm^2

P_m = 148.84 kN

σ_{incr} = 0.06 kN/cm^2

P_{incr} = 10.60 kN

$\pm\sigma_{incr}$ = 0.04 kN/cm^2

$\pm P_{incr}$ = 7.07 kN

m = 11635 g

Concrete	Specimen	Casting	Testing	Age	reading 1	reading 2	difference	ΔP	Δσ [Mpa]	strain	Elasticity modulus [GPa]
HVFAC	1	10-02-16	10-05-16	90	1790	1925	135	140.00	7.922		
					1805	1925	120			0.3000	26.408
					1805		120			0.3000	26.408
										average	**26.408**

m = 11700 g

Concrete	Specimen	Casting	Testing	Age	reading 1	reading 2	difference	ΔP	Δσ [Mpa]	strain	Elasticity modulus [GPa]
HVFAC	2	10-02-16	10-05-16	90	2001	2118	117	140.00	7.922		
					2009	2118	109			0.2725	29.073
					2009		109			0.2725	29.073
										average	**29.073**

m = 11650 g

Concrete	Specimen	Casting	Testing	Age	reading 1	reading 2	difference	ΔP	Δσ [Mpa]	strain	Elasticity modulus [GPa]
HVFAC	3	10-02-16	10-05-16	90	2095	2217	122	140.00	7.922		
					2103	2218	115			0.2875	27.556
					2104		114			0.2850	27.798
										average	**27.677**

Specimen cylinder

d = 15 cm

h = 30 cm

A = 176.71 cm^2

Lo = 200 mm

σ_0 = 0.05 kN/cm^2

P_0 = 8.84 kN

σ_m = 0.842 kN/cm^2

P_m = 148.84 kN

σ_{incr} = 0.06 kN/cm^2

P_{incr} = 10.60 kN

$\pm\sigma_{incr}$ = 0.04 kN/cm^2

$\pm P_{incr}$ = 7.07 kN

m = 11620 g

Concrete	Specimen	Casting	Testing	Age	reading 1	reading 2	difference	ΔP	Δσ [Mpa]	strain	Elasticity modulus [GPa]
HVFAC	1	10-02-16	07-10-16	240	2878	3000	122	140.00	7.922	0.3050	25.975
					2878	3000	122			0.3050	25.975

average 25.975

m = 11685 g

Concrete	Specimen	Casting	Testing	Age	reading 1	reading 2	difference	ΔP	Δσ [Mpa]	strain	Elasticity modulus [GPa]
HVFAC	2	10-02-16	07-10-16	240	2990	3100	110	140.00	7.922	0.2750	28.809
					2990	3100	110			0.2750	28.809

average 28.809

m = 11635 g

Concrete	Specimen	Casting	Testing	Age	reading 1	reading 2	difference	ΔP	Δσ [Mpa]	strain	Elasticity modulus [GPa]
HVFAC	3	10-02-16	07-10-16	240	3014	3106	92	140.00	7.922	0.2300	34.445
					3014	3106	92			0.2300	34.445

average 34.445

Specimen cylinder

d = 15 cm

h = 30 cm

A = 176.71 cm^2

Lo = 200 mm

σ_0 = 0.05 kN/cm^2

P_0 = 8.84 kN

σ_m = 0.955 kN/cm^2

P_m = 168.84 kN

σ_{incr} = 0.06 kN/cm^2

P_{incr} = 10.60 kN

$\pm\sigma_{incr}$ = 0.04 kN/cm^2

$\pm P_{incr}$ = 7.07 kN

m = **g**

Concrete	Specimen	Casting	Testing	Age	reading 1	reading 2	difference	ΔP	Δσ [Mpa]	strain	Elasticity modulus [GPa]
HVFAC	1	10-02-16	05-05-17	450	2194	2313	119	160.00	9.054	0.2975	30.434
					2194	2313	119			0.2975	30.434
										average	**30.434**

m = **g**

Concrete	Specimen	Casting	Testing	Age	reading 1	reading 2	difference	ΔP	Δσ [Mpa]	strain	Elasticity modulus [GPa]
HVFAC	2	10-02-16	05-05-17	450	2614	2734	120	160.00	9.054	0.3000	30.180
					2614	2734	120			0.3000	30.180
										average	**30.180**

m = **g**

Concrete	Specimen	Casting	Testing	Age	reading 1	reading 2	difference	ΔP	Δσ [Mpa]	strain	Elasticity modulus [GPa]
HVFAC	3	10-02-16	05-05-17	450	2525	2654	129	160.00	9.054		
					2535	2656	121			0.3025	29.931
					2535	2656	121			0.3025	29.931
										average	**29.931**

Experimental Measurements:
Shrinkage

NAC			Age					ε_{cs} (‰)	$\varepsilon_{cs,cor}$ (‰)	Prism P8							Prism P12							Prism P1						
	Date	Time	Days	Hours	Minutes	Days, eq	$t - t_s$			D1	D2	ε_1 (‰)	ε_2 (‰)	ε_{avr} (‰)	m (g)	Δm(%)	D1	D2	ε_1 (‰)	ε_2 (‰)	ε_{avr} (‰)	m (g)	Δm(%)	D1	D2	ε_1 (‰)	ε_2 (‰)	ε_{avr} (‰)	m (g)	Δm(%)
Casting	25-01-16	11:00	0	0	0	0.000	–	–		–	–	–	–	–			–	–	–	–	–			–	–	–	–	–		
After demoulding	26-01-16	12:00	1	0	0	1.000	0.100	0.000	0.000	-0.150	-0.217	0.000	0.000	0.000	12255	0	-0.191	-0.160	0.000	0.000	0.000	12270	0	-0.240	-0.289	0.000	0.000	0.000	12090	0
2	27-01-16	12:00	2	0	0	2.000	1.000	0.057	-0.014	-0.144	-0.216	0.060	0.010	0.035			-0.186	-0.157	0.050	0.030	0.040			-0.232	-0.278	0.080	0.110	0.095		
3	28-01-16	16:00	3	0	0	3.000	2.000	0.100	-0.029	-0.140	-0.206	0.100	0.110	0.105			-0.181	-0.154	0.100	0.060	0.080			-0.229	-0.277	0.110	0.120	0.115		
4	29-01-16	12:00	4	0	0	4.000	3.000	0.057	-0.043	-0.142	-0.209	0.080	0.080	0.080			-0.187	-0.159	0.040	0.010	0.025			-0.233	-0.283	0.070	0.060	0.065		
5	30-01-16	11:00	5	0	0	5.000	4.000	0.035	-0.065	-0.143	-0.215	0.070	0.020	0.045			-0.189	-0.161	0.020	-0.010	0.005			-0.234	-0.284	0.060	0.050	0.055		
6	31-01-16	12:00	6	0	0	6.000	5.000	0.000	-0.100	-0.146	-0.221	0.040	-0.040	0.000			-0.193	-0.165	-0.020	-0.050	-0.035			-0.235	-0.287	0.050	0.020	0.035		
Before loading 7	01-02-16	11:30	7	0	0	7.000	6.000	-0.017	-0.117	-0.147	-0.221	0.030	-0.040	-0.005			-0.195	-0.166	-0.040	-0.060	-0.050			-0.240	-0.288	0.000	0.010	0.005		
5min after load 7	01-02-16	11:30	7	0	5	7.003	6.003	-0.017	-0.117	-0.147	-0.221	0.030	-0.040	-0.005			-0.195	-0.166	-0.040	-0.060	-0.050			-0.240	-0.288	0.000	0.010	0.005		
1h	01-02-16	11:30	7	1	0	7.042	6.042	-0.017	-0.117	-0.147	-0.221	0.030	-0.040	-0.005			-0.195	-0.166	-0.040	-0.060	-0.050			-0.240	-0.288	0.000	0.010	0.005		
6h	01-02-16	11:30	7	6	0	7.250	6.250	-0.017	-0.117	-0.147	-0.221	0.030	-0.040	-0.005			-0.195	-0.166	-0.040	-0.060	-0.050			-0.240	-0.288	0.000	0.010	0.005		
8	02-02-16	14:00	8	0	0	8.000	7.000	-0.043	-0.143	-0.152	-0.225	-0.020	-0.080	-0.050			-0.198	-0.167	-0.070	-0.070	-0.070			-0.241	-0.290	-0.010	-0.010	-0.010		
9	03-02-16	15:00	9	0	0	9.000	8.000	-0.025	-0.125	-0.147	-0.221	0.030	-0.040	-0.005			-0.196	-0.168	-0.050	-0.080	-0.065			-0.241	-0.289	-0.010	0.000	-0.005		
10	04-02-16	12:00	10	0	0	10.000	9.000	-0.048	-0.148	-0.152	-0.226	-0.020	-0.090	-0.055			-0.196	-0.168	-0.050	-0.080	-0.065			-0.243	-0.291	-0.030	-0.020	-0.025		
11	05-02-16	14:00	11	0	0	11.000	10.000	-0.055	-0.155	-0.148	-0.224	0.020	-0.070	-0.025			-0.200	-0.170	-0.090	-0.100	-0.095			-0.244	-0.294	-0.040	-0.050	-0.045		
12	06-02-16	15:00	12	0	0	12.000	11.000	-0.097	-0.197	-0.156	-0.231	-0.060	-0.140	-0.100			-0.204	-0.172	-0.130	-0.120	-0.125			-0.247	-0.295	-0.070	-0.060	-0.065		
13	07-02-16	20:00	13	0	0	13.000	12.000	-0.078	-0.178	-0.152	-0.230	-0.020	-0.130	-0.075			-0.201	-0.172	-0.100	-0.120	-0.110			-0.247	-0.292	-0.070	-0.030	-0.050		
14	08-02-16	13:00	14	0	0	14.000	13.000	-0.080	-0.180	-0.155	-0.228	-0.050	-0.110	-0.080	12060	1.59	-0.202	-0.173	-0.110	-0.130	-0.120	12075	1.59	-0.245	-0.292	-0.050	-0.030	-0.040	11900	1.57
21	15-02-16	20:00	21	0	0	21.00	20.000	-0.178	-0.278	-0.162	-0.238	-0.120	-0.210	-0.165			-0.212	-0.182	-0.210	-0.220	-0.215			-0.256	-0.304	-0.160	-0.150	-0.155		
Before loading 28	22-02-16	11:00	28	0	0	28.00	27.000	-0.243	-0.343	-0.169	-0.245	-0.190	-0.280	-0.235	12035	1.80	-0.218	-0.190	-0.270	-0.300	-0.285	12045	1.83	-0.263	-0.308	-0.230	-0.190	-0.210	11870	1.82
5min after load 28	22-02-16	11:55	28	0	5	28.00	27.003	-0.243	-0.343	-0.169	-0.245	-0.190	-0.280	-0.235			-0.218	-0.190	-0.270	-0.300	-0.285			-0.263	-0.308	-0.230	-0.190	-0.210		
1h	22-02-16	13:00	28	1	0	28.04	27.042	-0.243	-0.343	-0.169	-0.245	-0.190	-0.280	-0.235			-0.218	-0.190	-0.270	-0.300	-0.285			-0.263	-0.308	-0.230	-0.190	-0.210		
6h	22-02-16	19:00	28	6	0	28.25	27.250	-0.243	-0.343	-0.169	-0.245	-0.190	-0.280	-0.235			-0.218	-0.190	-0.270	-0.300	-0.285			-0.263	-0.308	-0.230	-0.190	-0.210		
29	23-02-16	16:00	29	0	0	29.00	28.000	-0.242	-0.342	-0.169	-0.246	-0.190	-0.290	-0.240			-0.215	-0.191	-0.240	-0.310	-0.275			-0.263	-0.308	-0.230	-0.190	-0.210		
30	24-02-16	14:00	30	0	0	30.00	29.000	-0.233	-0.333	-0.168	-0.244	-0.180	-0.270	-0.225			-0.216	-0.190	-0.250	-0.300	-0.275			-0.262	-0.307	-0.220	-0.180	-0.200		
31	25-02-16	10:00	31	0	0	31.00	30.000	-0.233	-0.333	-0.167	-0.246	-0.170	-0.290	-0.230			-0.216	-0.188	-0.250	-0.280	-0.265			-0.262	-0.308	-0.220	-0.190	-0.205		
32	26-02-16	13:00	32	0	0	32.00	31.000	-0.238	-0.338	-0.168	-0.245	-0.180	-0.280	-0.230			-0.217	-0.187	-0.260	-0.270	-0.265			-0.264	-0.309	-0.240	-0.200	-0.220		
33	27-02-16	19:00	33	0	0	33.00	32.000	-0.250	-0.350	-0.168	-0.247	-0.180	-0.300	-0.240			-0.218	-0.191	-0.270	-0.310	-0.290			-0.264	-0.309	-0.240	-0.200	-0.220		
34	28-02-16	20:00	34	0	0	34.00	33.000	-0.245	-0.345	-0.168	-0.245	-0.180	-0.280	-0.230			-0.218	-0.192	-0.270	-0.320	-0.295			-0.262	-0.309	-0.220	-0.200	-0.210		
35	29-02-16	12:00	35	0	0	35.00	34.000	-0.268	-0.368	-0.172	-0.248	-0.220	-0.310	-0.265			-0.221	-0.192	-0.300	-0.320	-0.310			-0.265	-0.310	-0.250	-0.210	-0.230		
42	07-03-16	16:00	42	0	0	42.00	41.000	-0.303	-0.403	-0.173	-0.254	-0.230	-0.370	-0.300			-0.223	-0.198	-0.320	-0.380	-0.350			-0.269	-0.312	-0.290	-0.230	-0.260		
49	14-03-16	9:00	49	0	0	49.00	48.000	-0.312	-0.412	-0.170	-0.253	-0.200	-0.360	-0.280			-0.227	-0.198	-0.360	-0.380	-0.370			-0.270	-0.316	-0.300	-0.270	-0.285		
56	21-03-16	11:00	56	0	0	56.00	55.000	-0.368	-0.468	-0.173	-0.259	-0.230	-0.420	-0.325	11995	2.12	-0.242	-0.200	-0.510	-0.400	-0.455	12010	2.12	-0.276	-0.318	-0.360	-0.290	-0.325	11830	2.15
63	28-03-16	15:00	63	0	0	63.00	62.000	-0.382	-0.482	-0.174	-0.259	-0.240	-0.420	-0.330			-0.245	-0.201	-0.540	-0.410	-0.475			-0.279	-0.318	-0.390	-0.290	-0.340		
84	18-04-16	15:00	84	0	0	84.00	83.000	-0.440	-0.540	-0.183	-0.265	-0.330	-0.480	-0.405			-0.245	-0.212	-0.540	-0.520	-0.530			-0.281	-0.325	-0.410	-0.360	-0.385		
97	01-05-16	14:00	97	0	0	97.00	96.000	-0.440	-0.540	-0.181	-0.264	-0.310	-0.470	-0.390			-0.242	-0.215	-0.510	-0.550	-0.530			-0.282	-0.327	-0.420	-0.380	-0.400		
118	22-05-16	14:00	118	0	0	118.00	117.000	-0.435	-0.535	-0.180	-0.262	-0.300	-0.450	-0.375			-0.242	-0.215	-0.510	-0.550	-0.530			-0.281	-0.328	-0.410	-0.390	-0.400		
127	31-05-16	14:00	127	0	0	127.00	126.000	-0.438	-0.538	-0.182	-0.265	-0.320	-0.480	-0.400	11965	2.37	-0.240	-0.212	-0.490	-0.520	-0.505	11980	2.36	-0.284	-0.327	-0.440	-0.380	-0.410	11805	2.36
148	21-06-16	11:00	148	0	0	148.00	147.000	-0.443	-0.543	-0.183	-0.267	-0.330	-0.500	-0.415			-0.240	-0.211	-0.490	-0.510	-0.500			-0.285	-0.327	-0.450	-0.380	-0.415		
157	30-06-16	12:00	157	0	0	157.00	156.000	-0.427	-0.527	-0.181	-0.265	-0.310	-0.480	-0.395			-0.238	-0.209	-0.470	-0.490	-0.480			-0.283	-0.327	-0.430	-0.380	-0.405		
178	21-07-16	13:00	178	0	0	178.00	177.000	-0.440	-0.540	-0.184	-0.265	-0.340	-0.480	-0.410			-0.239	-0.212	-0.480	-0.520	-0.500			-0.283	-0.328	-0.430	-0.390	-0.410		
187	30-07-16	15:00	187	0	0	187.00	186.000	-0.457	-0.557	-0.185	-0.267	-0.350	-0.500	-0.425			-0.241	-0.212	-0.500	-0.520	-0.510			-0.287	-0.329	-0.470	-0.400	-0.435		
208	20-08-16	13:00	208	0	0	208.00	207.000	-0.455	-0.555	-0.184	-0.268	-0.340	-0.510	-0.425	11950	2.49	-0.240	-0.213	-0.490	-0.530	-0.510	11960	2.53	-0.285	-0.330	-0.450	-0.410	-0.430	11790	2.48
217	29-08-16	13:00	217	0	0	217.00	216.000	-0.487	-0.587	-0.187	-0.273	-0.370	-0.560	-0.465			-0.242	-0.216	-0.510	-0.560	-0.535			-0.288	-0.333	-0.480	-0.440	-0.460		
238	19-09-16	17:00	238	0	0	238.00	237.000	-0.460	-0.560	-0.184	-0.268	-0.340	-0.510	-0.425			-0.241	-0.214	-0.500	-0.540	-0.520			-0.287	-0.329	-0.470	-0.400	-0.435		
247	28-09-16	12:00	247	0	0	247.00	246.000	-0.470	-0.570	-0.185	-0.268	-0.350	-0.510	-0.430			-0.243	-0.214	-0.520	-0.540	-0.530			-0.290	-0.329	-0.500	-0.400	-0.450		
268	19-10-16	15:00	268	0	0	268.00	267.000	-0.485	-0.585	-0.186	-0.271	-0.360	-0.540	-0.450			-0.244	-0.215	-0.530	-0.550	-0.540			-0.290	-0.332	-0.500	-0.430	-0.465		
277	28-10-16	14:00	277	0	0	277.00	276.000	-0.505	-0.605	-0.188	-0.273	-0.380	-0.560	-0.470	11950	2.49	-0.245	-0.219	-0.540	-0.590	-0.565	11955	2.57	-0.292	-0.333	-0.520	-0.440	-0.480	11785	2.52
298	18-11-16	16:00	298	0	0	298.00	297.000	-0.503	-0.603	-0.188	-0.276	-0.380	-0.590	-0.485			-0.244	-0.219	-0.530	-0.590	-0.560			-0.292	-0.330	-0.520	-0.410	-0.465		
307	27-11-16	11:00	307	0	0	307.00	306.000	-0.495	-0.595	-0.185	-0.274	-0.350	-0.570	-0.460			-0.243	-0.217	-0.520	-0.570	-0.545			-0.293	-0.332	-0.530	-0.430	-0.480		
328	18-12-16	13:00	328	0	0	328.00	327.000	-0.522	-0.622	-0.190	-0.278	-0.400	-0.610	-0.505			-0.244	-0.219	-0.530	-0.590	-0.560			-0.294	-0.335	-0.540	-0.460	-0.500		
337	27-12-16	12:00	337	0	0	337.00	336.000	-0.513	-0.613	-0.192	-0.275	-0.420	-0.580	-0.500			-0.246	-0.216	-0.550	-0.560	-0.555			-0.293	-0.333	-0.530	-0.440	-0.485		
358	17-01-17	16:00	358	0	0	358.00	357.000	-0.518	-0.618	-0.189	-0.276	-0.390	-0.590	-0.490			-0.247	-0.218	-0.560	-0.580	-0.570			-0.293	-0.335	-0.530	-0.460	-0.495		
372	31-01-17	15:00	372	0	0	372.00	371.000	-0.533	-0.633	-0.189	-0.276	-0.390	-0.590	-0.490	11915	2.77	-0.250	-0.220	-0.590	-0.600	-0.595	11915	2.89	-0.295	-0.337	-0.550	-0.480	-0.515	11745	2.85
393	21-02-17	10:00	393	0	0	393.00	392.000	-0.540	-0.640	-0.189	-0.280	-0.390	-0.630	-0.510			-0.248	-0.222	-0.570	-0.620	-0.595			-0.295	-0.337	-0.550	-0.480	-0.515		
407	07-03-17	11:00	407	0	0	407.00	406.000	-0.557	-0.657	-0.193	-0.280	-0.430	-0.630	-0.530			-0.251	-0.221	-0.600	-0.610	-0.605			-0.298	-0.338	-0.580	-0.490	-0.535		
428	28-03-17	12:00	428	0	0	428.00	427.000	-0.552	-0.652	-0.193	-0.279	-0.430	-0.620	-0.525			-0.251	-0.221	-0.600	-0.610	-0.605			-0.297	-0.337	-0.570	-0.480	-0.525		
457	26-04-17	16:00	457	0	0	457.00	456.000	-0.567	-0.667	-0.192	-0.282	-0.420	-0.650	-0.535			-0.252	-0.223	-0.610	-0.630	-0.620			-0.298	-0.340	-0.580	-0.510	-0.545		
478	17-05-17	11:00	478	0	0	478.00	477.000	-0.545	-0.645	-0.190	-0.280	-0.400	-0.630	-0.515	11905	2.86	-0.248	-0.221	-0.570	-0.610	-0.590	11910	2.93	-0.296	-0.339	-0.560	-0.500	-0.530	11740	2.89

RAC		Age					ε_{cs} (‰)	Prism P2							Prism P4							Prism P1						
Date	Time	Days	Hours	Minutes	Days, eq	t - t_s		D1	D2	ε_1 (‰)	ε_2 (‰)	ε_{avr} (‰)	m (g)	Δm(%)	D1	D2	ε_1 (‰)	ε_2 (‰)	ε_{avr} (‰)	m (g)	Δm(%)	D1	D2	ε_1 (‰)	ε_2 (‰)	ε_{avr} (‰)	m (g)	Δm(%)
02-02-16	11:00	0	0	0	0.000	–	–	–	–	–	–	–			–	–	–	–	–			–	–	–	–	–		
03-02-16	15:00	1	0	0	1.000	0.100	0.000	-0.176	-0.173	0.000	0.000	0.000	11945	0	-0.159	-0.241	0.000	0.000	0.000	11960	0	-0.172	-0.163	0.000	0.000	0.000	11915	0
04-02-16	12:00	2	0	0	2.000	1.000	-0.058	-0.183	-0.178	-0.070	-0.050	-0.060			-0.168	-0.249	-0.090	-0.080	-0.085			-0.175	-0.166	-0.030	-0.030	-0.030		
05-02-16	14:00	3	0	0	3.000	2.000	-0.070	-0.185	-0.178	-0.090	-0.050	-0.070			-0.169	-0.247	-0.100	-0.060	-0.080			-0.180	-0.167	-0.080	-0.040	-0.060		
06-02-16	15:00	4	0	0	4.000	3.000	-0.110	-0.191	-0.181	-0.150	-0.080	-0.115			-0.174	-0.251	-0.150	-0.100	-0.125			-0.184	-0.169	-0.120	-0.060	-0.090		
07-02-16	20:00	5	0	0	5.000	4.000	-0.113	-0.19	-0.179	-0.140	-0.060	-0.100			-0.176	-0.250	-0.170	-0.090	-0.130			-0.186	-0.171	-0.140	-0.080	-0.110		
08-02-16	13:00	6	0	0	6.000	5.000	-0.120	-0.191	-0.18	-0.150	-0.070	-0.110			-0.178	-0.250	-0.190	-0.090	-0.140			-0.187	-0.170	-0.150	-0.070	-0.110		
09-02-16	14:00	7	0	0	7.000	6.000	-0.155	-0.192	-0.182	-0.160	-0.090	-0.125			-0.182	-0.254	-0.230	-0.130	-0.180			-0.192	-0.175	-0.200	-0.120	-0.160		
09-02-16	14:00	7	0	5	7.003	6.003	-0.155	-0.192	-0.182	-0.160	-0.090	-0.125			-0.182	-0.254	-0.230	-0.130	-0.180			-0.192	-0.175	-0.200	-0.120	-0.160		
09-02-16	14:00	7	1	0	7.042	6.042	-0.155	-0.192	-0.182	-0.160	-0.090	-0.125			-0.182	-0.254	-0.230	-0.130	-0.180			-0.192	-0.175	-0.200	-0.120	-0.160		
09-02-16	17:15	7	6	0	7.250	6.250	-0.140	-0.191	-0.182	-0.150	-0.090	-0.120			-0.180	-0.252	-0.210	-0.110	-0.160			-0.190	-0.173	-0.180	-0.100	-0.140		
10-02-16	13:30	8	0	0	8.000	7.000	-0.155	-0.194	-0.182	-0.180	-0.090	-0.135			-0.180	-0.255	-0.210	-0.140	-0.175			-0.191	-0.175	-0.190	-0.120	-0.155		
11-02-16	16:00	9	0	0	9.000	8.000	-0.162	-0.196	-0.18	-0.200	-0.070	-0.135			-0.184	-0.254	-0.250	-0.130	-0.190			-0.192	-0.175	-0.200	-0.120	-0.160		
12-02-16	12:00	10	0	0	10.000	9.000	-0.198	-0.198	-0.186	-0.220	-0.130	-0.175			-0.189	-0.256	-0.300	-0.150	-0.225			-0.196	-0.178	-0.240	-0.150	-0.195		
13-02-16	12:00	11	0	0	11.000	10.000	-0.207	-0.200	-0.187	-0.240	-0.140	-0.190			-0.191	-0.256	-0.320	-0.150	-0.235			-0.195	-0.179	-0.230	-0.160	-0.195		
14-02-16	20:00	12	0	0	12.000	11.000	-0.172	-0.195	-0.184	-0.190	-0.110	-0.150			-0.184	-0.255	-0.250	-0.140	-0.195			-0.192	-0.177	-0.200	-0.140	-0.170		
15-02-16	20:00	13	0	0	13.000	12.000	-0.220	-0.197	-0.186	-0.210	-0.130	-0.170			-0.192	-0.258	-0.330	-0.170	-0.250			-0.200	-0.183	-0.280	-0.200	-0.240		
16-02-16	15:00	14	0	0	14.000	13.000	-0.245	-0.201	-0.191	-0.250	-0.180	-0.215	11690	2.13	-0.194	-0.262	-0.350	-0.210	-0.280	11675	2.38	-0.200	-0.183	-0.280	-0.200	-0.240	11655	2.18
23-02-16	16:00	21	0	0	21.00	20.000	-0.32	-0.21	-0.199	-0.340	-0.260	-0.300			-0.202	-0.269	-0.430	-0.280	-0.355			-0.208	-0.188	-0.360	-0.250	-0.305		
01-03-16	11:00	28	0	0	28.00	27.000	-0.383	-0.219	-0.201	-0.430	-0.280	-0.355	11650	2.47	-0.209	-0.272	-0.500	-0.310	-0.405	11630	2.76	-0.216	-0.197	-0.440	-0.340	-0.390	11615	2.52
01-03-16	11:05	28	0	5	28.00	27.003	-0.383	-0.219	-0.201	-0.430	-0.280	-0.355			-0.209	-0.272	-0.500	-0.310	-0.405			-0.216	-0.197	-0.440	-0.340	-0.390		
01-03-16	12:00	28	1	0	28.04	27.042	-0.383	-0.219	-0.201	-0.430	-0.280	-0.355			-0.209	-0.272	-0.500	-0.310	-0.405			-0.216	-0.197	-0.440	-0.340	-0.390		
01-03-16	17:00	28	6	0	28.25	27.250	-0.383	-0.219	-0.201	-0.430	-0.280	-0.355			-0.209	-0.272	-0.500	-0.310	-0.405			-0.216	-0.197	-0.440	-0.340	-0.390		
02-03-16	13:00	29	0	0	29.00	28.000	-0.385	-0.218	-0.202	-0.420	-0.290	-0.355			-0.211	-0.272	-0.520	-0.310	-0.415			-0.216	-0.196	-0.440	-0.330	-0.385		
03-03-16	14:00	30	0	0	30.00	29.000	-0.387	-0.217	-0.202	-0.410	-0.290	-0.350			-0.212	-0.272	-0.530	-0.310	-0.420			-0.218	-0.195	-0.460	-0.320	-0.390		
04-03-16	13:00	31	0	0	31.00	30.000	-0.402	-0.22	-0.203	-0.440	-0.300	-0.370			-0.212	-0.273	-0.530	-0.320	-0.425			-0.219	-0.198	-0.470	-0.350	-0.410		
05-03-16	14:00	32	0	0	32.00	31.000	-0.395	-0.22	-0.202	-0.440	-0.290	-0.365			-0.211	-0.273	-0.520	-0.320	-0.420			-0.219	-0.196	-0.470	-0.330	-0.400		
06-03-16	17:00	33	0	0	33.00	32.000	-0.385	-0.22	-0.2	-0.440	-0.270	-0.355			-0.212	-0.273	-0.530	-0.320	-0.425			-0.216	-0.194	-0.440	-0.310	-0.375		
07-03-16	16:00	34	0	0	34.00	33.000	-0.393	-0.22	-0.202	-0.440	-0.290	-0.365			-0.212	-0.274	-0.530	-0.330	-0.430			-0.216	-0.196	-0.440	-0.330	-0.385		
08-03-16	11:00	35	0	0	35.00	34.000	-0.410	-0.222	-0.202	-0.460	-0.290	-0.375			-0.214	-0.276	-0.550	-0.350	-0.450			-0.219	-0.197	-0.470	-0.340	-0.405		
15-03-16	18:00	42	0	0	42.00	41.000	-0.443	-0.225	-0.204	-0.490	-0.310	-0.400			-0.217	-0.279	-0.580	-0.380	-0.480			-0.224	-0.201	-0.520	-0.380	-0.450		
22-03-16	11:00	49	0	0	49.00	48.000	-0.498	-0.23	-0.209	-0.540	-0.360	-0.450			-0.224	-0.284	-0.650	-0.430	-0.540			-0.229	-0.207	-0.570	-0.440	-0.505		
29-03-16	12:00	56	0	0	56.00	55.000	-0.507	-0.231	-0.208	-0.550	-0.350	-0.450	11605	2.85	-0.225	-0.285	-0.660	-0.440	-0.550	11575	3.22	-0.232	-0.207	-0.600	-0.440	-0.520	11565	2.94
05-04-16	14:00	63	0	0	63.00	62.000	-0.520	-0.232	-0.212	-0.560	-0.390	-0.475			-0.225	-0.287	-0.660	-0.460	-0.560			-0.232	-0.208	-0.600	-0.450	-0.525		
26-04-16	12:00	84	0	0	84.00	83.000	-0.587	-0.24	-0.215	-0.640	-0.420	-0.530			-0.235	-0.293	-0.760	-0.520	-0.640			-0.238	-0.215	-0.660	-0.520	-0.590		
09-05-16	14:00	97	0	0	97.00	96.000	-0.583	-0.238	-0.218	-0.620	-0.450	-0.535			-0.232	-0.293	-0.730	-0.520	-0.625			-0.238	-0.215	-0.660	-0.520	-0.590		
30-05-16	14:00	118	0	0	118.00	117.000	-0.610	-0.243	-0.22	-0.670	-0.470	-0.570			-0.236	-0.295	-0.770	-0.540	-0.655			-0.238	-0.218	-0.660	-0.550	-0.605		
08-06-16	14:00	127	0	0	127.00	126.000	-0.597	-0.242	-0.22	-0.660	-0.470	-0.565	11590	2.97	-0.234	-0.294	-0.750	-0.530	-0.640	11555	3.39	-0.236	-0.216	-0.640	-0.530	-0.585	11545	3.11
29-06-16	11:00	148	0	0	148.00	147.000	-0.627	-0.245	-0.221	-0.690	-0.480	-0.585			-0.238	-0.295	-0.790	-0.540	-0.665			-0.242	-0.219	-0.700	-0.560	-0.630		
08-07-16	12:00	157	0	0	157.00	156.000	-0.630	-0.245	-0.221	-0.690	-0.480	-0.585			-0.238	-0.296	-0.790	-0.550	-0.670			-0.242	-0.220	-0.700	-0.570	-0.635		
29-07-16	15:00	178	0	0	178.00	177.000	-0.637	-0.246	-0.22	-0.700	-0.470	-0.585			-0.239	-0.297	-0.800	-0.560	-0.680			-0.244	-0.220	-0.720	-0.570	-0.645		
07-08-16	16:00	187	0	0	187.00	186.000	-0.660	-0.248	-0.223	-0.720	-0.500	-0.610			-0.241	-0.300	-0.820	-0.590	-0.705			-0.244	-0.224	-0.720	-0.610	-0.665		
28-08-16	13:00	208	0	0	208.00	207.000	-0.673	-0.25	-0.224	-0.740	-0.510	-0.625	11570	3.14	-0.242	-0.301	-0.830	-0.600	-0.715	11535	3.55	-0.247	-0.224	-0.750	-0.610	-0.680	11525	3.27
06-09-16	13:00	217	0	0	217.00	216.000	-0.670	-0.251	-0.226	-0.750	-0.530	-0.640			-0.241	-0.300	-0.820	-0.590	-0.705			-0.245	-0.223	-0.730	-0.600	-0.665		
27-09-16	12:00	238	0	0	238.00	237.000	-0.667	-0.249	-0.225	-0.730	-0.520	-0.625			-0.241	-0.301	-0.820	-0.600	-0.710			-0.245	-0.223	-0.730	-0.600	-0.665		
06-10-16	12:00	247	0	0	247.00	246.000	-0.650	-0.248	-0.223	-0.720	-0.500	-0.610			-0.240	-0.300	-0.810	-0.590	-0.700			-0.243	-0.220	-0.710	-0.570	-0.640		
27-10-16	14:00	268	0	0	268.00	267.000	-0.702	-0.251	-0.229	-0.750	-0.560	-0.655			-0.244	-0.304	-0.850	-0.630	-0.740			-0.250	-0.227	-0.780	-0.640	-0.710		
05-11-16	11:00	277	0	0	277.00	276.000	-0.677	-0.249	-0.225	-0.730	-0.520	-0.625	11565	3.18	-0.242	-0.301	-0.830	-0.600	-0.715	11530	3.60	-0.248	-0.225	-0.760	-0.620	-0.690	11525	3.27
26-11-16	11:00	298	0	0	298.00	297.000	-0.688	-0.251	-0.224	-0.750	-0.510	-0.630			-0.246	-0.301	-0.870	-0.600	-0.735			-0.251	-0.224	-0.790	-0.610	-0.700		
05-12-16	11:00	307	0	0	307.00	306.000	-0.750	-0.257	-0.231	-0.810	-0.580	-0.695			-0.252	-0.307	-0.930	-0.660	-0.795			-0.257	-0.230	-0.850	-0.670	-0.760		
26-12-16	13:00	328	0	0	328.00	327.000	-0.732	-0.254	-0.229	-0.780	-0.560	-0.670			-0.251	-0.305	-0.920	-0.640	-0.780			-0.256	-0.228	-0.840	-0.650	-0.745		
04-01-17	14:00	337	0	0	337.00	336.000	-0.765	-0.259	-0.229	-0.830	-0.560	-0.695			-0.256	-0.308	-0.970	-0.670	-0.820			-0.261	-0.230	-0.890	-0.670	-0.780		
25-01-17	15:00	358	0	0	358.00	357.000	-0.775	-0.262	-0.230	-0.860	-0.570	-0.715			-0.257	-0.307	-0.980	-0.660	-0.820			-0.262	-0.231	-0.900	-0.680	-0.790		
08-02-17	16:00	372	0	0	372.00	371.000	-0.772	-0.261	-0.231	-0.850	-0.580	-0.715	11520	3.56	-0.256	-0.308	-0.970	-0.670	-0.820	11480	4.01	-0.260	-0.231	-0.880	-0.680	-0.780	11475	3.69
01-03-17	10:00	393	0	0	393.00	392.000	-0.767	-0.26	-0.231	-0.840	-0.580	-0.710			-0.257	-0.307	-0.980	-0.660	-0.820			-0.259	-0.230	-0.870	-0.670	-0.770		
15-03-17	12:00	407	0	0	407.00	406.000	-0.772	-0.26	-0.232	-0.840	-0.590	-0.715			-0.255	-0.309	-0.960	-0.680	-0.820			-0.259	-0.232	-0.870	-0.690	-0.780		
05-04-17	11:00	428	0	0	428.00	427.000	-0.785	-0.261	-0.233	-0.850	-0.600	-0.725			-0.257	-0.310	-0.980	-0.690	-0.835			-0.262	-0.232	-0.900	-0.690	-0.795		
04-05-17	16:00	457	0	0	457.00	456.000	-0.782	-0.261	-0.231	-0.850	-0.580	-0.715			-0.258	-0.310	-0.990	-0.690	-0.840			-0.262	-0.231	-0.900	-0.680	-0.790		
25-05-17	17:00	478	0	0	478.00	477.000	-0.782	-0.261	-0.231	-0.850	-0.580	-0.715	11515	3.60	-0.260	-0.308	-1.010	-0.670	-0.840	11475	4.06	-0.260	-0.233	-0.880	-0.700	-0.790	11470	3.73

			Age					ε_{cs} (‰)	Prism P9							Prism P11							Prism P7					
HVFAC	Date	Time	Days	Hours	Minutes	Days, eq	$t - t_s$		D1	D2	ε_1 (‰)	ε_2 (‰)	ε_{avr} (‰)	m (g)	Δm(%)	D1	D2	ε_1 (‰)	ε_2 (‰)	ε_{avr} (‰)	m (g)	Δm(%)	D1	D2	ε_1 (‰)	ε_2 (‰)	ε_{avr} (‰)	m (g)
Casting	10-02-16	11:00	0	0	0	0.000	–	–	–	–	–	–	–			–	–	–	–	–			–	–	–	–	–	
After demoulding	11-02-16	16:00	1	0	0	1.000	0.100	0.000	-0.141	-0.169	0.000	0.000	0.000	12085	0	-0.161	-0.232	0.000	0.000	0.000	11875	0	-0.596	-0.167	0.000	0.000	0.000	11665
2	12-02-16	11:00	2	0	0	2.000	1.000	-0.020	-0.145	-0.173	-0.040	-0.040	-0.040			-0.162	-0.232	-0.010	0.000	-0.005			-0.597	-0.169	-0.010	-0.020	-0.015	
3	13-02-16	12:00	3	0	0	3.000	2.000	-0.028	-0.146	-0.174	-0.050	-0.050	-0.050			-0.163	-0.232	-0.020	0.000	-0.010			-0.597	-0.171	-0.010	-0.040	-0.025	
4	14-02-16	20:00	4	0	0	4.000	3.000	-0.012	-0.144	-0.169	-0.030	0.000	-0.015			-0.161	-0.230	0.000	0.020	0.010			-0.598	-0.171	-0.020	-0.040	-0.030	
5	15-02-16	20:00	5	0	0	5.000	4.000	-0.090	-0.150	-0.180	-0.090	-0.110	-0.100			-0.170	-0.239	-0.090	-0.070	-0.080			-0.603	-0.178	-0.070	-0.110	-0.090	
6	16-02-16	15:00	6	0	0	6.000	5.000	-0.100	-0.152	-0.177	-0.110	-0.080	-0.095			-0.173	-0.239	-0.120	-0.070	-0.095			-0.606	-0.179	-0.100	-0.120	-0.110	
Before loading 7	17-02-16	10:55	7	0	0	7.000	6.000	-0.122	-0.153	-0.180	-0.120	-0.110	-0.115			-0.175	-0.242	-0.140	-0.100	-0.120			-0.606	-0.183	-0.100	-0.160	-0.130	
5min after load 7	17-02-16	11:00	7	0	5	7.003	6.003	-0.122	-0.153	-0.180	-0.120	-0.110	-0.115			-0.175	-0.242	-0.140	-0.100	-0.120			-0.606	-0.183	-0.100	-0.160	-0.130	
1h	17-02-16	12:00	7	1	0	7.042	6.042	-0.122	-0.153	-0.180	-0.120	-0.110	-0.115			-0.175	-0.242	-0.140	-0.100	-0.120			-0.606	-0.183	-0.100	-0.160	-0.130	
6h	17-02-16	17:00	7	6	0	7.250	6.250	-0.122	-0.153	-0.180	-0.120	-0.110	-0.115			-0.175	-0.242	-0.140	-0.100	-0.120			-0.606	-0.183	-0.100	-0.160	-0.130	
8	18-02-16	13:00	8	0	0	8.000	7.000	-0.125	-0.158	-0.180	-0.170	-0.110	-0.140			-0.174	-0.241	-0.130	-0.090	-0.110			-0.606	-0.182	-0.100	-0.150	-0.125	
9	19-02-16	11:00	9	0	0	9.000	8.000	-0.132	-0.156	-0.182	-0.150	-0.130	-0.140			-0.176	-0.243	-0.150	-0.110	-0.130			-0.606	-0.182	-0.100	-0.150	-0.125	
10	20-02-16	12:00	10	0	0	10.000	9.000	-0.158	-0.162	-0.184	-0.210	-0.150	-0.180			-0.180	-0.242	-0.190	-0.100	-0.145			-0.608	-0.185	-0.120	-0.180	-0.150	
11	21-02-16	13:00	11	0	0	11.000	10.000	-0.182	-0.162	-0.190	-0.210	-0.210	-0.210			-0.179	-0.247	-0.180	-0.150	-0.165			-0.610	-0.187	-0.140	-0.200	-0.170	
12	22-02-16	11:00	12	0	0	12.000	11.000	-0.192	-0.163	-0.186	-0.220	-0.170	-0.195			-0.183	-0.249	-0.220	-0.170	-0.195			-0.610	-0.190	-0.140	-0.230	-0.185	
13	23-02-16	16:00	13	0	0	13.000	12.000	-0.225	-0.167	-0.192	-0.260	-0.230	-0.245			-0.190	-0.250	-0.290	-0.180	-0.235			-0.613	-0.189	-0.170	-0.220	-0.195	
14	24-02-16	14:00	14	0	0	14.000	13.000	-0.235	-0.167	-0.193	-0.260	-0.240	-0.250	11550	4.43	-0.190	-0.250	-0.290	-0.180	-0.235	11555	2.69	-0.613	-0.194	-0.170	-0.270	-0.220	11240
21	02-03-16	13:00	21	0	0	21.00	20.000	-0.272	-0.169	-0.193	-0.280	-0.240	-0.260			-0.201	-0.258	-0.400	-0.260	-0.330			-0.616	-0.192	-0.200	-0.250	-0.225	
28	09-03-16	10:25	28	0	0	28.00	27.000	-0.330	-0.173	-0.197	-0.320	-0.280	-0.300	11510	4.76	-0.200	-0.262	-0.390	-0.300	-0.345	11520	2.99	-0.628	-0.204	-0.320	-0.370	-0.345	11195
28	09-03-16	10:35	28	0	5	28.00	27.003	-0.330	-0.173	-0.197	-0.320	-0.280	-0.300			-0.200	-0.262	-0.390	-0.300	-0.345			-0.628	-0.204	-0.320	-0.370	-0.345	
28	09-03-16	11:30	28	1	0	28.04	27.042	-0.330	-0.173	-0.197	-0.320	-0.280	-0.300			-0.200	-0.262	-0.390	-0.300	-0.345			-0.628	-0.204	-0.320	-0.370	-0.345	
28	09-03-16	16:30	28	6	0	28.25	27.250	-0.330	-0.173	-0.197	-0.320	-0.280	-0.300			-0.200	-0.262	-0.390	-0.300	-0.345			-0.628	-0.204	-0.320	-0.370	-0.345	
29	10-03-16	15:00	29	0	0	29.00	28.000	-0.315	-0.171	-0.196	-0.300	-0.270	-0.285			-0.199	-0.260	-0.380	-0.280	-0.330			-0.626	-0.203	-0.300	-0.360	-0.330	
30	11-03-16	15:00	30	0	0	30.00	29.000	-0.333	-0.175	-0.198	-0.340	-0.290	-0.315			-0.199	-0.262	-0.380	-0.300	-0.340			-0.630	-0.202	-0.340	-0.350	-0.345	
31	12-03-16	20:00	31	0	0	31.00	30.000	-0.327	-0.173	-0.198	-0.320	-0.290	-0.305			-0.197	-0.262	-0.360	-0.300	-0.330			-0.629	-0.203	-0.330	-0.360	-0.345	
32	13-03-16	18:00	32	0	0	32.00	31.000	-0.335	-0.174	-0.200	-0.330	-0.310	-0.320			-0.198	-0.262	-0.370	-0.300	-0.335			-0.630	-0.203	-0.340	-0.360	-0.350	
33	14-03-16	9:00	33	0	0	33.00	32.000	-0.338	-0.175	-0.200	-0.340	-0.310	-0.325			-0.198	-0.264	-0.370	-0.320	-0.345			-0.630	-0.202	-0.340	-0.350	-0.345	
34	15-03-16	18:00	34	0	0	34.00	33.000	-0.335	-0.174	-0.201	-0.330	-0.320	-0.325			-0.198	-0.263	-0.370	-0.310	-0.340			-0.631	-0.200	-0.350	-0.330	-0.340	
35	16-03-16	17:00	35	0	0	35.00	34.000	-0.332	-0.173	-0.200	-0.320	-0.310	-0.315			-0.198	-0.262	-0.370	-0.300	-0.335			-0.631	-0.201	-0.350	-0.340	-0.345	
42	23-03-16	12:00	42	0	0	42.00	41.000	-0.337	-0.172	-0.200	-0.310	-0.310	-0.310			-0.199	-0.264	-0.380	-0.320	-0.350			-0.630	-0.203	-0.340	-0.360	-0.350	
49	30-03-16	15:00	49	0	0	49.00	48.000	-0.388	-0.179	-0.203	-0.380	-0.340	-0.360			-0.205	-0.266	-0.440	-0.340	-0.390			-0.637	-0.209	-0.410	-0.420	-0.415	
56	06-04-16	12:00	56	0	0	56.00	55.000	-0.410	-0.182	-0.206	-0.410	-0.370	-0.390	11480	5.01	-0.206	-0.270	-0.450	-0.380	-0.415	11370	4.25	-0.638	-0.210	-0.420	-0.430	-0.425	11150
63	13-04-16	14:00	63	0	0	63.00	62.000	-0.427	-0.185	-0.207	-0.440	-0.380	-0.410			-0.208	-0.271	-0.470	-0.390	-0.430			-0.638	-0.213	-0.420	-0.460	-0.440	
84	04-05-16	14:00	84	0	0	84.00	83.000	-0.430	-0.184	-0.210	-0.430	-0.410	-0.420			-0.208	-0.271	-0.470	-0.390	-0.430			-0.637	-0.214	-0.410	-0.470	-0.440	
97	17-05-16	14:00	97	0	0	97.00	96.000	-0.410	-0.182	-0.208	-0.410	-0.390	-0.400			-0.206	-0.269	-0.450	-0.370	-0.410			-0.636	-0.211	-0.400	-0.440	-0.420	
118	07-06-16	12:00	118	0	0	118.00	117.000	-0.438	-0.185	-0.208	-0.440	-0.390	-0.415			-0.208	-0.269	-0.470	-0.370	-0.420			-0.643	-0.216	-0.470	-0.490	-0.480	
127	16-06-16	13:00	127	0	0	127.00	126.000	-0.438	-0.185	-0.208	-0.440	-0.390	-0.415	11480	5.01	-0.208	-0.269	-0.470	-0.370	-0.420	11365	4.29	-0.643	-0.216	-0.470	-0.490	-0.480	11145
148	07-07-16	13:00	148	0	0	148.00	147.000	-0.470	-0.190	-0.212	-0.490	-0.430	-0.460			-0.211	-0.273	-0.500	-0.410	-0.455			-0.645	-0.217	-0.490	-0.500	-0.495	
157	16-07-16	15:00	157	0	0	157.00	156.000	-0.478	-0.190	-0.212	-0.490	-0.430	-0.460			-0.213	-0.274	-0.520	-0.420	-0.470			-0.645	-0.219	-0.490	-0.520	-0.505	
178	06-08-16	16:00	178	0	0	178.00	177.000	-0.507	-0.193	-0.215	-0.520	-0.460	-0.490			-0.216	-0.278	-0.550	-0.460	-0.505			-0.647	-0.221	-0.510	-0.540	-0.525	
187	15-08-16	13:00	187	0	0	187.00	186.000	-0.492	-0.191	-0.213	-0.500	-0.440	-0.470			-0.213	-0.275	-0.520	-0.430	-0.475			-0.649	-0.220	-0.530	-0.530	-0.530	
208	05-09-16	13:00	208	0	0	208.00	207.000	-0.495	-0.191	-0.214	-0.500	-0.450	-0.475	11465	5.13	-0.214	-0.274	-0.530	-0.420	-0.475	11350	4.42	-0.648	-0.222	-0.520	-0.550	-0.535	11130
217	14-09-16	13:00	217	0	0	217.00	216.000	-0.508	-0.193	-0.214	-0.520	-0.450	-0.485			-0.217	-0.276	-0.560	-0.440	-0.500			-0.650	-0.221	-0.540	-0.540	-0.540	
238	05-10-16	12:00	238	0	0	238.00	237.000	-0.485	-0.190	-0.213	-0.490	-0.440	-0.465			-0.214	-0.274	-0.530	-0.420	-0.475			-0.646	-0.220	-0.500	-0.530	-0.515	
247	14-10-16	16:00	247	0	0	247.00	246.000	-0.492	-0.192	-0.213	-0.510	-0.440	-0.475			-0.214	-0.273	-0.530	-0.410	-0.470			-0.648	-0.221	-0.520	-0.540	-0.530	
268	04-11-16	11:00	268	0	0	268.00	267.000	-0.493	-0.190	-0.213	-0.490	-0.440	-0.465			-0.214	-0.276	-0.530	-0.440	-0.485			-0.648	-0.221	-0.520	-0.540	-0.530	
277	13-11-16	12:00	277	0	0	277.00	276.000	-0.502	-0.190	-0.215	-0.490	-0.460	-0.475	11465	5.13	-0.217	-0.275	-0.560	-0.430	-0.495	11350	4.42	-0.649	-0.221	-0.530	-0.540	-0.535	11125
298	04-12-16	11:00	298	0	0	298.00	297.000	-0.572	-0.198	-0.221	-0.570	-0.520	-0.545			-0.224	-0.284	-0.630	-0.520	-0.575			-0.655	-0.227	-0.590	-0.600	-0.595	
307	13-12-16	13:00	307	0	0	307.00	306.000	-0.530	-0.195	-0.216	-0.540	-0.470	-0.505			-0.220	-0.279	-0.590	-0.470	-0.530			-0.652	-0.222	-0.560	-0.550	-0.555	
328	03-01-17	14:00	328	0	0	328.00	327.000	-0.568	-0.199	-0.220	-0.580	-0.510	-0.545			-0.222	-0.283	-0.610	-0.510	-0.560			-0.656	-0.227	-0.600	-0.600	-0.600	
337	12-01-17	13:00	337	0	0	337.00	336.000	-0.563	-0.199	-0.219	-0.580	-0.500	-0.540			-0.224	-0.282	-0.630	-0.500	-0.565			-0.655	-0.225	-0.590	-0.580	-0.585	
358	02-02-17	13:00	358	0	0	358.00	357.000	-0.552	-0.197	-0.217	-0.560	-0.480	-0.520			-0.223	-0.281	-0.620	-0.490	-0.555			-0.656	-0.223	-0.600	-0.560	-0.580	
372	16-02-17	17:00	372	0	0	372.00	371.000	-0.587	-0.202	-0.222	-0.610	-0.530	-0.570	11420	5.50	-0.225	-0.286	-0.640	-0.540	-0.590	11305	4.80	-0.656	-0.227	-0.600	-0.600	-0.600	11075
393	09-03-17	11:00	393	0	0	393.00	392.000	-0.608	-0.201	-0.225	-0.600	-0.560	-0.580			-0.226	-0.288	-0.650	-0.560	-0.605			-0.660	-0.231	-0.640	-0.640	-0.640	
407	23-03-17	11:00	407	0	0	407.00	406.000	-0.597	-0.200	-0.224	-0.590	-0.550	-0.570			-0.225	-0.286	-0.640	-0.540	-0.590			-0.659	-0.230	-0.630	-0.630	-0.630	
428	13-04-17	10:00	428	0	0	428.00	427.000	-0.593	-0.200	-0.224	-0.590	-0.550	-0.570			-0.224	-0.285	-0.630	-0.530	-0.580			-0.658	-0.231	-0.620	-0.640	-0.630	
457	12-05-17	11:00	457	0	0	457.00	456.000	-0.595	-0.200	-0.223	-0.590	-0.540	-0.565			-0.224	-0.284	-0.630	-0.520	-0.575			-0.662	-0.230	-0.660	-0.630	-0.645	
478	02-06-17	17:00	478	0	0	478.00	477.000	-0.597	-0.201	-0.224	-0.600	-0.550	-0.575	11420	5.50	-0.223	-0.285	-0.620	-0.530	-0.575	11305	4.80	-0.660	-0.231	-0.640	-0.640	-0.640	11075

Experimental Measurements:

Creep

RAC7										σ =	14.5	MPa			
			Age												
	Date	Time	Days	Hours	Minutes	Days, eq	From loading (days)	ε_{tot} (‰)	$\varepsilon_{c\sigma}$ (‰)	ε_{cs} (‰)	ε_{ci} (‰)	ε_{cc} (‰)	φ_{exp}	$\varepsilon_{cc,s}$ (‰)	J (10^{-9} 1/Pa)
Casting	02-02-16	11:00	0	0	0	0.000	–	0.000	0.000	0.000	–	–	–	–	–
Before loading	09-02-16	10:45	7	0	0	7.000	0.000	-0.155	0.000	-0.155	0.000				0.000
5min after loading	09-02-16	11:15	7	0	5	7.003	0.003	-0.930	-0.775	-0.155	-0.775	0.000	0.000	0.000	0.053
1h	09-02-16	12:15	7	1	0	7.042	0.042	-1.121	-0.966	-0.155	-0.775	-0.191	0.246	-0.013	0.067
6h	09-02-16	17:15	7	6	0	7.250	0.250	-1.241	-1.101	-0.140	-0.775	-0.326	0.420	-0.022	0.076
1	10-02-16	13:30	8	0	0	8.000	1.000	-1.409	-1.254	-0.155	-0.775	-0.479	0.618	-0.033	0.086
2	11-02-16	16:00	9	0	0	9.000	2.000	-1.516	-1.354	-0.162	-0.775	-0.579	0.747	-0.040	0.093
3	12-02-16	12:00	10	0	0	10.000	3.000	-1.627	-1.428	-0.198	-0.775	-0.653	0.843	-0.045	0.099
4	13-02-16	12:00	11	0	0	11.000	4.000	-1.653	-1.446	-0.207	-0.775	-0.671	0.866	-0.046	0.100
5	14-02-16	20:00	12	0	0	12.000	5.000	-1.713	-1.541	-0.172	-0.775	-0.766	0.988	-0.053	0.106
6	15-02-16	20:00	13	0	0	13.000	6.000	-1.791	-1.571	-0.220	-0.775	-0.796	1.027	-0.055	0.108
7	16-02-16	15:00	14	0	0	14.000	7.000	-1.795	-1.550	-0.245	-0.775	-0.775	1.000	-0.053	0.107
14	23-02-16	16:00	21	0	0	21.00	14.00	-2.093	-1.773	-0.320	-0.775	-0.998	1.287	-0.069	0.122
21	01-03-16	11:00	28	0	0	28.00	21.00	-2.172	-1.788	-0.383	-0.775	-1.013	1.308	-0.070	0.123
28	08-03-16	11:00	35	0	0	35.00	28.00	-2.330	-1.920	-0.410	-0.775	-1.145	1.477	-0.079	0.132
56	05-04-16	14:00	63	0	0	63.00	56.00	-2.621	-2.101	-0.520	-0.775	-1.326	1.711	-0.091	0.145
90	09-05-16	14:00	97	0	0	97.00	90.00	-2.789	-2.206	-0.583	-0.775	-1.431	1.846	-0.099	0.152
120	08-06-16	14:00	127	0	0	127.00	120.00	-2.862	-2.265	-0.597	-0.775	-1.490	1.923	-0.103	0.156
150	08-07-16	12:00	157	0	0	157.00	150.00	-2.956	-2.326	-0.630	-0.775	-1.551	2.001	-0.107	0.160
180	07-08-16	16:00	187	0	0	187.00	180.00	-3.026	-2.366	-0.660	-0.775	-1.591	2.053	-0.110	0.163
210	06-09-16	13:00	217	0	0	217.00	210.00	-3.106	-2.436	-0.670	-0.775	-1.661	2.143	-0.115	0.168
240	06-10-16	12:00	247	0	0	247.00	240.00	-3.108	-2.458	-0.650	-0.775	-1.683	2.172	-0.116	0.170
270	05-11-16	11:00	277	0	0	277.00	270.00	-3.165	-2.488	-0.677	-0.775	-1.713	2.211	-0.118	0.172
300	05-12-16	11:00	307	0	0	307.00	300.00	-3.238	-2.488	-0.750	-0.775	-1.713	2.210	-0.118	0.172
330	04-01-17	14:00	337	0	0	337.00	330.00	-3.294	-2.529	-0.765	-0.775	-1.754	2.263	-0.121	0.174
365	08-02-17	16:00	372	0	0	372.00	365.00	-3.349	-2.578	-0.772	-0.775	-1.803	2.326	-0.124	0.178
400	15-03-17	12:00	407	0	0	407.00	400.00	-3.371	-2.599	-0.772	-0.775	-1.824	2.354	-0.126	0.179
450	04-05-17	16:00	457	0	0	457.00	450.00	-3.413	-2.631	-0.782	-0.775	-1.856	2.395	-0.128	0.181

Prism P12

D1	D2	D3	D4	ε_1 (‰)	$\varepsilon_{1,cc}$ (‰)	ε_2 (‰)	$\varepsilon_{2,cc}$ (‰)	ε_3 (‰)	$\varepsilon_{3,cc}$ (‰)	ε_4 (‰)	$\varepsilon_{4,cc}$ (‰)	ε_{avr} (‰)	$\varepsilon_{avr,cc}$ (‰)
–	–	–	–	–	–	–	–	–	–	–	–	–	–
-0.400	-0.208	-0.182	0.154	0.000	–	0.000	–	0.000	–	0.000	–	0.000	–
-0.443	-0.300	-0.333	0.094	-0.430	0.000	-0.920	0.000	-1.510	0.000	-0.600	0.000	-0.760	0.000
-0.449	-0.328	-0.378	0.076	-0.490	-0.060	-1.200	-0.280	-1.960	-0.450	-0.780	-0.180	-0.990	-0.230
-0.445	-0.336	-0.402	0.066	-0.450	-0.035	-1.280	-0.375	-2.200	-0.705	-0.880	-0.295	-1.080	-0.335
-0.448	-0.353	-0.430	0.051	-0.480	-0.050	-1.450	-0.530	-2.480	-0.970	-1.030	-0.430	-1.240	-0.480
-0.447	-0.366	-0.459	0.042	-0.470	-0.033	-1.580	-0.653	-2.770	-1.253	-1.120	-0.513	-1.350	-0.583
-0.450	-0.377	-0.469	0.033	-0.500	-0.027	-1.690	-0.727	-2.870	-1.317	-1.210	-0.567	-1.450	-0.647
	-0.383	-0.474	0.030			-1.750	-0.778	-2.920	-1.358	-1.240	-0.588	-1.495	-0.683
	-0.389	-0.486	0.025			-1.810	-0.873	-3.040	-1.513	-1.290	-0.673	-1.550	-0.773
	-0.398	-0.497	0.015			-1.900	-0.915	-3.150	-1.575	-1.390	-0.725	-1.645	-0.820
	-0.399	-0.498	0.016			-1.910	-0.900	-3.160	-1.560	-1.380	-0.690	-1.645	-0.795
	-0.431	-0.548	-0.014			-2.230	-1.145	-3.660	-1.985	-1.680	-0.915	-1.955	-1.030
	-0.440	-0.564	-0.022			-2.320	-1.172	-3.820	-2.082	-1.760	-0.932	-2.040	-1.052
	-0.458	-0.589	-0.037			-2.500	-1.325	-4.070	-2.305	-1.910	-1.055	-2.205	-1.190
	-0.491	-0.636	-0.067			-2.830	-1.545	-4.540	-2.665	-2.210	-1.245	-2.520	-1.395
	-0.511	-0.670	-0.081			-3.030	-1.682	-4.880	-2.942	-2.350	-1.322	-2.690	-1.502
	-0.519	-0.685	-0.088			-3.110	-1.748	-5.030	-3.078	-2.420	-1.378	-2.765	-1.563
	-0.531	-0.700	-0.096			-3.230	-1.835	-5.180	-3.195	-2.500	-1.425	-2.865	-1.630
	-0.538	-0.711	-0.101			-3.300	-1.875	-5.290	-3.275	-2.550	-1.445	-2.925	-1.660
	-0.546	-0.722	-0.112			-3.380	-1.945	-5.400	-3.375	-2.660	-1.545	-3.020	-1.745
	-0.547	-0.727	-0.110			-3.390	-1.975	-5.450	-3.445	-2.640	-1.545	-3.015	-1.760
	-0.553	-0.732	-0.119			-3.450	-2.008	-5.500	-3.468	-2.730	-1.608	-3.090	-1.808
	-0.561	-0.739	-0.126			-3.530	-2.015	-5.570	-3.465	-2.800	-1.605	-3.165	-1.810
	-0.567	-0.749	-0.130			-3.590	-2.060	-5.670	-3.550	-2.840	-1.630	-3.215	-1.845
	-0.573	-0.758	-0.134			-3.650	-2.113	-5.760	-3.633	-2.880	-1.663	-3.265	-1.888
	-0.574	-0.760	-0.138			-3.660	-2.123	-5.780	-3.653	-2.920	-1.703	-3.290	-1.913
	-0.580	-0.771	-0.142			-3.720	-2.173	-5.890	-3.753	-2.960	-1.733	-3.340	-1.953

Prism P13

D1	D2	D3	D4	ε_1 (‰)	$\varepsilon_{1,cc}$ (‰)	ε_2 (‰)	$\varepsilon_{2,cc}$ (‰)	ε_3 (‰)	$\varepsilon_{3,cc}$ (‰)	ε_4 (‰)	$\varepsilon_{4,cc}$ (‰)	ε_{avr} (‰)	$\varepsilon_{avr,cc}$ (‰)
–	–	–	–	–	–	–	–	–	–	–	–	–	–
0.055	-0.153	-0.182	-0.203	0.000	–	0.000	–	0.000	–	0.000	–	0.000	–
0.026	-0.274	-0.285	-0.223	-0.290	0.000	-1.210	0.000	-1.030	0.000	-0.200	0.000	-0.683	0.000
0.020	-0.301	-0.301	-0.234	-0.350	-0.060	-1.480	-0.270	-1.190	-0.160	-0.310	-0.110	-0.833	-0.150
0.012	-0.316	-0.325	-0.236	-0.430	-0.155	-1.630	-0.435	-1.430	-0.415	-0.330	-0.145	-0.955	-0.288
0.009	-0.333	-0.343	-0.242	-0.460	-0.170	-1.800	-0.590	-1.610	-0.580	-0.390	-0.190	-1.065	-0.383
0.002	-0.349	-0.359	-0.248	-0.530	-0.233	-1.960	-0.743	-1.770	-0.733	-0.450	-0.243	-1.178	-0.488
-0.013	-0.363	-0.367	-0.256	-0.680	-0.347	-2.100	-0.847	-1.850	-0.777	-0.530	-0.287	-1.290	-0.564
-0.012	-0.366	-0.373	-0.257	-0.670	-0.328	-2.130	-0.868	-1.910	-0.828	-0.540	-0.288	-1.313	-0.578
-0.014	-0.372	-0.375	-0.260	-0.690	-0.383	-2.190	-0.963	-1.930	-0.883	-0.570	-0.353	-1.345	-0.646
-0.017	-0.382	-0.386	-0.267	-0.720	-0.365	-2.290	-1.015	-2.040	-0.945	-0.640	-0.375	-1.423	-0.675
-0.022	-0.383	-0.386	-0.265	-0.770	-0.390	-2.300	-1.000	-2.040	-0.920	-0.620	-0.330	-1.433	-0.660
-0.034	-0.417	-0.424	-0.288	-0.890	-0.435	-2.640	-1.265	-2.420	-1.225	-0.850	-0.485	-1.700	-0.853
-0.043	-0.427	-0.434	-0.290	-0.980	-0.462	-2.740	-1.302	-2.520	-1.262	-0.870	-0.442	-1.778	-0.867
-0.055	-0.443	-0.453	-0.302	-1.100	-0.555	-2.900	-1.435	-2.710	-1.425	-0.990	-0.535	-1.925	-0.988
-0.070	-0.477	-0.489	-0.323	-1.250	-0.595	-3.240	-1.665	-3.070	-1.675	-1.200	-0.635	-2.190	-1.143
-0.077	-0.503	-0.511	-0.331	-1.320	-0.602	-3.500	-1.862	-3.290	-1.832	-1.280	-0.652	-2.348	-1.237
-0.079	-0.515	-0.521	-0.332	-1.340	-0.608	-3.620	-1.968	-3.390	-1.918	-1.290	-0.648	-2.410	-1.286
-0.085	-0.526	-0.533	-0.340	-1.400	-0.635	-3.730	-2.045	-3.510	-2.005	-1.370	-0.695	-2.503	-1.345
-0.090	-0.534	-0.543	-0.343	-1.450	-0.655	-3.810	-2.095	-3.610	-2.075	-1.400	-0.695	-2.568	-1.380
-0.098	-0.540	-0.549	-0.350	-1.530	-0.725	-3.870	-2.145	-3.670	-2.125	-1.470	-0.755	-2.635	-1.438
-0.097	-0.547	-0.552	-0.348	-1.520	-0.735	-3.940	-2.235	-3.700	-2.175	-1.450	-0.755	-2.653	-1.475
-0.096	-0.551	-0.557	-0.355	-1.510	-0.698	-3.980	-2.248	-3.750	-2.198	-1.520	-0.798	-2.690	-1.486
-0.103	-0.558	-0.571	-0.361	-1.580	-0.695	-4.050	-2.245	-3.890	-2.265	-1.580	-0.785	-2.775	-1.498
-0.109	-0.562	-0.580	-0.364	-1.640	-0.740	-4.090	-2.270	-3.980	-2.340	-1.610	-0.800	-2.830	-1.538
-0.114	-0.569	-0.585	-0.370	-1.690	-0.783	-4.160	-2.333	-4.030	-2.383	-1.670	-0.853	-2.888	-1.588
-0.111	-0.571	-0.590	-0.371	-1.660	-0.753	-4.180	-2.353	-4.080	-2.433	-1.680	-0.863	-2.900	-1.601
-0.111	-0.581	-0.594	-0.372	-1.660	-0.743	-4.280	-2.443	-4.120	-2.463	-1.690	-0.863	-2.938	-1.628

Prism P11

D1	D2	D3	D4	ε_1 (‰)	$\varepsilon_{1,cc}$ (‰)	ε_2 (‰)	$\varepsilon_{2,cc}$ (‰)	ε_3 (‰)	$\varepsilon_{3,cc}$ (‰)	ε_4 (‰)	$\varepsilon_{4,cc}$ (‰)	ε_{avr} (‰)	$\varepsilon_{avr,cr}$ (‰)
–	–	–	–	–	–	–	–	–	–	–	–	–	–
0.068	-0.314	-0.228	-0.160	0.000	–	0.000	–	0.000	–	0.000	–	0.000	–
-0.018	-0.480	-0.319	-0.170	-0.860	0.000	-1.660	0.000	-0.910	0.000	-0.100	0.000	-0.883	0.000
-0.041	-0.515	-0.323	-0.185	-1.090	-0.230	-2.010	-0.350	-0.950	-0.040	-0.250	-0.150	-1.075	-0.193
-0.059	-0.545	-0.337	-0.182	-1.270	-0.425	-2.310	-0.665	-1.090	-0.195	-0.220	-0.135	-1.223	-0.355
-0.080	-0.572	-0.348	-0.217	-1.480	-0.620	-2.580	-0.920	-1.200	-0.290	-0.570	-0.470	-1.458	-0.575
-0.088	-0.594	-0.354	-0.220	-1.560	-0.693	-2.800	-1.133	-1.260	-0.343	-0.600	-0.493	-1.555	-0.666
-0.102	-0.607	-0.369	-0.226	-1.700	-0.797	-2.930	-1.227	-1.410	-0.457	-0.660	-0.517	-1.675	-0.749
-0.104	-0.608	-0.370	-0.226	-1.720	-0.808	-2.940	-1.228	-1.420	-0.458	-0.660	-0.508	-1.685	-0.751
-0.117	-0.623	-0.376	-0.229	-1.850	-0.973	-3.090	-1.413	-1.480	-0.553	-0.690	-0.573	-1.778	-0.878
-0.125	-0.632	-0.380	-0.233	-1.930	-1.005	-3.180	-1.455	-1.520	-0.545	-0.730	-0.565	-1.840	-0.893
-0.126	-0.633	-0.380	-0.232	-1.940	-0.990	-3.190	-1.440	-1.520	-0.520	-0.720	-0.530	-1.843	-0.870
-0.154	-0.676	-0.413	-0.254	-2.220	-1.195	-3.620	-1.795	-1.850	-0.775	-0.940	-0.675	-2.158	-1.110
-0.166	-0.688	-0.419	-0.254	-2.340	-1.252	-3.740	-1.852	-1.910	-0.772	-0.940	-0.612	-2.233	-1.122
-0.183	-0.714	-0.432	-0.263	-2.510	-1.395	-4.000	-2.085	-2.040	-0.875	-1.030	-0.675	-2.395	-1.258
-0.220	-0.751	-0.458	-0.280	-2.880	-1.655	-4.370	-2.345	-2.300	-1.025	-1.200	-0.735	-2.688	-1.440
-0.238	-0.783	-0.473	-0.286	-3.060	-1.772	-4.690	-2.602	-2.450	-1.112	-1.260	-0.732	-2.865	-1.554
-0.251	-0.794	-0.479	-0.288	-3.190	-1.888	-4.800	-2.698	-2.510	-1.158	-1.280	-0.738	-2.945	-1.621
-0.256	-0.810	-0.489	-0.293	-3.240	-1.905	-4.960	-2.825	-2.610	-1.225	-1.330	-0.755	-3.035	-1.678
-0.268	-0.823	-0.495	-0.296	-3.360	-1.995	-5.090	-2.925	-2.670	-1.255	-1.360	-0.755	-3.120	-1.733
-0.273	-0.835	-0.500	-0.305	-3.410	-2.035	-5.210	-3.035	-2.720	-1.295	-1.450	-0.835	-3.198	-1.800
-0.271	-0.835	-0.504	-0.301	-3.390	-2.035	-5.210	-3.055	-2.760	-1.355	-1.410	-0.815	-3.193	-1.815
-0.278	-0.839	-0.511	-0.306	-3.460	-2.078	-5.250	-3.068	-2.830	-1.398	-1.460	-0.838	-3.250	-1.846
-0.278	-0.851	-0.519	-0.309	-3.460	-2.005	-5.370	-3.115	-2.910	-1.405	-1.490	-0.795	-3.308	-1.830
-0.285	-0.857	-0.526	-0.315	-3.530	-2.060	-5.430	-3.160	-2.980	-1.460	-1.550	-0.840	-3.373	-1.880
-0.291	-0.865	-0.532	-0.318	-3.590	-2.113	-5.510	-3.233	-3.040	-1.513	-1.580	-0.863	-3.430	-1.931
-0.295	-0.868	-0.536	-0.318	-3.630	-2.153	-5.540	-3.263	-3.080	-1.553	-1.580	-0.863	-3.458	-1.958
-0.297	-0.877	-0.536	-0.322	-3.650	-2.163	-5.630	-3.343	-3.080	-1.543	-1.620	-0.893	-3.495	-1.986

RAC28			Age					σ = 12.78 MPa							
	Date	Time	Days	Hours	Minutes	Days, eq	From loading (days)	ε_{tot} (‰)	$\varepsilon_{c\sigma}$ (‰)	ε_{cs} (‰)	ε_{ci} (‰)	ε_{cc} (‰)	φ_{exp}	$\varepsilon_{cc,s}$ (‰)	J (10^{-9} 1/Pa)
Casting	02-02-16	11:00	0	0	0	0.000	–	0.000	–	0.000	–	–	–	–	–
Before loading	01-03-16	10:55	28	0	0	28.000	0.000	-0.383	0.000	-0.383	0.000				0.000
5min after loading	01-03-16	11:05	28	0	5	28.003	0.003	-0.978	-0.594	-0.383	-0.594	0.000	0.000	0.000	0.046
1h	01-03-16	12:00	28	1	0	28.042	0.042	-1.058	-0.675	-0.383	-0.594	-0.081	0.136	-0.006	0.053
6h	01-03-16	17:00	28	6	0	28.250	0.250	-1.174	-0.791	-0.383	-0.594	-0.197	0.331	-0.015	0.062
1	02-03-16	13:00	29	0	0	29.000	1.000	-1.250	-0.865	-0.385	-0.594	-0.271	0.456	-0.021	0.068
2	03-03-16	14:00	30	0	0	30.000	2.000	-1.359	-0.973	-0.387	-0.594	-0.378	0.637	-0.030	0.076
3	04-03-16	13:00	31	0	0	31.000	3.000	-1.365	-0.963	-0.402	-0.594	-0.369	0.621	-0.029	0.075
4	05-03-16	14:00	32	0	0	32.000	4.000	-1.418	-1.023	-0.395	-0.594	-0.429	0.722	-0.034	0.080
5	06-03-16	17:00	33	0	0	33.000	5.000	-1.462	-1.077	-0.385	-0.594	-0.483	0.812	-0.038	0.084
6	07-03-16	16:00	34	0	0	34.000	6.000	-1.477	-1.083	-0.393	-0.594	-0.489	0.823	-0.038	0.085
7	08-03-16	11:00	35	0	0	35.000	7.000	-1.525	-1.115	-0.410	-0.594	-0.521	0.877	-0.041	0.087
14	15-03-16	18:00	42	0	0	42.00	14.00	-1.675	-1.232	-0.443	-0.594	-0.638	1.073	-0.050	0.096
21	22-03-16	11:00	49	0	0	49.00	21.00	-1.805	-1.307	-0.498	-0.594	-0.713	1.199	-0.056	0.102
28	29-03-16	12:00	56	0	0	56.00	28.00	-1.870	-1.363	-0.507	-0.594	-0.769	1.295	-0.060	0.107
56	26-04-16	12:00	84	0	0	84.00	56.00	-2.098	-1.512	-0.587	-0.594	-0.918	1.544	-0.072	0.118
90	30-05-16	14:00	118	0	0	118.00	90.00	-2.200	-1.590	-0.610	-0.594	-0.996	1.676	-0.078	0.124
120	29-06-16	11:00	148	0	0	148.00	120.00	-2.342	-1.715	-0.627	-0.594	-1.121	1.886	-0.088	0.134
150	29-07-16	15:00	178	0	0	178.00	150.00	-2.425	-1.788	-0.637	-0.594	-1.194	2.010	-0.093	0.140
180	28-08-16	13:00	208	0	0	208.00	180.00	-2.502	-1.828	-0.673	-0.594	-1.234	2.077	-0.097	0.143
210	27-09-16	12:00	238	0	0	238.00	210.00	-2.546	-1.879	-0.667	-0.594	-1.285	2.163	-0.101	0.147
240	27-10-16	14:00	268	0	0	268.00	240.00	-2.588	-1.887	-0.702	-0.594	-1.293	2.175	-0.101	0.148
270	26-11-16	11:00	298	0	0	298.00	270.00	-2.628	-1.940	-0.688	-0.594	-1.346	2.265	-0.105	0.152
300	26-12-16	13:00	328	0	0	328.00	300.00	-2.691	-1.959	-0.732	-0.594	-1.365	2.297	-0.107	0.153
330	25-01-17	15:00	358	0	0	358.00	330.00	-2.798	-2.023	-0.775	-0.594	-1.429	2.405	-0.112	0.158
365	01-03-17	10:00	393	0	0	393.00	365.00	-2.855	-2.088	-0.767	-0.594	-1.494	2.515	-0.117	0.163
400	05-04-17	11:00	428	0	0	428.00	400.00	-2.846	-2.061	-0.785	-0.594	-1.467	2.468	-0.115	0.161
450	25-05-17	17:00	478	0	0	478.00	450.00	-2.849	-2.068	-0.782	-0.594	-1.473	2.480	-0.115	0.162

Prism P7

D1	D2	D3	D4	ε_1 (‰)	$\varepsilon_{1,cc}$ (‰)	ε_2 (‰)	$\varepsilon_{2,cc}$ (‰)	ε_3 (‰)	$\varepsilon_{3,cc}$ (‰)	ε_4 (‰)	$\varepsilon_{4,cc}$ (‰)	ε_{avr} (‰)	$\varepsilon_{avr,cc}$ (‰)
–	–	–	–	–	–	–	–	–	–	–	–	–	–
-0.22	-0.23	-0.226	-0.308	0	–	0	–	0	–	0	–	0.000	–
-0.286	-0.258	-0.278	-0.393	-0.660	0.000	-0.280	0.000	-0.520	0.000	-0.850	0.000	-0.578	0.000
-0.294	-0.265	-0.285	-0.402	-0.740	-0.080	-0.350	-0.070	-0.590	-0.070	-0.940	-0.090	-0.655	-0.077
-0.302	-0.271	-0.296	-0.414	-0.820	-0.160	-0.410	-0.130	-0.700	-0.180	-1.060	-0.210	-0.748	-0.170
-0.318	-0.275	-0.305	-0.424	-0.980	-0.318	-0.450	-0.168	-0.790	-0.268	-1.160	-0.308	-0.845	-0.266
-0.326	-0.285	-0.312	-0.438	-1.060	-0.397	-0.550	-0.267	-0.860	-0.337	-1.300	-0.447	-0.943	-0.362
-0.326	-0.284	-0.315	-0.441	-1.060	-0.382	-0.540	-0.242	-0.890	-0.352	-1.330	-0.462	-0.955	-0.359
-0.332	-0.285	-0.322	-0.445	-1.120	-0.448	-0.550	-0.258	-0.960	-0.428	-1.370	-0.508	-1.000	-0.411
-0.336	-0.289	-0.325	-0.454	-1.160	-0.498	-0.590	-0.308	-0.990	-0.468	-1.460	-0.608	-1.050	-0.471
-0.337	-0.29	-0.327	-0.454	-1.170	-0.500	-0.600	-0.310	-1.010	-0.480	-1.460	-0.600	-1.060	-0.473
-0.342	-0.294	-0.331	-0.459	-1.220	-0.533	-0.640	-0.333	-1.050	-0.503	-1.510	-0.633	-1.105	-0.501
-0.356	-0.301	-0.35	-0.477	-1.360	-0.640	-0.710	-0.370	-1.240	-0.660	-1.690	-0.780	-1.250	-0.613
-0.372	-0.313	-0.363	-0.492	-1.520	-0.745	-0.830	-0.435	-1.370	-0.735	-1.840	-0.875	-1.390	-0.698
-0.375	-0.318	-0.369	-0.5	-1.550	-0.767	-0.880	-0.477	-1.430	-0.787	-1.920	-0.947	-1.445	-0.744
-0.401	-0.335	-0.396	-0.526	-1.810	-0.947	-1.050	-0.567	-1.700	-0.977	-2.180	-1.127	-1.685	-0.904
-0.41	-0.341	-0.406	-0.543	-1.900	-1.013	-1.110	-0.603	-1.800	-1.053	-2.350	-1.273	-1.790	-0.986
-0.425	-0.354	-0.422	-0.555	-2.050	-1.147	-1.240	-0.717	-1.960	-1.197	-2.470	-1.377	-1.930	-1.109
-0.441	-0.36	-0.428	-0.565	-2.210	-1.297	-1.300	-0.767	-2.020	-1.247	-2.570	-1.467	-2.025	-1.194
-0.446	-0.365	-0.437	-0.576	-2.260	-1.310	-1.350	-0.780	-2.110	-1.300	-2.680	-1.540	-2.100	-1.233
-0.449	-0.366	-0.44	-0.582	-2.290	-1.347	-1.360	-0.797	-2.140	-1.337	-2.740	-1.607	-2.133	-1.272
-0.454	-0.368	-0.443	-0.587	-2.340	-1.362	-1.380	-0.782	-2.170	-1.332	-2.790	-1.622	-2.170	-1.274
-0.456	-0.371	-0.449	-0.59	-2.360	-1.395	-1.410	-0.825	-2.230	-1.405	-2.820	-1.665	-2.205	-1.323
-0.467	-0.375	-0.455	-0.598	-2.470	-1.462	-1.450	-0.822	-2.290	-1.422	-2.900	-1.702	-2.278	-1.352
-0.477	-0.387	-0.465	-0.605	-2.570	-1.518	-1.570	-0.898	-2.390	-1.478	-2.970	-1.728	-2.375	-1.406
-0.48	-0.39	-0.473	-0.613	-2.600	-1.557	-1.600	-0.937	-2.470	-1.567	-3.050	-1.817	-2.430	-1.469
-0.482	-0.39	-0.473	-0.612	-2.620	-1.558	-1.600	-0.918	-2.470	-1.548	-3.040	-1.788	-2.433	-1.453
-0.48	-0.389	-0.472	-0.614	-2.600	-1.542	-1.590	-0.912	-2.460	-1.542	-3.060	-1.812	-2.428	-1.452

Prism P6

D1	D2	D3	D4	ε_1 (‰)	$\varepsilon_{1,cc}$ (‰)	ε_2 (‰)	$\varepsilon_{2,cc}$ (‰)	ε_3 (‰)	$\varepsilon_{3,cc}$ (‰)	ε_4 (‰)	$\varepsilon_{4,cc}$ (‰)	ε_{avr} (‰)	$\varepsilon_{avr,cc}$ (‰)
–	–	–	–	–	–	–	–	–	–	–	–	–	–
-0.386	-0.252	-0.152	-0.639	0	–	0	–	0	–	0	–	0.000	–
-0.502	-0.293	-0.154	-0.719	-1.16	0	-0.41	0	-0.02	0	-0.800	0	-0.605	0.000
-0.521	-0.303	-0.156	-0.724	-1.350	-0.190	-0.510	-0.100	-0.040	-0.020	-0.850	-0.050	-0.680	-0.075
-0.539	-0.315	-0.160	-0.736	-1.530	-0.370	-0.630	-0.220	-0.080	-0.060	-0.970	-0.170	-0.800	-0.195
-0.562	-0.322	-0.155	-0.745	-1.760	-0.598	-0.700	-0.288	-0.030	-0.008	-1.060	-0.258	-0.880	-0.273
-0.577	-0.330	-0.159	-0.760	-1.910	-0.747	-0.780	-0.367	-0.070	-0.047	-1.210	-0.407	-0.995	-0.387
-0.583	-0.333	-0.158	-0.757	-1.970	-0.792	-0.810	-0.382	-0.060	-0.022	-1.180	-0.362	-0.995	-0.372
-0.592	-0.335	-0.160	-0.762	-2.060	-0.888	-0.830	-0.408	-0.080	-0.048	-1.230	-0.418	-1.030	-0.413
-0.598	-0.342	-0.162	-0.768	-2.120	-0.958	-0.900	-0.488	-0.100	-0.078	-1.290	-0.488	-1.095	-0.488
-0.600	-0.342	-0.162	-0.767	-2.140	-0.970	-0.900	-0.480	-0.100	-0.070	-1.280	-0.470	-1.090	-0.475
-0.606	-0.345	-0.161	-0.773	-2.200	-1.013	-0.930	-0.493	-0.090	-0.043	-1.340	-0.513	-1.135	-0.503
-0.632	-0.359	-0.164	-0.788	-2.460	-1.240	-1.070	-0.600	-0.120	-0.040	-1.490	-0.630	-1.280	-0.615
-0.656	-0.372	-0.167	-0.801	-2.700	-1.425	-1.200	-0.675	-0.150	-0.015	-1.620	-0.705	-1.410	-0.690
-0.671	-0.377	-0.170	-0.807	-2.850	-1.567	-1.250	-0.717	-0.180	-0.037	-1.680	-0.757	-1.465	-0.737
-0.709	-0.397	-0.176	-0.829	-3.230	-1.867	-1.450	-0.837	-0.240	-0.017	-1.900	-0.897	-1.675	-0.867
	-0.407	-0.178	-0.842			-1.550	-0.913	-0.260	-0.013	-2.030	-1.003	-1.790	-0.958
	-0.416	-0.181	-0.860			-1.640	-0.987	-0.290	-0.027	-2.210	-1.167	-1.925	-1.077
	-0.428	-0.178	-0.863			-1.760	-1.097	-0.260	0.013	-2.240	-1.187	-2.000	-1.142
	-0.435	-0.179	-0.875			-1.830	-1.130	-0.270	0.040	-2.360	-1.270	-2.095	-1.200
	-0.438	-0.181	-0.883			-1.860	-1.167	-0.290	0.013	-2.440	-1.357	-2.150	-1.262
	-0.440	-0.180	-0.886			-1.880	-1.152	-0.280	0.058	-2.470	-1.352	-2.175	-1.252
	-0.443	-0.178	-0.890			-1.910	-1.195	-0.260	0.065	-2.510	-1.405	-2.210	-1.300
	-0.448	-0.177	-0.895			-1.960	-1.202	-0.250	0.118	-2.560	-1.412	-2.260	-1.307
	-0.463	-0.187	-0.900			-2.110	-1.308	-0.350	0.062	-2.610	-1.418	-2.360	-1.363
	-0.466	-0.188	-0.913			-2.140	-1.347	-0.360	0.043	-2.740	-1.557	-2.440	-1.452
	-0.464	-0.186	-0.911			-2.120	-1.308	-0.340	0.082	-2.720	-1.518	-2.420	-1.413
	-0.466	-0.183	-0.911			-2.140	-1.332	-0.310	0.108	-2.720	-1.522	-2.430	-1.427

Prism P5

D1	D2	D3	D4	ε_1 (‰)	$\varepsilon_{1,cc}$ (‰)	ε_2 (‰)	$\varepsilon_{2,cc}$ (‰)	ε_3 (‰)	$\varepsilon_{3,cc}$ (‰)	ε_4 (‰)	$\varepsilon_{4,cc}$ (‰)	ε_{avr} (‰)	$\varepsilon_{avr,cc}$ (‰)
–	–	–	–	–	–	–	–	–	–	–	–	–	–
-0.204	-0.217	-0.225	-0.285	0	–	0	–	0	–	0	–	0.000	–
-0.342	-0.273	-0.212	-0.349	-1.38	0	-0.56	0	0.13	0	-0.64	0	-0.600	0.000
-0.362	-0.282	-0.212	-0.358	-1.580	-0.200	-0.650	-0.090	0.130	0.000	-0.730	-0.090	-0.690	-0.090
-0.388	-0.296	-0.213	-0.371	-1.840	-0.460	-0.790	-0.230	0.120	-0.010	-0.860	-0.220	-0.825	-0.225
-0.409	-0.304	-0.205	-0.373	-2.050	-0.668	-0.870	-0.308	0.200	0.072	-0.880	-0.238	-0.875	-0.273
-0.431	-0.315	-0.206	-0.385	-2.270	-0.887	-0.980	-0.417	0.190	0.063	-1.000	-0.357	-0.990	-0.387
-0.435	-0.315	-0.205	-0.386	-2.310	-0.912	-0.980	-0.402	0.200	0.088	-1.010	-0.352	-0.995	-0.377
-0.445	-0.322	-0.206	-0.395	-2.410	-1.018	-1.050	-0.478	0.190	0.072	-1.100	-0.448	-1.075	-0.463
-0.452	-0.326	-0.206	-0.394	-2.480	-1.098	-1.090	-0.528	0.190	0.062	-1.090	-0.448	-1.090	-0.488
-0.456	-0.328	-0.206	-0.400	-2.520	-1.130	-1.110	-0.540	0.190	0.070	-1.150	-0.500	-1.130	-0.520
-0.466	-0.333	-0.206	-0.406	-2.620	-1.213	-1.160	-0.573	0.190	0.087	-1.210	-0.543	-1.185	-0.558
-0.496	-0.347	-0.209	-0.424	-2.920	-1.480	-1.300	-0.680	0.160	0.090	-1.390	-0.690	-1.345	-0.685
-0.523	-0.362	-0.212	-0.433	-3.190	-1.695	-1.450	-0.775	0.130	0.115	-1.480	-0.725	-1.465	-0.750
-0.539	-0.368	-0.213	-0.444	-3.350	-1.847	-1.510	-0.827	0.120	0.113	-1.590	-0.827	-1.550	-0.827
-0.585	-0.393	-0.212	-0.466	-3.810	-2.227	-1.760	-0.997	0.130	0.203	-1.810	-0.967	-1.785	-0.982
-0.612	-0.399	-0.212	-0.477	-4.080	-2.473	-1.820	-1.033	0.130	0.227	-1.920	-1.053	-1.870	-1.043
-0.639	-0.414	-0.214	-0.492	-4.350	-2.727	-1.970	-1.167	0.110	0.223	-2.070	-1.187	-2.020	-1.177
-0.662	-0.423	-0.206	-0.499	-4.580	-2.947	-2.060	-1.247	0.190	0.313	-2.140	-1.247	-2.100	-1.247
-0.677	-0.430	-0.208	-0.504	-4.730	-3.060	-2.130	-1.280	0.170	0.330	-2.190	-1.260	-2.160	-1.270
-0.684	-0.433	-0.208	-0.510	-4.800	-3.137	-2.160	-1.317	0.170	0.323	-2.250	-1.327	-2.205	-1.322
-0.692	-0.439	-0.209	-0.517	-4.880	-3.182	-2.220	-1.342	0.160	0.348	-2.320	-1.362	-2.270	-1.352
-0.705	-0.442	-0.210	-0.524	-5.010	-3.325	-2.250	-1.385	0.150	0.325	-2.390	-1.445	-2.320	-1.415
-0.715	-0.448	-0.207	-0.531	-5.110	-3.382	-2.310	-1.402	0.180	0.398	-2.460	-1.472	-2.385	-1.437
-0.731	-0.464	-0.211	-0.540	-5.270	-3.498	-2.470	-1.518	0.140	0.402	-2.550	-1.518	-2.510	-1.518
-0.737	-0.463	-0.211	-0.548	-5.330	-3.567	-2.460	-1.517	0.140	0.393	-2.630	-1.607	-2.545	-1.562
-0.745	-0.463	-0.210	-0.546	-5.410	-3.628	-2.460	-1.498	0.150	0.422	-2.610	-1.568	-2.535	-1.533
-0.746	-0.463	-0.211	-0.547	-5.420	-3.642	-2.460	-1.502	0.140	0.408	-2.620	-1.582	-2.540	-1.542

HVFAC7										**σ =**	**9.84**	MPa			
			Age												
	Date	**Time**	**Days**	**Hours**	**Minutes**	**Days, eq**	**From loading (days)**	ε_{tot} (‰)	$\varepsilon_{c\sigma}$ (‰)	ε_{cs} (‰)	ε_{ci} (‰)	ε_{cc} (‰)	φ_{exp}	$\varepsilon_{cc,s}$ (‰)	J (10^{-9} 1/Pa)
Casting	10-02-16	11:00	0	0	0	0.000	–	0.000	–	0.000	–	–	–	–	–
Before loading	17-02-16	10:00	7	0	0	7.000	0.000	-0.122	0.000	-0.122	0.000				0.000
5min after loading	17-02-16	11:00	7	0	5	7.003	0.003	-0.786	-0.664	-0.122	-0.664	0.000	0.000	0.000	0.068
1h	17-02-16	12:00	7	1	0	7.042	0.042	-0.873	-0.751	-0.122	-0.664	-0.086	0.130	-0.009	0.076
6h	17-02-16	17:00	7	6	0	7.250	0.250	-1.016	-0.894	-0.122	-0.664	-0.229	0.345	-0.023	0.091
1	18-02-16	13:00	8	0	0	8.000	1.000	-1.052	-0.927	-0.125	-0.664	-0.263	0.395	-0.027	0.094
2	19-02-16	11:00	9	0	0	9.000	2.000	-1.146	-1.014	-0.132	-0.664	-0.350	0.527	-0.036	0.103
3	20-02-16	12:00	10	0	0	10.000	3.000	-1.224	-1.066	-0.158	-0.664	-0.401	0.604	-0.041	0.108
4	21-02-16	13:00	11	0	0	11.000	4.000	-1.262	-1.080	-0.182	-0.664	-0.416	0.625	-0.042	0.110
5	22-02-16	11:00	12	0	0	12.000	5.000	-1.327	-1.135	-0.192	-0.664	-0.471	0.709	-0.048	0.115
6	23-02-16	16:00	13	0	0	13.000	6.000	-1.361	-1.136	-0.225	-0.664	-0.471	0.709	-0.048	0.115
7	24-02-16	14:00	14	0	0	14.000	7.000	-1.380	-1.145	-0.235	-0.664	-0.480	0.723	-0.049	0.116
14	02-03-16	13:00	21	0	0	21.00	14.00	-1.507	-1.235	-0.272	-0.664	-0.571	0.859	-0.058	0.126
21	09-03-16	12:00	28	0	0	28.00	21.00	-1.587	-1.257	-0.330	-0.664	-0.593	0.892	-0.060	0.128
28	16-03-16	17:00	35	0	0	35.00	28.00	-1.622	-1.290	-0.332	-0.664	-0.626	0.941	-0.064	0.131
56	13-04-16	14:00	63	0	0	63.00	56.00	-1.811	-1.385	-0.427	-0.664	-0.720	1.084	-0.073	0.141
90	17-05-16	14:00	97	0	0	97.00	90.00	-1.878	-1.468	-0.410	-0.664	-0.804	1.210	-0.082	0.149
120	16-06-16	13:00	127	0	0	127.00	120.00	-1.881	-1.442	-0.438	-0.664	-0.778	1.171	-0.079	0.147
150	16-07-16	15:00	157	0	0	157.00	150.00	-1.992	-1.514	-0.478	-0.664	-0.849	1.278	-0.086	0.154
180	15-08-16	13:00	187	0	0	187.00	180.00	-2.022	-1.530	-0.492	-0.664	-0.866	1.303	-0.088	0.155
210	14-09-16	13:00	217	0	0	217.00	210.00	-2.050	-1.542	-0.508	-0.664	-0.878	1.321	-0.089	0.157
240	14-10-16	16:00	247	0	0	247.00	240.00	-2.065	-1.573	-0.492	-0.664	-0.909	1.368	-0.092	0.160
270	13-11-16	12:00	277	0	0	277.00	270.00	-2.093	-1.591	-0.502	-0.664	-0.926	1.394	-0.094	0.162
300	13-12-16	13:00	307	0	0	307.00	300.00	-2.167	-1.637	-0.530	-0.664	-0.973	1.464	-0.099	0.166
330	12-01-17	13:00	337	0	0	337.00	330.00	-2.214	-1.650	-0.563	-0.664	-0.986	1.484	-0.100	0.168
365	16-02-17	17:00	372	0	0	372.00	365.00	-2.270	-1.684	-0.587	-0.664	-1.019	1.534	-0.104	0.171
400	23-03-17	11:00	407	0	0	407.00	400.00	-2.314	-1.717	-0.597	-0.664	-1.053	1.584	-0.107	0.174
450	12-05-17	11:00	457	0	0	457.00	450.00	-2.345	-1.750	-0.595	-0.664	-1.086	1.634	-0.110	0.178

Prism P12													
D1	D2	D3	D4	ε_1 (‰)	$\varepsilon_{1,cc}$ (‰)	ε_2 (‰)	$\varepsilon_{2,cc}$ (‰)	ε_3 (‰)	$\varepsilon_{3,cc}$ (‰)	ε_4 (‰)	$\varepsilon_{4,cc}$ (‰)	ε_{avr} (‰)	$\varepsilon_{avr,cc}$ (‰)
–	–	–	–	–	–	–	–	–	–	–	–	–	–
	-0.367	-0.418	-0.174			0.000	–	0.000	–	0.000	–	0.000	–
	-0.431	-0.523	-0.261			-0.640	0.000	-1.050	0.000	-0.870	0.000	-0.853	0.000
	-0.439	-0.536	-0.272			-0.720	-0.080	-1.180	-0.130	-0.980	-0.110	-0.960	-0.107
	-0.457	-0.553	-0.278			-0.900	-0.260	-1.350	-0.300	-1.040	-0.170	-1.097	-0.243
	-0.461	-0.559	-0.282			-0.940	-0.297	-1.410	-0.357	-1.080	-0.207	-1.143	-0.287
	-0.470	-0.570	-0.286			-1.030	-0.380	-1.520	-0.460	-1.120	-0.240	-1.223	-0.360
	-0.480	-0.580	-0.295			-1.130	-0.453	-1.620	-0.533	-1.210	-0.303	-1.320	-0.430
	-0.485	-0.582	-0.300			-1.180	-0.480	-1.640	-0.530	-1.260	-0.330	-1.360	-0.447
	-0.490	-0.592	-0.304			-1.230	-0.520	-1.740	-0.620	-1.300	-0.360	-1.423	-0.500
	-0.498	-0.595	-0.309			-1.310	-0.567	-1.770	-0.617	-1.350	-0.377	-1.477	-0.520
	-0.498	-0.598	-0.309			-1.310	-0.557	-1.800	-0.637	-1.350	-0.367	-1.487	-0.520
	-0.513	-0.613	-0.323			-1.460	-0.670	-1.950	-0.750	-1.490	-0.470	-1.633	-0.630
	-0.522	-0.622	-0.330			-1.550	-0.702	-2.040	-0.782	-1.560	-0.482	-1.717	-0.655
	-0.522	-0.626	-0.333			-1.550	-0.700	-2.080	-0.820	-1.590	-0.510	-1.740	-0.677
	-0.542	-0.649	-0.355			-1.750	-0.805	-2.310	-0.955	-1.810	-0.635	-1.957	-0.798
	-0.549	-0.662	-0.360			-1.820	-0.892	-2.440	-1.102	-1.860	-0.702	-2.040	-0.898
	-0.555	-0.660	-0.358			-1.880	-0.923	-2.420	-1.053	-1.840	-0.653	-2.047	-0.877
	-0.567	-0.673	-0.369			-2.000	-1.003	-2.550	-1.143	-1.950	-0.723	-2.167	-0.957
	-0.570	-0.676	-0.373			-2.030	-1.020	-2.580	-1.160	-1.990	-0.750	-2.200	-0.977
	-0.575	-0.681	-0.376			-2.080	-1.05333	-2.630	-1.193	-2.020	-0.763	-2.243	-1.003
	-0.574	-0.683	-0.377			-2.070	-1.06	-2.650	-1.23	-2.030	-0.79	-2.25	-1.027
	-0.579	-0.686	-0.381			-2.120	-1.1	-2.680	-1.25	-2.070	-0.82	-2.29	-1.057
	-0.564	-0.702	-0.403			-1.970	-0.92167	-2.840	-1.382	-2.290	-1.012	-2.367	-1.105
	-0.57	-0.708	-0.408			-2.030	-0.94833	-2.900	-1.408	-2.340	-1.028	-2.423	-1.128
	-0.578	-0.718	-0.417			-2.110	-1.005	-3	-1.485	-2.430	-1.095	-2.513	-1.195
	-0.579	-0.719	-0.421			-2.120	-1.005	-3.01	-1.485	-2.470	-1.125	-2.533	-1.205
	-0.58	-0.724	-0.427			-2.130	-1.01667	-3.06	-1.537	-2.530	-1.187	-2.573	-1.247

Prism P13													
D1	D2	D3	D4	ε_1 (‰)	$\varepsilon_{1,cc}$ (‰)	ε_2 (‰)	$\varepsilon_{2,cc}$ (‰)	ε_3 (‰)	$\varepsilon_{3,cc}$ (‰)	ε_4 (‰)	$\varepsilon_{4,cc}$ (‰)	ε_{avr} (‰)	$\varepsilon_{avr,cc}$ (‰)
–	–	–	–	–	–	–	–	–	–	–	–	–	–
-0.101	-0.182	-0.254	-0.2	0.000	–	0.000	–	0	–	0	–	0.000	–
-0.214	-0.272	-0.285	-0.242	-1.130	0.000	-0.900	0.000	-0.310	0.000	-0.420	0.000	-0.690	0.000
-0.221	-0.287	-0.289	-0.242	-1.200	-0.070	-1.050	-0.150	-0.350	-0.040	-0.420	0.000	-0.755	-0.065
-0.245	-0.300	-0.297	-0.254	-1.440	-0.310	-1.180	-0.280	-0.430	-0.120	-0.540	-0.120	-0.898	-0.208
-0.252	-0.306	-0.294	-0.252	-1.510	-0.377	-1.240	-0.337	-0.400	-0.087	-0.520	-0.097	-0.918	-0.224
-0.263	-0.316	-0.302	-0.268	-1.620	-0.480	-1.340	-0.430	-0.480	-0.160	-0.680	-0.250	-1.030	-0.330
-0.270	-0.327	-0.311	-0.266	-1.690	-0.523	-1.450	-0.513	-0.570	-0.223	-0.660	-0.203	-1.093	-0.366
-0.273	-0.331	-0.312	-0.269	-1.720	-0.530	-1.490	-0.530	-0.580	-0.210	-0.690	-0.210	-1.120	-0.370
-0.286	-0.337	-0.315	-0.274	-1.850	-0.650	-1.550	-0.580	-0.610	-0.230	-0.740	-0.250	-1.188	-0.428
-0.288	-0.339	-0.318	-0.274	-1.870	-0.637	-1.570	-0.567	-0.640	-0.227	-0.740	-0.217	-1.205	-0.412
-0.290	-0.344	-0.320	-0.277	-1.890	-0.647	-1.620	-0.607	-0.660	-0.237	-0.770	-0.237	-1.235	-0.432
-0.301	-0.360	-0.328	-0.287	-2.000	-0.720	-1.780	-0.730	-0.740	-0.280	-0.870	-0.300	-1.348	-0.508
-0.320	-0.366	-0.332	-0.292	-2.190	-0.852	-1.840	-0.732	-0.780	-0.262	-0.920	-0.292	-1.433	-0.534
-0.322	-0.371	-0.335	-0.296	-2.210	-0.870	-1.890	-0.780	-0.810	-0.290	-0.960	-0.330	-1.468	-0.568
-0.335	-0.385	-0.350	-0.312	-2.340	-0.905	-2.030	-0.825	-0.960	-0.345	-1.120	-0.395	-1.613	-0.618
-0.351	-0.396	-0.358	-0.313	-2.500	-1.082	-2.140	-0.952	-1.040	-0.442	-1.130	-0.422	-1.703	-0.724
-0.353	-0.393	-0.353	-0.313	-2.520	-1.073	-2.110	-0.893	-0.990	-0.363	-1.130	-0.393	-1.688	-0.681
-0.367	-0.410	-0.362	-0.320	-2.660	-1.173	-2.280	-1.023	-1.080	-0.413	-1.200	-0.423	-1.805	-0.758
-0.368	-0.412	-0.365	-0.324	-2.670	-1.170	-2.300	-1.030	-1.110	-0.430	-1.240	-0.450	-1.830	-0.770
-0.372	-0.414	-0.366	-0.323	-2.710	-1.193333333	-2.320	-1.033	-1.120	-0.423	-1.230	-0.423	-1.845	-0.768
-0.372	-0.416	-0.368	-0.326	-2.710	-1.21	-2.340	-1.07	-1.14	-0.46	-1.26	-0.47	-1.863	-0.803
-0.378	-0.419	-0.367	-0.328	-2.770	-1.26	-2.370	-1.09	-1.13	-0.44	-1.28	-0.48	-1.888	-0.818
-0.384	-0.423	-0.375	-0.337	-2.830	-1.291666667	-2.410	-1.102	-1.210	-0.492	-1.370	-0.542	-1.955	-0.857
-0.39	-0.427	-0.38	-0.34	-2.890	-1.318333333	-2.450	-1.108	-1.260	-0.508	-1.400	-0.538	-2.000	-0.868
-0.387	-0.433	-0.382	-0.344	-2.860	-1.265	-2.510	-1.145	-1.28	-0.505	-1.44	-0.555	-2.023	-0.868
-0.396	-0.435	-0.384	-0.35	-2.950	-1.345	-2.530	-1.155	-1.3	-0.515	-1.5	-0.605	-2.070	-0.905
-0.4	-0.441	-0.389	-0.352	-2.990	-1.387	-2.590	-1.217	-1.350	-0.567	-1.520	-0.627	-2.113	-0.949

Prism P14													
D1	D2	D3	D4	ε_1 (‰)	$\varepsilon_{1,cc}$ (‰)	ε_2 (‰)	$\varepsilon_{2,cc}$ (‰)	ε_3 (‰)	$\varepsilon_{3,cc}$ (‰)	ε_4 (‰)	$\varepsilon_{4,cc}$ (‰)	ε_{avr} (‰)	$\varepsilon_{avr,cc}$ (‰)
–	–	–	–	–	–	–	–	–	–	–	–	–	–
-0.154	-1.18	-0.203	-0.83	0.000	–	0.000	–	0	–	0	–	0.000	–
-0.274	-1.200	-0.224	-0.849	-1.200	0.000	-0.200	0.000	-0.210	0.000	-0.190	0.000	-0.450	0.000
-0.289	-1.222	-0.223	-0.848	-1.350	-0.150	-0.420	-0.220	-0.200	0.010	-0.180	0.010	-0.538	-0.088
-0.310	-1.245	-0.234	-0.853	-1.560	-0.360	-0.650	-0.450	-0.310	-0.100	-0.230	-0.040	-0.688	-0.238
-0.322	-1.252	-0.230	-0.855	-1.680	-0.477	-0.720	-0.517	-0.270	-0.057	-0.250	-0.057	-0.730	-0.277
-0.330	-1.265	-0.238	-0.862	-1.760	-0.550	-0.850	-0.640	-0.350	-0.130	-0.320	-0.120	-0.820	-0.360
-0.338	-1.280	-0.240	-0.867	-1.840	-0.603	-1.000	-0.763	-0.370	-0.123	-0.370	-0.143	-0.895	-0.408
-0.344	-1.283	-0.245	-0.871	-1.900	-0.640	-1.030	-0.770	-0.420	-0.150	-0.410	-0.160	-0.940	-0.430
-0.352	-1.290	-0.251	-0.876	-1.980	-0.710	-1.100	-0.830	-0.480	-0.200	-0.460	-0.200	-1.005	-0.485
-0.356	-1.295	-0.253	-0.877	-2.020	-0.717	-1.150	-0.847	-0.500	-0.187	-0.470	-0.177	-1.035	-0.482
-0.358	-1.297	-0.255	-0.878	-2.040	-0.727	-1.170	-0.857	-0.520	-0.197	-0.480	-0.177	-1.053	-0.489
-0.373	-1.313	-0.265	-0.886	-2.190	-0.840	-1.330	-0.980	-0.620	-0.260	-0.560	-0.220	-1.175	-0.575
-0.384	-1.323	-0.267	-0.892	-2.300	-0.892	-1.430	-1.022	-0.640	-0.222	-0.620	-0.222	-1.248	-0.589
-0.386	-1.332	-0.271	-0.895	-2.320	-0.910	-1.520	-1.110	-0.680	-0.260	-0.650	-0.250	-1.293	-0.633
-0.413	-1.362	-0.282	-0.910	-2.590	-1.085	-1.820	-1.315	-0.790	-0.275	-0.800	-0.305	-1.500	-0.745
-0.421	-1.363	-0.285	-0.909	-2.670	-1.182	-1.830	-1.342	-0.820	-0.322	-0.790	-0.312	-1.528	-0.789
-0.425	-1.368	-0.284	-0.907	-2.710	-1.193	-1.880	-1.363	-0.810	-0.283	-0.770	-0.263	-1.543	-0.776
-0.438	-1.379	-0.292	-0.914	-2.840	-1.283	-1.990	-1.433	-0.890	-0.323	-0.840	-0.293	-1.640	-0.833
-0.441	-1.385	-0.295	-0.914	-2.870	-1.300	-2.050	-1.480	-0.920	-0.340	-0.840	-0.280	-1.670	-0.850
-0.444	-1.388	-0.296	-0.918	-2.900	-1.313333333	-2.080	-1.493	-0.930	-0.333	-0.880	-0.303	-1.698	-0.861
-0.447	-1.39	-0.296	-0.921	-2.930	-1.36	-2.100	-1.53	-0.93	-0.35	-0.91	-0.35	-1.718	-0.898
-0.449	-1.394	-0.298	-0.92	-2.950	-1.37	-2.140	-1.56	-0.95	-0.36	-0.9	-0.33	-1.735	-0.905
-0.461	-1.41	-0.3	-0.922	-3.070	-1.461666667	-2.300	-1.692	-0.970	-0.352	-0.920	-0.322	-1.815	-0.957
-0.469	-1.417	-0.305	-0.917	-3.150	-1.508333333	-2.370	-1.728	-1.020	-0.368	-0.870	-0.238	-1.853	-0.961
-0.473	-1.424	-0.309	-0.925	-3.190	-1.525	-2.440	-1.775	-1.06	-0.385	-0.95	-0.295	-1.910	-0.995
-0.481	-1.43	-0.315	-0.93	-3.270	-1.595	-2.500	-1.825	-1.12	-0.435	-1	-0.335	-1.973	-1.048
-0.484	-1.436	-0.313	-0.928	-3.300	-1.627	-2.560	-1.887	-1.100	-0.417	-0.980	-0.317	-1.985	-1.062

HVFAC28										σ =	**10.2**	MPa			
			Age												
	Date	**Time**	**Days**	**Hours**	**Minutes**	**Days, eq**	**From loading (days)**	ε_{tot} (‰)	$\varepsilon_{c\sigma}$ (‰)	ε_{cs} (‰)	ε_{ci} (‰)	ε_{cc} (‰)	φ_{exp}	$\varepsilon_{cc,s}$ (‰)	J (10^{-9} 1/Pa)
Casting	10-02-16	11:00	0	0	0	0.000	–	0.000	–	0.000	–	–	–	–	–
Before loading	09-03-16	10:25	28	0	0	28.000	0.000	-0.330	0.000	-0.330	0.000				0.000
5min after loading	09-03-16	10:35	28	0	5	28.003	0.003	-0.823	-0.493	-0.330	-0.493	0.000	0.000	0.000	0.048
1h	09-03-16	11:30	28	1	0	28.042	0.042	-0.861	-0.531	-0.330	-0.493	-0.037	0.076	-0.004	0.052
6h	09-03-16	16:30	28	6	0	28.250	0.250	-0.907	-0.577	-0.330	-0.493	-0.083	0.169	-0.008	0.057
1	10-03-16	15:00	29	0	0	29.000	1.000	-0.949	-0.634	-0.315	-0.493	-0.141	0.285	-0.014	0.062
2	11-03-16	15:00	30	0	0	30.000	2.000	-0.973	-0.640	-0.333	-0.493	-0.147	0.297	-0.014	0.063
3	12-03-16	20:00	31	0	0	31.000	3.000	-1.015	-0.688	-0.327	-0.493	-0.195	0.395	-0.019	0.067
4	13-03-16	18:00	32	0	0	32.000	4.000	-1.030	-0.695	-0.335	-0.493	-0.202	0.409	-0.020	0.068
5	14-03-16	9:00	33	0	0	33.000	5.000	-1.038	-0.699	-0.338	-0.493	-0.206	0.417	-0.020	0.069
6	15-03-16	18:00	34	0	0	34.000	6.000	-1.034	-0.699	-0.335	-0.493	-0.206	0.417	-0.020	0.069
7	16-03-16	17:00	35	0	0	35.000	7.000	-1.055	-0.723	-0.332	-0.493	-0.230	0.466	-0.023	0.071
14	23-03-16	12:00	42	0	0	42.00	14.00	-1.123	-0.786	-0.337	-0.493	-0.293	0.593	-0.029	0.077
21	30-03-16	15:00	49	0	0	49.00	21.00	-1.226	-0.838	-0.388	-0.493	-0.344	0.698	-0.034	0.082
28	06-04-16	12:00	56	0	0	56.00	28.00	-1.246	-0.836	-0.410	-0.493	-0.343	0.694	-0.034	0.082
56	04-05-16	14:00	84	0	0	84.00	56.00	-1.335	-0.905	-0.430	-0.493	-0.412	0.834	-0.040	0.089
90	07-06-16	12:00	118	0	0	118.00	90.00	-1.437	-0.998	-0.438	-0.493	-0.505	1.024	-0.050	0.098
120	07-07-16	13:00	148	0	0	148.00	120.00	-1.488	-1.018	-0.470	-0.493	-0.524	1.063	-0.051	0.100
150	06-08-16	16:00	178	0	0	178.00	150.00	-1.528	-1.021	-0.507	-0.493	-0.528	1.069	-0.052	0.100
180	05-09-16	13:00	208	0	0	208.00	180.00	-1.598	-1.103	-0.495	-0.493	-0.609	1.235	-0.060	0.108
210	05-10-16	12:00	238	0	0	238.00	210.00	-1.591	-1.106	-0.485	-0.493	-0.613	1.242	-0.060	0.108
240	04-11-16	11:00	268	0	0	268.00	240.00	-1.653	-1.160	-0.493	-0.493	-0.667	1.351	-0.065	0.114
270	04-12-16	11:00	298	0	0	298.00	270.00	-1.685	-1.113	-0.572	-0.493	-0.620	1.257	-0.061	0.109
300	03-01-17	14:00	328	0	0	328.00	300.00	-1.746	-1.178	-0.568	-0.493	-0.684	1.387	-0.067	0.115
330	02-02-17	13:00	358	0	0	358.00	330.00	-1.788	-1.236	-0.552	-0.493	-0.743	1.505	-0.073	0.121
365	09-03-17	11:00	393	0	0	393.00	365.00	-1.789	-1.181	-0.608	-0.493	-0.688	1.394	-0.067	0.116
400	13-04-17	10:00	428	0	0	428.00	400.00	-1.867	-1.273	-0.593	-0.493	-0.780	1.581	-0.076	0.125
450	02-06-17	17:00	478	0	0	478.00	450.00	-1.857	-1.260	-0.597	-0.493	-0.767	1.554	-0.075	0.124

Prism P2

D1	D2	D3	D4	ε_1 (‰)	$\varepsilon_{1,cc}$ (‰)	ε_2 (‰)	$\varepsilon_{2,cc}$ (‰)	ε_3 (‰)	$\varepsilon_{3,cc}$ (‰)	ε_4 (‰)	$\varepsilon_{4,cc}$ (‰)	ε_{avr} (‰)	$\varepsilon_{avr,cc}$ (‰)
–	–	–	–	–	–	–	–	–	–	–	–	–	–
-0.304	-0.278	-0.609	-0.154	0.000	–	0.000	–	0.000	–	0.000	–	0.000	–
-0.326	-0.313	-0.683	-0.218	-0.220	0.000	-0.350	0.000	-0.740	0.000	-0.640	0.000	-0.488	0.000
-0.327	-0.317	-0.690	-0.225	-0.230	-0.010	-0.390	-0.040	-0.810	-0.070	-0.710	-0.070	-0.535	-0.047
-0.330	-0.322	-0.697	-0.232	-0.260	-0.040	-0.440	-0.090	-0.880	-0.140	-0.780	-0.140	-0.590	-0.103
-0.333	-0.321	-0.704	-0.242	-0.290	-0.085	-0.430	-0.095	-0.950	-0.225	-0.880	-0.255	-0.638	-0.165
-0.333	-0.323	-0.709	-0.244	-0.290	-0.067	-0.450	-0.097	-1.000	-0.257	-0.900	-0.257	-0.660	-0.169
-0.335	-0.328	-0.716	-0.250	-0.310	-0.093	-0.500	-0.153	-1.070	-0.333	-0.960	-0.323	-0.710	-0.226
-0.339	-0.325	-0.716	-0.254	-0.350	-0.125	-0.470	-0.115	-1.070	-0.325	-1.000	-0.355	-0.723	-0.230
-0.339	-0.326	-0.717	-0.254	-0.350	-0.122	-0.480	-0.122	-1.080	-0.332	-1.000	-0.352	-0.728	-0.232
-0.339	-0.326	-0.716	-0.253	-0.350	-0.125	-0.480	-0.125	-1.070	-0.325	-0.990	-0.345	-0.723	-0.230
-0.338	-0.330	-0.719	-0.257	-0.340	-0.118	-0.520	-0.168	-1.100	-0.358	-1.030	-0.388	-0.748	-0.258
-0.343	-0.329	-0.730	-0.265	-0.390	-0.163	-0.510	-0.153	-1.210	-0.463	-1.110	-0.463	-0.805	-0.311
-0.352	-0.339	-0.740	-0.281	-0.480	-0.202	-0.610	-0.202	-1.310	-0.512	-1.270	-0.572	-0.918	-0.372
-0.356	-0.337	-0.746	-0.285	-0.520	-0.220	-0.590	-0.160	-1.370	-0.550	-1.310	-0.590	-0.948	-0.380
-0.358	-0.344	-0.760	-0.301	-0.540	-0.220	-0.660	-0.210	-1.510	-0.670	-1.470	-0.730	-1.045	-0.458
-0.361	-0.352	-0.772	-0.317	-0.570	-0.242	-0.740	-0.282	-1.630	-0.782	-1.630	-0.882	-1.143	-0.547
-0.365	-0.349	-0.778	-0.323	-0.610	-0.250	-0.710	-0.220	-1.690	-0.810	-1.690	-0.910	-1.175	-0.548
-0.368	-0.353	-0.783	-0.330	-0.640	-0.243	-0.750	-0.223	-1.740	-0.823	-1.760	-0.943	-1.223	-0.558
-0.372	-0.357	-0.793	-0.339	-0.680	-0.295	-0.790	-0.275	-1.840	-0.935	-1.850	-1.045	-1.290	-0.638
-0.374	-0.356	-0.791	-0.340	-0.700	-0.325	-0.780	-0.275	-1.820	-0.925	-1.860	-1.065	-1.290	-0.648
-0.377	-0.365	-0.799	-0.348	-0.730	-0.347	-0.870	-0.357	-1.900	-0.997	-1.940	-1.137	-1.360	-0.709
-0.380	-0.366	-0.800	-0.352	-0.760	-0.298	-0.880	-0.288	-1.910	-0.928	-1.980	-1.098	-1.383	-0.653
-0.387	-0.366	-0.810	-0.357	-0.830	-0.372	-0.880	-0.292	-2.010	-1.032	-2.030	-1.152	-1.438	-0.712
-0.387	-0.373	-0.815	-0.366	-0.830	-0.388	-0.950	-0.378	-2.060	-1.098	-2.120	-1.258	-1.490	-0.781
-0.390	-0.369	-0.815	-0.366	-0.860	-0.362	-0.910	-0.282	-2.060	-1.042	-2.120	-1.202	-1.488	-0.722
-0.394	-0.380	-0.829	-0.376	-0.900	-0.417	-1.020	-0.407	-2.200	-1.197	-2.220	-1.317	-1.585	-0.834
-0.393	-0.378	-0.827	-0.379	-0.890	-0.403	-1.000	-0.383	-2.180	-1.173	-2.250	-1.343	-1.580	-0.826

Prism P3

D1	D2	D3	D4	ε_1 (‰)	$\varepsilon_{1,cc}$ (‰)	ε_2 (‰)	$\varepsilon_{2,cc}$ (‰)	ε_3 (‰)	$\varepsilon_{3,cc}$ (‰)	ε_4 (‰)	$\varepsilon_{4,cc}$ (‰)	ε_{avr} (‰)	$\varepsilon_{avr,cc}$ (‰)
–	–	–	–	–	–	–	–	–	–	–	–	–	–
-0.001	-0.210	-0.393	-0.098	0.000	–	0.000	–	0.000	–	0.000	–	0.000	–
-0.045	-0.270	-0.447	-0.136	-0.440	0.000	-0.600	0.000	-0.540	0.000	-0.380	0.000	-0.490	0.000
-0.052	-0.270	-0.451	-0.141	-0.510	-0.070	-0.600	0.000	-0.580	-0.040	-0.430	-0.050	-0.530	-0.040
-0.058	-0.276	-0.457	-0.143	-0.570	-0.130	-0.660	-0.060	-0.640	-0.100	-0.450	-0.070	-0.580	-0.090
-0.059	-0.279	-0.461	-0.152	-0.580	-0.155	-0.690	-0.105	-0.680	-0.155	-0.540	-0.175	-0.623	-0.148
-0.062	-0.282	-0.461	-0.150	-0.610	-0.167	-0.720	-0.117	-0.680	-0.137	-0.520	-0.137	-0.633	-0.139
-0.067	-0.285	-0.466	-0.154	-0.660	-0.223	-0.750	-0.153	-0.730	-0.193	-0.560	-0.183	-0.675	-0.188
-0.068	-0.287	-0.467	-0.159	-0.670	-0.225	-0.770	-0.165	-0.740	-0.195	-0.610	-0.225	-0.698	-0.203
-0.068	-0.289	-0.469	-0.157	-0.670	-0.222	-0.790	-0.182	-0.760	-0.212	-0.590	-0.202	-0.703	-0.204
-0.069	-0.290	-0.468	-0.156	-0.680	-0.235	-0.800	-0.195	-0.750	-0.205	-0.580	-0.195	-0.703	-0.208
-0.070	-0.292	-0.471	-0.157	-0.690	-0.248	-0.820	-0.218	-0.780	-0.238	-0.590	-0.208	-0.720	-0.228
-0.079	-0.295	-0.478	-0.166	-0.780	-0.333	-0.850	-0.243	-0.850	-0.303	-0.680	-0.293	-0.790	-0.293
-0.087	-0.307	-0.488	-0.178	-0.860	-0.362	-0.970	-0.312	-0.950	-0.352	-0.800	-0.362	-0.895	-0.347
-0.089	-0.311	-0.488	-0.180	-0.880	-0.360	-1.010	-0.330	-0.950	-0.330	-0.820	-0.360	-0.915	-0.345
-0.101	-0.318	-0.498	-0.190	-1.000	-0.460	-1.080	-0.380	-1.050	-0.410	-0.920	-0.440	-1.013	-0.423
-0.108	-0.326	-0.504	-0.200	-1.070	-0.522	-1.160	-0.452	-1.110	-0.462	-1.020	-0.532	-1.090	-0.492
-0.115	-0.332	-0.510	-0.207	-1.140	-0.560	-1.220	-0.480	-1.170	-0.490	-1.090	-0.570	-1.155	-0.525
-0.118	-0.332	-0.513	-0.209	-1.170	-0.553	-1.220	-0.443	-1.200	-0.483	-1.110	-0.553	-1.175	-0.508
-0.125	-0.342	-0.518	-0.217	-1.240	-0.635	-1.320	-0.555	-1.250	-0.545	-1.190	-0.645	-1.250	-0.595
-0.124	-0.341	-0.515	-0.217	-1.230	-0.635	-1.310	-0.555	-1.220	-0.525	-1.190	-0.655	-1.238	-0.593
-0.130	-0.343	-0.522	-0.225	-1.290	-0.687	-1.330	-0.567	-1.290	-0.587	-1.270	-0.727	-1.295	-0.642
-0.136	-0.349	-0.525	-0.226	-1.350	-0.668	-1.390	-0.548	-1.320	-0.538	-1.280	-0.658	-1.335	-0.603
-0.142	-0.353	-0.532	-0.233	-1.410	-0.732	-1.430	-0.592	-1.390	-0.612	-1.350	-0.732	-1.395	-0.667
-0.145	-0.356	-0.533	-0.237	-1.440	-0.778	-1.460	-0.638	-1.400	-0.638	-1.390	-0.788	-1.423	-0.711
-0.145	-0.359	-0.532	-0.236	-1.440	-0.722	-1.490	-0.612	-1.390	-0.572	-1.380	-0.722	-1.425	-0.657
-0.152	-0.362	-0.539	-0.245	-1.510	-0.807	-1.520	-0.657	-1.460	-0.657	-1.470	-0.827	-1.490	-0.737
-0.150	-0.361	-0.538	-0.244	-1.490	-0.783	-1.510	-0.643	-1.450	-0.643	-1.460	-0.813	-1.478	-0.721

Prism P8

D1	D2	D3	D4	ε_1 (‰)	$\varepsilon_{1,cc}$ (‰)	ε_2 (‰)	$\varepsilon_{2,cc}$ (‰)	ε_3 (‰)	$\varepsilon_{3,cc}$ (‰)	ε_4 (‰)	$\varepsilon_{4,cc}$ (‰)	ε_{avr} (‰)	$\varepsilon_{avr,cc}$ (‰)
–	–	–	–	–	–	–	–	–	–	–	–	–	–
-0.237	-0.200	-0.315	-0.188	0.000	–	0.000	–	0.000	–	0.000	–	0.000	–
-0.291	-0.290	-0.352	-0.208	-0.540	0.000	-0.900	0.000	-0.370	0.000	-0.200	0.000	-0.503	0.000
-0.292	-0.293	-0.354	-0.212	-0.550	-0.010	-0.930	-0.030	-0.390	-0.020	-0.240	-0.040	-0.528	-0.025
-0.301	-0.303	-0.348	-0.212	-0.640	-0.100	-1.030	-0.130	-0.330	0.040	-0.240	-0.040	-0.560	-0.058
-0.302	-0.305	-0.359	-0.213	-0.650	-0.125	-1.050	-0.165	-0.440	-0.085	-0.250	-0.065	-0.598	-0.110
-0.309	-0.310	-0.361	-0.215	-0.720	-0.177	-1.100	-0.197	-0.460	-0.087	-0.270	-0.067	-0.638	-0.132
-0.310	-0.314	-0.365	-0.219	-0.730	-0.193	-1.140	-0.243	-0.500	-0.133	-0.310	-0.113	-0.670	-0.171
-0.314	-0.315	-0.365	-0.218	-0.770	-0.225	-1.150	-0.245	-0.500	-0.125	-0.300	-0.095	-0.680	-0.173
-0.314	-0.318	-0.364	-0.221	-0.770	-0.222	-1.180	-0.272	-0.490	-0.112	-0.330	-0.122	-0.693	-0.182
-0.315	-0.317	-0.363	-0.220	-0.780	-0.235	-1.170	-0.265	-0.480	-0.105	-0.320	-0.115	-0.688	-0.180
-0.317	-0.320	-0.365	-0.221	-0.800	-0.258	-1.200	-0.298	-0.500	-0.128	-0.330	-0.128	-0.708	-0.203
-0.325	-0.330	-0.371	-0.227	-0.880	-0.333	-1.300	-0.393	-0.560	-0.183	-0.390	-0.183	-0.783	-0.273
-0.336	-0.341	-0.380	-0.233	-0.990	-0.392	-1.410	-0.452	-0.650	-0.222	-0.450	-0.192	-0.875	-0.314
-0.339	-0.345	-0.378	-0.232	-1.020	-0.400	-1.450	-0.470	-0.630	-0.180	-0.440	-0.160	-0.885	-0.303
-0.344	-0.359	-0.382	-0.238	-1.070	-0.430	-1.590	-0.590	-0.670	-0.200	-0.500	-0.200	-0.958	-0.355
-0.363	-0.370	-0.394	-0.248	-1.260	-0.612	-1.700	-0.692	-0.790	-0.312	-0.600	-0.292	-1.088	-0.477
-0.368	-0.378	-0.401	-0.250	-1.310	-0.630	-1.780	-0.740	-0.860	-0.350	-0.620	-0.280	-1.143	-0.500
-0.375	-0.383	-0.406	-0.254	-1.380	-0.663	-1.830	-0.753	-0.910	-0.363	-0.660	-0.283	-1.195	-0.516
-0.384	-0.391	-0.412	-0.258	-1.470	-0.765	-1.910	-0.845	-0.970	-0.435	-0.700	-0.335	-1.263	-0.595
-0.383	-0.392	-0.409	-0.258	-1.460	-0.765	-1.920	-0.865	-0.940	-0.415	-0.700	-0.345	-1.255	-0.598
-0.386	-0.398	-0.417	-0.265	-1.490	-0.787	-1.980	-0.917	-1.020	-0.487	-0.770	-0.407	-1.315	-0.649
-0.396	-0.400	-0.418	-0.265	-1.590	-0.808	-2.000	-0.858	-1.030	-0.418	-0.770	-0.328	-1.348	-0.603
-0.401	-0.408	-0.425	-0.272	-1.640	-0.862	-2.080	-0.942	-1.100	-0.492	-0.840	-0.402	-1.415	-0.674
-0.405	-0.416	-0.427	-0.276	-1.680	-0.918	-2.160	-1.038	-1.120	-0.528	-0.880	-0.458	-1.460	-0.736
-0.409	-0.417	-0.426	-0.274	-1.720	-0.902	-2.170	-0.992	-1.110	-0.462	-0.860	-0.382	-1.465	-0.684
-0.416	-0.424	-0.434	-0.280	-1.790	-0.987	-2.240	-1.077	-1.190	-0.557	-0.920	-0.457	-1.535	-0.769
-0.414	-0.423	-0.433	-0.279	-1.770	-0.963	-2.230	-1.063	-1.180	-0.543	-0.910	-0.443	-1.523	-0.753

Experimental Measurements:
Beam Deflections

NAC7

		0	5m	1h	6h	1d
Dial gauge	**Position (mm)**	01-02-16	01-02-16	01-02-16	01-02-16	02-02-16
U1	0	0.88	0.72	0.72	0.72	0.72
U2	530	12.5	7.72	7.37	7.2	6.84
U3	1200	26.45	18.08	17.49	17.13	16.51
U4	1600	22.69	13.52	12.88	12.51	11.94
U5	2000	26.05	17.56	16.97	16.62	16
U6	2670	17.19	12.13	11.77	11.67	11.16
U7	3200	2.84	2.2	2.15	2.13	2.1

		2d	3d	4d	5d	6d
Dial gauge	**Position (mm)**	03-02-16	04-02-16	05-02-16	06-02-16	07-02-16
U1	0	0.72	0.72	0.73	0.73	0.73
U2	530	6.76	6.57	6.4	6.26	6.11
U3	1200	16.22	15.86	15.56	15.32	15.08
U4	1600	11.63	11.25	10.92	10.65	10.4
U5	2000	15.69	15.33	15.02	14.78	14.54
U6	2670	10.98	10.76	10.67	10.53	10.36
U7	3200	2.08	2.06	2.05	2.04	2.03

		7d	14d	21d	28d	56d
Dial gauge	**Position (mm)**	08-02-16	15-02-16	22-02-16	29-02-16	28-03-16
U1	0	0.74	0.74	0.75	0.75	0.76
U2	530	6.03	5.57	5.22	4.95	4.25
U3	1200	14.95	14.15	13.56	13.09	11.9
U4	1600	10.25	9.41	8.77	8.27	6.99
U5	2000	14.41	13.61	13.01	12.55	11.35
U6	2670	10.17	9.7	9.3	9.01	8.24
U7	3200	2.02	1.98	1.95	1.94	1.88

		90d	120d	150d	180d	210d
Dial gauge	**Position (mm)**	01-05-16	31-05-16	30-06-16	30-07-16	29-08-16
U1	0	0.76	0.76	0.76	0.76	0.76
U2	530	3.89	3.84	3.63	3.41	3.33
U3	1200	11.3	11.2	10.83	10.45	10.32
U4	1600	6.34	6.25	5.86	5.46	5.32
U5	2000	10.72	10.64	10.27	9.9	9.76
U6	2670	7.87	7.81	7.63	7.33	7.25
U7	3200	1.85	1.85	1.83	1.81	1.8

		240d	270d	300d	330d	360d
Dial gauge	**Position (mm)**	28-09-16	28-10-16	27-11-16	27-12-16	31-01-17
U1	0	0.76	0.76	0.76	0.76	0.76
U2	530	3.28	3.15	2.96	2.76	2.57
U3	1200	10.23	10.02	9.68	9.33	8.99
U4	1600	5.22	4.99	4.63	4.26	3.9
U5	2000	9.67	9.47	9.29	8.93	8.42
U6	2670	7.19	7.06	6.84	6.61	6.4
U7	3200	1.8	1.78	1.76	1.75	1.73

		400d	450d
Dial gauge	**Position (mm)**	07-03-17	26-04-17
U1	0	0.76	0.76
U2	530	2.59	2.49
U3	1200	9.01	8.85
U4	1600	3.91	3.75
U5	2000	8.45	8.29
U6	2670	6.4	6.31
U7	3200	1.73	1.72

								-25	570	1170	1570	1970	2580	3170
			Age					Deflections						
NAC7	Date	Time	Days	Hours	Minutes	Days, eq	From loading (days)	U1 (mm)	U2 (mm)	U3 (mm)	U4 (mm)	U5 (mm)	U6 (mm)	U7 (mm)
Casting	25-01-16	11:00	0	0	0	0.000	–	–	–	–	–	–	–	–
Before loading	01-02-16	13:25	7	0	0	7.000	0.000	0	0	0	0	0	0	0
5min after loading	01-02-16	13:30	7	0	5	7.003	0.003	0.16	4.78	8.37	9.17	8.49	5.06	0.64
1h	01-02-16	14:30	7	1	0	7.042	0.042	0.16	5.13	8.96	9.81	9.08	5.42	0.69
6h	01-02-16	20:30	7	6	0	7.250	0.250	0.16	5.3	9.32	10.18	9.43	5.52	0.71
1	02-02-16	14:30	8	0	0	8.000	1.000	0.16	5.66	9.94	10.75	10.05	6.03	0.74
2	03-02-16	14:30	9	0	0	9.000	2.000	0.16	5.74	10.23	11.06	10.36	6.21	0.76
3	04-02-16	12:00	10	0	0	10.000	3.000	0.16	5.93	10.59	11.44	10.72	6.43	0.78
4	05-02-16	14:00	11	0	0	11.000	4.000	0.15	6.1	10.89	11.77	11.03	6.52	0.79
5	06-02-16	15:00	12	0	0	12.000	5.000	0.15	6.24	11.13	12.04	11.27	6.66	0.8
6	07-02-16	20:00	13	0	0	13.000	6.000	0.15	6.39	11.37	12.29	11.51	6.83	0.81
7	08-02-16	13:00	14	0	0	14.000	7.000	0.14	6.47	11.5	12.44	11.64	7.02	0.82
14	15-02-16	20:00	21	0	0	21.00	14.00	0.14	6.93	12.3	13.28	12.44	7.49	0.86
21	22-02-16	11:00	28	0	0	28.00	21.00	0.13	7.28	12.89	13.92	13.04	7.89	0.89
28	29-02-16	12:00	35	0	0	35.00	28.00	0.13	7.55	13.36	14.42	13.5	8.18	0.9
56	28-03-16	15:00	63	0	0	63.00	56.00	0.12	8.25	14.55	15.7	14.7	8.95	0.96
90	01-05-16	14:00	97	0	0	97.00	90.00	0.12	8.61	15.15	16.35	15.33	9.32	0.99
120	31-05-16	14:00	127	0	0	127.00	120.00	0.12	8.66	15.25	16.44	15.41	9.38	0.99
150	30-06-16	12:00	157	0	0	157.00	150.00	0.12	8.87	15.62	16.83	15.78	9.56	1.01
180	30-07-16	15:00	187	0	0	187.00	180.00	0.12	9.09	16	17.23	16.15	9.86	1.03
210	29-08-16	13:00	217	0	0	217.00	210.00	0.12	9.17	16.13	17.37	16.29	9.94	1.04
240	28-09-16	12:00	247	0	0	247.00	240.00	0.12	9.22	16.22	17.47	16.38	10	1.04
270	28-10-16	14:00	277	0	0	277.00	270.00	0.12	9.35	16.43	17.7	16.58	10.13	1.06
300	27-11-16	11:00	307	0	0	307.00	300.00	0.12	9.54	16.77	18.06	16.76	10.35	1.08
330	27-12-16	12:00	337	0	0	337.00	330.00	0.12	9.74	17.12	18.43	17.12	10.58	1.09
365	31-01-17	15:00	372	0	0	372.00	365.00	0.12	9.93	17.46	18.79	17.63	10.79	1.11
400	07-03-17	11:00	407	0	0	407.00	400.00	0.12	9.91	17.44	18.78	17.6	10.79	1.11
450	26-04-17	16:00	457	0	0	457.00	450.00	0.12	10.01	17.6	18.94	17.76	10.88	1.12

NAC28

		0	5m	1h	6h	1d
Dial gauge	**Position (mm)**	22-02-16	22-02-16	22-02-16	22-02-16	23-02-16
U1	0	8.88	8.69	8.68	8.67	8.66
U2	530	17.82	13.54	13.17	12.91	12.59
U3	1200	28.89	21.4	20.8	20.38	19.85
U4	1600	27.49	19.38	18.74	18.29	17.71
U5	2000	28.26	20.65	20.06	19.63	19.1
U6	2670	14.09	9.68	9.34	9.08	8.77
U7	3200	2.01	1.64	1.61	1.59	1.57

		2d	3d	4d	5d	6d
Dial gauge	**Position (mm)**	24-02-16	25-02-16	26-02-16	27-02-16	28-02-16
U1	0	8.65	8.65	8.65	8.65	8.64
U2	530	12.42	12.26	12.14	12.02	11.96
U3	1200	19.57	19.32	19.13	18.94	18.86
U4	1600	17.41	17.14	16.95	16.73	16.64
U5	2000	18.8	18.55	18.36	18.15	18.07
U6	2670	8.61	8.45	8.33	8.22	8.16
U7	3200	1.55	1.54	1.53	1.52	1.52

		7d	14d	21d	28d	56d
Dial gauge	**Position (mm)**	29-02-16	07-03-16	14-03-16	21-03-16	18-04-16
U1	0	8.64	8.65	8.64	8.64	8.63
U2	530	11.93	11.51	11.28	11.01	10.51
U3	1200	18.79	18.14	17.73	17.31	16.48
U4	1600	16.57	15.88	15.43	14.97	14.12
U5	2000	18	17.33	16.9	16.46	15.6
U6	2670	8.12	7.72	7.47	7.2	6.68
U7	3200	1.51	1.5	1.49	1.48	1.44

		90d	120d	150d	180d	210d
Dial gauge	**Position (mm)**	22-05-16	21-06-16	21-07-16	20-08-16	19-09-16
U1	0	8.63	8.62	8.61	8.61	8.61
U2	530	10.26	10.07	9.81	9.65	9.54
U3	1200	16.08	15.77	15.36	15.09	14.9
U4	1600	13.64	13.53	12.87	12.57	12.38
U5	2000	15.19	14.88	14.46	14.17	13.99
U6	2670	6.43	6.23	5.97	5.79	5.68
U7	3200	1.43	1.42	1.41	1.4	1.4

		240d	270d	300d	330d	365d
Dial gauge	**Position (mm)**	19-10-16	18-11-16	18-12-16	17-01-17	21-02-17
U1	0	8.6	8.59	8.59	8.59	8.59
U2	530	9.46	9.22	8.99	8.83	8.75
U3	1200	14.78	14.4	14.01	13.76	13.63
U4	1600	12.24	11.83	11.41	11.15	11.01
U5	2000	13.85	13.46	13.06	12.81	12.68
U6	2670	5.6	5.36	5.09	4.94	4.85
U7	3200	1.4	1.38	1.36	1.35	1.35

		400d	450d
Dial gauge	**Position (mm)**	28-03-17	17-05-17
U1	0	8.59	8.59
U2	530	8.7	8.76
U3	1200	13.52	13.61
U4	1600	10.88	10.98
U5	2000	12.56	12.65
U6	2670	4.78	4.83
U7	3200	1.35	1.35

								0	600	1200	1600	1940	2600	3200
			Age					Deflections						
NAC28	Date	Time	Days	Hours	Minutes	Days, eq	From loading (days)	U1 (mm)	U2 (mm)	U3 (mm)	U4 (mm)	U5 (mm)	U6 (mm)	U7 (mm)
Casting	25-01-16	11:00	0	0	0	0.000	–	–	–	–	–	–	–	–
Before loading	22-02-16	11:30	28	0	0	28.000	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5min after loading	22-02-16	12:05	28	0	5	28.003	0.003	0.19	4.28	7.49	8.11	7.61	4.41	0.37
1h	22-02-16	13:00	28	1	0	28.042	0.042	0.2	4.65	8.09	8.75	8.2	4.75	0.4
6h	22-02-16	19:00	28	6	0	28.250	0.250	0.21	4.91	8.51	9.2	8.63	5.01	0.42
1	23-02-16	16:00	29	0	0	29.000	1.000	0.22	5.23	9.04	9.78	9.16	5.32	0.44
2	24-02-16	14:00	30	0	0	30.000	2.000	0.23	5.4	9.32	10.08	9.46	5.48	0.46
3	25-02-16	10:00	31	0	0	31.000	3.000	0.23	5.56	9.57	10.35	9.71	5.64	0.47
4	26-02-16	13:00	32	0	0	32.000	4.000	0.23	5.68	9.76	10.54	9.9	5.76	0.48
5	27-02-16	19:00	33	0	0	33.000	5.000	0.23	5.8	9.95	10.76	10.11	5.87	0.49
6	28-02-16	20:00	34	0	0	34.000	6.000	0.24	5.86	10.03	10.85	10.19	5.93	0.49
7	29-02-16	12:00	35	0	0	35.000	7.000	0.24	5.89	10.1	10.92	10.26	5.97	0.5
14	07-03-16	16:00	42	0	0	42.00	14.00	0.23	6.31	10.75	11.61	10.93	6.37	0.51
21	14-03-16	9:00	49	0	0	49.00	21.00	0.24	6.54	11.16	12.06	11.36	6.62	0.52
28	21-03-16	11:00	56	0	0	56.00	28.00	0.24	6.81	11.58	12.52	11.8	6.89	0.53
56	18-04-16	15:00	84	0	0	84.00	56.00	0.25	7.31	12.41	13.37	12.66	7.41	0.57
90	22-05-16	14:00	118	0	0	118.00	90.00	0.25	7.56	12.81	13.85	13.07	7.66	0.58
120	21-06-16	11:00	148	0	0	148.00	120.00	0.26	7.75	13.12	13.96	13.38	7.86	0.59
150	21-07-16	13:00	178	0	0	178.00	150.00	0.27	8.01	13.53	14.62	13.8	8.12	0.6
180	20-08-16	13:00	208	0	0	208.00	180.00	0.27	8.17	13.8	14.92	14.09	8.3	0.61
210	19-09-16	17:00	238	0	0	238.00	210.00	0.27	8.28	13.99	15.11	14.27	8.41	0.61
240	19-10-16	15:00	268	0	0	268.00	240.00	0.28	8.36	14.11	15.25	14.41	8.49	0.61
270	18-11-16	16:00	298	0	0	298.00	270.00	0.29	8.6	14.49	15.66	14.8	8.73	0.63
300	18-12-16	13:00	328	0	0	328.00	300.00	0.29	8.83	14.88	16.08	15.2	9	0.65
330	17-01-17	16:00	358	0	0	358.00	330.00	0.29	8.99	15.13	16.34	15.45	9.15	0.66
365	21-02-17	10:00	393	0	0	393.00	365.00	0.29	9.07	15.26	16.48	15.58	9.24	0.66
400	28-03-17	12:00	428	0	0	428.00	400.00	0.29	9.12	15.37	16.61	15.7	9.31	0.66
450	17-05-17	11:00	478	0	0	478.00	450.00	0.29	9.06	15.28	16.51	15.61	9.26	0.66

RAC7

		0	5m	1h	6h	1d
Dial gauge	**Position (mm)**	09-02-16	09-02-16	09-02-16	09-02-16	10-02-16
U1	0	11.38	11.13	11.11	11.1	11.09
U2	530	14.27	8.3	7.88	7.62	7.23
U3	1200	23.4	13.28	12.58	12.13	11.5
U4	1600	25.08	14.19	13.46	12.98	12.3
U5	2000	24.21	13.12	12.44	12.02	11.4
U6	2670	16.24	10.59	10.26	10	9.62
U7	3200	6.82	6.56	6.55	6.55	6.54

		2d	3d	4d	5d	6d
Dial gauge	**Position (mm)**	11-02-16	12-02-16	13-02-16	14-02-16	15-02-16
U1	0	11.08	11.07	11.07	11.06	11.05
U2	530	6.96	6.78	6.65	6.49	6.38
U3	1200	11.04	10.76	10.54	10.28	10.09
U4	1600	11.81	11.51	11.28	11	10.8
U5	2000	10.94	10.65	10.45	10.18	9.99
U6	2670	9.35	9.19	9.06	8.9	8.79
U7	3200	6.54	6.53	6.53	6.53	6.53

		7d	14d	21d	28d	56d
Dial gauge	**Position (mm)**	16-02-16	23-02-16	01-03-16	08-03-16	05-04-16
U1	0	11.05	11.01	10.99	10.97	10.92
U2	530	6.29	5.64	5.19	4.84	4.06
U3	1200	9.95	8.89	8.19	7.63	6.22
U4	1600	10.65	9.53	8.78	8.18	6.69
U5	2000	9.86	8.81	8.11	7.57	6.17
U6	2670	8.71	8.08	7.66	7.31	6.46
U7	3200	6.53	6.52	6.51	6.51	6.5

		90d	120d	150d	180d	210d
Dial gauge	**Position (mm)**	09-05-16	08-06-16	08-07-16	07-08-16	06-09-16
U1	0	10.88	10.88	10.86	10.84	10.83
U2	530	3.6	3.48	3.09	2.87	2.76
U3	1200	5.51	5.31	4.66	4.32	4.15
U4	1600	5.96	5.73	5.06	4.69	4.52
U5	2000	5.5	5.32	4.66	4.32	4.15
U6	2670	6	5.87	5.48	5.27	5.16
U7	3200	6.49	6.49	6.49	6.49	6.48

		240d	270d	300d	330d	360d
Dial gauge	**Position (mm)**	06-10-16	05-11-16	05-12-16	04-01-17	08-02-17
U1	0	10.83	10.81	10.8	10.79	10.77
U2	530	2.69	2.44	2.16	1.91	1.73
U3	1200	4.04	3.65	3.2	2.81	2.55
U4	1600	4.41	3.99	3.51	3.1	2.83
U5	2000	4.05	3.67	3.2	2.82	2.74
U6	2670	5.09	4.84	4.57	4.31	4.15
U7	3200	6.48	6.48	6.47	6.47	6.47

		400d	450d
Dial gauge	**Position (mm)**	15-03-17	04-05-17
U1	0	10.77	10.76
U2	530	1.61	1.61
U3	1200	2.42	2.35
U4	1600	2.68	2.61
U5	2000	2.43	2.37
U6	2670	4.07	4.02
U7	3200	6.47	6.47

								10	610	1210	1610	2000	2600	3200
			Age					Deflections						
RAC7	Date	Time	Days	Hours	Minutes	Days, eq	From loading (days)	U1 (mm)	U2 (mm)	U3 (mm)	U4 (mm)	U5 (mm)	U6 (mm)	U7 (mm)
Casting	02-02-16	11:00	0	0	0	0.000	–	–	–	–	–	–	–	–
Before loading	09-02-16	13:05	7	0	0	7.000	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5min after loading	09-02-16	13:35	7	0	5	7.003	0.003	0.25	5.97	10.12	10.89	11.09	5.65	0.26
1h	09-02-16	14:30	7	1	0	7.042	0.042	0.27	6.39	10.82	11.62	11.77	5.98	0.27
6h	09-02-16	19:30	7	6	0	7.250	0.250	0.28	6.65	11.27	12.10	12.19	6.24	0.27
1	10-02-16	13:30	8	0	0	8.000	1.000	0.29	7.04	11.90	12.78	12.81	6.62	0.28
2	11-02-16	16:00	9	0	0	9.000	2.000	0.30	7.31	12.36	13.27	13.27	6.89	0.28
3	12-02-16	12:00	10	0	0	10.000	3.000	0.31	7.49	12.64	13.57	13.56	7.05	0.29
4	13-02-16	12:00	11	0	0	11.000	4.000	0.31	7.62	12.86	13.80	13.76	7.18	0.29
5	14-02-16	20:00	12	0	0	12.000	5.000	0.32	7.78	13.12	14.08	14.03	7.34	0.29
6	15-02-16	20:00	13	0	0	13.000	6.000	0.33	7.89	13.31	14.28	14.22	7.45	0.29
7	16-02-16	15:00	14	0	0	14.000	7.000	0.33	7.98	13.45	14.43	14.35	7.53	0.29
14	23-02-16	16:00	21	0	0	21.00	14.00	0.37	8.63	14.51	15.55	15.40	8.16	0.30
21	01-03-16	12:00	28	0	0	28.00	21.00	0.39	9.08	15.21	16.30	16.10	8.58	0.31
28	08-03-16	11:00	35	0	0	35.00	28.00	0.41	9.43	15.77	16.90	16.64	8.93	0.31
56	05-04-16	14:00	63	0	0	63.00	56.00	0.46	10.21	17.18	18.39	18.04	9.78	0.32
90	09-05-16	14:00	97	0	0	97.00	90.00	0.50	10.67	17.89	19.12	18.71	10.24	0.33
120	08-06-16	14:00	127	0	0	127.00	120.00	0.50	10.79	18.09	19.35	18.89	10.37	0.33
150	08-07-16	12:00	157	0	0	157.00	150.00	0.52	11.18	18.74	20.02	19.55	10.76	0.33
180	07-08-16	16:00	187	0	0	187.00	180.00	0.54	11.40	19.08	20.39	19.89	10.97	0.33
210	06-09-16	13:00	217	0	0	217.00	210.00	0.55	11.51	19.25	20.56	20.06	11.08	0.34
240	06-10-16	12:00	247	0	0	247.00	240.00	0.55	11.58	19.36	20.67	20.16	11.15	0.34
270	05-11-16	11:00	277	0	0	277.00	270.00	0.57	11.83	19.75	21.09	20.54	11.40	0.34
300	05-12-16	11:00	307	0	0	307.00	300.00	0.58	12.11	20.20	21.57	21.01	11.67	0.35
330	04-01-17	14:00	337	0	0	337.00	330.00	0.59	12.36	20.59	21.98	21.39	11.93	0.35
365	08-02-17	16:00	372	0	0	372.00	365.00	0.61	12.54	20.85	22.25	21.47	12.09	0.35
400	15-03-17	12:00	407	0	0	407.00	400.00	0.61	12.66	20.98	22.40	21.78	12.17	0.35
450	04-05-17	16:00	457	0	0	457.00	450.00	0.62	12.66	21.05	22.47	21.84	12.22	0.35

RAC28

		0	5m	1h	6h	1d
Dial gauge	**Position (mm)**	01-03-16	01-03-16	01-03-16	01-03-16	02-03-16
U1	0	8.6	8.55	8.55	8.56	8.56
U2	530	9.54	6.38	6.12	5.94	5.66
U3	1200	28.85	23.2	22.7	22.35	21.85
U4	1600	28.65	22.42	21.89	21.49	20.95
U5	2000	28.19	22.39	21.9	21.53	21.02
U6	2670	11.83	8.26	8.04	7.74	7.43
U7	3200	10.73	10.48	10.46	10.46	10.45

		2d	3d	4d	5d	6d
Dial gauge	**Position (mm)**	03-03-16	04-03-16	05-03-16	06-03-16	07-03-16
U1	0	8.56	8.57	8.57	8.57	8.57
U2	530	5.49	5.39	5.28	5.2	5.14
U3	1200	21.54	21.37	21.28	21.06	20.95
U4	1600	20.6	20.42	20.22	20.08	19.97
U5	2000	20.7	20.52	20.35	20.21	20.1
U6	2670	7.22	7.11	6.99	6.91	6.85
U7	3200	10.44	10.44	10.42	10.42	10.42

		7d	14d	21d	28d	56d
Dial gauge	**Position (mm)**	08-03-16	15-03-16	22-03-16	29-03-16	26-04-16
U1	0	8.57	8.57	8.57	8.57	8.58
U2	530	5.1	4.71	4.43	4.22	3.68
U3	1200	20.88	20.35	19.76	19.42	18.52
U4	1600	19.89	19.16	18.65	18.29	17.32
U5	2000	20.03	19.35	18.88	18.53	17.6
U6	2670	6.85	6.38	6.08	5.86	5.29
U7	3200	10.41	10.39	10.38	10.37	10.34

		90d	120d	150d	180d	210d
Dial gauge	**Position (mm)**	30-05-16	29-06-16	29-07-16	28-08-16	27-09-16
U1	0	8.58	8.58	8.58	8.57	8.57
U2	530	3.5	3.19	2.9	2.79	2.71
U3	1200	18.21	17.75	17.28	17.07	16.93
U4	1600	17	16.44	15.96	15.74	15.6
U5	2000	17.29	16.79	16.31	16.1	15.98
U6	2670	5.1	4.79	4.5	4.38	4.29
U7	3200	10.33	10.31	10.3	10.29	10.28

		240d	270d	300d	330d	365d
Dial gauge	**Position (mm)**	27-10-16	26-11-16	26-12-16	25-01-17	01-03-17
U1	0	8.57	8.57	8.57	8.57	8.58
U2	530	2.57	2.32	2.07	1.85	1.83
U3	1200	16.72	16.33	15.92	15.56	15.51
U4	1600	15.36	14.94	14.49	14.09	14.06
U5	2000	15.75	15.35	14.93	14.56	14.51
U6	2670	4.15	3.89	3.63	3.39	3.35
U7	3200	10.27	10.26	10.24	10.23	10.23

		400d	450d
Dial gauge	**Position (mm)**	25-05-17	25-05-17
U1	0	8.58	8.59
U2	530	1.74	1.78
U3	1200	15.34	15.43
U4	1600	13.9	13.96
U5	2000	14.37	14.43
U6	2670	3.26	3.3
U7	3200	10.22	10.22

								-10	595	1200	1590	1990	2590	3190
			Age					**Deflections**						
RAC28	**Date**	**Time**	**Days**	**Hours**	**Minutes**	**Days, eq**	**From loading (days)**	**U1 (mm)**	**U2 (mm)**	**U3 (mm)**	**U4 (mm)**	**U5 (mm)**	**U6 (mm)**	**U7 (mm)**
Casting	02-02-16	11:00	0	0	0	0.000	–	–	–	–	–	–	–	–
Before loading	01-03-16	13:55	28	0	0	28.000	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5min after loading	01-03-16	14:05	28	0	5	28.003	0.003	0.05	3.16	5.65	6.23	5.80	3.57	0.25
1h	01-03-16	15:00	28	1	0	28.042	0.042	0.05	3.42	6.15	6.76	6.29	3.79	0.27
6h	01-03-16	20:00	28	6	0	28.250	0.250	0.04	3.60	6.50	7.16	6.66	4.09	0.27
1	02-03-16	13:00	29	0	0	29.000	1.000	0.04	3.88	7.00	7.70	7.17	4.40	0.28
2	03-03-16	14:00	30	0	0	30.000	2.000	0.04	4.05	7.31	8.05	7.49	4.61	0.29
3	04-03-16	13:00	31	0	0	31.000	3.000	0.03	4.15	7.48	8.23	7.67	4.72	0.29
4	05-03-16	14:00	32	0	0	32.000	4.000	0.03	4.26	7.57	8.43	7.84	4.84	0.31
5	06-03-16	17:00	33	0	0	33.000	5.000	0.03	4.34	7.79	8.57	7.98	4.92	0.31
6	07-03-16	16:00	34	0	0	34.000	6.000	0.03	4.40	7.90	8.68	8.09	4.98	0.31
7	08-03-16	11:00	35	0	0	35.000	7.000	0.03	4.44	7.97	8.76	8.16	4.98	0.32
14	15-03-16	18:00	42	0	0	42.00	14.00	0.03	4.83	8.50	9.49	8.84	5.45	0.34
21	22-03-16	11:00	49	0	0	49.00	21.00	0.03	5.11	9.09	10.00	9.31	5.75	0.35
28	29-03-16	12:00	56	0	0	56.00	28.00	0.03	5.32	9.43	10.36	9.66	5.97	0.36
56	26-04-16	12:00	84	0	0	84.00	56.00	0.02	5.86	10.33	11.33	10.59	6.54	0.39
90	30-05-16	14:00	118	0	0	118.00	90.00	0.02	6.04	10.64	11.65	10.90	6.73	0.40
120	29-06-16	11:00	148	0	0	148.00	120.00	0.02	6.35	11.10	12.21	11.40	7.04	0.42
150	29-07-16	15:00	178	0	0	178.00	150.00	0.02	6.64	11.57	12.69	11.88	7.33	0.43
180	28-08-16	13:00	208	0	0	208.00	180.00	0.03	6.75	11.78	12.91	12.09	7.45	0.44
210	27-09-16	12:00	238	0	0	238.00	210.00	0.03	6.83	11.92	13.05	12.21	7.54	0.45
240	27-10-16	14:00	268	0	0	268.00	240.00	0.03	6.97	12.13	13.29	12.44	7.68	0.46
270	26-11-16	11:00	298	0	0	298.00	270.00	0.03	7.22	12.52	13.71	12.84	7.94	0.47
300	26-12-16	13:00	328	0	0	328.00	300.00	0.03	7.47	12.93	14.16	13.26	8.20	0.49
330	25-01-17	15:00	358	0	0	358.00	330.00	0.03	7.69	13.29	14.56	13.63	8.44	0.50
365	01-03-17	10:00	393	0	0	393.00	365.00	0.02	7.71	13.34	14.59	13.68	8.48	0.50
400	05-04-17	11:00	428	0	0	428.00	400.00	0.02	7.80	13.51	14.75	13.82	8.57	0.51
450	25-05-17	17:00	478	0	0	478.00	450.00	0.01	7.76	13.42	14.69	13.76	8.53	0.51

HVFAC7

		0	5m	1h	6h	1d
Dial gauge	**Position (mm)**	17-02-16	17-02-16	17-02-16	17-02-16	18-02-16
U1	0	6.53	6.33	6.31	6.3	6.29
U2	530	13.57	10.38	10.2	10.02	9.73
U3	1200	28.77	23.25	22.85	22.55	22.08
U4	1600	23.85	17.72	17.29	16.95	16.44
U5	2000	24.94	19.18	18.78	18.48	18.02
U6	2670	10.74	8.5	8.25	8.09	7.81
U7	3200	6.81	6.72	6.72	6.72	6.72

		2d	3d	4d	5d	6d
Dial gauge	**Position (mm)**	19-02-16	20-02-16	21-02-16	22-02-16	23-02-16
U1	0	6.29	6.28	6.28	6.27	6.26
U2	530	9.56	9.37	9.25	9.13	9.03
U3	1200	21.79	21.5	21.32	21.14	20.99
U4	1600	16.11	15.8	15.59	15.4	15.24
U5	2000	17.72	17.44	17.25	17.08	16.93
U6	2670	7.63	7.45	7.34	7.22	7.13
U7	3200	6.72	6.72	6.72	6.72	6.72

		7d	14d	21d	28d	56d
Dial gauge	**Position (mm)**	24-02-16	02-03-16	09-03-16	16-03-16	13-04-16
U1	0	6.26	6.24	6.23	6.23	6.21
U2	530	8.96	8.59	8.39	8.21	7.85
U3	1200	20.88	20.28	19.95	19.69	19.12
U4	1600	15.1	14.45	14.1	13.81	13.2
U5	2000	16.8	16.21	15.89	15.62	15.05
U6	2670	7.05	6.67	6.47	6.29	5.93
U7	3200	6.72	6.72	6.72	6.72	6.71

		90d	120d	150d	180d	210d
Dial gauge	**Position (mm)**	17-05-16	16-06-16	16-07-16	15-08-16	14-09-16
U1	0	6.21	6.21	6.2	6.19	6.19
U2	530	7.76	7.75	7.55	7.46	7.37
U3	1200	18.99	18.98	18.65	18.5	18.37
U4	1600	13.06	13.04	12.67	12.52	12.37
U5	2000	14.92	14.91	14.57	14.44	14.3
U6	2670	5.86	5.86	5.66	5.57	5.49
U7	3200	6.7	6.7	6.7	6.7	6.71

		240d	270d	300d	330d	360d
Dial gauge	**Position (mm)**	14-10-16	13-11-16	13-12-16	12-01-17	16-02-17
U1	0	6.19	6.18	6.17	6.17	6.16
U2	530	7.39	7.24	7.04	6.9	6.84
U3	1200	18.4	18.16	17.83	17.6	17.51
U4	1600	12.33	12.15	11.78	11.53	11.43
U5	2000	14.33	14.09	13.76	13.59	13.42
U6	2670	5.51	5.36	5.14	4.99	4.92
U7	3200	6.71	6.71	6.71	6.71	6.71

		400d	450d
Dial gauge	**Position (mm)**	23-03-17	12-05-17
U1	0	6.16	6.16
U2	530	6.84	6.83
U3	1200	17.49	17.47
U4	1600	11.42	11.4
U5	2000	13.4	13.38
U6	2670	4.91	4.9
U7	3200	6.71	6.71

								5	600	1200	1590	2000	2600	3200
			Age					Deflections						
HVFAC7	Date	Time	Days	Hours	Minutes	Days, eq	From loading (days)	U1 (mm)	U2 (mm)	U3 (mm)	U4 (mm)	U5 (mm)	U6 (mm)	U7 (mm)
Casting	10-02-16	11:00	0	0	0	0.000	–	–	–	–	–	–	–	–
Before loading	17-02-16	11:55	7	0	0	7.000	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5min after loading	17-02-16	12:00	7	0	5	7.003	0.003	0.20	3.19	5.52	6.13	5.76	2.24	0.09
1h	17-02-16	13:00	7	1	0	7.042	0.042	0.22	3.37	5.92	6.56	6.16	2.49	0.09
6h	17-02-16	18:00	7	6	0	7.250	0.250	0.23	3.55	6.22	6.90	6.46	2.65	0.09
1	18-02-16	13:00	8	0	0	8.000	1.000	0.24	3.84	6.69	7.41	6.92	2.93	0.09
2	19-02-16	11:00	9	0	0	9.000	2.000	0.24	4.01	6.98	7.74	7.22	3.11	0.09
3	20-02-16	12:00	10	0	0	10.000	3.000	0.25	4.20	7.27	8.05	7.50	3.29	0.09
4	21-02-16	13:00	11	0	0	11.000	4.000	0.25	4.32	7.45	8.26	7.69	3.40	0.09
5	22-02-16	11:00	12	0	0	12.000	5.000	0.26	4.44	7.63	8.45	7.86	3.52	0.09
6	23-02-16	16:00	13	0	0	13.000	6.000	0.27	4.54	7.78	8.61	8.01	3.61	0.09
7	24-02-16	14:00	14	0	0	14.000	7.000	0.27	4.61	7.89	8.75	8.14	3.69	0.09
14	02-03-16	13:00	21	0	0	21.00	14.00	0.29	4.98	8.49	9.40	8.73	4.07	0.09
21	09-03-16	12:00	28	0	0	28.00	21.00	0.30	5.18	8.82	9.75	9.05	4.27	0.09
28	16-03-16	11:00	35	0	0	35.00	28.00	0.30	5.36	9.08	10.04	9.32	4.45	0.09
56	13-04-16	14:00	63	0	0	63.00	56.00	0.32	5.72	9.65	10.65	9.89	4.81	0.10
90	17-05-16	14:00	97	0	0	97.00	90.00	0.32	5.81	9.78	10.79	10.02	4.88	0.11
120	16-06-16	13:00	127	0	0	127.00	120.00	0.32	5.82	9.79	10.81	10.03	4.88	0.11
150	16-07-16	15:00	157	0	0	157.00	150.00	0.33	6.02	10.12	11.18	10.37	5.08	0.11
180	15-08-16	13:00	187	0	0	187.00	180.00	0.34	6.11	10.27	11.33	10.50	5.17	0.11
210	14-09-16	13:00	217	0	0	217.00	210.00	0.34	6.20	10.40	11.48	10.64	5.25	0.10
240	14-10-16	16:00	247	0	0	247.00	240.00	0.34	6.18	10.37	11.52	10.61	5.23	0.10
270	13-11-16	12:00	277	0	0	277.00	270.00	0.35	6.33	10.61	11.70	10.85	5.38	0.10
300	13-12-16	13:00	307	0	0	307.00	300.00	0.36	6.53	10.94	12.07	11.18	5.60	0.10
330	12-01-17	13:00	337	0	0	337.00	330.00	0.36	6.67	11.17	12.32	11.35	5.75	0.10
365	16-02-17	17:00	372	0	0	372.00	365.00	0.37	6.73	11.26	12.42	11.52	5.82	0.10
400	23-03-17	11:00	407	0	0	407.00	400.00	0.37	6.73	11.28	12.43	11.54	5.83	0.10
450	12-05-17	12:00	457	0	0	457.00	450.00	0.37	6.74	11.30	12.45	11.56	5.84	0.10

HVFAC28

		0	5m	1h	6h	1d
Dial gauge	**Position (mm)**	09-03-16	09-03-16	09-03-16	09-03-16	10-03-16
U1	0	11.66	11.54	11.54	11.54	11.54
U2	530	29.15	27.14	27.02	26.94	26.85
U3	1200	27.24	23.69	23.45	23.28	23.13
U4	1600	31.15	27.11	26.85	26.67	26.5
U5	2000	25.05	21.27	21.02	20.85	20.69
U6	2670	29.56	27.29	27.15	27.05	26.97
U7	3200	11.19	10.98	10.98	10.97	10.96

		2d	3d	4d	5d	6d
Dial gauge	**Position (mm)**	11-03-16	12-03-16	13-03-16	14-03-16	15-03-16
U1	0	11.54	11.53	11.53	11.53	11.53
U2	530	26.79	26.72	26.67	26.65	26.58
U3	1200	23.01	22.89	22.8	22.76	22.64
U4	1600	26.4	26.26	26.16	26.1	25.98
U5	2000	20.59	20.46	20.38	20.32	20.21
U6	2670	26.88	26.8	26.77	26.73	26.65
U7	3200	10.96	10.96	10.95	10.95	10.95

		7d	14d	21d	28d	56d
Dial gauge	**Position (mm)**	16-03-16	23-03-16	30-03-16	06-04-16	04-05-16
U1	0	11.53	11.53	11.53	11.53	11.53
U2	530	26.55	26.35	26.35	26.1	25.84
U3	1200	22.59	22.26	22.05	21.85	21.41
U4	1600	25.93	25.57	25.35	25.14	24.67
U5	2000	20.16	19.82	19.62	19.42	18.99
U6	2670	26.63	26.43	26.29	26.19	26.09
U7	3200	10.95	10.94	10.93	10.93	10.9

		90d	120d	150d	180d	210d
Dial gauge	**Position (mm)**	07-06-16	07-07-16	06-08-16	05-09-16	05-10-16
U1	0	11.53	11.53	11.53	11.53	11.53
U2	530	25.77	25.55	25.43	25.37	25.32
U3	1200	21.28	20.9	20.7	20.59	20.52
U4	1600	24.54	24.14	23.96	23.82	23.74
U5	2000	18.86	18.5	18.38	18.19	18.11
U6	2670	25.84	25.6	25.48	25.42	25.37
U7	3200	10.9	10.88	10.88	10.86	10.86

		240d	270d	300d	330d	365d
Dial gauge	**Position (mm)**	04-11-16	04-12-16	03-01-17	02-02-17	09-03-17
U1	0	11.53	11.53	11.53	11.53	11.53
U2	530	25.18	24.99	24.84	24.7	24.66
U3	1200	20.28	19.98	19.74	19.5	19.43
U4	1600	23.47	23.16	22.89	22.65	22.55
U5	2000	17.88	17.58	17.35	17.12	17.05
U6	2670	25.22	25.13	24.91	24.91	24.72
U7	3200	10.85	10.85	10.85	10.85	10.85

		400d	450d
Dial gauge	**Position (mm)**	13-04-17	02-06-17
U1	0	11.53	11.53
U2	530	24.57	24.57
U3	1200	19.29	19.31
U4	1600	22.4	22.43
U5	2000	16.89	16.9
U6	2670	24.63	24.65
U7	3200	10.84	10.84

								-5	595	1195	1595	1990	2590	3185
			Age					Deflections						
HVFAC28	Date	Time	Days	Hours	Minutes	Days, eq	From loading (days)	U1 (mm)	U2 (mm)	U3 (mm)	U4 (mm)	U5 (mm)	U6 (mm)	U7 (mm)
Casting	10-02-16	11:00	0	0	0	0.000	–	–	–	–	–	–	–	–
Before loading	09-03-16	13:40	28	0	0	28.000	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5min after loading	09-03-16	13:50	28	0	5	28.003	0.003	0.12	2.01	3.55	4.04	3.78	2.27	0.21
1h	09-03-16	14:45	28	1	0	28.042	0.042	0.12	2.13	3.79	4.30	4.03	2.41	0.21
6h	09-03-16	19:45	28	6	0	28.250	0.250	0.12	2.21	3.96	4.48	4.20	2.51	0.22
1	10-03-16	15:00	29	0	0	29.000	1.000	0.12	2.30	4.11	4.65	4.36	2.59	0.23
2	11-03-16	15:00	30	0	0	30.000	2.000	0.12	2.36	4.23	4.75	4.46	2.68	0.23
3	12-03-16	20:00	31	0	0	31.000	3.000	0.13	2.43	4.35	4.89	4.59	2.76	0.23
4	13-03-16	18:00	32	0	0	32.000	4.000	0.13	2.48	4.44	4.99	4.67	2.79	0.24
5	14-03-16	9:00	33	0	0	33.000	5.000	0.13	2.50	4.48	5.05	4.73	2.83	0.24
6	15-03-16	18:00	34	0	0	34.000	6.000	0.13	2.57	4.60	5.17	4.84	2.91	0.24
7	16-03-16	11:00	35	0	0	35.000	7.000	0.13	2.60	4.65	5.22	4.89	2.93	0.24
14	23-03-16	12:00	42	0	0	42.00	14.00	0.13	2.80	4.98	5.58	5.23	3.13	0.25
21	30-03-16	15:00	49	0	0	49.00	21.00	0.13	2.80	5.19	5.80	5.43	3.27	0.26
28	06-04-16	12:00	56	0	0	56.00	28.00	0.13	3.05	5.39	6.01	5.63	3.37	0.26
56	04-05-16	14:00	84	0	0	84.00	56.00	0.13	3.31	5.83	6.48	6.06	3.47	0.29
90	07-06-16	12:00	118	0	0	118.00	90.00	0.13	3.38	5.96	6.61	6.19	3.72	0.29
120	07-07-16	13:00	148	0	0	148.00	120.00	0.13	3.60	6.34	7.01	6.55	3.96	0.31
150	06-08-16	16:00	178	0	0	178.00	150.00	0.13	3.72	6.54	7.19	6.67	4.08	0.31
180	05-09-16	13:00	208	0	0	208.00	180.00	0.13	3.78	6.65	7.33	6.86	4.14	0.33
210	05-10-16	12:00	238	0	0	238.00	210.00	0.13	3.83	6.72	7.41	6.94	4.19	0.33
240	04-11-16	11:00	268	0	0	268.00	240.00	0.13	3.97	6.96	7.68	7.17	4.34	0.34
270	04-12-16	11:00	298	0	0	298.00	270.00	0.13	4.16	7.26	7.99	7.47	4.43	0.34
300	03-01-17	14:00	328	0	0	328.00	300.00	0.13	4.31	7.50	8.26	7.70	4.65	0.34
330	02-02-17	13:00	358	0	0	358.00	330.00	0.13	4.45	7.74	8.50	7.93	4.65	0.34
365	09-03-17	11:00	393	0	0	393.00	365.00	0.13	4.49	7.81	8.60	8.00	4.84	0.34
400	13-04-17	10:00	428	0	0	428.00	400.00	0.13	4.58	7.95	8.75	8.16	4.93	0.35
450	02-06-17		478	0	0	478.00	450.00	0.13	4.58	7.93	8.72	8.15	4.91	0.35

Experimental Measurements:
Beam Strains

	NAC7				0	5m	1h	6h	1d	2d
	A	BOTTOM								
	From (mm)	To (mm)	Disks		01-02-16	01-02-16	01-02-16	01-02-16	02-02-16	03-02-16
1	870	970	1	2	-0.728	-0.661	-0.655	-0.65	-0.647	-0.647
2	1150	1250	3	4	-0.018	0.001	0.005	0.008	0.007	0.009
3	1250	1350	4	5	-0.248	-0.144	-0.135	-0.133	-0.128	-0.127
4	1350	1450	5	6	-0.122	0.066	0.079	0.085	0.096	0.097
5	1450	1550	6	7	-0.205	-0.036	-0.027	-0.021	-0.012	-0.01
6	1550	1650	7	8	0.099	0.082	0.084	0.085	0.081	0.082
7	1650	1750	8	9	-0.016	0.089	0.097	0.1	0.107	0.109
8	1750	1850	9	10	-0.596	-0.457	-0.448	-0.446	-0.438	-0.436
9	1850	1950	10	11	-0.422	-0.276	-0.266	-0.261	-0.253	-0.251
10	1950	2050	11	12	-0.216	-0.063	-0.053	-0.049	-0.042	-0.039
11	2230	2330	13	14	-0.173	0.029	0.042	0.052	0.063	0.065
	A	TOP								
	From (mm)	To (mm)	Disks							
12	870	970	15	16	-0.121	-0.159	-0.168	-0.164	-0.167	-0.165
13	1150	1250	17	18	-0.237	-0.288	-0.295	-0.295	-0.304	-0.309
14	1250	1350	18	19	-0.229	-0.28	-0.288	-0.286	-0.293	-0.298
15	1350	1450	19	20	-0.255	-0.303	-0.314	-0.312	-0.319	-0.324
16	1450	1550	20	21	0.057	0.003	-0.008	-0.007	-0.013	-0.02
17	1550	1650	21	22	0.025	-0.028	-0.037	-0.037	-0.093	-0.049
18	1650	1750	22	23	-0.093	-0.156	-0.178	-0.181	-0.192	-0.198
19	1750	1850	23	24	-0.146	-0.185	-0.186	-0.182	-0.19	-0.194
20	1850	1950	24	25	-0.478	-0.524	-0.536	-0.533	-0.539	-0.544
21	1950	2050	25	26	-0.459	-0.523	-0.532	-0.532	-0.539	-0.547
22	2230	2330	27	28	-0.177	-0.221	-0.234	-0.23	-0.235	-0.241
	A	MIDDLE								
	From (mm)	To (mm)	Disks							
23	1450	1550	29	30	-0.266	-0.276	-0.287	-0.284	-0.289	-0.292
24	1550	1650	30	31	0.004	0.005	-0.006	-0.005	-0.01	-0.012
25	1650	1750	31	32	0.322	0.32	0.307	0.31	0.309	0.303
26	1450	1550	33	34	-0.299	-0.28	-0.295	-0.29	-0.29	-0.294
27	1550	1650	34	35	0.171	0.221	0.209	0.214	0.213	0.213
28	1650	1750	35	36	-0.158	-0.123	-0.135	-0.13	-0.132	-0.133

					0	5m	1h	6h	1d	2d
	B	BOTTOM								
	From (mm)	To (mm)	Disks		01-02-16	01-02-16	01-02-16	01-02-16	02-02-16	03-02-16
1	870	970	1	2	0.014	0.087	0.091	0.095	0.101	0.099
2	1150	1250	3	4	-0.692	-0.543	-0.536	-0.533	-0.526	-0.525
3	1250	1350	4	5	-0.305	-0.168	-0.158	-0.153	-0.146	-0.149
4	1350	1450	5	6	0.989	1.129	1.134	1.139	1.147	1.146
5	1450	1550	6	7	0.359	0.468	0.473	0.477	0.483	0.479
6	1550	1650	7	8	-0.128	0.02	0.027	0.03	0.039	0.036
7	1650	1750	8	9	-0.469	-0.429	-0.423	-0.421	-0.418	-0.419
8	1750	1850	9	10	-0.185	-0.026	-0.019	-0.013	-0.005	-0.008
9	1850	1950	10	11	-0.321	-0.337	-0.336	-0.334	-0.341	-0.345
10	1950	2050	11	12	-0.032	0.128	0.138	0.144	0.15	0.154
11	2230	2330	13	14	-0.18	-0.098	-0.092	-0.091	-0.083	-0.087
	B	TOP								
	From (mm)	To (mm)	Disks							
12	870	970	15	16	-0.232	-0.273	-0.279	0.278	-0.281	-0.289
13	1150	1250	17	18	-0.27	-0.324	-0.33	-0.341	-0.336	-0.341
14	1250	1350	18	19	-1.107	-1.157	-1.164	-1.162	-1.165	-1.176
15	1350	1450	19	20	-0.502	-0.554	-0.553	-0.56	-0.565	-0.566
16	1450	1550	20	21	0.045	-0.009	-0.013	-0.014	-0.019	-0.026
17	1550	1650	21	22	-0.217	-0.277	-0.279	-0.286	-0.29	-0.298
18	1650	1750	22	23	-0.201	-0.245	-0.246	-0.249	-0.255	-0.261
19	1750	1850	23	24	-0.222	-0.273	-0.274	-0.277	-0.281	-0.288
20	1850	1950	24	25	-0.276	-0.336	-0.34	-0.345	-0.349	-0.358
21	1950	2050	25	26	-0.048	-0.097	-0.102	-0.102	-0.108	-0.115
22	2230	2330	27	28	-0.178	-0.217	-0.221	-0.223	-0.228	-0.234
	B	MIDDLE								
	From (mm)	To (mm)	Disks							
23	1450	1550	29	30	-0.475	-0.493	-0.495	-0.496	-0.5	-0.505
24	1550	1650	30	31	-0.21	-0.247	-0.25	-0.253	-0.256	-0.261
25	1650	1750	31	32	-0.217	-0.217	-0.218	-0.218	-0.222	-0.227
26	1450	1550	33	34	-0.425	-0.404	-0.403	-0.404	-0.404	-0.407
27	1550	1650	34	35	-0.215	-0.191	-0.188	-0.189	-0.19	-0.192
28	1650	1750	35	36	-0.199	-0.2	-0.202	-0.202	-0.203	-0.206

	NAC7				3d	4d	5d	6d	7d	14d
	A	**BOTTOM**								
	From (mm)	To (mm)	Disks		04-02-16	05-02-16	06-02-16	07-02-16	08-02-16	15-02-16
1	870	970	1	2	-0.65	-0.643	-0.643	-0.642	-0.642	-0.638
2	1150	1250	3	4	0.002	0.01	0.01	0.01	0.009	0.012
3	1250	1350	4	5	-0.13	-0.123	-0.123	-0.121	-0.123	-0.115
4	1350	1450	5	6	0.099	0.107	0.109	0.116	0.115	0.125
5	1450	1550	6	7	-0.011	-0.003	0.001	0.002	0.001	0.01
6	1550	1650	7	8	0.072	0.076	0.072	0.074	0.072	0.073
7	1650	1750	8	9	0.103	0.111	0.113	0.115	0.115	0.12
8	1750	1850	9	10	-0.439	-0.433	-0.433	-0.427	-0.43	-0.425
9	1850	1950	10	11	-0.253	-0.246	-0.244	-0.239	-0.241	-0.233
10	1950	2050	11	12	-0.043	-0.036	-0.033	-0.03	-0.029	-0.026
11	2230	2330	13	14	0.069	0.077	0.081	0.087	0.087	0.096
	A	**TOP**								
	From (mm)	To (mm)	Disks							
12	870	970	15	16	-0.15	-0.149	-0.151	-0.157	-0.155	-0.166
13	1150	1250	17	18	-0.314	-0.315	-0.316	-0.322	-0.321	-0.334
14	1250	1350	18	19	-0.303	-0.302	-0.305	-0.308	-0.308	-0.322
15	1350	1450	19	20	-0.332	-0.334	-0.337	-0.341	-0.34	-0.355
16	1450	1550	20	21	-0.027	-0.029	-0.031	-0.036	-0.036	-0.052
17	1550	1650	21	22	-0.054	-0.055	-0.054	-0.061	-0.063	-0.074
18	1650	1750	22	23	-0.202	-0.206	-0.206	-0.209	-0.213	-0.226
19	1750	1850	23	24	-0.201	-0.202	-0.205	-0.208	-0.209	-0.222
20	1850	1950	24	25	-0.549	-0.552	-0.551	-0.553	-0.558	-0.57
21	1950	2050	25	26	-0.552	-0.556	-0.556	-0.561	-0.565	-0.58
22	2230	2330	27	28	-0.245	-0.248	-0.247	-0.253	-0.256	0.267
	A	**MIDDLE**								
	From (mm)	To (mm)	Disks							
23	1450	1550	29	30	-0.296	-0.302	-0.302	-0.304	-0.306	-0.315
24	1550	1650	30	31	-0.017	-0.018	-0.017	-0.021	-0.023	-0.03
25	1650	1750	31	32	0.299	0.298	0.297	0.294	0.292	0.285
26	1450	1550	33	34	-0.296	-0.297	-0.295	-0.298	-0.298	-0.306
27	1550	1650	34	35	0.212	0.211	0.213	0.213	0.214	0.207
28	1650	1750	35	36	-0.135	-0.136	-0.136	-0.136	-0.138	-0.145

					3d	4d	5d	6d	7d	14d
	B	**BOTTOM**								
	From (mm)	To (mm)	Disks		04-02-16	05-02-16	06-02-16	07-02-16	08-02-16	15-02-16
1	870	970	1	2	0.103	0.108	0.107	0.111	0.108	0.103
2	1150	1250	3	4	-0.524	-0.516	-0.515	-0.511	-0.512	-0.507
3	1250	1350	4	5	-0.146	-0.142	-0.141	-0.135	-0.137	-0.131
4	1350	1450	5	6	1.15	1.154	1.154	1.16	1.16	1.161
5	1450	1550	6	7	0.484	0.484	0.483	0.489	0.487	0.489
6	1550	1650	7	8	0.04	0.043	0.044	0.053	0.049	0.053
7	1650	1750	8	9	-0.417	-0.418	-0.42	-0.413	-0.416	-0.418
8	1750	1850	9	10	-0.002	0.001	0	0.009	0.005	0.009
9	1850	1950	10	11	-0.347	-0.351	-0.355	-0.351	-0.354	-0.362
10	1950	2050	11	12	0.162	0.162	0.166	0.173	0.173	0.177
11	2230	2330	13	14	-0.081	-0.082	-0.079	-0.076	-0.077	-0.077
	B	**TOP**								
	From (mm)	To (mm)	Disks							
12	870	970	15	16	-0.292	-0.297	-0.296	-0.297	-0.301	-0.312
13	1150	1250	17	18	-0.347	-0.347	-0.35	-0.351	-0.354	-0.365
14	1250	1350	18	19	-1.182	-1.183	-1.184	-1.188	-1.194	-1.206
15	1350	1450	19	20	-0.577	-0.578	-0.581	-0.583	-0.588	-0.6
16	1450	1550	20	21	-0.031	-0.034	-0.038	-0.038	-0.046	-0.055
17	1550	1650	21	22	-0.302	-0.302	-0.306	-0.307	-0.315	-0.326
18	1650	1750	22	23	-0.265	-0.267	-0.272	-0.271	-0.274	-0.285
19	1750	1850	23	24	-0.292	-0.293	-0.296	-0.298	-0.303	-0.312
20	1850	1950	24	25	-0.361	-0.362	-0.367	-0.367	-0.372	-0.385
21	1950	2050	25	26	-0.119	-0.119	-0.124	-0.123	-0.129	-0.143
22	2230	2330	27	28	-0.239	-0.239	-0.241	-0.244	-0.25	-0.261
	B	**MIDDLE**								
	From (mm)	To (mm)	Disks							
23	1450	1550	29	30	-0.508	-0.509	-0.512	-0.512	-0.517	-0.526
24	1550	1650	30	31	-0.266	-0.265	-0.27	-0.269	-0.275	-0.283
25	1650	1750	31	32	-0.231	-0.229	-0.231	-0.231	-0.236	-0.244
26	1450	1550	33	34	-0.409	-0.407	-0.409	-0.408	-0.413	-0.418
27	1550	1650	34	35	-0.195	-0.193	-0.196	-0.195	-0.197	-0.205
28	1650	1750	35	36	-0.209	-0.207	-0.207	-0.209	-0.213	-0.216

NAC7					21d	28d	56d	90d	120d	150d
	A	**BOTTOM**								
	From (mm)	To (mm)	Disks		22-02-16	29-02-16	28-03-16	01-05-16	31-05-16	30-06-16
1	870	970	1	2	-0.641	-0.64	-0.639	-0.638	-0.645	-0.64
2	1150	1250	3	4	0.007	0.007	0.006	0.005	0.001	0.006
3	1250	1350	4	5	-0.121	-0.118	-0.113	-0.112	-0.116	-0.112
4	1350	1450	5	6	0.123	0.128	0.138	0.137	0.133	0.139
5	1450	1550	6	7	0.007	0.007	0.017	0.02	0.013	0.019
6	1550	1650	7	8	0.063	0.06	0.057	0.057	0.053	0.058
7	1650	1750	8	9	0.117	0.118	0.124	0.124	0.12	0.125
8	1750	1850	9	10	-0.427	-0.425	-0.42	-0.424	-0.43	-0.423
9	1850	1950	10	11	-0.237	-0.234	-0.226	-0.22	-0.234	-0.226
10	1950	2050	11	12	-0.027	-0.025	-0.019	-0.012	-0.02	-0.013
11	2230	2330	13	14	0.098	0.104	0.117	0.119	0.111	0.118
	A	**TOP**								
	From (mm)	To (mm)	Disks							
12	870	970	15	16	-0.18	-0.185	-0.202	-0.21	-0.216	-0.216
13	1150	1250	17	18	-0.349	-0.353	-0.372	-0.382	-0.387	-0.388
14	1250	1350	18	19	-0.332	-0.336	-0.354	-0.361	-0.366	-0.368
15	1350	1450	19	20	-0.369	-0.375	-0.395	-0.405	-0.409	-0.412
16	1450	1550	20	21	-0.064	-0.069	-0.09	-0.1	-0.106	-0.11
17	1550	1650	21	22	-0.085	-0.092	-0.109	-0.118	-0.121	-0.12
18	1650	1750	22	23	-0.237	-0.244	-0.264	-0.271	-0.276	-0.279
19	1750	1850	23	24	-0.236	-0.241	-0.26	-0.27	-0.27	-0.273
20	1850	1950	24	25	-0.581	-0.588	-0.606	-0.614	-0.614	-0.619
21	1950	2050	25	26	-0.592	-0.6	-0.624	-0.63	-0.635	-0.639
22	2230	2330	27	28	-0.281	-0.287	-0.304	-0.313	-0.317	-0.321
	A	**MIDDLE**								
	From (mm)	To (mm)	Disks							
23	1450	1550	29	30	-0.325	-0.332	-0.35	-0.357	-0.36	-0.362
24	1550	1650	30	31	-0.038	-0.042	-0.053	-0.062	-0.065	-0.068
25	1650	1750	31	32	0.275	0.273	0.259	0.251	0.249	0.248
26	1450	1550	33	34	-0.313	-0.315	-0.325	-0.331	-0.332	-0.335
27	1550	1650	34	35	0.203	0.2	0.194	0.188	0.185	0.185
28	1650	1750	35	36	-0.152	-0.154	-0.163	-0.167	-0.172	-0.172

					21d	28d	56d	90d	120d	150d
	B	**BOTTOM**								
	From (mm)	To (mm)	Disks		22-02-16	29-02-16	28-03-16	01-05-16	31-05-16	30-06-16
1	870	970	1	2	0.101	0.112	0.117	0.118	0.114	0.116
2	1150	1250	3	4	-0.508	-0.505	-0.498	-0.503	-0.507	-0.504
3	1250	1350	4	5	-0.138	-0.129	-0.126	-0.124	-0.128	-0.125
4	1350	1450	5	6	1.158	1.162	1.17	1.169	1.163	1.172
5	1450	1550	6	7	0.488	0.491	0.496	0.496	0.493	0.494
6	1550	1650	7	8	0.051	0.054	0.063	0.062	0.058	0.062
7	1650	1750	8	9	-0.419	-0.417	-0.415	-0.414	-0.416	-0.413
8	1750	1850	9	10	0.012	0.015	0.024	0.023	0.019	0.02
9	1850	1950	10	11	-0.371	-0.372	-0.378	-0.38	-0.379	-0.382
10	1950	2050	11	12	0.181	0.189	0.202	0.201	0.2	0.206
11	2230	2330	13	14	-0.08	-0.078	-0.072	-0.073	-0.075	-0.074
	B	**TOP**								
	From (mm)	To (mm)	Disks							
12	870	970	15	16	-0.325	-0.327	-0.339	-0.353	-0.355	-0.357
13	1150	1250	17	18	-0.377	-0.383	-0.398	-0.412	-0.418	-0.419
14	1250	1350	18	19	-1.221	-1.224	-1.239	-1.251	-1.256	-1.256
15	1350	1450	19	20	-0.613	-0.617	-0.633	-0.642	-0.645	-0.648
16	1450	1550	20	21	-0.067	-0.072	-0.091	-0.102	-0.105	-0.111
17	1550	1650	21	22	-0.34	-0.345	-0.362	-0.373	-0.378	-0.379
18	1650	1750	22	23	-0.298	-0.303	-0.318	-0.332	-0.336	-0.339
19	1750	1850	23	24	-0.324	-0.33	-0.344	-1.353	-1.358	-1.36
20	1850	1950	24	25	-0.397	-0.404	-0.419	-0.432	-0.436	-0.44
21	1950	2050	25	26	-0.155	-0.16	-0.175	-0.19	-0.193	-0.195
22	2230	2330	27	28	-0.274	-0.28	-0.295	-0.306	-0.309	-0.313
	B	**MIDDLE**								
	From (mm)	To (mm)	Disks							
23	1450	1550	29	30	-0.536	-0.541	-0.554	-0.563	-0.565	-0.569
24	1550	1650	30	31	-0.296	-0.299	-0.31	-0.32	-0.323	-0.327
25	1650	1750	31	32	-0.253	-0.257	-0.265	-0.274	-0.277	-0.28
26	1450	1550	33	34	-0.425	-0.425	-0.434	-0.438	-0.441	-0.443
27	1550	1650	34	35	-0.213	-0.214	-0.22	-0.227	-0.232	-0.233
28	1650	1750	35	36	-0.225	-0.224	-0.23	-0.235	-0.236	-0.238

	NAC7				180d	210d	240d	270d	300d	330d
	A	**BOTTOM**								
	From (mm)	To (mm)	Disks		30-07-16	29-08-16	28-09-16	28-10-16	27-11-16	27-12-16
1	870	970	1	2	-0.642	-0.642	-0.645	-0.643	-0.64	-0.634
2	1150	1250	3	4	0.005	0.005	0.004	0.005	0.007	0.01
3	1250	1350	4	5	-0.113	-0.113	-0.114	-0.113	-0.111	-0.106
4	1350	1450	5	6	0.14	0.14	0.138	0.142	0.146	0.152
5	1450	1550	6	7	0.021	0.0018	0.016	0.02	0.023	0.029
6	1550	1650	7	8	0.053	0.05	0.052	0.052	0.052	0.054
7	1650	1750	8	9	0.123	0.122	0.12	0.125	0.127	0.131
8	1750	1850	9	10	-0.426	-0.425	-0.425	-0.423	-0.421	-0.416
9	1850	1950	10	11	-0.228	-0.229	-0.231	-0.228	-0.224	-0.218
10	1950	2050	11	12	-0.016	-0.015	-0.017	-0.01	-0.011	-0.005
11	2230	2330	13	14	0.12	0.12	0.119	0.126	0.13	0.14
	A	**TOP**								
	From (mm)	To (mm)	Disks							
12	870	970	15	16	-0.223	-0.226	-0.225	-0.227	-0.232	-0.232
13	1150	1250	17	18	-0.396	-0.399	-0.4	-0.403	-0.407	-0.409
14	1250	1350	18	19	-0.375	-0.378	-0.38	-0.379	-0.382	-0.383
15	1350	1450	19	20	-0.417	-0.422	-0.422	-0.425	-0.428	-0.429
16	1450	1550	20	21	-0.117	-0.121	-0.124	-0.125	-0.128	-0.133
17	1550	1650	21	22	-0.132	-0.133	-0.136	-0.137	-0.139	-0.141
18	1650	1750	22	23	-0.286	-0.289	-0.292	-0.293	-0.297	-0.298
19	1750	1850	23	24	-0.281	-0.285	-0.287	-0.287	-0.291	-0.293
20	1850	1950	24	25	-0.623	-0.63	-0.631	-0.632	-0.633	-0.634
21	1950	2050	25	26	-0.646	-0.65	-0.651	-0.653	-0.658	-0.66
22	2230	2330	27	28	-0.325	-0.332	-0.333	-0.335	-0.338	-0.338
	A	**MIDDLE**								
	From (mm)	To (mm)	Disks							
23	1450	1550	29	30	-0.368	-0.373	-0.374	-0.375	-0.378	-0.379
24	1550	1650	30	31	-0.073	-0.075	-0.077	-0.076	-0.078	-0.078
25	1650	1750	31	32	0.24	0.239	0.238	0.237	0.235	0.236
26	1450	1550	33	34	-0.34	-0.34	-0.342	-0.343	-0.343	-0.343
27	1550	1650	34	35	0.181	0.18	0.178	0.177	0.177	0.179
28	1650	1750	35	36	-0.176	-0.178	-0.18	-0.179	-0.179	-0.179

					180d	210d	240d	270d	300d	330d
	B	**BOTTOM**								
	From (mm)	To (mm)	Disks		30-07-16	29-08-16	28-09-16	28-10-16	27-11-16	27-12-16
1	870	970	1	2	0.116	0.113	0.115	0.115	0.121	0.124
2	1150	1250	3	4	-0.502	-0.508	-0.504	-0.506	-0.498	-0.497
3	1250	1350	4	5	-0.126	-0.127	-0.129	-0.126	-0.122	-0.118
4	1350	1450	5	6	1.169	1.167	1.165	1.169	1.175	1.178
5	1450	1550	6	7	0.494	0.494	0.491	0.493	0.497	0.499
6	1550	1650	7	8	0.062	0.059	0.059	0.062	0.067	0.069
7	1650	1750	8	9	-0.416	-0.419	-0.416	-0.412	-0.411	-0.411
8	1750	1850	9	10	0.023	0.021	0.022	0.024	0.029	0.032
9	1850	1950	10	11	-0.39	-0.392	-0.39	-0.392	-0.391	-0.392
10	1950	2050	11	12	0.206	0.205	0.203	0.209	0.215	0.219
11	2230	2330	13	14	-0.075	-0.078	-0.076	-0.076	-0.07	-0.07
	B	**TOP**								
	From (mm)	To (mm)	Disks							
12	870	970	15	16	-0.364	-0.367	-0.367	-0.371	-0.368	-0.373
13	1150	1250	17	18	-0.428	-0.431	-0.434	-0.437	-0.437	-0.441
14	1250	1350	18	19	-1.268	-1.271	-1.273	-1.276	-1.274	-1.279
15	1350	1450	19	20	-0.656	-0.66	-0.659	-0.662	-0.661	-0.665
16	1450	1550	20	21	-0.12	-0.126	-0.126	-0.127	-0.132	-0.136
17	1550	1650	21	22	-0.388	-0.394	-0.394	-0.396	-0.396	-0.403
18	1650	1750	22	23	-0.348	-0.352	-0.353	-0.355	-0.357	-0.363
19	1750	1850	23	24	-1.367	-1.372	-1.371	-1.374	-1.375	-1.376
20	1850	1950	24	25	-0.447	-0.451	-0.45	-0.453	-0.453	-0.459
21	1950	2050	25	26	-0.203	-0.208	-0.208	-0.212	-0.212	-0.217
22	2230	2330	27	28	-0.32	-0.324	-0.324	-0.332	-0.328	-0.333
	B	**MIDDLE**								
	From (mm)	To (mm)	Disks							
23	1450	1550	29	30	-0.575	-0.581	-0.581	-0.582	-0.581	-0.584
24	1550	1650	30	31	-0.334	-0.337	-0.339	-0.343	-0.341	-0.345
25	1650	1750	31	32	-0.286	-0.287	-0.29	-0.29	-0.288	-0.292
26	1450	1550	33	34	-0.446	-0.451	-0.45	-0.452	-0.445	-0.45
27	1550	1650	34	35	-0.238	-0.242	-0.241	-0.244	-0.24	-0.242
28	1650	1750	35	36	-0.243	-0.247	-0.247	-0.246	-0.244	-0.245

NAC7

					365d	400d	450d
	A	**BOTTOM**					
	From (mm)	To (mm)	Disks		31-01-17	07-03-17	26-04-17
1	870	970	1	2	-0.633	-0.639	-0.635
2	1150	1250	3	4	0.01	0.007	0.009
3	1250	1350	4	5	-0.107	-0.11	-0.109
4	1350	1450	5	6	0.155	0.151	0.153
5	1450	1550	6	7	0.031	0.025	0.027
6	1550	1650	7	8	0.052	0.051	0.05
7	1650	1750	8	9	0.13	0.13	0.128
8	1750	1850	9	10	-0.416	-0.419	-0.419
9	1850	1950	10	11	-0.218	-0.22	-0.219
10	1950	2050	11	12	-0.001	-0.006	-0.004
11	2230	2330	13	14	0.144	0.136	0.137
	A	**TOP**					
	From (mm)	To (mm)	Disks				
12	870	970	15	16	-0.236	-0.24	-0.24
13	1150	1250	17	18	-0.416	-0.421	-0.42
14	1250	1350	18	19	-0.389	-0.392	-0.391
15	1350	1450	19	20	-0.438	-0.44	-0.44
16	1450	1550	20	21	-0.139	-0.142	-0.142
17	1550	1650	21	22	-0.147	-0.147	-0.148
18	1650	1750	22	23	-0.305	-0.306	-0.306
19	1750	1850	23	24	-0.3	-0.301	-0.301
20	1850	1950	24	25	-0.643	-0.642	-0.645
21	1950	2050	25	26	-0.665	-0.668	-0.667
22	2230	2330	27	28	-0.347	-0.349	-0.35
	A	**MIDDLE**					
	From (mm)	To (mm)	Disks				
23	1450	1550	29	30	-0.386	-0.386	-0.386
24	1550	1650	30	31	-0.084	-0.087	-0.086
25	1650	1750	31	32	0.226	0.227	0.228
26	1450	1550	33	34	-0.347	-0.35	-0.348
27	1550	1650	34	35	0.176	0.17	0.173
28	1650	1750	35	36	-0.185	-0.186	-0.184

					365d	400d	450d
	B	**BOTTOM**					
	From (mm)	To (mm)	Disks		31-01-17	07-03-17	26-04-17
1	870	970	1	2	0.12	0.123	0.123
2	1150	1250	3	4	-0.496	-0.498	-0.495
3	1250	1350	4	5	-0.119	-0.119	-0.119
4	1350	1450	5	6	1.175	1.177	1.177
5	1450	1550	6	7	0.5	0.5	0.5
6	1550	1650	7	8	0.071	0.07	0.074
7	1650	1750	8	9	-0.414	-0.412	-0.41
8	1750	1850	9	10	0.033	0.031	0.034
9	1850	1950	10	11	-0.397	-0.393	-0.393
10	1950	2050	11	12	0.218	0.218	0.021
11	2230	2330	13	14	-0.07	-0.071	-0.07
	B	**TOP**					
	From (mm)	To (mm)	Disks				
12	870	970	15	16	-0.377	-0.38	-0.381
13	1150	1250	17	18	-0.444	-0.448	-0.45
14	1250	1350	18	19	-1.286	-1.287	-1.288
15	1350	1450	19	20	-0.67	-0.671	-0.672
16	1450	1550	20	21	-0.14	-0.142	-0.144
17	1550	1650	21	22	-0.406	-0.406	-0.408
18	1650	1750	22	23	-0.366	-0.369	-0.368
19	1750	1850	23	24	-1.381	-1.383	-0.385
20	1850	1950	24	25	-0.462	-0.466	-0.467
21	1950	2050	25	26	-0.221	-0.224	-0.225
22	2230	2330	27	28	-0.338	-0.342	-0.34
	B	**MIDDLE**					
	From (mm)	To (mm)	Disks				
23	1450	1550	29	30	-0.587	-0.591	-0.59
24	1550	1650	30	31	-0.347	-0.352	-0.352
25	1650	1750	31	32	-0.296	-0.299	-0.299
26	1450	1550	33	34	-0.454	-0.456	-0.456
27	1550	1650	34	35	-0.246	-0.248	-0.245
28	1650	1750	35	36	-0.248	-0.252	-0.248

				σ =	14.54	MPa		SIDE A BOTTOM (‰)										
			Age					920	1200	1300	1400	1500	1600	1700	1800	1900	2000	2280
NAC7	**Date**	**Time**	**Days**	**Hours**	**Minutes**	**Days, eq**	**From loading (days)**	1	2	3	4	5	6	7	8	9	10	11
Casting	25-01-16	11:00	0	0	0	0.000	–	*31*	*31*	*31*	*31*	*31*	*31*	*31*	*31*	*31*	*31*	*31*
Before loading	01-02-16	13:25	7	0	0	7.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5min after loading	01-02-16	13:30	7	0	5	7.003	0.003	0.670	0.190	1.040	1.880	1.690	-0.170	1.050	1.390	1.460	1.530	2.020
1h	01-02-16	14:30	7	1	0	7.042	0.042	0.730	0.230	1.130	2.010	1.780	-0.150	1.130	1.480	1.560	1.630	2.150
6h	01-02-16	20:30	7	6	0	7.250	0.250	0.780	0.260	1.150	2.070	1.840	-0.140	1.160	1.500	1.610	1.670	2.250
1	02-02-16	14:30	8	0	0	8.000	1.000	0.810	0.250	1.200	2.180	1.930	-0.180	1.230	1.580	1.690	1.740	2.360
2	03-02-16	14:30	9	0	0	9.000	2.000	0.810	0.270	1.210	2.190	1.950	-0.170	1.250	1.600	1.710	1.770	2.380
3	04-02-16	14:30	10	0	0	10.000	3.000	0.780	0.200	1.180	2.210	1.940	-0.270	1.190	1.570	1.690	1.730	2.420
4	05-02-16	14:00	11	0	0	11.000	4.000	0.850	0.280	1.250	2.290	2.020	-0.230	1.270	1.630	1.760	1.800	2.500
5	06-02-16	15:00	12	0	0	12.000	5.000	0.850	0.280	1.250	2.310	2.060	-0.270	1.290	1.630	1.780	1.830	2.540
6	07-02-16	20:00	13	0	0	13.000	6.000	0.860	0.280	1.270	2.380	2.070	-0.250	1.310	1.690	1.830	1.860	2.600
7	08-02-16	13:00	14	0	0	14.000	7.000	0.860	0.270	1.250	2.370	2.060	-0.270	1.310	1.660	1.810	1.870	2.600
14	15-02-16	20:00	21	0	0	21.00	14.00	0.900	0.300	1.330	2.470	2.150	-0.260	1.360	1.710	1.890	1.900	2.690
21	22-02-16	11:30	28	0	0	28.00	21.00	0.870	0.250	1.270	2.450	2.120	-0.360	1.330	1.690	1.850	1.890	2.710
28	29-02-16	12:00	35	0	0	35.00	28.00	0.880	0.250	1.300	2.500	2.120	-0.390	1.340	1.710	1.880	1.910	2.770
56	28-03-16	15:00	63	0	0	63.00	56.00	0.890	0.240	1.350	2.600	2.220	-0.420	1.400	1.760	1.960	1.970	2.900
90	01-05-16	14:00	97	0	0	97.00	90.00	0.900	0.230	1.360	2.590	2.250	-0.420	1.400	1.720	2.020	2.040	2.920
120	31-05-16	14:00	127	0	0	127.00	120.00	0.830	0.190	1.320	2.550	2.180	-0.460	1.360	1.660	1.880	1.960	2.840
150	30-06-16	12:00	157	0	0	157.00	150.00	0.880	0.240	1.360	2.610	2.240	-0.410	1.410	1.730	1.960	2.030	2.910
180	30-07-16	15:00	187	0	0	187.00	180.00	0.860	0.230	1.350	2.620	2.260	-0.460	1.390	1.700	1.940	2.000	2.930
210	29-08-16	13:00	217	0	0	217.00	210.00	0.860	0.230	1.350	2.620	2.068	-0.490	1.380	1.710	1.930	2.010	2.930
240	28-09-16	12:00	247	0	0	247.00	240.00	0.830	0.220	1.340	2.600	2.210	-0.470	1.360	1.710	1.910	1.990	2.920
270	28-10-16	14:00	277	0	0	277.00	270.00	0.850	0.230	1.350	2.640	2.250	-0.470	1.410	1.730	1.940	2.060	2.990
300	27-11-16	11:00	307	0	0	307.00	300.00	0.880	0.250	1.370	2.680	2.280	-0.470	1.430	1.750	1.980	2.050	3.030
330	27-12-16	12:00	337	0	0	337.00	330.00	0.940	0.280	1.420	2.740	2.340	-0.450	1.470	1.800	2.040	2.110	3.130
365	31-01-17	15:00	372	0	0	372.00	365.00	0.950	0.280	1.410	2.770	2.360	-0.470	1.460	1.800	2.040	2.150	3.170
400	07-03-17	11:00	407	0	0	407.00	400.00	0.890	0.250	1.380	2.730	2.300	-0.480	1.460	1.770	2.020	2.100	3.090
450	26-04-17	16:00	457	0	0	457.00	450.00	0.930	0.270	1.390	2.750	2.320	-0.490	1.440	1.770	2.030	2.120	3.100
700	01-01-18		707	0	0	707.00	700.00											

								SIDE B BOTTOM (‰)										
			Age					920	1200	1300	1400	1500	1600	1700	1800	1900	2000	2280
	Date	**Time**	**Days**	**Hours**	**Minutes**	**Days, eq**	**From loading (days)**	1	2	3	4	5	6	7	8	9	10	11
Casting	25-01-16	11:00	0	0	0	0.000	–	*31*	*31*	*31*	*31*	*31*	*31*	*31*	*31*	*31*	*31*	*31*
Before loading	01-02-16	13:25	7	0	0	7.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5min after loading	01-02-16	13:30	7	0	5	7.003	0.003	0.730	1.490	1.370	1.400	1.090	1.480	0.400	1.590	-0.160	1.600	0.820
1h	01-02-16	14:30	7	1	0	7.042	0.042	0.770	1.560	1.470	1.450	1.140	1.550	0.460	1.660	-0.150	1.700	0.880
6h	01-02-16	20:30	7	6	0	7.250	0.250	0.810	1.590	1.520	1.500	1.180	1.580	0.480	1.720	-0.130	1.760	0.890
1	02-02-16	14:30	8	0	0	8.000	1.000	0.870	1.660	1.590	1.580	1.240	1.670	0.510	1.800	-0.200	1.820	0.970
2	03-02-16	14:30	9	0	0	9.000	2.000	0.850	1.670	1.560	1.570	1.200	1.640	0.500	1.770	-0.240	1.860	0.930
3	04-02-16	14:30	10	0	0	10.000	3.000	0.890	1.680	1.590	1.610	1.250	1.680	0.520	1.830	-0.260	1.940	0.990
4	05-02-16	14:00	11	0	0	11.000	4.000	0.940	1.760	1.630	1.650	1.250	1.710	0.510	1.860	-0.300	1.940	0.980
5	06-02-16	15:00	12	0	0	12.000	5.000	0.930	1.770	1.640	1.650	1.240	1.720	0.490	1.850	-0.340	1.980	1.010
6	07-02-16	20:00	13	0	0	13.000	6.000	0.970	1.810	1.700	1.710	1.300	1.810	0.560	1.940	-0.300	2.050	1.040
7	08-02-16	13:00	14	0	0	14.000	7.000	0.940	1.800	1.680	1.710	1.280	1.770	0.530	1.900	-0.330	2.050	1.030
14	15-02-16	20:00	21	0	0	21.00	14.00	0.890	1.850	1.740	1.720	1.300	1.810	0.510	1.940	-0.410	2.090	1.030
21	22-02-16	11:30	28	0	0	28.00	21.00	0.870	1.840	1.670	1.690	1.290	1.790	0.500	1.970	-0.500	2.130	1.000
28	29-02-16	12:00	35	0	0	35.00	28.00	0.980	1.870	1.760	1.730	1.320	1.820	0.520	2.000	-0.510	2.210	1.020
56	28-03-16	15:00	63	0	0	63.00	56.00	1.030	1.940	1.790	1.810	1.370	1.910	0.540	2.090	-0.570	2.340	1.080
90	01-05-16	14:00	97	0	0	97.00	90.00	1.040	1.890	1.810	1.800	1.370	1.900	0.550	2.080	-0.590	2.330	1.070
120	31-05-16	14:00	127	0	0	127.00	120.00	1.000	1.850	1.770	1.740	1.340	1.860	0.530	2.040	-0.580	2.320	1.050
150	30-06-16	12:00	157	0	0	157.00	150.00	1.020	1.880	1.800	1.830	1.350	1.900	0.560	2.050	-0.610	2.380	1.060
180	30-07-16	15:00	187	0	0	187.00	180.00	1.020	1.900	1.790	1.800	1.350	1.900	0.530	2.080	-0.690	2.380	1.050
210	29-08-16	13:00	217	0	0	217.00	210.00	0.990	1.840	1.780	1.780	1.350	1.870	0.500	2.060	-0.710	2.370	1.020
240	28-09-16	12:00	247	0	0	247.00	240.00	1.010	1.880	1.760	1.760	1.320	1.870	0.530	2.070	-0.690	2.350	1.040
270	28-10-16	14:00	277	0	0	277.00	270.00	1.010	1.860	1.790	1.800	1.340	1.900	0.570	2.090	-0.710	2.410	1.040
300	27-11-16	11:00	307	0	0	307.00	300.00	1.070	1.940	1.830	1.860	1.380	1.950	0.580	2.140	-0.700	2.470	1.100
330	27-12-16	12:00	337	0	0	337.00	330.00	1.100	1.950	1.870	1.890	1.400	1.970	0.580	2.170	-0.710	2.510	1.100
365	31-01-17	15:00	372	0	0	372.00	365.00	1.060	1.960	1.860	1.860	1.410	1.990	0.550	2.180	-0.760	2.500	1.100
400	07-03-17	11:00	407	0	0	407.00	400.00	1.090	1.940	1.860	1.880	1.410	1.980	0.570	2.160	-0.720	2.500	1.090
450	26-04-17	16:00	457	0	0	457.00	450.00	1.090	1.970	1.860	1.880	1.410	2.020	0.590	2.190	-0.720	0.530	1.100

				σ =	14.54	MPa		SIDE A TOP (‰)										
			Age					920	1200	1300	1400	1500	1600	1700	1800	1900	2000	2280
NAC7	Date	Time	Days	Hours	Minutes	Days, eq	From loading (days)	12	13	14	15	16	17	18	19	20	21	22
Casting	25-01-16	11:00	0	0	0	0.000	–	*197*	*197*	*197*	*197*	*197*	*197*	*197*	*197*	*197*	*197*	*197*
Before loading	01-02-16	13:25	7	0	0	7.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5min after loading	01-02-16	13:30	7	0	5	7.003	0.003	-0.380	-0.510	-0.510	-0.480	-0.540	-0.530	-0.630	-0.390	-0.460	-0.640	-0.440
1h	01-02-16	14:30	7	1	0	7.042	0.042	-0.470	-0.580	-0.590	-0.590	-0.650	-0.620	-0.850	-0.400	-0.580	-0.730	-0.570
6h	01-02-16	20:30	7	6	0	7.250	0.250	-0.430	-0.580	-0.570	-0.570	-0.640	-0.620	-0.880	-0.360	-0.550	-0.730	-0.530
1	02-02-16	14:30	8	0	0	8.000	1.000	-0.460	-0.670	-0.640	-0.640	-0.700	-1.180	-0.990	-0.440	-0.610	-0.800	-0.580
2	03-02-16	14:30	9	0	0	9.000	2.000	-0.440	-0.720	-0.690	-0.690	-0.770	-0.740	-1.050	-0.480	-0.660	-0.880	-0.640
3	04-02-16	14:30	10	0	0	10.000	3.000	-0.290	-0.770	-0.740	-0.770	-0.840	-0.790	-1.090	-0.550	-0.710	-0.930	-0.680
4	05-02-16	14:00	11	0	0	11.000	4.000	-0.280	-0.780	-0.730	-0.790	-0.860	-0.800	-1.130	-0.560	-0.740	-0.970	-0.710
5	06-02-16	15:00	12	0	0	12.000	5.000	-0.300	-0.790	-0.760	-0.820	-0.880	-0.790	-1.130	-0.590	-0.730	-0.970	-0.700
6	07-02-16	20:00	13	0	0	13.000	6.000	-0.360	-0.850	-0.790	-0.860	-0.930	-0.860	-1.160	-0.620	-0.750	-1.020	-0.760
7	08-02-16	13:00	14	0	0	14.000	7.000	-0.340	-0.840	-0.790	-0.850	-0.930	-0.880	-1.200	-0.630	-0.800	-1.060	-0.790
14	15-02-16	20:00	21	0	0	21.00	14.00	-0.450	-0.970	-0.930	-1.000	-1.090	-0.990	-1.330	-0.760	-0.920	-1.210	4.440
21	22-02-16	11:30	28	0	0	28.00	21.00	-0.590	-1.120	-1.030	-1.140	-1.210	-1.100	-1.440	-0.900	-1.030	-1.330	-1.040
28	29-02-16	12:00	35	0	0	35.00	28.00	-0.640	-1.160	-1.070	-1.200	-1.260	-1.170	-1.510	-0.950	-1.100	-1.410	-1.100
56	28-03-16	15:00	63	0	0	63.00	56.00	-0.810	-1.350	-1.250	-1.400	-1.470	-1.340	-1.710	-1.140	-1.280	-1.650	-1.270
90	01-05-16	14:00	97	0	0	97.00	90.00	-0.890	-1.450	-1.320	-1.500	-1.570	-1.430	-1.780	-1.240	-1.360	-1.710	-1.360
120	31-05-16	14:00	127	0	0	127.00	120.00	-0.950	-1.500	-1.370	-1.540	-1.630	-1.460	-1.830	-1.240	-1.360	-1.760	-1.400
150	30-06-16	12:00	157	0	0	157.00	150.00	-0.950	-1.510	-1.390	-1.570	-1.670	-1.450	-1.860	-1.270	-1.410	-1.800	-1.440
180	30-07-16	15:00	187	0	0	187.00	180.00	-1.020	-1.590	-1.460	-1.620	-1.740	-1.570	-1.930	-1.350	-1.450	-1.870	-1.480
210	29-08-16	13:00	217	0	0	217.00	210.00	-1.050	-1.620	-1.490	-1.670	-1.780	-1.580	-1.960	-1.390	-1.520	-1.910	-1.550
240	28-09-16	12:00	247	0	0	247.00	240.00	-1.040	-1.630	-1.510	-1.670	-1.810	-1.610	-1.990	-1.410	-1.530	-1.920	-1.560
270	28-10-16	14:00	277	0	0	277.00	270.00	-1.060	-1.660	-1.500	-1.700	-1.820	-1.620	-2.000	-1.410	-1.540	-1.940	-1.580
300	27-11-16	11:00	307	0	0	307.00	300.00	-1.110	-1.700	-1.530	-1.730	-1.850	-1.640	-2.040	-1.450	-1.550	-1.990	-1.610
330	27-12-16	12:00	337	0	0	337.00	330.00	-1.110	-1.720	-1.540	-1.740	-1.900	-1.660	-2.050	-1.470	-1.560	-2.010	-1.610
365	31-01-17	15:00	372	0	0	372.00	365.00	-1.150	-1.790	-1.600	-1.830	-1.960	-1.720	-2.120	-1.540	-1.650	-2.060	-1.700
400	07-03-17	11:00	407	0	0	407.00	400.00	-1.190	-1.840	-1.630	-1.850	-1.990	-1.720	-2.130	-1.550	-1.640	-2.090	-1.720
450	26-04-17	16:00	457	0	0	457.00	450.00	-1.190	-1.830	-1.620	-1.850	-1.990	-1.730	-2.130	-1.550	-1.670	-2.080	-1.730
700	01-01-18		707	0	0	707.00	700.00											

								SIDE B TOP (‰)										
			Age					920	1200	1300	1400	1500	1600	1700	1800	1900	2000	2280
	Date	Time	Days	Hours	Minutes	Days, eq	From loading (days)	12	13	14	15	16	17	18	19	20	21	22
Casting	25-01-16	11:00	0	0	0	0.000	–	*197*	*197*	*197*	*197*	*197*	*197*	*197*	*197*	*197*	*197*	*197*
Before loading	01-02-16	13:25	7	0	0	7.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5min after loading	01-02-16	13:30	7	0	5	7.003	0.003	-0.410	-0.540	-0.500	-0.520	-0.540	-0.600	-0.440	-0.510	-0.600	-0.490	-0.390
1h	01-02-16	14:30	7	1	0	7.042	0.042	-0.470	-0.600	-0.570	-0.510	-0.580	-0.620	-0.450	-0.520	-0.640	-0.540	-0.430
6h	01-02-16	20:30	7	6	0	7.250	0.250	5.100	-0.710	-0.550	-0.580	-0.590	-0.690	-0.480	-0.550	-0.690	-0.540	-0.450
1	02-02-16	14:30	8	0	0	8.000	1.000	-0.490	-0.660	-0.580	-0.630	-0.640	-0.730	-0.540	-0.590	-0.730	-0.600	-0.500
2	03-02-16	14:30	9	0	0	9.000	2.000	-0.570	-0.710	-0.690	-0.640	-0.710	-0.810	-0.600	-0.660	-0.820	-0.670	-0.560
3	04-02-16	14:30	10	0	0	10.000	3.000	-0.600	-0.770	-0.750	-0.750	-0.760	-0.850	-0.640	-0.700	-0.850	-0.710	-0.610
4	05-02-16	14:00	11	0	0	11.000	4.000	-0.650	-0.770	-0.760	-0.760	-0.790	-0.850	-0.660	-0.710	-0.860	-0.710	-0.610
5	06-02-16	15:00	12	0	0	12.000	5.000	-0.640	-0.800	-0.770	-0.790	-0.830	-0.890	-0.710	-0.740	-0.910	-0.760	-0.630
6	07-02-16	20:00	13	0	0	13.000	6.000	-0.650	-0.810	-0.810	-0.810	-0.830	-0.900	-0.700	-0.760	-0.910	-0.750	-0.660
7	08-02-16	13:00	14	0	0	14.000	7.000	-0.690	-0.840	-0.870	-0.860	-0.910	-0.980	-0.730	-0.810	-0.960	-0.810	-0.720
14	15-02-16	20:00	21	0	0	21.00	14.00	-0.800	-0.950	-0.990	-0.980	-1.000	-1.090	-0.840	-0.900	-1.090	-0.950	-0.830
21	22-02-16	11:30	28	0	0	28.00	21.00	-0.930	-1.070	-1.140	-1.110	-1.120	-1.230	-0.970	-1.020	-1.210	-1.070	-0.960
28	29-02-16	12:00	35	0	0	35.00	28.00	-0.950	-1.130	-1.170	-1.150	-1.170	-1.280	-1.020	-1.080	-1.280	-1.120	-1.020
56	28-03-16	15:00	63	0	0	63.00	56.00	-1.070	-1.280	-1.320	-1.310	-1.360	-1.450	-1.170	-1.220	-1.430	-1.270	-1.170
90	01-05-16	14:00	97	0	0	97.00	90.00	-1.210	-1.420	-1.440	-1.400	-1.470	-1.560	-1.310	-11.310	-1.560	-1.420	-1.280
120	31-05-16	14:00	127	0	0	127.00	120.00	-1.230	-1.480	-1.490	-1.430	-1.500	-1.610	-1.350	-11.360	-1.600	-1.450	-1.310
150	30-06-16	12:00	157	0	0	157.00	150.00	-1.250	-1.490	-1.490	-1.460	-1.560	-1.620	-1.380	-11.380	-1.640	-1.470	-1.350
180	30-07-16	15:00	187	0	0	187.00	180.00	-1.320	-1.580	-1.610	-1.540	-1.650	-1.710	-1.470	-11.450	-1.710	-1.550	-1.420
210	29-08-16	13:00	217	0	0	217.00	210.00	-1.350	-1.610	-1.640	-1.580	-1.710	-1.770	-1.510	-11.500	-1.750	-1.600	-1.460
240	28-09-16	12:00	247	0	0	247.00	240.00	-1.350	-1.640	-1.660	-1.570	-1.710	-1.770	-1.520	-11.490	-1.740	-1.600	-1.460
270	28-10-16	14:00	277	0	0	277.00	270.00	-1.390	-1.670	-1.690	-1.600	-1.720	-1.790	-1.540	-11.520	-1.770	-1.640	-1.540
300	27-11-16	11:00	307	0	0	307.00	300.00	-1.360	-1.670	-1.670	-1.590	-1.770	-1.790	-1.560	-11.530	-1.770	-1.640	-1.500
330	27-12-16	12:00	337	0	0	337.00	330.00	-1.410	-1.710	-1.720	-1.630	-1.810	-1.860	-1.620	-11.540	-1.830	-1.690	-1.550
365	31-01-17	15:00	372	0	0	372.00	365.00	-1.450	-1.740	-1.790	-1.680	-1.850	-1.890	-1.650	-11.590	-1.860	-1.730	-1.600
400	07-03-17	11:00	407	0	0	407.00	400.00	-1.480	-1.780	-1.800	-1.690	-1.870	-1.890	-1.680	-11.610	-1.900	-1.760	-1.640
450	26-04-17	16:00	457	0	0	457.00	450.00	-1.490	-1.800	-1.810	-1.700	-1.890	-1.910	-1.670	-1.630	-1.910	-1.770	-1.620

				σ =	14.54	MPa		SIDE A MIDDLE (‰)					
			Age					1500	1600	1700	1500	1600	1700
NAC7	**Date**	**Time**	**Days**	**Hours**	**Minutes**	**Days, eq**	**From loading (days)**	23	24	25	26	27	28
Casting	25-01-16	11:00	0	0	0	0.000	–	*155*	*155*	*155*	*115*	*115*	*115*
Before loading	01-02-16	13:25	7	0	0	7.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5min after loading	01-02-16	13:30	7	0	5	7.003	0.003	-0.100	0.010	-0.020	0.190	0.500	0.350
1h	01-02-16	14:30	7	1	0	7.042	0.042	-0.210	-0.100	-0.150	0.040	0.380	0.230
6h	01-02-16	20:30	7	6	0	7.250	0.250	-0.180	-0.090	-0.120	0.090	0.430	0.280
1	02-02-16	14:30	8	0	0	8.000	1.000	-0.230	-0.140	-0.130	0.090	0.420	0.260
2	03-02-16	14:30	9	0	0	9.000	2.000	-0.260	-0.160	-0.190	0.050	0.420	0.250
3	04-02-16	14:30	10	0	0	10.000	3.000	-0.300	-0.210	-0.230	0.030	0.410	0.230
4	05-02-16	14:00	11	0	0	11.000	4.000	-0.360	-0.220	-0.240	0.020	0.400	0.220
5	06-02-16	15:00	12	0	0	12.000	5.000	-0.360	-0.210	-0.250	0.040	0.420	0.220
6	07-02-16	20:00	13	0	0	13.000	6.000	-0.380	-0.250	-0.280	0.010	0.420	0.220
7	08-02-16	13:00	14	0	0	14.000	7.000	-0.400	-0.270	-0.300	0.010	0.430	0.200
14	15-02-16	20:00	21	0	0	21.00	14.00	-0.490	-0.340	-0.370	-0.070	0.360	0.130
21	22-02-16	11:30	28	0	0	28.00	21.00	-0.590	-0.420	-0.470	-0.140	0.320	0.060
28	29-02-16	12:00	35	0	0	35.00	28.00	-0.660	-0.460	-0.490	-0.160	0.290	0.040
56	28-03-16	15:00	63	0	0	63.00	56.00	-0.840	-0.570	-0.630	-0.260	0.230	-0.050
90	01-05-16	14:00	97	0	0	97.00	90.00	-0.910	-0.660	-0.710	-0.320	0.170	-0.090
120	31-05-16	14:00	127	0	0	127.00	120.00	-0.940	-0.690	-0.730	-0.330	0.140	-0.140
150	30-06-16	12:00	157	0	0	157.00	150.00	-0.960	-0.720	-0.740	-0.360	0.140	-0.140
180	30-07-16	15:00	187	0	0	187.00	180.00	-1.020	-0.770	-0.820	-0.410	0.100	-0.180
210	29-08-16	13:00	217	0	0	217.00	210.00	-1.070	-0.790	-0.830	-0.410	0.090	-0.200
240	28-09-16	12:00	247	0	0	247.00	240.00	-1.080	-0.810	-0.840	-0.430	0.070	-0.220
270	28-10-16	14:00	277	0	0	277.00	270.00	-1.090	-0.800	-0.850	-0.440	0.060	-0.210
300	27-11-16	11:00	307	0	0	307.00	300.00	-1.120	-0.820	-0.870	-0.440	0.060	-0.210
330	27-12-16	12:00	337	0	0	337.00	330.00	-1.130	-0.820	-0.860	-0.440	0.080	-0.210
365	31-01-17	15:00	372	0	0	372.00	365.00	-1.200	-0.880	-0.960	-0.480	0.050	-0.270
400	07-03-17	11:00	407	0	0	407.00	400.00	-1.200	-0.910	-0.950	-0.510	-0.010	-0.280
450	26-04-17	16:00	457	0	0	457.00	450.00	-1.200	-0.900	-0.940	-0.490	0.020	-0.260
700	01-01-18		707	0	0	707.00	700.00						

								SIDE B MIDDLE (‰)					
			Age					1500	1600	1700	1500	1600	1700
	Date	**Time**	**Days**	**Hours**	**Minutes**	**Days, eq**	**From loading (days)**	23	24	25	26	27	28
Casting	25-01-16	11:00	0	0	0	0.000	–	*155*	*155*	*155*	*115*	*115*	*115*
Before loading	01-02-16	13:25	7	0	0	7.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5min after loading	01-02-16	13:30	7	0	5	7.003	0.003	-0.180	-0.370	0.000	0.210	0.240	-0.010
1h	01-02-16	14:30	7	1	0	7.042	0.042	-0.200	-0.400	-0.010	0.220	0.270	-0.030
6h	01-02-16	20:30	7	6	0	7.250	0.250	-0.210	-0.430	-0.010	0.210	0.260	-0.030
1	02-02-16	14:30	8	0	0	8.000	1.000	-0.250	-0.460	-0.050	0.210	0.250	-0.040
2	03-02-16	14:30	9	0	0	9.000	2.000	-0.300	-0.510	-0.100	0.180	0.230	-0.070
3	04-02-16	14:30	10	0	0	10.000	3.000	-0.330	-0.560	-0.140	0.160	0.200	-0.100
4	05-02-16	14:00	11	0	0	11.000	4.000	-0.340	-0.550	-0.120	0.180	0.220	-0.080
5	06-02-16	15:00	12	0	0	12.000	5.000	-0.370	-0.600	-0.140	0.160	0.190	-0.080
6	07-02-16	20:00	13	0	0	13.000	6.000	-0.370	-0.590	-0.140	0.170	0.200	-0.100
7	08-02-16	13:00	14	0	0	14.000	7.000	-0.420	-0.650	-0.190	0.120	0.180	-0.140
14	15-02-16	20:00	21	0	0	21.00	14.00	-0.510	-0.730	-0.270	0.070	0.100	-0.170
21	22-02-16	11:30	28	0	0	28.00	21.00	-0.610	-0.860	-0.360	0.000	0.020	-0.260
28	29-02-16	12:00	35	0	0	35.00	28.00	-0.660	-0.890	-0.400	0.000	0.010	-0.250
56	28-03-16	15:00	63	0	0	63.00	56.00	-0.790	-1.000	-0.480	-0.090	-0.050	-0.310
90	01-05-16	14:00	97	0	0	97.00	90.00	-0.880	-1.100	-0.570	-0.130	-0.120	-0.360
120	31-05-16	14:00	127	0	0	127.00	120.00	-0.900	-1.130	-0.600	-0.160	-0.170	-0.370
150	30-06-16	12:00	157	0	0	157.00	150.00	-0.940	-1.170	-0.630	-0.180	-0.180	-0.390
180	30-07-16	15:00	187	0	0	187.00	180.00	-1.000	-1.240	-0.690	-0.210	-0.230	-0.440
210	29-08-16	13:00	217	0	0	217.00	210.00	-1.060	-1.270	-0.700	-0.260	-0.270	-0.480
240	28-09-16	12:00	247	0	0	247.00	240.00	-1.060	-1.290	-0.730	-0.250	-0.260	-0.480
270	28-10-16	14:00	277	0	0	277.00	270.00	-1.070	-1.330	-0.730	-0.270	-0.290	-0.470
300	27-11-16	11:00	307	0	0	307.00	300.00	-1.060	-1.310	-0.710	-0.200	-0.250	-0.450
330	27-12-16	12:00	337	0	0	337.00	330.00	-1.090	-1.350	-0.750	-0.250	-0.270	-0.460
365	31-01-17	15:00	372	0	0	372.00	365.00	-1.120	-1.370	-0.790	-0.290	-0.310	-0.490
400	07-03-17	11:00	407	0	0	407.00	400.00	-1.160	-1.420	-0.820	-0.310	-0.330	-0.530
450	26-04-17	16:00	457	0	0	457.00	450.00	-1.150	-1.420	-0.820	-0.310	-0.300	-0.490

	NAC28				0	5m	1h	6h	1d	2d
	A	**BOTTOM**								
	From (mm)	To (mm)	Disks		22-02-16	22-02-16	22-02-16	22-02-16	23-02-16	24-02-16
1	870	970	1	2	-0.035	0.033	0.04	0.043	0.049	0.049
2	1150	1250	3	4	-0.225	-0.09	-0.083	-0.079	-0.073	-0.071
3	1250	1350	4	5	-0.12	-0.015	-0.01	-0.006	-0.001	0
4	1350	1450	5	6	-0.508	-0.326	-0.322	-0.315	-0.307	-0.303
5	1450	1550	6	7	-0.088	-0.086	-0.091	-0.093	-0.092	-0.092
6	1550	1650	7	8	-0.127	-0.053	-0.046	-0.039	-0.03	-0.027
7	1650	1750	8	9	-0.172	-0.028	-0.022	-0.018	-0.012	-0.009
8	1750	1850	9	10	-0.412	-0.412	-0.407	-0.405	-0.403	-0.401
9	1850	1950	10	11	-1.711	-1.553	-1.546	-1.541	-1.536	-1.531
10	1950	2050	11	12	-0.186	-0.013	0	0.008	0.018	0.021
11	2230	2330	13	14	-0.186	-0.173	-0.175	-0.176	-0.177	-0.178
	A	**TOP**								
	From (mm)	To (mm)	Disks							
12	870	970	15	16	-0.408	-0.444	-0.446	-0.448	-0.454	-0.455
13	1150	1250	17	18	-1.015	-1.07	-1.074	-1.079	-1.081	-1.086
14	1250	1350	18	19	-0.661	-0.708	-0.713	-0.715	-0.72	-0.721
15	1350	1450	19	20	-0.224	-0.276	-0.28	-0.284	-0.287	-0.291
16	1450	1550	20	21	-0.555	-0.595	-0.598	-0.6	-0.604	-0.606
17	1550	1650	21	22	-1.019	-1.064	-1.067	-1.07	-1.075	-1.076
18	1650	1750	22	23	-0.321	-0.375	-0.379	-0.38	-0.386	-0.39
19	1750	1850	23	24	-0.673	-0.735	-0.741	-0.744	-0.748	-0.751
20	1850	1950	24	25	-0.012	-0.047	-0.051	-0.055	-0.057	-0.061
21	1950	2050	25	26	-0.269	-0.319	-0.32	-0.326	-0.328	-0.334
22	2230	2330	27	28	-0.75	-0.775	-0.779	-0.782	-0.784	-0.787
	A	**MIDDLE**								
	From (mm)	To (mm)	Disks							
23	1450	1550	29	30	-0.376	-0.388	-0.389	-0.389	-0.391	-0.393
24	1550	1650	30	31	-0.624	-0.637	-0.639	-0.639	-0.641	-0.642
25	1650	1750	31	32	-0.22	-0.235	-0.238	-0.241	-0.243	-0.247
26	1450	1550	33	34	-0.157					
27	1550	1650	34	35	-0.391					
28	1650	1750	35	36	-1.474	-1.432	-1.449	-1.452	-1.449	-1.452

					0	5m	1h	6h	1d	2d
	B	**BOTTOM**								
	From (mm)	To (mm)	Disks		22-02-16	22-02-16	22-02-16	22-02-16	23-02-16	24-02-16
1	870	970	1	2	-0.142	-0.137	-0.136	-0.134	-0.133	-0.135
2	1150	1250	3	4	-0.218	-0.062	-0.052	-0.044	-0.034	-0.032
3	1250	1350	4	5	-0.284	-0.185	-0.178	-0.169	-0.164	-0.163
4	1350	1450	5	6	-0.962	-0.866	-0.859	-0.855	-0.848	-0.85
5	1450	1550	6	7	-0.334	-0.233	-0.228	-0.225	-0.214	-0.217
6	1550	1650	7	8	-0.027	0.134	0.14	0.146	0.157	0.155
7	1650	1750	8	9	0.006	0.103	0.103	0.102	0.105	0.1
8	1750	1850	9	10	-0.267	-0.111	-0.104	-0.098	-0.089	-0.089
9	1850	1950	10	11	-0.476	-0.362	-0.356	-0.354	-0.345	-0.343
10	1950	2050	11	12	-0.338	-0.202	-0.194	-0.19	-0.183	-0.177
11	2230	2330	13	14	-0.215	-0.136	-0.132	-0.126	-0.118	-0.117
	B	**TOP**								
	From (mm)	To (mm)	Disks							
12	870	970	15	16	0.194	0.161	0.161	0.156	0.155	0.151
13	1150	1250	17	18	-0.21	-0.263	-0.262	-0.269	-0.271	-0.276
14	1250	1350	18	19	-0.073	-0.116	-0.117	-0.121	-0.125	-0.131
15	1350	1450	19	20	0.403	0.357	0.356	0.362	0.349	0.343
16	1450	1550	20	21	1.16	1.119	1.118	1.114	1.11	1.105
17	1550	1650	21	22	-0.296	-0.34	-0.342	-0.344	-0.349	-0.352
18	1650	1750	22	23	-0.641	-0.682	-0.682	-0.684	-0.689	-0.692
19	1750	1850	23	24	-0.205	-0.25	-0.252	-0.256	-0.261	-0.263
20	1850	1950	24	25	-0.421	-0.458	-0.459	-0.463	-0.467	-0.469
21	1950	2050	25	26	-0.357	-0.431	-0.43	-0.439	-0.439	-0.445
22	2230	2330	27	28	-0.187	-0.216	-0.216	-0.22	-0.223	-0.225
	B	**MIDDLE**								
	From (mm)	To (mm)	Disks							
23	1450	1550	29	30	-0.242	-0.249	-0.247	-0.251	-0.254	-0.256
24	1550	1650	30	31	-0.242	-0.245	-0.244	-0.246	-0.246	-0.25
25	1650	1750	31	32	0.043	0.031	0.035	0.032	0.031	0.027
26	1450	1550	33	34	-0.154	-0.127	-0.123	-0.125	0.125	0.126
27	1550	1650	34	35	-0.003	0.058	0.063	0.065	0.066	0.063
28	1650	1750	35	36	-0.146	-0.145	-0.143	-0.144	-0.146	-0.145

	NAC28				3d	4d	5d	6d	7d	14d
	A	**BOTTOM**								
	From (mm)	To (mm)	Disks		25-02-16	26-02-16	27-02-16	28-02-16	29-02-16	07-03-16
1	870	970	1	2	0.052	0.054	0.056	0.057	0.058	0.059
2	1150	1250	3	4	-0.068	-0.066	-0.064	-0.065	-0.063	-0.062
3	1250	1350	4	5	0.004	0.005	0.007	0.008	0.008	0.009
4	1350	1450	5	6	-0.298	-0.296	-0.293	-0.292	-0.293	-0.288
5	1450	1550	6	7	-0.092	-0.092	-0.094	-0.091	-0.092	-0.098
6	1550	1650	7	8	-0.022	-0.018	-0.017	-0.013	-0.015	-0.01
7	1650	1750	8	9	-0.003	-0.003	-0.001	0.001	0	0.004
8	1750	1850	9	10	-0.398	-0.4	-0.4	-0.397	-0.399	-0.401
9	1850	1950	10	11	-1.528	-1.526	-1.525	-1.522	-1.522	-1.521
10	1950	2050	11	12	0.027	0.03	0.033	0.037	0.035	0.041
11	2230	2330	13	14	-0.176	-0.178	-0.178	-0.177	-0.178	-0.184
	A	**TOP**								
	From (mm)	To (mm)	Disks							
12	870	970	15	16	-0.454	-0.457	-0.46	-0.457	-0.458	-0.468
13	1150	1250	17	18	-1.084	-1.088	-1.091	-1.093	-1.095	-1.102
14	1250	1350	18	19	-0.726	-0.728	-0.73	-0.732	-0.735	-0.744
15	1350	1450	19	20	-0.289	-0.293	-0.295	-0.297	-0.3	-0.307
16	1450	1550	20	21	-0.607	-0.607	-0.609	-0.61	-0.615	-0.622
17	1550	1650	21	22	-1.078	-1.081	-1.083	-1.084	-1.088	-1.097
18	1650	1750	22	23	-0.39	-0.394	-0.396	-0.397	-0.401	-0.409
19	1750	1850	23	24	-0.752	-0.756	-0.759	-0.759	-0.763	-0.771
20	1850	1950	24	25	-0.063	-0.065	-0.072	-0.069	-0.072	-0.081
21	1950	2050	25	26	-0.332	-0.336	-0.337	-0.339	-0.342	-0.35
22	2230	2330	27	28	-0.788	-0.789	-0.791	-0.792	-0.795	-0.803
	A	**MIDDLE**								
	From (mm)	To (mm)	Disks							
23	1450	1550	29	30	-0.392	-0.393	-0.395	-0.394	-0.398	-0.401
24	1550	1650	30	31	-0.643	-0.644	-0.646	-0.646	-0.65	-0.654
25	1650	1750	31	32	-0.248	-0.248	-0.253	-0.253	-0.259	-0.262
26	1450	1550	33	34						
27	1550	1650	34	35						
28	1650	1750	35	36	-1.451	-1.45	-1.452	-1.449	-1.452	-1.458

					3d	4d	5d	6d	7d	14d
	B	**BOTTOM**								
	From (mm)	To (mm)	Disks		25-02-16	26-02-16	27-02-16	28-02-16	29-02-16	07-03-16
1	870	970	1	2	-0.132	-0.13	-0.132	-0.129	-0.132	-0.133
2	1150	1250	3	4	-0.029	-0.025	-0.023	-0.021	-0.024	-0.016
3	1250	1350	4	5	-0.161	-0.157	-0.16	-0.155	-0.156	-0.156
4	1350	1450	5	6	-0.846	-0.844	-0.845	-0.841	-0.843	-0.842
5	1450	1550	6	7	-0.212	-0.21	-0.213	-0.208	-0.212	-0.207
6	1550	1650	7	8	0.161	0.164	0.163	0.168	0.165	0.172
7	1650	1750	8	9	0.103	0.103	0.101	0.103	0.1	0.1
8	1750	1850	9	10	-0.084	-0.08	-0.082	-0.078	-0.08	-0.077
9	1850	1950	10	11	-0.34	-0.338	-0.339	-0.335	-0.341	-0.336
10	1950	2050	11	12	-0.171	-0.17	-0.174	-0.166	-0.17	-0.165
11	2230	2330	13	14	-0.115	-0.114	-0.115	-0.11	-0.116	-0.108
	B	**TOP**								
	From (mm)	To (mm)	Disks							
12	870	970	15	16	0.149	0.148	0.146	0.145	0.143	0.135
13	1150	1250	17	18	-0.278	-0.28	-0.282	-0.283	-0.286	-0.294
14	1250	1350	18	19	-0.13	-0.132	-0.135	-0.136	-0.137	-0.147
15	1350	1450	19	20	0.343	0.34	0.339	0.339	0.337	0.327
16	1450	1550	20	21	1.104	1.103	1.098	1.097	1.097	1.087
17	1550	1650	21	22	-0.352	-0.354	-0.358	-0.358	-0.359	-0.369
18	1650	1750	22	23	-0.689	-0.692	-0.696	-0.694	-0.696	-0.708
19	1750	1850	23	24	-0.264	-0.266	-0.27	-0.272	-0.272	-0.28
20	1850	1950	24	25	-0.469	-0.47	-0.474	-0.47	-0.477	-0.484
21	1950	2050	25	26	-0.446	-0.446	-0.448	-0.446	-0.453	-0.459
22	2230	2330	27	28	-0.225	-0.227	-0.23	-0.229	-0.232	-0.24
	B	**MIDDLE**								
	From (mm)	To (mm)	Disks							
23	1450	1550	29	30	-0.255	-0.257	-0.258	-0.257	-0.259	-0.267
24	1550	1650	30	31	-0.248	-0.249	-0.251	-0.251	-0.253	-0.258
25	1650	1750	31	32	0.03	0.028	0.027	0.028	0.025	0.019
26	1450	1550	33	34	-0.126	-0.125	-0.127	-0.124	-0.125	-0.132
27	1550	1650	34	35	0.064	0.065	0.067	0.066	0.064	0.06
28	1650	1750	35	36	-0.146	-0.145	-0.148	-0.146	-0.148	-0.153

NAC28					21d	28d	56d	90d	120d	150d
	A	BOTTOM								
	From (mm)	To (mm)	Disks		14-03-16	21-03-16	18-04-16	22-05-16	21-06-16	21-07-16
1	870	970	1	2	0.059	0.064	0.066	0.065	0.068	0.066
2	1150	1250	3	4	-0.058	-0.057	-0.049	-0.048	-0.047	-0.048
3	1250	1350	4	5	0.011	0.014	0.013	0.016	0.016	0.015
4	1350	1450	5	6	-0.283	-0.28	-0.275	-0.272	-0.27	-0.269
5	1450	1550	6	7	-0.095	-0.098	-0.098	-0.097	-0.098	-0.1
6	1550	1650	7	8	-0.006	-0.001	0.004	0.006	0.008	0.011
7	1650	1750	8	9	0.006	0.009	0.012	0.014	0.014	0.015
8	1750	1850	9	10	-0.402	-0.401	-0.399	-0.398	-0.399	-0.4
9	1850	1950	10	11	-1.519	-1.514	-1.512	-1.51	-1.51	-1.51
10	1950	2050	11	12	0.048	0.053	0.058	0.063	0.065	0.068
11	2230	2330	13	14	-0.186	-0.187	-0.192	-0.19	-0.191	-0.191
	A	TOP								
	From (mm)	To (mm)	Disks							
12	870	970	15	16	-0.478	-0.48	-0.492	-0.498	-0.501	-0.506
13	1150	1250	17	18	-1.112	-1.116	-1.13	-1.134	-1.139	-1.143
14	1250	1350	18	19	-0.751	-0.755	-0.768	-0.776	-0.779	-0.786
15	1350	1450	19	20	-0.311	-0.314	-0.327	-0.33	-0.333	-0.339
16	1450	1550	20	21	-0.626	-0.629	-0.642	-0.647	-0.652	-0.654
17	1550	1650	21	22	-1.101	-1.106	-1.115	-1.119	-1.125	-1.126
18	1650	1750	22	23	-0.416	-0.42	-0.432	-0.439	-0.443	-0.45
19	1750	1850	23	24	-0.779	-0.785	-0.799	-0.803	-0.806	-0.807
20	1850	1950	24	25	-0.088	-0.093	-0.109	-0.112	-0.119	-0.125
21	1950	2050	25	26	-0.358	-0.361	-0.376	-0.381	-0.386	-0.392
22	2230	2330	27	28	-0.809	-0.812	-0.824	-0.827	-0.833	-0.837
	A	MIDDLE								
	From (mm)	To (mm)	Disks							
23	1450	1550	29	30	-0.405	-0.407	-0.414	-0.416	-0.421	-0.425
24	1550	1650	30	31	-0.659	-0.662	-0.67	-0.675	-0.681	-0.683
25	1650	1750	31	32	-0.267	-0.272	-0.276	-0.281	-0.287	-0.291
26	1450	1550	33	34						
27	1550	1650	34	35						
28	1650	1750	35	36	-1.459	-1.458	-1.46	-1.464	-1.468	-1.47

					21d	28d	56d	90d	120d	150d
	B	BOTTOM								
	From (mm)	To (mm)	Disks		14-03-16	21-03-16	18-04-16	22-05-16	21-06-16	21-07-16
1	870	970	1	2	-0.13	-0.128	-0.123	-0.121	-0.123	-0.121
2	1150	1250	3	4	-0.015	-0.009	-0.002	-0.003	0	0
3	1250	1350	4	5	-0.152	-0.149	-0.152	-0.154	-0.154	-0.154
4	1350	1450	5	6	-0.839	-0.836	-0.833	-0.83	-0.833	-0.828
5	1450	1550	6	7	-0.205	-0.204	-0.201	-0.199	-0.199	-0.198
6	1550	1650	7	8	0.176	0.18	0.183	0.185	0.186	0.189
7	1650	1750	8	9	0.098	0.098	0.095	0.096	0.096	0.091
8	1750	1850	9	10	-0.072	-0.069	-0.066	-0.064	-0.062	-0.058
9	1850	1950	10	11	-0.333	-0.331	-0.329	-0.325	-0.326	-0.326
10	1950	2050	11	12	-0.159	-0.158	-0.156	-0.156	-0.157	-0.154
11	2230	2330	13	14	-0.109	-0.108	-0.107	-0.106	-0.111	-0.11
	B	TOP								
	From (mm)	To (mm)	Disks							
12	870	970	15	16	0.132	0.126	0.114	0.108	0.104	0.099
13	1150	1250	17	18	-0.299	-0.305	-0.317	-0.324	-0.327	-0.335
14	1250	1350	18	19	-0.151	-0.156	-0.167	-0.169	-0.178	-0.181
15	1350	1450	19	20	0.323	0.318	0.306	0.302	0.296	0.292
16	1450	1550	20	21	1.085	1.077	1.066	1.059	1.056	1.048
17	1550	1650	21	22	-0.371	-0.379	-0.39	-0.393	-0.4	-0.404
18	1650	1750	22	23	-0.709	-0.714	-0.726	-0.732	-0.735	-0.739
19	1750	1850	23	24	-0.283	-0.292	-0.302	-0.303	-0.312	-0.315
20	1850	1950	24	25	-0.487	-0.492	-0.503	-0.509	-0.515	-0.516
21	1950	2050	25	26	-0.465	-0.472	-0.479	-0.484	-0.49	-0.492
22	2230	2330	27	28	-0.244	-0.25	-0.262	-0.264	-0.27	-0.273
	B	MIDDLE								
	From (mm)	To (mm)	Disks							
23	1450	1550	29	30	-0.27	-0.272	-0.281	-0.283	-0.29	-0.291
24	1550	1650	30	31	-0.261	-0.262	-0.27	-0.271	-0.278	-0.279
25	1650	1750	31	32	0.016	0.013	0.004	-0.003	-0.006	-0.004
26	1450	1550	33	34	-0.131	-0.134	-0.138	-0.137	-0.141	-0.143
27	1550	1650	34	35	0.063	0.059	0.05	0.048	0.046	0.049
28	1650	1750	35	36	-0.153	-0.157	-0.16	-0.158	-0.163	-0.165

NAC28					180d	210d	240d	270d	300d	330d
	A	**BOTTOM**								
	From (mm)	To (mm)	Disks		20-08-16	19-09-16	19-10-16	18-11-16	18-12-16	17-01-17
1	870	970	1	2	0.07	0.071	0.071	0.073	0.076	0.077
2	1150	1250	3	4	-0.045	-0.043	-0.051	-0.041	-0.044	-0.038
3	1250	1350	4	5	0.018	0.018	0.018	0.022	0.025	0.024
4	1350	1450	5	6	-0.267	-0.266	-0.265	-0.258	-0.253	-0.252
5	1450	1550	6	7	-0.1	-0.102	-0.104	-0.102	-0.105	-0.105
6	1550	1650	7	8	0.014	0.014	0.015	0.023	0.029	0.031
7	1650	1750	8	9	0.016	0.019	0.019	0.022	0.028	0.029
8	1750	1850	9	10	-0.4	-0.399	-0.401	-0.399	-0.4	-0.399
9	1850	1950	10	11	-1.51	-1.51	-1.51	-1.5	-1.501	-1.499
10	1950	2050	11	12	0.069	0.072	0.074	0.081	0.085	0.085
11	2230	2330	13	14	-0.193	-0.192	-0.195	-0.191	-0.195	-0.196
	A	**TOP**								
	From (mm)	To (mm)	Disks							
12	870	970	15	16	-0.512	-0.513	-0.513	-0.517	-0.519	-0.521
13	1150	1250	17	18	-1.149	-1.143	-1.151	-1.147	-1.16	-1.156
14	1250	1350	18	19	-0.788	-0.792	-0.796	-0.797	-0.806	-0.808
15	1350	1450	19	20	-0.341	-0.344	-0.346	-0.346	-0.352	-0.353
16	1450	1550	20	21	-0.656	-0.658	-0.662	-0.664	-0.668	-0.669
17	1550	1650	21	22	-1.135	-1.135	-1.14	-1.14	-1.145	-1.147
18	1650	1750	22	23	-0.454	-0.453	-0.459	-0.462	-0.468	-0.469
19	1750	1850	23	24	-0.817	-0.818	-0.821	-0.823	-0.827	-0.832
20	1850	1950	24	25	-0.127	-0.129	-0.134	-0.139	-0.141	-0.145
21	1950	2050	25	26	-0.394	-0.394	-0.399	-0.403	-0.409	-0.412
22	2230	2330	27	28	-0.842	-0.842	-0.846	-0.848	-0.853	-0.855
	A	**MIDDLE**								
	From (mm)	To (mm)	Disks							
23	1450	1550	29	30	-0.426	-0.424	-0.427	-0.431	-0.433	-0.434
24	1550	1650	30	31	-0.687	-0.688	-0.691	-0.695	-0.696	-0.698
25	1650	1750	31	32	-0.288	-0.293	-0.297	-0.314	-0.315	-0.318
26	1450	1550	33	34						
27	1550	1650	34	35						
28	1650	1750	35	36	-1.472	-1.473	-1.474	-1.473	-1.472	-1.475

					180d	210d	240d	270d	300d	330d
	B	**BOTTOM**								
	From (mm)	To (mm)	Disks		20-08-16	19-09-16	19-10-16	18-11-16	18-12-16	17-01-17
1	870	970	1	2	-0.123	-0.123	-0.123	-0.12	-0.117	-0.12
2	1150	1250	3	4	0.002	0.003	0.004	0.007	0.013	0.014
3	1250	1350	4	5	-0.154	-0.154	-0.15	-0.148	-0.146	-0.147
4	1350	1450	5	6	-0.828	-0.83	-0.827	-0.823	-0.819	-0.819
5	1450	1550	6	7	-0.196	-0.199	-0.195	-0.193	-0.193	-0.191
6	1550	1650	7	8	0.192	0.19	0.193	0.198	0.203	0.206
7	1650	1750	8	9	0.095	0.091	0.092	0.092	0.085	0.091
8	1750	1850	9	10	-0.056	-0.058	-0.056	-0.05	-0.045	-0.043
9	1850	1950	10	11	-0.326	-0.327	-0.324	-0.321	-0.318	-0.318
10	1950	2050	11	12	-0.15	-0.153	-0.151	-0.145	-0.141	-0.142
11	2230	2330	13	14	-0.109	-0.106	-0.107	-0.104	-0.1	-0.098
	B	**TOP**								
	From (mm)	To (mm)	Disks							
12	870	970	15	16	0.095	0.093	0.092	0.087	0.083	0.082
13	1150	1250	17	18	-0.339	-0.34	-0.343	-0.346	-0.35	-0.352
14	1250	1350	18	19	-0.187	-0.188	-0.191	-0.193	-0.199	-0.202
15	1350	1450	19	20	0.287	0.286	0.283	0.281	0.278	0.274
16	1450	1550	20	21	1.042	1.041	1.043	1.037	1.032	1.028
17	1550	1650	21	22	-0.407	-0.409	-0.409	-0.414	-0.416	-0.42
18	1650	1750	22	23	-0.742	-0.741	-0.745	-0.748	-0.749	-0.752
19	1750	1850	23	24	-0.319	-0.323	-0.324	-0.325	-0.331	-0.333
20	1850	1950	24	25	-0.519	-0.521	-0.524	-0.522	-0.53	-0.532
21	1950	2050	25	26	-0.494	-0.498	-0.498	-0.5	-0.504	-0.512
22	2230	2330	27	28	-0.276	-0.277	-0.281	-0.282	-0.285	-0.292
	B	**MIDDLE**								
	From (mm)	To (mm)	Disks							
23	1450	1550	29	30	-0.297	-0.296	-0.299	-0.299	-0.301	-0.304
24	1550	1650	30	31	-0.284	-0.282	-0.285	-0.287	-0.286	-0.289
25	1650	1750	31	32	-0.008	-0.007	-0.007	-0.012	-0.009	-0.015
26	1450	1550	33	34	-0.144	-0.144	-0.145	-0.146	-0.147	-0.148
27	1550	1650	34	35	0.042	0.044	0.043	0.045	0.042	0.039
28	1650	1750	35	36	-0.165	-0.166	-0.168	-0.165	-0.163	-0.169

NAC28

					360d	400d	450d
	A	**BOTTOM**					
	From (mm)	To (mm)	Disks		30-12-00	03-02-01	25-03-01
1	870	970	1	2	0.079	0.075	0.076
2	1150	1250	3	4	-0.035	-0.045	-0.046
3	1250	1350	4	5	0.024	0.022	0.018
4	1350	1450	5	6	-0.25	-0.252	-0.255
5	1450	1550	6	7	-0.102	-0.107	-0.102
6	1550	1650	7	8	0.034	0.03	0.028
7	1650	1750	8	9	0.029	0.026	0.023
8	1750	1850	9	10	-0.397	-0.399	-0.398
9	1850	1950	10	11	-1.5	-1.503	-1.501
10	1950	2050	11	12	0.087	0.083	0.083
11	2230	2330	13	14	-0.195	-0.199	-0.197
	A	**TOP**					
	From (mm)	To (mm)	Disks				
12	870	970	15	16	-0.526	-0.528	-0.528
13	1150	1250	17	18	-1.152	-1.162	-1.167
14	1250	1350	18	19	-0.81	-0.813	-0.813
15	1350	1450	19	20	-0.355	-0.359	-0.357
16	1450	1550	20	21	-0.672	-0.676	-0.675
17	1550	1650	21	22	-1.15	-1.146	-1.15
18	1650	1750	22	23	-0.475	-0.473	-0.474
19	1750	1850	23	24	-0.834	-0.835	-0.835
20	1850	1950	24	25	-0.146	-0.153	-0.148
21	1950	2050	25	26	-0.413	-0.416	-0.417
22	2230	2330	27	28	-0.858	-0.862	-0.859
	A	**MIDDLE**					
	From (mm)	To (mm)	Disks				
23	1450	1550	29	30	-0.437	-0.437	-0.436
24	1550	1650	30	31	-0.703	-0.702	-0.703
25	1650	1750	31	32	-0.317	-0.321	-0.32
26	1450	1550	33	34			
27	1550	1650	34	35			
28	1650	1750	35	36	-1.472	-1.477	-1.479

					360d	400d	450d
	B	**BOTTOM**					
	From (mm)	To (mm)	Disks		30-12-00	03-02-01	25-03-01
1	870	970	1	2	-0.119	-0.121	-0.116
2	1150	1250	3	4	0.013	0.013	0.012
3	1250	1350	4	5	-0.145	-0.149	-0.149
4	1350	1450	5	6	-0.819	-0.817	-0.818
5	1450	1550	6	7	-0.192	-0.193	-0.192
6	1550	1650	7	8	0.205	0.203	0.204
7	1650	1750	8	9	0.09	0.088	0.091
8	1750	1850	9	10	-0.044	-0.044	-0.045
9	1850	1950	10	11	-0.317	-0.319	-0.32
10	1950	2050	11	12	-0.142	-0.144	-0.145
11	2230	2330	13	14	-0.1	-0.101	-0.102
	B	**TOP**					
	From (mm)	To (mm)	Disks				
12	870	970	15	16	0.077	0.066	0.078
13	1150	1250	17	18	-0.355	-0.358	-0.353
14	1250	1350	18	19	-0.205	-0.199	-0.204
15	1350	1450	19	20	0.272	0.27	0.273
16	1450	1550	20	21	1.025	1.022	1.023
17	1550	1650	21	22	-0.422	-0.427	-0.423
18	1650	1750	22	23	-0.753	-0.755	-0.756
19	1750	1850	23	24	-0.337	-0.34	-0.334
20	1850	1950	24	25	-0.536	-0.532	-0.534
21	1950	2050	25	26	-0.505	-0.512	-0.511
22	2230	2330	27	28	-0.292	-0.297	-0.292
	B	**MIDDLE**					
	From (mm)	To (mm)	Disks				
23	1450	1550	29	30	-0.305	-0.309	-0.305
24	1550	1650	30	31	-0.291	-0.296	-0.292
25	1650	1750	31	32	-0.019	-0.018	-0.017
26	1450	1550	33	34	-0.149	-0.152	-0.147
27	1550	1650	34	35	0.04	0.036	0.036
28	1650	1750	35	36	-0.167	-0.174	-0.167

				σ =	13.42	MPa		SIDE A BOTTOM (‰)										
					Age			920	1200	1300	1400	1500	1600	1700	1800	1900	2000	2280
NAC28	**Date**	**Time**	**Days**	**Hours**	**Minutes**	**Days, eq**	**From loading (days)**	1	2	3	4	5	6	7	8	9	10	11
Casting	25-01-16	11:00	0	0	0	0.000	–	*31*	*31*	*31*	*31*	*31*	*31*	*31*	*31*	*31*	*31*	*31*
Before loading	22-02-16	11:30	28	0	0	28.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5min after loading	22-02-16	12:05	28	0	5	28.003	0.003	0.680	1.350	1.050	1.820	0.020	0.740	1.440	0.000	1.580	1.730	0.130
1h	22-02-16	13:00	28	1	0	28.042	0.042	0.750	1.420	1.100	1.860	-0.030	0.810	1.500	0.050	1.650	1.860	0.110
6h	22-02-16	19:00	28	6	0	28.250	0.250	0.780	1.460	1.140	1.930	-0.050	0.880	1.540	0.070	1.700	1.940	0.100
1	23-02-16	16:00	29	0	0	29.000	1.000	0.840	1.520	1.190	2.010	-0.040	0.970	1.600	0.090	1.750	2.040	0.090
2	24-02-16	14:00	30	0	0	30.000	2.000	0.840	1.540	1.200	2.050	-0.040	1.000	1.630	0.110	1.800	2.070	0.080
3	25-02-16	10:00	31	0	0	31.000	3.000	0.870	1.570	1.240	2.100	-0.040	1.050	1.690	0.140	1.830	2.130	0.100
4	26-02-16	13:00	32	0	0	32.000	4.000	0.890	1.590	1.250	2.120	-0.040	1.090	1.690	0.120	1.850	2.160	0.080
5	27-02-16	19:00	33	0	0	33.000	5.000	0.910	1.610	1.270	2.150	-0.060	1.100	1.710	0.120	1.860	2.190	0.080
6	28-02-16	20:00	34	0	0	34.000	6.000	0.920	1.600	1.280	2.160	-0.030	1.140	1.730	0.150	1.890	2.230	0.090
7	29-02-16	12:00	35	0	0	35.000	7.000	0.930	1.620	1.280	2.150	-0.040	1.120	1.720	0.130	1.890	2.210	0.080
14	07-03-16	16:00	42	0	0	42.00	14.00	0.940	1.630	1.290	2.200	-0.100	1.170	1.760	0.110	1.900	2.270	0.020
21	14-03-16	9:00	49	0	0	49.00	21.00	0.940	1.670	1.310	2.250	-0.070	1.210	1.780	0.100	1.920	2.340	0.000
28	21-03-16	11:00	56	0	0	56.00	28.00	0.990	1.680	1.340	2.280	-0.100	1.260	1.810	0.110	1.970	2.390	-0.010
56	18-04-16	15:00	84	0	0	84.00	56.00	1.010	1.760	1.330	2.330	-0.100	1.310	1.840	0.130	1.990	2.440	-0.060
90	22-05-16	14:00	118	0	0	118.00	90.00	1.000	1.770	1.360	2.360	-0.090	1.330	1.860	0.140	2.010	2.490	-0.040
120	21-06-16	11:00	148	0	0	148.00	120.00	1.030	1.780	1.360	2.380	-0.100	1.350	1.860	0.130	2.010	2.510	-0.050
150	21-07-16	13:00	178	0	0	178.00	150.00	1.010	1.770	1.350	2.390	-0.120	1.380	1.870	0.120	2.010	2.540	-0.050
180	20-08-16	13:00	208	0	0	208.00	180.00	1.050	1.800	1.380	2.410	-0.120	1.410	1.880	0.120	2.010	2.550	-0.070
210	19-09-16	17:00	238	0	0	238.00	210.00	1.060	1.820	1.380	2.420	-0.140	1.410	1.910	0.130	2.010	2.580	-0.060
240	19-10-16	15:00	268	0	0	268.00	240.00	1.060	1.740	1.380	2.430	-0.160	1.420	1.910	0.110	2.010	2.600	-0.090
270	18-11-16	16:00	298	0	0	298.00	270.00	1.080	1.840	1.420	2.500	-0.140	1.500	1.940	0.130	2.110	2.670	-0.050
300	18-12-16	13:00	328	0	0	328.00	300.00	1.110	1.810	1.450	2.550	-0.170	1.560	2.000	0.120	2.100	2.710	-0.090
330	17-01-17	16:00	358	0	0	358.00	330.00	1.120	1.870	1.440	2.560	-0.170	1.580	2.010	0.130	2.120	2.710	-0.100
365	21-02-17	10:00	393	0	0	393.00	365.00	1.140	1.900	1.440	2.580	-0.140	1.610	2.010	0.150	2.110	2.730	-0.090
400	28-03-17	12:00	428	0	0	428.00	400.00	1.100	1.800	1.420	2.560	-0.190	1.570	1.980	0.130	2.080	2.690	-0.130
450	17-05-17	11:00	478	0	0	478.00	450.00	1.110	1.790	1.380	2.530	-0.140	1.550	1.950	0.140	2.100	2.690	-0.110
700	22-01-18		728	0	0	728.00	700.00											

								SIDE B BOTTOM (‰)										
					Age			920	1200	1300	1400	1500	1600	1700	1800	1900	2000	2280
	Date	**Time**	**Days**	**Hours**	**Minutes**	**Days, eq**	**From loading (days)**	1	2	3	4	5	6	7	8	9	10	11
Casting	25-01-16	11:00	0	0	0	0.000	–	*31*	*31*	*31*	*31*	*31*	*31*	*31*	*31*	*31*	*31*	*31*
Before loading	22-02-16	11:30	28	0	0	28.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5min after loading	22-02-16	12:05	28	0	5	28.003	0.003	0.050	1.560	0.990	0.960	1.010	1.610	0.970	1.560	1.140	1.360	0.790
1h	22-02-16	13:00	28	1	0	28.042	0.042	0.060	1.660	1.060	1.030	1.060	1.670	0.970	1.630	1.200	1.440	0.830
6h	22-02-16	19:00	28	6	0	28.250	0.250	0.080	1.740	1.150	1.070	1.090	1.730	0.960	1.690	1.220	1.480	0.890
1	23-02-16	16:00	29	0	0	29.000	1.000	0.090	1.840	1.200	1.140	1.200	1.840	0.990	1.780	1.310	1.550	0.970
2	24-02-16	14:00	30	0	0	30.000	2.000	0.070	1.860	1.210	1.120	1.170	1.820	0.940	1.780	1.330	1.610	0.980
3	25-02-16	10:00	31	0	0	31.000	3.000	0.100	1.890	1.230	1.160	1.220	1.880	0.970	1.830	1.360	1.670	1.000
4	26-02-16	13:00	32	0	0	32.000	4.000	0.120	1.930	1.270	1.180	1.240	1.910	0.970	1.870	1.380	1.680	1.010
5	27-02-16	19:00	33	0	0	33.000	5.000	0.100	1.950	1.240	1.170	1.210	1.900	0.950	1.850	1.370	1.640	1.000
6	28-02-16	20:00	34	0	0	34.000	6.000	0.130	1.970	1.290	1.210	1.260	1.950	0.970	1.890	1.410	1.720	1.050
7	29-02-16	12:00	35	0	0	35.000	7.000	0.100	1.940	1.280	1.190	1.220	1.920	0.940	1.870	1.350	1.680	0.990
14	07-03-16	16:00	42	0	0	42.00	14.00	0.090	2.020	1.280	1.200	1.270	1.990	0.940	1.900	1.400	1.730	1.070
21	14-03-16	09:00	49	0	0	49.00	21.00	0.120	2.030	1.320	1.230	1.290	2.030	0.920	1.950	1.430	1.790	1.060
28	21-03-16	11:00	56	0	0	56.00	28.00	0.140	2.090	1.350	1.260	1.300	2.070	0.920	1.980	1.450	1.800	1.070
56	18-04-16	15:00	84	0	0	84.00	56.00	0.190	2.160	1.320	1.290	1.330	2.100	0.890	2.010	1.470	1.820	1.080
90	22-05-16	14:00	118	0	0	118.00	90.00	0.210	2.150	1.300	1.320	1.350	2.120	0.900	2.030	1.510	1.820	1.090
120	21-06-16	11:00	148	0	0	148.00	120.00	0.190	2.180	1.300	1.290	1.350	2.130	0.900	2.050	1.500	1.810	1.040
150	21-07-16	13:00	178	0	0	178.00	150.00	0.210	2.180	1.300	1.340	1.360	2.160	0.850	2.090	1.500	1.840	1.050
180	20-08-16	13:00	208	0	0	208.00	180.00	0.190	2.200	1.300	1.340	1.380	2.190	0.890	2.110	1.500	1.880	1.060
210	19-09-16	17:00	238	0	0	238.00	210.00	0.190	2.210	1.300	1.320	1.350	2.170	0.850	2.090	1.490	1.850	1.090
240	19-10-16	15:00	268	0	0	268.00	240.00	0.190	2.220	1.340	1.350	1.390	2.200	0.860	2.110	1.520	1.870	1.080
270	18-11-16	16:00	298	0	0	298.00	270.00	0.220	2.250	1.360	1.390	1.410	2.250	0.860	2.170	1.550	1.930	1.110
300	18-12-16	13:00	328	0	0	328.00	300.00	0.250	2.310	1.380	1.430	1.410	2.300	0.790	2.220	1.580	1.970	1.150
330	17-01-17	16:00	358	0	0	358.00	330.00	0.220	2.320	1.370	1.430	1.430	2.330	0.850	2.240	1.580	1.960	1.170
365	21-02-17	10:00	393	0	0	393.00	365.00	0.230	2.310	1.390	1.430	1.420	2.320	0.840	2.230	1.590	1.960	1.150
400	28-03-17	12:00	428	0	0	428.00	400.00	0.210	2.310	1.350	1.450	1.410	2.300	0.820	2.230	1.570	1.940	1.140
450	17-05-17	11:00	478	0	0	478.00	450.00	0.260	2.300	1.350	1.440	1.420	2.310	0.850	2.220	1.560	1.930	1.130

			σ =	13.42	MPa			SIDE A TOP (‰)										
			Age					920	1200	1300	1400	1500	1600	1700	1800	1900	2000	2280
NAC28	Date	Time	Days	Hours	Minutes	Days, eq	From loading (days)	12	13	14	15	16	17	18	19	20	21	22
Casting	25-01-16	11:00	0	0	0	0.000	–	*197*	*197*	*197*	*197*	*197*	*197*	*197*	*197*	*197*	*197*	*197*
Before loading	22-02-16	11:30	28	0	0	28.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5min after loading	22-02-16	12:05	28	0	5	28.003	0.003	-0.360	-0.550	-0.470	-0.520	-0.400	-0.450	-0.540	-0.620	-0.350	-0.500	-0.250
1h	22-02-16	13:00	28	1	0	28.042	0.042	-0.380	-0.590	-0.520	-0.560	-0.430	-0.480	-0.580	-0.680	-0.390	-0.510	-0.290
6h	22-02-16	19:00	28	6	0	28.250	0.250	-0.400	-0.640	-0.540	-0.600	-0.450	-0.510	-0.590	-0.710	-0.430	-0.570	-0.320
1	23-02-16	16:00	29	0	0	29.000	1.000	-0.460	-0.660	-0.590	-0.630	-0.490	-0.560	-0.650	-0.750	-0.450	-0.590	-0.340
2	24-02-16	14:00	30	0	0	30.000	2.000	-0.470	-0.710	-0.600	-0.670	-0.510	-0.570	-0.690	-0.780	-0.490	-0.650	-0.370
3	25-02-16	10:00	31	0	0	31.000	3.000	-0.460	-0.690	-0.650	-0.650	-0.520	-0.590	-0.690	-0.790	-0.510	-0.630	-0.380
4	26-02-16	13:00	32	0	0	32.000	4.000	-0.490	-0.730	-0.670	-0.690	-0.520	-0.620	-0.730	-0.830	-0.530	-0.670	-0.390
5	27-02-16	19:00	33	0	0	33.000	5.000	-0.520	-0.760	-0.690	-0.710	-0.540	-0.640	-0.750	-0.860	-0.600	-0.680	-0.410
6	28-02-16	20:00	34	0	0	34.000	6.000	-0.490	-0.780	-0.710	-0.730	-0.550	-0.650	-0.760	-0.860	-0.570	-0.700	-0.420
7	29-02-16	12:00	35	0	0	35.000	7.000	-0.500	-0.800	-0.740	-0.760	-0.600	-0.690	-0.800	-0.900	-0.600	-0.730	-0.450
14	07-03-16	16:00	42	0	0	42.00	14.00	-0.600	-0.870	-0.830	-0.830	-0.670	-0.780	-0.880	-0.980	-0.690	-0.810	-0.530
21	14-03-16	9:00	49	0	0	49.00	21.00	-0.700	-0.970	-0.900	-0.870	-0.710	-0.820	-0.950	-1.060	-0.760	-0.890	-0.590
28	21-03-16	11:00	56	0	0	56.00	28.00	-0.720	-1.010	-0.940	-0.900	-0.740	-0.870	-0.990	-1.120	-0.810	-0.920	-0.620
56	18-04-16	15:00	84	0	0	84.00	56.00	-0.840	-1.150	-1.070	-1.030	-0.870	-0.960	-1.110	-1.260	-0.970	-1.070	-0.740
90	22-05-16	14:00	118	0	0	118.00	90.00	-0.900	-1.190	-1.150	-1.060	-0.920	-1.000	-1.180	-1.300	-1.000	-1.120	-0.770
120	21-06-16	11:00	148	0	0	148.00	120.00	-0.930	-1.240	-1.180	-1.090	-0.970	-1.060	-1.220	-1.330	-1.070	-1.170	-0.830
150	21-07-16	13:00	178	0	0	178.00	150.00	-0.980	-1.280	-1.250	-1.150	-0.990	-1.070	-1.290	-1.340	-1.130	-1.230	-0.870
180	20-08-16	13:00	208	0	0	208.00	180.00	-1.040	-1.340	-1.270	-1.170	-1.010	-1.160	-1.330	-1.440	-1.150	-1.250	-0.920
210	19-09-16	17:00	238	0	0	238.00	210.00	-1.050	-1.280	-1.310	-1.200	-1.030	-1.160	-1.320	-1.450	-1.170	-1.250	-0.920
240	19-10-16	15:00	268	0	0	268.00	240.00	-1.050	-1.360	-1.350	-1.220	-1.070	-1.210	-1.380	-1.480	-1.220	-1.300	-0.960
270	18-11-16	16:00	298	0	0	298.00	270.00	-1.090	-1.320	-1.360	-1.220	-1.090	-1.210	-1.410	-1.500	-1.270	-1.340	-0.980
300	18-12-16	13:00	328	0	0	328.00	300.00	-1.110	-1.450	-1.450	-1.280	-1.130	-1.260	-1.470	-1.540	-1.290	-1.400	-1.030
330	17-01-17	16:00	358	0	0	358.00	330.00	-1.130	-1.410	-1.470	-1.290	-1.140	-1.280	-1.480	-1.590	-1.330	-1.430	-1.050
365	21-02-17	10:00	393	0	0	393.00	365.00	-1.180	-1.370	-1.490	-1.310	-1.170	-1.310	-1.540	-1.610	-1.340	-1.440	-1.080
400	28-03-17	12:00	428	0	0	428.00	400.00	-1.200	-1.470	-1.520	-1.350	-1.210	-1.270	-1.520	-1.620	-1.410	-1.470	-1.120
450	17-05-17	11:00	478	0	0	478.00	450.00	-1.200	-1.520	-1.520	-1.330	-1.200	-1.310	-1.530	-1.620	-1.360	-1.480	-1.090
700	22-01-18		728	0	0	728.00	700.00											

								SIDE B TOP (‰)										
			Age					920	1200	1300	1400	1500	1600	1700	1800	1900	2000	2280
	Date	Time	Days	Hours	Minutes	Days, eq	From loading (days)	12	13	14	15	16	17	18	19	20	21	22
Casting	25-01-16	11:00	0	0	0	0.000	–	*197*	*197*	*197*	*197*	*197*	*197*	*197*	*197*	*197*	*197*	*197*
Before loading	22-02-16	11:30	28	0	0	28.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5min after loading	22-02-16	12:05	28	0	5	28.003	0.003	-0.330	-0.530	-0.430	-0.460	-0.410	-0.440	-0.410	-0.450	-0.370	-0.740	-0.290
1h	22-02-16	13:00	28	1	0	28.042	0.042	-0.330	-0.520	-0.440	-0.470	-0.420	-0.460	-0.410	-0.470	-0.380	-0.730	-0.290
6h	22-02-16	19:00	28	6	0	28.250	0.250	-0.380	-0.590	-0.480	-0.410	-0.460	-0.480	-0.430	-0.510	-0.420	-0.820	-0.330
1	23-02-16	16:00	29	0	0	29.000	1.000	-0.390	-0.610	-0.520	-0.540	-0.500	-0.530	-0.480	-0.560	-0.460	-0.820	-0.360
2	24-02-16	14:00	30	0	0	30.000	2.000	-0.430	-0.660	-0.580	-0.600	-0.550	-0.560	-0.510	-0.580	-0.480	-0.880	-0.380
3	25-02-16	10:00	31	0	0	31.000	3.000	-0.450	-0.680	-0.570	-0.600	-0.560	-0.560	-0.480	-0.590	-0.480	-0.890	-0.380
4	26-02-16	13:00	32	0	0	32.000	4.000	-0.460	-0.700	-0.590	-0.630	-0.570	-0.580	-0.510	-0.610	-0.490	-0.890	-0.400
5	27-02-16	19:00	33	0	0	33.000	5.000	-0.480	-0.720	-0.620	-0.640	-0.620	-0.620	-0.550	-0.650	-0.530	-0.910	-0.430
6	28-02-16	20:00	34	0	0	34.000	6.000	-0.490	-0.730	-0.630	-0.640	-0.630	-0.620	-0.530	-0.670	-0.490	-0.890	-0.420
7	29-02-16	12:00	35	0	0	35.000	7.000	-0.510	-0.760	-0.640	-0.660	-0.630	-0.630	-0.550	-0.670	-0.560	-0.960	-0.450
14	07-03-16	16:00	42	0	0	42.00	14.00	-0.590	-0.840	-0.740	-0.760	-0.730	-0.730	-0.670	-0.750	-0.630	-1.020	-0.530
21	14-03-16	09:00	49	0	0	49.00	21.00	-0.620	-0.890	-0.780	-0.800	-0.750	-0.750	-0.680	-0.780	-0.660	-1.080	-0.570
28	21-03-16	11:00	56	0	0	56.00	28.00	-0.680	-0.950	-0.830	-0.850	-0.830	-0.830	-0.730	-0.870	-0.710	-1.150	-0.630
56	18-04-16	15:00	84	0	0	84.00	56.00	-0.800	-1.070	-0.940	-0.970	-0.940	-0.940	-0.850	-0.970	-0.820	-1.220	-0.750
90	22-05-16	14:00	118	0	0	118.00	90.00	-0.860	-1.140	-0.960	-1.010	-1.010	-0.970	-0.910	-0.980	-0.880	-1.270	-0.770
120	21-06-16	11:00	148	0	0	148.00	120.00	-0.900	-1.170	-1.050	-1.070	-1.040	-1.040	-0.940	-1.070	-0.940	-1.330	-0.830
150	21-07-16	13:00	178	0	0	178.00	150.00	-0.950	-1.250	-1.080	-1.110	-1.120	-1.080	-0.980	-1.100	-0.950	-1.350	-0.860
180	20-08-16	13:00	208	0	0	208.00	180.00	-0.990	-1.290	-1.140	-1.160	-1.180	-1.110	-1.010	-1.140	-0.980	-1.370	-0.890
210	19-09-16	17:00	238	0	0	238.00	210.00	-1.010	-1.300	-1.150	-1.170	-1.190	-1.130	-1.000	-1.180	-1.000	-1.410	-0.900
240	19-10-16	15:00	268	0	0	268.00	240.00	-1.020	-1.330	-1.180	-1.200	-1.170	-1.130	-1.040	-1.190	-1.030	-1.410	-0.940
270	18-11-16	16:00	298	0	0	298.00	270.00	-1.070	-1.360	-1.200	-1.220	-1.230	-1.180	-1.070	-1.200	-1.010	-1.430	-0.950
300	18-12-16	13:00	328	0	0	328.00	300.00	-1.110	-1.400	-1.260	-1.250	-1.280	-1.200	-1.080	-1.260	-1.090	-1.470	-0.980
330	17-01-17	16:00	358	0	0	358.00	330.00	-1.120	-1.420	-1.290	-1.290	-1.320	-1.240	-1.110	-1.280	-1.110	-1.550	-1.050
365	21-02-17	10:00	393	0	0	393.00	365.00	-1.170	-1.450	-1.320	-1.310	-1.350	-1.260	-1.120	-1.320	-1.150	-1.480	-1.050
400	28-03-17	12:00	428	0	0	428.00	400.00	-1.280	-1.480	-1.260	-1.330	-1.380	-1.310	-1.140	-1.350	-1.110	-1.550	-1.100
450	17-05-17	11:00	478	0	0	478.00	450.00	-1.160	-1.430	-1.310	-1.300	-1.370	-1.270	-1.150	-1.290	-1.130	-1.540	-1.050

NAC28			σ = 13.42 MPa					SIDE A MIDDLE (‰)					
			Age					1500	1600	1700	1500	1600	1700
	Date	Time	Days	Hours	Minutes	Days, eq	From loading (days)	23	24	25	26	27	28
Casting	25-01-16	11:00	0	0	0	0.000	–	*155*	*155*	*155*	*115*	*115*	*115*
Before loading	22-02-16	11:30	28	0	0	28.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5min after loading	22-02-16	12:05	28	0	5	28.003	0.003	-0.120	-0.130	-0.150	0.000	0.000	0.420
1h	22-02-16	13:00	28	1	0	28.042	0.042	-0.130	-0.150	-0.180	0.000	0.000	0.250
6h	22-02-16	19:00	28	6	0	28.250	0.250	-0.130	-0.150	-0.210	0.000	0.000	0.220
1	23-02-16	16:00	29	0	0	29.000	1.000	-0.150	-0.170	-0.230	0.000	0.000	0.250
2	24-02-16	14:00	30	0	0	30.000	2.000	-0.170	-0.180	-0.270	0.000	0.000	0.220
3	25-02-16	10:00	31	0	0	31.000	3.000	-0.160	-0.190	-0.280	0.000	0.000	0.230
4	26-02-16	13:00	32	0	0	32.000	4.000	-0.170	-0.200	-0.280	0.000	0.000	0.240
5	27-02-16	19:00	33	0	0	33.000	5.000	-0.190	-0.220	-0.330	0.000	0.000	0.220
6	28-02-16	20:00	34	0	0	34.000	6.000	-0.180	-0.220	-0.330	0.000	0.000	0.250
7	29-02-16	12:00	35	0	0	35.000	7.000	-0.220	-0.260	-0.390	0.000	0.000	0.220
14	07-03-16	16:00	42	0	0	42.00	14.00	-0.250	-0.300	-0.420	0.000	0.000	0.160
21	14-03-16	9:00	49	0	0	49.00	21.00	-0.290	-0.350	-0.470	0.000	0.000	0.150
28	21-03-16	11:00	56	0	0	56.00	28.00	-0.310	-0.380	-0.520	0.000	0.000	0.160
56	18-04-16	15:00	84	0	0	84.00	56.00	-0.380	-0.460	-0.560	0.000	0.000	0.140
90	22-05-16	14:00	118	0	0	118.00	90.00	-0.400	-0.510	-0.610	0.000	0.000	0.100
120	21-06-16	11:00	148	0	0	148.00	120.00	-0.450	-0.570	-0.670	0.000	0.000	0.060
150	21-07-16	13:00	178	0	0	178.00	150.00	-0.490	-0.590	-0.710	0.000	0.000	0.040
180	20-08-16	13:00	208	0	0	208.00	180.00	-0.500	-0.630	-0.680	0.000	0.000	0.020
210	19-09-16	17:00	238	0	0	238.00	210.00	-0.480	-0.640	-0.730	0.000	0.000	0.010
240	19-10-16	15:00	268	0	0	268.00	240.00	-0.510	-0.670	-0.770	0.000	0.000	0.000
270	18-11-16	16:00	298	0	0	298.00	270.00	-0.550	-0.710	-0.940	0.000	0.000	0.010
300	18-12-16	13:00	328	0	0	328.00	300.00	-0.570	-0.720	-0.950	0.000	0.000	0.020
330	17-01-17	16:00	358	0	0	358.00	330.00	-0.580	-0.740	-0.980	0.000	0.000	-0.010
365	21-02-17	10:00	393	0	0	393.00	365.00	-0.610	-0.790	-0.970	0.000	0.000	0.020
400	28-03-17	12:00	428	0	0	428.00	400.00	-0.610	-0.780	-1.010	0.000	0.000	-0.030
450	17-05-17	11:00	478	0	0	478.00	450.00	-0.600	-0.790	-1.000	0.000	0.000	-0.050
700	22-01-18		728	0	0	728.00	700.00						

								SIDE B MIDDLE (‰)					
			Age					1500	1600	1700	1500	1600	1700
	Date	Time	Days	Hours	Minutes	Days, eq	From loading (days)	23	24	25	26	27	28
Casting	25-01-16	11:00	0	0	0	0.000	–	*155*	*155*	*155*	*115*	*115*	*115*
Before loading	22-02-16	11:30	28	0	0	28.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5min after loading	22-02-16	12:05	28	0	5	28.003	0.003	-0.070	-0.030	-0.120	0.270	0.610	0.010
1h	22-02-16	13:00	28	1	0	28.042	0.042	-0.050	-0.020	-0.080	0.310	0.660	0.030
6h	22-02-16	19:00	28	6	0	28.250	0.250	-0.090	-0.040	-0.110	0.290	0.680	0.020
1	23-02-16	16:00	29	0	0	29.000	1.000	-0.120	-0.040	-0.120	2.790	0.690	0.000
2	24-02-16	14:00	30	0	0	30.000	2.000	-0.140	-0.080	-0.160	2.800	0.660	0.010
3	25-02-16	10:00	31	0	0	31.000	3.000	-0.130	-0.060	-0.130	0.280	0.670	0.000
4	26-02-16	13:00	32	0	0	32.000	4.000	-0.150	-0.070	-0.150	0.290	0.680	0.010
5	27-02-16	19:00	33	0	0	33.000	5.000	-0.160	-0.090	-0.160	0.270	0.700	-0.020
6	28-02-16	20:00	34	0	0	34.000	6.000	-0.150	-0.090	-0.150	0.300	0.690	0.000
7	29-02-16	12:00	35	0	0	35.000	7.000	-0.170	-0.110	-0.180	0.290	0.670	-0.020
14	07-03-16	16:00	42	0	0	42.00	14.00	-0.250	-0.160	-0.240	0.220	0.630	-0.070
21	14-03-16	09:00	49	0	0	49.00	21.00	-0.280	-0.190	-0.270	0.230	0.660	-0.070
28	21-03-16	11:00	56	0	0	56.00	28.00	-0.300	-0.200	-0.300	0.200	0.620	-0.110
56	18-04-16	15:00	84	0	0	84.00	56.00	-0.390	-0.280	-0.390	0.160	0.530	-0.140
90	22-05-16	14:00	118	0	0	118.00	90.00	-0.410	-0.290	-0.460	0.170	0.510	-0.120
120	21-06-16	11:00	148	0	0	148.00	120.00	-0.480	-0.360	-0.490	0.130	0.490	-0.170
150	21-07-16	13:00	178	0	0	178.00	150.00	-0.490	-0.370	-0.470	0.110	0.520	-0.190
180	20-08-16	13:00	208	0	0	208.00	180.00	-0.550	-0.420	-0.510	0.100	0.450	-0.190
210	19-09-16	17:00	238	0	0	238.00	210.00	-0.540	-0.400	-0.500	0.100	0.470	-0.200
240	19-10-16	15:00	268	0	0	268.00	240.00	-0.570	-0.430	-0.500	0.090	0.460	-0.220
270	18-11-16	16:00	298	0	0	298.00	270.00	-0.570	-0.450	-0.550	0.080	0.480	-0.190
300	18-12-16	13:00	328	0	0	328.00	300.00	-0.590	-0.440	-0.520	0.070	0.450	-0.170
330	17-01-17	16:00	358	0	0	358.00	330.00	-0.620	-0.470	-0.580	0.060	0.420	-0.230
365	21-02-17	10:00	393	0	0	393.00	365.00	-0.630	-0.490	-0.620	0.050	0.430	-0.210
400	28-03-17	12:00	428	0	0	428.00	400.00	-0.670	-0.540	-0.610	0.020	0.390	-0.280
450	17-05-17	11:00	478	0	0	478.00	450.00	-0.630	-0.500	-0.600	0.070	0.390	-0.210

	RAC7				0	5m	1h	6h	1d	2d
	A	BOTTOM								
	From (mm)	To (mm)	Disks		09-02-16	09-02-16	09-02-16	09-02-16	10-02-16	11-02-16
1	870	970	1	2	-0.215	-0.064	-0.053	-0.051	-0.044	-0.039
2	1150	1250	3	4	-0.299	-0.127	-0.12	-0.115	-0.111	-0.106
3	1250	1350	4	5	-0.352	-0.291	-0.284	-0.284	-0.282	-0.278
4	1350	1450	5	6	-0.239	-0.03	-0.023	-0.019	-0.012	-0.007
5	1450	1550	6	7	-0.535	-0.467	-0.46	-0.455	-0.453	-0.451
6	1550	1650	7	8	-0.315	-0.128	-0.122	-0.121	-0.117	-0.113
7	1650	1750	8	9	-0.205	-0.002	0.004	0.006	0.014	0.024
8	1750	1850	9	10	-2.049	-1.995	-1.991	-1.988	-1.99	-1.984
9	1850	1950	10	11	-0.019	0.137	0.145	0.147	0.154	0.159
10	1950	2050	11	12	-0.116	0.056	0.056	0.06	0.067	0.072
11	2230	2330	13	14	0.974	1.075	1.09	1.093	1.095	1.102
	A	TOP								
	From (mm)	To (mm)	Disks							
12	870	970	15	16	-2.252	-2.312	-2.317	-2.318	-2.328	-2.333
13	1150	1250	17	18	-0.169	-0.245	-0.249	-0.253	-0.262	-0.266
14	1250	1350	18	19	-0.398	-0.454	-0.456	-0.461	-0.47	-0.475
15	1350	1450	19	20	-0.162	-0.242	-0.245	-0.25	-0.255	-0.262
16	1450	1550	20	21	-0.289	-0.328	-0.33	-0.335	-0.343	-0.347
17	1550	1650	21	22	-1.304	-1.39	-1.391	-1.398	-1.407	-1.411
18	1650	1750	22	23	-0.08	-0.151	-0.151	-0.157	-0.165	-0.168
19	1750	1850	23	24	-1.309	-1.397	-1.397	-1.405	-1.412	-1.416
20	1850	1950	24	25	-0.817	-0.865	-0.866	-0.871	-0.879	-0.882
21	1950	2050	25	26	-0.014	-0.096	-0.095	-0.101	-0.106	-0.11
22	2230	2330	27	28	-0.133	-0.199	-0.188	-0.194	-0.202	-0.203
	A	MIDDLE								
	From (mm)	To (mm)	Disks							
23	1450	1550	29	30	-0.413	-0.432	-0.428	-0.433	-0.436	-0.44
24	1550	1650	30	31	-0.493	-0.509	-0.507	-0.512	-0.515	-0.517
25	1650	1750	31	32	-0.365	-0.384	-0.385	-0.388	-0.392	-0.394
26	1450	1550	33	34	-0.117	-0.109	-0.106	-0.108	-0.109	-0.108
27	1550	1650	34	35	1.042	1.088	1.091	1.087	1.088	1.088
28	1650	1750	35	36	-0.944	-0.922	-0.919	-0.92	-0.922	-0.92

					0	5m	1h	6h	1d	2d
	B	BOTTOM								
	From (mm)	To (mm)	Disks		09-02-16	09-02-16	09-02-16	09-02-16	10-02-16	11-02-16
1	870	970	1	2	-0.241	-0.119	-0.113	-0.108	-0.102	-0.098
2	1150	1250	3	4	-0.162	0	0	0.006	0.011	0.015
3	1250	1350	4	5	-0.982	-0.831	-0.826	-0.816	-0.82	-0.811
4	1350	1450	5	6	-0.381	-0.301	-0.301	-0.298	-0.3	-0.299
5	1450	1550	6	7	-0.202	-0.045	-0.038	-0.033	-0.027	-0.026
6	1550	1650	7	8	-0.222	-0.074	-0.071	-0.068	-0.066	-0.062
7	1650	1750	8	9	-3.013	-2.899	-2.895	-2.892	-2.893	-2.892
8	1750	1850	9	10	0.914	1.083	1.088	1.091	1.095	1.098
9	1850	1950	10	11	-0.488	-0.392	-0.389	-0.385	-0.384	-0.383
10	1950	2050	11	12	-1.16	-0.988	-0.984	-0.979	-0.976	-0.97
11	2230	2330	13	14	-0.136	-0.016	0.026	0.029	0.036	0.042
	B	TOP								
	From (mm)	To (mm)	Disks							
12	870	970	15	16	-0.097	-0.132	-0.137	-0.138	-0.147	-0.152
13	1150	1250	17	18	0.278	0.215	0.211	0.194	0.182	0.178
14	1250	1350	18	19	-1.021	-1.061	-1.078	-1.076	-1.083	-1.087
15	1350	1450	19	20	-0.808	-0.886	-0.897	-0.902	-0.911	-0.913
16	1450	1550	20	21	0.322	0.271	0.267	0.262	0.252	0.249
17	1550	1650	21	22	1.683	1.59	1.593	1.589	1.576	1.576
18	1650	1750	22	23	-2.497	-2.553	-2.56	-2.569	-2.576	-2.582
19	1750	1850	23	24	-0.182	-0.252	-0.251	-0.255	-0.266	-0.267
20	1850	1950	24	25	0.864	0.81	0.807	0.803	0.796	0.792
21	1950	2050	25	26	-0.594	-0.647	-0.651	-0.655	-0.665	-0.667
22	2230	2330	27	28	0.153	0.111	0.109	0.105	0.098	0.095
	B	MIDDLE								
	From (mm)	To (mm)	Disks							
23	1450	1550	29	30	0.219	0.204	0.202	0.198	0.192	0.192
24	1550	1650	30	31	-0.15	-0.175	-0.178	-0.184	-0.187	-0.19
25	1650	1750	31	32	-0.918	-0.939	-0.939	-0.941	-0.949	-0.949
26	1450	1550	33	34	0.386	0.42	0.419	0.418	0.415	0.417
27	1550	1650	34	35	-0.161	-0.129	-0.128	-0.127	-0.132	-0.132
28	1650	1750	35	36	-1.515	-1.489	-1.49	-1.489	-1.493	-1.492

	RAC7				3d	4d	5d	6d	7d	14d
	A	BOTTOM								
	From (mm)	To (mm)	Disks		12-02-16	13-02-16	14-02-16	15-02-16	16-02-16	23-02-16
1	870	970	1	2	-0.04	-0.034	-0.033	-0.029	-0.03	-0.026
2	1150	1250	3	4	-0.106	-0.105	-0.103	-0.101	-0.102	-0.099
3	1250	1350	4	5	-0.278	-0.275	-0.274	-0.268	-0.272	-0.275
4	1350	1450	5	6	-0.008	-0.003	0	0.003	0.003	0.009
5	1450	1550	6	7	-0.455	-0.451	-0.451	-0.447	-0.449	-0.454
6	1550	1650	7	8	-0.116	-0.112	-0.112	-0.107	-0.111	-0.11
7	1650	1750	8	9	0.021	0.023	0.026	0.033	0.028	0.035
8	1750	1850	9	10	-1.989	-1.987	-1.987	-1.984	-1.985	-1.988
9	1850	1950	10	11	0.154	0.16	0.161	0.166	0.162	0.163
10	1950	2050	11	12	0.069	0.073	0.074	0.08	0.075	0.078
11	2230	2330	13	14	1.098	1.102	1.105	1.111	1.104	1.103
	A	TOP								
	From (mm)	To (mm)	Disks							
12	870	970	15	16	-2.34	-2.337	-2.343	-2.342	-2.345	-2.36
13	1150	1250	17	18	-0.276	-0.274	-0.277	-0.278	-0.28	-0.3
14	1250	1350	18	19	-0.483	-0.481	-0.484	-0.486	-0.487	-0.508
15	1350	1450	19	20	-0.272	-0.269	-0.272	-0.274	-0.276	-0.293
16	1450	1550	20	21	-0.357	-0.353	-0.358	-0.358	-0.36	-0.378
17	1550	1650	21	22	-1.421	-1.417	-1.42	-1.424	-1.424	-1.441
18	1650	1750	22	23	-0.178	-0.176	-0.179	-0.181	-0.183	-0.202
19	1750	1850	23	24	-1.426	-1.423	-1.425	-1.429	-1.429	-1.446
20	1850	1950	24	25	-0.893	-0.887	-0.893	-0.894	-0.896	-0.913
21	1950	2050	25	26	-0.122	-0.12	-0.124	-0.125	-0.126	-0.144
22	2230	2330	27	28	-0.213	-0.212	-0.215	-0.217	-0.219	-0.236
	A	MIDDLE								
	From (mm)	To (mm)	Disks							
23	1450	1550	29	30	-0.448	-0.446	-0.447	-0.446	-0.451	-0.46
24	1550	1650	30	31	-0.526	-0.522	-0.526	-0.524	-0.528	-0.536
25	1650	1750	31	32	-0.403	-0.4	-0.403	-0.403	-0.406	-0.416
26	1450	1550	33	34	-0.115	-0.113	-0.116	-0.113	-0.116	-0.122
27	1550	1650	34	35	1.08	1.083	1.081	1.082	1.079	1.07
28	1650	1750	35	36	-0.929	-0.925	-0.926	-0.925	-0.928	-0.933

					3d	4d	5d	6d	7d	14d
	B	BOTTOM								
	From (mm)	To (mm)	Disks		12-02-16	13-02-16	14-02-16	15-02-16	16-02-16	23-02-16
1	870	970	1	2	-0.101	-0.095	-0.096	-0.092	-0.09	-0.088
2	1150	1250	3	4	0.012	0.018	0.02	0.022	0.024	0.024
3	1250	1350	4	5	-0.82	-0.807	-0.808	-0.806	-0.806	-0.805
4	1350	1450	5	6	-0.301	-0.3	-0.301	-0.299	-0.298	-0.301
5	1450	1550	6	7	-0.028	-0.022	-0.021	-0.021	-0.02	-0.015
6	1550	1650	7	8	-0.065	-0.061	-0.061	-0.062	-0.058	-0.056
7	1650	1750	8	9	-2.894	-2.888	-2.887	-2.892	-2.885	-2.883
8	1750	1850	9	10	1.1	1.103	1.104	1.1	1.107	1.107
9	1850	1950	10	11	-0.383	-0.381	-0.38	-0.384	-0.376	-0.378
10	1950	2050	11	12	-0.971	-0.966	-0.963	-0.971	-0.962	-0.961
11	2230	2330	13	14	0.042	0.042	0.045	0.043	0.051	0.058
	B	TOP								
	From (mm)	To (mm)	Disks							
12	870	970	15	16	-0.158	-0.157	-0.162	-0.16	-0.163	-0.179
13	1150	1250	17	18	0.173	0.175	0.167	0.168	0.167	0.143
14	1250	1350	18	19	-1.096	-1.094	-1.104	-1.099	-1.103	-1.117
15	1350	1450	19	20	-0.92	-0.922	-0.926	-0.923	-0.927	-0.942
16	1450	1550	20	21	0.24	0.239	0.238	0.238	0.233	0.212
17	1550	1650	21	22	1.561	1.564	1.563	1.563	1.569	1.53
18	1650	1750	22	23	-2.588	-2.59	-2.593	-2.595	-2.602	-2.621
19	1750	1850	23	24	-0.281	-0.276	-0.277	-0.278	-0.282	-0.303
20	1850	1950	24	25	0.784	0.787	0.781	0.782	0.777	0.762
21	1950	2050	25	26	-0.68	-0.675	-0.678	-0.675	-0.682	-0.698
22	2230	2330	27	28	0.09	0.089	0.086	0.088	0.08	0.069
	B	MIDDLE								
	From (mm)	To (mm)	Disks							
23	1450	1550	29	30	0.181	0.185	0.183	0.186	0.179	0.166
24	1550	1650	30	31	-0.198	-0.198	-0.2	-0.198	-0.203	-0.214
25	1650	1750	31	32	-0.958	-0.955	-0.957	-0.951	-0.962	-0.97
26	1450	1550	33	34	0.409	0.411	0.409	0.416	0.408	0.4
27	1550	1650	34	35	-0.141	-0.137	-0.137	-0.131	-0.139	-0.146
28	1650	1750	35	36	-1.5	-1.495	-1.497	-1.488	-1.5	-1.507

RAC7					21d	28d	56d	90d	120d	150d
	A	BOTTOM								
	From (mm)	To (mm)	Disks		01-03-16	08-03-16	05-04-16	09-05-16	08-06-16	08-07-16
1	870	970	1	2	-0.023	-0.021	-0.011	-0.009	-0.01	-0.006
2	1150	1250	3	4	-0.098	-0.096	-0.092	-0.091	-0.089	-0.088
3	1250	1350	4	5	-0.272	-0.273	-0.273	-0.273	-0.275	-0.278
4	1350	1450	5	6	0.016	0.018	0.026	0.027	0.025	0.027
5	1450	1550	6	7	-0.45	-0.455	-0.451	-0.452	-0.448	-0.453
6	1550	1650	7	8	-0.105	-0.106	-0.101	-0.1	-0.099	-0.099
7	1650	1750	8	9	0.041	0.042	0.05	0.051	0.05	0.051
8	1750	1850	9	10	-1.988	-1.991	-1.991	-1.992	-1.991	-1.993
9	1850	1950	10	11	0.167	0.167	0.17	0.168	0.167	0.168
10	1950	2050	11	12	0.086	0.086	0.097	0.097	0.096	0.097
11	2230	2330	13	14	1.106	1.106	1.11	1.108	1.114	1.11
	A	TOP								
	From (mm)	To (mm)	Disks							
12	870	970	15	16	-2.368	-2.382	-2.4	-2.412	-2.415	-2.422
13	1150	1250	17	18	-0.309	-0.321	-0.342	-0.356	-0.359	-0.367
14	1250	1350	18	19	-0.516	-0.524	-0.547	-0.558	-0.561	-0.568
15	1350	1450	19	20	-0.3	-0.31	-0.33	-0.343	-0.348	-0.353
16	1450	1550	20	21	-0.386	-0.398	-0.418	-0.432	-0.434	-0.44
17	1550	1650	21	22	-1.448	-1.461	-1.481	-1.492	-1.495	-1.501
18	1650	1750	22	23	-0.21	-0.222	-0.245	-0.258	-0.26	-0.266
19	1750	1850	23	24	-1.454	-1.465	-1.483	-1.5	-1.5	-1.506
20	1850	1950	24	25	-0.922	-0.935	-0.954	-0.969	-0.972	-0.978
21	1950	2050	25	26	-0.153	-0.163	-0.182	-0.194	-0.195	-0.201
22	2230	2330	27	28	-0.245	-0.256	-0.277	-0.291	-0.294	-0.3
	A	MIDDLE								
	From (mm)	To (mm)	Disks							
23	1450	1550	29	30	-0.467	-0.478	-0.493	-0.502	-0.504	-0.51
24	1550	1650	30	31	-0.542	-0.551	-0.564	-0.573	-0.572	-0.579
25	1650	1750	31	32	-0.422	-0.434	-0.447	-0.458	-0.461	-0.465
26	1450	1550	33	34	-0.125	-0.131	-0.14	-0.143	-0.145	-0.146
27	1550	1650	34	35	1.065	1.055	1.05	1.042	1.045	1.046
28	1650	1750	35	36	-0.937	-0.944	-0.952	-0.958	-0.96	-0.96

					21d	28d	56d	90d	120d	150d
	B	BOTTOM								
	From (mm)	To (mm)	Disks		01-03-16	08-03-16	05-04-16	09-05-16	08-06-16	08-07-16
1	870	970	1	2	-0.083	-0.091	-0.081	-0.081	-0.078	-0.079
2	1150	1250	3	4	0.028	0.024	0.033	0.034	0.034	0.036
3	1250	1350	4	5	-0.801	-0.805	-0.8	-0.802	-0.803	-0.802
4	1350	1450	5	6	-0.302	-0.311	-0.301	-0.303	-0.3	-0.302
5	1450	1550	6	7	-0.013	-0.017	-0.011	-0.016	-0.014	-0.014
6	1550	1650	7	8	-0.052	-0.061	-0.054	-0.056	-0.053	-0.052
7	1650	1750	8	9	-2.885	-2.891	-2.881	-2.883	-2.881	-2.884
8	1750	1850	9	10	1.112	1.105	1.116	1.116	1.124	1.119
9	1850	1950	10	11	-0.374	-0.381	-0.376	-0.379	-0.377	-0.378
10	1950	2050	11	12	-0.95	-0.96	-0.951	-0.947	-0.948	-0.941
11	2230	2330	13	14	0.064	0.061	0.076	0.075	0.077	0.083
	B	TOP								
	From (mm)	To (mm)	Disks							
12	870	970	15	16	-0.189	-0.205	-0.221	-0.231	-0.234	-0.244
13	1150	1250	17	18	0.135	0.123	0.109	0.092	0.091	0.082
14	1250	1350	18	19	-1.129	-1.148	-1.166	-1.168	-1.169	-1.18
15	1350	1450	19	20	-0.949	-0.969	-0.982	-0.993	-0.995	-1.003
16	1450	1550	20	21	0.205	0.191	0.172	0.16	0.154	0.146
17	1550	1650	21	22	1.53	1.517	1.494	1.475	1.478	1.467
18	1650	1750	22	23	-2.625	-2.648	-2.66	-2.669	-2.671	-2.68
19	1750	1850	23	24	-0.308	-0.323	-0.335	-0.352	-0.354	-0.36
20	1850	1950	24	25	0.755	0.739	0.722	0.711	0.71	0.698
21	1950	2050	25	26	-0.704	-0.725	-0.741	-0.754	-0.753	-0.767
22	2230	2330	27	28	0.061	0.044	0.032	0.023	0.021	0.011
	B	MIDDLE								
	From (mm)	To (mm)	Disks							
23	1450	1550	29	30	0.159	0.146	0.134	0.126	0.126	0.114
24	1550	1650	30	31	-0.222	-0.236	-0.248	-0.257	-0.257	-0.268
25	1650	1750	31	32	-0.975	-0.991	-0.999	-1.011	-1.009	-1.017
26	1450	1550	33	34	0.398	0.384	0.38	0.374	0.375	0.367
27	1550	1650	34	35	-0.149	-0.162	-0.168	-0.174	-0.175	-0.182
28	1650	1750	35	36	-1.506	-1.522	-1.522	-1.527	-1.524	-1.534

RAC7					180d	210d	240d	270d	300d	330d
	A	**BOTTOM**								
	From (mm)	To (mm)	Disks		07-08-16	06-09-16	06-10-16	05-11-16	05-12-16	04-01-17
1	870	970	1	2	-0.005	-0.007	-0.011	-0.009	0.003	0.004
2	1150	1250	3	4	-0.086	-0.089	-0.09	-0.087	-0.083	-0.081
3	1250	1350	4	5	-0.274	-0.28	-0.28	-0.279	-0.273	-0.275
4	1350	1450	5	6	0.032	0.025	0.022	0.03	0.041	0.042
5	1450	1550	6	7	-0.453	-0.455	-0.459	-0.458	-0.452	-0.454
6	1550	1650	7	8	-0.097	-0.1	-0.102	-0.1	-0.094	-0.093
7	1650	1750	8	9	0.054	0.05	0.045	0.05	0.062	0.063
8	1750	1850	9	10	-1.992	-1.994	-1.998	-1.995	-1.99	-1.988
9	1850	1950	10	11	0.17	0.165	0.161	0.164	0.172	0.172
10	1950	2050	11	12	0.1	0.096	0.092	0.096	0.107	0.107
11	2230	2330	13	14	1.111	1.106	1.104	1.105	1.112	1.112
	A	**TOP**								
	From (mm)	To (mm)	Disks							
12	870	970	15	16	-2.427	-2.429	-2.434	-2.437	-2.436	-2.441
13	1150	1250	17	18	-0.372	-0.377	-0.381	-0.385	-0.39	-0.394
14	1250	1350	18	19	-0.576	-0.58	-0.585	-0.587	-0.589	-0.595
15	1350	1450	19	20	-0.358	-0.362	-0.366	-0.369	-0.367	-0.375
16	1450	1550	20	21	-0.449	-0.452	-0.458	-0.462	-0.462	-0.468
17	1550	1650	21	22	-1.509	-1.512	-1.516	-1.518	-1.52	-1.523
18	1650	1750	22	23	-0.274	-0.276	-0.282	-0.286	-0.288	-0.295
19	1750	1850	23	24	-1.513	-1.516	-1.52	-1.523	-1.526	-1.529
20	1850	1950	24	25	-0.986	-0.988	-0.995	-0.997	-0.998	-1.003
21	1950	2050	25	26	-0.209	-0.213	-0.216	-0.22	-0.222	-0.229
22	2230	2330	27	28	-0.308	-0.313	-0.318	-0.319	-0.322	-0.328
	A	**MIDDLE**								
	From (mm)	To (mm)	Disks							
23	1450	1550	29	30	-0.516	-0.515	-0.52	-0.524	-0.525	-0.53
24	1550	1650	30	31	-0.584	-0.584	-0.59	-0.59	-0.593	-0.596
25	1650	1750	31	32	-0.471	-0.474	-0.481	-0.478	-0.48	-0.484
26	1450	1550	33	34	-0.149	-0.151	-0.154	-0.156	-0.154	-0.157
27	1550	1650	34	35	1.035	1.033	1.03	1.028	1.03	1.026
28	1650	1750	35	36	-0.964	-0.962	-0.971	-0.972	-0.968	-0.972

					180d	210d	240d	270d	300d	330d
	B	**BOTTOM**								
	From (mm)	To (mm)	Disks		07-08-16	06-09-16	06-10-16	05-11-16	05-12-16	04-01-17
1	870	970	1	2	-0.076	-0.079	-0.084	-0.078	-0.071	-0.072
2	1150	1250	3	4	0.037	0.032	0.03	0.034	0.04	0.042
3	1250	1350	4	5	-0.803	-0.806	-0.81	-0.806	-0.801	-0.802
4	1350	1450	5	6	-0.304	-0.306	-0.306	-0.305	-0.303	-0.302
5	1450	1550	6	7	-0.012	-0.018	-0.02	-0.015	-0.01	-0.009
6	1550	1650	7	8	-0.051	-0.057	-0.059	-0.054	-0.052	-0.05
7	1650	1750	8	9	-2.882	-2.889	-2.888	-2.884	-2.882	-2.88
8	1750	1850	9	10	1.125	1.116	1.119	1.12	1.126	1.123
9	1850	1950	10	11	-0.378	-0.383	-0.386	-0.384	-0.379	-0.381
10	1950	2050	11	12	-0.939	-0.945	-0.948	-0.937	-0.935	-0.938
11	2230	2330	13	14	0.086	0.077	0.077	0.086	0.093	0.098
	B	**TOP**								
	From (mm)	To (mm)	Disks							
12	870	970	15	16	-0.248	-0.252	-0.253	-0.256	-0.262	-0.265
13	1150	1250	17	18	0.073	0.078	0.072	0.068	0.063	0.059
14	1250	1350	18	19	-1.191	-1.196	-1.196	-1.199	-1.21	-1.208
15	1350	1450	19	20	-1.011	-1.014	-1.016	-1.018	-1.023	-1.027
16	1450	1550	20	21	0.142	0.137	0.133	0.128	0.126	0.12
17	1550	1650	21	22	1.462	1.457	1.456	1.449	1.45	1.442
18	1650	1750	22	23	-2.687	-2.681	-2.69	-2.695	-2.699	-2.703
19	1750	1850	23	24	-0.365	-0.368	-0.369	-0.371	-0.377	-0.379
20	1850	1950	24	25	0.693	0.686	0.684	0.681	0.678	0.673
21	1950	2050	25	26	-0.77	-0.776	-0.777	-0.777	-0.781	-0.789
22	2230	2330	27	28	0.006	0.005	0.001	0	-0.007	-0.007
	B	**MIDDLE**								
	From (mm)	To (mm)	Disks							
23	1450	1550	29	30	0.112	0.108	0.108	0.103	0.099	0.098
24	1550	1650	30	31	-0.27	-0.275	-0.28	-0.278	-0.281	-0.286
25	1650	1750	31	32	-1.023	-1.026	-1.027	-1.028	-1.034	-1.033
26	1450	1550	33	34	0.363	0.36	0.358	0.359	0.355	0.354
27	1550	1650	34	35	-0.184	-0.187	-0.188	-0.189	-0.192	-0.192
28	1650	1750	35	36	-1.535	-1.534	-1.54	-1.54	-1.539	-1.539

	RAC7				365d	400d	450d
	A	**BOTTOM**					
	From (mm)	To (mm)	Disks		08-02-17	15-03-17	04-05-17
1	870	970	1	2	0.003	0.005	0.003
2	1150	1250	3	4	-0.078	-0.077	-0.079
3	1250	1350	4	5	-0.275	-0.275	-0.277
4	1350	1450	5	6	0.041	0.042	0.041
5	1450	1550	6	7	-0.455	-0.452	-0.455
6	1550	1650	7	8	-0.091	-0.091	-0.093
7	1650	1750	8	9	0.064	0.063	0.06
8	1750	1850	9	10	-1.985	-1.986	-1.992
9	1850	1950	10	11	0.173	0.173	0.17
10	1950	2050	11	12	0.109	0.11	0.105
11	2230	2330	13	14	1.113	1.11	1.108
	A	**TOP**					
	From (mm)	To (mm)	Disks				
12	870	970	15	16	-2.446	-2.448	-2.449
13	1150	1250	17	18	-0.398	-0.4	-0.402
14	1250	1350	18	19	-0.599	-0.601	-0.604
15	1350	1450	19	20	-0.377	-0.379	-0.381
16	1450	1550	20	21	-0.474	-0.475	-0.476
17	1550	1650	21	22	-1.528	-1.53	-1.528
18	1650	1750	22	23	-0.299	-0.302	-0.302
19	1750	1850	23	24	-1.533	-1.534	-1.536
20	1850	1950	24	25	-1.009	-1.01	-1.013
21	1950	2050	25	26	-0.23	-0.232	-0.237
22	2230	2330	27	28	-0.335	-0.336	-0.341
	A	**MIDDLE**					
	From (mm)	To (mm)	Disks				
23	1450	1550	29	30	-0.53	-0.531	-0.536
24	1550	1650	30	31	-0.6	-0.598	-0.602
25	1650	1750	31	32	-0.488	-0.489	-0.491
26	1450	1550	33	34	-0.16	-0.159	-0.162
27	1550	1650	34	35	1.025	1.025	1.022
28	1650	1750	35	36	-0.974	-0.974	-0.976

					365d	400d	450d
	B	**BOTTOM**					
	From (mm)	To (mm)	Disks		08-02-17	15-03-17	04-05-17
1	870	970	1	2	-0.073	-0.071	-0.072
2	1150	1250	3	4	0.043	0.042	0.043
3	1250	1350	4	5	-0.801	-0.802	-0.806
4	1350	1450	5	6	-0.304	-0.301	-0.3
5	1450	1550	6	7	-0.01	-0.006	-0.009
6	1550	1650	7	8	-0.05	-0.049	-0.055
7	1650	1750	8	9	-2.881	-2.879	-2.882
8	1750	1850	9	10	1.123	1.127	1.126
9	1850	1950	10	11	-0.382	-0.378	-0.381
10	1950	2050	11	12	-0.934	-0.931	-0.937
11	2230	2330	13	14	0.092	0.097	0.085
	B	**TOP**					
	From (mm)	To (mm)	Disks				
12	870	970	15	16	-0.27	-0.269	-0.271
13	1150	1250	17	18	0.054	0.056	0.054
14	1250	1350	18	19	-1.214	-1.215	-1.212
15	1350	1450	19	20	-1.031	-1.032	-1.03
16	1450	1550	20	21	0.116	0.116	0.113
17	1550	1650	21	22	1.438	1.432	1.427
18	1650	1750	22	23	-2.711	-2.706	-2.71
19	1750	1850	23	24	-0.386	-0.384	-0.388
20	1850	1950	24	25	0.665	0.668	0.666
21	1950	2050	25	26	-0.793	-0.793	-0.802
22	2230	2330	27	28	-0.015	-0.013	-0.013
	B	**MIDDLE**					
	From (mm)	To (mm)	Disks				
23	1450	1550	29	30	0.095	0.096	0.096
24	1550	1650	30	31	-0.293	-0.29	-0.288
25	1650	1750	31	32	-1.038	-1.038	-1.04
26	1450	1550	33	34	0.35	0.352	0.351
27	1550	1650	34	35	-0.195	-0.196	-0.2
28	1650	1750	35	36	-1.543	-1.535	-1.534

				σ =	14.22	MPa		SIDE A BOTTOM (‰)										
			Age					920	1200	1300	1400	1500	1600	1700	1800	1900	2000	2280
RAC7	**Date**	**Time**	**Days**	**Hours**	**Minutes**	**Days, eq**	**From loading (days)**	1	2	3	4	5	6	7	8	9	10	11
Casting	02-02-16	11:00	0	0	0	0.000	–	*31*	*31*	*31*	*31*	*31*	*31*	*31*	*31*	*31*	*31*	*31*
Before loading	09-02-16	11:30	7	0	0	7.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5min after loading	09-02-16	13:35	7	0	5	7.003	0.003	1.510	1.720	0.610	2.090	0.680	1.870	2.030	0.540	1.560	1.720	1.010
1h	09-02-16	14:30	7	1	0	7.042	0.042	1.620	1.790	0.680	2.160	0.750	1.930	2.090	0.580	1.640	1.720	1.160
6h	09-02-16	19:30	7	6	0	7.250	0.250	1.640	1.840	0.680	2.200	0.800	1.940	2.110	0.610	1.660	1.760	1.190
1	10-02-16	13:30	8	0	0	8.000	1.000	1.710	1.880	0.700	2.270	0.820	1.980	2.190	0.590	1.730	1.830	1.210
2	11-02-16	16:00	9	0	0	9.000	2.000	1.760	1.930	0.740	2.320	0.840	2.020	2.290	0.650	1.780	1.880	1.280
3	12-02-16	12:00	10	0	0	10.000	3.000	1.750	1.930	0.740	2.310	0.800	1.990	2.260	0.600	1.730	1.850	1.240
4	13-02-16	12:00	11	0	0	11.000	4.000	1.810	1.940	0.770	2.360	0.840	2.030	2.280	0.620	1.790	1.890	1.280
5	14-02-16	20:00	12	0	0	12.000	5.000	1.820	1.960	0.780	2.390	0.840	2.030	2.310	0.620	1.800	1.900	1.310
6	15-02-16	20:00	13	0	0	13.000	6.000	1.860	1.980	0.840	2.420	0.880	2.080	2.380	0.650	1.850	1.960	1.370
7	16-02-16	15:00	14	0	0	14.000	7.000	1.850	1.970	0.800	2.420	0.860	2.040	2.330	0.640	1.810	1.910	1.300
14	23-02-16	16:00	21	0	0	21.00	14.00	1.890	2.000	0.770	2.480	0.810	2.050	2.400	0.610	1.820	1.940	1.290
21	01-03-16	12:00	28	0	0	28.00	21.00	1.920	2.010	0.800	2.550	0.850	2.100	2.460	0.610	1.860	2.020	1.320
28	08-03-16	11:00	35	0	0	35.00	28.00	1.940	2.030	0.790	2.570	0.800	2.090	2.470	0.580	1.860	2.020	1.320
56	05-04-16	14:00	63	0	0	63.00	56.00	2.040	2.070	0.790	2.650	0.840	2.140	2.550	0.580	1.890	2.130	1.360
90	09-05-16	14:00	97	0	0	97.00	90.00	2.060	2.080	0.790	2.660	0.830	2.150	2.560	0.570	1.870	2.130	1.340
120	08-06-16	14:00	127	0	0	127.00	120.00	2.050	2.100	0.770	2.640	0.870	2.160	2.550	0.580	1.860	2.120	1.400
150	08-07-16	12:00	157	0	0	157.00	150.00	2.090	2.110	0.740	2.660	0.820	2.160	2.560	0.560	1.870	2.130	1.360
180	07-08-16	16:00	187	0	0	187.00	180.00	2.100	2.130	0.780	2.710	0.820	2.180	2.590	0.570	1.890	2.160	1.370
210	06-09-16	13:00	217	0	0	217.00	210.00	2.080	2.100	0.720	2.640	0.800	2.150	2.550	0.550	1.840	2.120	1.320
240	06-10-16	12:00	247	0	0	247.00	240.00	2.040	2.090	0.720	2.610	0.760	2.130	2.500	0.510	1.800	2.080	1.300
270	05-11-16	11:00	277	0	0	277.00	270.00	2.060	2.120	0.730	2.690	0.770	2.150	2.550	0.540	1.830	2.120	1.310
300	05-12-16	11:00	307	0	0	307.00	300.00	2.180	2.160	0.790	2.800	0.830	2.210	2.670	0.590	1.910	2.230	1.380
330	04-01-17	14:00	337	0	0	337.00	330.00	2.190	2.180	0.770	2.810	0.810	2.220	2.680	0.610	1.910	2.230	1.380
365	08-02-17	16:00	372	0	0	372.00	365.00	2.180	2.210	0.770	2.800	0.800	2.240	2.690	0.640	1.920	2.250	1.390
400	15-03-17	12:00	407	0	0	407.00	400.00	2.200	2.220	0.770	2.810	0.830	2.240	2.680	0.630	1.920	2.260	1.360
450	04-05-17	17:00	457	0	0	457.00	450.00	2.180	2.200	0.750	2.800	0.800	2.220	2.650	0.570	1.890	2.210	1.340

								SIDE B BOTTOM (‰)										
			Age					920	1200	1300	1400	1500	1600	1700	1800	1900	2000	2280
	Date	**Time**	**Days**	**Hours**	**Minutes**	**Days, eq**	**From loading (days)**	1	2	3	4	5	6	7	8	9	10	11
Casting	02-02-16	11:00	0	0	0	0.000	–	*31*	*31*	*31*	*31*	*31*	*31*	*31*	*31*	*31*	*31*	*31*
Before loading	09-02-16	11:30	7	0	0	7.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5min after loading	09-02-16	13:35	7	0	5	7.003	0.003	1.220	1.620	1.510	0.800	1.570	1.480	1.140	1.690	0.960	1.720	1.200
1h	09-02-16	14:30	7	1	0	7.042	0.042	1.280	1.620	1.560	0.800	1.640	1.510	1.180	1.740	0.990	1.760	1.620
6h	09-02-16	19:30	7	6	0	7.250	0.250	1.330	1.680	1.660	0.830	1.690	1.540	1.210	1.770	1.030	1.810	1.650
1	10-02-16	13:30	8	0	0	8.000	1.000	1.390	1.730	1.620	0.810	1.750	1.560	1.200	1.810	1.040	1.840	1.720
2	11-02-16	16:00	9	0	0	9.000	2.000	1.430	1.770	1.710	0.820	1.760	1.600	1.210	1.840	1.050	1.900	1.780
3	12-02-16	12:00	10	0	0	10.000	3.000	1.400	1.740	1.620	0.800	1.740	1.570	1.190	1.860	1.050	1.890	1.780
4	13-02-16	12:00	11	0	0	11.000	4.000	1.460	1.800	1.750	0.810	1.800	1.610	1.250	1.890	1.070	1.940	1.780
5	14-02-16	20:00	12	0	0	12.000	5.000	1.450	1.820	1.740	0.800	1.810	1.610	1.260	1.900	1.080	1.970	1.810
6	15-02-16	20:00	13	0	0	13.000	6.000	1.490	1.840	1.760	0.820	1.810	1.600	1.210	1.860	1.040	1.890	1.790
7	16-02-16	15:00	14	0	0	14.000	7.000	1.510	1.860	1.760	0.830	1.820	1.640	1.280	1.930	1.120	1.980	1.870
14	23-02-16	16:00	21	0	0	21.00	14.00	1.530	1.860	1.770	0.800	1.870	1.660	1.300	1.930	1.100	1.990	1.940
21	01-03-16	12:00	28	0	0	28.00	21.00	1.580	1.900	1.810	0.790	1.890	1.700	1.280	1.980	1.140	2.100	2.000
28	08-03-16	11:00	35	0	0	35.00	28.00	1.500	1.860	1.770	0.700	1.850	1.610	1.220	1.910	1.070	2.000	1.970
56	05-04-16	14:00	63	0	0	63.00	56.00	1.600	1.950	1.820	0.800	1.910	1.680	1.320	2.020	1.120	2.090	2.120
90	09-05-16	14:00	97	0	0	97.00	90.00	1.600	1.960	1.800	0.780	1.860	1.660	1.300	2.020	1.090	2.130	2.110
120	08-06-16	14:00	127	0	0	127.00	120.00	1.630	1.960	1.790	0.810	1.880	1.690	1.320	2.100	1.110	2.120	2.130
150	08-07-16	12:00	157	0	0	157.00	150.00	1.620	1.980	1.800	0.790	1.880	1.700	1.290	2.050	1.100	2.190	2.190
180	07-08-16	16:00	187	0	0	187.00	180.00	1.650	1.990	1.790	0.770	1.900	1.710	1.310	2.110	1.100	2.210	2.220
210	06-09-16	13:00	217	0	0	217.00	210.00	1.620	1.940	1.760	0.750	1.840	1.650	1.240	2.020	1.050	2.150	2.130
240	06-10-16	12:00	247	0	0	247.00	240.00	1.570	1.920	1.720	0.750	1.820	1.630	1.250	2.050	1.020	2.120	2.130
270	05-11-16	11:00	277	0	0	277.00	270.00	1.630	1.960	1.760	0.760	1.870	1.680	1.290	2.060	1.040	2.230	2.220
300	05-12-16	11:00	307	0	0	307.00	300.00	1.700	2.020	1.810	0.780	1.920	1.700	1.310	2.120	1.090	2.250	2.290
330	04-01-17	14:00	337	0	0	337.00	330.00	1.690	2.040	1.800	0.790	1.930	1.720	1.330	2.090	1.070	2.220	2.340
365	08-02-17	16:00	372	0	0	372.00	365.00	1.680	2.050	1.810	0.770	1.920	1.720	1.320	2.090	1.060	2.260	2.280
400	15-03-17	12:00	407	0	0	407.00	400.00	1.700	2.040	1.800	0.800	1.960	1.730	1.340	2.130	1.100	2.290	2.330
450	04-05-17	17:00	457	0	0	457.00	450.00	1.690	2.050	1.760	0.810	1.930	1.670	1.310	2.120	1.070	2.230	2.210

				σ =	14.22	MPa		SIDE A TOP (‰)										
			Age					920	1200	1300	1400	1500	1600	1700	1800	1900	2000	2280
RAC7	**Date**	**Time**	**Days**	**Hours**	**Minutes**	**Days, eq**	**From loading (days)**	12	13	14	15	16	17	18	19	20	21	22
Casting	02-02-16	11:00	0	0	0	0.000	–	*197*	*197*	*197*	*197*	*197*	*197*	*197*	*197*	*197*	*197*	*197*
Before loading	09-02-16	11:30	7	0	0	7.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5min after loading	09-02-16	13:35	7	0	5	7.003	0.003	-0.600	-0.760	-0.560	-0.800	-0.390	-0.860	-0.710	-0.880	-0.480	-0.820	-0.660
1h	09-02-16	14:30	7	1	0	7.042	0.042	-0.650	-0.800	-0.580	-0.830	-0.410	-0.870	-0.710	-0.880	-0.490	-0.810	-0.550
6h	09-02-16	19:30	7	6	0	7.250	0.250	-0.660	-0.840	-0.630	-0.880	-0.460	-0.940	-0.770	-0.960	-0.540	-0.870	-0.610
1	10-02-16	13:30	8	0	0	8.000	1.000	-0.760	-0.930	-0.720	-0.930	-0.540	-1.030	-0.850	-1.030	-0.620	-0.920	-0.690
2	11-02-16	16:00	9	0	0	9.000	2.000	-0.810	-0.970	-0.770	-1.000	-0.580	-1.070	-0.880	-1.070	-0.650	-0.960	-0.700
3	12-02-16	12:00	10	0	0	10.000	3.000	-0.880	-1.070	-0.850	-1.100	-0.680	-1.170	-0.980	-1.170	-0.760	-1.080	-0.800
4	13-02-16	12:00	11	0	0	11.000	4.000	-0.850	-1.050	-0.830	-1.070	-0.640	-1.130	-0.960	-1.140	-0.700	-1.060	-0.790
5	14-02-16	20:00	12	0	0	12.000	5.000	-0.910	-1.080	-0.860	-1.100	-0.690	-1.160	-0.990	-1.160	-0.760	-1.100	-0.820
6	15-02-16	20:00	13	0	0	13.000	6.000	-0.900	-1.090	-0.880	-1.120	-0.690	-1.200	-1.010	-1.200	-0.770	-1.110	-0.840
7	16-02-16	15:00	14	0	0	14.000	7.000	-0.930	-1.110	-0.890	-1.140	-0.710	-1.200	-1.030	-1.200	-0.790	-1.120	-0.860
14	23-02-16	16:00	21	0	0	21.00	14.00	-1.080	-1.310	-1.100	-1.310	-0.890	-1.370	-1.220	-1.370	-0.960	-1.300	-1.030
21	01-03-16	12:00	28	0	0	28.00	21.00	-1.160	-1.400	-1.180	-1.380	-0.970	-1.440	-1.300	-1.450	-1.050	-1.390	-1.120
28	08-03-16	11:00	35	0	0	35.00	28.00	-1.300	-1.520	-1.260	-1.480	-1.090	-1.570	-1.420	-1.560	-1.180	-1.490	-1.230
56	05-04-16	14:00	63	0	0	63.00	56.00	-1.480	-1.730	-1.490	-1.680	-1.290	-1.770	-1.650	-1.740	-1.370	-1.680	-1.440
90	09-05-16	14:00	97	0	0	97.00	90.00	-1.600	-1.870	-1.600	-1.810	-1.430	-1.880	-1.780	-1.910	-1.520	-1.800	-1.580
120	08-06-16	14:00	127	0	0	127.00	120.00	-1.630	-1.900	-1.630	-1.860	-1.450	-1.910	-1.800	-1.910	-1.550	-1.810	-1.610
150	08-07-16	12:00	157	0	0	157.00	150.00	-1.700	-1.980	-1.700	-1.910	-1.510	-1.970	-1.860	-1.970	-1.610	-1.870	-1.670
180	07-08-16	16:00	187	0	0	187.00	180.00	-1.750	-2.030	-1.780	-1.960	-1.600	-2.050	-1.940	-2.040	-1.690	-1.950	-1.750
210	06-09-16	13:00	217	0	0	217.00	210.00	-1.770	-2.080	-1.820	-2.000	-1.630	-2.080	-1.960	-2.070	-1.710	-1.990	-1.800
240	06-10-16	12:00	247	0	0	247.00	240.00	-1.820	-2.120	-1.870	-2.040	-1.690	-2.120	-2.020	-2.110	-1.780	-2.020	-1.850
270	05-11-16	11:00	277	0	0	277.00	270.00	-1.850	-2.160	-1.890	-2.070	-1.730	-2.140	-2.060	-2.140	-1.800	-2.060	-1.860
300	05-12-16	11:00	307	0	0	307.00	300.00	-1.840	-2.210	-1.910	-2.050	-1.730	-2.160	-2.080	-2.170	-1.810	-2.080	-1.890
330	04-01-17	14:00	337	0	0	337.00	330.00	-1.890	-2.250	-1.970	-2.130	-1.790	-2.190	-2.150	-2.200	-1.860	-2.150	-1.950
365	08-02-17	16:00	372	0	0	372.00	365.00	-1.940	-2.290	-2.010	-2.150	-1.850	-2.240	-2.190	-2.240	-1.920	-2.160	-2.020
400	15-03-17	12:00	407	0	0	407.00	400.00	-1.960	-2.310	-2.030	-2.170	-1.860	-2.260	-2.220	-2.250	-1.930	-2.180	-2.030
450	04-05-17	17:00	457	0	0	457.00	450.00	-1.970	-2.330	-2.060	-2.190	-1.870	-2.240	-2.220	-2.270	-1.960	-2.230	-2.080

								SIDE B TOP (‰)										
			Age					920	1200	1300	1400	1500	1600	1700	1800	1900	2000	2280
	Date	**Time**	**Days**	**Hours**	**Minutes**	**Days, eq**	**From loading (days)**	12	13	14	15	16	17	18	19	20	21	22
Casting	02-02-16	11:00	0	0	0	0.000	–	*197*	*197*	*197*	*197*	*197*	*197*	*197*	*197*	*197*	*197*	*197*
Before loading	09-02-16	11:30	7	0	0	7.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5min after loading	09-02-16	13:35	7	0	5	7.003	0.003	-0.350	-0.630	-0.400	-0.780	-0.510	-0.930	-0.560	-0.700	-0.540	-0.530	-0.420
1h	09-02-16	14:30	7	1	0	7.042	0.042	-0.400	-0.670	-0.570	-0.890	-0.550	-0.900	-0.630	-0.690	-0.570	-0.570	-0.440
6h	09-02-16	19:30	7	6	0	7.250	0.250	-0.410	-0.840	-0.550	-0.940	-0.600	-0.940	-0.720	-0.730	-0.610	-0.610	-0.480
1	10-02-16	13:30	8	0	0	8.000	1.000	-0.500	-0.960	-0.620	-1.030	-0.700	-1.070	-0.790	-0.840	-0.680	-0.710	-0.550
2	11-02-16	16:00	9	0	0	9.000	2.000	-0.550	-1.000	-0.660	-1.050	-0.730	-1.070	-0.850	-0.850	-0.720	-0.730	-0.580
3	12-02-16	12:00	10	0	0	10.000	3.000	-0.610	-1.050	-0.750	-1.120	-0.820	-1.220	-0.910	-0.990	-0.800	-0.860	-0.630
4	13-02-16	12:00	11	0	0	11.000	4.000	-0.600	-1.030	-0.730	-1.140	-0.830	-1.190	-0.930	-0.940	-0.770	-0.810	-0.640
5	14-02-16	20:00	12	0	0	12.000	5.000	-0.650	-1.110	-0.830	-1.180	-0.840	-1.200	-0.960	-0.950	-0.830	-0.840	-0.670
6	15-02-16	20:00	13	0	0	13.000	6.000	-0.630	-1.100	-0.780	-1.150	-0.840	-1.200	-0.980	-0.960	-0.820	-0.810	-0.650
7	16-02-16	15:00	14	0	0	14.000	7.000	-0.660	-1.110	-0.820	-1.190	-0.890	-1.140	-1.050	-1.000	-0.870	-0.880	-0.730
14	23-02-16	16:00	21	0	0	21.00	14.00	-0.820	-1.350	-0.960	-1.340	-1.100	-1.530	-1.240	-1.210	-1.020	-1.040	-0.840
21	01-03-16	12:00	28	0	0	28.00	21.00	-0.920	-1.430	-1.080	-1.410	-1.170	-1.530	-1.280	-1.260	-1.090	-1.100	-0.920
28	08-03-16	11:00	35	0	0	35.00	28.00	-1.080	-1.550	-1.270	-1.610	-1.310	-1.660	-1.510	-1.410	-1.250	-1.310	-1.090
56	05-04-16	14:00	63	0	0	63.00	56.00	-1.240	-1.690	-1.450	-1.740	-1.500	-1.890	-1.630	-1.530	-1.420	-1.470	-1.210
90	09-05-16	14:00	97	0	0	97.00	90.00	-1.340	-1.860	-1.470	-1.850	-1.620	-2.080	-1.720	-1.700	-1.530	-1.600	-1.300
120	08-06-16	14:00	127	0	0	127.00	120.00	-1.370	-1.870	-1.480	-1.870	-1.680	-2.050	-1.740	-1.720	-1.540	-1.590	-1.320
150	08-07-16	12:00	157	0	0	157.00	150.00	-1.470	-1.960	-1.590	-1.950	-1.760	-2.160	-1.830	-1.780	-1.660	-1.730	-1.420
180	07-08-16	16:00	187	0	0	187.00	180.00	-1.510	-2.050	-1.700	-2.030	-1.800	-2.210	-1.900	-1.830	-1.710	-1.760	-1.470
210	06-09-16	13:00	217	0	0	217.00	210.00	-1.550	-2.000	-1.750	-2.060	-1.850	-2.260	-1.840	-1.860	-1.780	-1.820	-1.480
240	06-10-16	12:00	247	0	0	247.00	240.00	-1.560	-2.060	-1.750	-2.080	-1.890	-2.270	-1.930	-1.870	-1.800	-1.830	-1.520
270	05-11-16	11:00	277	0	0	277.00	270.00	-1.590	-2.100	-1.780	-2.100	-1.940	-2.340	-1.980	-1.890	-1.830	-1.830	-1.530
300	05-12-16	11:00	307	0	0	307.00	300.00	-1.650	-2.150	-1.890	-2.150	-1.960	-2.330	-2.020	-1.950	-1.860	-1.870	-1.600
330	04-01-17	14:00	337	0	0	337.00	330.00	-1.680	-2.190	-1.870	-2.190	-2.020	-2.410	-2.060	-1.970	-1.910	-1.950	-1.600
365	08-02-17	16:00	372	0	0	372.00	365.00	-1.730	-2.240	-1.930	-2.230	-2.060	-2.450	-2.140	-2.040	-1.990	-1.990	-1.680
400	15-03-17	12:00	407	0	0	407.00	400.00	-1.720	-2.220	-1.940	-2.240	-2.060	-2.510	-2.090	-2.020	-1.960	-1.990	-1.660
450	04-05-17	17:00	457	0	0	457.00	450.00	-1.740	-2.240	-1.910	-2.220	-2.090	-2.560	-2.130	-2.060	-1.980	-2.080	-1.660

			σ =	14.22		MPa		SIDE A MIDDLE (‰)					
			Age					1500	1600	1700	1500	1600	1700
RAC7	**Date**	**Time**	**Days**	**Hours**	**Minutes**	**Days, eq**	**From loading (days)**	23	24	25	26	27	28
Casting	02-02-16	11:00	0	0	0	0.000	–	*155*	*155*	*155*	*115*	*115*	*115*
Before loading	09-02-16	11:30	7	0	0	7.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5min after loading	09-02-16	13:35	7	0	5	7.003	0.003	-0.190	-0.160	-0.190	0.080	0.460	0.220
1h	09-02-16	14:30	7	1	0	7.042	0.042	-0.150	-0.140	-0.200	0.110	0.490	0.250
6h	09-02-16	19:30	7	6	0	7.250	0.250	-0.200	-0.190	-0.230	0.090	0.450	0.240
1	10-02-16	13:30	8	0	0	8.000	1.000	-0.230	-0.220	-0.270	0.080	0.460	0.220
2	11-02-16	16:00	9	0	0	9.000	2.000	-0.270	-0.240	-0.290	0.090	0.460	0.240
3	12-02-16	12:00	10	0	0	10.000	3.000	-0.350	-0.330	-0.380	0.020	0.380	0.150
4	13-02-16	12:00	11	0	0	11.000	4.000	-0.330	-0.290	-0.350	0.040	0.410	0.190
5	14-02-16	20:00	12	0	0	12.000	5.000	-0.340	-0.330	-0.380	0.010	0.390	0.180
6	15-02-16	20:00	13	0	0	13.000	6.000	-0.330	-0.310	-0.380	0.040	0.400	0.190
7	16-02-16	15:00	14	0	0	14.000	7.000	-0.380	-0.350	-0.410	0.010	0.370	0.160
14	23-02-16	16:00	21	0	0	21.00	14.00	-0.470	-0.430	-0.510	-0.050	0.280	0.110
21	01-03-16	12:00	28	0	0	28.00	21.00	-0.540	-0.490	-0.570	-0.080	0.230	0.070
28	08-03-16	11:00	35	0	0	35.00	28.00	-0.650	-0.580	-0.690	-0.140	0.130	0.000
56	05-04-16	14:00	63	0	0	63.00	56.00	-0.800	-0.710	-0.820	-0.230	0.080	-0.080
90	09-05-16	14:00	97	0	0	97.00	90.00	-0.890	-0.800	-0.930	-0.260	0.000	-0.140
120	08-06-16	14:00	127	0	0	127.00	120.00	-0.910	-0.790	-0.960	-0.280	0.030	-0.160
150	08-07-16	12:00	157	0	0	157.00	150.00	-0.970	-0.860	-1.000	-0.290	0.040	-0.160
180	07-08-16	16:00	187	0	0	187.00	180.00	-1.030	-0.910	-1.060	-0.320	-0.070	-0.200
210	06-09-16	13:00	217	0	0	217.00	210.00	-1.020	-0.910	-1.090	-0.340	-0.090	-0.180
240	06-10-16	12:00	247	0	0	247.00	240.00	-1.070	-0.970	-1.160	-0.370	-0.120	-0.270
270	05-11-16	11:00	277	0	0	277.00	270.00	-1.110	-0.970	-1.130	-0.390	-0.140	-0.280
300	05-12-16	11:00	307	0	0	307.00	300.00	-1.120	-1.000	-1.150	-0.370	-0.120	-0.240
330	04-01-17	14:00	337	0	0	337.00	330.00	-1.170	-1.030	-1.190	-0.400	-0.160	-0.280
365	08-02-17	16:00	372	0	0	372.00	365.00	-1.170	-1.070	-1.230	-0.430	-0.170	-0.300
400	15-03-17	12:00	407	0	0	407.00	400.00	-1.180	-1.050	-1.240	-0.420	-0.170	-0.300
450	04-05-17	17:00	457	0	0	457.00	450.00	-1.230	-1.090	-1.260	-0.450	-0.200	-0.320

								SIDE B MIDDLE (‰)					
			Age					1500	1600	1700	1500	1600	1700
	Date	**Time**	**Days**	**Hours**	**Minutes**	**Days, eq**	**From loading (days)**	23	24	25	26	27	28
Casting	02-02-16	11:00	0	0	0	0.000	–	*155*	*155*	*155*	*115*	*115*	*115*
Before loading	09-02-16	11:30	7	0	0	7.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5min after loading	09-02-16	13:35	7	0	5	7.003	0.003	-0.150	-0.250	-0.210	0.340	0.320	0.260
1h	09-02-16	14:30	7	1	0	7.042	0.042	-0.170	-0.280	-0.210	0.330	0.330	0.250
6h	09-02-16	19:30	7	6	0	7.250	0.250	-0.210	-0.340	-0.230	0.320	0.340	0.260
1	10-02-16	13:30	8	0	0	8.000	1.000	-0.270	-0.370	-0.310	0.290	0.290	0.220
2	11-02-16	16:00	9	0	0	9.000	2.000	-0.270	-0.400	-0.310	0.310	0.290	0.230
3	12-02-16	12:00	10	0	0	10.000	3.000	-0.380	-0.480	-0.400	0.230	0.200	0.150
4	13-02-16	12:00	11	0	0	11.000	4.000	-0.360	-0.500	-0.390	0.230	0.240	0.180
5	14-02-16	20:00	12	0	0	12.000	5.000	-0.360	-0.500	-0.390	0.230	0.240	0.180
6	15-02-16	20:00	13	0	0	13.000	6.000	-0.330	-0.480	-0.330	0.300	0.300	0.270
7	16-02-16	15:00	14	0	0	14.000	7.000	-0.400	-0.530	-0.440	0.220	0.220	0.150
14	23-02-16	16:00	21	0	0	21.00	14.00	-0.530	-0.640	-0.520	0.140	0.150	0.080
21	01-03-16	12:00	28	0	0	28.00	21.00	-0.600	-0.720	-0.570	0.120	0.120	0.090
28	08-03-16	11:00	35	0	0	35.00	28.00	-0.730	-0.860	-0.730	-0.020	-0.010	-0.070
56	05-04-16	14:00	63	0	0	63.00	56.00	-0.850	-0.980	-0.810	-0.060	-0.070	-0.070
90	09-05-16	14:00	97	0	0	97.00	90.00	-0.930	-1.070	-0.930	-0.120	-0.130	-0.120
120	08-06-16	14:00	127	0	0	127.00	120.00	-0.930	-1.070	-0.910	-0.110	-0.140	-0.090
150	08-07-16	12:00	157	0	0	157.00	150.00	-1.050	-1.180	-0.990	-0.190	-0.210	-0.190
180	07-08-16	16:00	187	0	0	187.00	180.00	-1.070	-1.200	-1.050	-0.230	-0.230	-0.200
210	06-09-16	13:00	217	0	0	217.00	210.00	-1.110	-1.250	-1.080	-0.260	-0.260	-0.190
240	06-10-16	12:00	247	0	0	247.00	240.00	-1.110	-1.300	-1.090	-0.280	-0.270	-0.250
270	05-11-16	11:00	277	0	0	277.00	270.00	-1.160	-1.280	-1.100	-0.270	-0.280	-0.250
300	05-12-16	11:00	307	0	0	307.00	300.00	-1.200	-1.310	-1.160	-0.310	-0.310	-0.240
330	04-01-17	14:00	337	0	0	337.00	330.00	-1.210	-1.360	-1.150	-0.320	-0.310	-0.240
365	08-02-17	16:00	372	0	0	372.00	365.00	-1.240	-1.430	-1.200	-0.360	-0.340	-0.280
400	15-03-17	12:00	407	0	0	407.00	400.00	-1.230	-1.400	-1.200	-0.340	-0.350	-0.200
450	04-05-17	17:00	457	0	0	457.00	450.00	-1.230	-1.380	-1.220	-0.350	-0.390	-0.190

	RAC28				0	5m	1h	6h	1d	2d
	A	BOTTOM								
	From (mm)	To (mm)	Disks		01-03-16	01-03-16	01-03-16	01-03-16	02-03-16	03-03-16
1	870	970	1	2	-0.202	-0.17	-0.162	-0.158	-0.154	-0.15
2	1150	1250	3	4	-0.168	-0.073	-0.071	-0.065	-0.058	-0.054
3	1250	1350	4	5	-0.152	-0.073	-0.065	-0.062	-0.053	-0.052
4	1350	1450	5	6	-1.578	-1.474	-1.466	-1.461	-1.453	-1.451
5	1450	1550	6	7	-0.16	-0.1	-0.096	-0.094	-0.087	-0.083
6	1550	1650	7	8	-0.007	-0.016	-0.013	-0.018	-0.015	-0.017
7	1650	1750	8	9	-0.01	0.118	0.13	0.138	0.152	0.158
8	1750	1850	9	10	-0.097	-0.008	-0.003	-0.002	0.006	0.009
9	1850	1950	10	11	-0.181	-0.137	-0.128	-0.129	-0.122	-0.117
10	1950	2050	11	12	-0.467	-0.343	-0.332	-0.328	-0.32	-0.316
11	2230	2330	13	14	-0.117	-0.129	-0.126	-0.131	-0.133	-0.132
	A	TOP								
	From (mm)	To (mm)	Disks							
12	870	970	15	16	-0.13	-0.158	-0.159	-0.159	-0.167	-0.166
13	1150	1250	17	18	-0.519	-0.567	-0.565	-0.57	-0.577	-0.578
14	1250	1350	18	19	-0.35	-0.387	-0.387	-0.389	-0.395	-0.397
15	1350	1450	19	20	-0.143	-0.186	-0.18	-0.19	-0.197	-0.197
16	1450	1550	20	21	-0.156	-0.189	-0.189	-0.192	-0.199	-0.2
17	1550	1650	21	22	-0.267	-0.317	-0.314	-0.32	-0.328	-0.327
18	1650	1750	22	23	-0.234	-0.267	-0.268	-0.271	-0.277	-0.278
19	1750	1850	23	24	-0.396	-0.434	-0.436	-0.439	-0.443	-0.448
20	1850	1950	24	25	-0.328	-0.368	-0.369	-0.371	-0.377	-0.384
21	1950	2050	25	26	-0.217	-0.258	-0.258	-0.264	-0.268	-0.27
22	2230	2330	27	28	-0.25	-0.29	-0.288	-0.292	-0.299	-0.298
	A	MIDDLE								
	From (mm)	To (mm)	Disks							
23	1450	1550	29	30	-0.279	-0.292	-0.29	-0.294	-0.294	-0.294
24	1550	1650	30	31	-0.237	-0.248	-0.249	-0.252	-0.255	-0.253
25	1650	1750	31	32	-0.53	-0.541	-0.539	-0.542	-0.545	-0.546
26	1450	1550	33	34	-0.563	-0.552	-0.551	-0.552	-0.55	-0.55
27	1550	1650	34	35	0.281	0.308	0.31	0.308	0.31	0.312
28	1650	1750	35	36	-0.387	-0.385	-0.387	-0.387	-0.387	-0.382

					0	5m	1h	6h	1d	2d
	B	BOTTOM								
	From (mm)	To (mm)	Disks		01-03-16	01-03-16	01-03-16	01-03-16	02-03-16	03-03-16
1	870	970	1	2	-0.231	-0.146	-0.147	-0.145	-0.141	-0.136
2	1150	1250	3	4	-0.138	-0.026	-0.019	-0.014	-0.009	-0.006
3	1250	1350	4	5	-0.619	-0.574	-0.573	-0.564	-0.56	-0.555
4	1350	1450	5	6	-0.42	-0.307	-0.302	-0.294	-0.29	-0.283
5	1450	1550	6	7	-0.83	-0.813	-0.813	-0.81	-0.806	-0.805
6	1550	1650	7	8	-0.246	-0.079	-0.073	-0.063	-0.053	-0.044
7	1650	1750	8	9	-0.423	-0.426	-0.428	-0.429	-0.431	-0.431
8	1750	1850	9	10	-0.581	-0.476	-0.471	-0.464	-0.458	-0.454
9	1850	1950	10	11	-0.586	-0.503	-0.497	-0.49	-0.486	-0.486
10	1950	2050	11	12	-0.227	-0.127	-0.127	-0.115	-0.115	-0.107
11	2230	2330	13	14	-0.007	0.03	0.034	0.039	0.043	0.049
	B	TOP								
	From (mm)	To (mm)	Disks							
12	870	970	15	16	2.07	2.035	2.032	2.031	2.026	2.024
13	1150	1250	17	18	-0.246	-0.29	-0.291	-0.297	-0.298	-0.303
14	1250	1350	18	19	-0.321	-0.358	-0.359	-0.361	-0.368	-0.372
15	1350	1450	19	20	-0.191	-0.231	-0.233	-0.234	-0.241	-0.243
16	1450	1550	20	21	-0.222	-0.263	-0.265	-0.267	-0.273	-0.276
17	1550	1650	21	22	-0.412	-0.459	-0.462	-0.462	-0.469	-0.473
18	1650	1750	22	23	-0.553	-0.596	-0.599	-0.603	-0.607	-0.611
19	1750	1850	23	24	-0.498	-0.533	-0.537	-0.541	-0.544	-0.547
20	1850	1950	24	25	-0.013	-0.052	-0.055	-0.061	-0.066	-0.065
21	1950	2050	25	26	-1.089	-1.127	-1.13	-1.133	-1.138	-1.14
22	2230	2330	27	28	0.453	0.418	0.413	0.411	0.404	0.401
	B	MIDDLE								
	From (mm)	To (mm)	Disks							
23	1450	1550	29	30	-0.198	-0.21	-0.213	-0.215	-0.218	-0.219
24	1550	1650	30	31	-0.024	-0.037	-0.036	-0.042	-0.044	-0.045
25	1650	1750	31	32	-0.538	-0.55	-0.553	-0.556	-0.559	-0.56
26	1450	1550	33	34	-0.205	-0.201	-0.202	-0.204	-0.203	-0.204
27	1550	1650	34	35	-0.06	-0.031	-0.031	-0.031	-0.029	-0.026
28	1650	1750	35	36	-0.878	-0.88	-0.882	-0.885	-0.885	-0.884

RAC28					3d	4d	5d	6d	7d	14d
	A	BOTTOM								
	From (mm)	To (mm)	Disks		04-03-16	05-03-16	06-03-16	07-03-16	08-03-16	15-03-16
1	870	970	1	2	-0.151	-0.15	-0.151	-0.147	-0.151	-0.149
2	1150	1250	3	4	-0.056	-0.049	-0.051	-0.049	-0.052	-0.046
3	1250	1350	4	5	-0.051	-0.048	-0.048	-0.046	-0.05	-0.045
4	1350	1450	5	6	-1.45	-1.449	-1.449	-1.446	-1.448	-1.443
5	1450	1550	6	7	-0.084	-0.084	-0.082	-0.08	-0.085	-0.081
6	1550	1650	7	8	-0.019	-0.02	-0.019	-0.018	-0.023	-0.025
7	1650	1750	8	9	0.16	0.164	0.164	0.167	0.164	0.174
8	1750	1850	9	10	0.01	0.012	0.008	0.013	0.008	0.012
9	1850	1950	10	11	-0.122	-0.119	-0.12	-0.116	-0.122	-0.118
10	1950	2050	11	12	-0.316	-0.312	-0.315	-0.311	-0.313	-0.308
11	2230	2330	13	14	-0.136	-0.135	-0.134	-0.135	-0.14	-0.145
	A	TOP								
	From (mm)	To (mm)	Disks							
12	870	970	15	16	-0.173	-0.172	-0.174	-0.172	-0.18	-0.191
13	1150	1250	17	18	-0.583	-0.581	-0.584	-0.585	-0.589	-0.597
14	1250	1350	18	19	-0.404	-0.401	-0.402	-0.404	-0.41	-0.417
15	1350	1450	19	20	-0.199	-0.201	-0.202	-0.204	-0.211	-0.218
16	1450	1550	20	21	-0.204	-0.205	-0.206	-0.206	-0.211	-0.218
17	1550	1650	21	22	-0.332	-0.333	-0.335	-0.337	-0.342	-0.352
18	1650	1750	22	23	-0.284	-0.285	-0.285	-0.285	-0.291	-0.297
19	1750	1850	23	24	-0.45	-0.45	-0.451	-0.452	-0.457	-0.466
20	1850	1950	24	25	-0.378	-0.383	-0.388	-0.394	-0.388	-0.399
21	1950	2050	25	26	-0.272	-0.273	-0.276	-0.275	-0.28	-0.29
22	2230	2330	27	28	-0.305	-0.304	-0.306	-0.307	-0.311	-0.32
	A	MIDDLE								
	From (mm)	To (mm)	Disks							
23	1450	1550	29	30	-0.298	-0.296	-0.298	-0.299	-0.303	-0.309
24	1550	1650	30	31	-0.256	-0.256	-0.258	-0.259	-0.264	-0.268
25	1650	1750	31	32	-0.547	-0.547	-0.548	-0.551	-0.554	-0.56
26	1450	1550	33	34	-0.552	-0.549	-0.551	-0.551	-0.555	-0.557
27	1550	1650	34	35	0.309	0.31	0.308	0.309	0.305	0.304
28	1650	1750	35	36	-0.391	-0.39	-0.389	-0.39	-0.393	-0.397

					3d	4d	5d	6d	7d	14d
	B	BOTTOM								
	From (mm)	To (mm)	Disks		04-03-16	05-03-16	06-03-16	07-03-16	08-03-16	15-03-16
1	870	970	1	2	-0.135	-0.126	-0.131	-0.134	-0.133	-0.13
2	1150	1250	3	4	-0.005	-0.001	0.005	0	0	0.003
3	1250	1350	4	5	-0.557	-0.552	-0.553	-0.554	-0.556	-0.557
4	1350	1450	5	6	-0.282	-0.28	-0.277	-0.278	-0.281	-0.274
5	1450	1550	6	7	-0.805	-0.803	-0.804	-0.804	-0.808	-0.807
6	1550	1650	7	8	-0.043	-0.037	-0.036	-0.036	-0.039	-0.026
7	1650	1750	8	9	-0.432	-0.431	-0.434	-0.434	-0.436	-0.439
8	1750	1850	9	10	-0.454	-0.452	-0.449	-0.448	-0.453	-0.445
9	1850	1950	10	11	-0.483	-0.479	-0.48	-0.48	-0.481	-0.481
10	1950	2050	11	12	-0.111	-0.106	-0.106	-0.107	-0.107	-0.106
11	2230	2330	13	14	0.047	0.051	0.05	0.051	0.049	0.05
	B	TOP								
	From (mm)	To (mm)	Disks							
12	870	970	15	16	2.024	2.021	2.019	2.019	2.013	2.004
13	1150	1250	17	18	-0.305	-0.305	-0.308	-0.307	-0.311	-0.321
14	1250	1350	18	19	-0.375	-0.375	-0.375	-0.378	-0.382	-0.392
15	1350	1450	19	20	-0.248	-0.249	-0.249	-0.252	-0.253	-0.266
16	1450	1550	20	21	-0.279	-0.283	-0.283	-0.284	-0.289	-0.3
17	1550	1650	21	22	-0.477	-0.478	-0.482	-0.481	-0.486	-0.495
18	1650	1750	22	23	-0.613	-0.613	-0.614	-0.616	-0.62	-0.63
19	1750	1850	23	24	-0.551	-0.55	-0.553	-0.553	-0.558	-0.568
20	1850	1950	24	25	-0.07	-0.071	-0.073	-0.073	-0.079	-0.089
21	1950	2050	25	26	-1.145	-1.147	-1.145	-1.148	-1.153	-1.16
22	2230	2330	27	28	0.398	0.399	0.397	0.397	0.391	0.38
	B	MIDDLE								
	From (mm)	To (mm)	Disks							
23	1450	1550	29	30	-0.223	-0.221	-0.222	-0.224	-0.227	-0.235
24	1550	1650	30	31	-0.049	-0.047	-0.049	-0.048	-0.053	-0.063
25	1650	1750	31	32	-0.563	-0.56	-0.562	-0.564	-0.567	-0.576
26	1450	1550	33	34	-0.206	-0.205	-0.207	-0.207	-0.211	-0.117
27	1550	1650	34	35	-0.03	-0.027	-0.026	-0.029	-0.034	-0.038
28	1650	1750	35	36	-0.888	-0.887	-0.887	-0.891	-0.893	-0.9

	RAC28				21d	28d	56d	90d	120d	150d
	A	BOTTOM								
	From (mm)	To (mm)	Disks		22-03-16	29-03-16	26-04-16	30-05-16	29-06-16	29-07-16
1	870	970	1	2	-0.144	-0.146	-0.147	-0.152	-0.151	-0.149
2	1150	1250	3	4	-0.047	-0.043	-0.038	-0.044	-0.038	-0.035
3	1250	1350	4	5	-0.04	-0.039	-0.034	-0.041	-0.038	-0.033
4	1350	1450	5	6	-1.439	-1.436	-1.43	-1.435	-1.433	-1.431
5	1450	1550	6	7	-0.077	-0.076	-0.072	-0.077	-0.075	-0.071
6	1550	1650	7	8	-0.026	-0.029	-0.03	-0.033	-0.032	-0.036
7	1650	1750	8	9	0.181	0.184	0.194	0.184	0.193	0.2
8	1750	1850	9	10	0.015	0.016	0.022	0.017	0.022	0.025
9	1850	1950	10	11	-0.118	-0.114	-0.11	-0.115	-0.111	-0.11
10	1950	2050	11	12	-0.301	-0.299	-0.292	-0.297	-0.294	-0.289
11	2230	2330	13	14	-0.146	-0.147	-0.148	-0.151	-0.15	-0.154
	A	TOP								
	From (mm)	To (mm)	Disks							
12	870	970	15	16	-0.191	-0.198	-0.21	-0.22	-0.224	-0.233
13	1150	1250	17	18	-0.601	-0.609	-0.619	-0.628	-0.633	-0.64
14	1250	1350	18	19	-0.42	-0.426	-0.435	-0.446	-0.452	-0.456
15	1350	1450	19	20	-0.222	-0.227	-0.236	-0.245	-0.251	-0.258
16	1450	1550	20	21	-0.226	-0.229	-0.241	-0.25	-0.253	-0.262
17	1550	1650	21	22	-0.356	-0.363	-0.372	-0.383	-0.387	-0.397
18	1650	1750	22	23	-0.305	-0.31	-0.319	-0.328	-0.332	-0.342
19	1750	1850	23	24	-0.469	-0.472	-0.49	-0.498	-0.502	-0.51
20	1850	1950	24	25	-0.409	-0.415	-0.423	-0.427	-0.434	-0.441
21	1950	2050	25	26	-0.294	-0.297	-0.313	-0.32	-0.325	-0.332
22	2230	2330	27	28	-0.327	-0.332	-0.344	-0.352	-0.356	-0.365
	A	MIDDLE								
	From (mm)	To (mm)	Disks							
23	1450	1550	29	30	-0.313	-0.315	-0.325	-0.334	-0.335	-0.341
24	1550	1650	30	31	-0.274	-0.275	-0.284	-0.292	-0.296	-0.3
25	1650	1750	31	32	-0.565	-0.567	-0.573	-0.583	-0.586	-0.593
26	1450	1550	33	34	-0.559	-0.561	-0.561	-0.57	-0.57	-0.574
27	1550	1650	34	35	0.299	0.298	0.294	0.286	0.285	0.28
28	1650	1750	35	36	-0.402	-0.403	-0.408	-0.413	-0.416	-0.421

					21d	28d	56d	90d	120d	150d
	B	BOTTOM								
	From (mm)	To (mm)	Disks		22-03-16	29-03-16	26-04-16	30-05-16	29-06-16	29-07-16
1	870	970	1	2	-0.127	-0.126	-0.121	-0.129	-0.119	-0.112
2	1150	1250	3	4	0.008	0.006	0.009	0.006	0.01	0.013
3	1250	1350	4	5	-0.547	-0.549	-0.544	-0.55	-0.545	-0.545
4	1350	1450	5	6	-0.269	-0.267	-0.264	-0.268	-0.265	-0.26
5	1450	1550	6	7	-0.805	-0.805	-0.805	-0.806	-0.804	-0.807
6	1550	1650	7	8	-0.018	-0.017	-0.006	-0.011	-0.003	0.002
7	1650	1750	8	9	-0.44	-0.444	-0.446	-0.451	-0.445	-0.45
8	1750	1850	9	10	-0.442	-0.441	-0.434	-0.441	-0.43	-0.434
9	1850	1950	10	11	-0.475	-0.472	-0.468	-0.476	-0.468	-0.471
10	1950	2050	11	12	-0.095	-0.095	-0.085	-0.089	-0.084	-0.085
11	2230	2330	13	14	0.055	0.055	0.062	0.057	0.063	0.062
	B	TOP								
	From (mm)	To (mm)	Disks							
12	870	970	15	16	1.997	1.988	1.977	1.97	1.972	1.959
13	1150	1250	17	18	-0.324	-0.332	-0.343	-0.348	-0.349	-0.356
14	1250	1350	18	19	-0.394	-0.405	-0.414	-0.422	-0.428	-0.437
15	1350	1450	19	20	-0.267	-0.274	-0.283	-0.2891	-0.299	-0.304
16	1450	1550	20	21	-0.304	-0.312	-0.321	-0.328	-0.337	-0.343
17	1550	1650	21	22	-0.5	-0.507	-0.52	-0.525	-0.533	-0.542
18	1650	1750	22	23	-0.631	-0.639	-0.651	-0.653	-0.661	-0.667
19	1750	1850	23	24	-0.57	-0.579	-0.591	-0.597	-0.606	-0.612
20	1850	1950	24	25	-0.089	-0.098	-0.11	-0.112	-0.123	-0.129
21	1950	2050	25	26	-1.161	-1.168	-1.18	-1.184	-1.191	-1.198
22	2230	2330	27	28	0.378	0.371	0.357	0.352	0.344	0.339
	B	MIDDLE								
	From (mm)	To (mm)	Disks							
23	1450	1550	29	30	-0.237	-0.243	-0.251	-0.256	-0.262	-0.266
24	1550	1650	30	31	-0.064	-0.068	-0.078	-0.084	-0.09	-0.094
25	1650	1750	31	32	-0.577	-0.583	-0.588	-0.591	-0.597	-0.601
26	1450	1550	33	34	-0.117	-0.122	-0.126	-0.13	-0.133	-0.137
27	1550	1650	34	35	-0.034	-0.04	-0.043	-0.049	-0.052	-0.052
28	1650	1750	35	36	-0.899	-0.903	-0.905	-0.907	-0.91	-0.913

	RAC28				180d	210d	240d	270d	300d	330d
	A	**BOTTOM**								
	From (mm)	To (mm)	Disks		28-08-16	27-09-16	27-10-16	26-11-16	26-12-16	25-01-17
1	870	970	1	2	-0.15	-0.151	-0.149	-0.152	-0.149	-0.149
2	1150	1250	3	4	-0.037	-0.038	-0.035	-0.036	-0.03	-0.029
3	1250	1350	4	5	-0.035	-0.038	-0.035	-0.038	-0.029	-0.029
4	1350	1450	5	6	-1.43	-1.432	-1.428	-1.423	-1.42	-1.419
5	1450	1550	6	7	-0.073	-0.073	-0.068	-0.067	-0.065	-0.067
6	1550	1650	7	8	-0.037	-0.036	-0.036	-0.043	-0.042	-0.046
7	1650	1750	8	9	0.198	0.194	0.201	0.208	0.216	0.219
8	1750	1850	9	10	0.023	0.022	0.025	0.026	0.027	0.032
9	1850	1950	10	11	-0.113	-0.114	-0.11	-0.113	-0.108	-0.105
10	1950	2050	11	12	-0.29	-0.29	-0.288	-0.288	-0.281	-0.278
11	2230	2330	13	14	-0.156	-0.155	-0.156	-0.16	-0.16	-0.162
	A	**TOP**								
	From (mm)	To (mm)	Disks							
12	870	970	15	16	-0.233	-0.236	-0.236	-0.246	-0.248	-0.253
13	1150	1250	17	18	-0.643	-0.645	-0.645	-0.655	-0.659	-0.666
14	1250	1350	18	19	-0.461	-0.465	-0.465	-0.471	-0.474	-0.478
15	1350	1450	19	20	-0.261	-0.263	-0.265	-0.27	-0.274	-0.279
16	1450	1550	20	21	-0.266	-0.269	-0.271	-0.274	-0.281	-0.285
17	1550	1650	21	22	-0.401	-0.407	-0.404	-0.405	-0.413	-0.418
18	1650	1750	22	23	-0.346	-0.349	-0.351	-0.352	-0.361	-0.367
19	1750	1850	23	24	-0.51	-0.514	-0.515	-0.519	-0.525	-0.531
20	1850	1950	24	25	-0.446	-0.45	-0.45	-0.448	-0.461	-0.465
21	1950	2050	25	26	-0.334	-0.34	-0.34	-0.339	-0.348	-0.355
22	2230	2330	27	28	-0.368	-0.371	-0.372	-0.374	-0.384	-0.392
	A	**MIDDLE**								
	From (mm)	To (mm)	Disks							
23	1450	1550	29	30	-0.345	-0.348	-0.347	-0.348	-0.355	-0.361
24	1550	1650	30	31	-0.304	-0.308	-0.306	-0.308	-0.313	-0.318
25	1650	1750	31	32	-0.596	-0.599	-0.598	-0.597	-0.606	-0.61
26	1450	1550	33	34	-0.578	-0.579	-0.577	-0.578	-0.581	-0.585
27	1550	1650	34	35	0.278	0.275	0.277	0.278	0.273	0.27
28	1650	1750	35	36	-0.423	-0.426	-0.424	-0.424	-0.429	-0.435

					180d	210d	240d	270d	300d	330d
	B	**BOTTOM**								
	From (mm)	To (mm)	Disks		28-08-16	27-09-16	27-10-16	26-11-16	26-12-16	25-01-17
1	870	970	1	2	-0.117	-0.121	-0.12	-0.115	-0.111	-0.111
2	1150	1250	3	4	0.012	0.011	0.013	0.008	0.016	0.017
3	1250	1350	4	5	-0.546	-0.55	-0.546	-0.545	-0.54	-0.538
4	1350	1450	5	6	-0.256	-0.259	-0.253	-0.259	-0.248	-0.244
5	1450	1550	6	7	-0.806	-0.807	-0.805	-0.813	-0.809	-0.809
6	1550	1650	7	8	0	0	0.003	0.005	0.015	0.018
7	1650	1750	8	9	-0.45	-0.451	-0.449	-0.46	-0.455	-0.455
8	1750	1850	9	10	-0.433	-0.434	-0.433	-0.438	-0.427	-0.425
9	1850	1950	10	11	-0.473	-0.47	-0.47	-0.47	-0.462	-0.466
10	1950	2050	11	12	-0.085	-0.082	-0.082	-0.081	-0.074	-0.072
11	2230	2330	13	14	0.062	0.066	0.063	0.06	0.069	0.072
	B	**TOP**								
	From (mm)	To (mm)	Disks							
12	870	970	15	16	1.954	1.953	1.95	1.942	1.938	1.929
13	1150	1250	17	18	-0.36	-0.367	-0.362	-0.374	-0.377	-0.381
14	1250	1350	18	19	-0.44	-0.443	-0.444	-0.449	-0.453	-0.458
15	1350	1450	19	20	-0.309	-0.312	-0.311	-0.319	-0.321	-0.327
16	1450	1550	20	21	-0.348	-0.353	-0.353	-0.356	-0.361	-0.369
17	1550	1650	21	22	-0.544	-0.549	-0.549	-0.556	-0.56	-0.569
18	1650	1750	22	23	-0.672	-0.677	-0.675	-0.68	-0.684	-0.69
19	1750	1850	23	24	-0.616	-0.622	-0.621	-0.624	-0.624	-0.634
20	1850	1950	24	25	-0.135	-0.136	-0.137	-0.143	-0.144	-0.154
21	1950	2050	25	26	-1.202	-1.205	-1.204	-1.209	-1.212	-1.218
22	2230	2330	27	28	0.335	0.327	0.331	0.322	0.317	0.314
	B	**MIDDLE**								
	From (mm)	To (mm)	Disks							
23	1450	1550	29	30	-0.27	-0.274	-0.275	-0.277	-0.281	-0.285
24	1550	1650	30	31	-0.097	-0.1	-0.099	-0.105	-0.107	-0.112
25	1650	1750	31	32	-0.607	-0.61	-0.608	-0.61	-0.615	-0.618
26	1450	1550	33	34	-0.141	-0.146	-0.142	-0.144	-0.148	-0.152
27	1550	1650	34	35	-0.057	-0.062	-0.057	-0.058	-0.058	-0.06
28	1650	1750	35	36	-0.917	-0.92	-0.917	-0.921	-0.923	-0.928

	RAC28				360d	400d	450d
	A	**BOTTOM**					
	From (mm)	To (mm)	Disks		30-12-00	03-02-01	25-03-01
1	870	970	1	2	-0.15	-0.151	-0.147
2	1150	1250	3	4	-0.035	-0.033	-0.03
3	1250	1350	4	5	-0.032	-0.03	-0.027
4	1350	1450	5	6	-1.419	-1.422	-1.419
5	1450	1550	6	7	-0.068	-0.068	-0.062
6	1550	1650	7	8	-0.047	-0.046	-0.039
7	1650	1750	8	9	0.213	0.213	0.216
8	1750	1850	9	10	0.025	0.028	0.03
9	1850	1950	10	11	-0.112	-0.113	-0.108
10	1950	2050	11	12	-0.286	-0.282	-0.28
11	2230	2330	13	14	-0.164	-0.164	-0.159
	A	**TOP**					
	From (mm)	To (mm)	Disks				
12	870	970	15	16	-0.256	-0.258	-0.256
13	1150	1250	17	18	-0.668	-0.669	-0.664
14	1250	1350	18	19	-0.485	-0.486	-0.484
15	1350	1450	19	20	-0.283	-0.284	-0.279
16	1450	1550	20	21	-0.29	-0.291	-0.288
17	1550	1650	21	22	-0.427	-0.425	-0.42
18	1650	1750	22	23	-0.37	-0.374	-0.368
19	1750	1850	23	24	-0.53	-0.534	-0.532
20	1850	1950	24	25	-0.47	-0.472	-0.468
21	1950	2050	25	26	-0.358	-0.361	-0.357
22	2230	2330	27	28	-0.395	-0.396	-0.394
	A	**MIDDLE**					
	From (mm)	To (mm)	Disks				
23	1450	1550	29	30	-0.362	-0.363	-0.362
24	1550	1650	30	31	-0.321	-0.323	-0.319
25	1650	1750	31	32	-0.613	-0.614	-0.612
26	1450	1550	33	34	-0.588	-0.587	-0.587
27	1550	1650	34	35	0.265	0.266	0.268
28	1650	1750	35	36	-0.437	-0.437	-0.434

					360d	400d	450d
	B	**BOTTOM**					
	From (mm)	To (mm)	Disks		30-12-00	03-02-01	25-03-01
1	870	970	1	2	-0.115	-0.113	-0.113
2	1150	1250	3	4	0.014	0.015	0.018
3	1250	1350	4	5	-0.543	-0.54	-0.538
4	1350	1450	5	6	-0.254	-0.247	-0.246
5	1450	1550	6	7	-0.81	-0.808	-0.804
6	1550	1650	7	8	0.014	0.017	0.016
7	1650	1750	8	9	-0.457	-0.457	-0.451
8	1750	1850	9	10	-0.43	-0.428	-0.426
9	1850	1950	10	11	-0.468	-0.465	-0.464
10	1950	2050	11	12	-0.077	-0.075	-0.066
11	2230	2330	13	14	0.066	0.069	0.071
	B	**TOP**					
	From (mm)	To (mm)	Disks				
12	870	970	15	16	1.928	1.925	1.931
13	1150	1250	17	18	-0.387	-0.385	-0.382
14	1250	1350	18	19	-0.464	-0.465	-0.461
15	1350	1450	19	20	-0.331	-0.332	-0.327
16	1450	1550	20	21	-0.372	-0.372	-0.369
17	1550	1650	21	22	-0.572	-0.572	-0.567
18	1650	1750	22	23	-0.694	-0.697	-0.691
19	1750	1850	23	24	-0.636	-0.639	-0.634
20	1850	1950	24	25	-0.156	-0.158	-0.155
21	1950	2050	25	26	-1.223	-1.223	-1.218
22	2230	2330	27	28	0.308	0.307	0.31
	B	**MIDDLE**					
	From (mm)	To (mm)	Disks				
23	1450	1550	29	30	-0.29	-0.292	-0.287
24	1550	1650	30	31	-0.115	-0.116	-0.111
25	1650	1750	31	32	-0.619	-0.621	-0.619
26	1450	1550	33	34	-0.155	-0.156	-0.153
27	1550	1650	34	35	-0.066	-0.065	-0.063
28	1650	1750	35	36	-0.928	-0.928	-0.924

			σ =	12.32	MPa		SIDE A BOTTOM (‰)										
			Age				920	1200	1300	1400	1500	1600	1700	1800	1900	2000	2280
RAC28	Date	Time	Days	Hours	Minutes	Days, eq	From loading (days)	1	2	3	4	5	6	7	8	9	10	11
Casting	02-02-16	11:00	0	0	0	0.000	–	*31*	*31*	*31*	*31*	*31*	*31*	*31*	*31*	*31*	*31*	*31*
Before loading	01-03-16	13:55	28	0	0	28.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5min after loading	01-03-16	14:05	28	0	5	28.003	0.003	0.320	0.950	0.790	1.040	0.600	-0.090	1.280	0.890	0.440	1.240	-0.120
1h	01-03-16	15:00	28	1	0	28.042	0.042	0.400	0.970	0.870	1.120	0.640	-0.060	1.400	0.940	0.530	1.350	-0.090
6h	01-03-16	20:00	28	6	0	28.250	0.250	0.440	1.030	0.900	1.170	0.660	-0.110	1.480	0.950	0.520	1.390	-0.140
1	02-03-16	13:00	29	0	0	29.000	1.000	0.480	1.100	0.990	1.250	0.730	-0.080	1.620	1.030	0.590	1.470	-0.160
2	03-03-16	14:00	30	0	0	30.000	2.000	0.520	1.140	1.000	1.270	0.770	-0.100	1.680	1.060	0.640	1.510	-0.150
3	04-03-16	13:00	31	0	0	31.000	3.000	0.510	1.120	1.010	1.280	0.760	-0.120	1.700	1.070	0.590	1.510	-0.190
4	05-03-16	14:00	32	0	0	32.000	4.000	0.520	1.190	1.040	1.290	0.760	-0.130	1.740	1.090	0.620	1.550	-0.180
5	06-03-16	17:00	33	0	0	33.000	5.000	0.510	1.170	1.040	1.290	0.780	-0.120	1.740	1.050	0.610	1.520	-0.170
6	07-03-16	16:00	34	0	0	34.000	6.000	0.550	1.190	1.060	1.320	0.800	-0.110	1.770	1.100	0.650	1.560	-0.180
7	08-03-16	11:00	35	0	0	35.000	7.000	0.510	1.160	1.020	1.300	0.750	-0.160	1.740	1.050	0.590	1.540	-0.230
14	15-03-16	18:00	42	0	0	42.00	14.00	0.530	1.220	1.070	1.350	0.790	-0.180	1.840	1.090	0.630	1.590	-0.280
21	22-03-16	11:00	49	0	0	49.00	21.00	0.580	1.210	1.120	1.390	0.830	-0.190	1.910	1.120	0.630	1.660	-0.290
28	29-03-16	12:00	56	0	0	56.00	28.00	0.560	1.250	1.130	1.420	0.840	-0.220	1.940	1.130	0.670	1.680	-0.300
56	26-04-16	14:00	84	0	0	84.00	56.00	0.550	1.300	1.180	1.480	0.880	-0.230	2.040	1.190	0.710	1.750	-0.310
90	30-05-16	11:00	118	0	0	118.00	90.00	0.500	1.240	1.110	1.430	0.830	-0.260	1.940	1.140	0.660	1.700	-0.340
120	29-06-16	15:00	148	0	0	148.00	120.00	0.510	1.300	1.140	1.450	0.850	-0.250	2.030	1.190	0.700	1.730	-0.330
150	29-07-16	13:00	178	0	0	178.00	150.00	0.530	1.330	1.190	1.470	0.890	-0.290	2.100	1.220	0.710	1.780	-0.370
180	28-08-16	12:00	208	0	0	208.00	180.00	0.520	1.310	1.170	1.480	0.870	-0.300	2.080	1.200	0.680	1.770	-0.390
210	27-09-16	14:00	238	0	0	238.00	210.00	0.510	1.300	1.140	1.460	0.870	-0.290	2.040	1.190	0.670	1.770	-0.380
240	27-10-16	11:00	268	0	0	268.00	240.00	0.530	1.330	1.170	1.500	0.920	-0.290	2.110	1.220	0.710	1.790	-0.390
270	26-11-16	13:00	298	0	0	298.00	270.00	0.500	1.320	1.140	1.550	0.930	-0.360	2.180	1.230	0.680	1.790	-0.430
300	26-12-16	15:00	328	0	0	328.00	300.00	0.530	1.380	1.230	1.580	0.950	-0.350	2.260	1.240	0.730	1.860	-0.430
330	25-01-17	10:00	358	0	0	358.00	330.00	0.530	1.390	1.230	1.590	0.930	-0.390	2.290	1.290	0.760	1.890	-0.450
365	01-03-17	11:00	393	0	0	393.00	365.00	0.520	1.330	1.200	1.590	0.920	-0.400	2.230	1.220	0.690	1.810	-0.470
400	05-04-17	12:00	428	0	0	428.00	400.00	0.510	1.350	1.220	1.560	0.920	-0.390	2.230	1.250	0.680	1.850	-0.470
450	25-05-17	17:00	478	0	0	478.00	450.00	0.550	1.380	1.250	1.590	0.980	-0.320	2.260	1.270	0.730	1.870	-0.420

							SIDE B BOTTOM (‰)										
			Age				920	1200	1300	1400	1500	1600	1700	1800	1900	2000	2280
	Date	Time	Days	Hours	Minutes	Days, eq	From loading (days)	1	2	3	4	5	6	7	8	9	10	11
Casting	02-02-16	11:00	0	0	0	0.000	–	*31*	*31*	*31*	*31*	*31*	*31*	*31*	*31*	*31*	*31*	*31*
Before loading	01-03-16	13:55	28	0	0	28.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5min after loading	01-03-16	14:05	28	0	5	28.003	0.003	0.850	1.120	0.450	1.130	0.170	1.670	-0.030	1.050	0.830	1.000	0.370
1h	01-03-16	15:00	28	1	0	28.042	0.042	0.840	1.190	0.460	1.180	0.170	1.730	-0.050	1.100	0.890	1.000	0.410
6h	01-03-16	20:00	28	6	0	28.250	0.250	0.860	1.240	0.550	1.260	0.200	1.830	-0.060	1.170	0.960	1.120	0.460
1	02-03-16	13:00	29	0	0	29.000	1.000	0.900	1.290	0.590	1.300	0.240	1.930	-0.080	1.230	1.000	1.120	0.500
2	03-03-16	14:00	30	0	0	30.000	2.000	0.950	1.320	0.640	1.370	0.250	2.020	-0.080	1.270	1.000	1.200	0.560
3	04-03-16	13:00	31	0	0	31.000	3.000	0.960	1.330	0.620	1.380	0.250	2.030	-0.090	1.270	1.030	1.160	0.540
4	05-03-16	14:00	32	0	0	32.000	4.000	1.050	1.370	0.670	1.400	0.270	2.090	-0.080	1.290	1.070	1.210	0.580
5	06-03-16	17:00	33	0	0	33.000	5.000	1.000	1.430	0.660	1.430	0.260	2.100	-0.110	1.320	1.060	1.210	0.570
6	07-03-16	16:00	34	0	0	34.000	6.000	0.970	1.380	0.650	1.420	0.260	2.100	-0.110	1.330	1.060	1.200	0.580
7	08-03-16	11:00	35	0	0	35.000	7.000	0.980	1.380	0.630	1.390	0.220	2.070	-0.130	1.280	1.050	1.200	0.560
14	15-03-16	18:00	42	0	0	42.00	14.00	1.010	1.410	0.620	1.460	0.230	2.200	-0.160	1.360	1.050	1.210	0.570
21	22-03-16	11:00	49	0	0	49.00	21.00	1.040	1.460	0.720	1.510	0.250	2.280	-0.170	1.390	1.110	1.320	0.620
28	29-03-16	12:00	56	0	0	56.00	28.00	1.050	1.440	0.700	1.530	0.250	2.290	-0.210	1.400	1.140	1.320	0.620
56	26-04-16	14:00	84	0	0	84.00	56.00	1.100	1.470	0.750	1.560	0.250	2.400	-0.230	1.470	1.180	1.420	0.690
90	30-05-16	11:00	118	0	0	118.00	90.00	1.020	1.440	0.690	1.520	0.240	2.350	-0.280	1.400	1.100	1.380	0.640
120	29-06-16	15:00	148	0	0	148.00	120.00	1.120	1.480	0.740	1.550	0.260	2.430	-0.220	1.510	1.180	1.430	0.700
150	29-07-16	13:00	178	0	0	178.00	150.00	1.190	1.510	0.740	1.600	0.230	2.480	-0.270	1.470	1.150	1.420	0.690
180	28-08-16	12:00	208	0	0	208.00	180.00	1.140	1.500	0.730	1.640	0.240	2.460	-0.270	1.480	1.130	1.420	0.690
210	27-09-16	14:00	238	0	0	238.00	210.00	1.100	1.490	0.690	1.610	0.230	2.460	-0.280	1.470	1.160	1.450	0.730
240	27-10-16	11:00	268	0	0	268.00	240.00	1.110	1.510	0.730	1.670	0.250	2.490	-0.260	1.480	1.160	1.450	0.700
270	26-11-16	13:00	298	0	0	298.00	270.00	1.160	1.460	0.740	1.610	0.170	2.510	-0.370	1.430	1.160	1.460	0.670
300	26-12-16	15:00	328	0	0	328.00	300.00	1.200	1.540	0.790	1.720	0.210	2.610	-0.320	1.540	1.240	1.530	0.760
330	25-01-17	10:00	358	0	0	358.00	330.00	1.200	1.550	0.810	1.760	0.210	2.640	-0.320	1.560	1.200	1.550	0.790
365	01-03-17	11:00	393	0	0	393.00	365.00	1.160	1.520	0.760	1.660	0.200	2.600	-0.340	1.510	1.180	1.500	0.730
400	05-04-17	12:00	428	0	0	428.00	400.00	1.180	1.530	0.790	1.730	0.220	2.630	-0.340	1.530	1.210	1.520	0.760
450	25-05-17	17:00	478	0	0	478.00	450.00	1.180	1.560	0.810	1.740	0.260	2.620	-0.280	1.550	1.220	1.610	0.780

				σ =	12.32	MPa		SIDE A TOP (‰)										
			Age					920	1200	1300	1400	1500	1600	1700	1800	1900	2000	2280
RAC28	Date	Time	Days	Hours	Minutes	Days, eq	From loading (days)	12	13	14	15	16	17	18	19	20	21	22
Casting	02-02-16	11:00	0	0	0	0.000	–	*197*	*197*	*197*	*197*	*197*	*197*	*197*	*197*	*197*	*197*	*197*
Before loading	01-03-16	13:55	28	0	0	28.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5min after loading	01-03-16	14:05	28	0	5	28.003	0.003	-0.280	-0.480	-0.370	-0.430	-0.330	-0.500	-0.330	-0.380	-0.400	-0.410	-0.400
1h	01-03-16	15:00	28	1	0	28.042	0.042	-0.290	-0.460	-0.370	-0.370	-0.330	-0.470	-0.340	-0.400	-0.410	-0.410	-0.380
6h	01-03-16	20:00	28	6	0	28.250	0.250	-0.290	-0.510	-0.390	-0.470	-0.360	-0.530	-0.370	-0.430	-0.430	-0.470	-0.420
1	02-03-16	13:00	29	0	0	29.000	1.000	-0.370	-0.580	-0.450	-0.540	-0.430	-0.610	-0.430	-0.470	-0.490	-0.510	-0.490
2	03-03-16	14:00	30	0	0	30.000	2.000	-0.360	-0.590	-0.470	-0.540	-0.440	-0.600	-0.440	-0.520	-0.560	-0.530	-0.480
3	04-03-16	13:00	31	0	0	31.000	3.000	-0.430	-0.640	-0.540	-0.560	-0.480	-0.650	-0.500	-0.540	-0.500	-0.550	-0.550
4	05-03-16	14:00	32	0	0	32.000	4.000	-0.420	-0.620	-0.510	-0.580	-0.490	-0.660	-0.510	-0.540	-0.550	-0.560	-0.540
5	06-03-16	17:00	33	0	0	33.000	5.000	-0.440	-0.650	-0.520	-0.590	-0.500	-0.680	-0.510	-0.550	-0.600	-0.590	-0.560
6	07-03-16	16:00	34	0	0	34.000	6.000	-0.420	-0.660	-0.540	-0.610	-0.500	-0.700	-0.510	-0.560	-0.660	-0.580	-0.570
7	08-03-16	11:00	35	0	0	35.000	7.000	-0.500	-0.700	-0.600	-0.680	-0.550	-0.750	-0.570	-0.610	-0.600	-0.630	-0.610
14	15-03-16	18:00	42	0	0	42.00	14.00	-0.610	-0.780	-0.670	-0.750	-0.620	-0.850	-0.630	-0.700	-0.710	-0.730	-0.700
21	22-03-16	11:00	49	0	0	49.00	21.00	-0.610	-0.820	-0.700	-0.790	-0.700	-0.890	-0.710	-0.730	-0.810	-0.770	-0.770
28	29-03-16	12:00	56	0	0	56.00	28.00	-0.680	-0.900	-0.760	-0.840	-0.730	-0.960	-0.760	-0.760	-0.870	-0.800	-0.820
56	26-04-16	14:00	84	0	0	84.00	56.00	-0.800	-1.000	-0.850	-0.930	-0.850	-1.050	-0.850	-0.940	-0.950	-0.960	-0.940
90	30-05-16	11:00	118	0	0	118.00	90.00	-0.900	-1.090	-0.960	-1.020	-0.940	-1.160	-0.940	-1.020	-0.990	-1.030	-1.020
120	29-06-16	15:00	148	0	0	148.00	120.00	-0.940	-1.140	-1.020	-1.080	-0.970	-1.200	-0.980	-1.060	-1.060	-1.080	-1.060
150	29-07-16	13:00	178	0	0	178.00	150.00	-1.030	-1.210	-1.060	-1.150	-1.060	-1.300	-1.080	-1.140	-1.130	-1.150	-1.150
180	28-08-16	12:00	208	0	0	208.00	180.00	-1.030	-1.240	-1.110	-1.180	-1.100	-1.340	-1.120	-1.140	-1.180	-1.170	-1.180
210	27-09-16	14:00	238	0	0	238.00	210.00	-1.060	-1.260	-1.150	-1.200	-1.130	-1.400	-1.150	-1.180	-1.220	-1.230	-1.210
240	27-10-16	11:00	268	0	0	268.00	240.00	-1.060	-1.260	-1.150	-1.220	-1.150	-1.370	-1.170	-1.190	-1.220	-1.230	-1.220
270	26-11-16	13:00	298	0	0	298.00	270.00	-1.160	-1.360	-1.210	-1.270	-1.180	-1.380	-1.180	-1.230	-1.200	-1.220	-1.240
300	26-12-16	15:00	328	0	0	328.00	300.00	-1.180	-1.400	-1.240	-1.310	-1.250	-1.460	-1.270	-1.290	-1.330	-1.310	-1.340
330	25-01-17	10:00	358	0	0	358.00	330.00	-1.230	-1.470	-1.280	-1.360	-1.290	-1.510	-1.330	-1.350	-1.370	-1.380	-1.420
365	01-03-17	11:00	393	0	0	393.00	365.00	-1.260	-1.490	-1.350	-1.400	-1.340	-1.600	-1.360	-1.340	-1.420	-1.410	-1.450
400	05-04-17	12:00	428	0	0	428.00	400.00	-1.280	-1.500	-1.360	-1.410	-1.350	-1.580	-1.400	-1.380	-1.440	-1.440	-1.460
450	25-05-17	17:00	478	0	0	478.00	450.00	-1.260	-1.450	-1.340	-1.360	-1.320	-1.530	-1.340	-1.360	-1.400	-1.400	-1.440

								SIDE B TOP (‰)										
			Age					920	1200	1300	1400	1500	1600	1700	1800	1900	2000	2280
	Date	Time	Days	Hours	Minutes	Days, eq	From loading (days)	12	13	14	15	16	17	18	19	20	21	22
Casting	02-02-16	11:00	0	0	0	0.000	–	*197*	*197*	*197*	*197*	*197*	*197*	*197*	*197*	*197*	*197*	*197*
Before loading	01-03-16	13:55	28	0	0	28.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5min after loading	01-03-16	14:05	28	0	5	28.003	0.003	-0.350	-0.440	-0.370	-0.400	-0.410	-0.470	-0.430	-0.350	-0.390	-0.380	-0.350
1h	01-03-16	15:00	28	1	0	28.042	0.042	-0.380	-0.450	-0.380	-0.420	-0.430	-0.500	-0.460	-0.390	-0.420	-0.410	-0.400
6h	01-03-16	20:00	28	6	0	28.250	0.250	-0.390	-0.510	-0.400	-0.430	-0.450	-0.500	-0.500	-0.430	-0.480	-0.440	-0.420
1	02-03-16	13:00	29	0	0	29.000	1.000	-0.440	-0.520	-0.470	-0.500	-0.510	-0.570	-0.540	-0.460	-0.530	-0.490	-0.490
2	03-03-16	14:00	30	0	0	30.000	2.000	-0.460	-0.570	-0.510	-0.520	-0.540	-0.610	-0.580	-0.490	-0.520	-0.510	-0.520
3	04-03-16	13:00	31	0	0	31.000	3.000	-0.460	-0.590	-0.540	-0.570	-0.570	-0.650	-0.600	-0.530	-0.570	-0.560	-0.550
4	05-03-16	14:00	32	0	0	32.000	4.000	-0.490	-0.590	-0.540	-0.580	-0.610	-0.660	-0.600	-0.520	-0.580	-0.580	-0.540
5	06-03-16	17:00	33	0	0	33.000	5.000	-0.510	-0.620	-0.540	-0.580	-0.610	-0.700	-0.610	-0.550	-0.600	-0.560	-0.560
6	07-03-16	16:00	34	0	0	34.000	6.000	-0.510	-0.610	-0.570	-0.610	-0.620	-0.690	-0.630	-0.550	-0.600	-0.590	-0.560
7	08-03-16	11:00	35	0	0	35.000	7.000	-0.570	-0.650	-0.610	-0.620	-0.670	-0.740	-0.670	-0.600	-0.660	-0.640	-0.620
14	15-03-16	18:00	42	0	0	42.00	14.00	-0.660	-0.750	-0.710	-0.750	-0.780	-0.830	-0.770	-0.700	-0.760	-0.710	-0.730
21	22-03-16	11:00	49	0	0	49.00	21.00	-0.730	-0.780	-0.730	-0.760	-0.820	-0.880	-0.780	-0.720	-0.760	-0.720	-0.750
28	29-03-16	12:00	56	0	0	56.00	28.00	-0.820	-0.860	-0.840	-0.830	-0.900	-0.950	-0.860	-0.810	-0.850	-0.790	-0.820
56	26-04-16	14:00	84	0	0	84.00	56.00	-0.930	-0.970	-0.930	-0.920	-0.990	-1.080	-0.980	-0.930	-0.970	-0.910	-0.960
90	30-05-16	11:00	118	0	0	118.00	90.00	-1.000	-1.020	-1.010	-0.981	-1.060	-1.130	-1.000	-0.990	-0.990	-0.950	-1.010
120	29-06-16	15:00	148	0	0	148.00	120.00	-0.980	-1.030	-1.070	-1.080	-1.150	-1.210	-1.080	-1.080	-1.100	-1.020	-1.090
150	29-07-16	13:00	178	0	0	178.00	150.00	-1.110	-1.100	-1.160	-1.130	-1.210	-1.300	-1.140	-1.140	-1.160	-1.090	-1.140
180	28-08-16	12:00	208	0	0	208.00	180.00	-1.160	-1.140	-1.190	-1.180	-1.260	-1.320	-1.190	-1.180	-1.220	-1.130	-1.180
210	27-09-16	14:00	238	0	0	238.00	210.00	-1.170	-1.210	-1.220	-1.210	-1.310	-1.370	-1.240	-1.240	-1.230	-1.160	-1.260
240	27-10-16	11:00	268	0	0	268.00	240.00	-1.200	-1.160	-1.230	-1.200	-1.310	-1.370	-1.220	-1.230	-1.240	-1.150	-1.220
270	26-11-16	13:00	298	0	0	298.00	270.00	-1.280	-1.280	-1.280	-1.280	-1.340	-1.440	-1.270	-1.260	-1.300	-1.200	-1.310
300	26-12-16	15:00	328	0	0	328.00	300.00	-1.320	-1.310	-1.320	-1.300	-1.390	-1.480	-1.310	-1.260	-1.310	-1.230	-1.360
330	25-01-17	10:00	358	0	0	358.00	330.00	-1.410	-1.350	-1.370	-1.360	-1.470	-1.570	-1.370	-1.360	-1.410	-1.290	-1.390
365	01-03-17	11:00	393	0	0	393.00	365.00	-1.420	-1.410	-1.430	-1.400	-1.500	-1.600	-1.410	-1.380	-1.430	-1.340	-1.450
400	05-04-17	12:00	428	0	0	428.00	400.00	-1.450	-1.390	-1.440	-1.410	-1.500	-1.600	-1.440	-1.410	-1.450	-1.340	-1.460
450	25-05-17	17:00	478	0	0	478.00	450.00	-1.390	-1.360	-1.400	-1.360	-1.470	-1.550	-1.380	-1.360	-1.420	-1.290	-1.430

				σ =	12.32	MPa		SIDE A MIDDLE (‰)					
			Age					1500	1600	1700	1500	1600	1700
RAC28	**Date**	**Time**	**Days**	**Hours**	**Minutes**	**Days, eq**	**From loading (days)**	23	24	25	26	27	28
Casting	02-02-16	11:00	0	0	0	0.000	–	*155*	*155*	*155*	*115*	*115*	*115*
Before loading	01-03-16	13:55	28	0	0	28.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5min after loading	01-03-16	14:05	28	0	5	28.003	0.003	-0.130	-0.110	-0.110	0.110	0.270	0.020
1h	01-03-16	15:00	28	1	0	28.042	0.042	-0.110	-0.120	-0.090	0.120	0.290	0.000
6h	01-03-16	20:00	28	6	0	28.250	0.250	-0.150	-0.150	-0.120	0.110	0.270	0.000
1	02-03-16	13:00	29	0	0	29.000	1.000	-0.150	-0.180	-0.150	0.130	0.290	0.000
2	03-03-16	14:00	30	0	0	30.000	2.000	-0.150	-0.160	-0.160	0.130	0.310	0.050
3	04-03-16	13:00	31	0	0	31.000	3.000	-0.190	-0.190	-0.170	0.110	0.280	-0.040
4	05-03-16	14:00	32	0	0	32.000	4.000	-0.170	-0.190	-0.170	0.140	0.290	-0.030
5	06-03-16	17:00	33	0	0	33.000	5.000	-0.190	-0.210	-0.180	0.120	0.270	-0.020
6	07-03-16	16:00	34	0	0	34.000	6.000	-0.200	-0.220	-0.210	0.120	0.280	-0.030
7	08-03-16	11:00	35	0	0	35.000	7.000	-0.240	-0.270	-0.240	0.080	0.240	-0.060
14	15-03-16	18:00	42	0	0	42.00	14.00	-0.300	-0.310	-0.300	0.060	0.230	-0.100
21	22-03-16	11:00	49	0	0	49.00	21.00	-0.340	-0.370	-0.350	0.040	0.180	-0.150
28	29-03-16	12:00	56	0	0	56.00	28.00	-0.360	-0.380	-0.370	0.020	0.170	-0.160
56	26-04-16	14:00	84	0	0	84.00	56.00	-0.460	-0.470	-0.430	0.020	0.130	-0.210
90	30-05-16	11:00	118	0	0	118.00	90.00	-0.550	-0.550	-0.530	-0.070	0.050	-0.260
120	29-06-16	15:00	148	0	0	148.00	120.00	-0.560	-0.590	-0.560	-0.070	0.040	-0.290
150	29-07-16	13:00	178	0	0	178.00	150.00	-0.620	-0.630	-0.630	-0.110	-0.010	-0.340
180	28-08-16	12:00	208	0	0	208.00	180.00	-0.660	-0.670	-0.660	-0.150	-0.030	-0.360
210	27-09-16	14:00	238	0	0	238.00	210.00	-0.690	-0.710	-0.690	-0.160	-0.060	-0.390
240	27-10-16	11:00	268	0	0	268.00	240.00	-0.680	-0.690	-0.680	-0.140	-0.040	-0.370
270	26-11-16	13:00	298	0	0	298.00	270.00	-0.690	-0.710	-0.670	-0.150	-0.030	-0.370
300	26-12-16	15:00	328	0	0	328.00	300.00	-0.760	-0.760	-0.760	-0.180	-0.080	-0.420
330	25-01-17	10:00	358	0	0	358.00	330.00	-0.820	-0.810	-0.800	-0.220	-0.110	-0.480
365	01-03-17	11:00	393	0	0	393.00	365.00	-0.830	-0.840	-0.830	-0.250	-0.160	-0.500
400	05-04-17	12:00	428	0	0	428.00	400.00	-0.840	-0.860	-0.840	-0.240	-0.150	-0.500
450	25-05-17	17:00	478	0	0	478.00	450.00	-0.830	-0.820	-0.820	-0.240	-0.130	-0.470

								SIDE B MIDDLE (‰)					
			Age					1500	1600	1700	1500	1600	1700
	Date	**Time**	**Days**	**Hours**	**Minutes**	**Days, eq**	**From loading (days)**	23	24	25	26	27	28
Casting	02-02-16	11:00	0	0	0	0.000	–	*155*	*155*	*155*	*115*	*115*	*115*
Before loading	01-03-16	13:55	28	0	0	28.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5min after loading	01-03-16	14:05	28	0	5	28.003	0.003	-0.120	-0.130	-0.120	0.040	0.290	-0.020
1h	01-03-16	15:00	28	1	0	28.042	0.042	-0.150	-0.120	-0.150	0.030	0.290	-0.040
6h	01-03-16	20:00	28	6	0	28.250	0.250	-0.170	-0.180	-0.180	0.010	0.290	-0.070
1	02-03-16	13:00	29	0	0	29.000	1.000	-0.200	-0.200	-0.210	0.020	0.310	-0.070
2	03-03-16	14:00	30	0	0	30.000	2.000	-0.210	-0.210	-0.220	0.010	0.340	-0.060
3	04-03-16	13:00	31	0	0	31.000	3.000	-0.250	-0.250	-0.250	-0.010	0.300	-0.100
4	05-03-16	14:00	32	0	0	32.000	4.000	-0.230	-0.230	-0.220	0.000	0.330	-0.090
5	06-03-16	17:00	33	0	0	33.000	5.000	-0.240	-0.250	-0.240	-0.020	0.340	-0.090
6	07-03-16	16:00	34	0	0	34.000	6.000	-0.260	-0.240	-0.260	-0.020	0.310	-0.130
7	08-03-16	11:00	35	0	0	35.000	7.000	-0.290	-0.290	-0.290	-0.060	0.260	-0.150
14	15-03-16	18:00	42	0	0	42.00	14.00	-0.370	-0.390	-0.380	0.880	0.220	-0.220
21	22-03-16	11:00	49	0	0	49.00	21.00	-0.390	-0.400	-0.390	0.880	0.260	-0.210
28	29-03-16	12:00	56	0	0	56.00	28.00	-0.450	-0.440	-0.450	0.830	0.200	-0.250
56	26-04-16	14:00	84	0	0	84.00	56.00	-0.530	-0.540	-0.500	0.790	0.170	-0.270
90	30-05-16	11:00	118	0	0	118.00	90.00	-0.580	-0.600	-0.530	0.750	0.110	-0.290
120	29-06-16	15:00	148	0	0	148.00	120.00	-0.640	-0.660	-0.590	0.720	0.080	-0.320
150	29-07-16	13:00	178	0	0	178.00	150.00	-0.680	-0.700	-0.630	0.680	0.080	-0.350
180	28-08-16	12:00	208	0	0	208.00	180.00	-0.720	-0.730	-0.690	0.640	0.030	-0.390
210	27-09-16	14:00	238	0	0	238.00	210.00	-0.760	-0.760	-0.720	0.590	-0.020	-0.420
240	27-10-16	11:00	268	0	0	268.00	240.00	-0.770	-0.750	-0.700	0.630	0.030	-0.390
270	26-11-16	13:00	298	0	0	298.00	270.00	-0.790	-0.810	-0.720	0.610	0.020	-0.430
300	26-12-16	15:00	328	0	0	328.00	300.00	-0.830	-0.830	-0.770	0.570	0.020	-0.450
330	25-01-17	10:00	358	0	0	358.00	330.00	-0.870	-0.880	-0.800	0.530	0.000	-0.500
365	01-03-17	11:00	393	0	0	393.00	365.00	-0.920	-0.910	-0.810	0.500	-0.060	-0.500
400	05-04-17	12:00	428	0	0	428.00	400.00	-0.940	-0.920	-0.830	0.490	-0.050	-0.500
450	25-05-17	17:00	478	0	0	478.00	450.00	-0.890	-0.870	-0.810	0.520	-0.030	-0.460

HVFAC7					0	5m	1h	6h	1d	2d
	A	BOTTOM								
	From (mm)	To (mm)	Disks		17-02-16	17-02-16	17-02-16	17-02-16	18-02-16	19-02-16
1	870	970	1	2	-0.134	-0.045	-0.038	-0.037	-0.027	-0.026
2	1150	1250	3	4	-0.225	-0.114	-0.111	-0.107	-0.099	-0.096
3	1250	1350	4	5	-0.192	-0.2	-0.207	-0.211	-0.213	-0.215
4	1350	1450	5	6	-0.922	-0.829	-0.823	-0.82	-0.816	-0.814
5	1450	1550	6	7	-0.177	-0.078	-0.074	-0.071	-0.06	-0.056
6	1550	1650	7	8	-0.177	-0.187	-0.186	-0.188	-0.191	-0.193
7	1650	1750	8	9	-0.088	0.03	0.036	0.04	0.047	0.052
8	1750	1850	9	10	-0.114	0	0.004	0.008	0.015	0.02
9	1850	1950	10	11	-0.126	-0.077	-0.074	-0.074	-0.069	-0.064
10	1950	2050	11	12	-0.221	-0.11	-0.108	-0.101	-0.097	-0.092
11	2230	2330	13	14	-0.217	-0.104	-0.102	-0.103	-0.096	-0.091
	A	TOP								
	From (mm)	To (mm)	Disks							
12	870	970	15	16	-0.121	-0.154	-0.157	-0.165	-0.166	-0.166
13	1150	1250	17	18	-0.122	-0.166	-0.167	-0.178	-0.179	-0.179
14	1250	1350	18	19	-0.183	-0.219	-0.22	-0.225	-0.232	-0.231
15	1350	1450	19	20	-0.516	-0.56	-0.564	-0.569	-0.573	-0.576
16	1450	1550	20	21	-0.414	-0.451	-0.454	-0.459	-0.462	-0.465
17	1550	1650	21	22	-0.288	-0.327	-0.33	-0.335	-0.34	-0.34
18	1650	1750	22	23	-0.228	-0.268	-0.273	-0.278	-0.281	-0.282
19	1750	1850	23	24	-0.092	-0.131	-0.135	-0.14	-0.142	-0.145
20	1850	1950	24	25	-0.403	-0.446	-0.45	-0.455	-0.46	-0.464
21	1950	2050	25	26	0.517	0.465	0.462	0.463	0.457	0.455
22	2230	2330	27	28	-0.442	-0.49	-0.494	-0.499	-0.503	-0.506
	A	MIDDLE								
	From (mm)	To (mm)	Disks							
23	1450	1550	29	30	-0.264	-0.27	-0.28	-0.283	-0.284	-0.286
24	1550	1650	30	31	-0.137	-0.147	-0.149	-0.151	-0.154	-0.154
25	1650	1750	31	32	0.594	0.577	0.577	0.573	0.569	0.57
26	1450	1550	33	34	-0.739	-0.73	-0.732	-0.729	-0.732	-0.728
27	1550	1650	34	35	-0.174	-0.17	-0.182	-0.181	-0.186	-0.184
28	1650	1750	35	36	0.699	0.726	0.726	0.726	0.725	0.729

					0	5m	1h	6h	1d	2d
	B	BOTTOM								
	From (mm)	To (mm)	Disks		17-02-16	17-02-16	17-02-16	17-02-16	18-02-16	19-02-16
1	870	970	1	2	-0.091	-0.004	0.004	0.006	0.013	0.015
2	1150	1250	3	4	0.046	0.146	0.153	0.152	0.158	0.163
3	1250	1350	4	5	0.097	0.157	0.161	0.162	0.167	0.172
4	1350	1450	5	6	0.677	0.79	0.795	0.799	0.802	0.806
5	1450	1550	6	7	-0.471	-0.469	-0.469	-0.474	-0.471	-0.47
6	1550	1650	7	8	-1.042	-0.918	-0.909	-0.905	-0.899	-0.892
7	1650	1750	8	9	-0.178	-0.07	-0.063	-0.061	-0.068	-0.045
8	1750	1850	9	10	-4.006	-3.93	-3.931	-3.925	-3.922	-3.917
9	1850	1950	10	11	-0.152	-0.064	-0.062	-0.06	-0.054	-0.048
10	1950	2050	11	12	-0.149	-0.132	-0.133	-0.133	-0.13	-0.128
11	2230	2330	13	14	-0.127	-0.043	-0.038	-0.035	-0.029	-0.022
	B	TOP								
	From (mm)	To (mm)	Disks							
12	870	970	15	16	-0.027	-0.117	-0.121	-0.117	-0.132	-0.129
	1150	1250	17	18	0.3	0.268	0.267	0.266	0.253	0.257
14	1250	1350	18	19	-0.127	-0.174	-0.177	-0.171	-0.179	-0.179
15	1350	1450	19	20	-1.371	-1.413	-1.418	-1.418	-1.426	-1.427
16	1450	1550	20	21	-0.203	-0.245	-0.25	-0.25	-0.258	-0.261
17	1550	1650	21	22	-0.135	-0.171	-0.174	-0.174	-0.186	-0.182
18	1650	1750	22	23	-0.215	-0.249	-0.254	-0.254	-0.261	-0.26
19	1750	1850	23	24	-1.213	-1.245	-1.249	-1.25	-1.257	-1.254
20	1850	1950	24	25	-1.161	-1.199	-1.201	-1.2	-1.21	-1.208
21	1950	2050	25	26	-0.197	-0.231	-0.233	-0.238	-0.244	-0.243
22	2230	2330	27	28	-0.139	-0.174	-0.176	-0.177	-0.186	-0.184
	B	MIDDLE								
	From (mm)	To (mm)	Disks							
23	1450	1550	29	30	-0.129	-0.139	-0.141	-0.141	-0.144	-0.144
24	1550	1650	30	31	-0.369	-0.381	-0.382	-0.382	-0.388	-0.386
25	1650	1750	31	32	-0.179	-0.186	-0.187	-0.187	-0.191	-0.189
26	1450	1550	33	34	-0.134	-0.139	-0.142	-0.139	-0.144	-0.143
27	1550	1650	34	35	-0.254	-0.219	-0.22	-0.216	-0.217	-0.213
28	1650	1750	35	36	-0.175	-0.146	-0.147	-0.146	-0.146	-0.142

HVFAC7

					3d	4d	5d	6d	7d	14d
	A	BOTTOM								
	From (mm)	To (mm)	Disks		20-02-16	21-02-16	22-02-16	23-02-16	24-02-16	02-03-16
1	870	970	1	2	-0.023	-0.02	-0.016	-0.015	-0.012	-0.012
2	1150	1250	3	4	-0.091	-0.088	-0.085	-0.083	-0.081	-0.077
3	1250	1350	4	5	-0.217	-0.221	-0.224	-0.223	-0.224	-0.232
4	1350	1450	5	6	-0.811	-0.809	-0.814	-0.81	-0.806	-0.806
5	1450	1550	6	7	-0.054	-0.05	-0.051	-0.046	-0.042	-0.038
6	1550	1650	7	8	-0.196	-0.197	-0.201	-0.201	-0.202	-0.21
7	1650	1750	8	9	0.056	0.058	0.06	0.061	0.065	0.067
8	1750	1850	9	10	0.023	0.026	0.027	0.029	0.032	0.035
9	1850	1950	10	11	-0.065	-0.063	-0.066	-0.064	-0.062	-0.064
10	1950	2050	11	12	-0.091	-0.088	-0.088	-0.086	-0.085	-0.082
11	2230	2330	13	14	-0.091	-0.088	-0.088	-0.087	-0.084	-0.084
	A	TOP								
	From (mm)	To (mm)	Disks							
12	870	970	15	16	-0.17	-0.175	-0.177	-0.177	-0.178	-0.189
13	1150	1250	17	18	-0.186	-0.189	-0.193	-0.194	-0.194	-0.203
14	1250	1350	18	19	-0.237	-0.239	-0.248	-0.247	-0.245	-0.256
15	1350	1450	19	20	-0.58	-0.583	-0.588	-0.588	-0.588	-0.598
16	1450	1550	20	21	-0.468	-0.471	-0.475	-0.477	-0.476	-0.487
17	1550	1650	21	22	-0.344	-0.347	-0.352	-0.354	-0.353	-0.363
18	1650	1750	22	23	-0.289	-0.291	-0.295	-0.296	-0.297	-0.307
19	1750	1850	23	24	-0.147	-0.152	-0.156	-0.159	-0.156	-0.168
20	1850	1950	24	25	-0.468	-0.473	-0.478	-0.478	-0.479	-0.492
21	1950	2050	25	26	0.446	0.447	0.438	0.439	0.44	0.425
22	2230	2330	27	28	-0.512	-0.513	-0.52	-0.522	-0.52	-0.532
	A	MIDDLE								
	From (mm)	To (mm)	Disks							
23	1450	1550	29	30	-0.288	-0.292	-0.296	-0.298	-0.295	-0.304
24	1550	1650	30	31	-0.156	-0.159	-0.162			
25	1650	1750	31	32	0.567	0.564	0.559			
26	1450	1550	33	34	-0.73	-0.731	-0.732	-0.734	-0.727	-0.733
27	1550	1650	34	35	-0.189	-0.191	-0.195	-0.198	-0.199	-0.207
28	1650	1750	35	36	0.73	0.728	0.723	0.725	0.726	0.725

					3d	4d	5d	6d	7d	14d
	B	BOTTOM								
	From (mm)	To (mm)	Disks		20-02-16	21-02-16	22-02-16	23-02-16	24-02-16	02-03-16
1	870	970	1	2	0.017	0.016	0.014	0.02	0.022	0.019
2	1150	1250	3	4	0.161	0.163	0.162	0.163	0.167	0.162
3	1250	1350	4	5	0.172	0.171	0.173	0.175	0.178	0.175
4	1350	1450	5	6	0.808	0.807	0.808	0.811	0.813	0.811
5	1450	1550	6	7	-0.471	-0.477	-0.475	-0.477	-0.475	-0.484
6	1550	1650	7	8	-0.891	-0.891	-0.889	-0.888	-0.882	-0.875
7	1650	1750	8	9	-0.045	-0.045	-0.043	-0.044	-0.041	-0.044
8	1750	1850	9	10	-3.916	-3.914	-3.918	-3.917	-3.913	-3.915
9	1850	1950	10	11	-0.046	-0.048	-0.046	-0.045	-0.04	-0.041
10	1950	2050	11	12	-0.129	-0.131	-0.127	-0.13	-0.127	-0.133
11	2230	2330	13	14	-0.023	-0.023	-0.02	-0.02	-0.016	-0.022
	B	TOP								
	From (mm)	To (mm)	Disks							
12	870	970	15	16	-0.138	-0.14	-0.15	-0.145	-0.144	-0.163
13	1150	1250	17	18	0.25	0.245	0.241	0.243	0.24	0.229
14	1250	1350	18	19	-0.182	-0.186	-0.19	-0.19	-0.191	-0.202
15	1350	1450	19	20	-1.43	-1.433	-1.434	-1.437	-1.438	-1.448
16	1450	1550	20	21	-0.265	-0.267	-0.27	-0.273	-0.272	-0.282
17	1550	1650	21	22	-0.19	-0.193	-0.196	-0.199	-0.198	-0.211
18	1650	1750	22	23	-0.266	-0.268	-0.271	-0.274	-0.273	-0.282
19	1750	1850	23	24	-1.259	-1.265	-1.266	-1.264	-1.269	-1.279
20	1850	1950	24	25	-1.216	-1.216	-1.218	-1.222	-1.22	-1.232
21	1950	2050	25	26	-0.247	-0.255	-0.255	-0.26	-0.259	-0.271
22	2230	2330	27	28	-0.191	-0.193	-0.196	-0.198	-0.199	-0.212
	B	MIDDLE								
	From (mm)	To (mm)	Disks							
23	1450	1550	29	30	-0.15	-0.151	-0.152	-0.152	-0.154	-0.16
24	1550	1650	30	31	-0.392	-0.394	-0.395	-0.397	-0.399	-0.407
25	1650	1750	31	32	-0.194	-0.198	-0.198	-0.197	-0.198	-0.207
26	1450	1550	33	34	-0.149	-0.149	-0.15	-0.153	-0.151	-0.16
27	1550	1650	34	35	-0.217	-0.218	-0.216	-0.218	-0.215	-0.222
28	1650	1750	35	36	-0.146	-0.145	-0.145	-0.148	-0.144	-0.15

HVFAC7					21d	28d	56d	90d	120d	150d
	A	BOTTOM								
	From (mm)	To (mm)	Disks		09-03-16	16-03-16	13-04-16	17-05-16	16-06-16	16-07-16
1	870	970	1	2	-0.012	-0.01	-0.007	-0.009	-0.013	-0.015
2	1150	1250	3	4	-0.075	-0.075	-0.072	-0.077	-0.079	-0.082
3	1250	1350	4	5	-0.24	-0.24	-0.241	-0.24	-0.243	-0.248
4	1350	1450	5	6	-0.805	-0.806	-0.802	-0.805	-0.807	-0.811
5	1450	1550	6	7	-0.036	-0.035	-0.031	-0.035	-0.043	-0.043
6	1550	1650	7	8	-0.215	-0.215	-0.219	-0.22	-0.219	-0.227
7	1650	1750	8	9	0.069	0.072	0.076	0.074	0.069	0.067
8	1750	1850	9	10	0.037	0.04	0.045	0.039	0.034	0.036
9	1850	1950	10	11	-0.065	-0.064	-0.066	-0.068	-0.069	-0.077
10	1950	2050	11	12	-0.084	-0.081	-0.077	-0.08	-0.083	-0.086
11	2230	2330	13	14	-0.084	-0.081	-0.077	-0.082	-0.088	-0.089
	A	TOP								
	From (mm)	To (mm)	Disks							
12	870	970	15	16	-0.195	-0.198	-0.206	-0.213	-0.214	-0.222
13	1150	1250	17	18	-0.21	-0.214	-0.223	-0.229	-0.232	-0.238
14	1250	1350	18	19	-0.265	-0.272	-0.279	-0.281	-0.288	-0.295
15	1350	1450	19	20	-0.606	-0.613	-0.615	-0.618	-0.624	-0.63
16	1450	1550	20	21	-0.494	-0.501	-0.507	-0.51	-0.513	-0.521
17	1550	1650	21	22	-0.368	-0.376	-0.381	-0.385	-0.39	-0.396
18	1650	1750	22	23	-0.313	-0.32	-0.325	-0.33	-0.333	-0.341
19	1750	1850	23	24	-0.174	-0.179	-0.187	-0.191	-0.194	-0.202
20	1850	1950	24	25	-0.499	-0.506	-0.512	-0.521	-0.521	-0.528
21	1950	2050	25	26	0.42	0.414	0.408	0.401	0.401	0.492
22	2230	2330	27	28	-0.536	-0.543	-0.544	-0.551	-0.548	-0.559
	A	MIDDLE								
	From (mm)	To (mm)	Disks							
23	1450	1550	29	30	-0.308	-0.314	-0.319	-0.322	-0.324	-0.332
24	1550	1650	30	31						
25	1650	1750	31	32						
26	1450	1550	33	34	-0.736	-0.738	-0.74	-0.745	-0.748	-0.752
27	1550	1650	34	35	-0.211	-0.218	-0.22	-0.221	-0.222	-0.228
28	1650	1750	35	36	0.722	0.718	0.718	0.714	0.71	0.704

					21d	28d	56d	90d	120d	150d
	B	BOTTOM								
	From (mm)	To (mm)	Disks		09-03-16	16-03-16	13-04-16	17-05-16	16-06-16	16-07-16
1	870	970	1	2	0.025	0.025	0.024	0.024	0.027	0.02
2	1150	1250	3	4	0.165	0.168	0.171	0.166	0.165	0.159
3	1250	1350	4	5	0.175	0.176	0.176	0.176	0.169	0.167
4	1350	1450	5	6	0.813	0.818	0.815	0.812	0.816	0.812
5	1450	1550	6	7	-0.482	-0.48	-0.483	-0.486	-0.497	-0.491
6	1550	1650	7	8	-0.877	-0.872	-0.873	-0.873	-0.872	-0.88
7	1650	1750	8	9	-0.042	-0.04	-0.043	-0.041	-0.048	-0.055
8	1750	1850	9	10	-3.919	-3.913	-3.914	-3.916	-3.919	-3.922
9	1850	1950	10	11	-0.04	-0.038	-0.038	-0.038	-0.043	-0.044
10	1950	2050	11	12	-0.131	-0.132	-0.132	-0.129	-0.132	-0.137
11	2230	2330	13	14	-0.019	-0.017	-0.019	-0.018	-0.025	-0.026
	B	TOP								
	From (mm)	To (mm)	Disks							
12	870	970	15	16	-0.164	-0.164	-0.175	-0.176	-0.179	-0.189
13	1150	1250	17	18	0.224	0.222	0.208	0.209	0.206	0.196
14	1250	1350	18	19	-0.207	-0.207	-0.219	-0.222	-0.226	-0.232
15	1350	1450	19	20	-1.457	-1.458	-1.469	-1.47	-1.472	-1.481
16	1450	1550	20	21	-0.287	-0.29	-0.304	-0.304	-0.308	-0.319
17	1550	1650	21	22	-0.214	-0.218	-0.231	-0.232	-0.237	-0.242
18	1650	1750	22	23	-0.29	-0.291	-0.303	-0.304	-0.305	-0.313
19	1750	1850	23	24	-1.286	-1.286	-1.296	-1.296	-1.297	-1.304
20	1850	1950	24	25	-1.235	-1.235	-1.248	-1.251	-1.254	-1.261
21	1950	2050	25	26	-0.277	-0.281	-0.297	-0.296	-0.301	-0.304
22	2230	2330	27	28	-0.217	-0.218	-0.23	-0.234	-0.236	-0.244
	B	MIDDLE								
	From (mm)	To (mm)	Disks							
23	1450	1550	29	30	-0.167	-0.167	-0.176	-0.176	-0.181	-0.191
24	1550	1650	30	31	-0.412	-0.413	-0.422	-0.425	-0.425	-0.433
25	1650	1750	31	32	-0.209	-0.21	-0.22	-0.221	-0.224	-0.231
26	1450	1550	33	34	-0.163	-0.163	-0.17	-0.167	-0.171	-0.178
27	1550	1650	34	35	-0.22	-0.219	-0.227	-0.227	-0.234	-0.237
28	1650	1750	35	36	-0.151	-0.152	-0.159	-0.159	-0.166	-0.171

HVFAC7

					180d	210d	240d	270d	300d	330d
	A	**BOTTOM**								
	From (mm)	To (mm)	Disks		15-08-16	14-09-16	14-10-16	13-11-16	13-12-16	12-01-17
1	870	970	1	2	-0.013	-0.015	-0.013	-0.011	-0.008	-0.005
2	1150	1250	3	4	-0.081	-0.082	-0.079	-0.078	-0.076	-0.075
3	1250	1350	4	5	-0.246	-0.248	-0.244	-0.249	-0.25	-0.252
4	1350	1450	5	6	-0.808	-0.808	-0.806	-0.806	-0.804	-0.801
5	1450	1550	6	7	-0.043	-0.043	-0.043	-0.039	-0.038	-0.036
6	1550	1650	7	8	-0.224	-0.228	-0.223	-0.225	-0.227	-0.231
7	1650	1750	8	9	0.071	0.068	0.071	0.073	0.078	0.08
8	1750	1850	9	10	0.038	0.037	0.04	0.043	0.046	0.049
9	1850	1950	10	11	-0.074	-0.076	-0.072	-0.071	-0.071	-0.068
10	1950	2050	11	12	-0.084	-0.082	-0.082	-0.079	-0.08	-0.074
11	2230	2330	13	14	-0.088	-0.086	-0.084	-0.082	-0.078	-0.075
	A	**TOP**								
	From (mm)	To (mm)	Disks							
12	870	970	15	16	-0.224	-0.226	-0.225	-0.226	-0.233	-0.235
13	1150	1250	17	18	-0.239	-0.241	-0.241	-0.242	-0.25	-0.249
14	1250	1350	18	19	-0.303	-0.302	-0.299	-0.303	-0.312	-0.318
15	1350	1450	19	20	-0.632	-0.633	-0.633	-0.632	-0.64	-0.642
16	1450	1550	20	21	-0.522	-0.526	-0.524	-0.527	-0.532	-0.536
17	1550	1650	21	22	-0.398	-0.4	-0.399	-0.403	-0.407	-0.409
18	1650	1750	22	23	-0.343	-0.346	-0.344	-0.345	-0.352	-0.354
19	1750	1850	23	24	-0.203	-0.206	-0.204	-0.206	-0.213	-0.216
20	1850	1950	24	25	-0.531	-0.535	-0.535	-0.538	-0.545	-0.547
21	1950	2050	25	26	0.491	0.492	0.497			
22	2230	2330	27	28	-0.562	-0.563	-0.561	-0.562	-0.568	-0.573
	A	**MIDDLE**								
	From (mm)	To (mm)	Disks							
23	1450	1550	29	30	-0.334	-0.334	-0.336	-0.337	-0.344	-0.345
24	1550	1650	30	31						
25	1650	1750	31	32						
26	1450	1550	33	34	-0.755	-0.754	-0.755	-0.754	-0.758	-0.755
27	1550	1650	34	35	-0.23	-0.234	-0.23	-0.232	-0.239	-0.238
28	1650	1750	35	36	0.703	0.702	0.703	0.706	0.705	0.704

					180d	210d	240d	270d	300d	330d
	B	**BOTTOM**								
	From (mm)	To (mm)	Disks		15-08-16	14-09-16	14-10-16	13-11-16	13-12-16	12-01-17
1	870	970	1	2	0.021	0.022	0.027	0.027	0.03	0.032
2	1150	1250	3	4	0.16	0.159	0.158	0.157	0.163	0.161
3	1250	1350	4	5	0.167	0.169	0.17	0.171	0.169	0.173
4	1350	1450	5	6	0.809	0.811	0.811	0.814	0.813	0.816
5	1450	1550	6	7	-0.492	-0.494	-0.49	-0.495	-0.496	-0.492
6	1550	1650	7	8	-0.876	-0.879	-0.897	-0.869	-0.876	-0.872
7	1650	1750	8	9	-0.047	-0.048	-0.035	-0.041	-0.047	-0.046
8	1750	1850	9	10	-3.918	-3.918	-3.918	-3.916	-3.912	-3.911
9	1850	1950	10	11	-0.045	-0.044	-0.042	-0.041	-0.041	-0.037
10	1950	2050	11	12	-0.135	-0.136	-0.135	-0.133	-0.136	-0.135
11	2230	2330	13	14	-0.027	-0.026	-0.025	-0.023	-0.023	-0.019
	B	**TOP**								
	From (mm)	To (mm)	Disks							
12	870	970	15	16	-0.195	-0.194	-0.192	-0.188	-0.202	-0.204
13	1150	1250	17	18	0.193	0.19	0.193	0.19	0.184	0.18
14	1250	1350	18	19	-0.233	-0.238	-0.238	-0.241	-0.243	-0.245
15	1350	1450	19	20	-1.482	-1.487	-1.485	-1.489	-1.491	-1.496
16	1450	1550	20	21	-0.319	-0.323	-0.323	-0.326	-0.331	-0.333
17	1550	1650	21	22	-0.245	-0.246	-0.249	-0.249	-0.255	-0.258
18	1650	1750	22	23	-0.316	-0.321	-0.319	-0.319	-0.326	-0.328
19	1750	1850	23	24	-1.307	-1.309	-1.308	-1.311	-1.319	-1.317
20	1850	1950	24	25	-1.262	-1.266	-1.268	-1.27	-1.271	-1.274
21	1950	2050	25	26	-0.307	-0.31	-0.309	-0.308	-0.314	-0.317
22	2230	2330	27	28	-0.248	-0.25	-0.249	-0.251	-0.256	-0.259
	B	**MIDDLE**								
	From (mm)	To (mm)	Disks							
23	1450	1550	29	30	-0.191	-0.194	-0.193	-0.193	-0.195	-0.198
24	1550	1650	30	31	-0.435	-0.439	-0.437	-0.436	-0.442	-0.445
25	1650	1750	31	32	-0.232	-0.236	-0.235	-0.232	-0.236	-0.239
26	1450	1550	33	34	-0.178	-0.181	-0.178	-0.179	-0.178	-0.184
27	1550	1650	34	35	-0.237	-0.243	-0.241	-0.238	-0.237	-0.238
28	1650	1750	35	36	-0.171	-0.175	-0.174	-0.172	-0.174	-0.173

	HVFAC7				365d	400d	450d
	A	**BOTTOM**					
	From (mm)	To (mm)	Disks		16-02-17	23-03-17	12-05-17
1	870	970	1	2	-0.007	-0.009	-0.008
2	1150	1250	3	4	-0.073	-0.076	-0.071
3	1250	1350	4	5	-0.252	-0.251	-0.256
4	1350	1450	5	6	-0.8	-0.803	-0.806
5	1450	1550	6	7	-0.034	-0.042	-0.04
6	1550	1650	7	8	-0.228	-0.23	-0.229
7	1650	1750	8	9	0.081	0.075	0.074
8	1750	1850	9	10	0.048	0.045	0.044
9	1850	1950	10	11	-0.071	-0.074	-0.074
10	1950	2050	11	12	-0.076	-0.078	-0.079
11	2230	2330	13	14	-0.077	-0.079	-0.08
	A	**TOP**					
	From (mm)	To (mm)	Disks				
12	870	970	15	16	-0.236	-0.239	-0.239
13	1150	1250	17	18	-0.251	-0.254	-0.254
14	1250	1350	18	19	-0.312	-0.319	-0.32
15	1350	1450	19	20	-0.642	-0.647	-0.648
16	1450	1550	20	21	-0.537	-0.539	-0.539
17	1550	1650	21	22	-0.411	-0.414	-0.413
18	1650	1750	22	23	-0.358	-0.359	-0.36
19	1750	1850	23	24	-0.216	-0.22	-0.221
20	1850	1950	24	25	-0.547	-0.555	-0.554
21	1950	2050	25	26			
22	2230	2330	27	28	-0.572	-0.576	-0.578
	A	**MIDDLE**					
	From (mm)	To (mm)	Disks				
23	1450	1550	29	30	-0.345	-0.35	-0.349
24	1550	1650	30	31			
25	1650	1750	31	32			
26	1450	1550	33	34	-0.756	-0.762	-0.762
27	1550	1650	34	35	-0.238	-0.24	-0.238
28	1650	1750	35	36	0.702	0.699	0.696

					365d	400d	450d
	B	**BOTTOM**					
	From (mm)	To (mm)	Disks		16-02-17	23-03-17	12-05-17
1	870	970	1	2	0.032	0.031	0.029
2	1150	1250	3	4	0.161	0.16	0.159
3	1250	1350	4	5	0.172	0.171	0.169
4	1350	1450	5	6	0.814	0.818	0.816
5	1450	1550	6	7	-0.488	-0.49	-0.493
6	1550	1650	7	8	-0.873	-0.869	-0.875
7	1650	1750	8	9	-0.046	-0.052	-0.051
8	1750	1850	9	10	-3.914	-3.91	-3.911
9	1850	1950	10	11	-0.04	-0.039	-0.042
10	1950	2050	11	12	-0.136	-0.135	-0.135
11	2230	2330	13	14	-0.019	-0.02	-0.022
	B	**TOP**					
	From (mm)	To (mm)	Disks				
12	870	970	15	16	-0.205	-0.208	-0.206
13	1150	1250	17	18	0.182	0.18	0.179
14	1250	1350	18	19	-0.251	-0.251	-0.252
15	1350	1450	19	20	-1.501	-1.501	-1.499
16	1450	1550	20	21	-0.339	-0.341	-0.34
17	1550	1650	21	22	-0.261	-0.26	-0.262
18	1650	1750	22	23	-0.332	-0.332	-0.332
19	1750	1850	23	24	-1.32	-1.322	-1.319
20	1850	1950	24	25	-1.275	-1.28	-1.278
21	1950	2050	25	26	-0.317	-0.325	-0.323
22	2230	2330	27	28	-0.264	-0.266	-0.263
	B	**MIDDLE**					
	From (mm)	To (mm)	Disks				
23	1450	1550	29	30	-0.202	-0.203	-0.201
24	1550	1650	30	31	-0.448	-0.448	-0.446
25	1650	1750	31	32	-0.242	-0.243	-0.243
26	1450	1550	33	34	-0.187	-0.181	-0.185
27	1550	1650	34	35	-0.242	-0.244	-0.245
28	1650	1750	35	36	-0.177	-0.18	-0.183

				σ =	9.85	MPa		SIDE A BOTTOM (‰)										
			Age					920	1200	1300	1400	1500	1600	1700	1800	1900	2000	2280
HVFAC7	**Date**	**Time**	**Days**	**Hours**	**Minutes**	**Days, eq**	**From loading (days)**	1	2	3	4	5	6	7	8	9	10	11
Casting	10-02-16	11:00	0	0	0	0.000	–	*31*	*31*	*31*	*31*	*31*	*31*	*31*	*31*	*31*	*31*	*31*
Before loading	17-02-16	11:55	7	0	0	7.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5min after loading	17-02-16	12:00	7	0	5	7.003	0.003	0.890	1.110	-0.080	0.930	0.990	-0.100	1.180	1.140	0.490	1.110	1.130
1h	17-02-16	13:00	7	1	0	7.042	0.042	0.960	1.140	-0.150	0.990	1.030	-0.090	1.240	1.180	0.520	1.130	1.150
6h	17-02-16	18:00	7	6	0	7.250	0.250	0.970	1.180	-0.190	1.020	1.060	-0.110	1.280	1.220	0.520	1.200	1.140
1	18-02-16	13:00	8	0	0	8.000	1.000	1.070	1.260	-0.210	1.060	1.170	-0.140	1.350	1.290	0.570	1.240	1.210
2	19-02-16	11:00	9	0	0	9.000	2.000	1.080	1.290	-0.230	1.080	1.210	-0.160	1.400	1.340	0.620	1.290	1.260
3	20-02-16	12:00	10	0	0	10.000	3.000	1.110	1.340	-0.250	1.110	1.230	-0.190	1.440	1.370	0.610	1.300	1.260
4	21-02-16	13:00	11	0	0	11.000	4.000	1.140	1.370	-0.290	1.130	1.270	-0.200	1.460	1.400	0.630	1.330	1.290
5	22-02-16	13:00	12	0	0	12.000	5.000	1.180	1.400	-0.320	1.080	1.260	-0.240	1.480	1.410	0.600	1.330	1.290
6	23-02-16	16:00	13	0	0	13.000	6.000	1.190	1.420	-0.310	1.120	1.310	-0.240	1.490	1.430	0.620	1.350	1.300
7	24-02-16	14:00	14	0	0	14.000	7.000	1.220	1.440	-0.320	1.160	1.350	-0.250	1.530	1.460	0.640	1.360	1.330
14	02-03-16	13:00	21	0	0	21.00	14.00	1.220	1.480	-0.400	1.160	1.390	-0.330	1.550	1.490	0.620	1.390	1.330
21	09-03-16	13:00	28	0	0	28.00	21.00	1.220	1.500	-0.480	1.170	1.410	-0.380	1.570	1.510	0.610	1.370	1.330
28	16-03-16	17:00	35	0	0	35.00	28.00	1.240	1.500	-0.480	1.160	1.420	-0.380	1.600	1.540	0.620	1.400	1.360
56	13-04-16	14:00	63	0	0	63.00	56.00	1.270	1.530	-0.490	1.200	1.460	-0.420	1.640	1.590	0.600	1.440	1.400
90	17-05-16	14:00	97	0	0	97.00	90.00	1.250	1.480	-0.480	1.170	1.420	-0.430	1.620	1.530	0.580	1.410	1.350
120	16-06-16	13:00	127	0	0	127.00	120.00	1.210	1.460	-0.510	1.150	1.340	-0.420	1.570	1.480	0.570	1.380	1.290
150	16-07-16	15:00	157	0	0	157.00	150.00	1.190	1.430	-0.560	1.110	1.340	-0.500	1.550	1.500	0.490	1.350	1.280
180	15-08-16	13:00	187	0	0	187.00	180.00	1.210	1.440	-0.540	1.140	1.340	-0.470	1.590	1.520	0.520	1.370	1.290
210	14-09-16	13:00	217	0	0	217.00	210.00	1.190	1.430	-0.560	1.140	1.340	-0.510	1.560	1.510	0.500	1.390	1.310
240	14-10-16	16:00	247	0	0	247.00	240.00	1.210	1.460	-0.520	1.160	1.340	-0.460	1.590	1.540	0.540	1.390	1.330
270	13-11-16	12:00	277	0	0	277.00	270.00	1.230	1.470	-0.570	1.160	1.380	-0.480	1.610	1.570	0.550	1.420	1.350
300	13-12-16	13:00	307	0	0	307.00	300.00	1.260	1.490	-0.580	1.180	1.390	-0.500	1.660	1.600	0.550	1.410	1.390
330	12-01-17	13:00	337	0	0	337.00	330.00	1.290	1.500	-0.600	1.210	1.410	-0.540	1.680	1.630	0.580	1.470	1.420
365	16-02-17	17:00	372	0	0	372.00	365.00	1.270	1.520	-0.600	1.220	1.430	-0.510	1.690	1.620	0.550	1.450	1.400
400	23-03-17	11:00	407	0	0	407.00	400.00	1.250	1.490	-0.590	1.190	1.350	-0.530	1.630	1.590	0.520	1.430	1.380
450	12-05-17	15:00	457	0	0	457.00	450.00	1.260	1.540	-0.640	1.160	1.370	-0.520	1.620	1.580	0.520	1.420	1.370

								SIDE B BOTTOM (‰)										
			Age					920	1200	1300	1400	1500	1600	1700	1800	1900	2000	2280
	Date	**Time**	**Days**	**Hours**	**Minutes**	**Days, eq**	**From loading (days)**	1	2	3	4	5	6	7	8	9	10	11
Casting	10-02-16	11:00	0	0	0	0.000	–	*31*	*31*	*31*	*31*	*31*	*31*	*31*	*31*	*31*	*31*	*31*
Before loading	17-02-16	11:55	7	0	0	7.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5min after loading	17-02-16	12:00	7	0	5	7.003	0.003	0.870	1.000	0.600	1.130	0.020	1.240	1.080	0.760	0.880	0.170	0.840
1h	17-02-16	13:00	7	1	0	7.042	0.042	0.950	1.070	0.640	1.180	0.020	1.330	1.150	0.750	0.900	0.160	0.890
6h	17-02-16	18:00	7	6	0	7.250	0.250	0.970	1.060	0.650	1.220	-0.030	1.370	1.170	0.810	0.920	0.160	0.920
1	18-02-16	13:00	8	0	0	8.000	1.000	1.040	1.120	0.700	1.250	0.000	1.430	1.100	0.840	0.980	0.190	0.980
2	19-02-16	11:00	9	0	0	9.000	2.000	1.060	1.170	0.750	1.290	0.010	1.500	1.330	0.890	1.040	0.210	1.050
3	20-02-16	12:00	10	0	0	10.000	3.000	1.080	1.150	0.750	1.310	0.000	1.510	1.330	0.900	1.060	0.200	1.040
4	21-02-16	13:00	11	0	0	11.000	4.000	1.070	1.170	0.740	1.300	-0.060	1.510	1.330	0.920	1.040	0.180	1.040
5	22-02-16	13:00	12	0	0	12.000	5.000	1.050	1.160	0.760	1.310	-0.040	1.530	1.350	0.880	1.060	0.220	1.070
6	23-02-16	16:00	13	0	0	13.000	6.000	1.110	1.170	0.780	1.340	-0.060	1.540	1.340	0.890	1.070	0.190	1.070
7	24-02-16	14:00	14	0	0	14.000	7.000	1.130	1.210	0.810	1.360	-0.040	1.600	1.370	0.930	1.120	0.220	1.110
14	02-03-16	13:00	21	0	0	21.00	14.00	1.100	1.160	0.780	1.340	-0.130	1.670	1.340	0.910	1.110	0.160	1.050
21	09-03-16	13:00	28	0	0	28.00	21.00	1.160	1.190	0.780	1.360	-0.110	1.650	1.360	0.870	1.120	0.180	1.080
28	16-03-16	17:00	35	0	0	35.00	28.00	1.160	1.220	0.790	1.410	-0.090	1.700	1.380	0.930	1.140	0.170	1.100
56	13-04-16	14:00	63	0	0	63.00	56.00	1.150	1.250	0.790	1.380	-0.120	1.690	1.350	0.920	1.140	0.170	1.080
90	17-05-16	14:00	97	0	0	97.00	90.00	1.150	1.200	0.790	1.350	-0.150	1.690	1.370	0.900	1.140	0.200	1.090
120	16-06-16	13:00	127	0	0	127.00	120.00	1.180	1.190	0.720	1.390	-0.260	1.700	1.300	0.870	1.090	0.170	1.020
150	16-07-16	15:00	157	0	0	157.00	150.00	1.110	1.130	0.700	1.350	-0.200	1.620	1.230	0.840	1.080	0.120	1.010
180	15-08-16	13:00	187	0	0	187.00	180.00	1.120	1.140	0.700	1.320	-0.210	1.660	1.310	0.880	1.070	0.140	1.000
210	14-09-16	13:00	217	0	0	217.00	210.00	1.130	1.130	0.720	1.340	-0.230	1.630	1.300	0.880	1.080	0.130	1.010
240	14-10-16	16:00	247	0	0	247.00	240.00	1.180	1.120	0.730	1.340	-0.190	1.450	1.430	0.880	1.100	0.140	1.020
270	13-11-16	12:00	277	0	0	277.00	270.00	1.180	1.110	0.740	1.370	-0.240	1.730	1.370	0.900	1.110	0.160	1.040
300	13-12-16	13:00	307	0	0	307.00	300.00	1.210	1.170	0.720	1.360	-0.250	1.660	1.310	0.940	1.110	0.130	1.040
330	12-01-17	13:00	337	0	0	337.00	330.00	1.230	1.150	0.760	1.390	-0.210	1.700	1.320	0.950	1.150	0.140	1.080
365	16-02-17	17:00	372	0	0	372.00	365.00	1.230	1.150	0.750	1.370	-0.170	1.690	1.320	0.920	1.120	0.130	1.080
400	23-03-17	11:00	407	0	0	407.00	400.00	1.220	1.140	0.740	1.410	-0.190	1.730	1.260	0.960	1.130	0.140	1.070
450	12-05-17	15:00	457	0	0	457.00	450.00	1.200	1.130	0.720	1.390	-0.220	1.670	1.270	0.950	1.100	0.140	1.050

				σ =	9.85	MPa		SIDE A TOP (‰)										
			Age					920	1200	1300	1400	1500	1600	1700	1800	1900	2000	2280
HVFAC7	**Date**	**Time**	**Days**	**Hours**	**Minutes**	**Days, eq**	**From loading (days)**	12	13	14	15	16	17	18	19	20	21	22
Casting	10-02-16	11:00	0	0	0	0.000	–	*197*	*197*	*197*	*197*	*197*	*197*	*197*	*197*	*197*	*197*	*197*
Before loading	17-02-16	11:55	7	0	0	7.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5min after loading	17-02-16	12:00	7	0	5	7.003	0.003	-0.330	-0.440	-0.360	-0.440	-0.370	-0.390	-0.400	-0.390	-0.430	-0.520	-0.480
1h	17-02-16	13:00	7	1	0	7.042	0.042	-0.360	-0.450	-0.370	-0.480	-0.400	-0.420	-0.450	-0.430	-0.470	-0.550	-0.520
6h	17-02-16	18:00	7	6	0	7.250	0.250	-0.440	-0.560	-0.420	-0.530	-0.450	-0.470	-0.500	-0.480	-0.520	-0.540	-0.570
1	18-02-16	13:00	8	0	0	8.000	1.000	-0.450	-0.570	-0.490	-0.570	-0.480	-0.520	-0.530	-0.500	-0.570	-0.600	-0.610
2	19-02-16	11:00	9	0	0	9.000	2.000	-0.450	-0.570	-0.480	-0.600	-0.510	-0.520	-0.540	-0.530	-0.610	-0.620	-0.640
3	20-02-16	12:00	10	0	0	10.000	3.000	-0.490	-0.640	-0.540	-0.640	-0.540	-0.560	-0.610	-0.550	-0.650	-0.710	-0.700
4	21-02-16	13:00	11	0	0	11.000	4.000	-0.540	-0.670	-0.560	-0.670	-0.570	-0.590	-0.630	-0.600	-0.700	-0.700	-0.710
5	22-02-16	13:00	12	0	0	12.000	5.000	-0.560	-0.710	-0.650	-0.720	-0.610	-0.640	-0.670	-0.640	-0.750	-0.790	-0.780
6	23-02-16	16:00	13	0	0	13.000	6.000	-0.560	-0.720	-0.640	-0.720	-0.630	-0.660	-0.680	-0.670	-0.750	-0.780	-0.800
7	24-02-16	14:00	14	0	0	14.000	7.000	-0.570	-0.720	-0.620	-0.720	-0.620	-0.650	-0.690	-0.640	-0.760	-0.770	-0.780
14	02-03-16	13:00	21	0	0	21.00	14.00	-0.680	-0.810	-0.730	-0.820	-0.730	-0.750	-0.790	-0.760	-0.890	-0.920	-0.900
21	09-03-16	13:00	28	0	0	28.00	21.00	-0.740	-0.880	-0.820	-0.900	-0.800	-0.800	-0.850	-0.820	-0.960	-0.970	-0.940
28	16-03-16	17:00	35	0	0	35.00	28.00	-0.770	-0.920	-0.890	-0.970	-0.870	-0.880	-0.920	-0.870	-1.030	-1.030	-1.010
56	13-04-16	14:00	63	0	0	63.00	56.00	-0.850	-1.010	-0.960	-0.990	-0.930	-0.930	-0.970	-0.950	-1.090	-1.090	-1.020
90	17-05-16	14:00	97	0	0	97.00	90.00	-0.920	-1.070	-0.980	-1.020	-0.960	-0.970	-1.020	-0.990	-1.180	-1.160	-1.090
120	16-06-16	13:00	127	0	0	127.00	120.00	-0.930	-1.100	-1.050	-1.080	-0.990	-1.020	-1.050	-1.020	-1.180	-1.160	-1.060
150	16-07-16	15:00	157	0	0	157.00	150.00	-1.010	-1.160	-1.120	-1.140	-1.070	-1.080	-1.130	-1.100	-1.250	-0.250	-1.170
180	15-08-16	13:00	187	0	0	187.00	180.00	-1.030	-1.170	-1.200	-1.160	-1.080	-1.100	-1.150	-1.110	-1.280	-0.260	-1.200
210	14-09-16	13:00	217	0	0	217.00	210.00	-1.050	-1.190	-1.190	-1.170	-1.120	-1.120	-1.180	-1.140	-1.320	-0.250	-1.210
240	14-10-16	16:00	247	0	0	247.00	240.00	-1.040	-1.190	-1.160	-1.170	-1.100	-1.110	-1.160	-1.120	-1.320	-0.200	-1.190
270	13-11-16	12:00	277	0	0	277.00	270.00	-1.050	-1.200	-1.200	-1.160	-1.130	-1.150	-1.170	-1.140	-1.350	0.000	-1.200
300	13-12-16	13:00	307	0	0	307.00	300.00	-1.120	-1.280	-1.290	-1.240	-1.180	-1.190	-1.240	-1.210	-1.420	0.000	-1.260
330	12-01-17	13:00	337	0	0	337.00	330.00	-1.140	-1.270	-1.350	-1.260	-1.220	-1.210	-1.260	-1.240	-1.440	0.000	-1.310
365	16-02-17	17:00	372	0	0	372.00	365.00	-1.150	-1.290	-1.290	-1.260	-1.230	-1.230	-1.300	-1.240	-1.440	0.000	-1.300
400	23-03-17	11:00	407	0	0	407.00	400.00	-1.180	-1.320	-1.360	-1.310	-1.250	-1.260	-1.310	-1.280	-1.520	0.000	-1.340
450	12-05-17	15:00	457	0	0	457.00	450.00	-1.180	-1.320	-1.370	-1.320	-1.250	-1.250	-1.320	-1.290	-1.510	0.000	-1.360

								SIDE B TOP (‰)										
			Age					920	1200	1300	1400	1500	1600	1700	1800	1900	2000	2280
	Date	**Time**	**Days**	**Hours**	**Minutes**	**Days, eq**	**From loading (days)**	12	13	14	15	16	17	18	19	20	21	22
Casting	10-02-16	11:00	0	0	0	0.000	–	*197*	*197*	*197*	*197*	*197*	*197*	*197*	*197*	*197*	*197*	*197*
Before loading	17-02-16	11:55	7	0	0	7.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5min after loading	17-02-16	12:00	7	0	5	7.003	0.003	-0.900	-0.320	-0.470	-0.420	-0.420	-0.360	-0.340	-0.320	-0.380	-0.340	-0.350
1h	17-02-16	13:00	7	1	0	7.042	0.042	-0.940	-0.330	-0.500	-0.470	-0.470	-0.390	-0.390	-0.360	-0.400	-0.360	-0.370
6h	17-02-16	18:00	7	6	0	7.250	0.250	-0.900	-0.340	-0.440	-0.470	-0.470	-0.390	-0.390	-0.370	-0.390	-0.410	-0.380
1	18-02-16	13:00	8	0	0	8.000	1.000	-1.050	-0.470	-0.520	-0.550	-0.550	-0.510	-0.460	-0.440	-0.490	-0.470	-0.470
2	19-02-16	11:00	9	0	0	9.000	2.000	-1.020	-0.430	-0.520	-0.560	-0.580	-0.470	-0.450	-0.410	-0.470	-0.460	-0.450
3	20-02-16	12:00	10	0	0	10.000	3.000	-1.110	-0.500	-0.550	-0.590	-0.620	-0.550	-0.510	-0.460	-0.550	-0.500	-0.520
4	21-02-16	13:00	11	0	0	11.000	4.000	-1.130	-0.550	-0.590	-0.620	-0.640	-0.580	-0.530	-0.520	-0.550	-0.580	-0.540
5	22-02-16	13:00	12	0	0	12.000	5.000	-1.230	-0.590	-0.630	-0.630	-0.670	-0.610	-0.560	-0.530	-0.570	-0.580	-0.570
6	23-02-16	16:00	13	0	0	13.000	6.000	-1.180	-0.570	-0.630	-0.660	-0.700	-0.640	-0.590	-0.510	-0.610	-0.630	-0.590
7	24-02-16	14:00	14	0	0	14.000	7.000	-1.170	-0.600	-0.640	-0.670	-0.690	-0.630	-0.580	-0.560	-0.590	-0.620	-0.600
14	02-03-16	13:00	21	0	0	21.00	14.00	-1.360	-0.710	-0.750	-0.770	-0.790	-0.760	-0.670	-0.660	-0.710	-0.740	-0.730
21	09-03-16	13:00	28	0	0	28.00	21.00	-1.370	-0.760	-0.800	-0.860	-0.840	-0.790	-0.750	-0.730	-0.740	-0.800	-0.780
28	16-03-16	17:00	35	0	0	35.00	28.00	-1.370	-0.780	-0.800	-0.870	-0.870	-0.830	-0.760	-0.730	-0.740	-0.840	-0.790
56	13-04-16	14:00	63	0	0	63.00	56.00	-1.480	-0.920	-0.920	-0.980	-1.010	-0.960	-0.880	-0.830	-0.870	-1.000	-0.910
90	17-05-16	14:00	97	0	0	97.00	90.00	-1.490	-0.910	-0.950	-0.990	-1.010	-0.970	-0.890	-0.830	-0.900	-0.990	-0.950
120	16-06-16	13:00	127	0	0	127.00	120.00	-1.520	-0.940	-0.990	-1.010	-1.050	-1.020	-0.900	-0.840	-0.930	-1.040	-0.970
150	16-07-16	15:00	157	0	0	157.00	150.00	-1.620	-1.040	-1.050	-1.100	-1.160	-1.070	-0.980	-0.910	-1.000	-1.070	-1.050
180	15-08-16	13:00	187	0	0	187.00	180.00	-1.680	-1.070	-1.060	-1.110	-1.160	-1.100	-1.010	-0.940	-1.010	-1.100	-1.090
210	14-09-16	13:00	217	0	0	217.00	210.00	-1.670	-1.100	-1.110	-1.160	-1.200	-1.110	-1.060	-0.960	-1.050	-1.130	-1.110
240	14-10-16	16:00	247	0	0	247.00	240.00	-1.650	-1.070	-1.110	-1.140	-1.200	-1.140	-1.040	-0.950	-1.070	-1.120	-1.100
270	13-11-16	12:00	277	0	0	277.00	270.00	-1.610	-1.100	-1.140	-1.180	-1.230	-1.140	-1.040	-0.980	-1.090	-1.110	-1.120
300	13-12-16	13:00	307	0	0	307.00	300.00	-1.750	-1.160	-1.160	-1.200	-1.280	-1.200	-1.110	-1.060	-1.100	-1.170	-1.170
330	12-01-17	13:00	337	0	0	337.00	330.00	-1.770	-1.200	-1.180	-1.250	-1.300	-1.230	-1.130	-1.040	-1.130	-1.200	-1.200
365	16-02-17	17:00	372	0	0	372.00	365.00	-1.780	-1.180	-1.240	-1.300	-1.360	-1.260	-1.170	-1.070	-1.140	-1.200	-1.250
400	23-03-17	11:00	407	0	0	407.00	400.00	-1.810	-1.200	-1.240	-1.300	-1.380	-1.250	-1.170	-1.090	-1.190	-1.280	-1.270
450	12-05-17	15:00	457	0	0	457.00	450.00	-1.790	-1.210	-1.250	-1.280	-1.370	-1.270	-1.170	-1.060	-1.170	-1.260	-1.240

				σ =	9.85	MPa		SIDE A MIDDLE (‰)					
			Age					1500	1600	1700	1500	1600	1700
HVFAC7	**Date**	**Time**	**Days**	**Hours**	**Minutes**	**Days, eq**	**From loading (days)**	23	24	25	26	27	28
Casting	10-02-16	11:00	0	0	0	0.000	–	*155*	*155*	*155*	*115*	*115*	*115*
Before loading	17-02-16	11:55	7	0	0	7.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5min after loading	17-02-16	12:00	7	0	5	7.003	0.003	-0.060	-0.100	-0.170	0.090	0.040	0.270
1h	17-02-16	13:00	7	1	0	7.042	0.042	-0.160	-0.120	-0.170	0.070	-0.080	0.270
6h	17-02-16	18:00	7	6	0	7.250	0.250	-0.190	-0.140	-0.210	0.100	-0.070	0.270
1	18-02-16	13:00	8	0	0	8.000	1.000	-0.200	-0.170	-0.250	0.070	-0.120	0.260
2	19-02-16	11:00	9	0	0	9.000	2.000	-0.220	-0.170	-0.240	0.110	-0.100	0.300
3	20-02-16	12:00	10	0	0	10.000	3.000	-0.240	-0.190	-0.270	0.090	-0.150	0.310
4	21-02-16	13:00	11	0	0	11.000	4.000	-0.280	-0.220	-0.300	0.080	-0.170	0.290
5	22-02-16	13:00	12	0	0	12.000	5.000	-0.320	-0.250	-0.350	0.070	-0.210	0.240
6	23-02-16	16:00	13	0	0	13.000	6.000	-0.340	0.000	0.000	0.050	-0.240	0.260
7	24-02-16	14:00	14	0	0	14.000	7.000	-0.310	0.000	0.000	0.120	-0.250	0.270
14	02-03-16	13:00	21	0	0	21.00	14.00	-0.400	0.000	0.000	0.060	-0.330	0.260
21	09-03-16	13:00	28	0	0	28.00	21.00	-0.440	0.000	0.000	0.030	-0.370	0.230
28	16-03-16	17:00	35	0	0	35.00	28.00	-0.500	0.000	0.000	0.010	-0.440	0.190
56	13-04-16	14:00	63	0	0	63.00	56.00	-0.550	0.000	0.000	-0.010	-0.460	0.190
90	17-05-16	14:00	97	0	0	97.00	90.00	-0.580	0.000	0.000	-0.060	-0.470	0.150
120	16-06-16	13:00	127	0	0	127.00	120.00	-0.600	0.000	0.000	-0.090	-0.480	0.110
150	16-07-16	15:00	157	0	0	157.00	150.00	-0.680	0.000	0.000	-0.130	-0.540	0.050
180	15-08-16	13:00	187	0	0	187.00	180.00	-0.700	0.000	0.000	-0.160	-0.560	0.040
210	14-09-16	13:00	217	0	0	217.00	210.00	-0.700	0.000	0.000	-0.150	-0.600	0.030
240	14-10-16	16:00	247	0	0	247.00	240.00	-0.720	0.000	0.000	-0.160	-0.560	0.040
270	13-11-16	12:00	277	0	0	277.00	270.00	-0.730	0.000	0.000	-0.150	-0.580	0.070
300	13-12-16	13:00	307	0	0	307.00	300.00	-0.800	0.000	0.000	-0.190	-0.650	0.060
330	12-01-17	13:00	337	0	0	337.00	330.00	-0.810	0.000	0.000	-0.160	-0.640	0.050
365	16-02-17	17:00	372	0	0	372.00	365.00	-0.810	0.000	0.000	-0.170	-0.640	0.030
400	23-03-17	11:00	407	0	0	407.00	400.00	-0.860	0.000	0.000	-0.230	-0.660	0.000
450	12-05-17	15:00	457	0	0	457.00	450.00	-0.850	0.000	0.000	-0.230	-0.640	-0.030

								SIDE B MIDDLE (‰)					
			Age					1500	1600	1700	1500	1600	1700
	Date	**Time**	**Days**	**Hours**	**Minutes**	**Days, eq**	**From loading (days)**	23	24	25	26	27	28
Casting	10-02-16	11:00	0	0	0	0.000	–	*155*	*155*	*155*	*115*	*115*	*115*
Before loading	17-02-16	11:55	7	0	0	7.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5min after loading	17-02-16	12:00	7	0	5	7.003	0.003	-0.100	-0.120	-0.070	-0.050	0.350	0.290
1h	17-02-16	13:00	7	1	0	7.042	0.042	-0.120	-0.130	-0.080	-0.080	0.340	0.280
6h	17-02-16	18:00	7	6	0	7.250	0.250	-0.120	-0.130	-0.080	-0.050	0.380	0.290
1	18-02-16	13:00	8	0	0	8.000	1.000	-0.150	-0.190	-0.120	-0.100	0.370	0.290
2	19-02-16	11:00	9	0	0	9.000	2.000	-0.150	-0.170	-0.100	-0.090	0.410	0.330
3	20-02-16	12:00	10	0	0	10.000	3.000	-0.210	-0.230	-0.150	-0.150	0.370	0.290
4	21-02-16	13:00	11	0	0	11.000	4.000	-0.220	-0.250	-0.190	-0.150	0.360	0.300
5	22-02-16	13:00	12	0	0	12.000	5.000	-0.230	-0.260	-0.190	-0.160	0.380	0.300
6	23-02-16	16:00	13	0	0	13.000	6.000	-0.230	-0.280	-0.180	-0.190	0.360	0.270
7	24-02-16	14:00	14	0	0	14.000	7.000	-0.250	-0.300	-0.190	-0.170	0.390	0.310
14	02-03-16	13:00	21	0	0	21.00	14.00	-0.310	-0.380	-0.280	-0.260	0.320	0.250
21	09-03-16	13:00	28	0	0	28.00	21.00	-0.380	-0.430	-0.300	-0.290	0.340	0.240
28	16-03-16	17:00	35	0	0	35.00	28.00	-0.380	-0.440	-0.310	-0.290	0.350	0.230
56	13-04-16	14:00	63	0	0	63.00	56.00	-0.470	-0.530	-0.410	-0.360	0.270	0.160
90	17-05-16	14:00	97	0	0	97.00	90.00	-0.470	-0.560	-0.420	-0.330	0.270	0.160
120	16-06-16	13:00	127	0	0	127.00	120.00	-0.520	-0.560	-0.450	-0.370	0.200	0.090
150	16-07-16	15:00	157	0	0	157.00	150.00	-0.620	-0.640	-0.520	-0.440	0.170	0.040
180	15-08-16	13:00	187	0	0	187.00	180.00	-0.620	-0.660	-0.530	-0.440	0.170	0.040
210	14-09-16	13:00	217	0	0	217.00	210.00	-0.650	-0.700	-0.570	-0.470	0.110	0.000
240	14-10-16	16:00	247	0	0	247.00	240.00	-0.640	-0.680	-0.560	-0.440	0.130	0.010
270	13-11-16	12:00	277	0	0	277.00	270.00	-0.640	-0.670	-0.530	-0.450	0.160	0.030
300	13-12-16	13:00	307	0	0	307.00	300.00	-0.660	-0.730	-0.570	-0.440	0.170	0.010
330	12-01-17	13:00	337	0	0	337.00	330.00	-0.690	-0.760	-0.600	-0.500	0.160	0.020
365	16-02-17	17:00	372	0	0	372.00	365.00	-0.730	-0.790	-0.630	-0.530	0.120	-0.020
400	23-03-17	11:00	407	0	0	407.00	400.00	-0.740	-0.790	-0.640	-0.470	0.100	-0.050
450	12-05-17	15:00	457	0	0	457.00	450.00	-0.720	-0.770	-0.640	-0.510	0.090	-0.080

HVFAC28					0	5m	1h	6h	1d	2d
	A	BOTTOM								
	From (mm)	To (mm)	Disks		09-03-16	09-03-16	09-03-16	09-03-16	10-03-16	11-03-16
1	870	970	1	2	0.079	0.114	0.116	0.12	0.118	0.124
2	1150	1250	3	4	-0.072	-0.084	-0.085	-0.084	-0.088	-0.085
3	1250	1350	4	5	-0.279	-0.243	-0.237	-0.231	-0.233	-0.228
4	1350	1450	5	6	-0.686	-0.609	-0.601	-0.594	-0.594	-0.587
5	1450	1550	6	7	1.328	1.326	1.328	1.333	1.331	1.333
6	1550	1650	7	8	-1.85	-1.77	-1.764	-1.757	-1.757	-1.751
7	1650	1750	8	9	-0.378	-0.347	-0.345	-0.336	-0.338	-0.335
8	1750	1850	9	10	-0.413	-0.341	-0.339	-0.331	-0.332	-0.327
9	1850	1950	10	11	-0.58	-0.501	-0.498	-0.487	-0.488	-0.483
10	1950	2050	11	12	-0.945	-0.872	-0.862	-0.858	-0.854	-0.85
11	2230	2330	13	14	-0.357	-0.269	-0.263	-0.255	-0.253	-0.248
	A	TOP								
	From (mm)	To (mm)	Disks							
12	870	970	15	16	-0.212	-0.231	-0.233	-0.231	-0.233	-0.235
13	1150	1250	17	18	-0.365	-0.396	-0.396	-0.395	-0.399	-0.401
14	1250	1350	18	19	-0.79	-0.81	-0.809	-0.808	-0.811	-0.813
15	1350	1450	19	20	0.507	0.472	0.47	0.471	0.468	0.466
16	1450	1550	20	21	-0.293	-0.319	-0.322	-0.319	-0.322	-0.325
17	1550	1650	21	22	-0.479	-0.51	-0.512	-0.511	-0.514	-0.516
18	1650	1750	22	23	-0.223	-0.254	-0.257	-0.257	-0.259	-0.261
19	1750	1850	23	24	-0.187	-0.215	-0.218	-0.216	-0.219	-0.221
20	1850	1950	24	25	-0.419	-0.451	-0.455	-0.453	-0.455	-0.456
21	1950	2050	25	26	-0.582	-0.618	-0.619	-0.62	-0.622	-0.622
22	2230	2330	27	28	-0.173	-0.202	-0.203	-0.203	-0.207	-0.205
	A	MIDDLE								
	From (mm)	To (mm)	Disks							
23	1450	1550	29	30	-0.595	-0.606	-0.611	-0.607	-0.609	-0.61
24	1550	1650	30	31	-0.562	-0.573	-0.578	-0.573	-0.577	-0.578
25	1650	1750	31	32	-0.155	-0.169	-0.171	-0.17	-0.171	-0.169
26	1450	1550	33	34	-0.156	-0.159	-0.163	-0.159	-0.161	-0.159
27	1550	1650	34	35	-0.542	-0.529	-0.531	-0.525	-0.526	-0.524
28	1650	1750	35	36	-0.461	-0.456	-0.459	-0.456	-0.458	-0.455

					0	5m	1h	6h	1d	2d
	B	BOTTOM								
	From (mm)	To (mm)	Disks		09-03-16	09-03-16	09-03-16	09-03-16	10-03-16	11-03-16
1	870	970	1	2	-0.203	-0.158	-0.159	-0.155	-0.153	-0.154
2	1150	1250	3	4	-1.623	-1.568	-1.572	-1.597	-1.6	-1.602
3	1250	1350	4	5	-0.286	-0.216	-0.212	-0.186	-0.182	-0.183
4	1350	1450	5	6	-0.337	-0.267	-0.267	-0.26	-0.261	-0.259
5	1450	1550	6	7	-1.754	-1.703	-1.704	-1.697	-1.696	-1.694
6	1550	1650	7	8	-0.281	-0.207	-0.206	-0.2	-0.199	-0.198
7	1650	1750	8	9	-0.217	-0.167	-0.163	-0.154	-0.156	-0.154
8	1750	1850	9	10	-0.458	-0.426	-0.43	-0.426	-0.427	-0.427
9	1850	1950	10	11	-0.768	-0.743	-0.744	-0.737	-0.739	-0.737
10	1950	2050	11	12	-0.479	-0.418	-0.42	-0.413	-0.412	-0.41
11	2230	2330	13	14	-0.163	-0.124	-0.125	-0.118	-0.121	-0.118
	B	TOP								
	From (mm)	To (mm)	Disks							
12	870	970	15	16	-0.277	-0.301	-0.302	-0.3	-0.306	-0.303
13	1150	1250	17	18	0.002	-0.026	-0.025	-0.026	-0.032	-0.033
14	1250	1350	18	19	-0.875	-0.903	-0.909	-0.905	-0.909	-0.911
15	1350	1450	19	20	-0.512	-0.542	-0.545	-0.543	-0.547	-0.548
16	1450	1550	20	21	-2.376	-2.405	-2.409	-2.404	-2.41	-2.413
17	1550	1650	21	22	-0.663	-0.692	-0.697	-0.695	-0.698	-0.7
18	1650	1750	22	23	-0.424	-0.446	-0.452	-0.448	-0.45	-0.455
19	1750	1850	23	24	0.429	0.409	0.402	0.394	0.372	0.371
20	1850	1950	24	25	-1.662	-1.683	-1.696	-1.702	-1.615	-1.618
21	1950	2050	25	26	-0.158	-0.185	-0.191	-0.187	-0.191	-0.193
22	2230	2330	27	28	0.181	0.158	0.156	0.156	0.153	0.152
	B	MIDDLE								
	From (mm)	To (mm)	Disks							
23	1450	1550	29	30	-0.337	-0.346	-0.351	-0.349	-0.352	-0.351
24	1550	1650	30	31	-0.256	-0.266	-0.27	-0.267	-0.27	-0.272
25	1650	1750	31	32	-0.226	-0.236	-0.237	-0.236	-0.239	-0.239
26	1450	1550	33	34	-0.189	-0.221	-0.224	-0.223	-0.221	-0.222
27	1550	1650	34	35	-1.118	-1.069	-1.073	-1.069	-1.07	-1.07
28	1650	1750	35	36	-0.591	-0.57	-0.568	-0.565	-0.567	-0.568

	HVFAC28				3d	4d	5d	6d	7d	14d
	A	**BOTTOM**								
	From (mm)	To (mm)	Disks		12-03-16	13-03-16	14-03-16	15-03-16	16-03-16	23-03-16
1	870	970	1	2	0.122	0.123	0.122	0.121	0.124	0.13
2	1150	1250	3	4	-0.088	-0.089	-0.091	-0.093	-0.091	-0.092
3	1250	1350	4	5	-0.227	-0.226	-0.228	-0.227	-0.224	-0.219
4	1350	1450	5	6	-0.589	-0.586	-0.586	-0.589	-0.581	-0.577
5	1450	1550	6	7	1.334	1.331	1.322	1.327	1.327	1.331
6	1550	1650	7	8	-1.753	-1.75	-1.752	-1.751	-1.748	-1.742
7	1650	1750	8	9	-0.337	-0.334	-0.336	-0.336	-0.334	-0.33
8	1750	1850	9	10	-0.326	-0.325	-0.327	-0.328	-0.325	-0.319
9	1850	1950	10	11	-0.485	-0.483	-0.485	-0.485	-0.482	-0.476
10	1950	2050	11	12	-0.852	-0.849	-0.851	-0.851	-0.843	-0.842
11	2230	2330	13	14	-0.249	-0.246	-0.248	-0.247	-0.242	-0.237
	A	**TOP**								
	From (mm)	To (mm)	Disks							
12	870	970	15	16	-0.237	-0.236	-0.239	-0.242	-0.239	-0.241
13	1150	1250	17	18	-0.402	-0.401	-0.405	-0.406	-0.404	-0.408
14	1250	1350	18	19	-0.815	-0.814	-0.817	-0.819	-0.816	-0.819
15	1350	1450	19	20	0.464	0.464	0.462	0.459	0.461	0.456
16	1450	1550	20	21	-0.326	-0.329	-0.329	-0.332	-0.33	-0.331
17	1550	1650	21	22	-0.517	-0.519	-0.519	-0.522	-0.52	-0.522
18	1650	1750	22	23	-0.265	-0.263	-0.266	-0.267	-0.266	-0.27
19	1750	1850	23	24	-0.226	-0.224	-0.225	-0.23	-0.228	-0.23
20	1850	1950	24	25	-0.462	-0.461	-0.462	-0.465	-0.463	-0.467
21	1950	2050	25	26	-0.63	-0.626	-0.628	-0.633	-0.628	-0.635
22	2230	2330	27	28	-0.21	-0.207	-0.211	-0.214	-0.212	-0.213
	A	**MIDDLE**								
	From (mm)	To (mm)	Disks							
23	1450	1550	29	30	-0.614	-0.612	-0.615	-0.615	-0.612	-0.614
24	1550	1650	30	31	-0.58	-0.58	-0.581	-0.583	-0.581	-0.584
25	1650	1750	31	32	-0.176	-0.173	-0.174	-0.178	-0.175	-0.176
26	1450	1550	33	34	-0.168	-0.161	-0.164	-0.167	-0.162	-0.165
27	1550	1650	34	35	-0.528	-0.524	-0.526	-0.529	-0.523	-0.525
28	1650	1750	35	36	-0.46	-0.456	-0.457	-0.463	-0.459	-0.457

					3d	4d	5d	6d	7d	14d
	B	**BOTTOM**								
	From (mm)	To (mm)	Disks		12-03-16	13-03-16	14-03-16	15-03-16	16-03-16	23-03-16
1	870	970	1	2	-0.155	-0.151	-0.154	-0.151	-0.153	-0.15
2	1150	1250	3	4	-1.602	-1.599	-1.601	-1.599	-1.597	-1.595
3	1250	1350	4	5	-0.182	-0.177	-0.178	-0.178	-0.176	-0.172
4	1350	1450	5	6	-0.26	-0.258	-0.259	-0.259	-0.256	-0.254
5	1450	1550	6	7	-1.695	-1.69	-1.692	-1.688	-1.686	-1.684
6	1550	1650	7	8	-0.199	-0.195	-0.198	-0.197	-0.195	-0.192
7	1650	1750	8	9	-0.155	-0.152	-0.155	-0.157	-0.153	-0.15
8	1750	1850	9	10	-0.423	-0.422	-0.423	-0.424	-0.421	-0.421
9	1850	1950	10	11	-0.738	-0.737	-0.737	-0.739	-0.738	-0.732
10	1950	2050	11	12	-0.41	-0.409	-0.407	-0.407	-0.405	-0.399
11	2230	2330	13	14	-0.119	-0.116	-0.118	-0.116	-0.115	-0.112
	B	**TOP**								
	From (mm)	To (mm)	Disks							
12	870	970	15	16	-0.309	-0.308	-0.309	-0.309	-0.311	-0.315
13	1150	1250	17	18	-0.036	-0.035	-0.039	-0.038	-0.04	-0.042
14	1250	1350	18	19	-0.918	-0.912	-0.918	-0.919	-0.919	-0.922
15	1350	1450	19	20	-0.549	-0.548	-0.553	-0.552	-0.551	-0.557
16	1450	1550	20	21	-2.415	-2.415	-2.416	-2.416	-2.416	-2.42
17	1550	1650	21	22	-0.703	-0.701	-0.703	-0.705	-0.707	-0.709
18	1650	1750	22	23	-0.457	-0.456	-0.458	-0.46	-0.461	-0.464
19	1750	1850	23	24	0.367	0.369	0.367	0.366	0.366	0.36
20	1850	1950	24	25	-1.623	-1.621	-1.623	-1.624	-1.623	-1.629
21	1950	2050	25	26	-0.197	-0.195	-0.197	-0.198	-0.197	-0.203
22	2230	2330	27	28	0.149	0.151	0.148	0.149	0.146	0.144
	B	**MIDDLE**								
	From (mm)	To (mm)	Disks							
23	1450	1550	29	30	-0.355	-0.353	-0.358	-0.355	-0.356	-0.36
24	1550	1650	30	31	-0.276	-0.272	-0.276	-0.275	-0.273	-0.277
25	1650	1750	31	32	-0.242	-0.238	-0.244	-0.243	-0.244	-0.247
26	1450	1550	33	34	-0.225	-0.222	-0.227	-0.223	-0.224	-0.226
27	1550	1650	34	35	-1.073	-1.069	-1.072	-1.071	-1.07	-1.074
28	1650	1750	35	36	-0.569	-0.567	-0.571	-0.573	-0.571	-0.572

HVFAC28					21d	28d	56d	90d	120d	150d
	A	BOTTOM								
	From (mm)	To (mm)	Disks		30-03-16	06-04-16	04-05-16	07-06-16	07-07-16	06-08-16
1	870	970	1	2	0.126	0.131	0.132	0.133	0.133	0.132
2	1150	1250	3	4	-0.098	-0.096	-0.098	-0.096	-0.102	-0.106
3	1250	1350	4	5	-0.222	-0.219	-0.217	-0.216	-0.217	-0.216
4	1350	1450	5	6	-0.582	-0.575	-0.573	-0.578	-0.571	-0.571
5	1450	1550	6	7	1.327	1.328	1.32	1.331	1.327	1.318
6	1550	1650	7	8	-1.743	-1.743	-1.737	-1.736	-1.736	-1.736
7	1650	1750	8	9	-0.331	-0.331	-0.328	-0.329	-0.33	-0.331
8	1750	1850	9	10	-0.32	-0.32	-0.317	-0.317	-0.317	-0.317
9	1850	1950	10	11	-0.477	-0.477	-0.475	-0.476	-0.474	-0.476
10	1950	2050	11	12	-0.84	-0.841	-0.837	-0.836	-0.835	-0.836
11	2230	2330	13	14	-0.236	-0.235	-0.23	-0.231	-0.226	-0.228
	A	TOP								
	From (mm)	To (mm)	Disks							
12	870	970	15	16	-0.246	-0.25	-0.252	-0.254	-0.259	-0.265
13	1150	1250	17	18	-0.415	-0.418	-0.422	-0.423	-0.43	-0.438
14	1250	1350	18	19	-0.826	-0.829	-0.834	-0.836	-0.843	-0.849
15	1350	1450	19	20	0.448	0.447	0.44	0.439	0.432	0.426
16	1450	1550	20	21	-0.338	-0.341	-0.348	-0.346	-0.356	-0.36
17	1550	1650	21	22	-0.53	-0.531	-0.538	-0.538	-0.545	-0.551
18	1650	1750	22	23	-0.275	-0.277	-0.285	-0.283	-0.293	-0.298
19	1750	1850	23	24	-0.234	-0.237	-0.244	-0.243	-0.251	-0.257
20	1850	1950	24	25	-0.47	-0.475	-0.48	-0.483	-0.491	-0.497
21	1950	2050	25	26	-0.64	-0.643	-0.647	-0.649	-0.655	-0.663
22	2230	2330	27	28	-0.223	-0.223	-0.23	-0.231	-0.236	-0.243
	A	MIDDLE								
	From (mm)	To (mm)	Disks							
23	1450	1550	29	30	-0.619	-0.624	-0.626	-0.628	-0.633	-0.638
24	1550	1650	30	31	-0.589	-0.591	-0.593	-0.591	-0.598	-0.602
25	1650	1750	31	32	-0.181	-0.186	-0.188	-0.191	-0.193	-0.201
26	1450	1550	33	34	-0.17	-0.171	-0.17	-0.174	-0.176	-0.182
27	1550	1650	34	35	-0.53	-0.532	-0.533	-0.535	-0.538	-0.542
28	1650	1750	35	36	-0.461	-0.465	-0.465	-0.468	-0.472	-0.476

					21d	28d	56d	90d	120d	150d
	B	BOTTOM								
	From (mm)	To (mm)	Disks		30-03-16	06-04-16	04-05-16	07-06-16	07-07-16	06-08-16
1	870	970	1	2	-0.153	-0.149	-0.148	-0.146	-0.147	-0.146
2	1150	1250	3	4	-1.598	-1.593	-1.592	-1.59	-1.591	-1.592
3	1250	1350	4	5	-0.176	-0.172	-0.171	-0.171	-0.17	-0.169
4	1350	1450	5	6	-0.258	-0.255	-0.253	-0.253	-0.253	-0.254
5	1450	1550	6	7	-1.684	-1.681	-1.679	-1.679	-1.674	-1.678
6	1550	1650	7	8	-0.193	-0.188	-0.186	-0.187	-0.186	-0.186
7	1650	1750	8	9	-0.154	-0.15	-0.15	-0.15	-0.151	-0.151
8	1750	1850	9	10	-0.424	-0.419	-0.416	-0.416	-0.416	-0.416
9	1850	1950	10	11	-0.738	-0.735	-0.734	-0.734	-0.736	-0.734
10	1950	2050	11	12	-0.402	-0.4	-0.396	-0.397	-0.394	-0.393
11	2230	2330	13	14	-0.114	-0.113	-0.111	-0.11	-0.11	-0.108
	B	TOP								
	From (mm)	To (mm)	Disks							
12	870	970	15	16	-0.323	-0.324	-0.329	-0.329	-0.337	-0.34
13	1150	1250	17	18	-0.052	-0.051	-0.059	-0.059	-0.068	-0.072
14	1250	1350	18	19	-0.93	-0.928	-0.933	-0.936	-0.936	-0.943
15	1350	1450	19	20	-0.562	-0.562	-0.568	-0.572	-0.579	-0.581
16	1450	1550	20	21	-2.43	-2.429	-2.433	-2.435	-2.444	-2.446
17	1550	1650	21	22	-0.714	-0.716	-0.724	-0.725	-0.733	-0.734
18	1650	1750	22	23	-0.471	-0.472	-0.479	-0.481	-0.489	-0.492
19	1750	1850	23	24	0.355	0.356	0.349	0.349	0.341	0.338
20	1850	1950	24	25	-1.637	-1.635	-1.644	-1.644	-1.652	-1.654
21	1950	2050	25	26	-0.21	-0.21	-0.218	-0.22	-0.226	-0.227
22	2230	2330	27	28	0.138	0.139	0.131	0.128	0.124	0.12
	B	MIDDLE								
	From (mm)	To (mm)	Disks							
23	1450	1550	29	30	-0.366	-0.362	-0.368	-0.371	-0.376	-0.379
24	1550	1650	30	31	-0.283	-0.284	-0.288	-0.287	-0.297	-0.297
25	1650	1750	31	32	-0.253	-0.25	-0.257	-0.26	-0.265	-0.268
26	1450	1550	33	34	-0.23	-0.23	-0.233	-0.234	-0.241	-0.237
27	1550	1650	34	35	-1.078	-1.077	-1.079	-1.079	-1.082	-1.085
28	1650	1750	35	36	-0.578	-0.575	-0.578	-0.581	-0.582	-0.583

HVFAC28					180d	210d	240d	270d	300d	330d
	A	BOTTOM								
	From (mm)	To (mm)	Disks		05-09-16	05-10-16	04-11-16	04-12-16	03-01-17	02-02-17
1	870	970	1	2	0.128	0.129	0.129	0.131	0.137	0.14
2	1150	1250	3	4	-0.107	-0.105	-0.11	-0.111	-0.11	-0.109
3	1250	1350	4	5	-0.22	-0.218	-0.217	-0.215	-0.209	-0.208
4	1350	1450	5	6	-0.575	-0.574	-0.573	-0.566	-0.56	-0.559
5	1450	1550	6	7	1.314	1.323	1.312	1.313	1.305	1.312
6	1550	1650	7	8	-1.738	-1.735	-1.739	-1.734	-1.73	-1.73
7	1650	1750	8	9	-0.334	-0.331	-0.331	-0.33	-0.327	-0.323
8	1750	1850	9	10	-0.32	-0.32	-0.316	-0.313	-0.308	-0.307
9	1850	1950	10	11	-0.478	-0.476	-0.476	-0.471	-0.467	-0.465
10	1950	2050	11	12	-0.836	-0.836	-0.833	-0.829	-0.823	0.821
11	2230	2330	13	14	-0.231	-0.23	-0.228	-0.223	-0.217	-0.212
	A	TOP								
	From (mm)	To (mm)	Disks							
12	870	970	15	16	-0.269	-0.27	-0.274	-0.273	-0.277	-0.279
13	1150	1250	17	18	-0.441	-0.443	-0.446	-0.448	-0.453	-0.45
14	1250	1350	18	19	-0.854	-0.855	-0.858	-0.86	-0.86	-0.862
15	1350	1450	19	20	0.421	0.42	0.418	0.415	0.414	0.412
16	1450	1550	20	21	-0.365	-0.365	-0.371	-0.372	-0.373	-0.377
17	1550	1650	21	22	-0.554	-0.554	-0.559	-0.562	-0.563	-0.566
18	1650	1750	22	23	-0.301	-0.303	-0.308	-0.31	-0.312	-0.313
19	1750	1850	23	24	-0.261	-0.26	-0.265	-0.266	-0.266	-0.269
20	1850	1950	24	25	-0.499	-0.502	-0.505	-0.507	-0.51	-0.512
21	1950	2050	25	26	-0.663	-0.667	-0.669	-0.672	-0.674	-0.677
22	2230	2330	27	28	-0.246	-0.248	-0.251	-0.253	-0.256	-0.255
	A	MIDDLE								
	From (mm)	To (mm)	Disks							
23	1450	1550	29	30	-0.641	-0.641	-0.644	-0.644	-0.645	-0.648
24	1550	1650	30	31	-0.606	-0.606	-0.607	-0.608	-0.61	-0.612
25	1650	1750	31	32	-0.202	-0.202	-0.205	-0.208	-0.213	-0.208
26	1450	1550	33	34	-0.184	-0.185	-0.186	-0.186	-0.19	-0.188
27	1550	1650	34	35	-0.544	-0.545	-0.546	-0.547	-0.546	-0.547
28	1650	1750	35	36	-0.479	-0.479	-0.481	-0.48	-0.479	-0.48

					180d	210d	240d	270d	300d	330d
	B	BOTTOM								
	From (mm)	To (mm)	Disks		05-09-16	05-10-16	04-11-16	04-12-16	03-01-17	02-02-17
1	870	970	1	2	-0.15	-0.146	-0.146	-0.142	-0.146	-0.137
2	1150	1250	3	4	-1.596	-1.594	-1.594	-1.59	-1.589	-1.588
3	1250	1350	4	5	-0.175	-0.173	-0.171	-0.166	-0.166	-0.163
4	1350	1450	5	6	-0.257	-0.254	-0.254	-0.25	-0.249	-0.244
5	1450	1550	6	7	-1.682	-1.682	-1.676	-1.67	-1.673	-1.67
6	1550	1650	7	8	-0.189	-0.188	-0.185	-0.181	-0.178	-0.174
7	1650	1750	8	9	-0.155	-0.158	-0.155	-0.153	-0.151	-0.148
8	1750	1850	9	10	-0.418	-0.42	-0.417	-0.413	-0.413	-0.41
9	1850	1950	10	11	-0.733	-0.738	-0.735	-0.735	-0.735	-0.73
10	1950	2050	11	12	-0.395	-0.397	-0.395	-0.392	-0.389	-0.385
11	2230	2330	13	14	-0.111	-0.115	-0.112	-0.107	-0.106	-0.101
	B	TOP								
	From (mm)	To (mm)	Disks							
12	870	970	15	16	-0.345	-0.347	-0.35	-0.352	-0.358	-0.355
13	1150	1250	17	18	-0.078	-0.078	-0.082	-0.085	-0.091	-0.089
14	1250	1350	18	19	-0.949	-0.953	-0.951	-0.953	-0.961	-0.966
15	1350	1450	19	20	-0.584	-0.586	-0.589	-0.59	-0.594	-0.59
16	1450	1550	20	21	-2.455	-2.455	-2.455	-2.46	-2.462	-2.464
17	1550	1650	21	22	-0.741	-0.741	-0.747	-0.746	-0.754	-0.748
18	1650	1750	22	23	-0.499	-0.5	-0.503	-0.504	-0.509	-0.509
19	1750	1850	23	24	0.331	0.33	0.328	0.327	0.322	0.322
20	1850	1950	24	25	-1.662	-1.663	-1.665	-1.666	-1.673	-1.669
21	1950	2050	25	26	-0.235	-0.237	-0.239	-0.241	-0.246	-0.246
22	2230	2330	27	28	0.112	0.11	0.11	0.109	0.103	0.107
	B	MIDDLE								
	From (mm)	To (mm)	Disks							
23	1450	1550	29	30	-0.384	-0.384	-0.387	-0.389	-0.393	-0.388
24	1550	1650	30	31	-0.304	-0.306	-0.304	-0.308	-0.31	-0.309
25	1650	1750	31	32	-0.273	-0.274	-0.275	-0.275	-0.278	-0.276
26	1450	1550	33	34	-0.245	-0.244	-0.249	-0.247	-0.25	-0.246
27	1550	1650	34	35	-1.089	-1.089	-1.092	-1.09	-1.095	-1.09
28	1650	1750	35	36	-0.588	-0.588	-0.588	-0.587	-0.588	-0.587

	HVFAC28				360d	400d	450d
	A	**BOTTOM**					
	From (mm)	To (mm)	Disks		09-03-17	13-04-17	02-06-17
1	870	970	1	2	0.134	0.139	0.135
2	1150	1250	3	4	-0.111	-0.11	-0.108
3	1250	1350	4	5	-0.211	-0.209	-0.212
4	1350	1450	5	6	-0.56	-0.559	-0.561
5	1450	1550	6	7	1.312	1.316	1.303
6	1550	1650	7	8	-1.731	-1.721	-1.725
7	1650	1750	8	9	-0.33	-0.326	-0.328
8	1750	1850	9	10	-0.312	-0.308	-0.31
9	1850	1950	10	11	-0.467	-0.464	-0.469
10	1950	2050	11	12	-0.827	-0.824	-0.823
11	2230	2330	13	14	-0.219	-0.213	-0.217
	A	**TOP**					
	From (mm)	To (mm)	Disks				
12	870	970	15	16	-0.285	-0.282	-0.282
13	1150	1250	17	18	-0.46	-0.457	-0.456
14	1250	1350	18	19	-0.869	-0.867	-0.867
15	1350	1450	19	20	0.403	0.406	0.406
16	1450	1550	20	21	-0.382	-0.38	-0.38
17	1550	1650	21	22	-0.572	-0.569	-0.568
18	1650	1750	22	23	-0.319	-0.316	-0.317
19	1750	1850	23	24	-0.275	-0.273	-0.272
20	1850	1950	24	25	-0.515	-0.518	-0.516
21	1950	2050	25	26	-0.683	-0.682	-0.679
22	2230	2330	27	28	-0.262	-0.26	-0.26
	A	**MIDDLE**					
	From (mm)	To (mm)	Disks				
23	1450	1550	29	30	-0.649	-0.649	-0.648
24	1550	1650	30	31	-0.618	-0.615	-0.616
25	1650	1750	31	32	-0.214	-0.211	-0.209
26	1450	1550	33	34	-0.194	-0.19	-0.188
27	1550	1650	34	35	-0.552	-0.549	-0.548
28	1650	1750	35	36	-0.487	-0.482	-0.483

					360d	400d	450d
	B	**BOTTOM**					
	From (mm)	To (mm)	Disks		09-03-17	13-04-17	02-06-17
1	870	970	1	2	-0.14	-0.141	-0.137
2	1150	1250	3	4	-1.591	-1.588	-1.586
3	1250	1350	4	5	-0.167	-0.166	-0.165
4	1350	1450	5	6	-0.251	-0.247	-0.247
5	1450	1550	6	7	-1.672	-1.668	-1.667
6	1550	1650	7	8	-0.176	-0.176	-0.174
7	1650	1750	8	9	-0.151	-0.148	-0.149
8	1750	1850	9	10	-0.412	-0.411	-0.407
9	1850	1950	10	11	-0.736	-0.735	-0.734
10	1950	2050	11	12	-0.389	-0.385	-0.386
11	2230	2330	13	14	-0.107	-0.103	-0.106
	B	**TOP**					
	From (mm)	To (mm)	Disks				
12	870	970	15	16	-0.36	-0.36	-0.36
13	1150	1250	17	18	-0.095	-0.1	-0.094
14	1250	1350	18	19	-0.963	-0.962	-0.958
15	1350	1450	19	20	-0.596	-0.598	-0.598
16	1450	1550	20	21	-2.463	-2.467	-2.462
17	1550	1650	21	22	-0.757	-0.758	-0.755
18	1650	1750	22	23	-0.514	-0.516	-0.512
19	1750	1850	23	24	0.317	0.316	0.317
20	1850	1950	24	25	-1.675	-1.677	-1.673
21	1950	2050	25	26	-0.25	-0.252	-0.252
22	2230	2330	27	28	0.099	0.097	0.096
	B	**MIDDLE**					
	From (mm)	To (mm)	Disks				
23	1450	1550	29	30	-0.394	-0.396	-0.393
24	1550	1650	30	31	-0.316	-0.314	-0.314
25	1650	1750	31	32	-0.282	-0.285	-0.283
26	1450	1550	33	34	-0.251	-0.252	-0.248
27	1550	1650	34	35	-1.09	-1.096	-1.088
28	1650	1750	35	36	-0.596	-0.592	-0.591

			σ =		10.13	MPa		SIDE A BOTTOM (‰)										
			Age					920	1200	1300	1400	1500	1600	1700	1800	1900	2000	2280
HVFAC28	**Date**	**Time**	**Days**	**Hours**	**Minutes**	**Days, eq**	**From loading (days)**	1	2	3	4	5	6	7	8	9	10	11
Casting	10-02-16	11:00	0	0	0	0.000	–	*31*	*31*	*31*	*31*	*31*	*31*	*31*	*31*	*31*	*31*	*31*
Before loading	09-03-16	13:40	28	0	0	28.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5min after loading	09-03-16	13:50	28	0	5	28.003	0.003	0.350	-0.120	0.360	0.770	-0.020	0.800	0.310	0.720	0.790	0.730	0.880
1h	09-03-16	14:45	28	1	0	28.042	0.042	0.370	-0.130	0.420	0.850	0.000	0.860	0.330	0.740	0.820	0.830	0.940
6h	09-03-16	19:45	28	6	0	28.250	0.250	0.410	-0.120	0.480	0.920	0.050	0.930	0.420	0.820	0.930	0.870	1.020
1	10-03-16	15:00	29	0	0	29.000	1.000	0.390	-0.160	0.460	0.920	0.030	0.930	0.400	0.810	0.920	0.910	1.040
2	11-03-16	15:00	30	0	0	30.000	2.000	0.450	-0.130	0.510	0.990	0.050	0.990	0.430	0.860	0.970	0.950	1.090
3	12-03-16	20:00	31	0	0	31.000	3.000	0.430	-0.160	0.520	0.970	0.060	0.970	0.410	0.870	0.950	0.930	1.080
4	13-03-16	18:00	32	0	0	32.000	4.000	0.440	-0.170	0.530	1.000	0.030	1.000	0.440	0.880	0.970	0.960	1.110
5	14-03-16	9:00	33	0	0	33.000	5.000	0.430	-0.190	0.510	1.000	-0.060	0.980	0.420	0.860	0.950	0.940	1.090
6	15-03-16	18:00	34	0	0	34.000	6.000	0.420	-0.210	0.520	0.970	-0.010	0.990	0.420	0.850	0.950	0.940	1.100
7	16-03-16	17:00	35	0	0	35.000	7.000	0.450	-0.190	0.550	1.050	-0.010	1.020	0.440	0.880	0.980	1.020	1.150
14	23-03-16	12:00	42	0	0	42.00	14.00	0.510	-0.200	0.600	1.090	0.030	1.080	0.480	0.940	1.040	1.030	1.200
21	30-03-16	15:00	49	0	0	49.00	21.00	0.470	-0.260	0.570	1.040	-0.010	1.070	0.470	0.930	1.030	1.050	1.210
28	06-04-16	12:00	56	0	0	56.00	28.00	0.520	-0.240	0.600	1.110	0.000	1.070	0.470	0.930	1.030	1.040	1.220
56	04-05-16	14:00	84	0	0	84.00	56.00	0.530	-0.260	0.620	1.130	-0.080	1.130	0.500	0.960	1.050	1.080	1.270
90	07-06-16	12:00	118	0	0	118.00	90.00	0.540	-0.240	0.630	1.080	0.030	1.140	0.490	0.960	1.040	1.090	1.260
120	07-07-16	13:00	148	0	0	148.00	120.00	0.540	-0.300	0.620	1.150	-0.010	1.140	0.480	0.960	1.060	1.100	1.310
150	06-08-16	16:00	178	0	0	178.00	150.00	0.530	-0.340	0.630	1.150	-0.100	1.140	0.470	0.960	1.040	1.090	1.290
180	05-09-16	13:00	208	0	0	208.00	180.00	0.490	-0.350	0.590	1.110	-0.140	1.120	0.440	0.930	1.020	1.090	1.260
210	05-10-16	12:00	238	0	0	238.00	210.00	0.500	-0.330	0.610	1.120	-0.050	1.150	0.470	0.930	1.040	1.090	1.270
240	04-11-16	11:00	268	0	0	268.00	240.00	0.500	-0.380	0.620	1.130	-0.160	1.110	0.470	0.970	1.040	1.120	1.290
270	04-12-16	11:00	298	0	0	298.00	270.00	0.520	-0.390	0.640	1.200	-0.150	1.160	0.480	1.000	1.090	1.160	1.340
300	03-01-17	14:00	328	0	0	328.00	300.00	0.580	-0.380	0.700	1.260	-0.230	1.200	0.510	1.050	1.130	1.220	1.400
330	02-02-17	13:00	358	0	0	358.00	330.00	0.610	-0.370	0.710	1.270	-0.160	1.200	0.550	1.060	1.150	17.660	1.450
365	09-03-17	11:00	393	0	0	393.00	365.00	0.550	-0.390	0.680	1.260	-0.160	1.190	0.480	1.010	1.130	1.180	1.380
400	13-04-17	10:00	428	0	0	428.00	400.00	0.600	-0.380	0.700	1.270	-0.120	1.290	0.520	1.050	1.160	1.210	1.440
450	02-06-17	17:00	478	0	0	478.00	450.00	0.560	-0.360	0.670	1.250	-0.250	1.250	0.500	1.030	1.110	1.220	1.400

								SIDE B BOTTOM (‰)										
			Age					920	1200	1300	1400	1500	1600	1700	1800	1900	2000	2280
	Date	**Time**	**Days**	**Hours**	**Minutes**	**Days, eq**	**From loading (days)**	1	2	3	4	5	6	7	8	9	10	11
Casting	10-02-16	11:00	0	0	0	0.000	–	*31*	*31*	*31*	*31*	*31*	*31*	*31*	*31*	*31*	*31*	*31*
Before loading	09-03-16	13:40	28	0	0	28.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5min after loading	09-03-16	13:50	28	0	5	28.003	0.003	0.450	0.550	0.700	0.700	0.510	0.740	0.500	0.320	0.250	0.610	0.390
1h	09-03-16	14:45	28	1	0	28.042	0.042	0.440	0.510	0.740	0.700	0.500	0.750	0.540	0.280	0.240	0.590	0.380
6h	09-03-16	19:45	28	6	0	28.250	0.250	0.480	0.260	1.000	0.770	0.570	0.810	0.630	0.320	0.310	0.660	0.450
1	10-03-16	15:00	29	0	0	29.000	1.000	0.500	0.230	1.040	0.760	0.580	0.820	0.610	0.310	0.290	0.670	0.420
2	11-03-16	15:00	30	0	0	30.000	2.000	0.490	0.210	1.030	0.780	0.600	0.830	0.630	0.310	0.310	0.690	0.450
3	12-03-16	20:00	31	0	0	31.000	3.000	0.480	0.210	1.040	0.770	0.590	0.820	0.620	0.350	0.300	0.690	0.440
4	13-03-16	18:00	32	0	0	32.000	4.000	0.520	0.240	1.090	0.790	0.640	0.860	0.650	0.360	0.310	0.700	0.470
5	14-03-16	9:00	33	0	0	33.000	5.000	0.490	0.220	1.080	0.780	0.620	0.830	0.620	0.350	0.310	0.720	0.450
6	15-03-16	18:00	34	0	0	34.000	6.000	0.520	0.240	1.080	0.780	0.660	0.840	0.600	0.340	0.290	0.720	0.470
7	16-03-16	17:00	35	0	0	35.000	7.000	0.500	0.260	1.100	0.810	0.680	0.860	0.640	0.370	0.300	0.740	0.480
14	23-03-16	12:00	42	0	0	42.00	14.00	0.530	0.280	1.140	0.830	0.700	0.890	0.670	0.370	0.360	0.800	0.510
21	30-03-16	15:00	49	0	0	49.00	21.00	0.500	0.250	1.100	0.790	0.700	0.880	0.630	0.340	0.300	0.770	0.490
28	06-04-16	12:00	56	0	0	56.00	28.00	0.540	0.300	1.140	0.820	0.730	0.930	0.670	0.390	0.330	0.790	0.500
56	04-05-16	14:00	84	0	0	84.00	56.00	0.550	0.310	1.150	0.840	0.750	0.950	0.670	0.420	0.340	0.830	0.520
90	07-06-16	12:00	118	0	0	118.00	90.00	0.570	0.330	1.150	0.840	0.750	0.940	0.670	0.420	0.340	0.820	0.530
120	07-07-16	13:00	148	0	0	148.00	120.00	0.560	0.320	1.160	0.840	0.800	0.950	0.660	0.420	0.320	0.850	0.530
150	06-08-16	16:00	178	0	0	178.00	150.00	0.570	0.310	1.170	0.830	0.760	0.950	0.660	0.420	0.340	0.860	0.550
180	05-09-16	13:00	208	0	0	208.00	180.00	0.530	0.270	1.110	0.800	0.720	0.920	0.620	0.400	0.350	0.840	0.520
210	05-10-16	12:00	238	0	0	238.00	210.00	0.570	0.290	1.130	0.830	0.720	0.930	0.590	0.380	0.300	0.820	0.480
240	04-11-16	11:00	268	0	0	268.00	240.00	0.570	0.290	1.150	0.830	0.780	0.960	0.620	0.410	0.330	0.840	0.510
270	04-12-16	11:00	298	0	0	298.00	270.00	0.610	0.330	1.200	0.870	0.840	1.000	0.640	0.450	0.330	0.870	0.560
300	03-01-17	14:00	328	0	0	328.00	300.00	0.570	0.340	1.200	0.880	0.810	1.030	0.660	0.450	0.330	0.900	0.570
330	02-02-17	13:00	358	0	0	358.00	330.00	0.660	0.350	1.230	0.930	0.840	1.070	0.690	0.480	0.380	0.940	0.620
365	09-03-17	11:00	393	0	0	393.00	365.00	0.630	0.320	1.190	0.860	0.820	1.050	0.660	0.460	0.320	0.900	0.560
400	13-04-17	10:00	428	0	0	428.00	400.00	0.620	0.350	1.200	0.900	0.860	1.050	0.690	0.470	0.330	0.940	0.600
450	02-06-17	17:00	478	0	0	478.00	450.00	0.660	0.370	1.210	0.900	0.870	1.070	0.680	0.510	0.340	0.930	0.570

				σ =	10.13	MPa		SIDE A TOP (‰)										
			Age					920	1200	1300	1400	1500	1600	1700	1800	1900	2000	2280
HVFAC28	**Date**	**Time**	**Days**	**Hours**	**Minutes**	**Days, eq**	**From loading (days)**	12	13	14	15	16	17	18	19	20	21	22
								195	*195*	*195*	*195*	*195*	*195*	*195*	*195*	*195*	*195*	*195*
Casting	10-02-16	11:00	0	0	0	0.000	–											
Before loading	09-03-16	13:40	28	0	0	28.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5min after loading	09-03-16	13:50	28	0	5	28.003	0.003	-0.190	-0.310	-0.200	-0.350	-0.260	-0.310	-0.310	-0.280	-0.320	-0.360	-0.290
1h	09-03-16	14:45	28	1	0	28.042	0.042	-0.210	-0.310	-0.190	-0.370	-0.290	-0.330	-0.340	-0.310	-0.360	-0.370	-0.300
6h	09-03-16	19:45	28	6	0	28.250	0.250	-0.190	-0.300	-0.180	-0.360	-0.260	-0.320	-0.340	-0.290	-0.340	-0.380	-0.300
1	10-03-16	15:00	29	0	0	29.000	1.000	-0.210	-0.340	-0.210	-0.390	-0.290	-0.350	-0.360	-0.320	-0.360	-0.400	-0.340
2	11-03-16	15:00	30	0	0	30.000	2.000	-0.230	-0.360	-0.230	-0.410	-0.320	-0.370	-0.380	-0.340	-0.370	-0.400	-0.320
3	12-03-16	20:00	31	0	0	31.000	3.000	-0.250	-0.370	-0.250	-0.430	-0.330	-0.380	-0.420	-0.390	-0.430	-0.480	-0.370
4	13-03-16	18:00	32	0	0	32.000	4.000	-0.240	-0.360	-0.240	-0.430	-0.360	-0.400	-0.400	-0.370	-0.420	-0.440	-0.340
5	14-03-16	9:00	33	0	0	33.000	5.000	-0.270	-0.400	-0.270	-0.450	-0.360	-0.400	-0.430	-0.380	-0.430	-0.460	-0.380
6	15-03-16	18:00	34	0	0	34.000	6.000	-0.300	-0.410	-0.290	-0.480	-0.390	-0.430	-0.440	-0.430	-0.460	-0.510	-0.410
7	16-03-16	17:00	35	0	0	35.000	7.000	-0.270	-0.390	-0.260	-0.460	-0.370	-0.410	-0.430	-0.410	-0.440	-0.460	-0.390
14	23-03-16	12:00	42	0	0	42.00	14.00	-0.290	-0.430	-0.290	-0.510	-0.380	-0.430	-0.470	-0.430	-0.480	-0.530	-0.400
21	30-03-16	15:00	49	0	0	49.00	21.00	-0.340	-0.500	-0.360	-0.590	-0.450	-0.510	-0.520	-0.470	-0.510	-0.580	-0.500
28	06-04-16	12:00	56	0	0	56.00	28.00	-0.380	-0.530	-0.390	-0.600	-0.480	-0.520	-0.540	-0.500	-0.560	-0.610	-0.500
56	04-05-16	14:00	84	0	0	84.00	56.00	-0.400	-0.570	-0.440	-0.670	-0.550	-0.590	-0.620	-0.570	-0.610	-0.650	-0.570
90	07-06-16	12:00	118	0	0	118.00	90.00	-0.420	-0.580	-0.460	-0.680	-0.530	-0.590	-0.600	-0.560	-0.640	-0.670	-0.580
120	07-07-16	13:00	148	0	0	148.00	120.00	-0.470	-0.650	-0.530	-0.750	-0.630	-0.660	-0.700	-0.640	-0.720	-0.730	-0.630
150	06-08-16	16:00	178	0	0	178.00	150.00	-0.530	-0.730	-0.590	-0.810	-0.670	-0.720	-0.750	-0.700	-0.780	-0.810	-0.700
180	05-09-16	13:00	208	0	0	208.00	180.00	-0.570	-0.760	-0.640	-0.860	-0.720	-0.750	-0.780	-0.740	-0.800	-0.810	-0.730
210	05-10-16	12:00	238	0	0	238.00	210.00	-0.580	-0.780	-0.650	-0.870	-0.720	-0.750	-0.800	-0.730	-0.830	-0.850	-0.750
240	04-11-16	11:00	268	0	0	268.00	240.00	-0.620	-0.810	-0.680	-0.890	-0.780	-0.800	-0.850	-0.780	-0.860	-0.870	-0.780
270	04-12-16	11:00	298	0	0	298.00	270.00	-0.610	-0.830	-0.700	-0.920	-0.790	-0.830	-0.870	-0.790	-0.880	-0.900	-0.800
300	03-01-17	14:00	328	0	0	328.00	300.00	-0.650	-0.880	-0.700	-0.930	-0.800	-0.840	-0.890	-0.790	-0.910	-0.920	-0.830
330	02-02-17	13:00	358	0	0	358.00	330.00	-0.670	-0.850	-0.720	-0.950	-0.840	-0.870	-0.900	-0.820	-0.930	-0.950	-0.820
365	09-03-17	11:00	393	0	0	393.00	365.00	-0.730	-0.950	-0.790	-1.040	-0.890	-0.930	-0.960	-0.880	-0.960	-1.010	-0.890
400	13-04-17	10:00	428	0	0	428.00	400.00	-0.700	-0.920	-0.770	-1.010	-0.870	-0.900	-0.930	-0.860	-0.990	-1.000	-0.870
450	02-06-17	17:00	478	0	0	478.00	450.00	-0.700	-0.910	-0.770	-1.010	-0.870	-0.890	-0.940	-0.850	-0.970	-0.970	-0.870

								SIDE B TOP (‰)										
			Age					920	1200	1300	1400	1500	1600	1700	1800	1900	2000	2280
	Date	**Time**	**Days**	**Hours**	**Minutes**	**Days, eq**	**From loading (days)**	12	13	14	15	16	17	18	19	20	21	22
								195	*195*	*195*	*195*	*195*	*195*	*195*	*195*	*195*	*195*	*195*
Casting	10-02-16	11:00	0	0	0	0.000	–											
Before loading	09-03-16	13:40	28	0	0	28.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5min after loading	09-03-16	13:50	28	0	5	28.003	0.003	-0.240	-0.280	-0.280	-0.300	-0.290	-0.290	-0.220	-0.200	-0.210	-0.270	-0.230
1h	09-03-16	14:45	28	1	0	28.042	0.042	-0.250	-0.270	-0.340	-0.330	-0.330	-0.340	-0.280	-0.270	-0.340	-0.330	-0.250
6h	09-03-16	19:45	28	6	0	28.250	0.250	-0.230	-0.280	-0.300	-0.310	-0.280	-0.320	-0.240	-0.350	-0.400	-0.290	-0.250
1	10-03-16	15:00	29	0	0	29.000	1.000	-0.290	-0.340	-0.340	-0.350	-0.340	-0.350	-0.260	-0.570	0.470	-0.330	-0.280
2	11-03-16	15:00	30	0	0	30.000	2.000	-0.260	-0.350	-0.360	-0.360	-0.370	-0.370	-0.310	-0.580	0.440	-0.350	-0.290
3	12-03-16	20:00	31	0	0	31.000	3.000	-0.320	-0.380	-0.430	-0.370	-0.390	-0.400	-0.330	-0.620	0.390	-0.390	-0.320
4	13-03-16	18:00	32	0	0	32.000	4.000	-0.310	-0.370	-0.370	-0.360	-0.390	-0.380	-0.320	-0.600	0.410	-0.370	-0.300
5	14-03-16	9:00	33	0	0	33.000	5.000	-0.320	-0.410	-0.430	-0.410	-0.400	-0.400	-0.340	-0.620	0.390	-0.390	-0.330
6	15-03-16	18:00	34	0	0	34.000	6.000	-0.320	-0.400	-0.440	-0.400	-0.400	-0.420	-0.360	-0.630	0.380	-0.400	-0.320
7	16-03-16	17:00	35	0	0	35.000	7.000	-0.340	-0.420	-0.440	-0.390	-0.400	-0.440	-0.370	-0.630	0.390	-0.390	-0.350
14	23-03-16	12:00	42	0	0	42.00	14.00	-0.380	-0.440	-0.470	-0.450	-0.440	-0.460	-0.400	-0.690	0.330	-0.450	-0.370
21	30-03-16	15:00	49	0	0	49.00	21.00	-0.460	-0.540	-0.550	-0.500	-0.540	-0.510	-0.470	-0.740	0.250	-0.520	-0.430
28	06-04-16	12:00	56	0	0	56.00	28.00	-0.470	-0.530	-0.530	-0.500	-0.530	-0.530	-0.480	-0.730	0.270	-0.520	-0.420
56	04-05-16	14:00	84	0	0	84.00	56.00	-0.520	-0.610	-0.580	-0.560	-0.570	-0.610	-0.550	-0.800	0.180	-0.600	-0.500
90	07-06-16	12:00	118	0	0	118.00	90.00	-0.520	-0.610	-0.610	-0.600	-0.590	-0.620	-0.570	-0.800	0.180	-0.620	-0.530
120	07-07-16	13:00	148	0	0	148.00	120.00	-0.600	-0.700	-0.610	-0.670	-0.680	-0.700	-0.650	-0.880	0.100	-0.680	-0.570
150	06-08-16	16:00	178	0	0	178.00	150.00	-0.630	-0.740	-0.680	-0.690	-0.700	-0.710	-0.680	-0.910	0.080	-0.690	-0.610
180	05-09-16	13:00	208	0	0	208.00	180.00	-0.680	-0.800	-0.740	-0.720	-0.790	-0.780	-0.750	-0.980	0.000	-0.770	-0.690
210	05-10-16	12:00	238	0	0	238.00	210.00	-0.700	-0.800	-0.780	-0.740	-0.790	-0.780	-0.760	-0.990	-0.010	-0.790	-0.710
240	04-11-16	11:00	268	0	0	268.00	240.00	-0.730	-0.840	-0.760	-0.770	-0.790	-0.840	-0.790	-1.010	-0.030	-0.810	-0.710
270	04-12-16	11:00	298	0	0	298.00	270.00	-0.750	-0.870	-0.780	-0.780	-0.840	-0.830	-0.800	-1.020	-0.040	-0.830	-0.720
300	03-01-17	14:00	328	0	0	328.00	300.00	-0.810	-0.930	-0.860	-0.820	-0.860	-0.910	-0.850	-1.070	-0.110	-0.880	-0.780
330	02-02-17	13:00	358	0	0	358.00	330.00	-0.780	-0.910	-0.910	-0.780	-0.880	-0.850	-0.850	-1.070	-0.070	-0.880	-0.740
365	09-03-17	11:00	393	0	0	393.00	365.00	-0.830	-0.970	-0.880	-0.840	-0.870	-0.940	-0.900	-1.120	-0.130	-0.920	-0.820
400	13-04-17	10:00	428	0	0	428.00	400.00	-0.830	-1.020	-0.870	-0.860	-0.910	-0.950	-0.920	-1.130	-0.150	-0.940	-0.840
450	02-06-17	17:00	478	0	0	478.00	450.00	-0.830	-0.960	-0.830	-0.860	-0.860	-0.920	-0.880	-1.120	-0.110	-0.940	-0.850

			σ = 10.13 MPa					SIDE A MIDDLE (‰)					
			Age					1500	1600	1700	1500	1600	1700
HVFAC28	**Date**	**Time**	**Days**	**Hours**	**Minutes**	**Days, eq**	**From loading (days)**	23	24	25	26	27	28
Casting	10-02-16	11:00	0	0	0	0.000	–	*155*	*155*	*155*	*115*	*115*	*115*
Before loading	09-03-16	13:40	28	0	0	28.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5min after loading	09-03-16	13:50	28	0	5	28.003	0.003	-0.110	-0.110	-0.140	-0.030	0.130	0.050
1h	09-03-16	14:45	28	1	0	28.042	0.042	-0.160	-0.160	-0.160	-0.070	0.110	0.020
6h	09-03-16	19:45	28	6	0	28.250	0.250	-0.120	-0.110	-0.150	-0.030	0.170	0.050
1	10-03-16	15:00	29	0	0	29.000	1.000	-0.140	-0.150	-0.160	-0.050	0.160	0.030
2	11-03-16	15:00	30	0	0	30.000	2.000	-0.150	-0.160	-0.140	-0.030	0.180	0.060
3	12-03-16	20:00	31	0	0	31.000	3.000	-0.190	-0.180	-0.210	-0.120	0.140	0.010
4	13-03-16	18:00	32	0	0	32.000	4.000	-0.170	-0.180	-0.180	-0.050	0.180	0.050
5	14-03-16	9:00	33	0	0	33.000	5.000	-0.200	-0.190	-0.190	-0.080	0.160	0.040
6	15-03-16	18:00	34	0	0	34.000	6.000	-0.200	-0.210	-0.230	-0.110	0.130	-0.020
7	16-03-16	17:00	35	0	0	35.000	7.000	-0.170	-0.190	-0.200	-0.060	0.190	0.020
14	23-03-16	12:00	42	0	0	42.00	14.00	-0.190	-0.220	-0.210	-0.090	0.170	0.040
21	30-03-16	15:00	49	0	0	49.00	21.00	-0.240	-0.270	-0.260	-0.140	0.120	0.000
28	06-04-16	12:00	56	0	0	56.00	28.00	-0.290	-0.290	-0.310	-0.150	0.100	-0.040
56	04-05-16	14:00	84	0	0	84.00	56.00	-0.310	-0.310	-0.330	-0.140	0.090	-0.040
90	07-06-16	12:00	118	0	0	118.00	90.00	-0.330	-0.290	-0.360	-0.180	0.070	-0.070
120	07-07-16	13:00	148	0	0	148.00	120.00	-0.380	-0.360	-0.380	-0.200	0.040	-0.110
150	06-08-16	16:00	178	0	0	178.00	150.00	-0.430	-0.400	-0.460	-0.260	0.000	-0.150
180	05-09-16	13:00	208	0	0	208.00	180.00	-0.460	-0.440	-0.470	-0.280	-0.020	-0.180
210	05-10-16	12:00	238	0	0	238.00	210.00	-0.460	-0.440	-0.470	-0.290	-0.030	-0.180
240	04-11-16	11:00	268	0	0	268.00	240.00	-0.490	-0.450	-0.500	-0.300	-0.040	-0.200
270	04-12-16	11:00	298	0	0	298.00	270.00	-0.490	-0.460	-0.530	-0.300	-0.050	-0.190
300	03-01-17	14:00	328	0	0	328.00	300.00	-0.500	-0.480	-0.580	-0.340	-0.040	-0.180
330	02-02-17	13:00	358	0	0	358.00	330.00	-0.530	-0.500	-0.530	-0.320	-0.050	-0.190
365	09-03-17	11:00	393	0	0	393.00	365.00	-0.540	-0.560	-0.590	-0.380	-0.100	-0.260
400	13-04-17	10:00	428	0	0	428.00	400.00	-0.540	-0.530	-0.560	-0.340	-0.070	-0.210
450	02-06-17	17:00	478	0	0	478.00	450.00	-0.530	-0.540	-0.540	-0.320	-0.060	-0.220

								SIDE B MIDDLE (‰)					
			Age					1500	1600	1700	1500	1600	1700
	Date	**Time**	**Days**	**Hours**	**Minutes**	**Days, eq**	**From loading (days)**	23	24	25	26	27	28
Casting	10-02-16	11:00	0	0	0	0.000	–	*155*	*155*	*155*	*115*	*115*	*115*
Before loading	09-03-16	13:40	28	0	0	28.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5min after loading	09-03-16	13:50	28	0	5	28.003	0.003	-0.090	-0.100	-0.100	-0.320	0.490	0.210
1h	09-03-16	14:45	28	1	0	28.042	0.042	-0.140	-0.140	-0.110	-0.350	0.450	0.230
6h	09-03-16	19:45	28	6	0	28.250	0.250	-0.120	-0.110	-0.100	-0.340	0.490	0.260
1	10-03-16	15:00	29	0	0	29.000	1.000	-0.150	-0.140	-0.130	-0.320	0.480	0.240
2	11-03-16	15:00	30	0	0	30.000	2.000	-0.140	-0.160	-0.130	-0.330	0.480	0.230
3	12-03-16	20:00	31	0	0	31.000	3.000	-0.180	-0.200	-0.160	-0.360	0.450	0.220
4	13-03-16	18:00	32	0	0	32.000	4.000	-0.160	-0.160	-0.120	-0.330	0.490	0.240
5	14-03-16	9:00	33	0	0	33.000	5.000	-0.210	-0.200	-0.180	-0.380	0.460	0.200
6	15-03-16	18:00	34	0	0	34.000	6.000	-0.180	-0.190	-0.170	-0.340	0.470	0.180
7	16-03-16	17:00	35	0	0	35.000	7.000	-0.190	-0.170	-0.180	-0.350	0.480	0.200
14	23-03-16	12:00	42	0	0	42.00	14.00	-0.230	-0.210	-0.210	-0.370	0.440	0.190
21	30-03-16	15:00	49	0	0	49.00	21.00	-0.290	-0.270	-0.270	-0.410	0.400	0.130
28	06-04-16	12:00	56	0	0	56.00	28.00	-0.250	-0.280	-0.240	-0.410	0.410	0.160
56	04-05-16	14:00	84	0	0	84.00	56.00	-0.310	-0.320	-0.310	-0.440	0.390	0.130
90	07-06-16	12:00	118	0	0	118.00	90.00	-0.340	-0.310	-0.340	-0.450	0.390	0.100
120	07-07-16	13:00	148	0	0	148.00	120.00	-0.390	-0.410	-0.390	-0.520	0.360	0.090
150	06-08-16	16:00	178	0	0	178.00	150.00	-0.420	-0.410	-0.420	-0.480	0.330	0.080
180	05-09-16	13:00	208	0	0	208.00	180.00	-0.470	-0.480	-0.470	-0.560	0.290	0.030
210	05-10-16	12:00	238	0	0	238.00	210.00	-0.470	-0.500	-0.480	-0.550	0.290	0.030
240	04-11-16	11:00	268	0	0	268.00	240.00	-0.500	-0.480	-0.490	-0.600	0.260	0.030
270	04-12-16	11:00	298	0	0	298.00	270.00	-0.520	-0.520	-0.490	-0.580	0.280	0.040
300	03-01-17	14:00	328	0	0	328.00	300.00	-0.560	-0.540	-0.520	-0.610	0.230	0.030
330	02-02-17	13:00	358	0	0	358.00	330.00	-0.510	-0.530	-0.500	-0.570	0.280	0.040
365	09-03-17	11:00	393	0	0	393.00	365.00	-0.570	-0.600	-0.560	-0.620	0.280	-0.050
400	13-04-17	10:00	428	0	0	428.00	400.00	-0.590	-0.580	-0.590	-0.630	0.220	-0.010
450	02-06-17	17:00	478	0	0	478.00	450.00	-0.560	-0.580	-0.570	-0.590	0.300	0.000

Appendix B

Analysis of Shrinkage and Creep Results

Analysis of Shrinkage and Creep Results:
Shrinkage

INPUT FOR MODEL B4

	NAC	RAC	HVFAC	
a/c =	6.363	5.979	8.100	
w/c =	0.615	0.614	0.975	
c =	284.6	285.0	200.0	
V/S (mm)=	30	30	30	
k_s =	1.25	1.25	1.25	
_f_c =	30.5	28.1	22.6	
τ_{cem} =	0.016	0.016	0.010	
$p_{\tau a}$ =	-0.33	-0.33	-0.33	
$p_{\tau w}$ =	-0.06	-0.06	-0.06	
$p_{\tau c}$ =	-0.10	-0.10	-0.10	
τ_0 =	0.016	0.016	0.009	
$k_{\tau a}$ =	0.59	2.30	0.59	
τ_{sh} =	53.10	207.00	29.87	
ε_{cem} =	360.0	360.0	360.0	1E-06
$p_{\varepsilon a}$ =	-0.80	-0.80	-0.80	
$p_{\varepsilon w}$ =	1.10	1.10	1.10	
$p_{\varepsilon c}$ =	0.11	0.11	0.11	
ε_0 =	568.151	596.183	747.988	1E-06
$k_{\varepsilon a}$ =	0.71	1.60	0.71	
t_{607} =	644.30	644.30	644.3	
t_{ts} =	57.40	220.87	220.87	
$\varepsilon_{sh,inf}$ (^t_s) =	-417.954	-960.445	-534.72	1E-06
$\tau_{au,cem}$ =	1.0	1.0	1.0	
$r_{\tau w}$ =	3.0	3.0	3.0	
τ_{au} =	4.239	4.218	16.891	
$\varepsilon_{au,cem}$ =	210.0	210.0	289.8	1E-06
$r_{\varepsilon a}$ =	-0.75	-0.75	-0.75	
$r_{\varepsilon w}$ =	-3.5	-3.5	0.0	
$\varepsilon_{au,inf}$ =	-37.26	-39.27	-231.39	1E-06
r_t =	-4.50	-4.50	-4.50	
r_α =	1.00	1.00	1.20	
α =	1.618	1.616	3.079	

NAC

t_s (days)	$t - t_s$ (days)	T (°C)	RH (%)	^t – ^t_s (days)	S(^t)	k_h	ε_{sh} (^t,^t_s) (1E-06)	ε_{au} (^t,^t_s) (1E-06)	$\varepsilon_{sh,total}$ (^t,^t_s) (‰)	$\varepsilon_{sh,exp,cor}$ (^t,^t_s) (1E-06)
1	0.100	21.3	48.7	0.106	0.045	0.884	-16.6	0.0	-0.017	
	1.0	21.3	48.7	1.062	0.140	0.884	-51.7	-0.1	-0.052	-0.043
β_{Th}	2.0	21.3	48.7	2.124	0.197	0.884	-72.8	-0.5	-0.073	-0.065
1	3.0	21.3	48.7	3.2	0.240	0.884	-88.7	-1.6	-0.090	
	4.0	21.3	48.7	4.2	0.276	0.884	-102.0	-3.4	-0.105	
	5.0	21.3	48.7	5.3	0.306	0.884	-113.1	-5.6	-0.119	-0.100
	6.0	21.3	48.7	6.4	0.333	0.884	-123.0	-8.0	-0.131	-0.117
	6.0	21.3	48.7	6.4	0.333	0.884	-123.0	-8.0	-0.131	-0.117
	6.0	21.3	48.7	6.4	0.334	0.884	-123.4	-8.1	-0.132	-0.117
	6.3	21.3	48.7	6.6	0.340	0.884	-125.6	-8.6	-0.134	-0.117
	7.0	21.3	48.7	7.4	0.358	0.884	-132.3	-10.4	-0.143	-0.143
	8.0	21.3	48.7	8.5	0.380	0.884	-140.4	-12.7	-0.153	-0.125
	9.0	21.3	48.7	9.6	0.401	0.884	-148.2	-14.8	-0.163	-0.148
	10.0	21.3	48.7	10.6	0.420	0.884	-155.2	-16.7	-0.172	-0.155
	11.0	21.3	48.7	11.7	0.437	0.884	-161.5	-18.4	-0.180	-0.197
	12.0	21.3	48.7	12.7	0.454	0.884	-167.7	-19.9	-0.188	-0.178
	13.0	21.3	48.7	13.8	0.470	0.884	-173.7	-21.3	-0.195	-0.180
	20.0	21.3	48.7	21.2	0.560	0.884	-206.9	-27.7	-0.235	-0.278
	27.0	21.3	48.7	28.7	0.626	0.884	-231.3	-30.8	-0.262	-0.343
	27.0	21.3	48.7	28.7	0.626	0.884	-231.3	-30.8	-0.262	-0.343
	27.0	21.3	48.7	28.7	0.626	0.884	-231.3	-30.9	-0.262	-0.343
	27.3	21.3	48.7	28.9	0.628	0.884	-232.0	-30.9	-0.263	-0.343
	28.0	21.3	48.7	29.7	0.634	0.884	-234.2	-31.2	-0.265	-0.342
	29.0	21.3	48.7	30.8	0.642	0.884	-237.2	-31.5	-0.269	-0.333
	30.0	21.3	48.7	31.9	0.650	0.884	-240.2	-31.7	-0.272	-0.333
	31.0	21.3	48.7	32.9	0.657	0.884	-242.7	-32.0	-0.275	-0.338
	32.0	21.3	48.7	34.0	0.664	0.884	-245.3	-32.2	-0.278	-0.350
	33.0	21.3	48.7	35.1	0.671	0.884	-247.9	-32.4	-0.280	-0.345
	34.0	21.3	48.7	36.1	0.678	0.884	-250.5	-32.6	-0.283	-0.368
	41.0	21.3	48.7	43.5	0.719	0.884	-265.6	-33.7	-0.299	-0.403
	48.0	21.3	48.7	51.0	0.753	0.884	-278.2	-34.5	-0.313	-0.412
	55.0	21.3	48.7	58.4	0.781	0.884	-288.6	-35.0	-0.324	-0.468
	62.0	21.3	48.7	65.9	0.805	0.884	-297.4	-35.4	-0.333	-0.482
	83.0	21.3	48.7	88.2	0.859	0.884	-317.4	-36.1	-0.354	-0.540
	96.0	21.3	48.7	102.0	0.882	0.884	-325.9	-36.3	-0.362	-0.540
	117.0	21.3	48.7	124.3	0.910	0.884	-336.2	-36.6	-0.373	-0.535
	126.0	21.3	48.7	133.8	0.920	0.884	-339.9	-36.6	-0.377	-0.538
	147.0	21.3	48.7	156.1	0.937	0.884	-346.2	-36.8	-0.383	-0.543
	156.0	21.3	48.7	165.7	0.943	0.884	-348.4	-36.8	-0.385	-0.527
	177.0	21.3	48.7	188.0	0.955	0.884	-352.8	-36.9	-0.390	-0.540
	186.0	21.3	48.7	197.6	0.959	0.884	-354.3	-36.9	-0.391	-0.557
	207.0	21.3	48.7	219.9	0.966	0.884	-356.9	-37.0	-0.394	-0.555
	216.0	21.3	48.7	229.4	0.969	0.884	-358.0	-37.0	-0.395	-0.587
	237.0	21.3	48.7	251.7	0.975	0.884	-360.2	-37.0	-0.397	-0.560
	246.0	21.3	48.7	261.3	0.977	0.884	-361.0	-37.0	-0.398	-0.570
	267.0	21.3	48.7	283.6	0.981	0.884	-362.5	-37.1	-0.400	-0.585
	276.0	21.3	48.7	293.2	0.982	0.884	-362.8	-37.1	-0.400	-0.605
	297.0	21.3	48.7	315.5	0.985	0.884	-363.9	-37.1	-0.401	-0.603
	306.0	21.3	48.7	325.0	0.986	0.884	-364.3	-37.1	-0.401	-0.595
	327.0	21.3	48.7	347.3	0.988	0.884	-365.0	-37.1	-0.402	-0.622
	336.0	21.3	48.7	356.9	0.989	0.884	-365.4	-37.1	-0.403	-0.613
	357.0	21.3	48.7	379.2	0.990	0.884	-365.8	-37.1	-0.403	-0.618
	371.0	21.3	48.7	394.1	0.991	0.884	-366.1	-37.2	-0.403	-0.633
	392.0	21.3	48.7	416.4	0.993	0.884	-366.9	-37.2	-0.404	-0.640
	406.0	21.3	48.7	431.2	0.993	0.884	-366.9	-37.2	-0.404	-0.657
	427.0	21.3	48.7	453.5	0.994	0.884	-367.3	-37.2	-0.405	-0.652
	456.0	21.3	48.7	484.3	0.995	0.884	-367.6	-37.2	-0.405	-0.667
	477.0	21.3	48.7	506.7	0.996	0.884	-368.0	-37.2	-0.405	-0.645
	1000.0	21.3	48.7	1062.2	1.000	0.884	-369.5	-37.2	-0.407	
	2500.0	21.3	48.7	2655.4	1.000	0.884	-369.5	-37.3	-0.407	
	5000.0	21.3	48.7	5310.8	1.000	0.884	-369.5	-37.3	-0.407	
	10000.0	21.3	48.7	10621.6	1.000	0.884	-369.5	-37.3	-0.407	

RAC

t_s (days)	**$t - t_s$ (days)**	**T (°C)**	**RH (%)**	**^t – ^t_s (days)**	**S(^t)**	**k_h**	**ε_{sh} (^t,^t_s) (1E-06)**	**ε_{au} (^t,^t_s) (1E-06)**	**$\varepsilon_{sh,total}$ (^t,^t_s) (‰)**	**$\varepsilon_{sh,exp}$ (^t,^t_s) (1E-06)**
1	0.100	21.3	48.7	0.106	0.023	0.884	-19.5	0.0	-0.020	
	1.0	21.3	48.7	1.062	0.072	0.884	-61.1	-0.1	-0.061	-0.058
β_{Th}	2.0	21.3	48.7	2.124	0.101	0.884	-85.8	-0.5	-0.086	-0.070
1	3.0	21.3	48.7	3.2	0.123	0.884	-104.4	-1.7	-0.106	-0.110
	4.0	21.3	48.7	4.2	0.142	0.884	-120.6	-3.6	-0.124	-0.113
	5.0	21.3	48.7	5.3	0.159	0.884	-135.0	-5.9	-0.141	-0.120
	6.0	21.3	48.7	6.4	0.174	0.884	-147.7	-8.5	-0.156	-0.155
	6.0	21.3	48.7	6.4	0.174	0.884	-147.7	-8.5	-0.156	-0.155
	6.0	21.3	48.7	6.4	0.174	0.884	-147.7	-8.6	-0.156	-0.155
	6.3	21.3	48.7	6.6	0.177	0.884	-150.3	-9.1	-0.159	-0.140
	7.0	21.3	48.7	7.4	0.187	0.884	-158.8	-11.0	-0.170	-0.155
	8.0	21.3	48.7	8.5	0.200	0.884	-169.8	-13.4	-0.183	-0.162
	9.0	21.3	48.7	9.6	0.212	0.884	-180.0	-15.6	-0.196	-0.198
	10.0	21.3	48.7	10.6	0.223	0.884	-189.3	-17.7	-0.207	-0.207
	11.0	21.3	48.7	11.7	0.233	0.884	-197.8	-19.5	-0.217	-0.172
	12.0	21.3	48.7	12.7	0.243	0.884	-206.3	-21.1	-0.227	-0.220
	13.0	21.3	48.7	13.8	0.253	0.884	-214.8	-22.5	-0.237	-0.245
	20.0	21.3	48.7	21.2	0.310	0.884	-263.2	-29.2	-0.292	-0.320
	27.0	21.3	48.7	28.7	0.356	0.884	-302.3	-32.5	-0.335	-0.383
	27.0	21.3	48.7	28.7	0.356	0.884	-302.3	-32.5	-0.335	-0.383
	27.0	21.3	48.7	28.7	0.356	0.884	-302.3	-32.5	-0.335	-0.383
	27.3	21.3	48.7	28.9	0.357	0.884	-303.1	-32.6	-0.336	-0.383
	28.0	21.3	48.7	29.7	0.362	0.884	-307.4	-32.9	-0.340	-0.385
	29.0	21.3	48.7	30.8	0.368	0.884	-312.4	-33.2	-0.346	-0.387
	30.0	21.3	48.7	31.9	0.373	0.884	-316.7	-33.5	-0.350	-0.402
	31.0	21.3	48.7	32.9	0.379	0.884	-321.8	-33.7	-0.356	-0.395
	32.0	21.3	48.7	34.0	0.384	0.884	-326.0	-34.0	-0.360	-0.385
	33.0	21.3	48.7	35.1	0.390	0.884	-331.1	-34.2	-0.365	-0.393
	34.0	21.3	48.7	36.1	0.395	0.884	-335.4	-34.4	-0.370	-0.410
	41.0	21.3	48.7	43.5	0.429	0.884	-364.2	-35.6	-0.400	-0.443
	48.0	21.3	48.7	51.0	0.459	0.884	-389.7	-36.4	-0.426	-0.498
	55.0	21.3	48.7	58.4	0.486	0.884	-412.6	-36.9	-0.450	-0.507
	62.0	21.3	48.7	65.9	0.511	0.884	-433.9	-37.3	-0.471	-0.520
	83.0	21.3	48.7	88.2	0.573	0.884	-486.5	-38.0	-0.525	-0.587
	96.0	21.3	48.7	102.0	0.606	0.884	-514.5	-38.3	-0.553	-0.583
	117.0	21.3	48.7	124.3	0.650	0.884	-551.9	-38.5	-0.590	-0.610
	126.0	21.3	48.7	133.8	0.666	0.884	-565.5	-38.6	-0.604	-0.597
	147.0	21.3	48.7	156.1	0.701	0.884	-595.2	-38.8	-0.634	-0.627
	156.0	21.3	48.7	165.7	0.714	0.884	-606.2	-38.8	-0.645	-0.630
	177.0	21.3	48.7	188.0	0.741	0.884	-629.1	-38.9	-0.668	-0.637
	186.0	21.3	48.7	197.6	0.752	0.884	-638.5	-38.9	-0.677	-0.660
	207.0	21.3	48.7	219.9	0.774	0.884	-657.2	-39.0	-0.696	-0.673
	216.0	21.3	48.7	229.4	0.783	0.884	-664.8	-39.0	-0.704	-0.670
	237.0	21.3	48.7	251.7	0.801	0.884	-680.1	-39.0	-0.719	-0.667
	246.0	21.3	48.7	261.3	0.809	0.884	-686.9	-39.0	-0.726	-0.650
	267.0	21.3	48.7	283.6	0.824	0.884	-699.6	-39.1	-0.739	-0.702
	276.0	21.3	48.7	293.2	0.831	0.884	-705.5	-39.1	-0.745	-0.677
	297.0	21.3	48.7	315.5	0.844	0.884	-716.6	-39.1	-0.756	-0.688
	306.0	21.3	48.7	325.0	0.849	0.884	-720.8	-39.1	-0.760	-0.750
	327.0	21.3	48.7	347.3	0.861	0.884	-731.0	-39.1	-0.770	-0.732
	336.0	21.3	48.7	356.9	0.865	0.884	-734.4	-39.1	-0.774	-0.765
	357.0	21.3	48.7	379.2	0.875	0.884	-742.9	-39.1	-0.782	-0.775
	371.0	21.3	48.7	394.1	0.881	0.884	-748.0	-39.2	-0.787	-0.772
	392.0	21.3	48.7	416.4	0.889	0.884	-754.8	-39.2	-0.794	-0.767
	406.0	21.3	48.7	431.2	0.894	0.884	-759.0	-39.2	-0.798	-0.772
	427.0	21.3	48.7	453.5	0.902	0.884	-765.8	-39.2	-0.805	-0.785
	456.0	21.3	48.7	484.3	0.910	0.884	-772.6	-39.2	-0.812	-0.782
	477.0	21.3	48.7	506.7	0.916	0.884	-777.7	-39.2	-0.817	-0.782
	1000.0	21.3	48.7	1062.2	0.979	0.884	-831.2	-39.2	-0.870	
	2500.0	21.3	48.7	2655.4	0.998	0.884	-847.3	-39.3	-0.887	
	5000.0	21.3	48.7	5310.8	1.000	0.884	-849.0	-39.3	-0.888	
	10000.0	21.3	48.7	10621.6	1.000	0.884	-849.0	-39.3	-0.888	

HVFAC

t_s (days)	$t - t_s$ (days)	T (°C)	RH (%)	^t – ^t_s (days)	S(^t)	k_h	ε_{sh} (^t,^t_s) (1E-06)	ε_{au} (^t,^t_s) (1E-06)	$\varepsilon_{sh,total}$ (^t,^t_s) (‰)	$\varepsilon_{sh,exp}$ (^t,^t_s) (1E-06)
1	0.100	21.3	48.7	0.106	0.060	0.884	-28.4	0.0	-0.028	
	1.0	21.3	48.7	1.062	0.186	0.884	-87.9	0.0	-0.088	-0.020
β_{Th}	2.0	21.3	48.7	2.124	0.261	0.884	-123.4	0.0	-0.123	-0.028
1	3.0	21.3	48.7	3.2	0.315	0.884	-148.9	0.0	-0.149	-0.012
	4.0	21.3	48.7	4.2	0.360	0.884	-170.2	0.0	-0.170	-0.090
	5.0	21.3	48.7	5.3	0.398	0.884	-188.1	0.0	-0.188	-0.100
	6.0	21.3	48.7	6.4	0.432	0.884	-204.2	0.0	-0.204	-0.122
	6.0	21.3	48.7	6.4	0.432	0.884	-204.2	0.0	-0.204	-0.122
	6.0	21.3	48.7	6.4	0.433	0.884	-204.7	0.0	-0.205	-0.122
	6.3	21.3	48.7	6.6	0.439	0.884	-207.5	0.0	-0.208	-0.122
	7.0	21.3	48.7	7.4	0.461	0.884	-217.9	0.0	-0.218	-0.125
	8.0	21.3	48.7	8.5	0.488	0.884	-230.7	0.0	-0.231	-0.132
	9.0	21.3	48.7	9.6	0.512	0.884	-242.0	-0.1	-0.242	-0.158
	10.0	21.3	48.7	10.6	0.534	0.884	-252.4	-0.4	-0.253	-0.182
	11.0	21.3	48.7	11.7	0.555	0.884	-262.3	-0.9	-0.263	-0.192
	12.0	21.3	48.7	12.7	0.574	0.884	-271.3	-2.0	-0.273	-0.225
	13.0	21.3	48.7	13.8	0.591	0.884	-279.4	-3.7	-0.283	-0.235
	20.0	21.3	48.7	21.2	0.688	0.884	-325.2	-46.5	-0.372	-0.272
	27.0	21.3	48.7	28.7	0.753	0.884	-355.9	-111.4	-0.467	-0.330
	27.0	21.3	48.7	28.7	0.753	0.884	-355.9	-111.5	-0.467	-0.330
	27.0	21.3	48.7	28.7	0.753	0.884	-355.9	-111.8	-0.468	-0.330
	27.3	21.3	48.7	28.9	0.755	0.884	-356.9	-113.5	-0.470	-0.330
	28.0	21.3	48.7	29.7	0.761	0.884	-359.7	-119.5	-0.479	-0.315
	29.0	21.3	48.7	30.8	0.768	0.884	-363.0	-127.0	-0.490	-0.333
	30.0	21.3	48.7	31.9	0.775	0.884	-366.3	-134.1	-0.500	-0.327
	31.0	21.3	48.7	32.9	0.782	0.884	-369.6	-140.8	-0.510	-0.335
	32.0	21.3	48.7	34.0	0.788	0.884	-372.5	-146.9	-0.519	-0.338
	33.0	21.3	48.7	35.1	0.794	0.884	-375.3	-152.6	-0.528	-0.335
	34.0	21.3	48.7	36.1	0.800	0.884	-378.2	-157.9	-0.536	-0.332
	41.0	21.3	48.7	43.5	0.836	0.884	-395.2	-185.4	-0.581	-0.337
	48.0	21.3	48.7	51.0	0.863	0.884	-407.9	-201.3	-0.609	-0.388
	55.0	21.3	48.7	58.4	0.885	0.884	-418.3	-210.9	-0.629	-0.410
	62.0	21.3	48.7	65.9	0.902	0.884	-426.4	-216.9	-0.643	-0.427
	83.0	21.3	48.7	88.2	0.938	0.884	-443.4	-225.3	-0.669	-0.430
	96.0	21.3	48.7	102.0	0.952	0.884	-450.0	-227.4	-0.677	-0.410
	117.0	21.3	48.7	124.3	0.967	0.884	-457.1	-229.2	-0.686	-0.438
	126.0	21.3	48.7	133.8	0.971	0.884	-459.0	-229.7	-0.689	-0.438
	147.0	21.3	48.7	156.1	0.980	0.884	-463.2	-230.3	-0.694	-0.470
	156.0	21.3	48.7	165.7	0.982	0.884	-464.2	-230.5	-0.695	-0.478
	177.0	21.3	48.7	188.0	0.987	0.884	-466.5	-230.8	-0.697	-0.507
	186.0	21.3	48.7	197.6	0.988	0.884	-467.0	-230.9	-0.698	-0.492
	207.0	21.3	48.7	219.9	0.991	0.884	-468.4	-231.0	-0.699	-0.495
	216.0	21.3	48.7	229.4	0.992	0.884	-468.9	-231.1	-0.700	-0.508
	237.0	21.3	48.7	251.7	0.994	0.884	-469.9	-231.1	-0.701	-0.485
	246.0	21.3	48.7	261.3	0.995	0.884	-470.3	-231.2	-0.702	-0.492
	267.0	21.3	48.7	283.6	0.996	0.884	-470.8	-231.2	-0.702	-0.493
	276.0	21.3	48.7	293.2	0.996	0.884	-470.8	-231.2	-0.702	-0.502
	297.0	21.3	48.7	315.5	0.997	0.884	-471.3	-231.3	-0.703	-0.572
	306.0	21.3	48.7	325.0	0.997	0.884	-471.3	-231.3	-0.703	-0.530
	327.0	21.3	48.7	347.3	0.998	0.884	-471.7	-231.3	-0.703	-0.568
	336.0	21.3	48.7	356.9	0.998	0.884	-471.7	-231.3	-0.703	-0.563
	357.0	21.3	48.7	379.2	0.998	0.884	-471.7	-231.3	-0.703	-0.552
	371.0	21.3	48.7	394.1	0.999	0.884	-472.2	-231.3	-0.704	-0.587
	392.0	21.3	48.7	416.4	0.999	0.884	-472.2	-231.3	-0.704	-0.608
	406.0	21.3	48.7	431.2	0.999	0.884	-472.2	-231.3	-0.704	-0.597
	427.0	21.3	48.7	453.5	0.999	0.884	-472.2	-231.3	-0.704	-0.593
	456.0	21.3	48.7	484.3	0.999	0.884	-472.2	-231.4	-0.704	-0.595
	477.0	21.3	48.7	506.7	0.999	0.884	-472.2	-231.4	-0.704	-0.597
	1000.0	21.3	48.7	1062.2	1.000	0.884	-472.7	-231.4	-0.704	
	2500.0	21.3	48.7	2655.4	1.000	0.884	-472.7	-231.4	-0.704	
	5000.0	21.3	48.7	5310.8	1.000	0.884	-472.7	-231.4	-0.704	
	10000.0	21.3	48.7	10621.6	1.000	0.884	-472.7	-231.4	-0.704	

INPUT FOR MODEL B4 - CALIBRATED

	NAC	RAC	HVFAC	
a/c =	6.363	5.979	8.100	
w/c =	0.615	0.614	0.975	
c =	284.6	285.0	200.0	
V/S (mm)=	30	30	30	
k_s =	1.25	1.25	1.25	
$\_f_c$ =	30.5	28.1	22.6	
τ_{cem} =	0.016	0.016	0.010	
$p_{\tau a}$ =	-0.33	-0.33	-0.33	
$p_{\tau w}$ =	-0.06	-0.06	-0.06	
$p_{\tau c}$ =	-0.10	-0.10	-0.10	
τ_0 =	0.016	0.016	0.009	
$k_{\tau a}$ =	1.18	2.30	1.45	
τ_{sh} =	106.20	207.00	73.41	
ε_{cem} =	360.0	360.0	360.0	1E-06
$p_{\varepsilon a}$ =	-0.80	-0.80	-0.80	
$p_{\varepsilon w}$ =	1.10	1.10	1.10	
$p_{\varepsilon c}$ =	0.11	0.11	0.11	
ε_0 =	568.151	596.183	747.988	1E-06
$k_{\varepsilon a}$ =	1.24	1.60	0.55	
t_{607} =	644.30	644.30	644.3	
t_{ts} =	113.80	220.87	220.87	
$\varepsilon_{sh,inf}$ (^t_s) =	-716.218	-960.445	-414.219	1E-06
$\tau_{au,cem}$ =	1.0	1.0	1.0	
$r_{\tau w}$ =	3.0	3.0	3.0	
τ_{au} =	4.239	4.218	16.891	
$\varepsilon_{au,cem}$ =	210.0	210.0	289.8	1E-06
$r_{\varepsilon a}$ =	-0.75	-0.75	-0.75	
$r_{\varepsilon w}$ =	-3.5	-3.5	0.0	
$\varepsilon_{au,inf}$ =	-37.26	-39.27	-231.39	1E-06
r_t =	-4.50	-4.50	-4.50	
r_α =	1.00	1.00	1.20	
α =	1.618	1.616	3.079	

NAC

t_s (days)	$t - t_s$ (days)	T (°C)	RH (%)	^t – ^t_s (days)	S(^t)	k_h	ε_{sh} (^t,^t_s) (1E-06)	ε_{au} (^t,^t_s) (1E-06)	$\varepsilon_{sh,total}$ (^t,^t_s) (‰)	$\varepsilon_{sh,exp,cor}$ (^t,^t_s) (1E-06)
1	0.100	21.3	48.7	0.106	0.032	0.884	-20.3	0.0	-0.020	
	1.0	21.3	48.7	1.062	0.100	0.884	-63.3	-0.1	-0.063	-0.043
β_{Th}	2.0	21.3	48.7	2.124	0.140	0.884	-88.6	-0.5	-0.089	-0.065
1	3.0	21.3	48.7	3.2	0.171	0.884	-108.3	-1.6	-0.110	
	4.0	21.3	48.7	4.2	0.197	0.884	-124.7	-3.4	-0.128	
	5.0	21.3	48.7	5.3	0.220	0.884	-139.3	-5.6	-0.145	-0.100
	6.0	21.3	48.7	6.4	0.240	0.884	-152.0	-8.0	-0.160	-0.117
	6.0	21.3	48.7	6.4	0.240	0.884	-152.0	-8.0	-0.160	-0.117
	6.0	21.3	48.7	6.4	0.241	0.884	-152.6	-8.1	-0.161	-0.117
	6.3	21.3	48.7	6.6	0.245	0.884	-155.1	-8.6	-0.164	-0.117
	7.0	21.3	48.7	7.4	0.259	0.884	-164.0	-10.4	-0.174	-0.143
	8.0	21.3	48.7	8.5	0.276	0.884	-174.7	-12.7	-0.187	-0.125
	9.0	21.3	48.7	9.6	0.291	0.884	-184.2	-14.8	-0.199	-0.148
	10.0	21.3	48.7	10.6	0.306	0.884	-193.7	-16.7	-0.210	-0.155
	11.0	21.3	48.7	11.7	0.320	0.884	-202.6	-18.4	-0.221	-0.197
	12.0	21.3	48.7	12.7	0.333	0.884	-210.8	-19.9	-0.231	-0.178
	13.0	21.3	48.7	13.8	0.346	0.884	-219.1	-21.3	-0.240	-0.180
	20.0	21.3	48.7	21.2	0.420	0.884	-265.9	-27.7	-0.294	-0.278
	27.0	21.3	48.7	28.7	0.477	0.884	-302.0	-30.8	-0.333	-0.343
	27.0	21.3	48.7	28.7	0.477	0.884	-302.0	-30.8	-0.333	-0.343
	27.0	21.3	48.7	28.7	0.478	0.884	-302.6	-30.9	-0.334	-0.343
	27.3	21.3	48.7	28.9	0.479	0.884	-303.3	-30.9	-0.334	-0.343
	28.0	21.3	48.7	29.7	0.485	0.884	-307.1	-31.2	-0.338	-0.342
	29.0	21.3	48.7	30.8	0.492	0.884	-311.5	-31.5	-0.343	-0.333
	30.0	21.3	48.7	31.9	0.499	0.884	-315.9	-31.7	-0.348	-0.333
	31.0	21.3	48.7	32.9	0.506	0.884	-320.4	-32.0	-0.352	-0.338
	32.0	21.3	48.7	34.0	0.512	0.884	-324.2	-32.2	-0.356	-0.350
	33.0	21.3	48.7	35.1	0.519	0.884	-328.6	-32.4	-0.361	-0.345
	34.0	21.3	48.7	36.1	0.525	0.884	-332.4	-32.6	-0.365	-0.368
	41.0	21.3	48.7	43.5	0.565	0.884	-357.7	-33.7	-0.391	-0.403
	48.0	21.3	48.7	51.0	0.600	0.884	-379.9	-34.5	-0.414	-0.412
	55.0	21.3	48.7	58.4	0.630	0.884	-398.9	-35.0	-0.434	-0.468
	62.0	21.3	48.7	65.9	0.657	0.884	-416.0	-35.4	-0.451	-0.482
	83.0	21.3	48.7	88.2	0.722	0.884	-457.1	-36.1	-0.493	-0.540
	96.0	21.3	48.7	102.0	0.753	0.884	-476.8	-36.3	-0.513	-0.540
	117.0	21.3	48.7	124.3	0.794	0.884	-502.7	-36.6	-0.539	-0.535
	126.0	21.3	48.7	133.8	0.808	0.884	-511.6	-36.6	-0.548	-0.538
	147.0	21.3	48.7	156.1	0.837	0.884	-529.9	-36.8	-0.567	-0.543
	156.0	21.3	48.7	165.7	0.848	0.884	-536.9	-36.8	-0.574	-0.527
	177.0	21.3	48.7	188.0	0.869	0.884	-550.2	-36.9	-0.587	-0.540
	186.0	21.3	48.7	197.6	0.877	0.884	-555.3	-36.9	-0.592	-0.557
	207.0	21.3	48.7	219.9	0.893	0.884	-565.4	-37.0	-0.602	-0.555
	216.0	21.3	48.7	229.4	0.900	0.884	-569.8	-37.0	-0.607	-0.587
	237.0	21.3	48.7	251.7	0.912	0.884	-577.4	-37.0	-0.614	-0.560
	246.0	21.3	48.7	261.3	0.917	0.884	-580.6	-37.0	-0.618	-0.570
	267.0	21.3	48.7	283.6	0.927	0.884	-586.9	-37.1	-0.624	-0.585
	276.0	21.3	48.7	293.2	0.930	0.884	-588.8	-37.1	-0.626	-0.605
	297.0	21.3	48.7	315.5	0.938	0.884	-593.9	-37.1	-0.631	-0.603
	306.0	21.3	48.7	325.0	0.941	0.884	-595.8	-37.1	-0.633	-0.595
	327.0	21.3	48.7	347.3	0.948	0.884	-600.2	-37.1	-0.637	-0.622
	336.0	21.3	48.7	356.9	0.950	0.884	-601.5	-37.1	-0.639	-0.613
	357.0	21.3	48.7	379.2	0.955	0.884	-604.6	-37.1	-0.642	-0.618
	371.0	21.3	48.7	394.1	0.958	0.884	-606.5	-37.2	-0.644	-0.633
	392.0	21.3	48.7	416.4	0.963	0.884	-609.7	-37.2	-0.647	-0.640
	406.0	21.3	48.7	431.2	0.965	0.884	-611.0	-37.2	-0.648	-0.657
	427.0	21.3	48.7	453.5	0.968	0.884	-612.9	-37.2	-0.650	-0.652
	456.0	21.3	48.7	484.3	0.972	0.884	-615.4	-37.2	-0.653	-0.667
	477.0	21.3	48.7	506.7	0.975	0.884	-617.3	-37.2	-0.655	-0.645
	1000.0	21.3	48.7	1062.2	0.996	0.884	-630.6	-37.2	-0.668	
	2500.0	21.3	48.7	2655.4	1.000	0.884	-633.1	-37.3	-0.670	
	5000.0	21.3	48.7	5310.8	1.000	0.884	-633.1	-37.3	-0.670	
	10000.0	21.3	48.7	10621.6	1.000	0.884	-633.1	-37.3	-0.670	

RAC

t_s (days)	$t - t_s$ (days)	T (°C)	RH (%)	$\hat{}t - \hat{}t_s$ (days)	$S(\hat{}t)$	k_h	ε_{sh} $(\hat{}t,\hat{}t_s)$ (1E-06)	ε_{au} $(\hat{}t,\hat{}t_s)$ (1E-06)	$\varepsilon_{sh,total}$ $(\hat{}t,\hat{}t_s)$ (‰)	$\varepsilon_{sh,exp}$ $(\hat{}t,\hat{}t_s)$ (1E-06)
1	0.100	21.3	48.7	0.106	0.023	0.884	-19.5	0.0	-0.020	
	1.0	21.3	48.7	1.062	0.072	0.884	-61.1	-0.1	-0.061	-0.058
β_{Th}	2.0	21.3	48.7	2.124	0.101	0.884	-85.8	-0.5	-0.086	-0.070
1	3.0	21.3	48.7	3.2	0.123	0.884	-104.4	-1.7	-0.106	-0.110
	4.0	21.3	48.7	4.2	0.142	0.884	-120.6	-3.6	-0.124	-0.113
	5.0	21.3	48.7	5.3	0.159	0.884	-135.0	-5.9	-0.141	-0.120
	6.0	21.3	48.7	6.4	0.174	0.884	-147.7	-8.5	-0.156	-0.155
	6.0	21.3	48.7	6.4	0.174	0.884	-147.7	-8.5	-0.156	-0.155
	6.0	21.3	48.7	6.4	0.174	0.884	-147.7	-8.6	-0.156	-0.155
	6.3	21.3	48.7	6.6	0.177	0.884	-150.3	-9.1	-0.159	-0.140
	7.0	21.3	48.7	7.4	0.187	0.884	-158.8	-11.0	-0.170	-0.155
	8.0	21.3	48.7	8.5	0.200	0.884	-169.8	-13.4	-0.183	-0.162
	9.0	21.3	48.7	9.6	0.212	0.884	-180.0	-15.6	-0.196	-0.198
	10.0	21.3	48.7	10.6	0.223	0.884	-189.3	-17.7	-0.207	-0.207
	11.0	21.3	48.7	11.7	0.233	0.884	-197.8	-19.5	-0.217	-0.172
	12.0	21.3	48.7	12.7	0.243	0.884	-206.3	-21.1	-0.227	-0.220
	13.0	21.3	48.7	13.8	0.253	0.884	-214.8	-22.5	-0.237	-0.245
	20.0	21.3	48.7	21.2	0.310	0.884	-263.2	-29.2	-0.292	-0.320
	27.0	21.3	48.7	28.7	0.356	0.884	-302.3	-32.5	-0.335	-0.383
	27.0	21.3	48.7	28.7	0.356	0.884	-302.3	-32.5	-0.335	-0.383
	27.0	21.3	48.7	28.7	0.356	0.884	-302.3	-32.5	-0.335	-0.383
	27.3	21.3	48.7	28.9	0.357	0.884	-303.1	-32.6	-0.336	-0.383
	28.0	21.3	48.7	29.7	0.362	0.884	-307.4	-32.9	-0.340	-0.385
	29.0	21.3	48.7	30.8	0.368	0.884	-312.4	-33.2	-0.346	-0.387
	30.0	21.3	48.7	31.9	0.373	0.884	-316.7	-33.5	-0.350	-0.402
	31.0	21.3	48.7	32.9	0.379	0.884	-321.8	-33.7	-0.356	-0.395
	32.0	21.3	48.7	34.0	0.384	0.884	-326.0	-34.0	-0.360	-0.385
	33.0	21.3	48.7	35.1	0.390	0.884	-331.1	-34.2	-0.365	-0.393
	34.0	21.3	48.7	36.1	0.395	0.884	-335.4	-34.4	-0.370	-0.410
	41.0	21.3	48.7	43.5	0.429	0.884	-364.2	-35.6	-0.400	-0.443
	48.0	21.3	48.7	51.0	0.459	0.884	-389.7	-36.4	-0.426	-0.498
	55.0	21.3	48.7	58.4	0.486	0.884	-412.6	-36.9	-0.450	-0.507
	62.0	21.3	48.7	65.9	0.511	0.884	-433.9	-37.3	-0.471	-0.520
	83.0	21.3	48.7	88.2	0.573	0.884	-486.5	-38.0	-0.525	-0.587
	96.0	21.3	48.7	102.0	0.606	0.884	-514.5	-38.3	-0.553	-0.583
	117.0	21.3	48.7	124.3	0.650	0.884	-551.9	-38.5	-0.590	-0.610
	126.0	21.3	48.7	133.8	0.666	0.884	-565.5	-38.6	-0.604	-0.597
	147.0	21.3	48.7	156.1	0.701	0.884	-595.2	-38.8	-0.634	-0.627
	156.0	21.3	48.7	165.7	0.714	0.884	-606.2	-38.8	-0.645	-0.630
	177.0	21.3	48.7	188.0	0.741	0.884	-629.1	-38.9	-0.668	-0.637
	186.0	21.3	48.7	197.6	0.752	0.884	-638.5	-38.9	-0.677	-0.660
	207.0	21.3	48.7	219.9	0.774	0.884	-657.2	-39.0	-0.696	-0.673
	216.0	21.3	48.7	229.4	0.783	0.884	-664.8	-39.0	-0.704	-0.670
	237.0	21.3	48.7	251.7	0.801	0.884	-680.1	-39.0	-0.719	-0.667
	246.0	21.3	48.7	261.3	0.809	0.884	-686.9	-39.0	-0.726	-0.650
	267.0	21.3	48.7	283.6	0.824	0.884	-699.6	-39.1	-0.739	-0.702
	276.0	21.3	48.7	293.2	0.831	0.884	-705.5	-39.1	-0.745	-0.677
	297.0	21.3	48.7	315.5	0.844	0.884	-716.6	-39.1	-0.756	-0.688
	306.0	21.3	48.7	325.0	0.849	0.884	-720.8	-39.1	-0.760	-0.750
	327.0	21.3	48.7	347.3	0.861	0.884	-731.0	-39.1	-0.770	-0.732
	336.0	21.3	48.7	356.9	0.865	0.884	-734.4	-39.1	-0.774	-0.765
	357.0	21.3	48.7	379.2	0.875	0.884	-742.9	-39.1	-0.782	-0.775
	371.0	21.3	48.7	394.1	0.881	0.884	-748.0	-39.2	-0.787	-0.772
	392.0	21.3	48.7	416.4	0.889	0.884	-754.8	-39.2	-0.794	-0.767
	406.0	21.3	48.7	431.2	0.894	0.884	-759.0	-39.2	-0.798	-0.772
	427.0	21.3	48.7	453.5	0.902	0.884	-765.8	-39.2	-0.805	-0.785
	456.0	21.3	48.7	484.3	0.910	0.884	-772.6	-39.2	-0.812	-0.782
	477.0	21.3	48.7	506.7	0.916	0.884	-777.7	-39.2	-0.817	-0.782
	1000.0	21.3	48.7	1062.2	0.979	0.884	-831.2	-39.2	-0.870	
	2500.0	21.3	48.7	2655.4	0.998	0.884	-847.3	-39.3	-0.887	
	5000.0	21.3	48.7	5310.8	1.000	0.884	-849.0	-39.3	-0.888	
	10000.0	21.3	48.7	10621.6	1.000	0.884	-849.0	-39.3	-0.888	

HVFAC

t_s (days)	$t - t_s$ (days)	T (°C)	RH (%)	$\hat{}t - \hat{}t_s$ (days)	$S(\hat{}t)$	k_h	ε_{sh} $(\hat{}t,\hat{}t_s)$ (1E-06)	ε_{au} $(\hat{}t,\hat{}t_s)$ (1E-06)	$\varepsilon_{sh,total}$ $(\hat{}t,\hat{}t_s)$ (‰)	$\varepsilon_{sh,exp}$ $(\hat{}t,\hat{}t_s)$ (1E-06)
1	0.100	21.3	48.7	0.106	0.038	0.884	-13.9	0.0	-0.014	
	1.0	21.3	48.7	1.062	0.120	0.884	-43.9	0.0	-0.044	-0.020
β_{Th}	2.0	21.3	48.7	2.124	0.168	0.884	-61.5	0.0	-0.062	-0.028
1	3.0	21.3	48.7	3.2	0.205	0.884	-75.1	0.0	-0.075	-0.012
	4.0	21.3	48.7	4.2	0.236	0.884	-86.4	0.0	-0.086	-0.090
	5.0	21.3	48.7	5.3	0.263	0.884	-96.3	0.0	-0.096	-0.100
	6.0	21.3	48.7	6.4	0.286	0.884	-104.7	0.0	-0.105	-0.122
	6.0	21.3	48.7	6.4	0.286	0.884	-104.7	0.0	-0.105	-0.122
	6.0	21.3	48.7	6.4	0.287	0.884	-105.1	0.0	-0.105	-0.122
	6.3	21.3	48.7	6.6	0.292	0.884	-106.9	0.0	-0.107	-0.122
	7.0	21.3	48.7	7.4	0.308	0.884	-112.8	0.0	-0.113	-0.125
	8.0	21.3	48.7	8.5	0.328	0.884	-120.1	0.0	-0.120	-0.132
	9.0	21.3	48.7	9.6	0.346	0.884	-126.7	-0.1	-0.127	-0.158
	10.0	21.3	48.7	10.6	0.363	0.884	-132.9	-0.4	-0.133	-0.182
	11.0	21.3	48.7	11.7	0.379	0.884	-138.8	-0.9	-0.140	-0.192
	12.0	21.3	48.7	12.7	0.394	0.884	-144.3	-2.0	-0.146	-0.225
	13.0	21.3	48.7	13.8	0.408	0.884	-149.4	-3.7	-0.153	-0.235
	20.0	21.3	48.7	21.2	0.491	0.884	-179.8	-46.5	-0.226	-0.272
	27.0	21.3	48.7	28.7	0.555	0.884	-203.2	-111.4	-0.315	-0.330
	27.0	21.3	48.7	28.7	0.555	0.884	-203.2	-111.5	-0.315	-0.330
	27.0	21.3	48.7	28.7	0.555	0.884	-203.2	-111.8	-0.315	-0.330
	27.3	21.3	48.7	28.9	0.557	0.884	-204.0	-113.5	-0.318	-0.330
	28.0	21.3	48.7	29.7	0.563	0.884	-206.2	-119.5	-0.326	-0.315
	29.0	21.3	48.7	30.8	0.570	0.884	-208.7	-127.0	-0.336	-0.333
	30.0	21.3	48.7	31.9	0.578	0.884	-211.6	-134.1	-0.346	-0.327
	31.0	21.3	48.7	32.9	0.585	0.884	-214.2	-140.8	-0.355	-0.335
	32.0	21.3	48.7	34.0	0.592	0.884	-216.8	-146.9	-0.364	-0.338
	33.0	21.3	48.7	35.1	0.599	0.884	-219.3	-152.6	-0.372	-0.335
	34.0	21.3	48.7	36.1	0.605	0.884	-221.5	-157.9	-0.379	-0.332
	41.0	21.3	48.7	43.5	0.647	0.884	-236.9	-185.4	-0.422	-0.337
	48.0	21.3	48.7	51.0	0.682	0.884	-249.7	-201.3	-0.451	-0.388
	55.0	21.3	48.7	58.4	0.712	0.884	-260.7	-210.9	-0.472	-0.410
	62.0	21.3	48.7	65.9	0.738	0.884	-270.2	-216.9	-0.487	-0.427
	83.0	21.3	48.7	88.2	0.799	0.884	-292.6	-225.3	-0.518	-0.430
	96.0	21.3	48.7	102.0	0.827	0.884	-302.8	-227.4	-0.530	-0.410
	117.0	21.3	48.7	124.3	0.862	0.884	-315.6	-229.2	-0.545	-0.438
	126.0	21.3	48.7	133.8	0.874	0.884	-320.0	-229.7	-0.550	-0.438
	147.0	21.3	48.7	156.1	0.897	0.884	-328.5	-230.3	-0.559	-0.470
	156.0	21.3	48.7	165.7	0.906	0.884	-331.7	-230.5	-0.562	-0.478
	177.0	21.3	48.7	188.0	0.922	0.884	-337.6	-230.8	-0.568	-0.507
	186.0	21.3	48.7	197.6	0.928	0.884	-339.8	-230.9	-0.571	-0.492
	207.0	21.3	48.7	219.9	0.939	0.884	-343.8	-231.0	-0.575	-0.495
	216.0	21.3	48.7	229.4	0.943	0.884	-345.3	-231.1	-0.576	-0.508
	237.0	21.3	48.7	251.7	0.952	0.884	-348.6	-231.1	-0.580	-0.485
	246.0	21.3	48.7	261.3	0.955	0.884	-349.7	-231.2	-0.581	-0.492
	267.0	21.3	48.7	283.6	0.962	0.884	-352.3	-231.2	-0.584	-0.493
	276.0	21.3	48.7	293.2	0.964	0.884	-353.0	-231.2	-0.584	-0.502
	297.0	21.3	48.7	315.5	0.969	0.884	-354.8	-231.3	-0.586	-0.572
	306.0	21.3	48.7	325.0	0.971	0.884	-355.6	-231.3	-0.587	-0.530
	327.0	21.3	48.7	347.3	0.975	0.884	-357.0	-231.3	-0.588	-0.568
	336.0	21.3	48.7	356.9	0.976	0.884	-357.4	-231.3	-0.589	-0.563
	357.0	21.3	48.7	379.2	0.979	0.884	-358.5	-231.3	-0.590	-0.552
	371.0	21.3	48.7	394.1	0.981	0.884	-359.2	-231.3	-0.591	-0.587
	392.0	21.3	48.7	416.4	0.983	0.884	-359.9	-231.3	-0.591	-0.608
	406.0	21.3	48.7	431.2	0.984	0.884	-360.3	-231.3	-0.592	-0.597
	427.0	21.3	48.7	453.5	0.986	0.884	-361.0	-231.3	-0.592	-0.593
	456.0	21.3	48.7	484.3	0.988	0.884	-361.8	-231.4	-0.593	-0.595
	477.0	21.3	48.7	506.7	0.990	0.884	-362.5	-231.4	-0.594	-0.597
	1000.0	21.3	48.7	1062.2	0.999	0.884	-365.8	-231.4	-0.597	
	2500.0	21.3	48.7	2655.4	1.000	0.884	-366.2	-231.4	-0.598	
	5000.0	21.3	48.7	5310.8	1.000	0.884	-366.2	-231.4	-0.598	
	10000.0	21.3	48.7	10621.6	1.000	0.884	-366.2	-231.4	-0.598	

INPUT AND CALCULATION - MC10

NAC		t_s (days)	$t - t_s$ (days)	T (°C)	RH (%)	$(t - t_s)_T$ (days)	β_{as} (t)	β_{RH}	β_{ds} $(t\text{-}t_s)_T$	ε_{cas} (t) (1E-6)	ε_{cds} (t) (1E-6)	ε_{cs} (t) (‰)	$\varepsilon_{cs,exp}$ (t) (‰)
f_{cm} =	30.5	1	0.100	21.3	48.7	0.106	0.061	-1.371	0.029	-2.4	-24.3	-0.027	
α_{as} =	600		1.0	21.3	48.7	1.06	0.181	-1.371	0.091	-7.2	-76.1	-0.083	-0.043
ε_{cas0} =	-39.56	1E-06	2.0	21.3	48.7	2.12	0.246	-1.371	0.129	-9.7	-107.9	-0.118	-0.065
α_{ds1} =	6		3.0	21.3	48.7	3.2	0.293	-1.371	0.157	-11.6	-131.4	-0.143	
α_{ds2} =	0.012		4.0	21.3	48.7	4.2	0.330	-1.371	0.18	-13.1	-150.6	-0.164	
ε_{cds0} =	610.28	1E-06	5.0	21.3	48.7	5.3	0.361	-1.371	0.201	-14.3	-168.2	-0.183	-0.100
β_{s1} =	1.00		6.0	21.3	48.7	6.4	0.387	-1.371	0.219	-15.3	-183.2	-0.199	-0.117
h_0 =	60		6.0	21.3	48.7	6.4	0.387	-1.371	0.219	-15.3	-183.2	-0.199	-0.117
			6.0	21.3	48.7	6.4	0.388	-1.371	0.22	-15.3	-184.1	-0.199	-0.117
			6.3	21.3	48.7	6.6	0.393	-1.371	0.224	-15.5	-187.4	-0.203	-0.117
			7.0	21.3	48.7	7.4	0.411	-1.371	0.236	-16.3	-197.5	-0.214	-0.143
			8.0	21.3	48.7	8.5	0.432	-1.371	0.251	-17.1	-210	-0.227	-0.125
			9.0	21.3	48.7	9.5	0.451	-1.371	0.265	-17.8	-221.7	-0.240	-0.148
			10.0	21.3	48.7	10.6	0.469	-1.371	0.279	-18.6	-233.4	-0.252	-0.155
			11.0	21.3	48.7	11.7	0.485	-1.371	0.291	-19.2	-243.5	-0.263	-0.197
			12.0	21.3	48.7	12.7	0.500	-1.371	0.303	-19.8	-253.5	-0.273	-0.178
			13.0	21.3	48.7	13.8	0.514	-1.371	0.314	-20.3	-262.7	-0.283	-0.180
			20.0	21.3	48.7	21.2	0.591	-1.371	0.38	-23.4	-317.9	-0.341	-0.278
			27.0	21.3	48.7	28.6	0.646	-1.371	0.43	-25.6	-359.8	-0.385	-0.343
			27.0	21.3	48.7	28.6	0.646	-1.371	0.43	-25.6	-359.8	-0.385	-0.343
			27.0	21.3	48.7	28.7	0.647	-1.371	0.431	-25.6	-360.6	-0.386	-0.343
			27.3	21.3	48.7	28.9	0.648	-1.371	0.432	-25.6	-361.5	-0.387	-0.343
			28.0	21.3	48.7	29.7	0.653	-1.371	0.437	-25.8	-365.6	-0.391	-0.342
			29.0	21.3	48.7	30.7	0.659	-1.371	0.443	-26.1	-370.7	-0.397	-0.333
			30.0	21.3	48.7	31.8	0.666	-1.371	0.449	-26.3	-375.7	-0.402	-0.333
			31.0	21.3	48.7	32.9	0.672	-1.371	0.455	-26.6	-380.7	-0.407	-0.338
			32.0	21.3	48.7	33.9	0.677	-1.371	0.461	-26.8	-385.7	-0.413	-0.350
			33.0	21.3	48.7	35.0	0.683	-1.371	0.466	-27	-389.9	-0.417	-0.345
			34.0	21.3	48.7	36.0	0.688	-1.371	0.472	-27.2	-394.9	-0.422	-0.368
			41.0	21.3	48.7	43.5	0.722	-1.371	0.506	-28.6	-423.4	-0.452	-0.403
			48.0	21.3	48.7	50.9	0.750	-1.371	0.536	-29.7	-448.5	-0.478	-0.412
			55.0	21.3	48.7	58.3	0.773	-1.371	0.562	-30.6	-470.2	-0.501	-0.468
			62.0	21.3	48.7	65.7	0.793	-1.371	0.586	-31.4	-490.3	-0.522	-0.482
			83.0	21.3	48.7	88.0	0.838	-1.371	0.641	-33.2	-536.3	-0.570	-0.540
			96.0	21.3	48.7	101.8	0.859	-1.371	0.668	-34	-558.9	-0.593	-0.540
			117.0	21.3	48.7	124.0	0.885	-1.371	0.704	-35	-589	-0.624	-0.535
			126.0	21.3	48.7	133.6	0.894	-1.371	0.717	-35.4	-599.9	-0.635	-0.538
			147.0	21.3	48.7	155.8	0.912	-1.371	0.744	-36.1	-622.5	-0.659	-0.543
			156.0	21.3	48.7	165.4	0.918	-1.371	0.753	-36.3	-630	-0.666	-0.527
			177.0	21.3	48.7	187.7	0.930	-1.371	0.773	-36.8	-646.8	-0.684	-0.540
			186.0	21.3	48.7	197.2	0.935	-1.371	0.781	-37	-653.5	-0.691	-0.557
			207.0	21.3	48.7	219.5	0.944	-1.371	0.797	-37.3	-666.8	-0.704	-0.555
			216.0	21.3	48.7	229.0	0.947	-1.371	0.803	-37.5	-671.9	-0.709	-0.587
			237.0	21.3	48.7	251.3	0.954	-1.371	0.816	-37.7	-682.7	-0.720	-0.560
			246.0	21.3	48.7	260.8	0.957	-1.371	0.821	-37.9	-686.9	-0.725	-0.570
			267.0	21.3	48.7	283.1	0.962	-1.371	0.832	-38.1	-696.1	-0.734	-0.585
			276.0	21.3	48.7	292.6	0.964	-1.371	0.836	-38.1	-699.5	-0.738	-0.605
			297.0	21.3	48.7	314.9	0.968	-1.371	0.845	-38.3	-707	-0.745	-0.603
			306.0	21.3	48.7	324.4	0.970	-1.371	0.849	-38.4	-710.4	-0.749	-0.595
			327.0	21.3	48.7	346.7	0.973	-1.371	0.856	-38.5	-716.2	-0.755	-0.622
			336.0	21.3	48.7	356.2	0.974	-1.371	0.859	-38.5	-718.7	-0.757	-0.613
			357.0	21.3	48.7	378.5	0.977	-1.371	0.866	-38.7	-724.6	-0.763	-0.618
			371.0	21.3	48.7	393.3	0.979	-1.371	0.87	-38.7	-727.9	-0.767	-0.633
			392.0	21.3	48.7	415.6	0.981	-1.371	0.876	-38.8	-732.9	-0.772	-0.640
			406.0	21.3	48.7	430.4	0.982	-1.371	0.88	-38.8	-736.3	-0.775	-0.657
			427.0	21.3	48.7	452.7	0.984	-1.371	0.884	-38.9	-739.6	-0.779	-0.652
			456.0	21.3	48.7	483.4	0.986	-1.371	0.891	-39	-745.5	-0.785	-0.667
			477.0	21.3	48.7	505.7	0.987	-1.371	0.895	-39	-748.8	-0.788	-0.645
			1000.0	21.3	48.7	1060.2	0.998	-1.371	0.945	-39.5	-790.7	-0.830	
			2500.0	21.3	48.7	2650.4	1.000	-1.371	0.977	-39.6	-817.4	-0.857	
			5000.0	21.3	48.7	5300.8	1.000	-1.371	0.988	-39.6	-826.7	-0.866	
			10000.0	21.3	48.7	10601.7	1.000	-1.371	0.994	-39.6	-831.7	-0.871	

RAC		t_s (days)	$t-t_s$ (days)	T (°C)	RH (%)	$(t-t_s)_T$ (days)	β_{as} (t)	β_{RH}	β_{ds} $(t-t_s)_T$	ε_{cas} (t) (1E-6)	ε_{cds} (t) (1E-6)	ε_{cs} (t) (‰)	$\varepsilon_{cs,exp}$ (t) (‰)
f_{cm} =	28.1	1	0.100	21.3	48.7	0.106	0.061	-1.371	0.029	-2.1	-25.0	-0.027	
α_{as} =	600		1.0	21.3	48.7	1.06	0.181	-1.371	0.091	-6.2	-78.4	-0.085	-0.058
ε_{cas0} =	-34.47	1E-06	2.0	21.3	48.7	2.12	0.246	-1.371	0.129	-8.5	-111.1	-0.120	-0.07
α_{ds1} =	6		3.0	21.3	48.7	3.2	0.293	-1.371	0.157	-10.1	-135.2	-0.145	-0.110
α_{ds2} =	0.012		4.0	21.3	48.7	4.2	0.330	-1.371	0.180	-11.4	-155.0	-0.166	-0.113
ε_{cds0} =	628.11	1E-06	5.0	21.3	48.7	5.3	0.361	-1.371	0.201	-12.4	-173.1	-0.186	-0.120
β_{s1} =	1.00		6.0	21.3	48.7	6.4	0.387	-1.371	0.219	-13.3	-188.6	-0.202	-0.155
h_0 =	60		6.0	21.3	48.7	6.4	0.387	-1.371	0.219	-13.3	-188.6	-0.202	-0.155
			6.0	21.3	48.7	6.4	0.388	-1.371	0.220	-13.4	-189.5	-0.203	-0.155
			6.3	21.3	48.7	6.6	0.393	-1.371	0.224	-13.5	-192.9	-0.206	-0.140
			7.0	21.3	48.7	7.4	0.411	-1.371	0.236	-14.2	-203.2	-0.217	-0.155
			8.0	21.3	48.7	8.5	0.432	-1.371	0.251	-14.9	-216.1	-0.231	-0.162
			9.0	21.3	48.7	9.5	0.451	-1.371	0.265	-15.5	-228.2	-0.244	-0.198
			10.0	21.3	48.7	10.6	0.469	-1.371	0.279	-16.2	-240.3	-0.257	-0.207
			11.0	21.3	48.7	11.7	0.485	-1.371	0.291	-16.7	-250.6	-0.267	-0.172
			12.0	21.3	48.7	12.7	0.500	-1.371	0.303	-17.2	-260.9	-0.278	-0.220
			13.0	21.3	48.7	13.8	0.514	-1.371	0.314	-17.7	-270.4	-0.288	-0.245
			20.0	21.3	48.7	21.2	0.591	-1.371	0.380	-20.4	-327.2	-0.348	-0.320
			27.0	21.3	48.7	28.6	0.646	-1.371	0.430	-22.3	-370.3	-0.393	-0.383
			27.0	21.3	48.7	28.6	0.646	-1.371	0.430	-22.3	-370.3	-0.393	-0.383
			27.0	21.3	48.7	28.7	0.647	-1.371	0.431	-22.3	-371.2	-0.394	-0.383
			27.3	21.3	48.7	28.9	0.648	-1.371	0.432	-22.3	-372.0	-0.394	-0.383
			28.0	21.3	48.7	29.7	0.653	-1.371	0.437	-22.5	-376.3	-0.399	-0.385
			29.0	21.3	48.7	30.7	0.659	-1.371	0.443	-22.7	-381.5	-0.404	-0.387
			30.0	21.3	48.7	31.8	0.666	-1.371	0.449	-23.0	-386.7	-0.410	-0.402
			31.0	21.3	48.7	32.9	0.672	-1.371	0.455	-23.2	-391.8	-0.415	-0.395
			32.0	21.3	48.7	33.9	0.677	-1.371	0.461	-23.3	-397.0	-0.420	-0.385
			33.0	21.3	48.7	35.0	0.683	-1.371	0.466	-23.5	-401.3	-0.425	-0.393
			34.0	21.3	48.7	36.0	0.688	-1.371	0.472	-23.7	-406.5	-0.430	-0.410
			41.0	21.3	48.7	43.5	0.722	-1.371	0.506	-24.9	-435.7	-0.461	-0.443
			48.0	21.3	48.7	50.9	0.750	-1.371	0.536	-25.9	-461.6	-0.488	-0.498
			55.0	21.3	48.7	58.3	0.773	-1.371	0.562	-26.6	-484.0	-0.511	-0.507
			62.0	21.3	48.7	65.7	0.793	-1.371	0.586	-27.3	-504.6	-0.532	-0.520
			83.0	21.3	48.7	88.0	0.838	-1.371	0.641	-28.9	-552.0	-0.581	-0.587
			96.0	21.3	48.7	101.8	0.859	-1.371	0.668	-29.6	-575.2	-0.605	-0.583
			117.0	21.3	48.7	124.0	0.885	-1.371	0.704	-30.5	-606.2	-0.637	-0.610
			126.0	21.3	48.7	133.6	0.894	-1.371	0.717	-30.8	-617.4	-0.648	-0.597
			147.0	21.3	48.7	155.8	0.912	-1.371	0.744	-31.4	-640.7	-0.672	-0.627
			156.0	21.3	48.7	165.4	0.918	-1.371	0.753	-31.6	-648.4	-0.680	-0.630
			177.0	21.3	48.7	187.7	0.930	-1.371	0.773	-32.1	-665.7	-0.698	-0.637
			186.0	21.3	48.7	197.2	0.935	-1.371	0.781	-32.2	-672.5	-0.705	-0.660
			207.0	21.3	48.7	219.5	0.944	-1.371	0.797	-32.5	-686.3	-0.719	-0.673
			216.0	21.3	48.7	229.0	0.947	-1.371	0.803	-32.6	-691.5	-0.724	-0.670
			237.0	21.3	48.7	251.3	0.954	-1.371	0.816	-32.9	-702.7	-0.736	-0.667
			246.0	21.3	48.7	260.8	0.957	-1.371	0.821	-33.0	-707.0	-0.740	-0.650
			267.0	21.3	48.7	283.1	0.962	-1.371	0.832	-33.2	-716.5	-0.750	-0.702
			276.0	21.3	48.7	292.6	0.964	-1.371	0.836	-33.2	-719.9	-0.753	-0.677
			297.0	21.3	48.7	314.9	0.968	-1.371	0.845	-33.4	-727.7	-0.761	-0.688
			306.0	21.3	48.7	324.4	0.970	-1.371	0.849	-33.4	-731.1	-0.765	-0.750
			327.0	21.3	48.7	346.7	0.973	-1.371	0.856	-33.5	-737.1	-0.771	-0.732
			336.0	21.3	48.7	356.2	0.974	-1.371	0.859	-33.6	-739.7	-0.773	-0.765
			357.0	21.3	48.7	378.5	0.977	-1.371	0.866	-33.7	-745.7	-0.779	-0.775
			371.0	21.3	48.7	393.3	0.979	-1.371	0.870	-33.7	-749.2	-0.783	-0.772
			392.0	21.3	48.7	415.6	0.981	-1.371	0.876	-33.8	-754.4	-0.788	-0.767
			406.0	21.3	48.7	430.4	0.982	-1.371	0.880	-33.8	-757.8	-0.792	-0.772
			427.0	21.3	48.7	452.7	0.984	-1.371	0.884	-33.9	-761.2	-0.795	-0.785
			456.0	21.3	48.7	483.4	0.986	-1.371	0.891	-34.0	-767.3	-0.801	-0.782
			477.0	21.3	48.7	505.7	0.987	-1.371	0.895	-34.0	-770.7	-0.805	-0.782
			1000.0	21.3	48.7	1060.2	0.998	-1.371	0.945	-34.4	-813.8	-0.848	
			2500.0	21.3	48.7	2650.4	1.000	-1.371	0.977	-34.5	-841.3	-0.876	
			5000.0	21.3	48.7	5300.8	1.000	-1.371	0.988	-34.5	-850.8	-0.885	
			10000.0	21.3	48.7	10601.7	1.000	-1.371	0.994	-34.5	-856.0	-0.891	

HVFAC		t_s (days)	$t-t_s$ (days)	T (°C)	RH (%)	$(t-t_s)_T$ (days)	β_{as} (t)	β_{RH}	β_{ds} $(t-t_s)_T$	ε_{cas} (t) (1E-6)	ε_{cds} (t) (1E-6)	ε_{cs} (t) (‰)	$\varepsilon_{cs,exp}$ (t) (‰)
f_{cm} =	22.6		0.100	21.3	48.7	0.106	0.061	-1.371	0.029	-1.4	-26.7	-0.028	-0.020
α_{as} =	600		1.0	21.3	48.7	1.06	0.181	-1.371	0.091	-4.3	-83.7	-0.088	-0.028
ε_{cas0} =	-23.49	1E-06	2.0	21.3	48.7	2.12	0.246	-1.371	0.129	-5.8	-118.7	-0.125	-0.012
α_{ds1} =	6		3.0	21.3	48.7	3.2	0.293	-1.371	0.157	-6.9	-144.4	-0.151	
α_{ds2} =	0.012		4.0	21.3	48.7	4.2	0.330	-1.371	0.180	-7.8	-165.6	-0.173	-0.090
ε_{cds0} =	670.97	1E-06	5.0	21.3	48.7	5.3	0.361	-1.371	0.201	-8.5	-184.9	-0.193	-0.100
β_{s1} =	1.00		6.0	21.3	48.7	6.4	0.387	-1.371	0.219	-9.1	-201.5	-0.211	-0.122
h_0 =	60		6.0	21.3	48.7	6.4	0.387	-1.371	0.219	-9.1	-201.5	-0.211	-0.122
			6.0	21.3	48.7	6.4	0.388	-1.371	0.220	-9.1	-202.4	-0.212	-0.122
			6.3	21.3	48.7	6.6	0.393	-1.371	0.224	-9.2	-206.1	-0.215	-0.122
			7.0	21.3	48.7	7.4	0.411	-1.371	0.236	-9.7	-217.1	-0.227	-0.125
			8.0	21.3	48.7	8.5	0.432	-1.371	0.251	-10.1	-230.9	-0.241	-0.132
			9.0	21.3	48.7	9.5	0.451	-1.371	0.265	-10.6	-243.8	-0.254	-0.158
			10.0	21.3	48.7	10.6	0.469	-1.371	0.279	-11.0	-256.7	-0.268	-0.182
			11.0	21.3	48.7	11.7	0.485	-1.371	0.291	-11.4	-267.7	-0.279	-0.192
			12.0	21.3	48.7	12.7	0.500	-1.371	0.303	-11.7	-278.7	-0.290	-0.225
			13.0	21.3	48.7	13.8	0.514	-1.371	0.314	-12.1	-288.8	-0.301	-0.235
			20.0	21.3	48.7	21.2	0.591	-1.371	0.380	-13.9	-349.6	-0.364	-0.272
			27.0	21.3	48.7	28.6	0.646	-1.371	0.430	-15.2	-395.6	-0.411	-0.330
			27.0	21.3	48.7	28.6	0.646	-1.371	0.430	-15.2	-395.6	-0.411	-0.330
			27.0	21.3	48.7	28.7	0.647	-1.371	0.431	-15.2	-396.5	-0.412	-0.330
			27.3	21.3	48.7	28.9	0.648	-1.371	0.432	-15.2	-397.4	-0.413	-0.330
			28.0	21.3	48.7	29.7	0.653	-1.371	0.437	-15.3	-402.0	-0.417	-0.315
			29.0	21.3	48.7	30.7	0.659	-1.371	0.443	-15.5	-407.5	-0.423	-0.333
			30.0	21.3	48.7	31.8	0.666	-1.371	0.449	-15.6	-413.0	-0.429	-0.327
			31.0	21.3	48.7	32.9	0.672	-1.371	0.455	-15.8	-418.6	-0.434	-0.335
			32.0	21.3	48.7	33.9	0.677	-1.371	0.461	-15.9	-424.1	-0.440	-0.338
			33.0	21.3	48.7	35.0	0.683	-1.371	0.466	-16.0	-428.7	-0.445	-0.335
			34.0	21.3	48.7	36.0	0.688	-1.371	0.472	-16.2	-434.2	-0.450	-0.332
			41.0	21.3	48.7	43.5	0.722	-1.371	0.506	-17.0	-465.5	-0.483	-0.337
			48.0	21.3	48.7	50.9	0.750	-1.371	0.536	-17.6	-493.1	-0.511	-0.388
			55.0	21.3	48.7	58.3	0.773	-1.371	0.562	-18.2	-517.0	-0.535	-0.410
			62.0	21.3	48.7	65.7	0.793	-1.371	0.586	-18.6	-539.1	-0.558	-0.427
			83.0	21.3	48.7	88.0	0.838	-1.371	0.641	-19.7	-589.7	-0.609	-0.430
			96.0	21.3	48.7	101.8	0.859	-1.371	0.668	-20.2	-614.5	-0.635	-0.410
			117.0	21.3	48.7	124.0	0.885	-1.371	0.704	-20.8	-647.6	-0.668	-0.438
			126.0	21.3	48.7	133.6	0.894	-1.371	0.717	-21.0	-659.6	-0.681	-0.438
			147.0	21.3	48.7	155.8	0.912	-1.371	0.744	-21.4	-684.4	-0.706	-0.470
			156.0	21.3	48.7	165.4	0.918	-1.371	0.753	-21.6	-692.7	-0.714	-0.478
			177.0	21.3	48.7	187.7	0.930	-1.371	0.773	-21.8	-711.1	-0.733	-0.507
			186.0	21.3	48.7	197.2	0.935	-1.371	0.781	-22.0	-718.4	-0.740	-0.492
			207.0	21.3	48.7	219.5	0.944	-1.371	0.797	-22.2	-733.2	-0.755	-0.495
			216.0	21.3	48.7	229.0	0.947	-1.371	0.803	-22.2	-738.7	-0.761	-0.508
			237.0	21.3	48.7	251.3	0.954	-1.371	0.816	-22.4	-750.6	-0.773	-0.485
			246.0	21.3	48.7	260.8	0.957	-1.371	0.821	-22.5	-755.2	-0.778	-0.492
			267.0	21.3	48.7	283.1	0.962	-1.371	0.832	-22.6	-765.4	-0.788	-0.493
			276.0	21.3	48.7	292.6	0.964	-1.371	0.836	-22.6	-769.0	-0.792	-0.502
			297.0	21.3	48.7	314.9	0.968	-1.371	0.845	-22.7	-777.3	-0.800	-0.572
			306.0	21.3	48.7	324.4	0.970	-1.371	0.849	-22.8	-781.0	-0.804	-0.530
			327.0	21.3	48.7	346.7	0.973	-1.371	0.856	-22.9	-787.4	-0.810	-0.568
			336.0	21.3	48.7	356.2	0.974	-1.371	0.859	-22.9	-790.2	-0.813	-0.563
			357.0	21.3	48.7	378.5	0.977	-1.371	0.866	-22.9	-796.6	-0.820	-0.552
			371.0	21.3	48.7	393.3	0.979	-1.371	0.870	-23.0	-800.3	-0.823	-0.587
			392.0	21.3	48.7	415.6	0.981	-1.371	0.876	-23.0	-805.8	-0.829	-0.608
			406.0	21.3	48.7	430.4	0.982	-1.371	0.880	-23.1	-809.5	-0.833	-0.597
			427.0	21.3	48.7	452.7	0.984	-1.371	0.884	-23.1	-813.2	-0.836	-0.593
			456.0	21.3	48.7	483.4	0.986	-1.371	0.891	-23.2	-819.6	-0.843	-0.595
			477.0	21.3	48.7	505.7	0.987	-1.371	0.895	-23.2	-823.3	-0.847	-0.597
			1000.0	21.3	48.7	1060.2	0.998	-1.371	0.945	-23.4	-869.3	-0.893	
			2500.0	21.3	48.7	2650.4	1.000	-1.371	0.977	-23.5	-898.7	-0.922	
			5000.0	21.3	48.7	5300.8	1.000	-1.371	0.988	-23.5	-908.9	-0.932	
			10000.0	21.3	48.7	10601.7	1.000	-1.371	0.994	-23.5	-914.4	-0.938	

INPUT AND CALCULATION - MC10 - CALIBRATED

NAC		t_s (days)	$t - t_s$ (days)	T (°C)	RH (%)	$(t - t_s)_T$ (days)	β_{as} (t)	β_{RH}	β_{ds} $(t\text{-}t_s)_T$	ε_{cas} (t) (1E-6)	ε_{cds} (t) (1E-6)	ε_{cs} (t) (‰)	$\varepsilon_{cs,exp}$ (t) (‰)
f_{cm} =	30.5	1	0.100	21.3	48.7	0.106	0.061	-1.371	0.029	-2.4	-19.7	-0.022	
α_{as} =	600		1.0	21.3	48.7	1.06	0.181	-1.371	0.091	-7.2	-61.9	-0.069	-0.043
ε_{cas0} =	-39.56	1E-06	2.0	21.3	48.7	2.12	0.246	-1.371	0.129	-9.7	-87.7	-0.097	-0.065
α_{ds1} =	4.5		3.0	21.3	48.7	3.2	0.293	-1.371	0.157	-11.6	-106.7	-0.118	
α_{ds2} =	0.012		4.0	21.3	48.7	4.2	0.330	-1.371	0.18	-13.1	-122.4	-0.136	
ε_{cds0} =	495.85	1E-06	5.0	21.3	48.7	5.3	0.361	-1.371	0.201	-14.3	-136.6	-0.151	-0.100
β_{s1} =	1.00		6.0	21.3	48.7	6.4	0.387	-1.371	0.219	-15.3	-148.9	-0.164	-0.117
h_0 =	60		6.0	21.3	48.7	6.4	0.387	-1.371	0.219	-15.3	-148.9	-0.164	-0.117
			6.0	21.3	48.7	6.4	0.388	-1.371	0.22	-15.3	-149.6	-0.165	-0.117
			6.3	21.3	48.7	6.6	0.393	-1.371	0.224	-15.5	-152.3	-0.168	-0.117
			7.0	21.3	48.7	7.4	0.411	-1.371	0.236	-16.3	-160.4	-0.177	-0.143
			8.0	21.3	48.7	8.5	0.432	-1.371	0.251	-17.1	-170.6	-0.188	-0.125
			9.0	21.3	48.7	9.5	0.451	-1.371	0.265	-17.8	-180.1	-0.198	-0.148
			10.0	21.3	48.7	10.6	0.469	-1.371	0.279	-18.6	-189.7	-0.208	-0.155
			11.0	21.3	48.7	11.7	0.485	-1.371	0.291	-19.2	-197.8	-0.217	-0.197
			12.0	21.3	48.7	12.7	0.500	-1.371	0.303	-19.8	-206	-0.226	-0.178
			13.0	21.3	48.7	13.8	0.514	-1.371	0.314	-20.3	-213.5	-0.234	-0.180
			20.0	21.3	48.7	21.2	0.591	-1.371	0.38	-23.4	-258.3	-0.282	-0.278
			27.0	21.3	48.7	28.6	0.646	-1.371	0.43	-25.6	-292.3	-0.318	-0.343
			27.0	21.3	48.7	28.6	0.646	-1.371	0.43	-25.6	-292.3	-0.318	-0.343
			27.0	21.3	48.7	28.7	0.647	-1.371	0.431	-25.6	-293	-0.319	-0.343
			27.3	21.3	48.7	28.9	0.648	-1.371	0.432	-25.6	-293.7	-0.319	-0.343
			28.0	21.3	48.7	29.7	0.653	-1.371	0.437	-25.8	-297.1	-0.323	-0.342
			29.0	21.3	48.7	30.7	0.659	-1.371	0.443	-26.1	-301.2	-0.327	-0.333
			30.0	21.3	48.7	31.8	0.666	-1.371	0.449	-26.3	-305.2	-0.332	-0.333
			31.0	21.3	48.7	32.9	0.672	-1.371	0.455	-26.6	-309.3	-0.336	-0.338
			32.0	21.3	48.7	33.9	0.677	-1.371	0.461	-26.8	-313.4	-0.340	-0.350
			33.0	21.3	48.7	35.0	0.683	-1.371	0.466	-27	-316.8	-0.344	-0.345
			34.0	21.3	48.7	36.0	0.688	-1.371	0.472	-27.2	-320.9	-0.348	-0.368
			41.0	21.3	48.7	43.5	0.722	-1.371	0.506	-28.6	-344	-0.373	-0.403
			48.0	21.3	48.7	50.9	0.750	-1.371	0.536	-29.7	-364.4	-0.394	-0.412
			55.0	21.3	48.7	58.3	0.773	-1.371	0.562	-30.6	-382.1	-0.413	-0.468
			62.0	21.3	48.7	65.7	0.793	-1.371	0.586	-31.4	-398.4	-0.430	-0.482
			83.0	21.3	48.7	88.0	0.838	-1.371	0.641	-33.2	-435.8	-0.469	-0.540
			96.0	21.3	48.7	101.8	0.859	-1.371	0.668	-34	-454.1	-0.488	-0.540
			117.0	21.3	48.7	124.0	0.885	-1.371	0.704	-35	-478.6	-0.514	-0.535
			126.0	21.3	48.7	133.6	0.894	-1.371	0.717	-35.4	-487.4	-0.523	-0.538
			147.0	21.3	48.7	155.8	0.912	-1.371	0.744	-36.1	-505.8	-0.542	-0.543
			156.0	21.3	48.7	165.4	0.918	-1.371	0.753	-36.3	-511.9	-0.548	-0.527
			177.0	21.3	48.7	187.7	0.930	-1.371	0.773	-36.8	-525.5	-0.562	-0.540
			186.0	21.3	48.7	197.2	0.935	-1.371	0.781	-37	-530.9	-0.568	-0.557
			207.0	21.3	48.7	219.5	0.944	-1.371	0.797	-37.3	-541.8	-0.579	-0.555
			216.0	21.3	48.7	229.0	0.947	-1.371	0.803	-37.5	-545.9	-0.583	-0.587
			237.0	21.3	48.7	251.3	0.954	-1.371	0.816	-37.7	-554.7	-0.592	-0.560
			246.0	21.3	48.7	260.8	0.957	-1.371	0.821	-37.9	-558.1	-0.596	-0.570
			267.0	21.3	48.7	283.1	0.962	-1.371	0.832	-38.1	-565.6	-0.604	-0.585
			276.0	21.3	48.7	292.6	0.964	-1.371	0.836	-38.1	-568.3	-0.606	-0.605
			297.0	21.3	48.7	314.9	0.968	-1.371	0.845	-38.3	-574.4	-0.613	-0.603
			306.0	21.3	48.7	324.4	0.970	-1.371	0.849	-38.4	-577.2	-0.616	-0.595
			327.0	21.3	48.7	346.7	0.973	-1.371	0.856	-38.5	-581.9	-0.620	-0.622
			336.0	21.3	48.7	356.2	0.974	-1.371	0.859	-38.5	-584	-0.623	-0.613
			357.0	21.3	48.7	378.5	0.977	-1.371	0.866	-38.7	-588.7	-0.627	-0.618
			371.0	21.3	48.7	393.3	0.979	-1.371	0.87	-38.7	-591.4	-0.630	-0.633
			392.0	21.3	48.7	415.6	0.981	-1.371	0.876	-38.8	-595.5	-0.634	-0.640
			406.0	21.3	48.7	430.4	0.982	-1.371	0.88	-38.8	-598.2	-0.637	-0.657
			427.0	21.3	48.7	452.7	0.984	-1.371	0.884	-38.9	-601	-0.640	-0.652
			456.0	21.3	48.7	483.4	0.986	-1.371	0.891	-39	-605.7	-0.645	-0.667
			477.0	21.3	48.7	505.7	0.987	-1.371	0.895	-39	-608.4	-0.647	-0.645
			1000.0	21.3	48.7	1060.2	0.998	-1.371	0.945	-39.5	-642.4	-0.682	
			2500.0	21.3	48.7	2650.4	1.000	-1.371	0.977	-39.6	-664.2	-0.704	
			5000.0	21.3	48.7	5300.8	1.000	-1.371	0.988	-39.6	-671.7	-0.711	
			10000.0	21.3	48.7	10601.7	1.000	-1.371	0.994	-39.6	-675.7	-0.715	

RAC		t_s (days)	$t - t_s$ (days)	T (°C)	RH (%)	$(t - t_s)_T$ (days)	β_{as} (t)	β_{RH}	β_{ds} $(t-t_s)_T$	ε_{cas} (t) (1E-6)	ε_{cds} (t) (1E-6)	ε_{cs} (t) (‰)	$\varepsilon_{cs,exp}$ (t) (‰)
f_{cm} =	28.1	1	0.100	21.3	48.7	0.106	0.061	-1.371	0.029	-2.1	-23.4	-0.026	
α_{as} =	600		1.0	21.3	48.7	1.06	0.181	-1.371	0.091	-6.2	-73.5	-0.080	-0.058
ε_{cas0} =	-34.47	1E-06	2.0	21.3	48.7	2.12	0.246	-1.371	0.129	-8.5	-104.1	-0.113	-0.070
α_{ds1} =	5.5		3.0	21.3	48.7	3.2	0.293	-1.371	0.157	-10.1	-126.8	-0.137	-0.110
α_{ds2} =	0.012		4.0	21.3	48.7	4.2	0.330	-1.371	0.180	-11.4	-145.3	-0.157	-0.113
ε_{cds0} =	588.86	1E-06	5.0	21.3	48.7	5.3	0.361	-1.371	0.201	-12.4	-162.3	-0.175	-0.120
β_{s1} =	1.00		6.0	21.3	48.7	6.4	0.387	-1.371	0.219	-13.3	-176.8	-0.190	-0.155
h_0 =	60		6.0	21.3	48.7	6.4	0.387	-1.371	0.219	-13.3	-176.8	-0.190	-0.155
			6.0	21.3	48.7	6.4	0.388	-1.371	0.220	-13.4	-177.6	-0.191	-0.155
			6.3	21.3	48.7	6.6	0.393	-1.371	0.224	-13.5	-180.8	-0.194	-0.140
			7.0	21.3	48.7	7.4	0.411	-1.371	0.236	-14.2	-190.5	-0.205	-0.155
			8.0	21.3	48.7	8.5	0.432	-1.371	0.251	-14.9	-202.6	-0.218	-0.162
			9.0	21.3	48.7	9.5	0.451	-1.371	0.265	-15.5	-213.9	-0.229	-0.198
			10.0	21.3	48.7	10.6	0.469	-1.371	0.279	-16.2	-225.2	-0.241	-0.207
			11.0	21.3	48.7	11.7	0.485	-1.371	0.291	-16.7	-234.9	-0.252	-0.172
			12.0	21.3	48.7	12.7	0.500	-1.371	0.303	-17.2	-244.6	-0.262	-0.220
			13.0	21.3	48.7	13.8	0.514	-1.371	0.314	-17.7	-253.5	-0.271	-0.245
			20.0	21.3	48.7	21.2	0.591	-1.371	0.380	-20.4	-306.8	-0.327	-0.320
			27.0	21.3	48.7	28.6	0.646	-1.371	0.430	-22.3	-347.2	-0.370	-0.383
			27.0	21.3	48.7	28.6	0.646	-1.371	0.430	-22.3	-347.2	-0.370	-0.383
			27.0	21.3	48.7	28.7	0.647	-1.371	0.431	-22.3	-348.0	-0.370	-0.383
			27.3	21.3	48.7	28.9	0.648	-1.371	0.432	-22.3	-348.8	-0.371	-0.383
			28.0	21.3	48.7	29.7	0.653	-1.371	0.437	-22.5	-352.8	-0.375	-0.385
			29.0	21.3	48.7	30.7	0.659	-1.371	0.443	-22.7	-357.6	-0.380	-0.387
			30.0	21.3	48.7	31.8	0.666	-1.371	0.449	-23.0	-362.5	-0.386	-0.402
			31.0	21.3	48.7	32.9	0.672	-1.371	0.455	-23.2	-367.3	-0.391	-0.395
			32.0	21.3	48.7	33.9	0.677	-1.371	0.461	-23.3	-372.2	-0.396	-0.385
			33.0	21.3	48.7	35.0	0.683	-1.371	0.466	-23.5	-376.2	-0.400	-0.393
			34.0	21.3	48.7	36.0	0.688	-1.371	0.472	-23.7	-381.1	-0.405	-0.410
			41.0	21.3	48.7	43.5	0.722	-1.371	0.506	-24.9	-408.5	-0.433	-0.443
			48.0	21.3	48.7	50.9	0.750	-1.371	0.536	-25.9	-432.7	-0.459	-0.498
			55.0	21.3	48.7	58.3	0.773	-1.371	0.562	-26.6	-453.7	-0.480	-0.507
			62.0	21.3	48.7	65.7	0.793	-1.371	0.586	-27.3	-473.1	-0.500	-0.520
			83.0	21.3	48.7	88.0	0.838	-1.371	0.641	-28.9	-517.5	-0.546	-0.587
			96.0	21.3	48.7	101.8	0.859	-1.371	0.668	-29.6	-539.3	-0.569	-0.583
			117.0	21.3	48.7	124.0	0.885	-1.371	0.704	-30.5	-568.4	-0.599	-0.610
			126.0	21.3	48.7	133.6	0.894	-1.371	0.717	-30.8	-578.9	-0.610	-0.597
			147.0	21.3	48.7	155.8	0.912	-1.371	0.744	-31.4	-600.7	-0.632	-0.627
			156.0	21.3	48.7	165.4	0.918	-1.371	0.753	-31.6	-607.9	-0.640	-0.630
			177.0	21.3	48.7	187.7	0.930	-1.371	0.773	-32.1	-624.1	-0.656	-0.637
			186.0	21.3	48.7	197.2	0.935	-1.371	0.781	-32.2	-630.5	-0.663	-0.660
			207.0	21.3	48.7	219.5	0.944	-1.371	0.797	-32.5	-643.4	-0.676	-0.673
			216.0	21.3	48.7	229.0	0.947	-1.371	0.803	-32.6	-648.3	-0.681	-0.670
			237.0	21.3	48.7	251.3	0.954	-1.371	0.816	-32.9	-658.8	-0.692	-0.667
			246.0	21.3	48.7	260.8	0.957	-1.371	0.821	-33.0	-662.8	-0.696	-0.650
			267.0	21.3	48.7	283.1	0.962	-1.371	0.832	-33.2	-671.7	-0.705	-0.702
			276.0	21.3	48.7	292.6	0.964	-1.371	0.836	-33.2	-674.9	-0.708	-0.677
			297.0	21.3	48.7	314.9	0.968	-1.371	0.845	-33.4	-682.2	-0.716	-0.688
			306.0	21.3	48.7	324.4	0.970	-1.371	0.849	-33.4	-685.4	-0.719	-0.750
			327.0	21.3	48.7	346.7	0.973	-1.371	0.856	-33.5	-691.1	-0.725	-0.732
			336.0	21.3	48.7	356.2	0.974	-1.371	0.859	-33.6	-693.5	-0.727	-0.765
			357.0	21.3	48.7	378.5	0.977	-1.371	0.866	-33.7	-699.1	-0.733	-0.775
			371.0	21.3	48.7	393.3	0.979	-1.371	0.870	-33.7	-702.4	-0.736	-0.772
			392.0	21.3	48.7	415.6	0.981	-1.371	0.876	-33.8	-707.2	-0.741	-0.767
			406.0	21.3	48.7	430.4	0.982	-1.371	0.880	-33.8	-710.4	-0.744	-0.772
			427.0	21.3	48.7	452.7	0.984	-1.371	0.884	-33.9	-713.7	-0.748	-0.785
			456.0	21.3	48.7	483.4	0.986	-1.371	0.891	-34.0	-719.3	-0.753	-0.782
			477.0	21.3	48.7	505.7	0.987	-1.371	0.895	-34.0	-722.6	-0.757	-0.782
			1000.0	21.3	48.7	1060.2	0.998	-1.371	0.945	-34.4	-762.9	-0.797	
			2500.0	21.3	48.7	2650.4	1.000	-1.371	0.977	-34.5	-788.8	-0.823	
			5000.0	21.3	48.7	5300.8	1.000	-1.371	0.988	-34.5	-797.6	-0.832	
			10000.0	21.3	48.7	10601.7	1.000	-1.371	0.994	-34.5	-802.5	-0.837	

HVFAC		**t_s (days)**	**$t - t_s$ (days)**	**T (°C)**	**RH (%)**	**$(t - t_s)_T$ (days)**	**$\beta_{as}(t)$**	**β_{RH}**	**$\beta_{ds}(t-t_s)_T$**	**$\varepsilon_{cas}(t)$ (1E-6)**	**$\varepsilon_{cds}(t)$ (1E-6)**	**$\varepsilon_{cs}(t)$ (‰)**	**$\varepsilon_{cs,exp}(t)$ (‰)**
f_{cm} =	22.6	1	0.100	21.3	48.7	0.106	0.061	-1.371	0.029	-1.4	-18.3	-0.020	-0.020
α_{as} =	600		1.0	21.3	48.7	1.06	0.181	-1.371	0.091	-4.3	-57.6	-0.062	-0.028
ε_{cas0} =	-23.49	1E-06	2.0	21.3	48.7	2.12	0.246	-1.371	0.129	-5.8	-81.6	-0.087	-0.012
α_{ds1} =	3.5		3.0	21.3	48.7	3.2	0.293	-1.371	0.157	-6.9	-99.3	-0.106	
α_{ds2} =	0.012		4.0	21.3	48.7	4.2	0.330	-1.371	0.180	-7.8	-113.8	-0.122	-0.090
ε_{cds0} =	461.29	1E-06	5.0	21.3	48.7	5.3	0.361	-1.371	0.201	-8.5	-127.1	-0.136	-0.100
β_{s1} =	1.00		6.0	21.3	48.7	6.4	0.387	-1.371	0.219	-9.1	-138.5	-0.148	-0.122
h_0 =	60		6.0	21.3	48.7	6.4	0.387	-1.371	0.219	-9.1	-138.5	-0.148	-0.122
			6.0	21.3	48.7	6.4	0.388	-1.371	0.220	-9.1	-139.1	-0.148	-0.122
			6.3	21.3	48.7	6.6	0.393	-1.371	0.224	-9.2	-141.7	-0.151	-0.122
			7.0	21.3	48.7	7.4	0.411	-1.371	0.236	-9.7	-149.3	-0.159	-0.125
			8.0	21.3	48.7	8.5	0.432	-1.371	0.251	-10.1	-158.7	-0.169	-0.132
			9.0	21.3	48.7	9.5	0.451	-1.371	0.265	-10.6	-167.6	-0.178	-0.158
			10.0	21.3	48.7	10.6	0.469	-1.371	0.279	-11.0	-176.4	-0.187	-0.182
			11.0	21.3	48.7	11.7	0.485	-1.371	0.291	-11.4	-184.0	-0.195	-0.192
			12.0	21.3	48.7	12.7	0.500	-1.371	0.303	-11.7	-191.6	-0.203	-0.225
			13.0	21.3	48.7	13.8	0.514	-1.371	0.314	-12.1	-198.6	-0.211	-0.235
			20.0	21.3	48.7	21.2	0.591	-1.371	0.380	-13.9	-240.3	-0.254	-0.272
			27.0	21.3	48.7	28.6	0.646	-1.371	0.430	-15.2	-271.9	-0.287	-0.330
			27.0	21.3	48.7	28.6	0.646	-1.371	0.430	-15.2	-271.9	-0.287	-0.330
			27.0	21.3	48.7	28.7	0.647	-1.371	0.431	-15.2	-272.6	-0.288	-0.330
			27.3	21.3	48.7	28.9	0.648	-1.371	0.432	-15.2	-273.2	-0.288	-0.330
			28.0	21.3	48.7	29.7	0.653	-1.371	0.437	-15.3	-276.4	-0.292	-0.315
			29.0	21.3	48.7	30.7	0.659	-1.371	0.443	-15.5	-280.2	-0.296	-0.333
			30.0	21.3	48.7	31.8	0.666	-1.371	0.449	-15.6	-284.0	-0.300	-0.327
			31.0	21.3	48.7	32.9	0.672	-1.371	0.455	-15.8	-287.8	-0.304	-0.335
			32.0	21.3	48.7	33.9	0.677	-1.371	0.461	-15.9	-291.5	-0.307	-0.338
			33.0	21.3	48.7	35.0	0.683	-1.371	0.466	-16.0	-294.7	-0.311	-0.335
			34.0	21.3	48.7	36.0	0.688	-1.371	0.472	-16.2	-298.5	-0.315	-0.332
			41.0	21.3	48.7	43.5	0.722	-1.371	0.506	-17.0	-320.0	-0.337	-0.337
			48.0	21.3	48.7	50.9	0.750	-1.371	0.536	-17.6	-339.0	-0.357	-0.388
			55.0	21.3	48.7	58.3	0.773	-1.371	0.562	-18.2	-355.4	-0.374	-0.410
			62.0	21.3	48.7	65.7	0.793	-1.371	0.586	-18.6	-370.6	-0.389	-0.427
			83.0	21.3	48.7	88.0	0.838	-1.371	0.641	-19.7	-405.4	-0.425	-0.430
			96.0	21.3	48.7	101.8	0.859	-1.371	0.668	-20.2	-422.5	-0.443	-0.410
			117.0	21.3	48.7	124.0	0.885	-1.371	0.704	-20.8	-445.2	-0.466	-0.438
			126.0	21.3	48.7	133.6	0.894	-1.371	0.717	-21.0	-453.5	-0.475	-0.438
			147.0	21.3	48.7	155.8	0.912	-1.371	0.744	-21.4	-470.5	-0.492	-0.470
			156.0	21.3	48.7	165.4	0.918	-1.371	0.753	-21.6	-476.2	-0.498	-0.478
			177.0	21.3	48.7	187.7	0.930	-1.371	0.773	-21.8	-488.9	-0.511	-0.507
			186.0	21.3	48.7	197.2	0.935	-1.371	0.781	-22.0	-493.9	-0.516	-0.492
			207.0	21.3	48.7	219.5	0.944	-1.371	0.797	-22.2	-504.0	-0.526	-0.495
			216.0	21.3	48.7	229.0	0.947	-1.371	0.803	-22.2	-507.8	-0.530	-0.508
			237.0	21.3	48.7	251.3	0.954	-1.371	0.816	-22.4	-516.1	-0.539	-0.485
			246.0	21.3	48.7	260.8	0.957	-1.371	0.821	-22.5	-519.2	-0.542	-0.492
			267.0	21.3	48.7	283.1	0.962	-1.371	0.832	-22.6	-526.2	-0.549	-0.493
			276.0	21.3	48.7	292.6	0.964	-1.371	0.836	-22.6	-528.7	-0.551	-0.502
			297.0	21.3	48.7	314.9	0.968	-1.371	0.845	-22.7	-534.4	-0.557	-0.572
			306.0	21.3	48.7	324.4	0.970	-1.371	0.849	-22.8	-536.9	-0.560	-0.530
			327.0	21.3	48.7	346.7	0.973	-1.371	0.856	-22.9	-541.4	-0.564	-0.568
			336.0	21.3	48.7	356.2	0.974	-1.371	0.859	-22.9	-543.3	-0.566	-0.563
			357.0	21.3	48.7	378.5	0.977	-1.371	0.866	-22.9	-547.7	-0.571	-0.552
			371.0	21.3	48.7	393.3	0.979	-1.371	0.870	-23.0	-550.2	-0.573	-0.587
			392.0	21.3	48.7	415.6	0.981	-1.371	0.876	-23.0	-554.0	-0.577	-0.608
			406.0	21.3	48.7	430.4	0.982	-1.371	0.880	-23.1	-556.5	-0.580	-0.597
			427.0	21.3	48.7	452.7	0.984	-1.371	0.884	-23.1	-559.1	-0.582	-0.593
			456.0	21.3	48.7	483.4	0.986	-1.371	0.891	-23.2	-563.5	-0.587	-0.595
			477.0	21.3	48.7	505.7	0.987	-1.371	0.895	-23.2	-566.0	-0.589	-0.597
			1000.0	21.3	48.7	1060.2	0.998	-1.371	0.945	-23.4	-597.6	-0.621	
			2500.0	21.3	48.7	2650.4	1.000	-1.371	0.977	-23.5	-617.9	-0.641	
			5000.0	21.3	48.7	5300.8	1.000	-1.371	0.988	-23.5	-624.8	-0.648	
			10000.0	21.3	48.7	10601.7	1.000	-1.371	0.994	-23.5	-628.6	-0.652	

INPUT AND CALCULATION - EC2

NAC		t_s (days)	$t - t_s$ (days)	T (ºC)	RH (%)	$(t - t_s)_T$ (days)	β_{as} (t)	β_{ds} $(t-t_s)_T$	β_{RH}	ε_{cas} (t) (1E-6)	ε_{cds} (t) (1E-6)	ε_{cs} (t) (‰)	$\varepsilon_{cs,exp}$ (t) (‰)
f_{cm} =	30.5	1	0.100	21.3	48.7	0.106	0.061	0.006	1.371	1.9	4.4	-0.006	
$\varepsilon_{ca,inf}$ =	31.25	1E-06	1.0	21.3	48.7	1.06	0.181	0.054	1.371	5.7	39.6	-0.045	-0.043
h_0 =	60		2.0	21.3	48.7	2.12	0.246	0.102	1.371	7.7	74.8	-0.083	-0.065
k_h =	1.0		3.0	21.3	48.7	3.2	0.293	0.146	1.371	9.2	107.0	-0.116	
α_{ds1} =	6		4.0	21.3	48.7	4.2	0.330	0.186	1.371	10.3	136.4	-0.147	
α_{ds2} =	0.11		5.0	21.3	48.7	5.3	0.361	0.222	1.371	11.3	162.8	-0.174	-0.100
ε_{cd0} =	733.20	1E-06	6.0	21.3	48.7	6.4	0.387	0.255	1.371	12.1	187.0	-0.199	-0.117
			6.0	21.3	48.7	6.4	0.387	0.255	1.371	12.1	187.0	-0.199	-0.117
			6.0	21.3	48.7	6.4	0.388	0.256	1.371	12.1	187.7	-0.200	-0.117
			6.3	21.3	48.7	6.6	0.393	0.263	1.371	12.3	192.8	-0.205	-0.117
			7.0	21.3	48.7	7.4	0.411	0.285	1.371	12.8	209.0	-0.222	-0.143
			8.0	21.3	48.7	8.5	0.432	0.313	1.371	13.5	229.5	-0.243	-0.125
			9.0	21.3	48.7	9.5	0.451	0.339	1.371	14.1	248.6	-0.263	-0.148
			10.0	21.3	48.7	10.6	0.469	0.363	1.371	14.7	266.2	-0.281	-0.155
			11.0	21.3	48.7	11.7	0.485	0.385	1.371	15.2	282.3	-0.298	-0.197
			12.0	21.3	48.7	12.7	0.500	0.406	1.371	15.6	297.7	-0.313	-0.178
			13.0	21.3	48.7	13.8	0.514	0.426	1.371	16.1	312.3	-0.328	-0.180
			20.0	21.3	48.7	21.2	0.591	0.533	1.371	18.5	390.8	-0.409	-0.278
			27.0	21.3	48.7	28.6	0.646	0.606	1.371	20.2	444.3	-0.465	-0.343
			27.0	21.3	48.7	28.6	0.646	0.606	1.371	20.2	444.3	-0.465	-0.343
			27.0	21.3	48.7	28.7	0.647	0.607	1.371	20.2	445.1	-0.465	-0.343
			27.3	21.3	48.7	28.9	0.648	0.608	1.371	20.3	445.8	-0.466	-0.343
			28.0	21.3	48.7	29.7	0.653	0.615	1.371	20.4	450.9	-0.471	-0.342
			29.0	21.3	48.7	30.7	0.659	0.623	1.371	20.6	456.8	-0.477	-0.333
			30.0	21.3	48.7	31.8	0.666	0.631	1.371	20.8	462.6	-0.483	-0.333
			31.0	21.3	48.7	32.9	0.672	0.639	1.371	21.0	468.5	-0.490	-0.338
			32.0	21.3	48.7	33.9	0.677	0.646	1.371	21.2	473.6	-0.495	-0.350
			33.0	21.3	48.7	35.0	0.683	0.653	1.371	21.3	478.8	-0.500	-0.345
			34.0	21.3	48.7	36.0	0.688	0.660	1.371	21.5	483.9	-0.505	-0.368
			41.0	21.3	48.7	43.5	0.722	0.700	1.371	22.6	513.2	-0.536	-0.403
			48.0	21.3	48.7	50.9	0.750	0.732	1.371	23.4	536.7	-0.560	-0.412
			55.0	21.3	48.7	58.3	0.773	0.758	1.371	24.2	555.8	-0.580	-0.468
			62.0	21.3	48.7	65.7	0.793	0.780	1.371	24.8	571.9	-0.597	-0.482
			83.0	21.3	48.7	88.0	0.838	0.826	1.371	26.2	605.6	-0.632	-0.540
			96.0	21.3	48.7	101.8	0.859	0.846	1.371	26.8	620.3	-0.647	-0.540
			117.0	21.3	48.7	124.0	0.885	0.870	1.371	27.7	637.9	-0.666	-0.535
			126.0	21.3	48.7	133.6	0.894	0.878	1.371	27.9	643.7	-0.672	-0.538
			147.0	21.3	48.7	155.8	0.912	0.893	1.371	28.5	654.7	-0.683	-0.543
			156.0	21.3	48.7	165.4	0.918	0.899	1.371	28.7	659.1	-0.688	-0.527
			177.0	21.3	48.7	187.7	0.930	0.910	1.371	29.1	667.2	-0.696	-0.540
			186.0	21.3	48.7	197.2	0.935	0.914	1.371	29.2	670.1	-0.699	-0.557
			207.0	21.3	48.7	219.5	0.944	0.922	1.371	29.5	676.0	-0.706	-0.555
			216.0	21.3	48.7	229.0	0.947	0.925	1.371	29.6	678.2	-0.708	-0.587
			237.0	21.3	48.7	251.3	0.954	0.931	1.371	29.8	682.6	-0.712	-0.560
			246.0	21.3	48.7	260.8	0.957	0.933	1.371	29.9	684.1	-0.714	-0.570
			267.0	21.3	48.7	283.1	0.962	0.938	1.371	30.1	687.7	-0.718	-0.585
			276.0	21.3	48.7	292.6	0.964	0.940	1.371	30.1	689.2	-0.719	-0.605
			297.0	21.3	48.7	314.9	0.968	0.944	1.371	30.3	692.1	-0.722	-0.603
			306.0	21.3	48.7	324.4	0.970	0.946	1.371	30.3	693.6	-0.724	-0.595
			327.0	21.3	48.7	346.7	0.973	0.949	1.371	30.4	695.8	-0.726	-0.622
			336.0	21.3	48.7	356.2	0.974	0.950	1.371	30.4	696.5	-0.727	-0.613
			357.0	21.3	48.7	378.5	0.977	0.953	1.371	30.5	698.7	-0.729	-0.618
			371.0	21.3	48.7	393.3	0.979	0.955	1.371	30.6	700.2	-0.731	-0.633
			392.0	21.3	48.7	415.6	0.981	0.957	1.371	30.7	701.7	-0.732	-0.640
			406.0	21.3	48.7	430.4	0.982	0.959	1.371	30.7	703.1	-0.734	-0.657
			427.0	21.3	48.7	452.7	0.984	0.961	1.371	30.8	704.6	-0.735	-0.652
			456.0	21.3	48.7	483.4	0.986	0.963	1.371	30.8	706.1	-0.737	-0.667
			477.0	21.3	48.7	505.7	0.987	0.965	1.371	30.8	707.5	-0.738	-0.645
			1000.0	21.3	48.7	1060.2	0.998	0.983	1.371	31.2	720.7	-0.752	
			2500.0	21.3	48.7	2650.4	1.000	0.993	1.371	31.3	728.1	-0.759	
			5000.0	21.3	48.7	5300.8	1.000	0.997	1.371	31.3	731.0	-0.762	
			10000.0	21.3	48.7	10601.7	1.000	0.998	1.371	31.3	731.7	-0.763	

RAC		t_s (days)	$t - t_s$ (days)	T (ºC)	RH (%)	$(t - t_s)_T$ (days)	β_{as} (t)	β_{ds} $(t-t_s)_T$	β_{RH}	ε_{cas} (t) (1E-6)	ε_{cds} (t) (1E-6)	ε_{cs} (t) (‰)	$\varepsilon_{cs,exp}$ (t) (‰)
f_{cm} =	28.1	1	0.100	21.3	48.7	0.106	0.061	0.006	1.371	1.5	4.5	-0.006	
$\varepsilon_{ca,inf}$ =	25.25	1E-06	1.0	21.3	48.7	1.06	0.181	0.054	1.371	4.6	40.7	-0.045	-0.058
h_0 =	60		2.0	21.3	48.7	2.12	0.246	0.102	1.371	6.2	76.8	-0.083	-0.070
k_h =	1.0		3.0	21.3	48.7	3.2	0.293	0.146	1.371	7.4	109.9	-0.117	-0.110
α_{ds1} =	6		4.0	21.3	48.7	4.2	0.330	0.186	1.371	8.3	140.0	-0.148	-0.113
α_{ds2} =	0.11		5.0	21.3	48.7	5.3	0.361	0.222	1.371	9.1	167.1	-0.176	-0.120
ε_{cd0} =	752.80	1E-06	6.0	21.3	48.7	6.4	0.387	0.255	1.371	9.8	192.0	-0.202	-0.155
			6.0	21.3	48.7	6.4	0.387	0.255	1.371	9.8	192.0	-0.202	-0.155
			6.0	21.3	48.7	6.4	0.388	0.256	1.371	9.8	192.7	-0.203	-0.155
			6.3	21.3	48.7	6.6	0.393	0.263	1.371	9.9	198.0	-0.208	-0.140
			7.0	21.3	48.7	7.4	0.411	0.285	1.371	10.4	214.5	-0.225	-0.155
			8.0	21.3	48.7	8.5	0.432	0.313	1.371	10.9	235.6	-0.247	-0.162
			9.0	21.3	48.7	9.5	0.451	0.339	1.371	11.4	255.2	-0.267	-0.198
			10.0	21.3	48.7	10.6	0.469	0.363	1.371	11.8	273.3	-0.285	-0.207
			11.0	21.3	48.7	11.7	0.485	0.385	1.371	12.2	289.8	-0.302	-0.172
			12.0	21.3	48.7	12.7	0.500	0.406	1.371	12.6	305.6	-0.318	-0.220
			13.0	21.3	48.7	13.8	0.514	0.426	1.371	13.0	320.7	-0.334	-0.245
			20.0	21.3	48.7	21.2	0.591	0.533	1.371	14.9	401.2	-0.416	-0.320
			27.0	21.3	48.7	28.6	0.646	0.606	1.371	16.3	456.2	-0.473	-0.383
			27.0	21.3	48.7	28.6	0.646	0.606	1.371	16.3	456.2	-0.473	-0.383
			27.0	21.3	48.7	28.7	0.647	0.607	1.371	16.3	456.9	-0.473	-0.383
			27.3	21.3	48.7	28.9	0.648	0.608	1.371	16.4	457.7	-0.474	-0.383
			28.0	21.3	48.7	29.7	0.653	0.615	1.371	16.5	463.0	-0.480	-0.385
			29.0	21.3	48.7	30.7	0.659	0.623	1.371	16.6	469.0	-0.486	-0.387
			30.0	21.3	48.7	31.8	0.666	0.631	1.371	16.8	475.0	-0.492	-0.402
			31.0	21.3	48.7	32.9	0.672	0.639	1.371	17.0	481.0	-0.498	-0.395
			32.0	21.3	48.7	33.9	0.677	0.646	1.371	17.1	486.3	-0.503	-0.385
			33.0	21.3	48.7	35.0	0.683	0.653	1.371	17.2	491.6	-0.509	-0.393
			34.0	21.3	48.7	36.0	0.688	0.66	1.371	17.4	496.8	-0.514	-0.410
			41.0	21.3	48.7	43.5	0.722	0.7	1.371	18.2	527.0	-0.545	-0.443
			48.0	21.3	48.7	50.9	0.750	0.732	1.371	18.9	551.0	-0.570	-0.498
			55.0	21.3	48.7	58.3	0.773	0.758	1.371	19.5	570.6	-0.590	-0.507
			62.0	21.3	48.7	65.7	0.793	0.78	1.371	20.0	587.2	-0.607	-0.520
			83.0	21.3	48.7	88.0	0.838	0.826	1.371	21.2	621.8	-0.643	-0.587
			96.0	21.3	48.7	101.8	0.859	0.846	1.371	21.7	636.9	-0.659	-0.583
			117.0	21.3	48.7	124.0	0.885	0.87	1.371	22.3	654.9	-0.677	-0.610
			126.0	21.3	48.7	133.6	0.894	0.878	1.371	22.6	661.0	-0.684	-0.597
			147.0	21.3	48.7	155.8	0.912	0.893	1.371	23.0	672.3	-0.695	-0.627
			156.0	21.3	48.7	165.4	0.918	0.899	1.371	23.2	676.8	-0.700	-0.630
			177.0	21.3	48.7	187.7	0.930	0.91	1.371	23.5	685.0	-0.709	-0.637
			186.0	21.3	48.7	197.2	0.935	0.914	1.371	23.6	688.1	-0.712	-0.660
			207.0	21.3	48.7	219.5	0.944	0.922	1.371	23.8	694.1	-0.718	-0.673
			216.0	21.3	48.7	229.0	0.947	0.925	1.371	23.9	696.3	-0.720	-0.670
			237.0	21.3	48.7	251.3	0.954	0.931	1.371	24.1	700.9	-0.725	-0.667
			246.0	21.3	48.7	260.8	0.957	0.933	1.371	24.2	702.4	-0.727	-0.650
			267.0	21.3	48.7	283.1	0.962	0.938	1.371	24.3	706.1	-0.730	-0.702
			276.0	21.3	48.7	292.6	0.964	0.94	1.371	24.3	707.6	-0.732	-0.677
			297.0	21.3	48.7	314.9	0.968	0.944	1.371	24.4	710.6	-0.735	-0.688
			306.0	21.3	48.7	324.4	0.970	0.946	1.371	24.5	712.1	-0.737	-0.750
			327.0	21.3	48.7	346.7	0.973	0.949	1.371	24.6	714.4	-0.739	-0.732
			336.0	21.3	48.7	356.2	0.974	0.95	1.371	24.6	715.2	-0.740	-0.765
			357.0	21.3	48.7	378.5	0.977	0.953	1.371	24.7	717.4	-0.742	-0.775
			371.0	21.3	48.7	393.3	0.979	0.955	1.371	24.7	718.9	-0.744	-0.772
			392.0	21.3	48.7	415.6	0.981	0.957	1.371	24.8	720.4	-0.745	-0.767
			406.0	21.3	48.7	430.4	0.982	0.959	1.371	24.8	721.9	-0.747	-0.772
			427.0	21.3	48.7	452.7	0.984	0.961	1.371	24.8	723.4	-0.748	-0.785
			456.0	21.3	48.7	483.4	0.986	0.963	1.371	24.9	724.9	-0.750	-0.782
			477.0	21.3	48.7	505.7	0.987	0.965	1.371	24.9	726.5	-0.751	-0.782
			1000.0	21.3	48.7	1060.2	0.998	0.983	1.371	25.2	740.0	-0.765	
			2500.0	21.3	48.7	2650.4	1.000	0.993	1.371	25.3	747.5	-0.773	
			5000.0	21.3	48.7	5300.8	1.000	0.997	1.371	25.3	750.5	-0.776	
			10000.0	21.3	48.7	10601.7	1.000	0.998	1.371	25.3	751.3	-0.777	

HVFAC		t_s (days)	$t - t_s$ (days)	T (ºC)	RH (%)	$(t - t_s)_T$ (days)	β_{as} (t)	β_{ds} $(t-t_s)_T$	β_{RH}	ε_{cas} (t) (1E-6)	ε_{cds} (t) (1E-6)	ε_{cs} (t) (‰)	$\varepsilon_{cs,exp}$ (t) (‰)
f_{cm} =	22.6	1	0.100	21.3	48.7	0.106	0.061	0.006	1.371	0.7	4.8	-0.006	-0.020
$\varepsilon_{ca,inf}$ =	11.50	1E-06	1.0	21.3	48.7	1.06	0.181	0.054	1.371	2.1	43.2	-0.045	-0.028
h_0 =	60		2.0	21.3	48.7	2.12	0.246	0.102	1.371	2.8	81.6	-0.084	-0.012
k_h =	1.0		3.0	21.3	48.7	3.2	0.293	0.146	1.371	3.4	116.8	-0.120	
α_{ds1} =	6		4.0	21.3	48.7	4.2	0.330	0.186	1.371	3.8	148.8	-0.153	-0.090
α_{ds2} =	0.11		5.0	21.3	48.7	5.3	0.361	0.222	1.371	4.2	177.6	-0.182	-0.100
ε_{cd0} =	799.80	1E-06	6.0	21.3	48.7	6.4	0.387	0.255	1.371	4.5	203.9	-0.208	-0.122
			6.0	21.3	48.7	6.4	0.387	0.255	1.371	4.5	203.9	-0.208	-0.122
			6.0	21.3	48.7	6.4	0.388	0.256	1.371	4.5	204.7	-0.209	-0.122
			6.3	21.3	48.7	6.6	0.393	0.263	1.371	4.5	210.3	-0.215	-0.122
			7.0	21.3	48.7	7.4	0.411	0.285	1.371	4.7	227.9	-0.233	-0.125
			8.0	21.3	48.7	8.5	0.432	0.313	1.371	5.0	250.3	-0.255	-0.132
			9.0	21.3	48.7	9.5	0.451	0.339	1.371	5.2	271.1	-0.276	-0.158
			10.0	21.3	48.7	10.6	0.469	0.363	1.371	5.4	290.3	-0.296	-0.182
			11.0	21.3	48.7	11.7	0.485	0.385	1.371	5.6	307.9	-0.314	-0.192
			12.0	21.3	48.7	12.7	0.500	0.406	1.371	5.8	324.7	-0.331	-0.225
			13.0	21.3	48.7	13.8	0.514	0.426	1.371	5.9	340.7	-0.347	-0.235
			20.0	21.3	48.7	21.2	0.591	0.533	1.371	6.8	426.3	-0.433	-0.272
			27.0	21.3	48.7	28.6	0.646	0.606	1.371	7.4	484.7	-0.492	-0.330
			27.0	21.3	48.7	28.6	0.646	0.606	1.371	7.4	484.7	-0.492	-0.330
			27.0	21.3	48.7	28.7	0.647	0.607	1.371	7.4	485.5	-0.493	-0.330
			27.3	21.3	48.7	28.9	0.648	0.608	1.371	7.5	486.3	-0.494	-0.330
			28.0	21.3	48.7	29.7	0.653	0.615	1.371	7.5	491.9	-0.499	-0.315
			29.0	21.3	48.7	30.7	0.659	0.623	1.371	7.6	498.3	-0.506	-0.333
			30.0	21.3	48.7	31.8	0.666	0.631	1.371	7.7	504.7	-0.512	-0.327
			31.0	21.3	48.7	32.9	0.672	0.639	1.371	7.7	511.1	-0.519	-0.335
			32.0	21.3	48.7	33.9	0.677	0.646	1.371	7.8	516.7	-0.525	-0.338
			33.0	21.3	48.7	35.0	0.683	0.653	1.371	7.9	522.3	-0.530	-0.335
			34.0	21.3	48.7	36.0	0.688	0.66	1.371	7.9	527.9	-0.536	-0.332
			41.0	21.3	48.7	43.5	0.722	0.7	1.371	8.3	559.9	-0.568	-0.337
			48.0	21.3	48.7	50.9	0.750	0.732	1.371	8.6	585.5	-0.594	-0.388
			55.0	21.3	48.7	58.3	0.773	0.758	1.371	8.9	606.2	-0.615	-0.410
			62.0	21.3	48.7	65.7	0.793	0.78	1.371	9.1	623.8	-0.633	-0.427
			83.0	21.3	48.7	88.0	0.838	0.826	1.371	9.6	660.6	-0.670	-0.430
			96.0	21.3	48.7	101.8	0.859	0.846	1.371	9.9	676.6	-0.687	-0.410
			117.0	21.3	48.7	124.0	0.885	0.87	1.371	10.2	695.8	-0.706	-0.438
			126.0	21.3	48.7	133.6	0.894	0.878	1.371	10.3	702.2	-0.713	-0.438
			147.0	21.3	48.7	155.8	0.912	0.893	1.371	10.5	714.2	-0.725	-0.470
			156.0	21.3	48.7	165.4	0.918	0.899	1.371	10.6	719.0	-0.730	-0.478
			177.0	21.3	48.7	187.7	0.930	0.91	1.371	10.7	727.8	-0.739	-0.507
			186.0	21.3	48.7	197.2	0.935	0.914	1.371	10.8	731.0	-0.742	-0.492
			207.0	21.3	48.7	219.5	0.944	0.922	1.371	10.9	737.4	-0.748	-0.495
			216.0	21.3	48.7	229.0	0.947	0.925	1.371	10.9	739.8	-0.751	-0.508
			237.0	21.3	48.7	251.3	0.954	0.931	1.371	11.0	744.6	-0.756	-0.485
			246.0	21.3	48.7	260.8	0.957	0.933	1.371	11.0	746.2	-0.757	-0.492
			267.0	21.3	48.7	283.1	0.962	0.938	1.371	11.1	750.2	-0.761	-0.493
			276.0	21.3	48.7	292.6	0.964	0.94	1.371	11.1	751.8	-0.763	-0.502
			297.0	21.3	48.7	314.9	0.968	0.944	1.371	11.1	755.0	-0.766	-0.572
			306.0	21.3	48.7	324.4	0.970	0.946	1.371	11.2	756.6	-0.768	-0.530
			327.0	21.3	48.7	346.7	0.973	0.949	1.371	11.2	759.0	-0.770	-0.568
			336.0	21.3	48.7	356.2	0.974	0.95	1.371	11.2	759.8	-0.771	-0.563
			357.0	21.3	48.7	378.5	0.977	0.953	1.371	11.2	762.2	-0.773	-0.552
			371.0	21.3	48.7	393.3	0.979	0.955	1.371	11.3	763.8	-0.775	-0.587
			392.0	21.3	48.7	415.6	0.981	0.957	1.371	11.3	765.4	-0.777	-0.608
			406.0	21.3	48.7	430.4	0.982	0.959	1.371	11.3	767.0	-0.778	-0.597
			427.0	21.3	48.7	452.7	0.984	0.961	1.371	11.3	768.6	-0.780	-0.593
			456.0	21.3	48.7	483.4	0.986	0.963	1.371	11.3	770.2	-0.782	-0.595
			477.0	21.3	48.7	505.7	0.987	0.965	1.371	11.4	771.8	-0.783	-0.597
			1000.0	21.3	48.7	1060.2	0.998	0.983	1.371	11.5	786.2	-0.798	
			2500.0	21.3	48.7	2650.4	1.000	0.993	1.371	11.5	794.2	-0.806	
			5000.0	21.3	48.7	5300.8	1.000	0.997	1.371	11.5	797.4	-0.809	
			10000.0	21.3	48.7	10601.7	1.000	0.998	1.371	11.5	798.2	-0.810	

INPUT AND CALCULATION - EC2 - CALIBRATED

NAC		t_s (days)	$t - t_s$ (days)	T (ºC)	RH (%)	$(t - t_s)_T$ (days)	β_{as} (t)	β_{ds} $(t\text{-}t_s)_T$	β_{RH}	ε_{cas} (t) (1E-6)	ε_{cds} (t) (1E-6)	ε_{cs} (t) (‰)	$\varepsilon_{cs,exp}$ (t) (‰)
f_{cm} =	30.5	1	0.100	21.3	48.7	0.106	0.061	0.006	1.371	1.9	3.8	-0.006	
$\varepsilon_{ca,inf}$ =	31.25	1E-06	1.0	21.3	48.7	1.06	0.181	0.054	1.371	5.7	34.6	-0.040	-0.043
h_0 =	60		2.0	21.3	48.7	2.12	0.246	0.102	1.371	7.7	65.4	-0.073	-0.065
k_h =	1.0		3.0	21.3	48.7	3.2	0.293	0.146	1.371	9.2	93.7	-0.103	
α_{ds1} =	5		4.0	21.3	48.7	4.2	0.330	0.186	1.371	10.3	119.3	-0.130	
α_{ds2} =	0.11		5.0	21.3	48.7	5.3	0.361	0.222	1.371	11.3	142.4	-0.154	-0.100
ε_{cd0} =	641.60	1E-06	6.0	21.3	48.7	6.4	0.387	0.255	1.371	12.1	163.6	-0.176	-0.117
			6.0	21.3	48.7	6.4	0.387	0.255	1.371	12.1	163.6	-0.176	-0.117
			6.0	21.3	48.7	6.4	0.388	0.256	1.371	12.1	164.2	-0.176	-0.117
			6.3	21.3	48.7	6.6	0.393	0.263	1.371	12.3	168.7	-0.181	-0.117
			7.0	21.3	48.7	7.4	0.411	0.285	1.371	12.8	182.9	-0.196	-0.143
			8.0	21.3	48.7	8.5	0.432	0.313	1.371	13.5	200.8	-0.214	-0.125
			9.0	21.3	48.7	9.5	0.451	0.339	1.371	14.1	217.5	-0.232	-0.148
			10.0	21.3	48.7	10.6	0.469	0.363	1.371	14.7	232.9	-0.248	-0.155
			11.0	21.3	48.7	11.7	0.485	0.385	1.371	15.2	247.0	-0.262	-0.197
			12.0	21.3	48.7	12.7	0.500	0.406	1.371	15.6	260.5	-0.276	-0.178
			13.0	21.3	48.7	13.8	0.514	0.426	1.371	16.1	273.3	-0.289	-0.180
			20.0	21.3	48.7	21.2	0.591	0.533	1.371	18.5	342.0	-0.361	-0.278
			27.0	21.3	48.7	28.6	0.646	0.606	1.371	20.2	388.8	-0.409	-0.343
			27.0	21.3	48.7	28.6	0.646	0.606	1.371	20.2	388.8	-0.409	-0.343
			27.0	21.3	48.7	28.7	0.647	0.607	1.371	20.2	389.5	-0.410	-0.343
			27.3	21.3	48.7	28.9	0.648	0.608	1.371	20.3	390.1	-0.410	-0.343
			28.0	21.3	48.7	29.7	0.653	0.615	1.371	20.4	394.6	-0.415	-0.342
			29.0	21.3	48.7	30.7	0.659	0.623	1.371	20.6	399.7	-0.420	-0.333
			30.0	21.3	48.7	31.8	0.666	0.631	1.371	20.8	404.8	-0.426	-0.333
			31.0	21.3	48.7	32.9	0.672	0.639	1.371	21.0	410.0	-0.431	-0.338
			32.0	21.3	48.7	33.9	0.677	0.646	1.371	21.2	414.5	-0.436	-0.350
			33.0	21.3	48.7	35.0	0.683	0.653	1.371	21.3	419.0	-0.440	-0.345
			34.0	21.3	48.7	36.0	0.688	0.660	1.371	21.5	423.5	-0.445	-0.368
			41.0	21.3	48.7	43.5	0.722	0.700	1.371	22.6	449.1	-0.472	-0.403
			48.0	21.3	48.7	50.9	0.750	0.732	1.371	23.4	469.7	-0.493	-0.412
			55.0	21.3	48.7	58.3	0.773	0.758	1.371	24.2	486.3	-0.511	-0.468
			62.0	21.3	48.7	65.7	0.793	0.780	1.371	24.8	500.4	-0.525	-0.482
			83.0	21.3	48.7	88.0	0.838	0.826	1.371	26.2	530.0	-0.556	-0.540
			96.0	21.3	48.7	101.8	0.859	0.846	1.371	26.8	542.8	-0.570	-0.540
			117.0	21.3	48.7	124.0	0.885	0.870	1.371	27.7	558.2	-0.586	-0.535
			126.0	21.3	48.7	133.6	0.894	0.878	1.371	27.9	563.3	-0.591	-0.538
			147.0	21.3	48.7	155.8	0.912	0.893	1.371	28.5	572.9	-0.601	-0.543
			156.0	21.3	48.7	165.4	0.918	0.899	1.371	28.7	576.8	-0.606	-0.527
			177.0	21.3	48.7	187.7	0.930	0.910	1.371	29.1	583.9	-0.613	-0.540
			186.0	21.3	48.7	197.2	0.935	0.914	1.371	29.2	586.4	-0.616	-0.557
			207.0	21.3	48.7	219.5	0.944	0.922	1.371	29.5	591.6	-0.621	-0.555
			216.0	21.3	48.7	229.0	0.947	0.925	1.371	29.6	593.5	-0.623	-0.587
			237.0	21.3	48.7	251.3	0.954	0.931	1.371	29.8	597.3	-0.627	-0.560
			246.0	21.3	48.7	260.8	0.957	0.933	1.371	29.9	598.6	-0.629	-0.570
			267.0	21.3	48.7	283.1	0.962	0.938	1.371	30.1	601.8	-0.632	-0.585
			276.0	21.3	48.7	292.6	0.964	0.940	1.371	30.1	603.1	-0.633	-0.605
			297.0	21.3	48.7	314.9	0.968	0.944	1.371	30.3	605.7	-0.636	-0.603
			306.0	21.3	48.7	324.4	0.970	0.946	1.371	30.3	607.0	-0.637	-0.595
			327.0	21.3	48.7	346.7	0.973	0.949	1.371	30.4	608.9	-0.639	-0.622
			336.0	21.3	48.7	356.2	0.974	0.950	1.371	30.4	609.5	-0.640	-0.613
			357.0	21.3	48.7	378.5	0.977	0.953	1.371	30.5	611.4	-0.642	-0.618
			371.0	21.3	48.7	393.3	0.979	0.955	1.371	30.6	612.7	-0.643	-0.633
			392.0	21.3	48.7	415.6	0.981	0.957	1.371	30.7	614.0	-0.645	-0.640
			406.0	21.3	48.7	430.4	0.982	0.959	1.371	30.7	615.3	-0.646	-0.657
			427.0	21.3	48.7	452.7	0.984	0.961	1.371	30.8	616.6	-0.647	-0.652
			456.0	21.3	48.7	483.4	0.986	0.963	1.371	30.8	617.9	-0.649	-0.667
			477.0	21.3	48.7	505.7	0.987	0.965	1.371	30.8	619.1	-0.650	-0.645
			1000.0	21.3	48.7	1060.2	0.998	0.983	1.371	31.2	630.7	-0.662	
			2500.0	21.3	48.7	2650.4	1.000	0.993	1.371	31.3	637.1	-0.668	
			5000.0	21.3	48.7	5300.8	1.000	0.997	1.371	31.3	639.7	-0.671	
			10000.0	21.3	48.7	10601.7	1.000	0.998	1.371	31.3	640.3	-0.672	

RAC		t_s (days)	$t - t_s$ (days)	T (ºC)	RH (%)	$(t - t_s)_T$ (days)	β_{as} (t)	β_{ds} $(t-t_s)_T$	β_{RH}	ε_{cas} (t) (1E-6)	ε_{cds} (t) (1E-6)	ε_{cs} (t) (‰)	$\varepsilon_{cs,exp}$ (t) (‰)
f_{cm} =	28.1	1	0.100	21.3	48.7	0.106	0.061	0.006	1.371	1.5	4.5	-0.006	
$\varepsilon_{ca,inf}$ =	25.25	1E-06	1.0	21.3	48.7	1.06	0.181	0.054	1.371	4.6	40.7	-0.045	-0.058
h_0 =	60		2.0	21.3	48.7	2.12	0.246	0.102	1.371	6.2	76.8	-0.083	-0.070
k_h =	1.0		3.0	21.3	48.7	3.2	0.293	0.146	1.371	7.4	109.9	-0.117	-0.110
α_{ds1} =	6		4.0	21.3	48.7	4.2	0.330	0.186	1.371	8.3	140.0	-0.148	-0.113
α_{ds2} =	0.11		5.0	21.3	48.7	5.3	0.361	0.222	1.371	9.1	167.1	-0.176	-0.120
ε_{cd0} =	752.80	1E-06	6.0	21.3	48.7	6.4	0.387	0.255	1.371	9.8	192.0	-0.202	-0.155
			6.0	21.3	48.7	6.4	0.387	0.255	1.371	9.8	192.0	-0.202	-0.155
			6.0	21.3	48.7	6.4	0.388	0.256	1.371	9.8	192.7	-0.203	-0.155
			6.3	21.3	48.7	6.6	0.393	0.263	1.371	9.9	198.0	-0.208	-0.140
			7.0	21.3	48.7	7.4	0.411	0.285	1.371	10.4	214.5	-0.225	-0.155
			8.0	21.3	48.7	8.5	0.432	0.313	1.371	10.9	235.6	-0.247	-0.162
			9.0	21.3	48.7	9.5	0.451	0.339	1.371	11.4	255.2	-0.267	-0.198
			10.0	21.3	48.7	10.6	0.469	0.363	1.371	11.8	273.3	-0.285	-0.207
			11.0	21.3	48.7	11.7	0.485	0.385	1.371	12.2	289.8	-0.302	-0.172
			12.0	21.3	48.7	12.7	0.500	0.406	1.371	12.6	305.6	-0.318	-0.220
			13.0	21.3	48.7	13.8	0.514	0.426	1.371	13.0	320.7	-0.334	-0.245
			20.0	21.3	48.7	21.2	0.591	0.533	1.371	14.9	401.2	-0.416	-0.320
			27.0	21.3	48.7	28.6	0.646	0.606	1.371	16.3	456.2	-0.473	-0.383
			27.0	21.3	48.7	28.6	0.646	0.606	1.371	16.3	456.2	-0.473	-0.383
			27.0	21.3	48.7	28.7	0.647	0.607	1.371	16.3	456.9	-0.473	-0.383
			27.3	21.3	48.7	28.9	0.648	0.608	1.371	16.4	457.7	-0.474	-0.383
			28.0	21.3	48.7	29.7	0.653	0.615	1.371	16.5	463.0	-0.480	-0.385
			29.0	21.3	48.7	30.7	0.659	0.623	1.371	16.6	469.0	-0.486	-0.387
			30.0	21.3	48.7	31.8	0.666	0.631	1.371	16.8	475.0	-0.492	-0.402
			31.0	21.3	48.7	32.9	0.672	0.639	1.371	17.0	481.0	-0.498	-0.395
			32.0	21.3	48.7	33.9	0.677	0.646	1.371	17.1	486.3	-0.503	-0.385
			33.0	21.3	48.7	35.0	0.683	0.653	1.371	17.2	491.6	-0.509	-0.393
			34.0	21.3	48.7	36.0	0.688	0.66	1.371	17.4	496.8	-0.514	-0.410
			41.0	21.3	48.7	43.5	0.722	0.7	1.371	18.2	527.0	-0.545	-0.443
			48.0	21.3	48.7	50.9	0.750	0.732	1.371	18.9	551.0	-0.570	-0.498
			55.0	21.3	48.7	58.3	0.773	0.758	1.371	19.5	570.6	-0.590	-0.507
			62.0	21.3	48.7	65.7	0.793	0.78	1.371	20.0	587.2	-0.607	-0.520
			83.0	21.3	48.7	88.0	0.838	0.826	1.371	21.2	621.8	-0.643	-0.587
			96.0	21.3	48.7	101.8	0.859	0.846	1.371	21.7	636.9	-0.659	-0.583
			117.0	21.3	48.7	124.0	0.885	0.87	1.371	22.3	654.9	-0.677	-0.610
			126.0	21.3	48.7	133.6	0.894	0.878	1.371	22.6	661.0	-0.684	-0.597
			147.0	21.3	48.7	155.8	0.912	0.893	1.371	23.0	672.3	-0.695	-0.627
			156.0	21.3	48.7	165.4	0.918	0.899	1.371	23.2	676.8	-0.700	-0.630
			177.0	21.3	48.7	187.7	0.930	0.91	1.371	23.5	685.0	-0.709	-0.637
			186.0	21.3	48.7	197.2	0.935	0.914	1.371	23.6	688.1	-0.712	-0.660
			207.0	21.3	48.7	219.5	0.944	0.922	1.371	23.8	694.1	-0.718	-0.673
			216.0	21.3	48.7	229.0	0.947	0.925	1.371	23.9	696.3	-0.720	-0.670
			237.0	21.3	48.7	251.3	0.954	0.931	1.371	24.1	700.9	-0.725	-0.667
			246.0	21.3	48.7	260.8	0.957	0.933	1.371	24.2	702.4	-0.727	-0.650
			267.0	21.3	48.7	283.1	0.962	0.938	1.371	24.3	706.1	-0.730	-0.702
			276.0	21.3	48.7	292.6	0.964	0.94	1.371	24.3	707.6	-0.732	-0.677
			297.0	21.3	48.7	314.9	0.968	0.944	1.371	24.4	710.6	-0.735	-0.688
			306.0	21.3	48.7	324.4	0.970	0.946	1.371	24.5	712.1	-0.737	-0.750
			327.0	21.3	48.7	346.7	0.973	0.949	1.371	24.6	714.4	-0.739	-0.732
			336.0	21.3	48.7	356.2	0.974	0.95	1.371	24.6	715.2	-0.740	-0.765
			357.0	21.3	48.7	378.5	0.977	0.953	1.371	24.7	717.4	-0.742	-0.775
			371.0	21.3	48.7	393.3	0.979	0.955	1.371	24.7	718.9	-0.744	-0.772
			392.0	21.3	48.7	415.6	0.981	0.957	1.371	24.8	720.4	-0.745	-0.767
			406.0	21.3	48.7	430.4	0.982	0.959	1.371	24.8	721.9	-0.747	-0.772
			427.0	21.3	48.7	452.7	0.984	0.961	1.371	24.8	723.4	-0.748	-0.785
			456.0	21.3	48.7	483.4	0.986	0.963	1.371	24.9	724.9	-0.750	-0.782
			477.0	21.3	48.7	505.7	0.987	0.965	1.371	24.9	726.5	-0.751	-0.782
			1000.0	21.3	48.7	1060.2	0.998	0.983	1.371	25.2	740.0	-0.765	
			2500.0	21.3	48.7	2650.4	1.000	0.993	1.371	25.3	747.5	-0.773	
			5000.0	21.3	48.7	5300.8	1.000	0.997	1.371	25.3	750.5	-0.776	
			10000.0	21.3	48.7	10601.7	1.000	0.998	1.371	25.3	751.3	-0.777	

HVFAC		t_s (days)	$t - t_s$ (days)	T (ºC)	RH (%)	$(t - t_s)_T$ (days)	β_{as} (t)	β_{ds} $(t\text{-}t_s)_T$	β_{RH}	ε_{cas} (t) (1E-6)	ε_{cds} (t) (1E-6)	ε_{cs} (t) (‰)	$\varepsilon_{cs,exp}$ (t) (‰)
f_{cm} =	22.6	1	0.100	21.3	48.7	0.106	0.061	0.006	1.371	0.7	3.6	-0.004	-0.020
$\varepsilon_{ca,inf}$ =	11.50	1E-06	1.0	21.3	48.7	1.06	0.181	0.054	1.371	2.1	32.4	-0.035	-0.028
h_0 =	60		2.0	21.3	48.7	2.12	0.246	0.102	1.371	2.8	61.2	-0.064	-0.012
k_h =	1.0		3.0	21.3	48.7	3.2	0.293	0.146	1.371	3.4	87.6	-0.091	
α_{ds1} =	4		4.0	21.3	48.7	4.2	0.330	0.186	1.371	3.8	111.6	-0.115	-0.090
α_{ds2} =	0.11		5.0	21.3	48.7	5.3	0.361	0.222	1.371	4.2	133.2	-0.137	-0.100
ε_{cd0} =	599.80	1E-06	6.0	21.3	48.7	6.4	0.387	0.255	1.371	4.5	152.9	-0.157	-0.122
			6.0	21.3	48.7	6.4	0.387	0.255	1.371	4.5	152.9	-0.157	-0.122
			6.0	21.3	48.7	6.4	0.388	0.256	1.371	4.5	153.5	-0.158	-0.122
			6.3	21.3	48.7	6.6	0.393	0.263	1.371	4.5	157.7	-0.162	-0.122
			7.0	21.3	48.7	7.4	0.411	0.285	1.371	4.7	170.9	-0.176	-0.125
			8.0	21.3	48.7	8.5	0.432	0.313	1.371	5.0	187.7	-0.193	-0.132
			9.0	21.3	48.7	9.5	0.451	0.339	1.371	5.2	203.3	-0.209	-0.158
			10.0	21.3	48.7	10.6	0.469	0.363	1.371	5.4	217.7	-0.223	-0.182
			11.0	21.3	48.7	11.7	0.485	0.385	1.371	5.6	230.9	-0.237	-0.192
			12.0	21.3	48.7	12.7	0.500	0.406	1.371	5.8	243.5	-0.249	-0.225
			13.0	21.3	48.7	13.8	0.514	0.426	1.371	5.9	255.5	-0.261	-0.235
			20.0	21.3	48.7	21.2	0.591	0.533	1.371	6.8	319.7	-0.327	-0.272
			27.0	21.3	48.7	28.6	0.646	0.606	1.371	7.4	363.5	-0.371	-0.330
			27.0	21.3	48.7	28.6	0.646	0.606	1.371	7.4	363.5	-0.371	-0.330
			27.0	21.3	48.7	28.7	0.647	0.607	1.371	7.4	364.1	-0.372	-0.330
			27.3	21.3	48.7	28.9	0.648	0.608	1.371	7.5	364.7	-0.372	-0.330
			28.0	21.3	48.7	29.7	0.653	0.615	1.371	7.5	368.9	-0.376	-0.315
			29.0	21.3	48.7	30.7	0.659	0.623	1.371	7.6	373.7	-0.381	-0.333
			30.0	21.3	48.7	31.8	0.666	0.631	1.371	7.7	378.5	-0.386	-0.327
			31.0	21.3	48.7	32.9	0.672	0.639	1.371	7.7	383.3	-0.391	-0.335
			32.0	21.3	48.7	33.9	0.677	0.646	1.371	7.8	387.5	-0.395	-0.338
			33.0	21.3	48.7	35.0	0.683	0.653	1.371	7.9	391.7	-0.400	-0.335
			34.0	21.3	48.7	36.0	0.688	0.66	1.371	7.9	395.9	-0.404	-0.332
			41.0	21.3	48.7	43.5	0.722	0.7	1.371	8.3	419.9	-0.428	-0.337
			48.0	21.3	48.7	50.9	0.750	0.732	1.371	8.6	439.1	-0.448	-0.388
			55.0	21.3	48.7	58.3	0.773	0.758	1.371	8.9	454.6	-0.464	-0.410
			62.0	21.3	48.7	65.7	0.793	0.78	1.371	9.1	467.8	-0.477	-0.427
			83.0	21.3	48.7	88.0	0.838	0.826	1.371	9.6	495.4	-0.505	-0.430
			96.0	21.3	48.7	101.8	0.859	0.846	1.371	9.9	507.4	-0.517	-0.410
			117.0	21.3	48.7	124.0	0.885	0.87	1.371	10.2	521.8	-0.532	-0.438
			126.0	21.3	48.7	133.6	0.894	0.878	1.371	10.3	526.6	-0.537	-0.438
			147.0	21.3	48.7	155.8	0.912	0.893	1.371	10.5	535.6	-0.546	-0.470
			156.0	21.3	48.7	165.4	0.918	0.899	1.371	10.6	539.2	-0.550	-0.478
			177.0	21.3	48.7	187.7	0.930	0.91	1.371	10.7	545.8	-0.557	-0.507
			186.0	21.3	48.7	197.2	0.935	0.914	1.371	10.8	548.2	-0.559	-0.492
			207.0	21.3	48.7	219.5	0.944	0.922	1.371	10.9	553.0	-0.564	-0.495
			216.0	21.3	48.7	229.0	0.947	0.925	1.371	10.9	554.8	-0.566	-0.508
			237.0	21.3	48.7	251.3	0.954	0.931	1.371	11.0	558.4	-0.569	-0.485
			246.0	21.3	48.7	260.8	0.957	0.933	1.371	11.0	559.6	-0.571	-0.492
			267.0	21.3	48.7	283.1	0.962	0.938	1.371	11.1	562.6	-0.574	-0.493
			276.0	21.3	48.7	292.6	0.964	0.94	1.371	11.1	563.8	-0.575	-0.502
			297.0	21.3	48.7	314.9	0.968	0.944	1.371	11.1	566.2	-0.577	-0.572
			306.0	21.3	48.7	324.4	0.970	0.946	1.371	11.2	567.4	-0.579	-0.530
			327.0	21.3	48.7	346.7	0.973	0.949	1.371	11.2	569.2	-0.580	-0.568
			336.0	21.3	48.7	356.2	0.974	0.95	1.371	11.2	569.8	-0.581	-0.563
			357.0	21.3	48.7	378.5	0.977	0.953	1.371	11.2	571.6	-0.583	-0.552
			371.0	21.3	48.7	393.3	0.979	0.955	1.371	11.3	572.8	-0.584	-0.587
			392.0	21.3	48.7	415.6	0.981	0.957	1.371	11.3	574.0	-0.585	-0.608
			406.0	21.3	48.7	430.4	0.982	0.959	1.371	11.3	575.2	-0.587	-0.597
			427.0	21.3	48.7	452.7	0.984	0.961	1.371	11.3	576.4	-0.588	-0.593
			456.0	21.3	48.7	483.4	0.986	0.963	1.371	11.3	577.6	-0.589	-0.595
			477.0	21.3	48.7	505.7	0.987	0.965	1.371	11.4	578.8	-0.590	-0.597
			1000.0	21.3	48.7	1060.2	0.998	0.983	1.371	11.5	589.6	-0.601	
			2500.0	21.3	48.7	2650.4	1.000	0.993	1.371	11.5	595.6	-0.607	
			5000.0	21.3	48.7	5300.8	1.000	0.997	1.371	11.5	598.0	-0.610	
			10000.0	21.3	48.7	10601.7	1.000	0.998	1.371	11.5	598.6	-0.610	

INPUT FOR THE ACI 209R MODEL

	NAC	**RAC**	**HVFAC**	
f_{cm} =	30.5	28.1	22.6	
V/S (mm)=	30	30	30	
f =	39.81	39.81	39.81	
α =	1	1	1	
$\varepsilon_{shu,0}$ =	780	780	780	1E-06
$\gamma_{sh,VS}$	1.042	1.042	1.042	
s =	75	110	70	
$\gamma_{sh,s}$ =	1.011	1.067	1.003	
ψ =	81.8	81.8	100.000	
$\gamma_{sh,\psi}$ =	1.064	1.064	1.1	
c =	284.6	285.0	200.0	
$\gamma_{sh,c}$ =	0.924	0.924	0.872	
α_{air} =	2.5	4.0	1.5	
$\gamma_{sh,\alpha}$ =	1.000	1.000	1.000	
γ_{sh} =	1.124	1.186	1.088	
ε_{shu} =	876.7	925.1	848.6	1E-06

NAC

t_s (days)	$t - t_s$ (days)	T (ºC)	RH (%)	β (t)	$\gamma_{sh,tc}$	$\gamma_{sh,RH}$	ε_{sh} (t,t_s) (‰)	$\varepsilon_{cs,exp}$ (t) (‰)
1	0.100	21.3	48.7	0.003	1.202	0.903	-0.003	
	1.0	21.3	48.7	0.025		0.903	-0.022	-0.043
	2.0	21.3	48.7	0.048		0.903	-0.042	-0.065
	3.0	21.3	48.7	0.070		0.903	-0.061	
	4.0	21.3	48.7	0.091		0.903	-0.080	
	5.0	21.3	48.7	0.112		0.903	-0.098	-0.100
	6.0	21.3	48.7	0.131		0.903	-0.115	-0.117
	6.0	21.3	48.7	0.131		0.903	-0.115	-0.117
	6.0	21.3	48.7	0.132		0.903	-0.116	-0.117
	6.3	21.3	48.7	0.136		0.903	-0.119	-0.117
	7.0	21.3	48.7	0.150		0.903	-0.132	-0.143
	8.0	21.3	48.7	0.167		0.903	-0.146	-0.125
	9.0	21.3	48.7	0.184		0.903	-0.161	-0.148
	10.0	21.3	48.7	0.201		0.903	-0.176	-0.155
	11.0	21.3	48.7	0.216		0.903	-0.189	-0.197
	12.0	21.3	48.7	0.232		0.903	-0.203	-0.178
	13.0	21.3	48.7	0.246		0.903	-0.216	-0.180
	20.0	21.3	48.7	0.334		0.903	-0.293	-0.278
	27.0	21.3	48.7	0.404		0.903	-0.354	-0.343
	27.0	21.3	48.7	0.404		0.903	-0.354	-0.343
	27.0	21.3	48.7	0.405		0.903	-0.355	-0.343
	27.3	21.3	48.7	0.406		0.903	-0.356	-0.343
	28.0	21.3	48.7	0.413		0.903	-0.362	-0.342
	29.0	21.3	48.7	0.421		0.903	-0.369	-0.333
	30.0	21.3	48.7	0.430		0.903	-0.377	-0.333
	31.0	21.3	48.7	0.438		0.903	-0.384	-0.338
	32.0	21.3	48.7	0.446		0.903	-0.391	-0.350
	33.0	21.3	48.7	0.453		0.903	-0.397	-0.345
	34.0	21.3	48.7	0.461		0.903	-0.404	-0.368
	41.0	21.3	48.7	0.507		0.903	-0.444	-0.403
	48.0	21.3	48.7	0.547		0.903	-0.480	-0.412
	55.0	21.3	48.7	0.580		0.903	-0.508	-0.468
	62.0	21.3	48.7	0.609		0.903	-0.534	-0.482
	83.0	21.3	48.7	0.676		0.903	-0.593	-0.540
	96.0	21.3	48.7	0.707		0.903	-0.620	-0.540
	117.0	21.3	48.7	0.746		0.903	-0.654	-0.535
	126.0	21.3	48.7	0.760		0.903	-0.666	-0.538
	147.0	21.3	48.7	0.787		0.903	-0.690	-0.543
	156.0	21.3	48.7	0.797		0.903	-0.699	-0.527
	177.0	21.3	48.7	0.816		0.903	-0.715	-0.540
	186.0	21.3	48.7	0.824		0.903	-0.722	-0.557
	207.0	21.3	48.7	0.839		0.903	-0.736	-0.555
	216.0	21.3	48.7	0.844		0.903	-0.740	-0.587
	237.0	21.3	48.7	0.856		0.903	-0.750	-0.560
	246.0	21.3	48.7	0.861		0.903	-0.755	-0.570
	267.0	21.3	48.7	0.870		0.903	-0.763	-0.585
	276.0	21.3	48.7	0.874		0.903	-0.766	-0.605
	297.0	21.3	48.7	0.882		0.903	-0.773	-0.603
	306.0	21.3	48.7	0.885		0.903	-0.776	-0.595
	327.0	21.3	48.7	0.891		0.903	-0.781	-0.622
	336.0	21.3	48.7	0.894		0.903	-0.784	-0.613
	357.0	21.3	48.7	0.900		0.903	-0.789	-0.618
	371.0	21.3	48.7	0.903		0.903	-0.792	-0.633
	392.0	21.3	48.7	0.908		0.903	-0.796	-0.640
	406.0	21.3	48.7	0.911		0.903	-0.799	-0.657
	427.0	21.3	48.7	0.915		0.903	-0.802	-0.652
	456.0	21.3	48.7	0.920		0.903	-0.807	-0.667
	477.0	21.3	48.7	0.923		0.903	-0.809	-0.645
	1000.0	21.3	48.7	0.962		0.903	-0.843	
	2500.0	21.3	48.7	0.984		0.903	-0.863	
	5000.0	21.3	48.7	0.992		0.903	-0.870	
	10000.0	21.3	48.7	0.996		0.903	-0.873	

RAC

t_s (days)	$t - t_s$ (days)	T (ºC)	RH (%)	β (t)	$\gamma_{sh,tc}$	$\gamma_{sh,RH}$	$\varepsilon_{sh}(t,t_s)$ (‰)	$\varepsilon_{cs,exp}(t)$ (‰)
1	0.100	21.3	48.7	0.003	1.202	0.903	-0.003	
	1.0	21.3	48.7	0.025		0.903	-0.023	-0.058
	2.0	21.3	48.7	0.048		0.903	-0.044	-0.070
	3.0	21.3	48.7	0.070		0.903	-0.065	-0.110
	4.0	21.3	48.7	0.091		0.903	-0.084	-0.113
	5.0	21.3	48.7	0.112		0.903	-0.104	-0.120
	6.0	21.3	48.7	0.131		0.903	-0.121	-0.155
	6.0	21.3	48.7	0.131		0.903	-0.121	-0.155
	6.0	21.3	48.7	0.132		0.903	-0.122	-0.155
	6.3	21.3	48.7	0.136		0.903	-0.126	-0.140
	7.0	21.3	48.7	0.150		0.903	-0.139	-0.155
	8.0	21.3	48.7	0.167		0.903	-0.154	-0.162
	9.0	21.3	48.7	0.184		0.903	-0.170	-0.198
	10.0	21.3	48.7	0.201		0.903	-0.186	-0.207
	11.0	21.3	48.7	0.216		0.903	-0.200	-0.172
	12.0	21.3	48.7	0.232		0.903	-0.215	-0.220
	13.0	21.3	48.7	0.246		0.903	-0.228	-0.245
	20.0	21.3	48.7	0.334		0.903	-0.309	-0.320
	27.0	21.3	48.7	0.404		0.903	-0.374	-0.383
	27.0	21.3	48.7	0.404		0.903	-0.374	-0.383
	27.0	21.3	48.7	0.405		0.903	-0.375	-0.383
	27.3	21.3	48.7	0.406		0.903	-0.376	-0.383
	28.0	21.3	48.7	0.413		0.903	-0.382	-0.385
	29.0	21.3	48.7	0.421		0.903	-0.389	-0.387
	30.0	21.3	48.7	0.430		0.903	-0.398	-0.402
	31.0	21.3	48.7	0.438		0.903	-0.405	-0.395
	32.0	21.3	48.7	0.446		0.903	-0.413	-0.385
	33.0	21.3	48.7	0.453		0.903	-0.419	-0.393
	34.0	21.3	48.7	0.461		0.903	-0.426	-0.410
	41.0	21.3	48.7	0.507		0.903	-0.469	-0.443
	48.0	21.3	48.7	0.547		0.903	-0.506	-0.498
	55.0	21.3	48.7	0.580		0.903	-0.537	-0.507
	62.0	21.3	48.7	0.609		0.903	-0.563	-0.520
	83.0	21.3	48.7	0.676		0.903	-0.625	-0.587
	96.0	21.3	48.7	0.707		0.903	-0.654	-0.583
	117.0	21.3	48.7	0.746		0.903	-0.690	-0.610
	126.0	21.3	48.7	0.760		0.903	-0.703	-0.597
	147.0	21.3	48.7	0.787		0.903	-0.728	-0.627
	156.0	21.3	48.7	0.797		0.903	-0.737	-0.630
	177.0	21.3	48.7	0.816		0.903	-0.755	-0.637
	186.0	21.3	48.7	0.824		0.903	-0.762	-0.660
	207.0	21.3	48.7	0.839		0.903	-0.776	-0.673
	216.0	21.3	48.7	0.844		0.903	-0.781	-0.670
	237.0	21.3	48.7	0.856		0.903	-0.792	-0.667
	246.0	21.3	48.7	0.861		0.903	-0.797	-0.650
	267.0	21.3	48.7	0.870		0.903	-0.805	-0.702
	276.0	21.3	48.7	0.874		0.903	-0.809	-0.677
	297.0	21.3	48.7	0.882		0.903	-0.816	-0.688
	306.0	21.3	48.7	0.885		0.903	-0.819	-0.750
	327.0	21.3	48.7	0.891		0.903	-0.824	-0.732
	336.0	21.3	48.7	0.894		0.903	-0.827	-0.765
	357.0	21.3	48.7	0.900		0.903	-0.833	-0.775
	371.0	21.3	48.7	0.903		0.903	-0.835	-0.772
	392.0	21.3	48.7	0.908		0.903	-0.840	-0.767
	406.0	21.3	48.7	0.911		0.903	-0.843	-0.772
	427.0	21.3	48.7	0.915		0.903	-0.846	-0.785
	456.0	21.3	48.7	0.920		0.903	-0.851	-0.782
	477.0	21.3	48.7	0.923		0.903	-0.854	-0.782
	1000.0	21.3	48.7	0.962		0.903	-0.890	
	2500.0	21.3	48.7	0.984		0.903	-0.910	
	5000.0	21.3	48.7	0.992		0.903	-0.918	
	10000.0	21.3	48.7	0.996		0.903	-0.921	

HVFAC

t_s (days)	$t - t_s$ (days)	T (ºC)	RH (%)	$\beta(t)$	$\gamma_{sh,tc}$	$\gamma_{sh,RH}$	$\varepsilon_{sh}(t,t_s)$ (‰)	$\varepsilon_{cs,exp}(t)$ (‰)
1	0.100	21.3	48.7	0.003	1.202	0.903	-0.003	-0.020
	1.0	21.3	48.7	0.025		0.903	-0.021	-0.028
	2.0	21.3	48.7	0.048		0.903	-0.041	-0.012
	3.0	21.3	48.7	0.070		0.903	-0.059	
	4.0	21.3	48.7	0.091		0.903	-0.077	-0.090
	5.0	21.3	48.7	0.112		0.903	-0.095	-0.100
	6.0	21.3	48.7	0.131		0.903	-0.111	-0.122
	6.0	21.3	48.7	0.131		0.903	-0.111	-0.122
	6.0	21.3	48.7	0.132		0.903	-0.112	-0.122
	6.3	21.3	48.7	0.136		0.903	-0.115	-0.122
	7.0	21.3	48.7	0.150		0.903	-0.127	-0.125
	8.0	21.3	48.7	0.167		0.903	-0.142	-0.132
	9.0	21.3	48.7	0.184		0.903	-0.156	-0.158
	10.0	21.3	48.7	0.201		0.903	-0.171	-0.182
	11.0	21.3	48.7	0.216		0.903	-0.183	-0.192
	12.0	21.3	48.7	0.232		0.903	-0.197	-0.225
	13.0	21.3	48.7	0.246		0.903	-0.209	-0.235
	20.0	21.3	48.7	0.334		0.903	-0.283	-0.272
	27.0	21.3	48.7	0.404		0.903	-0.343	-0.330
	27.0	21.3	48.7	0.404		0.903	-0.343	-0.330
	27.0	21.3	48.7	0.405		0.903	-0.344	-0.330
	27.3	21.3	48.7	0.406		0.903	-0.345	-0.330
	28.0	21.3	48.7	0.413		0.903	-0.350	-0.315
	29.0	21.3	48.7	0.421		0.903	-0.357	-0.333
	30.0	21.3	48.7	0.430		0.903	-0.365	-0.327
	31.0	21.3	48.7	0.438		0.903	-0.372	-0.335
	32.0	21.3	48.7	0.446		0.903	-0.378	-0.338
	33.0	21.3	48.7	0.453		0.903	-0.384	-0.335
	34.0	21.3	48.7	0.461		0.903	-0.391	-0.332
	41.0	21.3	48.7	0.507		0.903	-0.430	-0.337
	48.0	21.3	48.7	0.547		0.903	-0.464	-0.388
	55.0	21.3	48.7	0.580		0.903	-0.492	-0.410
	62.0	21.3	48.7	0.609		0.903	-0.517	-0.427
	83.0	21.3	48.7	0.676		0.903	-0.574	-0.430
	96.0	21.3	48.7	0.707		0.903	-0.600	-0.410
	117.0	21.3	48.7	0.746		0.903	-0.633	-0.438
	126.0	21.3	48.7	0.760		0.903	-0.645	-0.438
	147.0	21.3	48.7	0.787		0.903	-0.668	-0.470
	156.0	21.3	48.7	0.797		0.903	-0.676	-0.478
	177.0	21.3	48.7	0.816		0.903	-0.692	-0.507
	186.0	21.3	48.7	0.824		0.903	-0.699	-0.492
	207.0	21.3	48.7	0.839		0.903	-0.712	-0.495
	216.0	21.3	48.7	0.844		0.903	-0.716	-0.508
	237.0	21.3	48.7	0.856		0.903	-0.726	-0.485
	246.0	21.3	48.7	0.861		0.903	-0.731	-0.492
	267.0	21.3	48.7	0.870		0.903	-0.738	-0.493
	276.0	21.3	48.7	0.874		0.903	-0.742	-0.502
	297.0	21.3	48.7	0.882		0.903	-0.748	-0.572
	306.0	21.3	48.7	0.885		0.903	-0.751	-0.530
	327.0	21.3	48.7	0.891		0.903	-0.756	-0.568
	336.0	21.3	48.7	0.894		0.903	-0.759	-0.563
	357.0	21.3	48.7	0.900		0.903	-0.764	-0.552
	371.0	21.3	48.7	0.903		0.903	-0.766	-0.587
	392.0	21.3	48.7	0.908		0.903	-0.771	-0.608
	406.0	21.3	48.7	0.911		0.903	-0.773	-0.597
	427.0	21.3	48.7	0.915		0.903	-0.776	-0.593
	456.0	21.3	48.7	0.920		0.903	-0.781	-0.595
	477.0	21.3	48.7	0.923		0.903	-0.783	-0.597
	1000.0	21.3	48.7	0.962		0.903	-0.816	
	2500.0	21.3	48.7	0.984		0.903	-0.835	
	5000.0	21.3	48.7	0.992		0.903	-0.842	
	10000.0	21.3	48.7	0.996		0.903	-0.845	

INPUT FOR THE ACI 209R MODEL - CALIBRATED

	NAC	**RAC**	**HVFAC**	
f_{cm} =	30.5	28.1	22.6	
V/S (mm)=	30	30	30	
f =	39.81	39.81	39.81	
α =	1	1	1	
$\varepsilon_{shu,0}$ =	650	725	615	1E-06
$\gamma_{sh,VS}$	1.042	1.042	1.042	
s =	75	110	70	
$\gamma_{sh,s}$ =	1.011	1.067	1.003	
ψ =	81.8	81.8	100.000	
$\gamma_{sh,\psi}$ =	1.064	1.064	1.1	
c =	284.6	285.0	200.0	
$\gamma_{sh,c}$ =	0.924	0.924	0.872	
α_{air} =	2.5	4.0	1.5	
$\gamma_{sh,\alpha}$ =	1.000	1.000	1.000	
γ_{sh} =	1.124	1.186	1.088	
ε_{shu} =	730.6	859.9	669.1	1E-06

NAC

t_s (days)	$t - t_s$ (days)	T (ºC)	RH (%)	β (t)	$\gamma_{sh,tc}$	$\gamma_{sh,RH}$	ε_{sh} (t,t_s) (‰)	$\varepsilon_{cs,exp}$ (t) (‰)
1	0.100	21.3	48.7	0.003	1.202	0.903	-0.002	
	1.0	21.3	48.7	0.025		0.903	-0.018	-0.043
	2.0	21.3	48.7	0.048		0.903	-0.035	-0.065
	3.0	21.3	48.7	0.070		0.903	-0.051	
	4.0	21.3	48.7	0.091		0.903	-0.066	
	5.0	21.3	48.7	0.112		0.903	-0.082	-0.100
	6.0	21.3	48.7	0.131		0.903	-0.096	-0.117
	6.0	21.3	48.7	0.131		0.903	-0.096	-0.117
	6.0	21.3	48.7	0.132		0.903	-0.096	-0.117
	6.3	21.3	48.7	0.136		0.903	-0.099	-0.117
	7.0	21.3	48.7	0.150		0.903	-0.110	-0.143
	8.0	21.3	48.7	0.167		0.903	-0.122	-0.125
	9.0	21.3	48.7	0.184		0.903	-0.134	-0.148
	10.0	21.3	48.7	0.201		0.903	-0.147	-0.155
	11.0	21.3	48.7	0.216		0.903	-0.158	-0.197
	12.0	21.3	48.7	0.232		0.903	-0.169	-0.178
	13.0	21.3	48.7	0.246		0.903	-0.180	-0.180
	20.0	21.3	48.7	0.334		0.903	-0.244	-0.278
	27.0	21.3	48.7	0.404		0.903	-0.295	-0.343
	27.0	21.3	48.7	0.404		0.903	-0.295	-0.343
	27.0	21.3	48.7	0.405		0.903	-0.296	-0.343
	27.3	21.3	48.7	0.406		0.903	-0.297	-0.343
	28.0	21.3	48.7	0.413		0.903	-0.302	-0.342
	29.0	21.3	48.7	0.421		0.903	-0.308	-0.333
	30.0	21.3	48.7	0.430		0.903	-0.314	-0.333
	31.0	21.3	48.7	0.438		0.903	-0.320	-0.338
	32.0	21.3	48.7	0.446		0.903	-0.326	-0.350
	33.0	21.3	48.7	0.453		0.903	-0.331	-0.345
	34.0	21.3	48.7	0.461		0.903	-0.337	-0.368
	41.0	21.3	48.7	0.507		0.903	-0.370	-0.403
	48.0	21.3	48.7	0.547		0.903	-0.400	-0.412
	55.0	21.3	48.7	0.580		0.903	-0.424	-0.468
	62.0	21.3	48.7	0.609		0.903	-0.445	-0.482
	83.0	21.3	48.7	0.676		0.903	-0.494	-0.540
	96.0	21.3	48.7	0.707		0.903	-0.517	-0.540
	117.0	21.3	48.7	0.746		0.903	-0.545	-0.535
	126.0	21.3	48.7	0.760		0.903	-0.555	-0.538
	147.0	21.3	48.7	0.787		0.903	-0.575	-0.543
	156.0	21.3	48.7	0.797		0.903	-0.582	-0.527
	177.0	21.3	48.7	0.816		0.903	-0.596	-0.540
	186.0	21.3	48.7	0.824		0.903	-0.602	-0.557
	207.0	21.3	48.7	0.839		0.903	-0.613	-0.555
	216.0	21.3	48.7	0.844		0.903	-0.617	-0.587
	237.0	21.3	48.7	0.856		0.903	-0.625	-0.560
	246.0	21.3	48.7	0.861		0.903	-0.629	-0.570
	267.0	21.3	48.7	0.870		0.903	-0.636	-0.585
	276.0	21.3	48.7	0.874		0.903	-0.639	-0.605
	297.0	21.3	48.7	0.882		0.903	-0.644	-0.603
	306.0	21.3	48.7	0.885		0.903	-0.647	-0.595
	327.0	21.3	48.7	0.891		0.903	-0.651	-0.622
	336.0	21.3	48.7	0.894		0.903	-0.653	-0.613
	357.0	21.3	48.7	0.900		0.903	-0.658	-0.618
	371.0	21.3	48.7	0.903		0.903	-0.660	-0.633
	392.0	21.3	48.7	0.908		0.903	-0.663	-0.640
	406.0	21.3	48.7	0.911		0.903	-0.666	-0.657
	427.0	21.3	48.7	0.915		0.903	-0.668	-0.652
	456.0	21.3	48.7	0.920		0.903	-0.672	-0.667
	477.0	21.3	48.7	0.923		0.903	-0.674	-0.645
	1000.0	21.3	48.7	0.962		0.903	-0.703	
	2500.0	21.3	48.7	0.984		0.903	-0.719	
	5000.0	21.3	48.7	0.992		0.903	-0.725	
	10000.0	21.3	48.7	0.996		0.903	-0.728	

RAC

t_s (days)	$t - t_s$ (days)	T (ºC)	RH (%)	β (t)	$\gamma_{sh,tc}$	$\gamma_{sh,RH}$	ε_{sh} (t,t_s) (‰)	$\varepsilon_{cs,exp}$ (t) (‰)
1	0.100	21.3	48.7	0.003	1.202	0.903	-0.003	
	1.0	21.3	48.7	0.025		0.903	-0.021	-0.058
	2.0	21.3	48.7	0.048		0.903	-0.041	-0.070
	3.0	21.3	48.7	0.070		0.903	-0.060	-0.110
	4.0	21.3	48.7	0.091		0.903	-0.078	-0.113
	5.0	21.3	48.7	0.112		0.903	-0.096	-0.120
	6.0	21.3	48.7	0.131		0.903	-0.113	-0.155
	6.0	21.3	48.7	0.131		0.903	-0.113	-0.155
	6.0	21.3	48.7	0.132		0.903	-0.114	-0.155
	6.3	21.3	48.7	0.136		0.903	-0.117	-0.140
	7.0	21.3	48.7	0.150		0.903	-0.129	-0.155
	8.0	21.3	48.7	0.167		0.903	-0.144	-0.162
	9.0	21.3	48.7	0.184		0.903	-0.158	-0.198
	10.0	21.3	48.7	0.201		0.903	-0.173	-0.207
	11.0	21.3	48.7	0.216		0.903	-0.186	-0.172
	12.0	21.3	48.7	0.232		0.903	-0.199	-0.220
	13.0	21.3	48.7	0.246		0.903	-0.212	-0.245
	20.0	21.3	48.7	0.334		0.903	-0.287	-0.320
	27.0	21.3	48.7	0.404		0.903	-0.347	-0.383
	27.0	21.3	48.7	0.404		0.903	-0.347	-0.383
	27.0	21.3	48.7	0.405		0.903	-0.348	-0.383
	27.3	21.3	48.7	0.406		0.903	-0.349	-0.383
	28.0	21.3	48.7	0.413		0.903	-0.355	-0.385
	29.0	21.3	48.7	0.421		0.903	-0.362	-0.387
	30.0	21.3	48.7	0.430		0.903	-0.370	-0.402
	31.0	21.3	48.7	0.438		0.903	-0.377	-0.395
	32.0	21.3	48.7	0.446		0.903	-0.384	-0.385
	33.0	21.3	48.7	0.453		0.903	-0.390	-0.393
	34.0	21.3	48.7	0.461		0.903	-0.396	-0.410
	41.0	21.3	48.7	0.507		0.903	-0.436	-0.443
	48.0	21.3	48.7	0.547		0.903	-0.470	-0.498
	55.0	21.3	48.7	0.580		0.903	-0.499	-0.507
	62.0	21.3	48.7	0.609		0.903	-0.524	-0.520
	83.0	21.3	48.7	0.676		0.903	-0.581	-0.587
	96.0	21.3	48.7	0.707		0.903	-0.608	-0.583
	117.0	21.3	48.7	0.746		0.903	-0.641	-0.610
	126.0	21.3	48.7	0.760		0.903	-0.654	-0.597
	147.0	21.3	48.7	0.787		0.903	-0.677	-0.627
	156.0	21.3	48.7	0.797		0.903	-0.685	-0.630
	177.0	21.3	48.7	0.816		0.903	-0.702	-0.637
	186.0	21.3	48.7	0.824		0.903	-0.709	-0.660
	207.0	21.3	48.7	0.839		0.903	-0.721	-0.673
	216.0	21.3	48.7	0.844		0.903	-0.726	-0.670
	237.0	21.3	48.7	0.856		0.903	-0.736	-0.667
	246.0	21.3	48.7	0.861		0.903	-0.740	-0.650
	267.0	21.3	48.7	0.870		0.903	-0.748	-0.702
	276.0	21.3	48.7	0.874		0.903	-0.752	-0.677
	297.0	21.3	48.7	0.882		0.903	-0.758	-0.688
	306.0	21.3	48.7	0.885		0.903	-0.761	-0.750
	327.0	21.3	48.7	0.891		0.903	-0.766	-0.732
	336.0	21.3	48.7	0.894		0.903	-0.769	-0.765
	357.0	21.3	48.7	0.900		0.903	-0.774	-0.775
	371.0	21.3	48.7	0.903		0.903	-0.776	-0.772
	392.0	21.3	48.7	0.908		0.903	-0.781	-0.767
	406.0	21.3	48.7	0.911		0.903	-0.783	-0.772
	427.0	21.3	48.7	0.915		0.903	-0.787	-0.785
	456.0	21.3	48.7	0.920		0.903	-0.791	-0.782
	477.0	21.3	48.7	0.923		0.903	-0.794	-0.782
	1000.0	21.3	48.7	0.962		0.903	-0.827	
	2500.0	21.3	48.7	0.984		0.903	-0.846	
	5000.0	21.3	48.7	0.992		0.903	-0.853	
	10000.0	21.3	48.7	0.996		0.903	-0.856	

HVFAC

t_s (days)	$t - t_s$ (days)	T (ºC)	RH (%)	β (t)	$\gamma_{sh,tc}$	$\gamma_{sh,RH}$	$\varepsilon_{sh}(t,t_s)$ (‰)	$\varepsilon_{cs,exp}(t)$ (‰)
1	0.100	21.3	48.7	0.003	1.202	0.903	-0.002	-0.020
	1.0	21.3	48.7	0.025		0.903	-0.017	-0.028
	2.0	21.3	48.7	0.048		0.903	-0.032	-0.012
	3.0	21.3	48.7	0.070		0.903	-0.047	
	4.0	21.3	48.7	0.091		0.903	-0.061	-0.090
	5.0	21.3	48.7	0.112		0.903	-0.075	-0.100
	6.0	21.3	48.7	0.131		0.903	-0.088	-0.122
	6.0	21.3	48.7	0.131		0.903	-0.088	-0.122
	6.0	21.3	48.7	0.132		0.903	-0.088	-0.122
	6.3	21.3	48.7	0.136		0.903	-0.091	-0.122
	7.0	21.3	48.7	0.150		0.903	-0.100	-0.125
	8.0	21.3	48.7	0.167		0.903	-0.112	-0.132
	9.0	21.3	48.7	0.184		0.903	-0.123	-0.158
	10.0	21.3	48.7	0.201		0.903	-0.134	-0.182
	11.0	21.3	48.7	0.216		0.903	-0.145	-0.192
	12.0	21.3	48.7	0.232		0.903	-0.155	-0.225
	13.0	21.3	48.7	0.246		0.903	-0.165	-0.235
	20.0	21.3	48.7	0.334		0.903	-0.223	-0.272
	27.0	21.3	48.7	0.404		0.903	-0.270	-0.330
	27.0	21.3	48.7	0.404		0.903	-0.270	-0.330
	27.0	21.3	48.7	0.405		0.903	-0.271	-0.330
	27.3	21.3	48.7	0.406		0.903	-0.272	-0.330
	28.0	21.3	48.7	0.413		0.903	-0.276	-0.315
	29.0	21.3	48.7	0.421		0.903	-0.282	-0.333
	30.0	21.3	48.7	0.430		0.903	-0.288	-0.327
	31.0	21.3	48.7	0.438		0.903	-0.293	-0.335
	32.0	21.3	48.7	0.446		0.903	-0.298	-0.338
	33.0	21.3	48.7	0.453		0.903	-0.303	-0.335
	34.0	21.3	48.7	0.461		0.903	-0.308	-0.332
	41.0	21.3	48.7	0.507		0.903	-0.339	-0.337
	48.0	21.3	48.7	0.547		0.903	-0.366	-0.388
	55.0	21.3	48.7	0.580		0.903	-0.388	-0.410
	62.0	21.3	48.7	0.609		0.903	-0.407	-0.427
	83.0	21.3	48.7	0.676		0.903	-0.452	-0.430
	96.0	21.3	48.7	0.707		0.903	-0.473	-0.410
	117.0	21.3	48.7	0.746		0.903	-0.499	-0.438
	126.0	21.3	48.7	0.760		0.903	-0.509	-0.438
	147.0	21.3	48.7	0.787		0.903	-0.527	-0.470
	156.0	21.3	48.7	0.797		0.903	-0.533	-0.478
	177.0	21.3	48.7	0.816		0.903	-0.546	-0.507
	186.0	21.3	48.7	0.824		0.903	-0.551	-0.492
	207.0	21.3	48.7	0.839		0.903	-0.561	-0.495
	216.0	21.3	48.7	0.844		0.903	-0.565	-0.508
	237.0	21.3	48.7	0.856		0.903	-0.573	-0.485
	246.0	21.3	48.7	0.861		0.903	-0.576	-0.492
	267.0	21.3	48.7	0.870		0.903	-0.582	-0.493
	276.0	21.3	48.7	0.874		0.903	-0.585	-0.502
	297.0	21.3	48.7	0.882		0.903	-0.590	-0.572
	306.0	21.3	48.7	0.885		0.903	-0.592	-0.530
	327.0	21.3	48.7	0.891		0.903	-0.596	-0.568
	336.0	21.3	48.7	0.894		0.903	-0.598	-0.563
	357.0	21.3	48.7	0.900		0.903	-0.602	-0.552
	371.0	21.3	48.7	0.903		0.903	-0.604	-0.587
	392.0	21.3	48.7	0.908		0.903	-0.608	-0.608
	406.0	21.3	48.7	0.911		0.903	-0.610	-0.597
	427.0	21.3	48.7	0.915		0.903	-0.612	-0.593
	456.0	21.3	48.7	0.920		0.903	-0.616	-0.595
	477.0	21.3	48.7	0.923		0.903	-0.618	-0.597
	1000.0	21.3	48.7	0.962		0.903	-0.644	
	2500.0	21.3	48.7	0.984		0.903	-0.658	
	5000.0	21.3	48.7	0.992		0.903	-0.664	
	10000.0	21.3	48.7	0.996		0.903	-0.666	

INPUT AND CALCULATION - GL2000

NAC		t_s (days)	$t – t_s$ (days)	T (°C)	RH (%)	$\beta(h)$ (t)	$\beta(t\text{-}t_s)$	ε_{sh} (t,t_s) (‰)	$\varepsilon_{cs,exp}$ (t) (‰)
f_{cm} =	30.5	1	0.100	21.3	48.7	0.934	0.001	-0.001	
V/S (mm)=	30		1.0	21.3	48.7	0.934	0.009	-0.006	-0.043
$\varepsilon_{shu,0}$ =	900	1E-06	2.0	21.3	48.7	0.934	0.018	-0.011	-0.065
k =	0.75		3.0	21.3	48.7	0.934	0.027	-0.017	
ε_{shu} =	669.4	1E-06	4.0	21.3	48.7	0.934	0.036	-0.023	
			5.0	21.3	48.7	0.934	0.044	-0.028	-0.100
			6.0	21.3	48.7	0.934	0.053	-0.033	-0.117
			6.0	21.3	48.7	0.934	0.053	-0.033	-0.117
			6.0	21.3	48.7	0.934	0.053	-0.033	-0.117
			6.3	21.3	48.7	0.934	0.055	-0.034	-0.117
			7.0	21.3	48.7	0.934	0.061	-0.038	-0.143
			8.0	21.3	48.7	0.934	0.069	-0.043	-0.125
			9.0	21.3	48.7	0.934	0.077	-0.048	-0.148
			10.0	21.3	48.7	0.934	0.085	-0.053	-0.155
			11.0	21.3	48.7	0.934	0.092	-0.058	-0.197
			12.0	21.3	48.7	0.934	0.100	-0.063	-0.178
			13.0	21.3	48.7	0.934	0.107	-0.067	-0.180
			20.0	21.3	48.7	0.934	0.156	-0.098	-0.278
			27.0	21.3	48.7	0.934	0.200	-0.125	-0.343
			27.0	21.3	48.7	0.934	0.200	-0.125	-0.343
			27.0	21.3	48.7	0.934	0.200	-0.125	-0.343
			27.3	21.3	48.7	0.934	0.201	-0.126	-0.343
			28.0	21.3	48.7	0.934	0.206	-0.129	-0.342
			29.0	21.3	48.7	0.934	0.212	-0.133	-0.333
			30.0	21.3	48.7	0.934	0.217	-0.136	-0.333
			31.0	21.3	48.7	0.934	0.223	-0.139	-0.338
			32.0	21.3	48.7	0.934	0.229	-0.143	-0.350
			33.0	21.3	48.7	0.934	0.234	-0.146	-0.345
			34.0	21.3	48.7	0.934	0.239	-0.149	-0.368
			41.0	21.3	48.7	0.934	0.275	-0.172	-0.403
			48.0	21.3	48.7	0.934	0.308	-0.193	-0.412
			55.0	21.3	48.7	0.934	0.337	-0.211	-0.468
			62.0	21.3	48.7	0.934	0.365	-0.228	-0.482
			83.0	21.3	48.7	0.934	0.435	-0.272	-0.540
			96.0	21.3	48.7	0.934	0.471	-0.294	-0.540
			117.0	21.3	48.7	0.934	0.520	-0.325	-0.535
			126.0	21.3	48.7	0.934	0.538	-0.336	-0.538
			147.0	21.3	48.7	0.934	0.576	-0.360	-0.543
			156.0	21.3	48.7	0.934	0.591	-0.370	-0.527
			177.0	21.3	48.7	0.934	0.621	-0.388	-0.540
			186.0	21.3	48.7	0.934	0.633	-0.396	-0.557
			207.0	21.3	48.7	0.934	0.657	-0.411	-0.555
			216.0	21.3	48.7	0.934	0.667	-0.417	-0.587
			237.0	21.3	48.7	0.934	0.687	-0.430	-0.560
			246.0	21.3	48.7	0.934	0.695	-0.435	-0.570
			267.0	21.3	48.7	0.934	0.712	-0.445	-0.585
			276.0	21.3	48.7	0.934	0.719	-0.450	-0.605
			297.0	21.3	48.7	0.934	0.733	-0.458	-0.603
			306.0	21.3	48.7	0.934	0.739	-0.462	-0.595
			327.0	21.3	48.7	0.934	0.752	-0.470	-0.622
			336.0	21.3	48.7	0.934	0.757	-0.473	-0.613
			357.0	21.3	48.7	0.934	0.768	-0.480	-0.618
			371.0	21.3	48.7	0.934	0.775	-0.485	-0.633
			392.0	21.3	48.7	0.934	0.784	-0.490	-0.640
			406.0	21.3	48.7	0.934	0.790	-0.494	-0.657
			427.0	21.3	48.7	0.934	0.798	-0.499	-0.652
			456.0	21.3	48.7	0.934	0.809	-0.506	-0.667
			477.0	21.3	48.7	0.934	0.815	-0.510	-0.645
			1000.0	21.3	48.7	0.934	0.903	-0.565	
			2500.0	21.3	48.7	0.934	0.959	-0.600	
			5000.0	21.3	48.7	0.934	0.979	-0.612	
			10000.0	21.3	48.7	0.934	0.989	-0.618	

RAC

		t_s (days)
f_{cm} =	28.1	1
V/S (mm)=	30	
$\varepsilon_{shu,0}$ =	900	1E-06
k =	0.75	
ε_{shu} =	697.4	1E-06

$t - t_s$ (days)	T (ºC)	RH (%)	β(h) (t)	β(t-t_s)	ε_{sh} (t,t_s) (‰)	$\varepsilon_{cs,exp}$ (t) (‰)
0.100	21.3	48.7	0.934	0.001	-0.001	
1.0	21.3	48.7	0.934	0.009	-0.006	-0.058
2.0	21.3	48.7	0.934	0.018	-0.012	-0.070
3.0	21.3	48.7	0.934	0.027	-0.018	-0.110
4.0	21.3	48.7	0.934	0.036	-0.023	-0.113
5.0	21.3	48.7	0.934	0.044	-0.029	-0.120
6.0	21.3	48.7	0.934	0.053	-0.035	-0.155
6.0	21.3	48.7	0.934	0.053	-0.035	-0.155
6.0	21.3	48.7	0.934	0.053	-0.035	-0.155
6.3	21.3	48.7	0.934	0.055	-0.036	-0.140
7.0	21.3	48.7	0.934	0.061	-0.040	-0.155
8.0	21.3	48.7	0.934	0.069	-0.045	-0.162
9.0	21.3	48.7	0.934	0.077	-0.050	-0.198
10.0	21.3	48.7	0.934	0.085	-0.055	-0.207
11.0	21.3	48.7	0.934	0.092	-0.060	-0.172
12.0	21.3	48.7	0.934	0.100	-0.065	-0.220
13.0	21.3	48.7	0.934	0.107	-0.070	-0.245
20.0	21.3	48.7	0.934	0.156	-0.102	-0.320
27.0	21.3	48.7	0.934	0.200	-0.130	-0.383
27.0	21.3	48.7	0.934	0.200	-0.130	-0.383
27.0	21.3	48.7	0.934	0.200	-0.130	-0.383
27.3	21.3	48.7	0.934	0.201	-0.131	-0.383
28.0	21.3	48.7	0.934	0.206	-0.134	-0.385
29.0	21.3	48.7	0.934	0.212	-0.138	-0.387
30.0	21.3	48.7	0.934	0.217	-0.141	-0.402
31.0	21.3	48.7	0.934	0.223	-0.145	-0.395
32.0	21.3	48.7	0.934	0.229	-0.149	-0.385
33.0	21.3	48.7	0.934	0.234	-0.152	-0.393
34.0	21.3	48.7	0.934	0.239	-0.156	-0.410
41.0	21.3	48.7	0.934	0.275	-0.179	-0.443
48.0	21.3	48.7	0.934	0.308	-0.201	-0.498
55.0	21.3	48.7	0.934	0.337	-0.220	-0.507
62.0	21.3	48.7	0.934	0.365	-0.238	-0.520
83.0	21.3	48.7	0.934	0.435	-0.283	-0.587
96.0	21.3	48.7	0.934	0.471	-0.307	-0.583
117.0	21.3	48.7	0.934	0.520	-0.339	-0.610
126.0	21.3	48.7	0.934	0.538	-0.350	-0.597
147.0	21.3	48.7	0.934	0.576	-0.375	-0.627
156.0	21.3	48.7	0.934	0.591	-0.385	-0.630
177.0	21.3	48.7	0.934	0.621	-0.405	-0.637
186.0	21.3	48.7	0.934	0.633	-0.412	-0.660
207.0	21.3	48.7	0.934	0.657	-0.428	-0.673
216.0	21.3	48.7	0.934	0.667	-0.434	-0.670
237.0	21.3	48.7	0.934	0.687	-0.447	-0.667
246.0	21.3	48.7	0.934	0.695	-0.453	-0.650
267.0	21.3	48.7	0.934	0.712	-0.464	-0.702
276.0	21.3	48.7	0.934	0.719	-0.468	-0.677
297.0	21.3	48.7	0.934	0.733	-0.477	-0.688
306.0	21.3	48.7	0.934	0.739	-0.481	-0.750
327.0	21.3	48.7	0.934	0.752	-0.490	-0.732
336.0	21.3	48.7	0.934	0.757	-0.493	-0.765
357.0	21.3	48.7	0.934	0.768	-0.500	-0.775
371.0	21.3	48.7	0.934	0.775	-0.505	-0.772
392.0	21.3	48.7	0.934	0.784	-0.511	-0.767
406.0	21.3	48.7	0.934	0.790	-0.515	-0.772
427.0	21.3	48.7	0.934	0.798	-0.520	-0.785
456.0	21.3	48.7	0.934	0.809	-0.527	-0.782
477.0	21.3	48.7	0.934	0.815	-0.531	-0.782
1000.0	21.3	48.7	0.934	0.903	-0.588	
2500.0	21.3	48.7	0.934	0.959	-0.625	
5000.0	21.3	48.7	0.934	0.979	-0.638	
10000.0	21.3	48.7	0.934	0.989	-0.644	

HVFAC

		t_s (days)
f_{cm} =	22.6	1
V/S (mm)=	30	
$\varepsilon_{shu,0}$ =	900	1E-06
k =	0.75	
ε_{shu} =	777.7	1E-06

$t - t_s$ (days)	T (ºC)	RH (%)	β(h) (t)	β(t-t_s)	ε_{sh} (t,t_s) (‰)	$\varepsilon_{cs,exp}$ (t) (‰)
0.100	21.3	48.7	0.934	0.001	-0.001	-0.020
1.0	21.3	48.7	0.934	0.009	-0.007	-0.028
2.0	21.3	48.7	0.934	0.018	-0.013	-0.012
3.0	21.3	48.7	0.934	0.027	-0.020	
4.0	21.3	48.7	0.934	0.036	-0.026	-0.090
5.0	21.3	48.7	0.934	0.044	-0.032	-0.100
6.0	21.3	48.7	0.934	0.053	-0.038	-0.122
6.0	21.3	48.7	0.934	0.053	-0.038	-0.122
6.0	21.3	48.7	0.934	0.053	-0.038	-0.122
6.3	21.3	48.7	0.934	0.055	-0.040	-0.122
7.0	21.3	48.7	0.934	0.061	-0.044	-0.125
8.0	21.3	48.7	0.934	0.069	-0.050	-0.132
9.0	21.3	48.7	0.934	0.077	-0.056	-0.158
10.0	21.3	48.7	0.934	0.085	-0.062	-0.182
11.0	21.3	48.7	0.934	0.092	-0.067	-0.192
12.0	21.3	48.7	0.934	0.100	-0.073	-0.225
13.0	21.3	48.7	0.934	0.107	-0.078	-0.235
20.0	21.3	48.7	0.934	0.156	-0.113	-0.272
27.0	21.3	48.7	0.934	0.200	-0.145	-0.330
27.0	21.3	48.7	0.934	0.200	-0.145	-0.330
27.0	21.3	48.7	0.934	0.200	-0.145	-0.330
27.3	21.3	48.7	0.934	0.201	-0.146	-0.330
28.0	21.3	48.7	0.934	0.206	-0.150	-0.315
29.0	21.3	48.7	0.934	0.212	-0.154	-0.333
30.0	21.3	48.7	0.934	0.217	-0.158	-0.327
31.0	21.3	48.7	0.934	0.223	-0.162	-0.335
32.0	21.3	48.7	0.934	0.229	-0.166	-0.338
33.0	21.3	48.7	0.934	0.234	-0.170	-0.335
34.0	21.3	48.7	0.934	0.239	-0.174	-0.332
41.0	21.3	48.7	0.934	0.275	-0.200	-0.337
48.0	21.3	48.7	0.934	0.308	-0.224	-0.388
55.0	21.3	48.7	0.934	0.337	-0.245	-0.410
62.0	21.3	48.7	0.934	0.365	-0.265	-0.427
83.0	21.3	48.7	0.934	0.435	-0.316	-0.430
96.0	21.3	48.7	0.934	0.471	-0.342	-0.410
117.0	21.3	48.7	0.934	0.520	-0.378	-0.438
126.0	21.3	48.7	0.934	0.538	-0.391	-0.438
147.0	21.3	48.7	0.934	0.576	-0.418	-0.470
156.0	21.3	48.7	0.934	0.591	-0.429	-0.478
177.0	21.3	48.7	0.934	0.621	-0.451	-0.507
186.0	21.3	48.7	0.934	0.633	-0.460	-0.492
207.0	21.3	48.7	0.934	0.657	-0.477	-0.495
216.0	21.3	48.7	0.934	0.667	-0.484	-0.508
237.0	21.3	48.7	0.934	0.687	-0.499	-0.485
246.0	21.3	48.7	0.934	0.695	-0.505	-0.492
267.0	21.3	48.7	0.934	0.712	-0.517	-0.493
276.0	21.3	48.7	0.934	0.719	-0.522	-0.502
297.0	21.3	48.7	0.934	0.733	-0.532	-0.572
306.0	21.3	48.7	0.934	0.739	-0.537	-0.530
327.0	21.3	48.7	0.934	0.752	-0.546	-0.568
336.0	21.3	48.7	0.934	0.757	-0.550	-0.563
357.0	21.3	48.7	0.934	0.768	-0.558	-0.552
371.0	21.3	48.7	0.934	0.775	-0.563	-0.587
392.0	21.3	48.7	0.934	0.784	-0.569	-0.608
406.0	21.3	48.7	0.934	0.790	-0.574	-0.597
427.0	21.3	48.7	0.934	0.798	-0.580	-0.593
456.0	21.3	48.7	0.934	0.809	-0.588	-0.595
477.0	21.3	48.7	0.934	0.815	-0.592	-0.597
1000.0	21.3	48.7	0.934	0.903	-0.656	
2500.0	21.3	48.7	0.934	0.959	-0.697	
5000.0	21.3	48.7	0.934	0.979	-0.711	
10000.0	21.3	48.7	0.934	0.989	-0.718	

INPUT AND CALCULATION - GL2000 - CALIBRATED

NAC		t_s (days)	$t - t_s$ (days)	T (ºC)	RH (%)	β(h) (t)	β(t-t_s)	ε_{sh} (t,t_s) (‰)	$\varepsilon_{cs,exp}$ (t) (‰)
f_{cm} =	30.5	1	0.100	21.3	48.7	0.934	0.002	-0.002	
V/S (mm)=	30		1.0	21.3	48.7	0.934	0.020	-0.015	-0.043
$\varepsilon_{shu,0}$ =	1100	1E-06	2.0	21.3	48.7	0.934	0.040	-0.031	-0.065
k =	0.75		3.0	21.3	48.7	0.934	0.059	-0.045	
ε_{shu} =	818.2	1E-06	4.0	21.3	48.7	0.934	0.077	-0.059	
			5.0	21.3	48.7	0.934	0.094	-0.072	-0.100
			6.0	21.3	48.7	0.934	0.111	-0.085	-0.117
			6.0	21.3	48.7	0.934	0.111	-0.085	-0.117
			6.0	21.3	48.7	0.934	0.112	-0.086	-0.117
			6.3	21.3	48.7	0.934	0.115	-0.088	-0.117
			7.0	21.3	48.7	0.934	0.127	-0.097	-0.143
			8.0	21.3	48.7	0.934	0.143	-0.109	-0.125
			9.0	21.3	48.7	0.934	0.158	-0.121	-0.148
			10.0	21.3	48.7	0.934	0.172	-0.131	-0.155
			11.0	21.3	48.7	0.934	0.186	-0.142	-0.197
			12.0	21.3	48.7	0.934	0.200	-0.153	-0.178
			13.0	21.3	48.7	0.934	0.213	-0.163	-0.180
			20.0	21.3	48.7	0.934	0.294	-0.225	-0.278
			27.0	21.3	48.7	0.934	0.360	-0.275	-0.343
			27.0	21.3	48.7	0.934	0.360	-0.275	-0.343
			27.0	21.3	48.7	0.934	0.360	-0.275	-0.343
			27.3	21.3	48.7	0.934	0.362	-0.277	-0.343
			28.0	21.3	48.7	0.934	0.368	-0.281	-0.342
			29.0	21.3	48.7	0.934	0.377	-0.288	-0.333
			30.0	21.3	48.7	0.934	0.385	-0.294	-0.333
			31.0	21.3	48.7	0.934	0.392	-0.300	-0.338
			32.0	21.3	48.7	0.934	0.400	-0.306	-0.350
			33.0	21.3	48.7	0.934	0.407	-0.311	-0.345
			34.0	21.3	48.7	0.934	0.415	-0.317	-0.368
			41.0	21.3	48.7	0.934	0.461	-0.352	-0.403
			48.0	21.3	48.7	0.934	0.500	-0.382	-0.412
			55.0	21.3	48.7	0.934	0.534	-0.408	-0.468
			62.0	21.3	48.7	0.934	0.564	-0.431	-0.482
			83.0	21.3	48.7	0.934	0.634	-0.485	-0.540
			96.0	21.3	48.7	0.934	0.667	-0.510	-0.540
			117.0	21.3	48.7	0.934	0.709	-0.542	-0.535
			126.0	21.3	48.7	0.934	0.724	-0.553	-0.538
			147.0	21.3	48.7	0.934	0.754	-0.576	-0.543
			156.0	21.3	48.7	0.934	0.765	-0.585	-0.527
			177.0	21.3	48.7	0.934	0.787	-0.601	-0.540
			186.0	21.3	48.7	0.934	0.795	-0.608	-0.557
			207.0	21.3	48.7	0.934	0.812	-0.621	-0.555
			216.0	21.3	48.7	0.934	0.818	-0.625	-0.587
			237.0	21.3	48.7	0.934	0.832	-0.636	-0.560
			246.0	21.3	48.7	0.934	0.837	-0.640	-0.570
			267.0	21.3	48.7	0.934	0.848	-0.648	-0.585
			276.0	21.3	48.7	0.934	0.852	-0.651	-0.605
			297.0	21.3	48.7	0.934	0.861	-0.658	-0.603
			306.0	21.3	48.7	0.934	0.864	-0.660	-0.595
			327.0	21.3	48.7	0.934	0.872	-0.666	-0.622
			336.0	21.3	48.7	0.934	0.875	-0.669	-0.613
			357.0	21.3	48.7	0.934	0.881	-0.673	-0.618
			371.0	21.3	48.7	0.934	0.885	-0.676	-0.633
			392.0	21.3	48.7	0.934	0.891	-0.681	-0.640
			406.0	21.3	48.7	0.934	0.894	-0.683	-0.657
			427.0	21.3	48.7	0.934	0.899	-0.687	-0.652
			456.0	21.3	48.7	0.934	0.905	-0.692	-0.667
			477.0	21.3	48.7	0.934	0.909	-0.695	-0.645
			1000.0	21.3	48.7	0.934	0.954	-0.729	
			2500.0	21.3	48.7	0.934	0.981	-0.750	
			5000.0	21.3	48.7	0.934	0.990	-0.757	
			10000.0	21.3	48.7	0.934	0.995	-0.760	

RAC		***t_s* (days)**	***$t - t_s$* (days)**	***T (ºC)***	***RH (%)***	***β(h) (t)***	***β(t-t_s)***	***ε_{sh} (t,t_s) (‰)***	***$\varepsilon_{cs,exp}$ (t) (‰)***
***f_{cm}* =**	28.1	1	0.100	21.3	48.7	0.934	0.002	-0.002	
V/S (mm)=	30		1.0	21.3	48.7	0.934	0.020	-0.017	-0.058
$\varepsilon_{shu,0}$ =	1200	1E-06	2.0	21.3	48.7	0.934	0.040	-0.035	-0.070
***k* =**	0.75		3.0	21.3	48.7	0.934	0.059	-0.051	-0.110
ε_{shu} =	929.9	1E-06	4.0	21.3	48.7	0.934	0.077	-0.067	-0.113
			5.0	21.3	48.7	0.934	0.094	-0.082	-0.120
			6.0	21.3	48.7	0.934	0.111	-0.096	-0.155
			6.0	21.3	48.7	0.934	0.111	-0.096	-0.155
			6.0	21.3	48.7	0.934	0.112	-0.097	-0.155
			6.3	21.3	48.7	0.934	0.115	-0.100	-0.140
			7.0	21.3	48.7	0.934	0.127	-0.110	-0.155
			8.0	21.3	48.7	0.934	0.143	-0.124	-0.162
			9.0	21.3	48.7	0.934	0.158	-0.137	-0.198
			10.0	21.3	48.7	0.934	0.172	-0.149	-0.207
			11.0	21.3	48.7	0.934	0.186	-0.162	-0.172
			12.0	21.3	48.7	0.934	0.200	-0.174	-0.220
			13.0	21.3	48.7	0.934	0.213	-0.185	-0.245
			20.0	21.3	48.7	0.934	0.294	-0.255	-0.320
			27.0	21.3	48.7	0.934	0.360	-0.313	-0.383
			27.0	21.3	48.7	0.934	0.360	-0.313	-0.383
			27.0	21.3	48.7	0.934	0.360	-0.313	-0.383
			27.3	21.3	48.7	0.934	0.362	-0.314	-0.383
			28.0	21.3	48.7	0.934	0.368	-0.320	-0.385
			29.0	21.3	48.7	0.934	0.377	-0.327	-0.387
			30.0	21.3	48.7	0.934	0.385	-0.334	-0.402
			31.0	21.3	48.7	0.934	0.392	-0.340	-0.395
			32.0	21.3	48.7	0.934	0.400	-0.347	-0.385
			33.0	21.3	48.7	0.934	0.407	-0.353	-0.393
			34.0	21.3	48.7	0.934	0.415	-0.360	-0.410
			41.0	21.3	48.7	0.934	0.461	-0.400	-0.443
			48.0	21.3	48.7	0.934	0.500	-0.434	-0.498
			55.0	21.3	48.7	0.934	0.534	-0.464	-0.507
			62.0	21.3	48.7	0.934	0.564	-0.490	-0.520
			83.0	21.3	48.7	0.934	0.634	-0.551	-0.587
			96.0	21.3	48.7	0.934	0.667	-0.579	-0.583
			117.0	21.3	48.7	0.934	0.709	-0.616	-0.610
			126.0	21.3	48.7	0.934	0.724	-0.629	-0.597
			147.0	21.3	48.7	0.934	0.754	-0.655	-0.627
			156.0	21.3	48.7	0.934	0.765	-0.664	-0.630
			177.0	21.3	48.7	0.934	0.787	-0.684	-0.637
			186.0	21.3	48.7	0.934	0.795	-0.690	-0.660
			207.0	21.3	48.7	0.934	0.812	-0.705	-0.673
			216.0	21.3	48.7	0.934	0.818	-0.710	-0.670
			237.0	21.3	48.7	0.934	0.832	-0.723	-0.667
			246.0	21.3	48.7	0.934	0.837	-0.727	-0.650
			267.0	21.3	48.7	0.934	0.848	-0.737	-0.702
			276.0	21.3	48.7	0.934	0.852	-0.740	-0.677
			297.0	21.3	48.7	0.934	0.861	-0.748	-0.688
			306.0	21.3	48.7	0.934	0.864	-0.750	-0.750
			327.0	21.3	48.7	0.934	0.872	-0.757	-0.732
			336.0	21.3	48.7	0.934	0.875	-0.760	-0.765
			357.0	21.3	48.7	0.934	0.881	-0.765	-0.775
			371.0	21.3	48.7	0.934	0.885	-0.769	-0.772
			392.0	21.3	48.7	0.934	0.891	-0.774	-0.767
			406.0	21.3	48.7	0.934	0.894	-0.776	-0.772
			427.0	21.3	48.7	0.934	0.899	-0.781	-0.785
			456.0	21.3	48.7	0.934	0.905	-0.786	-0.782
			477.0	21.3	48.7	0.934	0.909	-0.789	-0.782
			1000.0	21.3	48.7	0.934	0.954	-0.829	
			2500.0	21.3	48.7	0.934	0.981	-0.852	
			5000.0	21.3	48.7	0.934	0.990	-0.860	
			10000.0	21.3	48.7	0.934	0.995	-0.864	

HVFAC		t_s (days)	$t - t_s$ (days)	T (ºC)	RH (%)	β(h) (t)	β(t-t_s)	ε_{sh} (t,t_s) (‰)	$\varepsilon_{cs,exp}$ (t) (‰)
f_{cm} =	22.6	1	0.100	21.3	48.7	0.934	0.002	-0.001	-0.020
V/S (mm)=	30		1.0	21.3	48.7	0.934	0.020	-0.014	-0.028
$\varepsilon_{shu,0}$ =	850	1E-06	2.0	21.3	48.7	0.934	0.040	-0.027	-0.012
k =	0.75		3.0	21.3	48.7	0.934	0.059	-0.040	
ε_{shu} =	734.5	1E-06	4.0	21.3	48.7	0.934	0.077	-0.053	-0.090
			5.0	21.3	48.7	0.934	0.094	-0.064	-0.100
			6.0	21.3	48.7	0.934	0.111	-0.076	-0.122
			6.0	21.3	48.7	0.934	0.111	-0.076	-0.122
			6.0	21.3	48.7	0.934	0.112	-0.077	-0.122
			6.3	21.3	48.7	0.934	0.115	-0.079	-0.122
			7.0	21.3	48.7	0.934	0.127	-0.087	-0.125
			8.0	21.3	48.7	0.934	0.143	-0.098	-0.132
			9.0	21.3	48.7	0.934	0.158	-0.108	-0.158
			10.0	21.3	48.7	0.934	0.172	-0.118	-0.182
			11.0	21.3	48.7	0.934	0.186	-0.128	-0.192
			12.0	21.3	48.7	0.934	0.200	-0.137	-0.225
			13.0	21.3	48.7	0.934	0.213	-0.146	-0.235
			20.0	21.3	48.7	0.934	0.294	-0.202	-0.272
			27.0	21.3	48.7	0.934	0.360	-0.247	-0.330
			27.0	21.3	48.7	0.934	0.360	-0.247	-0.330
			27.0	21.3	48.7	0.934	0.360	-0.247	-0.330
			27.3	21.3	48.7	0.934	0.362	-0.248	-0.330
			28.0	21.3	48.7	0.934	0.368	-0.252	-0.315
			29.0	21.3	48.7	0.934	0.377	-0.259	-0.333
			30.0	21.3	48.7	0.934	0.385	-0.264	-0.327
			31.0	21.3	48.7	0.934	0.392	-0.269	-0.335
			32.0	21.3	48.7	0.934	0.400	-0.274	-0.338
			33.0	21.3	48.7	0.934	0.407	-0.279	-0.335
			34.0	21.3	48.7	0.934	0.415	-0.285	-0.332
			41.0	21.3	48.7	0.934	0.461	-0.316	-0.337
			48.0	21.3	48.7	0.934	0.500	-0.343	-0.388
			55.0	21.3	48.7	0.934	0.534	-0.366	-0.410
			62.0	21.3	48.7	0.934	0.564	-0.387	-0.427
			83.0	21.3	48.7	0.934	0.634	-0.435	-0.430
			96.0	21.3	48.7	0.934	0.667	-0.458	-0.410
			117.0	21.3	48.7	0.934	0.709	-0.486	-0.438
			126.0	21.3	48.7	0.934	0.724	-0.497	-0.438
			147.0	21.3	48.7	0.934	0.754	-0.517	-0.470
			156.0	21.3	48.7	0.934	0.765	-0.525	-0.478
			177.0	21.3	48.7	0.934	0.787	-0.540	-0.507
			186.0	21.3	48.7	0.934	0.795	-0.545	-0.492
			207.0	21.3	48.7	0.934	0.812	-0.557	-0.495
			216.0	21.3	48.7	0.934	0.818	-0.561	-0.508
			237.0	21.3	48.7	0.934	0.832	-0.571	-0.485
			246.0	21.3	48.7	0.934	0.837	-0.574	-0.492
			267.0	21.3	48.7	0.934	0.848	-0.582	-0.493
			276.0	21.3	48.7	0.934	0.852	-0.584	-0.502
			297.0	21.3	48.7	0.934	0.861	-0.591	-0.572
			306.0	21.3	48.7	0.934	0.864	-0.593	-0.530
			327.0	21.3	48.7	0.934	0.872	-0.598	-0.568
			336.0	21.3	48.7	0.934	0.875	-0.600	-0.563
			357.0	21.3	48.7	0.934	0.881	-0.604	-0.552
			371.0	21.3	48.7	0.934	0.885	-0.607	-0.587
			392.0	21.3	48.7	0.934	0.891	-0.611	-0.608
			406.0	21.3	48.7	0.934	0.894	-0.613	-0.597
			427.0	21.3	48.7	0.934	0.899	-0.617	-0.593
			456.0	21.3	48.7	0.934	0.905	-0.621	-0.595
			477.0	21.3	48.7	0.934	0.909	-0.624	-0.597
			1000.0	21.3	48.7	0.934	0.954	-0.654	
			2500.0	21.3	48.7	0.934	0.981	-0.673	
			5000.0	21.3	48.7	0.934	0.990	-0.679	
			10000.0	21.3	48.7	0.934	0.995	-0.683	

Analysis of Shrinkage and Creep Results:

Creep

CREEP CALCULATION ACCORDING TO B4 - RAC7

			t_s (days)	t (days)	T (°C)	RH (%)	^t (days)	^t-^t_0 (days)	k_h	p_1	Q_f (^t_0)	Z (^t_0)	Q (^t,^t_0)	p_2	p_3	p_4	C_0 (^t,^t_0) x 1E-6	H (^t,^t_s)	H_c (^t_0,^t_s)	p_5 x 1E-6	C_d (^t,^t_0,^t_s) x 1E-6	J (^t,^t_0) x 1E-9	J_{exp} (^t,^t_0) x 1E-9
a/c =	5.979		1	0.100	21.3	48.7	0.044	–	0.884	0.7	0.3253	–	–	0.0586	0.0393	0.0034	–	–	0.911	777.0	–	–	–
w/c =	0.614			7.000	21.3	48.7	7.373	0.000	0.884			0.0000	0.000				0.00	0.913			0.00	0.000	0.000
c =	285.0		β_{Th}	7.003	21.3	48.7	7.377	0.004	0.884	q_1 x 1E-6	r (^t_0)	0.1675	0.167	$p_{2,w}$	$p_{3,a}$	$p_{4,a}$	46.66	0.913	$p_{5,H}$	$p_{5,a}$	0.00	0.072	0.053
V/S (mm)=	30		1	7.042	21.3	48.7	7.417	0.044	0.884	22.73	10.1606	0.2022	0.202	3.0	-1.1	-0.9	56.49	0.913	8.0	-1.0	0.00	0.083	0.067
k_s =	1.25			7.250	21.3	48.7	7.639	0.266	0.884			0.2317	0.231				64.93	0.912			0.00	0.092	0.076
_f_c =	28.1		t_0 (days)	8.00	21.3	48.7	8.44	1.07	0.884			0.2565	0.254		$p_{3,w}$	$p_{4,w}$	72.51	0.907	$p_{5,\varepsilon}$	$p_{5,w}$	2.18	0.102	0.086
_E_c (7) =	26200		7	9.00	21.3	48.7	9.50	2.13	0.884			0.2694	0.266		0.4	2.45	77.20	0.900	-0.85	0.78	3.67	0.108	0.093
_E_c (28) =	30800			10.00	21.3	48.7	10.56	3.19	0.884			0.2772	0.272				80.11	0.895			4.47	0.112	0.099
τ_{sh} =	207.00		^t_0 (days)	11.00	21.3	48.7	11.62	4.25	0.884			0.2829	0.277	q_2 x 1E-6	q_3 x 1E-6	q_4 x 1E-6	82.58	0.889		q_5 x 1E-6	5.30	0.116	0.100
$\varepsilon_{sh,inf}$ (^t_s) =	-960.4	1E-06	7.373	12.00	21.3	48.7	12.68	5.31	0.884			0.2873	0.280	247.2	11.82	11.05	84.43	0.884		462.27	5.94	0.118	0.106
				13.00	21.3	48.7	13.75	6.38	0.884			0.2910	0.283				86.18	0.879			6.53	0.121	0.108
				14.00	21.3	48.7	14.81	7.44	0.884			0.2941	0.285				87.60	0.874			7.09	0.123	0.107
				21.00	21.3	48.7	22.24	14.87	0.884			0.3083	0.295				95.02	0.845			10.08	0.134	0.122
				28.00	21.3	48.7	29.68	22.31	0.884			0.3169	0.300				99.72	0.822			12.32	0.141	0.123
				35.00	21.3	48.7	37.11	29.74	0.884			0.3230	0.303				103.13	0.803			14.16	0.146	0.132
				63.00	21.3	48.7	66.85	59.48	0.884			0.3381	0.309				111.60	0.744			20.24	0.162	0.145
				97.00	21.3	48.7	102.97	95.60	0.884			0.3487	0.313				117.70	0.696			25.88	0.174	0.152
				127.00	21.3	48.7	134.83	127.46	0.884			0.3553	0.315				121.38	0.665			29.99	0.182	0.156
				157.00	21.3	48.7	166.70	159.33	0.884			0.3604	0.316				124.14	0.641			33.48	0.188	0.160
				187.00	21.3	48.7	198.56	191.19	0.884			0.3646	0.317				126.45	0.621			36.61	0.194	0.163
				217.00	21.3	48.7	230.43	223.06	0.884			0.3681	0.317				128.21	0.605			39.29	0.198	0.168
				247.00	21.3	48.7	262.29	254.92	0.884			0.3713	0.318				129.99	0.591			41.76	0.203	0.170
				277.00	21.3	48.7	294.16	286.79	0.884			0.3740	0.318				131.35	0.580			43.79	0.206	0.172
				307.00	21.3	48.7	326.02	318.65	0.884			0.3765	0.319				132.81	0.570			45.71	0.210	0.172
				337.00	21.3	48.7	357.89	350.52	0.884			0.3788	0.319				133.91	0.561			47.50	0.212	0.174
				372.00	21.3	48.7	395.06	387.69	0.884			0.3811	0.320				135.33	0.553			49.15	0.216	0.178
				407.00	21.3	48.7	432.24	424.87	0.884			0.3833	0.320				136.39	0.546			50.62	0.218	0.179
				457.00	21.3	48.7	485.34	477.97	0.884			0.3861	0.320				137.76	0.537			52.58	0.222	0.181
				1000.0	21.3	48.7	1062.10	1054.73	0.884			0.4053	0.322				147.53	0.500			61.38	0.241	
				2500.0	21.3	48.7	2655.34	2647.97	0.884			0.4283	0.323				158.64	0.488			64.52	0.256	
				5000.0	21.3	48.7	5310.73	5303.36	0.884			0.4461	0.324				167.11	0.487			64.78	0.265	
				10000.0	21.3	48.7	10621.53	10614.16	0.884			0.4642	0.324				175.36	0.487			64.78	0.274	

CREEP CALCULATION ACCORDING TO B4 - RAC28

			t_s (days)	t (days)	T (°C)	RH (%)	^t (days)	^t-^t_0 (days)	k_h	p_1	Q_f (^t_0)	Z (^t_0)	Q (^t,^t_0)	p_2	p_3	p_4	C_0 (^t,^t_0) x 1E-6	H (^t,^t_s)	H_c (^t_0,^t_s)	p_5 x 1E-6	C_d (^t,^t_0,^t_s) x 1E-6	J (^t,^t_0) x 1E-9	J_{exp} (^t,^t_0) x 1E-9
a/c =	5.979		1	0.100	21.3	48.7	0.044	–	0.884	0.7	0.1772	–	–	0.0586	0.0393	0.0034	–	–	0.817	777.0	–	–	–
w/c =	0.614			28.000	21.3	48.7	29.678	0.000	0.884			0.0000	0.000				0.00	0.822			0.00	0.000	0.000
c =	285.0		β_{Th}	28.003	21.3	48.7	29.682	0.004	0.884	q_1 x 1E-6	r (^t_0)	0.0835	0.083	$p_{2,w}$	$p_{3,a}$	$p_{4,a}$	25.89	0.822	$p_{5,H}$	$p_{5,a}$	0.00	0.050	0.046
V/S (mm)=	30		1	28.042	21.3	48.7	29.722	0.044	0.884	22.73	10.5535	0.1008	0.101	3.0	-1.1	-0.9	31.47	0.822	8.0	-1.0	0.00	0.056	0.053
k_s =	1.25			28.250	21.3	48.7	29.944	0.266	0.884			0.1155	0.115				35.96	0.822			0.00	0.061	0.062
_f_c =	28.1		t_0 (days)	29.00	21.3	48.7	30.74	1.06	0.884			0.1278	0.127		$p_{3,w}$	$p_{4,w}$	40.01	0.819	$p_{5,\varepsilon}$	$p_{5,w}$	0.00	0.065	0.068
_E_c(7) =	26200		28	30.00	21.3	48.7	31.80	2.12	0.884			0.1343	0.134		0.4	2.45	42.53	0.816	-0.85	0.78	1.58	0.069	0.076
_E_c(28) =	30800			31.00	21.3	48.7	32.86	3.18	0.884			0.1382	0.137				43.89	0.814			2.74	0.072	0.075
τ_{sh} =	207.00		^t_0 (days)	32.00	21.3	48.7	33.93	4.25	0.884			0.1410	0.140	q_2 x 1E-6	q_3 x 1E-6	q_4 x 1E-6	45.17	0.811		q_5 x 1E-6	3.90	0.075	0.080
$\varepsilon_{sh,inf}$ (^t_s) =	-960.4	1E-06	29.678	33.00	21.3	48.7	34.99	5.31	0.884			0.1432	0.142	247.2	11.82	11.05	46.14	0.808		462.27	4.81	0.077	0.084
				34.00	21.3	48.7	36.05	6.37	0.884			0.1450	0.143				46.84	0.805			5.59	0.078	0.085
				35.00	21.3	48.7	37.11	7.43	0.884			0.1466	0.145				47.75	0.803			6.06	0.080	0.087
				42.00	21.3	48.7	44.55	14.87	0.884			0.1537	0.151				51.71	0.786			9.34	0.087	0.096
				49.00	21.3	48.7	51.98	22.30	0.884			0.1579	0.154				54.43	0.770			11.89	0.092	0.102
				56.00	21.3	48.7	59.42	29.74	0.884			0.1610	0.156				56.60	0.757			13.82	0.097	0.107
				84.00	21.3	48.7	89.16	59.48	0.884			0.1685	0.161				62.81	0.713			20.06	0.110	0.118
				118.00	21.3	48.7	125.27	95.59	0.884			0.1738	0.164				67.65	0.674			25.75	0.120	0.124
				148.00	21.3	48.7	157.14	127.46	0.884			0.1771	0.166				70.85	0.647			29.96	0.128	0.134
				178.00	21.3	48.7	189.00	159.32	0.884			0.1796	0.167				73.31	0.626			33.44	0.134	0.140
				208.00	21.3	48.7	220.87	191.19	0.884			0.1817	0.168				75.41	0.609			36.42	0.139	0.143
				238.00	21.3	48.7	252.73	223.05	0.884			0.1835	0.169				77.26	0.595			38.99	0.144	0.147
				268.00	21.3	48.7	284.60	254.92	0.884			0.1850	0.169				78.67	0.583			41.29	0.148	0.148
				298.00	21.3	48.7	316.46	286.78	0.884			0.1864	0.170				80.18	0.573			43.28	0.151	0.152
				328.00	21.3	48.7	348.33	318.65	0.884			0.1877	0.170				81.32	0.564			45.12	0.154	0.153
				358.00	21.3	48.7	380.19	350.51	0.884			0.1888	0.170				82.36	0.556			46.81	0.157	0.158
				393.00	21.3	48.7	417.37	387.69	0.884			0.1900	0.171				83.72	0.549			48.32	0.160	0.163
				428.00	21.3	48.7	454.54	424.86	0.884			0.1911	0.171				84.73	0.542			49.87	0.163	0.161
				478.00	21.3	48.7	507.65	477.97	0.884			0.1925	0.171				86.04	0.534			51.69	0.166	0.162
				1000.0	21.3	48.7	1062.10	1032.42	0.884			0.2018	0.173				95.29	0.500			60.03	0.184	
				2500.0	21.3	48.7	2655.34	2625.66	0.884			0.2134	0.175				106.66	0.488			63.23	0.199	
				5000.0	21.3	48.7	5310.73	5281.05	0.884			0.2223	0.176				115.14	0.487			63.51	0.209	
				10000.0	21.3	48.7	10621.53	10591.85	0.884			0.2313	0.176				123.38	0.487			63.51	0.217	

CREEP CALCULATION ACCORDING TO B4 - HVFAC7

			t_s (days)	t (days)	T (°C)	RH (%)	^t (days)	^t-^t$_0$ (days)	k_h	p_1	Q_f (^t$_0$)	Z (^t$_0$)	Q (^t,^t$_0$)	p_2	p_3	p_4	C_0 (^t,^t$_0$) x 1E-6	H (^t,^t$_s$)	H_c (^t$_0$,^t$_s$)	p_5 x 1E-6	C_d (^t,^t$_0$,^t$_s$) x 1E-6	J (^t,^t$_0$) x 1E-9	J_{exp} (^t,^t$_0$) x 1E-9
a/c =	8.100		1	0.100	21.3	48.7	0.044	–	0.884	0.7	0.3253	–	–	0.021682	0.091569	0.002142	–	–	0.779	1243.2	–	–	–
w/c =	0.975			7.000	21.3	48.7	7.373	0.000	0.884			0.0000	0.000				0.00	0.784			0.00	0.000	0.000
c =	200.0		β_{Th}	7.003	21.3	48.7	7.377	0.004	0.884	q_1 x 1E-6	r (^t$_0$)	0.1675	0.167	$p_{2,w}$	$p_{3,a}$	$p_{4,a}$	77.15	0.784	$p_{5,H}$	$p_{5,a}$	0.00	0.106	0.068
V/S (mm)=	30		1	7.042	21.3	48.7	7.417	0.044	0.884	24.39	10.1606	0.2022	0.202	3.0	-1.1	-0.9	93.37	0.784	8.0	-1.0	0.00	0.124	0.076
k_s =	1.25			7.250	21.3	48.7	7.639	0.266	0.884			0.2317	0.231				107.29	0.780			0.00	0.138	0.091
_f_c =	22.6		t_0 (days)	8.00	21.3	48.7	8.44	1.07	0.884			0.2565	0.254		$p_{3,w}$	$p_{4,w}$	119.72	0.769	$p_{5,\varepsilon}$	$p_{5,w}$	16.48	0.168	0.094
_E_c(7) =	25200		7	9.00	21.3	48.7	9.50	2.13	0.884			0.2694	0.266		0.4	2.45	127.30	0.756	-0.85	0.78	25.67	0.185	0.103
_E_c(28) =	28700			10.00	21.3	48.7	10.56	3.19	0.884			0.2772	0.272				131.98	0.744			32.47	0.197	0.108
τ_{sh} =	29.87		^t$_0$ (days)	11.00	21.3	48.7	11.62	4.25	0.884			0.2829	0.277	q_2 x 1E-6	q_3 x 1E-6	q_4 x 1E-6	135.92	0.732		q_5 x 1E-6	38.59	0.207	0.110
$\varepsilon_{sh,inf}$ (^t$_s$) =	-534.7	1E-06	7.373	12.00	21.3	48.7	12.68	5.31	0.884			0.2873	0.280	366.24	35.14	16.45	138.88	0.722		1288.27	43.41	0.215	0.115
				13.00	21.3	48.7	13.75	6.38	0.884			0.2910	0.283				141.66	0.712			48.10	0.223	0.115
				14.00	21.3	48.7	14.81	7.44	0.884			0.2941	0.285				143.91	0.703			52.24	0.229	0.116
				21.00	21.3	48.7	22.24	14.87	0.884			0.3083	0.295				155.62	0.654			74.87	0.265	0.126
				28.00	21.3	48.7	29.68	22.31	0.884			0.3169	0.300				163.02	0.620			91.53	0.289	0.128
				35.00	21.3	48.7	37.11	29.74	0.884			0.3230	0.303				168.38	0.596			104.12	0.307	0.131
				63.00	21.3	48.7	66.85	59.48	0.884			0.3381	0.309				181.70	0.541			136.51	0.354	0.141
				97.00	21.3	48.7	102.97	95.60	0.884			0.3487	0.313				191.28	0.515			153.94	0.381	0.149
				127.00	21.3	48.7	134.83	127.46	0.884			0.3553	0.315				197.07	0.504			161.80	0.396	0.147
				157.00	21.3	48.7	166.70	159.33	0.884			0.3604	0.316				201.41	0.498			166.21	0.405	0.154
				187.00	21.3	48.7	198.56	191.19	0.884			0.3646	0.317				205.06	0.494			169.20	0.411	0.155
				217.00	21.3	48.7	230.43	223.06	0.884			0.3681	0.317				207.85	0.492			170.72	0.416	0.157
				247.00	21.3	48.7	262.29	254.92	0.884			0.3713	0.318				210.64	0.490			172.24	0.420	0.160
				277.00	21.3	48.7	294.16	286.79	0.884			0.3740	0.318				212.79	0.489			173.01	0.423	0.162
				307.00	21.3	48.7	326.02	318.65	0.884			0.3765	0.319				215.09	0.489			173.01	0.426	0.166
				337.00	21.3	48.7	357.89	350.52	0.884			0.3788	0.319				216.84	0.488			173.78	0.428	0.168
				372.00	21.3	48.7	395.06	387.69	0.884			0.3811	0.320				219.05	0.488			173.78	0.431	0.171
				407.00	21.3	48.7	432.24	424.87	0.884			0.3833	0.320				220.74	0.488			173.78	0.433	0.174
				457.00	21.3	48.7	485.34	477.97	0.884			0.3861	0.320				222.92	0.487			174.55	0.436	0.178
				1000.0	21.3	48.7	1062.10	1054.73	0.884			0.4053	0.322				238.36	0.487			174.55	0.452	
				2500.0	21.3	48.7	2655.34	2647.97	0.884			0.4283	0.323				255.99	0.487			174.55	0.471	
				5000.0	21.3	48.7	5310.73	5303.36	0.884			0.4461	0.324				269.46	0.487			174.55	0.485	
				10000.0	21.3	48.7	10621.53	10614.16	0.884			0.4642	0.324				282.59	0.487			174.55	0.499	

CREEP CALCULATION ACCORDING TO B4 - HVFAC28

			t_s (days)	t (days)	T (°C)	RH (%)	^t (days)	^t-^t$_0$ (days)	k_h	p_1	Q_f (^t$_0$)	Z (^t$_0$)	Q (^t,^t$_0$)	p_2	p_3	p_4	C_0 (^t,^t$_0$) x 1E-6	H (^t,^t$_s$)	H_c (^t$_0$,^t$_s$)	p_5 x 1E-6	C_d (^t,^t$_0$,^t$_s$) x 1E-6	J (^t,^t$_0$) x 1E-9	J_{exp} (^t,^t$_0$) x 1E-9
a/c =	8.100		1	0.100	21.3	48.7	0.044	–	0.884	0.7	0.1772	–	–	0.021682	0.091569	0.002142	–	–	0.614	1243.2	–	–	–
w/c =	0.975			28.000	21.3	48.7	29.678	0.000	0.884			0.0000	0.000				0.00	0.620			0.00	0.000	0.000
c =	200.0		β_{Th}	28.003	21.3	48.7	29.682	0.004	0.884	q_1 x 1E-6	r (^t$_0$)	0.0835	0.083	$p_{2,w}$	$p_{3,a}$	$p_{4,a}$	46.38	0.620	$p_{5,H}$	$p_{5,a}$	0.00	0.074	0.048
V/S (mm)=	30		1	28.042	21.3	48.7	29.722	0.044	0.884	24.39	10.5535	0.1008	0.101	3.0	-1.1	-0.9	56.31	0.620	8.0	-1.0	0.00	0.084	0.052
k_s =	1.25			28.250	21.3	48.7	29.944	0.266	0.884			0.1155	0.115				64.37	0.619			0.00	0.093	0.057
_f_c =	22.6		t_0 (days)	29.00	21.3	48.7	30.74	1.06	0.884			0.1278	0.127		$p_{3,w}$	$p_{4,w}$	71.55	0.616	$p_{5,\epsilon}$	$p_{5,w}$	0.00	0.100	0.062
_E_c(7) =	25200		28	30.00	21.3	48.7	31.80	2.12	0.884			0.1343	0.134		0.4	2.45	75.92	0.612	-0.85	0.78	14.03	0.119	0.063
_E_c(28) =	28700			31.00	21.3	48.7	32.86	3.18	0.884			0.1382	0.137				78.30	0.609			22.32	0.130	0.067
τ_{sh} =	29.87		^t$_0$ (days)	32.00	21.3	48.7	33.93	4.25	0.884			0.1410	0.140	q_2 x 1E-6	q_3 x 1E-6	q_4 x 1E-6	80.47	0.605		q_5 x 1E-6	30.19	0.140	0.068
$\varepsilon_{sh,inf}$ (^t$_s$) =	-534.7	1E-06	29.678	33.00	21.3	48.7	34.99	5.31	0.884			0.1432	0.142	366.24	35.14	16.45	82.13	0.602		1288.27	35.08	0.147	0.069
				34.00	21.3	48.7	36.05	6.37	0.884			0.1450	0.143				83.33	0.599			39.46	0.152	0.069
				35.00	21.3	48.7	37.11	7.43	0.884			0.1466	0.145				84.84	0.596			43.49	0.158	0.071
				42.00	21.3	48.7	44.55	14.87	0.884			0.1537	0.151				91.40	0.577			64.86	0.186	0.077
				49.00	21.3	48.7	51.98	22.30	0.884			0.1579	0.154				95.85	0.562			79.37	0.206	0.082
				56.00	21.3	48.7	59.42	29.74	0.884			0.1610	0.156				99.37	0.551			89.46	0.219	0.082
				84.00	21.3	48.7	89.16	59.48	0.884			0.1685	0.161				109.32	0.522			115.24	0.256	0.089
				118.00	21.3	48.7	125.27	95.59	0.884			0.1738	0.164				117.03	0.506			129.47	0.278	0.098
				148.00	21.3	48.7	157.14	127.46	0.884			0.1771	0.166				122.11	0.499			135.76	0.290	0.100
				178.00	21.3	48.7	189.00	159.32	0.884			0.1796	0.167				126.00	0.495			139.38	0.298	0.100
				208.00	21.3	48.7	220.87	191.19	0.884			0.1817	0.168				129.33	0.492			142.11	0.304	0.108
				238.00	21.3	48.7	252.73	223.05	0.884			0.1835	0.169				132.26	0.491			143.02	0.308	0.108
				268.00	21.3	48.7	284.60	254.92	0.884			0.1850	0.169				134.51	0.490			143.94	0.311	0.114
				298.00	21.3	48.7	316.46	286.78	0.884			0.1864	0.170				136.88	0.489			144.85	0.315	0.109
				328.00	21.3	48.7	348.33	318.65	0.884			0.1877	0.170				138.70	0.488			145.77	0.317	0.115
				358.00	21.3	48.7	380.19	350.51	0.884			0.1888	0.170				140.35	0.488			145.77	0.319	0.121
				393.00	21.3	48.7	417.37	387.69	0.884			0.1900	0.171				142.48	0.488			145.77	0.321	0.116
				428.00	21.3	48.7	454.54	424.86	0.884			0.1911	0.171				144.09	0.488			145.77	0.323	0.125
				478.00	21.3	48.7	507.65	477.97	0.884			0.1925	0.171				146.18	0.487			146.69	0.326	0.124
				1000.0	21.3	48.7	1062.10	1032.42	0.884			0.2018	0.173				160.84	0.487			146.69	0.342	
				2500.0	21.3	48.7	2655.34	2625.66	0.884			0.2134	0.175				178.86	0.487			146.69	0.361	
				5000.0	21.3	48.7	5310.73	5281.05	0.884			0.2223	0.176				192.34	0.487			146.69	0.375	
				10000.0	21.3	48.7	10621.53	10591.85	0.884			0.2313	0.176				205.47	0.487			146.69	0.389	

CREEP CALCULATION ACCORDING TO B4 - RAC7 - CALIBRATED

			t_s (days)	t (days)	T (°C)	RH (%)	^t (days)	^t-^t_0 (days)	k_h	p_1	Q_f (^t_0)	Z (^t_0)	Q (^t,^t_0)	p_2	p_3	p_4	C_0 (^t,^t_0) x 1E-6	H (^t,^t_s)	H_c (^t_0,^t_s)	p_5 x 1E-6	C_d (^t,^t_0,^t_s) x 1E-6	J (^t,^t_0) x 1E-9	J_{exp} (^t,^t_0) x 1E-9
a/c =	5.979		1	0.100	21.3	48.7	0.044	–	0.884	0.42	0.3253	–	–	0.0586	0.0393	0.0034	–	–	0.911	777.0	–	–	–
w/c =	0.614			7.000	21.3	48.7	7.373	0.000	0.884			0.0000	0.000				0.00	0.913			0.00	0.000	0.000
c =	285.0		β_{Th}	7.003	21.3	48.7	7.377	0.004	0.884	**q_1 x 1E-6**	**r (^t_0)**	0.1675	0.167	**$p_{2,w}$**	**$p_{3,a}$**	**$p_{4,a}$**	43.20	0.913	**$p_{5,H}$**	**$p_{5,a}$**	0.00	0.060	0.053
V/S (mm)=	30		1	7.042	21.3	48.7	7.417	0.044	0.884	13.64	10.1606	0.2022	0.202	2.90	26	-5	52.29	0.913	8.0	-5.0	0.00	0.069	0.067
k_s =	1.25			7.250	21.3	48.7	7.639	0.266	0.884			0.2317	0.231				60.10	0.912			0.00	0.077	0.076
_f_c =	28.1		**t_0 (days)**	8.00	21.3	48.7	8.44	1.07	0.884			0.2565	0.254		**$p_{3,w}$**	**$p_{4,w}$**	67.08	0.907	**$p_{5,\varepsilon}$**	**$p_{5,w}$**	1.63	0.087	0.086
_E_c(7) =	26200		7	9.00	21.3	48.7	9.50	2.13	0.884			0.2694	0.266		0	2.2	71.38	0.900	-0.85	0.15	2.75	0.092	0.093
_E_c(28) =	30800			10.00	21.3	48.7	10.56	3.19	0.884			0.2772	0.272				74.02	0.895			3.35	0.096	0.099
τ_{sh} =	207.00		**^t_0 (days)**	11.00	21.3	48.7	11.62	4.25	0.884			0.2829	0.277	**q_2 x 1E-6**	**q_3 x 1E-6**	**q_4 x 1E-6**	76.28	0.889		**q_5 x 1E-6**	3.97	0.099	0.100
$\varepsilon_{sh,inf}$ (^t_s) =	-960.4	1E-06	7.373	12.00	21.3	48.7	12.68	5.31	0.884			0.2873	0.280	235.62	8.45	9.94	77.95	0.884		346.5	4.45	0.101	0.106
				13.00	21.3	48.7	13.75	6.38	0.884			0.2910	0.283				79.55	0.879			4.89	0.103	0.108
				14.00	21.3	48.7	14.81	7.44	0.884			0.2941	0.285				80.83	0.874			5.32	0.105	0.107
				21.00	21.3	48.7	22.24	14.87	0.884			0.3083	0.295				87.56	0.845			7.56	0.114	0.122
				28.00	21.3	48.7	29.68	22.31	0.884			0.3169	0.300				91.80	0.822			9.23	0.120	0.123
				35.00	21.3	48.7	37.11	29.74	0.884			0.3230	0.303				94.87	0.803			10.61	0.125	0.132
				63.00	21.3	48.7	66.85	59.48	0.884			0.3381	0.309				102.48	0.744			15.17	0.138	0.145
				97.00	21.3	48.7	102.97	95.60	0.884			0.3487	0.313				107.96	0.696			19.40	0.148	0.152
				127.00	21.3	48.7	134.83	127.46	0.884			0.3553	0.315				111.26	0.665			22.48	0.154	0.156
				157.00	21.3	48.7	166.70	159.33	0.884			0.3604	0.316				113.72	0.641			25.09	0.160	0.160
				187.00	21.3	48.7	198.56	191.19	0.884			0.3646	0.317				115.79	0.621			27.44	0.164	0.163
				217.00	21.3	48.7	230.43	223.06	0.884			0.3681	0.317				117.35	0.605			29.45	0.168	0.168
				247.00	21.3	48.7	262.29	254.92	0.884			0.3713	0.318				118.95	0.591			31.30	0.171	0.170
				277.00	21.3	48.7	294.16	286.79	0.884			0.3740	0.318				120.15	0.580			32.82	0.174	0.172
				307.00	21.3	48.7	326.02	318.65	0.884			0.3765	0.319				121.47	0.570			34.26	0.177	0.172
				337.00	21.3	48.7	357.89	350.52	0.884			0.3788	0.319				122.44	0.561			35.61	0.179	0.174
				372.00	21.3	48.7	395.06	387.69	0.884			0.3811	0.320				123.72	0.553			36.84	0.182	0.178
				407.00	21.3	48.7	432.24	424.87	0.884			0.3833	0.320				124.66	0.546			37.95	0.184	0.179
				457.00	21.3	48.7	485.34	477.97	0.884			0.3861	0.320				125.88	0.537			39.41	0.187	0.181
				1000.0	21.3	48.7	1062.10	1054.73	0.884			0.4053	0.322				134.57	0.500			46.01	0.203	
				2500.0	21.3	48.7	2655.34	2647.97	0.884			0.4283	0.323				144.44	0.488			48.36	0.215	
				5000.0	21.3	48.7	5310.73	5303.36	0.884			0.4461	0.324				151.98	0.487			48.56	0.224	
				10000.0	21.3	48.7	10621.53	10614.16	0.884			0.4642	0.324				159.28	0.487			48.56	0.231	

CREEP CALCULATION ACCORDING TO B4 - HVFAC7 - CALIBRATED

			t_s (days)	t (days)	T (°C)	RH (%)	^t (days)	^t-^t_0 (days)	k_h	p_1	Q_f (^t_0)	Z (^t_0)	Q (^t,^t_0)	p_2	p_3	p_4	C_0 (^t,^t_0) x 1E-6	H (^t,^t_s)	H_c (^t_0,^t_s)	p_5 x 1E-6	C_d (^t,^t_0,^t_s) x 1E-6	J (^t,^t_0) x 1E-9	J_{exp} (^t,^t_0) x 1E-9
a/c =	8.100		1	0.100	21.3	48.7	0.044	–	0.884	1.26	0.3253	–	–	0.021682	0.091569	0.002142	–	–	0.853	1243.2	–	–	–
w/c =	0.975			7.000	21.3	48.7	7.373	0.000	0.884			0.0000	0.000				0.00	0.857			0.00	0.000	0.000
c =	200.0		β_{Th}	7.003	21.3	48.7	7.377	0.004	0.884	q_1 x 1E-6	r (^t_0)	0.1675	0.167	$p_{2,w}$	$p_{3,a}$	$p_{4,a}$	26.51	0.857	$p_{5,H}$	$p_{5,a}$	0.00	0.072	0.068
V/S (mm)=	30		1	7.042	21.3	48.7	7.417	0.044	0.884	43.90	10.1606	0.2022	0.202	2.00	-1.1	-0.9	32.08	0.857	8.0	-2.5	0.00	0.078	0.076
k_s =	1.25			7.250	21.3	48.7	7.639	0.266	0.884			0.2317	0.231				36.78	0.854			0.00	0.083	0.091
_f_c =	22.6		t_0 (days)	8.00	21.3	48.7	8.44	1.07	0.884			0.2565	0.254		$p_{3,w}$	$p_{4,w}$	40.79	0.846	$p_{5,\varepsilon}$	$p_{5,w}$	3.87	0.091	0.094
_E_c(7) =	25200		7	9.00	21.3	48.7	9.50	2.13	0.884			0.2694	0.266		-0.5	0.75	43.10	0.837	-0.85	0	5.96	0.096	0.103
_E_c(28) =	28700			10.00	21.3	48.7	10.56	3.19	0.884			0.2772	0.272				44.43	0.827			7.76	0.099	0.108
τ_{sh} =	73.41		^t_0 (days)	11.00	21.3	48.7	11.62	4.25	0.884			0.2829	0.277	q_2 x 1E-6	q_3 x 1E-6	q_4 x 1E-6	45.55	0.819		q_5 x 1E-6	9.02	0.101	0.110
$\varepsilon_{sh,inf}$ (^t_s) =	-414.2	1E-06	7.373	12.00	21.3	48.7	12.68	5.31	0.884			0.2873	0.280	142.74	5.87	3.31	46.34	0.811		489.3	10.20	0.103	0.115
				13.00	21.3	48.7	13.75	6.38	0.884			0.2910	0.283				47.10	0.803			11.32	0.105	0.115
				14.00	21.3	48.7	14.81	7.44	0.884			0.2941	0.285				47.68	0.796			12.26	0.107	0.116
				21.00	21.3	48.7	22.24	14.87	0.884			0.3083	0.295				50.68	0.754			17.73	0.115	0.126
				28.00	21.3	48.7	29.68	22.31	0.884			0.3169	0.300				52.48	0.722			21.96	0.122	0.128
				35.00	21.3	48.7	37.11	29.74	0.884			0.3230	0.303				53.75	0.696			25.57	0.127	0.131
				63.00	21.3	48.7	66.85	59.48	0.884			0.3381	0.309				56.79	0.628			36.26	0.140	0.141
				97.00	21.3	48.7	102.97	95.60	0.884			0.3487	0.313				58.96	0.582			44.89	0.151	0.149
				127.00	21.3	48.7	134.83	127.46	0.884			0.3553	0.315				60.24	0.557			50.19	0.158	0.147
				157.00	21.3	48.7	166.70	159.33	0.884			0.3604	0.316				61.17	0.540			54.07	0.163	0.154
				187.00	21.3	48.7	198.56	191.19	0.884			0.3646	0.317				61.96	0.528			56.96	0.167	0.155
				217.00	21.3	48.7	230.43	223.06	0.884			0.3681	0.317				62.51	0.519			59.21	0.170	0.157
				247.00	21.3	48.7	262.29	254.92	0.884			0.3713	0.318				63.13	0.513			60.76	0.172	0.160
				277.00	21.3	48.7	294.16	286.79	0.884			0.3740	0.318				63.55	0.508			62.07	0.173	0.162
				307.00	21.3	48.7	326.02	318.65	0.884			0.3765	0.319				64.08	0.504			63.14	0.175	0.166
				337.00	21.3	48.7	357.89	350.52	0.884			0.3788	0.319				64.42	0.501			63.95	0.176	0.168
				372.00	21.3	48.7	395.06	387.69	0.884			0.3811	0.320				64.93	0.498			64.77	0.178	0.171
				407.00	21.3	48.7	432.24	424.87	0.884			0.3833	0.320				65.26	0.496			65.32	0.179	0.174
				457.00	21.3	48.7	485.34	477.97	0.884			0.3861	0.320				65.69	0.494			65.88	0.180	0.178
				1000.0	21.3	48.7	1062.10	1054.73	0.884			0.4053	0.322				68.87	0.488			67.58	0.185	
				2500.0	21.3	48.7	2655.34	2647.97	0.884			0.4283	0.323				72.42	0.487			67.86	0.189	
				5000.0	21.3	48.7	5310.73	5303.36	0.884			0.4461	0.324				75.14	0.487			67.86	0.192	
				10000.0	21.3	48.7	10621.53	10614.16	0.884			0.4642	0.324				77.72	0.487			67.86	0.194	

CREEP CALCULATION ACCORDING TO B4 - HVFAC28 - CALIBRATED

			t_s (days)	t (days)	T (°C)	RH (%)	^t (days)	^t-^t_0 (days)	k_h	p_1	Q_f (^t_0)	Z (^t_0)	Q (^t,^t_0)	p_2	p_3	p_4	C_0 (^t,^t_0) x 1E-6	H (^t,^t_s)	H_c (^t_0,^t_s)	p_5 x 1E-6	C_d (^t,^t_0,^t_s) x 1E-6	J (^t,^t_0) x 1E-9	J_{exp} (^t,^t_0) x 1E-9
a/c =	8.100		1	0.100	21.3	48.7	0.044	–	0.884	0.77	0.1772	–	–	0.021682	0.091569	0.002142	–	–	0.715	1243.2	–	–	–
w/c =	0.975			28.000	21.3	48.7	29.678	0.000	0.884			0.0000	0.000				0.00	0.722			0.00	0.000	0.000
c =	200.0		β_{Th}	28.003	21.3	48.7	29.682	0.004	0.884	q_1 x 1E-6	r (^t_0)	0.0835	0.083	$p_{2,w}$	$p_{3,a}$	$p_{4,a}$	14.52	0.722	$p_{5,H}$	$p_{5,a}$	0.00	0.042	0.048
V/S (mm)=	30		1	28.042	21.3	48.7	29.722	0.044	0.884	26.83	10.5535	0.1008	0.101	2.0	-1.1	-0.9	17.64	0.722	8.0	-3.1	0.00	0.046	0.052
k_s =	1.25			28.250	21.3	48.7	29.944	0.266	0.884			0.1155	0.115				20.14	0.721			0.00	0.048	0.057
_f_c =	22.6		t_0 (days)	29.00	21.3	48.7	30.74	1.06	0.884			0.1278	0.127		$p_{3,w}$	$p_{4,w}$	22.33	0.718	$p_{5,\varepsilon}$	$p_{5,w}$	0.00	0.051	0.062
_E_c(7) =	25200		28	30.00	21.3	48.7	31.80	2.12	0.884			0.1343	0.134		-0.5	0.75	23.65	0.714	-0.85	0	2.10	0.054	0.063
_E_c(28) =	28700			31.00	21.3	48.7	32.86	3.18	0.884			0.1382	0.137				24.31	0.710			4.73	0.057	0.067
τ_{sh} =	73.41		^t_0 (days)	32.00	21.3	48.7	33.93	4.25	0.884			0.1410	0.140	q_2 x 1E-6	q_3 x 1E-6	q_4 x 1E-6	24.94	0.707		q_5 x 1E-6	6.02	0.059	0.068
$\varepsilon_{sh,inf}$ (^t_s) =	-414.2	1E-06	29.678	33.00	21.3	48.7	34.99	5.31	0.884			0.1432	0.142	142.74	5.87	3.31	25.39	0.703		408.67	7.43	0.061	0.069
				34.00	21.3	48.7	36.05	6.37	0.884			0.1450	0.143				25.69	0.700			8.36	0.062	0.069
				35.00	21.3	48.7	37.11	7.43	0.884			0.1466	0.145				26.12	0.696			9.48	0.064	0.071
				42.00	21.3	48.7	44.55	14.87	0.884			0.1537	0.151				27.81	0.675			14.37	0.071	0.077
				49.00	21.3	48.7	51.98	22.30	0.884			0.1579	0.154				28.89	0.657			17.98	0.075	0.082
				56.00	21.3	48.7	59.42	29.74	0.884			0.1610	0.156				29.71	0.641			21.03	0.079	0.082
				84.00	21.3	48.7	89.16	59.48	0.884			0.1685	0.161				32.01	0.596			29.52	0.090	0.089
				118.00	21.3	48.7	125.27	95.59	0.884			0.1738	0.164				33.73	0.563			36.06	0.099	0.098
				148.00	21.3	48.7	157.14	127.46	0.884			0.1771	0.166				34.87	0.544			40.04	0.104	0.100
				178.00	21.3	48.7	189.00	159.32	0.884			0.1796	0.167				35.71	0.531			42.89	0.108	0.100
				208.00	21.3	48.7	220.87	191.19	0.884			0.1817	0.168				36.43	0.521			45.15	0.111	0.108
				238.00	21.3	48.7	252.73	223.05	0.884			0.1835	0.169				37.08	0.514			46.77	0.113	0.108
				268.00	21.3	48.7	284.60	254.92	0.884			0.1850	0.169				37.52	0.509			47.94	0.115	0.114
				298.00	21.3	48.7	316.46	286.78	0.884			0.1864	0.170				38.06	0.505			48.90	0.116	0.109
				328.00	21.3	48.7	348.33	318.65	0.884			0.1877	0.170				38.42	0.502			49.62	0.117	0.115
				358.00	21.3	48.7	380.19	350.51	0.884			0.1888	0.170				38.74	0.499			50.36	0.118	0.121
				393.00	21.3	48.7	417.37	387.69	0.884			0.1900	0.171				39.23	0.497			50.85	0.119	0.116
				428.00	21.3	48.7	454.54	424.86	0.884			0.1911	0.171				39.55	0.495			51.34	0.120	0.125
				478.00	21.3	48.7	507.65	477.97	0.884			0.1925	0.171				39.96	0.493			51.84	0.121	0.124
				1000.0	21.3	48.7	1062.10	1032.42	0.884			0.2018	0.173				42.99	0.488			53.10	0.126	
				2500.0	21.3	48.7	2655.34	2625.66	0.884			0.2134	0.175				46.68	0.487			53.35	0.130	
				5000.0	21.3	48.7	5310.73	5281.05	0.884			0.2223	0.176				49.40	0.487			53.35	0.133	
				10000.0	21.3	48.7	10621.53	10591.85	0.884			0.2313	0.176				51.98	0.487			53.35	0.135	

CREEP CALCULATION ACCORDING TO MC10 - RAC7

		t_0 (days)	t (days)	T (°C)	RH (%)	t_T (days)	$(t-t_0)_T$ (days)	$\beta_{bc}(f_{cm})$	$\beta_{bc}(t,t_0)$	$\varphi_{bc}(t,t_0)$	$\beta_{dc}(f_{cm})$	$\beta(RH)$	$\beta_{dc}(t_0)$	$\beta_{dc}(t,t_0)$	$\varphi_{dc}(t,t_0)$	$\varphi(t,t_0)$	$\varphi_\sigma(t,t_0)$	$J(t,t_0)$ x 1E-9	$J_{exp}(t,t_0)$ x 1E-9
$f_c(t_0)$ =	23.0	7	7.000	21.3	48.7	7.421	–	0.1743	–	–	3.8611	–	0.5688	–	–	–	–	0.000	–
f_{cm} =	28.1		7.000	21.3	48.7	7.421	0.000		0.000	0.000		1.3104		0.0000	0.000	0.000	0.000	0.039	0.000
$E_c(t_0)$ =	25.4	α	7.003	21.3	48.7	7.425	0.004		0.023	0.004		1.3104	$\gamma(t_0)$	0.0195	0.056	0.060	0.085	0.043	0.053
E_{cm} =	27.0	1	7.042	21.3	48.7	7.465	0.044		0.231	0.040		1.3104	0.3041	0.0405	0.117	0.157	0.222	0.048	0.067
h =	60		7.250	21.3	48.7	7.686	0.265		0.942	0.164		1.3104		0.0699	0.201	0.365	0.516	0.058	0.076
α_{fcm} =	1.116	$t_{0,T}$	8.00	21.3	48.7	8.481	1.06		1.982	0.345		1.3104		0.1065	0.306	0.652	0.921	0.073	0.086
β_h =	1674	7.421	9.00	21.3	48.7	9.542	2.12		2.604	0.454		1.3104		0.1315	0.378	0.832	1.176	0.083	0.093
σ =	14.5		10.00	21.3	48.7	10.602	3.18		2.985	0.520		1.3104		0.1487	0.428	0.948	1.340	0.089	0.099
σ/f_{cm} =	0.630	$t_{0,adj}$	11.00	21.3	48.7	11.662	4.24		3.260	0.568		1.3104		0.1622	0.467	1.035	1.462	0.094	0.100
		12.527	12.00	21.3	48.7	12.722	5.30		3.475	0.606		1.3104		0.1736	0.500	1.105	1.562	0.097	0.106
			13.00	21.3	48.7	13.782	6.36		3.652	0.637		1.3104		0.1834	0.528	1.164	1.645	0.100	0.108
			14.00	21.3	48.7	14.842	7.42		3.803	0.663		1.3104		0.1922	0.553	1.216	1.718	0.103	0.107
			21.00	21.3	48.7	22.264	14.84		4.485	0.782		1.3104		0.2370	0.682	1.464	2.068	0.116	0.122
			28.00	21.3	48.7	29.685	22.26		4.886	0.852		1.3104		0.2677	0.770	1.622	2.292	0.124	0.123
			35.00	21.3	48.7	37.106	29.69		5.172	0.901		1.3104		0.2918	0.840	1.741	2.460	0.130	0.132
			63.00	21.3	48.7	66.791	59.37		5.862	1.022		1.3104		0.3584	1.031	2.053	2.901	0.147	0.145
			97.00	21.3	48.7	102.836	95.42		6.336	1.104		1.3104		0.4115	1.184	2.289	3.234	0.159	0.152
			127.00	21.3	48.7	134.641	127.22		6.623	1.154		1.3104		0.4467	1.286	2.440	3.447	0.167	0.156
			157.00	21.3	48.7	166.446	159.03		6.846	1.193		1.3104		0.4755	1.368	2.562	3.619	0.173	0.160
			187.00	21.3	48.7	198.251	190.83		7.028	1.225		1.3104		0.5000	1.439	2.664	3.764	0.179	0.163
			217.00	21.3	48.7	230.056	222.64		7.182	1.252		1.3104		0.5213	1.500	2.752	3.888	0.183	0.168
			247.00	21.3	48.7	261.861	254.44		7.315	1.275		1.3104		0.5401	1.554	2.829	3.998	0.187	0.170
			277.00	21.3	48.7	293.666	286.25		7.433	1.296		1.3104		0.5571	1.603	2.899	4.096	0.191	0.172
			307.00	21.3	48.7	325.471	318.05		7.538	1.314		1.3104		0.5724	1.647	2.961	4.184	0.194	0.172
			337.00	21.3	48.7	357.276	349.86		7.634	1.331		1.3104		0.5864	1.688	3.018	4.264	0.197	0.174
			372.00	21.3	48.7	394.382	386.96		7.734	1.348		1.3104		0.6013	1.730	3.079	4.350	0.200	0.178
			407.00	21.3	48.7	431.488	424.07		7.826	1.364		1.3104		0.6149	1.770	3.134	4.428	0.203	0.179
			457.00	21.3	48.7	484.496	477.08		7.944	1.385		1.3104		0.6326	1.821	3.205	4.529	0.207	0.181
			1000.0	21.3	48.7	1060.167	1052.75		8.735	1.523		1.3104		0.7487	2.155	3.677	5.196	0.232	
			2500.0	21.3	48.7	2650.418	2643.00		9.655	1.683		1.3104		0.8614	2.479	4.162	5.880	0.257	
			5000.0	21.3	48.7	5300.837	5293.42		10.350	1.804		1.3104		0.9198	2.647	4.451	6.289	0.272	
			10000.0	21.3	48.7	10601.67	10594.25		11.044	1.925		1.3104		0.9564	2.752	4.677	6.609	0.284	

CREEP CALCULATION ACCORDING TO MC10 - RAC28

		t_0 (days)	t (days)	T (°C)	RH (%)	t_T (days)	$(t-t_0)_T$ (days)	$\beta_{bc}(f_{cm})$	$\beta_{bc}(t,t_0)$	$\varphi_{bc}(t,t_0)$	$\beta_{dc}(f_{cm})$	$\beta(RH)$	$\beta_{dc}(t_0)$	$\beta_{dc}(t,t_0)$	$\varphi_{dc}(t,t_0)$	$\varphi(t,t_0)$	$\varphi_{\sigma}(t,t_0)$	$J(t,t_0)$ x 1E-9	$J_{exp}(t,t_0)$ x 1E-9
$f_c(t_0)$ =	28.1	28	28.000	21.3	48.7	29.685	0.000	0.1743	–	–	3.8611	–	0.4705	–	–	–	–	0.000	–
f_{cm} =	28.1		28.000	21.3	48.7	29.685	0.000		0.000	0.000		1.3104		0.0000	0.000	0.000	0.000	0.037	0.000
$E_c(t_0)$ =	27.0	α	28.003	21.3	48.7	29.688	0.003		0.003	0.000		1.3104	$\gamma(t_0)$	0.0104	0.025	0.025	0.027	0.038	0.046
E_{cm} =	27.0	1	28.042	21.3	48.7	29.729	0.044		0.036	0.006		1.3104	0.3449	0.0263	0.063	0.069	0.075	0.040	0.053
h =	60		28.250	21.3	48.7	29.95	0.265		0.200	0.035		1.3104		0.0489	0.116	0.151	0.164	0.043	0.062
α_{fcm} =	1.116	$t_{0,T}$	29.00	21.3	48.7	30.745	1.06		0.635	0.111		1.3104		0.0788	0.188	0.298	0.324	0.049	0.068
β_h =	1674	29.685	30.00	21.3	48.7	31.805	2.12		1.020	0.178		1.3104		0.1001	0.238	0.416	0.452	0.054	0.076
σ =	12.78		31.00	21.3	48.7	32.865	3.18		1.298	0.226		1.3104		0.1151	0.274	0.500	0.543	0.057	0.075
σ/f_{cm} =	0.455	$t_{0,adj}$	32.00	21.3	48.7	33.925	4.24		1.515	0.264		1.3104		0.1271	0.303	0.567	0.615	0.060	0.080
		34.102	33.00	21.3	48.7	34.986	5.30		1.693	0.295		1.3104		0.1372	0.327	0.622	0.675	0.062	0.084
			34.00	21.3	48.7	36.046	6.36		1.844	0.321		1.3104		0.1461	0.348	0.669	0.727	0.064	0.085
			35.00	21.3	48.7	37.106	7.42		1.975	0.344		1.3104		0.1541	0.367	0.711	0.772	0.066	0.087
			42.00	21.3	48.7	44.527	14.84		2.597	0.453		1.3104		0.1954	0.465	0.918	0.996	0.074	0.096
			49.00	21.3	48.7	51.948	22.26		2.977	0.519		1.3104		0.2244	0.534	1.053	1.143	0.079	0.102
			56.00	21.3	48.7	59.369	29.68		3.252	0.567		1.3104		0.2474	0.589	1.156	1.255	0.084	0.107
			84.00	21.3	48.7	89.054	59.37		3.925	0.684		1.3104		0.3123	0.743	1.428	1.550	0.094	0.118
			118.00	21.3	48.7	125.1	95.42		4.392	0.766		1.3104		0.3653	0.870	1.635	1.775	0.103	0.124
			148.00	21.3	48.7	156.905	127.22		4.677	0.815		1.3104		0.4009	0.954	1.770	1.921	0.108	0.134
			178.00	21.3	48.7	188.71	159.03		4.898	0.854		1.3104		0.4303	1.024	1.878	2.039	0.113	0.140
			208.00	21.3	48.7	220.515	190.83		5.079	0.885		1.3104		0.4556	1.085	1.970	2.139	0.116	0.143
			238.00	21.3	48.7	252.32	222.64		5.233	0.912		1.3104		0.4776	1.137	2.049	2.225	0.119	0.147
			268.00	21.3	48.7	284.125	254.44		5.366	0.935		1.3104		0.4973	1.184	2.119	2.301	0.122	0.148
			298.00	21.3	48.7	315.93	286.25		5.483	0.956		1.3104		0.5150	1.226	2.182	2.369	0.125	0.152
			328.00	21.3	48.7	347.735	318.05		5.588	0.974		1.3104		0.5311	1.264	2.238	2.430	0.127	0.153
			358.00	21.3	48.7	379.54	349.86		5.683	0.990		1.3104		0.5459	1.300	2.290	2.486	0.129	0.158
			393.00	21.3	48.7	416.646	386.96		5.783	1.008		1.3104		0.5616	1.337	2.345	2.546	0.131	0.163
			428.00	21.3	48.7	453.752	424.07		5.874	1.024		1.3104		0.5761	1.371	2.395	2.601	0.133	0.161
			478.00	21.3	48.7	506.76	477.08		5.992	1.044		1.3104		0.5949	1.416	2.461	2.671	0.136	0.162
			1000.0	21.3	48.7	1060.167	1030.48		6.761	1.178		1.3104		0.7169	1.707	2.885	3.132	0.153	
			2500.0	21.3	48.7	2650.418	2620.73		7.693	1.341		1.3104		0.8434	2.008	3.349	3.636	0.172	
			5000.0	21.3	48.7	5300.837	5271.15		8.392	1.463		1.3104		0.9093	2.165	3.627	3.938	0.183	
			10000.0	21.3	48.7	10601.67	10571.99		9.088	1.584		1.3104		0.9506	2.263	3.847	4.177	0.192	

CREEP CALCULATION ACCORDING TO MC10 - HVFAC7

		t_0 (days)	t (days)	T (°C)	RH (%)	t_T (days)	$(t-t_0)_T$ (days)	$\beta_{bc}(f_{cm})$	$\beta_{bc}(t,t_0)$	$\varphi_{bc}(t,t_0)$	$\beta_{dc}(f_{cm})$	$\beta(RH)$	$\beta_{dc}(t_0)$	$\beta_{dc}(t,t_0)$	$\varphi_{dc}(t,t_0)$	$\varphi(t,t_0)$	$\varphi_\sigma(t,t_0)$	$J(t,t_0)$ x 1E-9	$J_{exp}(t,t_0)$ x 1E-9
$f_c(t_0)$ =	18.5	7	7.000	21.3	48.7	7.421	–	0.203	–	–	5.2378	–	0.5688	–	–	–	–	0.000	–
f_{cm} =	22.6		7.000	21.3	48.7	7.421	0.000		0.000	0.000		1.3104		0.0000	0.000	0.000	0.000	0.038	0.000
$E_c(t_0)$ =	26.5	α	7.003	21.3	48.7	7.425	0.004		0.023	0.005		1.3104	$\gamma(t_0)$	0.0189	0.074	0.079	0.096	0.041	0.068
E_{cm} =	28.1	1	7.042	21.3	48.7	7.465	0.044		0.231	0.047		1.3104	0.3041	0.0392	0.153	0.200	0.244	0.046	0.076
h =	60		7.250	21.3	48.7	7.686	0.265		0.942	0.191		1.3104		0.0676	0.264	0.455	0.555	0.057	0.091
α_{fcm} =	1.244	$t_{0,T}$	8.00	21.3	48.7	8.481	1.06		1.982	0.402		1.3104		0.1030	0.402	0.804	0.980	0.073	0.094
β_h =	1866	7.421	9.00	21.3	48.7	9.542	2.12		2.604	0.529		1.3104		0.1272	0.497	1.025	1.250	0.082	0.103
σ =	9.84		10.00	21.3	48.7	10.602	3.18		2.985	0.606		1.3104		0.1439	0.562	1.168	1.423	0.088	0.108
σ/f_{cm} =	0.532	$t_{0,adj}$	11.00	21.3	48.7	11.662	4.24		3.260	0.662		1.3104		0.1570	0.613	1.275	1.553	0.093	0.110
		12.527	12.00	21.3	48.7	12.722	5.30		3.475	0.705		1.3104		0.1680	0.656	1.361	1.659	0.097	0.115
			13.00	21.3	48.7	13.782	6.36		3.652	0.741		1.3104		0.1775	0.693	1.434	1.748	0.100	0.115
			14.00	21.3	48.7	14.842	7.42		3.803	0.772		1.3104		0.1860	0.726	1.498	1.826	0.103	0.116
			21.00	21.3	48.7	22.264	14.84		4.485	0.910		1.3104		0.2294	0.896	1.806	2.201	0.116	0.126
			28.00	21.3	48.7	29.685	22.26		4.886	0.992		1.3104		0.2592	1.012	2.004	2.442	0.125	0.128
			35.00	21.3	48.7	37.106	29.69		5.172	1.050		1.3104		0.2825	1.103	2.153	2.624	0.131	0.131
			63.00	21.3	48.7	66.791	59.37		5.862	1.190		1.3104		0.3472	1.355	2.546	3.102	0.148	0.141
			97.00	21.3	48.7	102.836	95.42		6.336	1.286		1.3104		0.3988	1.557	2.843	3.465	0.161	0.149
			127.00	21.3	48.7	134.641	127.22		6.623	1.344		1.3104		0.4331	1.691	3.035	3.699	0.169	0.147
			157.00	21.3	48.7	166.446	159.03		6.846	1.390		1.3104		0.4613	1.801	3.191	3.889	0.176	0.154
			187.00	21.3	48.7	198.251	190.83		7.028	1.427		1.3104		0.4853	1.895	3.321	4.048	0.182	0.155
			217.00	21.3	48.7	230.056	222.64		7.182	1.458		1.3104		0.5062	1.976	3.434	4.185	0.187	0.157
			247.00	21.3	48.7	261.861	254.44		7.315	1.485		1.3104		0.5248	2.049	3.534	4.307	0.191	0.160
			277.00	21.3	48.7	293.666	286.25		7.433	1.509		1.3104		0.5415	2.114	3.623	4.416	0.195	0.162
			307.00	21.3	48.7	325.471	318.05		7.538	1.530		1.3104		0.5566	2.173	3.703	4.513	0.198	0.166
			337.00	21.3	48.7	357.276	349.86		7.634	1.550		1.3104		0.5704	2.227	3.776	4.603	0.202	0.168
			372.00	21.3	48.7	394.382	386.96		7.734	1.570		1.3104		0.5852	2.285	3.855	4.698	0.205	0.171
			407.00	21.3	48.7	431.488	424.07		7.826	1.589		1.3104		0.5988	2.338	3.926	4.785	0.208	0.174
			457.00	21.3	48.7	484.496	477.08		7.944	1.613		1.3104		0.6163	2.406	4.019	4.898	0.212	0.178
			1000.0	21.3	48.7	1060.167	1052.75		8.735	1.773		1.3104		0.7334	2.863	4.636	5.651	0.239	
			2500.0	21.3	48.7	2650.418	2643.00		9.655	1.960		1.3104		0.8501	3.319	5.279	6.434	0.267	
			5000.0	21.3	48.7	5300.837	5293.42		10.350	2.101		1.3104		0.9123	3.562	5.663	6.901	0.283	
			10000.0	21.3	48.7	10601.67	10594.25		11.044	2.242		1.3104		0.9519	3.716	5.958	7.262	0.296	

CREEP CALCULATION ACCORDING TO MC10 - HVFAC28

		t_0 (days)	t (days)	T (°C)	RH (%)	t_T (days)	$(t-t_0)_T$ (days)	$\beta_{bc}(f_{cm})$	$\beta_{bc}(t,t_0)$	$\varphi_{bc}(t,t_0)$	$\beta_{dc}(f_{cm})$	$\beta(RH)$	$\beta_{dc}(t_0)$	$\beta_{dc}(t,t_0)$	$\varphi_{dc}(t,t_0)$	$\varphi(t,t_0)$	$\varphi_\sigma(t,t_0)$	$J(t,t_0)$ x 1E-9	$J_{exp}(t,t_0)$ x 1E-9
$f_c(t_0)$ =	22.6	28	28.000	21.3	48.7	29.685	0.000	0.203	–	–	5.2378	–	0.4705	–	–	–	–	0.000	–
f_{cm} =	22.6		28.000	21.3	48.7	29.685	0.000		0.000	0.000		1.3104		0.0000	0.000	0.000	0.000	0.036	0.000
$E_c(t_0)$ =	28.1	α	28.003	21.3	48.7	29.688	0.003		0.003	0.001		1.3104	$\gamma(t_0)$	0.0100	0.032	0.033	0.035	0.037	0.048
E_{cm} =	28.1	1	28.042	21.3	48.7	29.729	0.044		0.036	0.007		1.3104	0.3449	0.0254	0.082	0.089	0.097	0.039	0.052
h =	60		28.250	21.3	48.7	29.95	0.265		0.200	0.041		1.3104		0.0471	0.152	0.193	0.208	0.043	0.057
α_{fcm} =	1.244	$t_{0,T}$	29.00	21.3	48.7	30.745	1.06		0.635	0.129		1.3104		0.0759	0.245	0.374	0.404	0.050	0.062
β_h =	1866	29.685	30.00	21.3	48.7	31.805	2.12		1.020	0.207		1.3104		0.0964	0.311	0.518	0.560	0.056	0.063
σ =	10.2		31.00	21.3	48.7	32.865	3.18		1.298	0.263		1.3104		0.1109	0.358	0.622	0.671	0.059	0.067
σ/f_{cm} =	0.451	$t_{0,adj}$	32.00	21.3	48.7	33.925	4.24		1.515	0.307		1.3104		0.1224	0.395	0.703	0.759	0.063	0.068
		34.102	33.00	21.3	48.7	34.986	5.30		1.693	0.344		1.3104		0.1322	0.427	0.771	0.832	0.065	0.069
			34.00	21.3	48.7	36.046	6.36		1.844	0.374		1.3104		0.1408	0.455	0.829	0.895	0.067	0.069
			35.00	21.3	48.7	37.106	7.42		1.975	0.401		1.3104		0.1484	0.479	0.880	0.951	0.069	0.071
			42.00	21.3	48.7	44.527	14.84		2.597	0.527		1.3104		0.1882	0.608	1.135	1.226	0.079	0.077
			49.00	21.3	48.7	51.948	22.26		2.977	0.604		1.3104		0.2162	0.698	1.302	1.407	0.086	0.082
			56.00	21.3	48.7	59.369	29.68		3.252	0.660		1.3104		0.2384	0.770	1.430	1.544	0.091	0.082
			84.00	21.3	48.7	89.054	59.37		3.925	0.797		1.3104		0.3012	0.973	1.770	1.911	0.104	0.089
			118.00	21.3	48.7	125.1	95.42		4.392	0.892		1.3104		0.3525	1.138	2.030	2.192	0.114	0.098
			148.00	21.3	48.7	156.905	127.22		4.677	0.949		1.3104		0.3871	1.250	2.200	2.376	0.120	0.100
			178.00	21.3	48.7	188.71	159.03		4.898	0.994		1.3104		0.4158	1.343	2.337	2.524	0.125	0.100
			208.00	21.3	48.7	220.515	190.83		5.079	1.031		1.3104		0.4404	1.422	2.453	2.650	0.130	0.108
			238.00	21.3	48.7	252.32	222.64		5.233	1.062		1.3104		0.4620	1.492	2.554	2.759	0.134	0.108
			268.00	21.3	48.7	284.125	254.44		5.366	1.089		1.3104		0.4813	1.554	2.643	2.855	0.137	0.114
			298.00	21.3	48.7	315.93	286.25		5.483	1.113		1.3104		0.4987	1.610	2.723	2.941	0.140	0.109
			328.00	21.3	48.7	347.735	318.05		5.588	1.134		1.3104		0.5145	1.661	2.796	3.020	0.143	0.115
			358.00	21.3	48.7	379.54	349.86		5.683	1.154		1.3104		0.5291	1.709	2.862	3.091	0.146	0.121
			393.00	21.3	48.7	416.646	386.96		5.783	1.174		1.3104		0.5447	1.759	2.933	3.168	0.148	0.116
			428.00	21.3	48.7	453.752	424.07		5.874	1.193		1.3104		0.5590	1.805	2.998	3.238	0.151	0.125
			478.00	21.3	48.7	506.76	477.08		5.992	1.216		1.3104		0.5776	1.865	3.082	3.328	0.154	0.124
			1000.0	21.3	48.7	1060.167	1030.48		6.761	1.372		1.3104		0.7002	2.261	3.634	3.924	0.175	
			2500.0	21.3	48.7	2650.418	2620.73		7.693	1.562		1.3104		0.8307	2.683	4.244	4.584	0.199	
			5000.0	21.3	48.7	5300.837	5271.15		8.392	1.704		1.3104		0.9008	2.909	4.613	4.982	0.213	
			10000.0	21.3	48.7	10601.67	10571.99		9.088	1.845		1.3104		0.9455	3.053	4.898	5.290	0.224	

CREEP CALCULATION ACCORDING TO MC10 - RAC7 - CALIBRATED

		t_0 (days)	t (days)	T (°C)	RH (%)	t_T (days)	$(t-t_0)_T$ (days)	$\beta_{bc}(f_{cm})$	$\beta_{bc}(t,t_0)$	$\varphi_{bc}(t,t_0)$	$\beta_{dc}(f_{cm})$	$\beta(RH)$	$\beta_{dc}(t_0)$	$\beta_{dc}(t,t_0)$	$\varphi_{dc}(t,t_0)$	$\varphi(t,t_0)$	$\varphi_{\sigma}(t,t_0)$	$J(t,t_0)$ x 1E-9	$J_{exp}(t,t_0)$ x 1E-9
$f_c(t_0)$ =	23.0	7	7.000	21.3	48.7	7.421	–	0.2517	–	–	1.64	–	0.5688	–	–	–	–	0.000	–
f_{cm} =	28.1		7.000	21.3	48.7	7.421	0.000		0.000	0.000		1.3104		0.0000	0.000	0.000	0.000	0.039	0.000
$E_c(t_0)$ =	25.4	α	7.003	21.3	48.7	7.425	0.004	**bc**	0.023	0.006	**dc**	1.3104	$\gamma(t_0)$	0.0195	0.024	0.030	0.042	0.041	0.053
E_{cm} =	27.0	1	7.042	21.3	48.7	7.465	0.044	2.6	0.231	0.058	175	1.3104	0.3041	0.0405	0.050	0.108	0.152	0.045	0.067
h =	60		7.250	21.3	48.7	7.686	0.265		0.942	0.237		1.3104		0.0699	0.085	0.322	0.456	0.056	0.076
α_{fcm} =	1.116	$t_{0,T}$	8.00	21.3	48.7	8.481	1.06		1.982	0.499		1.3104		0.1065	0.130	0.629	0.889	0.072	0.086
β_h =	1674	7.421	9.00	21.3	48.7	9.542	2.12		2.604	0.656		1.3104		0.1315	0.161	0.816	1.153	0.082	0.093
σ =	14.5		10.00	21.3	48.7	10.602	3.18		2.985	0.751		1.3104		0.1487	0.182	0.933	1.318	0.088	0.099
σ/f_{cm} =	0.630	$t_{0,adj}$	11.00	21.3	48.7	11.662	4.24		3.260	0.820		1.3104		0.1622	0.198	1.019	1.439	0.093	0.100
		12.527	12.00	21.3	48.7	12.722	5.30		3.475	0.875		1.3104		0.1736	0.212	1.087	1.536	0.096	0.106
			13.00	21.3	48.7	13.782	6.36		3.652	0.919		1.3104		0.1834	0.224	1.143	1.616	0.099	0.108
			14.00	21.3	48.7	14.842	7.42		3.803	0.957		1.3104		0.1922	0.235	1.192	1.684	0.102	0.107
			21.00	21.3	48.7	22.264	14.84		4.485	1.129		1.3104		0.2370	0.290	1.418	2.004	0.114	0.122
			28.00	21.3	48.7	29.685	22.26		4.886	1.230		1.3104		0.2677	0.327	1.557	2.200	0.121	0.123
			35.00	21.3	48.7	37.106	29.69		5.172	1.302		1.3104		0.2918	0.357	1.658	2.343	0.126	0.132
			63.00	21.3	48.7	66.791	59.37		5.862	1.476		1.3104		0.3584	0.438	1.914	2.704	0.140	0.145
			97.00	21.3	48.7	102.836	95.42		6.336	1.595		1.3104		0.4115	0.503	2.098	2.964	0.149	0.152
			127.00	21.3	48.7	134.641	127.22		6.623	1.667		1.3104		0.4467	0.546	2.213	3.127	0.155	0.156
			157.00	21.3	48.7	166.446	159.03		6.846	1.723		1.3104		0.4755	0.581	2.304	3.256	0.160	0.160
			187.00	21.3	48.7	198.251	190.83		7.028	1.769		1.3104		0.5000	0.611	2.380	3.363	0.164	0.163
			217.00	21.3	48.7	230.056	222.64		7.182	1.808		1.3104		0.5213	0.637	2.445	3.454	0.167	0.168
			247.00	21.3	48.7	261.861	254.44		7.315	1.841		1.3104		0.5401	0.660	2.501	3.534	0.170	0.170
			277.00	21.3	48.7	293.666	286.25		7.433	1.871		1.3104		0.5571	0.681	2.552	3.606	0.173	0.172
			307.00	21.3	48.7	325.471	318.05		7.538	1.897		1.3104		0.5724	0.700	2.597	3.669	0.175	0.172
			337.00	21.3	48.7	357.276	349.86		7.634	1.921		1.3104		0.5864	0.717	2.638	3.728	0.177	0.174
			372.00	21.3	48.7	394.382	386.96		7.734	1.947		1.3104		0.6013	0.735	2.682	3.789	0.180	0.178
			407.00	21.3	48.7	431.488	424.07		7.826	1.970		1.3104		0.6149	0.752	2.721	3.845	0.182	0.179
			457.00	21.3	48.7	484.496	477.08		7.944	1.999		1.3104		0.6326	0.773	2.773	3.918	0.184	0.181
			1000.0	21.3	48.7	1060.167	1052.75		8.735	2.199		1.3104		0.7487	0.915	3.114	4.400	0.202	
			2500.0	21.3	48.7	2650.418	2643.00		9.655	2.430		1.3104		0.8614	1.053	3.483	4.921	0.222	
			5000.0	21.3	48.7	5300.837	5293.42		10.350	2.605		1.3104		0.9198	1.124	3.729	5.269	0.235	
			10000.0	21.3	48.7	10601.67	10594.25		11.044	2.780		1.3104		0.9564	1.169	3.949	5.579	0.246	

CREEP CALCULATION ACCORDING TO MC10 - RAC28 - CALIBRATED

		t_0 (days)	t (days)	T (°C)	RH (%)	t_T (days)	$(t-t_0)_T$ (days)	$\beta_{bc}(f_{cm})$	$\beta_{bc}(t,t_0)$	$\varphi_{bc}(t,t_0)$	$\beta_{dc}(f_{cm})$	$\beta(RH)$	$\beta_{dc}(t_0)$	$\beta_{dc}(t,t_0)$	$\varphi_{dc}(t,t_0)$	$\varphi(t,t_0)$	$\varphi_\sigma(t,t_0)$	$J(t,t_0)$ x 1E-9	$J_{exp}(t,t_0)$ x 1E-9
$f_c(t_0)$ =	28.1	28	28.000	21.3	48.7	29.685	0.000	0.3485	–	–	2.8115	–	0.4705	–	–	–	–	0.000	–
f_{cm} =	28.1		28.000	21.3	48.7	29.685	0.000		0.000	0.000		1.3104		0.0000	0.000	0.000	0.000	0.037	0.000
$E_c(t_0)$ =	27.0	α	28.003	21.3	48.7	29.688	0.003	**bc**	0.003	0.001	**dc**	1.3104	$\gamma(t_0)$	0.0104	0.018	0.019	0.021	0.038	0.046
E_{cm} =	27.0	1	28.042	21.3	48.7	29.729	0.044	3.6	0.036	0.013	300	1.3104	0.3449	0.0263	0.046	0.058	0.063	0.039	0.053
h =	60		28.250	21.3	48.7	29.95	0.265		0.200	0.070		1.3104		0.0489	0.085	0.155	0.168	0.043	0.062
α_{fcm} =	1.116	$t_{0,T}$	29.00	21.3	48.7	30.745	1.06		0.635	0.221		1.3104		0.0788	0.137	0.358	0.389	0.051	0.068
β_h =	1674	29.685	30.00	21.3	48.7	31.805	2.12		1.020	0.356		1.3104		0.1001	0.174	0.529	0.574	0.058	0.076
σ =	12.78		31.00	21.3	48.7	32.865	3.18		1.298	0.452		1.3104		0.1151	0.200	0.652	0.708	0.063	0.075
σ/f_{cm} =	0.455	$t_{0,adj}$	32.00	21.3	48.7	33.925	4.24		1.515	0.528		1.3104		0.1271	0.220	0.748	0.812	0.067	0.080
		34.102	33.00	21.3	48.7	34.986	5.30		1.693	0.590		1.3104		0.1372	0.238	0.828	0.899	0.070	0.084
			34.00	21.3	48.7	36.046	6.36		1.844	0.643		1.3104		0.1461	0.253	0.896	0.973	0.073	0.085
			35.00	21.3	48.7	37.106	7.42		1.975	0.688		1.3104		0.1541	0.267	0.956	1.037	0.075	0.087
			42.00	21.3	48.7	44.527	14.84		2.597	0.905		1.3104		0.1954	0.339	1.244	1.350	0.087	0.096
			49.00	21.3	48.7	51.948	22.26		2.977	1.037		1.3104		0.2244	0.389	1.426	1.549	0.094	0.102
			56.00	21.3	48.7	59.369	29.68		3.252	1.133		1.3104		0.2474	0.429	1.562	1.696	0.100	0.107
			84.00	21.3	48.7	89.054	59.37		3.925	1.368		1.3104		0.3123	0.541	1.909	2.073	0.114	0.118
			118.00	21.3	48.7	125.1	95.42		4.392	1.531		1.3104		0.3653	0.633	2.164	2.349	0.124	0.124
			148.00	21.3	48.7	156.905	127.22		4.677	1.630		1.3104		0.4009	0.695	2.325	2.524	0.131	0.134
			178.00	21.3	48.7	188.71	159.03		4.898	1.707		1.3104		0.4303	0.746	2.453	2.663	0.136	0.140
			208.00	21.3	48.7	220.515	190.83		5.079	1.770		1.3104		0.4556	0.790	2.560	2.779	0.140	0.143
			238.00	21.3	48.7	252.32	222.64		5.233	1.824		1.3104		0.4776	0.828	2.651	2.879	0.144	0.147
			268.00	21.3	48.7	284.125	254.44		5.366	1.870		1.3104		0.4973	0.862	2.732	2.966	0.147	0.148
			298.00	21.3	48.7	315.93	286.25		5.483	1.911		1.3104		0.5150	0.893	2.803	3.044	0.150	0.152
			328.00	21.3	48.7	347.735	318.05		5.588	1.947		1.3104		0.5311	0.921	2.868	3.114	0.152	0.153
			358.00	21.3	48.7	379.54	349.86		5.683	1.980		1.3104		0.5459	0.946	2.927	3.177	0.155	0.158
			393.00	21.3	48.7	416.646	386.96		5.783	2.015		1.3104		0.5616	0.973	2.989	3.245	0.157	0.163
			428.00	21.3	48.7	453.752	424.07		5.874	2.047		1.3104		0.5761	0.999	3.046	3.307	0.160	0.161
			478.00	21.3	48.7	506.76	477.08		5.992	2.088		1.3104		0.5949	1.031	3.119	3.387	0.162	0.162
			1000.0	21.3	48.7	1060.167	1030.48		6.761	2.356		1.3104		0.7169	1.243	3.599	3.907	0.182	
			2500.0	21.3	48.7	2650.418	2620.73		7.693	2.681		1.3104		0.8434	1.462	4.143	4.498	0.204	
			5000.0	21.3	48.7	5300.837	5271.15		8.392	2.925		1.3104		0.9093	1.576	4.501	4.886	0.218	
			10000.0	21.3	48.7	10601.67	10571.99		9.088	3.167		1.3104		0.9506	1.648	4.815	5.227	0.231	

CREEP CALCULATION ACCORDING TO MC10 - HVFAC7 - CALIBRATED

		t_0 (days)	t (days)	T (°C)	RH (%)	t_T (days)	$(t-t_0)_T$ (days)	$\beta_{bc}(f_{cm})$	$\beta_{bc}(t,t_0)$	$\varphi_{bc}(t,t_0)$	$\beta_{dc}(f_{cm})$	$\beta(RH)$	$\beta_{dc}(t_0)$	$\beta_{dc}(t,t_0)$	$\varphi_{dc}(t,t_0)$	$\varphi(t,t_0)$	$\varphi_\sigma(t,t_0)$	$J(t,t_0)$ x 1E-9	$J_{exp}(t,t_0)$ x 1E-9
$f_c(t_0)$ =	18.5	7	7.000	21.3	48.7	7.421	–	0.4059	–	–	0.6357	–	0.5688	–	–	–	–	0.000	–
f_{cm} =	22.6		7.000	21.3	48.7	7.421	0.000		0.000	0.000		1.3104		0.0000	0.000	0.000	0.000	0.038	0.000
$E_c(t_0)$ =	26.5	α	7.003	21.3	48.7	7.425	0.004	bc	0.023	0.009	dc	1.3104	$\gamma(t_0)$	0.0189	0.009	0.018	0.022	0.039	0.068
E_{cm} =	28.1	1	7.042	21.3	48.7	7.465	0.044	3.6	0.231	0.094	50	1.3104	0.3041	0.0392	0.019	0.112	0.137	0.043	0.076
h =	60		7.250	21.3	48.7	7.686	0.265		0.942	0.382		1.3104		0.0676	0.032	0.414	0.505	0.056	0.091
α_{fcm} =	1.244	$t_{0,T}$	8.00	21.3	48.7	8.481	1.06		1.982	0.805		1.3104		0.1030	0.049	0.853	1.040	0.075	0.094
β_h =	1866	7.421	9.00	21.3	48.7	9.542	2.12		2.604	1.057		1.3104		0.1272	0.060	1.117	1.362	0.086	0.103
σ =	9.84		10.00	21.3	48.7	10.602	3.18		2.985	1.211		1.3104		0.1439	0.068	1.280	1.560	0.093	0.108
σ/f_{cm} =	0.532	$t_{0,adj}$	11.00	21.3	48.7	11.662	4.24		3.260	1.323		1.3104		0.1570	0.074	1.397	1.703	0.098	0.110
		12.527	12.00	21.3	48.7	12.722	5.30		3.475	1.411		1.3104		0.1680	0.080	1.490	1.816	0.102	0.115
			13.00	21.3	48.7	13.782	6.36		3.652	1.482		1.3104		0.1775	0.084	1.566	1.909	0.106	0.115
			14.00	21.3	48.7	14.842	7.42		3.803	1.543		1.3104		0.1860	0.088	1.632	1.988	0.109	0.116
			21.00	21.3	48.7	22.264	14.84		4.485	1.820		1.3104		0.2294	0.109	1.929	2.351	0.121	0.126
			28.00	21.3	48.7	29.685	22.26		4.886	1.983		1.3104		0.2592	0.123	2.106	2.567	0.129	0.128
			35.00	21.3	48.7	37.106	29.69		5.172	2.099		1.3104		0.2825	0.134	2.233	2.722	0.135	0.131
			63.00	21.3	48.7	66.791	59.37		5.862	2.380		1.3104		0.3472	0.165	2.544	3.101	0.148	0.141
			97.00	21.3	48.7	102.836	95.42		6.336	2.572		1.3104		0.3988	0.189	2.761	3.364	0.157	0.149
			127.00	21.3	48.7	134.641	127.22		6.623	2.688		1.3104		0.4331	0.205	2.893	3.526	0.163	0.147
			157.00	21.3	48.7	166.446	159.03		6.846	2.779		1.3104		0.4613	0.219	2.997	3.653	0.168	0.154
			187.00	21.3	48.7	198.251	190.83		7.028	2.853		1.3104		0.4853	0.230	3.083	3.757	0.171	0.155
			217.00	21.3	48.7	230.056	222.64		7.182	2.915		1.3104		0.5062	0.240	3.155	3.845	0.175	0.157
			247.00	21.3	48.7	261.861	254.44		7.315	2.969		1.3104		0.5248	0.249	3.218	3.922	0.177	0.160
			277.00	21.3	48.7	293.666	286.25		7.433	3.017		1.3104		0.5415	0.257	3.274	3.990	0.180	0.162
			307.00	21.3	48.7	325.471	318.05		7.538	3.060		1.3104		0.5566	0.264	3.324	4.051	0.182	0.166
			337.00	21.3	48.7	357.276	349.86		7.634	3.098		1.3104		0.5704	0.270	3.369	4.106	0.184	0.168
			372.00	21.3	48.7	394.382	386.96		7.734	3.139		1.3104		0.5852	0.277	3.417	4.164	0.186	0.171
			407.00	21.3	48.7	431.488	424.07		7.826	3.177		1.3104		0.5988	0.284	3.460	4.217	0.188	0.174
			457.00	21.3	48.7	484.496	477.08		7.944	3.224		1.3104		0.6163	0.292	3.516	4.286	0.190	0.178
			1000.0	21.3	48.7	1060.167	1052.75		8.735	3.546		1.3104		0.7334	0.348	3.893	4.745	0.207	
			2500.0	21.3	48.7	2650.418	2643.00		9.655	3.919		1.3104		0.8501	0.403	4.322	5.267	0.225	
			5000.0	21.3	48.7	5300.837	5293.42		10.350	4.201		1.3104		0.9123	0.432	4.633	5.647	0.239	
			10000.0	21.3	48.7	10601.67	10594.25		11.044	4.483		1.3104		0.9519	0.451	4.934	6.013	0.252	

CREEP CALCULATION ACCORDING TO MC10 - HVFAC28 - CALIBRATED

		t_0 (days)	t (days)	T (°C)	RH (%)	t_T (days)	$(t-t_0)_T$ (days)	$\beta_{bc}(f_{cm})$	$\beta_{bc}(t,t_0)$	$\varphi_{bc}(t,t_0)$	$\beta_{dc}(f_{cm})$	$\beta(RH)$	$\beta_{dc}(t_0)$	$\beta_{dc}(t,t_0)$	$\varphi_{dc}(t,t_0)$	$\varphi(t,t_0)$	$\varphi_\sigma(t,t_0)$	$J(t,t_0)$ x 1E-9	$J_{exp}(t,t_0)$ x 1E-9
$f_c(t_0)$ =	22.6	28	28.000	21.3	48.7	29.685	0.000	0.2819	–	–	1.907	–	0.4705	–	–	–	–	0.000	–
f_{cm} =	22.6		28.000	21.3	48.7	29.685	0.000		0.000	0.000		1.3104		0.0000	0.000	0.000	0.000	0.036	0.000
$E_c(t_0)$ =	28.1	α	28.003	21.3	48.7	29.688	0.003	bc	0.003	0.001	dc	1.3104	$\gamma(t_0)$	0.0100	0.012	0.012	0.013	0.036	0.048
E_{cm} =	28.1	1	28.042	21.3	48.7	29.729	0.044	2.5	0.036	0.010	150	1.3104	0.3449	0.0254	0.030	0.040	0.043	0.037	0.052
h =	60		28.250	21.3	48.7	29.95	0.265		0.200	0.056		1.3104		0.0471	0.055	0.112	0.121	0.040	0.057
α_{fcm} =	1.244	$t_{0,T}$	29.00	21.3	48.7	30.745	1.06		0.635	0.179		1.3104		0.0759	0.089	0.268	0.290	0.046	0.062
β_h =	1866	29.685	30.00	21.3	48.7	31.805	2.12		1.020	0.288		1.3104		0.0964	0.113	0.401	0.433	0.051	0.063
σ =	10.2		31.00	21.3	48.7	32.865	3.18		1.298	0.366		1.3104		0.1109	0.130	0.496	0.536	0.055	0.067
σ/f_{cm} =	0.451	$t_{0,adj}$	32.00	21.3	48.7	33.925	4.24		1.515	0.427		1.3104		0.1224	0.144	0.571	0.617	0.058	0.068
		34.102	33.00	21.3	48.7	34.986	5.30		1.693	0.477		1.3104		0.1322	0.155	0.633	0.683	0.060	0.069
			34.00	21.3	48.7	36.046	6.36		1.844	0.520		1.3104		0.1408	0.166	0.685	0.740	0.062	0.069
			35.00	21.3	48.7	37.106	7.42		1.975	0.557		1.3104		0.1484	0.174	0.731	0.790	0.064	0.071
			42.00	21.3	48.7	44.527	14.84		2.597	0.732		1.3104		0.1882	0.221	0.953	1.030	0.072	0.077
			49.00	21.3	48.7	51.948	22.26		2.977	0.839		1.3104		0.2162	0.254	1.093	1.181	0.078	0.082
			56.00	21.3	48.7	59.369	29.68		3.252	0.917		1.3104		0.2384	0.280	1.197	1.293	0.082	0.082
			84.00	21.3	48.7	89.054	59.37		3.925	1.107		1.3104		0.3012	0.354	1.461	1.578	0.092	0.089
			118.00	21.3	48.7	125.1	95.42		4.392	1.238		1.3104		0.3525	0.414	1.653	1.785	0.099	0.098
			148.00	21.3	48.7	156.905	127.22		4.677	1.318		1.3104		0.3871	0.455	1.774	1.916	0.104	0.100
			178.00	21.3	48.7	188.71	159.03		4.898	1.381		1.3104		0.4158	0.489	1.870	2.019	0.107	0.100
			208.00	21.3	48.7	220.515	190.83		5.079	1.432		1.3104		0.4404	0.518	1.950	2.106	0.111	0.108
			238.00	21.3	48.7	252.32	222.64		5.233	1.475		1.3104		0.4620	0.543	2.018	2.180	0.113	0.108
			268.00	21.3	48.7	284.125	254.44		5.366	1.513		1.3104		0.4813	0.566	2.078	2.245	0.115	0.114
			298.00	21.3	48.7	315.93	286.25		5.483	1.546		1.3104		0.4987	0.586	2.132	2.303	0.118	0.109
			328.00	21.3	48.7	347.735	318.05		5.588	1.575		1.3104		0.5145	0.605	2.180	2.355	0.119	0.115
			358.00	21.3	48.7	379.54	349.86		5.683	1.602		1.3104		0.5291	0.622	2.224	2.402	0.121	0.121
			393.00	21.3	48.7	416.646	386.96		5.783	1.630		1.3104		0.5447	0.640	2.271	2.452	0.123	0.116
			428.00	21.3	48.7	453.752	424.07		5.874	1.656		1.3104		0.5590	0.657	2.313	2.498	0.124	0.125
			478.00	21.3	48.7	506.76	477.08		5.992	1.689		1.3104		0.5776	0.679	2.368	2.558	0.127	0.124
			1000.0	21.3	48.7	1060.167	1030.48		6.761	1.906		1.3104		0.7002	0.823	2.729	2.948	0.140	
			2500.0	21.3	48.7	2650.418	2620.73		7.693	2.169		1.3104		0.8307	0.977	3.145	3.397	0.156	
			5000.0	21.3	48.7	5300.837	5271.15		8.392	2.366		1.3104		0.9008	1.059	3.425	3.699	0.167	
			10000.0	21.3	48.7	10601.67	10571.99		9.088	2.562		1.3104		0.9455	1.112	3.674	3.968	0.177	

CREEP CALCULATION ACCORDING TO EC2 - RAC7

		t_0 (days)	t (days)	T (°C)	RH (%)	t_T (days)	$(t-t_0)_T$ (days)	$\beta(f_{cm})$	$\beta(t_0)$	$\beta(RH)$	φ_0	β_h	$\beta_c(t,t_0)$	$\varphi(t,t_0)$	$\varphi_k(t,t_0)$	$J(t,t_0)$ x 1E-9	$J_{exp}(t,t_0)$ x 1E-9
$f_c(t_0)$ =	23.0	7	7.000	21.3	48.7	7.421	–	3.1692	0.5688	–	–	–	–	–	–	0.000	–
f_{cm} =	28.1		7.000	21.3	48.7	7.421	0.000			2.3104	4.165	340.01	0.000	0.000	0.000	0.037	0.000
$E_c(t_0)$ =	25.4	α	7.003	21.3	48.7	7.425	0.004	coeff.		2.3104	4.165	340.01	0.033	0.137	0.180	0.044	0.053
E_{cm} =	27.0	1	7.042	21.3	48.7	7.465	0.044	16.8		2.3104	4.165	340.01	0.068	0.283	0.371	0.051	0.067
h_0 =	60		7.250	21.3	48.7	7.686	0.265			2.3104	4.165	340.01	0.117	0.487	0.639	0.060	0.076
α_1 =	1.166	$t_{0,T}$	8.00	21.3	48.7	8.481	1.06			2.3104	4.165	340.01	0.177	0.737	0.966	0.072	0.086
α_2 =	1.045	7.421	9.00	21.3	48.7	9.542	2.12			2.3104	4.165	340.01	0.218	0.908	1.190	0.079	0.093
α_3 =	1.116		10.00	21.3	48.7	10.602	3.18			2.3104	4.165	340.01	0.246	1.025	1.343	0.085	0.099
σ =	14.5	$t_{0,adj}$	11.00	21.3	48.7	11.662	4.24			2.3104	4.165	340.01	0.267	1.112	1.458	0.089	0.100
σ/f_{cm} =	0.630	12.527	12.00	21.3	48.7	12.722	5.30			2.3104	4.165	340.01	0.286	1.191	1.561	0.093	0.106
			13.00	21.3	48.7	13.782	6.36			2.3104	4.165	340.01	0.301	1.254	1.643	0.095	0.108
			14.00	21.3	48.7	14.842	7.42			2.3104	4.165	340.01	0.315	1.312	1.720	0.098	0.107
			21.00	21.3	48.7	22.264	14.84			2.3104	4.165	340.01	0.386	1.608	2.107	0.112	0.122
			28.00	21.3	48.7	29.685	22.26			2.3104	4.165	340.01	0.433	1.803	2.364	0.121	0.123
			35.00	21.3	48.7	37.106	29.69			2.3104	4.165	340.01	0.469	1.953	2.561	0.128	0.132
			63.00	21.3	48.7	66.791	59.37			2.3104	4.165	340.01	0.564	2.349	3.079	0.146	0.145
			97.00	21.3	48.7	102.836	95.42			2.3104	4.165	340.01	0.634	2.641	3.461	0.160	0.152
			127.00	21.3	48.7	134.641	127.22			2.3104	4.165	340.01	0.677	2.820	3.696	0.168	0.156
			157.00	21.3	48.7	166.446	159.03			2.3104	4.165	340.01	0.710	2.957	3.876	0.174	0.160
			187.00	21.3	48.7	198.251	190.83			2.3104	4.165	340.01	0.736	3.065	4.018	0.179	0.163
			217.00	21.3	48.7	230.056	222.64			2.3104	4.165	340.01	0.757	3.153	4.133	0.183	0.168
			247.00	21.3	48.7	261.861	254.44			2.3104	4.165	340.01	0.775	3.228	4.231	0.187	0.170
			277.00	21.3	48.7	293.666	286.25			2.3104	4.165	340.01	0.791	3.295	4.319	0.190	0.172
			307.00	21.3	48.7	325.471	318.05			2.3104	4.165	340.01	0.804	3.349	4.389	0.192	0.172
			337.00	21.3	48.7	357.276	349.86			2.3104	4.165	340.01	0.816	3.399	4.455	0.195	0.174
			372.00	21.3	48.7	394.382	386.96			2.3104	4.165	340.01	0.828	3.449	4.521	0.197	0.178
			407.00	21.3	48.7	431.488	424.07			2.3104	4.165	340.01	0.838	3.490	4.575	0.199	0.179
			457.00	21.3	48.7	484.496	477.08			2.3104	4.165	340.01	0.851	3.544	4.646	0.201	0.181
			1000.0	21.3	48.7	1060.167	1052.75			2.3104	4.165	340.01	0.919	3.828	5.017	0.214	
			2500.0	21.3	48.7	2650.418	2643.00			2.3104	4.165	340.01	0.964	4.015	5.263	0.223	
			5000.0	21.3	48.7	5300.837	5293.42			2.3104	4.165	340.01	0.981	4.086	5.356	0.226	
			10000.0	21.3	48.7	10601.67	10594.25			2.3104	4.165	340.01	0.991	4.128	5.410	0.228	

CREEP CALCULATION ACCORDING TO EC2 - RAC28

		t_0 (days)	t (days)	T (°C)	RH (%)	t_T (days)	$(t-t_0)_T$ (days)	β (f_{cm})	β (t_0)	β (RH)	φ_0	β_h	β_c (t,t_0)	φ (t,t_0)	φ_k (t,t_0)	J (t,t_0) x 1E-9	J_{exp} (t,t_0) x 1E-9
$f_c(t_0)$ =	28.1	28	28.000	21.3	48.7	29.685	–	3.1692	0.4705	–	–	–	–	–	–	0.000	–
f_{cm} =	28.1		28.000	21.3	48.7	29.685	0.000			2.3104	3.445	340.01	0.000	0.000	0.000	0.035	0.000
$E_c(t_0)$ =	27.0	α	28.003	21.3	48.7	29.688	0.003	**coeff.**		2.3104	3.445	340.01	0.030	0.103	0.104	0.039	0.046
E_{cm} =	27.0	1	28.042	21.3	48.7	29.729	0.044	16.8		2.3104	3.445	340.01	0.068	0.234	0.236	0.044	0.053
h_0 =	60		28.250	21.3	48.7	29.95	0.265			2.3104	3.445	340.01	0.117	0.403	0.406	0.050	0.062
α_1 =	1.166	$t_{0,T}$	29.00	21.3	48.7	30.745	1.06			2.3104	3.445	340.01	0.177	0.610	0.614	0.057	0.068
α_2 =	1.045	29.685	30.00	21.3	48.7	31.805	2.12			2.3104	3.445	340.01	0.218	0.751	0.756	0.062	0.076
α_3 =	1.116		31.00	21.3	48.7	32.865	3.18			2.3104	3.445	340.01	0.246	0.847	0.854	0.065	0.075
σ =	12.78	$t_{0,adj}$	32.00	21.3	48.7	33.925	4.24			2.3104	3.445	340.01	0.267	0.920	0.926	0.068	0.080
σ/f_{cm} =	0.455	34.102	33.00	21.3	48.7	34.986	5.30			2.3104	3.445	340.01	0.286	0.985	0.992	0.070	0.084
			34.00	21.3	48.7	36.046	6.36			2.3104	3.445	340.01	0.301	1.037	1.044	0.072	0.085
			35.00	21.3	48.7	37.106	7.42			2.3104	3.445	340.01	0.315	1.085	1.093	0.074	0.087
			42.00	21.3	48.7	44.527	14.84			2.3104	3.445	340.01	0.386	1.330	1.339	0.083	0.096
			49.00	21.3	48.7	51.948	22.26			2.3104	3.445	340.01	0.433	1.492	1.502	0.088	0.102
			56.00	21.3	48.7	59.369	29.68			2.3104	3.445	340.01	0.469	1.616	1.627	0.093	0.107
			84.00	21.3	48.7	89.054	59.37			2.3104	3.445	340.01	0.564	1.943	1.957	0.104	0.118
			118.00	21.3	48.7	125.1	95.42			2.3104	3.445	340.01	0.634	2.184	2.200	0.113	0.124
			148.00	21.3	48.7	156.905	127.22			2.3104	3.445	340.01	0.677	2.332	2.349	0.118	0.134
			178.00	21.3	48.7	188.71	159.03			2.3104	3.445	340.01	0.710	2.446	2.464	0.122	0.140
			208.00	21.3	48.7	220.515	190.83			2.3104	3.445	340.01	0.736	2.536	2.554	0.125	0.143
			238.00	21.3	48.7	252.32	222.64			2.3104	3.445	340.01	0.757	2.608	2.627	0.128	0.147
			268.00	21.3	48.7	284.125	254.44			2.3104	3.445	340.01	0.775	2.670	2.689	0.130	0.148
			298.00	21.3	48.7	315.93	286.25			2.3104	3.445	340.01	0.791	2.725	2.745	0.132	0.152
			328.00	21.3	48.7	347.735	318.05			2.3104	3.445	340.01	0.804	2.770	2.790	0.134	0.153
			358.00	21.3	48.7	379.54	349.86			2.3104	3.445	340.01	0.816	2.811	2.831	0.135	0.158
			393.00	21.3	48.7	416.646	386.96			2.3104	3.445	340.01	0.828	2.852	2.873	0.137	0.163
			428.00	21.3	48.7	453.752	424.07			2.3104	3.445	340.01	0.838	2.887	2.908	0.138	0.161
			478.00	21.3	48.7	506.76	477.08			2.3104	3.445	340.01	0.851	2.932	2.953	0.139	0.162
			1000.0	21.3	48.7	1060.167	1030.48			2.3104	3.445	340.01	0.918	3.163	3.185	0.148	
			2500.0	21.3	48.7	2650.418	2620.73			2.3104	3.445	340.01	0.964	3.321	3.345	0.153	
			5000.0	21.3	48.7	5300.837	5271.15			2.3104	3.445	340.01	0.981	3.380	3.404	0.155	
			10000.0	21.3	48.7	10601.67	10571.99			2.3104	3.445	340.01	0.991	3.414	3.439	0.157	

CREEP CALCULATION ACCORDING TO EC2 - HVFAC7

		t_0 (days)	t (days)	T (°C)	RH (%)	t_T (days)	$(t-t_0)_T$ (days)	$\beta(f_{cm})$	$\beta(t_0)$	β (RH)	φ_0	β_h	$\beta_c(t,t_0)$	$\varphi(t,t_0)$	$\varphi_k(t,t_0)$	$J(t,t_0)$ x 1E-9	$J_{exp}(t,t_0)$ x 1E-9
$f_c(t_0)$ =	18.5	7	7.000	21.3	48.7	7.421	–	3.5339	0.5688	–	–	–	–	–	–	0.000	–
f_{cm} =	22.6		7.000	21.3	48.7	7.421	0.000			2.3104	4.644	340.01	0.000	0.000	0.000	0.036	0.000
$E_c(t_0)$ =	26.5	α	7.003	21.3	48.7	7.425	0.004	**coeff.**		2.3104	4.644	340.01	0.033	0.153	0.173	0.042	0.068
E_{cm} =	28.1	1	7.042	21.3	48.7	7.465	0.044	16.8		2.3104	4.644	340.01	0.068	0.316	0.357	0.048	0.076
h_0 =	60		7.250	21.3	48.7	7.686	0.265			2.3104	4.644	340.01	0.117	0.543	0.614	0.057	0.091
α_1 =	1.358	$t_{0,T}$	8.00	21.3	48.7	8.481	1.06			2.3104	4.644	340.01	0.177	0.822	0.929	0.067	0.094
α_2 =	1.091	7.421	9.00	21.3	48.7	9.542	2.12			2.3104	4.644	340.01	0.218	1.012	1.145	0.075	0.103
α_3 =	1.244		10.00	21.3	48.7	10.602	3.18			2.3104	4.644	340.01	0.246	1.142	1.292	0.080	0.108
σ =	9.84	$t_{0,adj}$	11.00	21.3	48.7	11.662	4.24			2.3104	4.644	340.01	0.267	1.240	1.402	0.083	0.110
σ/f_{cm} =	0.532	12.527	12.00	21.3	48.7	12.722	5.30			2.3104	4.644	340.01	0.286	1.328	1.502	0.087	0.115
			13.00	21.3	48.7	13.782	6.36			2.3104	4.644	340.01	0.301	1.398	1.581	0.090	0.115
			14.00	21.3	48.7	14.842	7.42			2.3104	4.644	340.01	0.315	1.463	1.654	0.092	0.116
			21.00	21.3	48.7	22.264	14.84			2.3104	4.644	340.01	0.386	1.793	2.027	0.105	0.126
			28.00	21.3	48.7	29.685	22.26			2.3104	4.644	340.01	0.433	2.011	2.274	0.113	0.128
			35.00	21.3	48.7	37.106	29.69			2.3104	4.644	340.01	0.469	2.178	2.463	0.119	0.131
			63.00	21.3	48.7	66.791	59.37			2.3104	4.644	340.01	0.564	2.619	2.962	0.136	0.141
			97.00	21.3	48.7	102.836	95.42			2.3104	4.644	340.01	0.634	2.944	3.329	0.149	0.149
			127.00	21.3	48.7	134.641	127.22			2.3104	4.644	340.01	0.677	3.144	3.555	0.156	0.147
			157.00	21.3	48.7	166.446	159.03			2.3104	4.644	340.01	0.710	3.297	3.728	0.162	0.154
			187.00	21.3	48.7	198.251	190.83			2.3104	4.644	340.01	0.736	3.418	3.865	0.167	0.155
			217.00	21.3	48.7	230.056	222.64			2.3104	4.644	340.01	0.757	3.516	3.975	0.171	0.157
			247.00	21.3	48.7	261.861	254.44			2.3104	4.644	340.01	0.775	3.599	4.070	0.174	0.160
			277.00	21.3	48.7	293.666	286.25			2.3104	4.644	340.01	0.791	3.673	4.154	0.177	0.162
			307.00	21.3	48.7	325.471	318.05			2.3104	4.644	340.01	0.804	3.734	4.222	0.179	0.166
			337.00	21.3	48.7	357.276	349.86			2.3104	4.644	340.01	0.816	3.790	4.285	0.181	0.168
			372.00	21.3	48.7	394.382	386.96			2.3104	4.644	340.01	0.828	3.845	4.348	0.183	0.171
			407.00	21.3	48.7	431.488	424.07			2.3104	4.644	340.01	0.838	3.892	4.400	0.185	0.174
			457.00	21.3	48.7	484.496	477.08			2.3104	4.644	340.01	0.851	3.952	4.469	0.187	0.178
			1000.0	21.3	48.7	1060.167	1052.75			2.3104	4.644	340.01	0.919	4.268	4.826	0.199	
			2500.0	21.3	48.7	2650.418	2643.00			2.3104	4.644	340.01	0.964	4.477	5.062	0.208	
			5000.0	21.3	48.7	5300.837	5293.42			2.3104	4.644	340.01	0.981	4.556	5.151	0.211	
			10000.0	21.3	48.7	10601.67	10594.25			2.3104	4.644	340.01	0.991	4.602	5.204	0.212	

CREEP CALCULATION ACCORDING TO EC2 - HVFAC28

		t_0 (days)	t (days)	T (°C)	RH (%)	t_T (days)	$(t-t_0)_T$ (days)	$\beta(f_{cm})$	$\beta(t_0)$	β (RH)	φ_0	β_h	$\beta_c(t,t_0)$	$\varphi(t,t_0)$	$\varphi_k(t,t_0)$	$J(t,t_0)$ x 1E-9	$J_{exp}(t,t_0)$ x 1E-9
$f_c(t_0)$ =	22.6	28	28.000	21.3	48.7	29.685	–	3.5339	0.4705	–	–	–	–	–	–	0.000	–
f_{cm} =	22.6		28.000	21.3	48.7	29.685	0.000			2.3104	3.842	340.01	0.000	0.000	0.000	0.034	0.000
$E_c(t_0)$ =	28.1	α	28.003	21.3	48.7	29.688	0.003	coeff.		2.3104	3.842	340.01	0.030	0.115	0.115	0.038	0.048
E_{cm} =	28.1	1	28.042	21.3	48.7	29.729	0.044	16.8		2.3104	3.842	340.01	0.068	0.261	0.262	0.043	0.052
h_0 =	60		28.250	21.3	48.7	29.95	0.265			2.3104	3.842	340.01	0.117	0.450	0.450	0.049	0.057
α_1 =	1.358	$t_{0,T}$	29.00	21.3	48.7	30.745	1.06			2.3104	3.842	340.01	0.177	0.680	0.681	0.057	0.062
α_2 =	1.091	29.685	30.00	21.3	48.7	31.805	2.12			2.3104	3.842	340.01	0.218	0.838	0.839	0.062	0.063
α_3 =	1.244		31.00	21.3	48.7	32.865	3.18			2.3104	3.842	340.01	0.246	0.945	0.947	0.066	0.067
σ =	10.2	$t_{0,adj}$	32.00	21.3	48.7	33.925	4.24			2.3104	3.842	340.01	0.267	1.026	1.028	0.069	0.068
σ/f_{cm} =	0.451	34.102	33.00	21.3	48.7	34.986	5.30			2.3104	3.842	340.01	0.286	1.099	1.101	0.071	0.069
			34.00	21.3	48.7	36.046	6.36			2.3104	3.842	340.01	0.301	1.156	1.159	0.073	0.069
			35.00	21.3	48.7	37.106	7.42			2.3104	3.842	340.01	0.315	1.210	1.213	0.075	0.071
			42.00	21.3	48.7	44.527	14.84			2.3104	3.842	340.01	0.386	1.483	1.486	0.084	0.077
			49.00	21.3	48.7	51.948	22.26			2.3104	3.842	340.01	0.433	1.664	1.667	0.090	0.082
			56.00	21.3	48.7	59.369	29.68			2.3104	3.842	340.01	0.469	1.802	1.805	0.095	0.082
			84.00	21.3	48.7	89.054	59.37			2.3104	3.842	340.01	0.564	2.167	2.171	0.107	0.089
			118.00	21.3	48.7	125.1	95.42			2.3104	3.842	340.01	0.634	2.436	2.441	0.117	0.098
			148.00	21.3	48.7	156.905	127.22			2.3104	3.842	340.01	0.677	2.601	2.606	0.122	0.100
			178.00	21.3	48.7	188.71	159.03			2.3104	3.842	340.01	0.710	2.728	2.733	0.127	0.100
			208.00	21.3	48.7	220.515	190.83			2.3104	3.842	340.01	0.736	2.828	2.833	0.130	0.108
			238.00	21.3	48.7	252.32	222.64			2.3104	3.842	340.01	0.757	2.908	2.914	0.133	0.108
			268.00	21.3	48.7	284.125	254.44			2.3104	3.842	340.01	0.775	2.978	2.983	0.135	0.114
			298.00	21.3	48.7	315.93	286.25			2.3104	3.842	340.01	0.791	3.039	3.045	0.137	0.109
			328.00	21.3	48.7	347.735	318.05			2.3104	3.842	340.01	0.804	3.089	3.095	0.139	0.115
			358.00	21.3	48.7	379.54	349.86			2.3104	3.842	340.01	0.816	3.135	3.141	0.140	0.121
			393.00	21.3	48.7	416.646	386.96			2.3104	3.842	340.01	0.828	3.181	3.188	0.142	0.116
			428.00	21.3	48.7	453.752	424.07			2.3104	3.842	340.01	0.838	3.220	3.226	0.143	0.125
			478.00	21.3	48.7	506.76	477.08			2.3104	3.842	340.01	0.851	3.270	3.276	0.145	0.124
			1000.0	21.3	48.7	1060.167	1030.48			2.3104	3.842	340.01	0.918	3.527	3.534	0.154	
			2500.0	21.3	48.7	2650.418	2620.73			2.3104	3.842	340.01	0.964	3.704	3.711	0.160	
			5000.0	21.3	48.7	5300.837	5271.15			2.3104	3.842	340.01	0.981	3.769	3.777	0.162	
			10000.0	21.3	48.7	10601.67	10571.99			2.3104	3.842	340.01	0.991	3.807	3.815	0.163	

CREEP CALCULATION ACCORDING TO EC2 - RAC7 - CALIBRATED

		t_0 (days)	t (days)	T (°C)	RH (%)	t_T (days)	$(t-t_0)_T$ (days)	$\beta(f_{cm})$	$\beta(t_0)$	β (RH)	φ_0	β_h	$\beta_c(t,t_0)$	$\varphi(t,t_0)$	$\varphi_k(t,t_0)$	$J(t,t_0)$ x 1E-9	$J_{exp}(t,t_0)$ x 1E-9
$f_c(t_0)$ =	23.0	7	7.000	21.3	48.7	7.421	–	2.6410	0.5688	–	–	–	–	–	–	0.000	–
f_{cm} =	28.1		7.000	21.3	48.7	7.421	0.000			2.3104	3.471	129.99	0.000	0.000	0.000	0.037	0.000
$E_c(t_0)$ =	25.4	α	7.003	21.3	48.7	7.425	0.004	coeff.	H	2.3104	3.471	129.99	0.044	0.153	0.200	0.045	0.053
E_{cm} =	27.0	1	7.042	21.3	48.7	7.465	0.044	14	-2	2.3104	3.471	129.99	0.091	0.316	0.414	0.052	0.067
h_0 =	60		7.250	21.3	48.7	7.686	0.265			2.3104	3.471	129.99	0.156	0.541	0.710	0.063	0.076
α_1 =	1.166	$t_{0,T}$	8.00	21.3	48.7	8.481	1.06			2.3104	3.471	129.99	0.236	0.819	1.074	0.075	0.086
α_2 =	1.045	7.421	9.00	21.3	48.7	9.542	2.12			2.3104	3.471	129.99	0.290	1.007	1.319	0.084	0.093
α_3 =	1.116		10.00	21.3	48.7	10.602	3.18			2.3104	3.471	129.99	0.326	1.132	1.483	0.090	0.099
σ =	14.5	$t_{0,adj}$	11.00	21.3	48.7	11.662	4.24			2.3104	3.471	129.99	0.355	1.232	1.615	0.094	0.100
σ/f_{cm} =	0.630	12.527	12.00	21.3	48.7	12.722	5.30			2.3104	3.471	129.99	0.378	1.312	1.720	0.098	0.106
			13.00	21.3	48.7	13.782	6.36			2.3104	3.471	129.99	0.399	1.385	1.815	0.102	0.108
			14.00	21.3	48.7	14.842	7.42			2.3104	3.471	129.99	0.417	1.447	1.897	0.104	0.107
			21.00	21.3	48.7	22.264	14.84			2.3104	3.471	129.99	0.505	1.753	2.298	0.119	0.122
			28.00	21.3	48.7	29.685	22.26			2.3104	3.471	129.99	0.562	1.951	2.557	0.128	0.123
			35.00	21.3	48.7	37.106	29.69			2.3104	3.471	129.99	0.604	2.096	2.748	0.134	0.132
			63.00	21.3	48.7	66.791	59.37			2.3104	3.471	129.99	0.706	2.451	3.212	0.151	0.145
			97.00	21.3	48.7	102.836	95.42			2.3104	3.471	129.99	0.773	2.683	3.517	0.162	0.152
			127.00	21.3	48.7	134.641	127.22			2.3104	3.471	129.99	0.810	2.812	3.685	0.167	0.156
			157.00	21.3	48.7	166.446	159.03			2.3104	3.471	129.99	0.836	2.902	3.804	0.172	0.160
			187.00	21.3	48.7	198.251	190.83			2.3104	3.471	129.99	0.856	2.971	3.895	0.175	0.163
			217.00	21.3	48.7	230.056	222.64			2.3104	3.471	129.99	0.871	3.023	3.963	0.177	0.168
			247.00	21.3	48.7	261.861	254.44			2.3104	3.471	129.99	0.884	3.068	4.022	0.179	0.170
			277.00	21.3	48.7	293.666	286.25			2.3104	3.471	129.99	0.894	3.103	4.068	0.181	0.172
			307.00	21.3	48.7	325.471	318.05			2.3104	3.471	129.99	0.902	3.131	4.104	0.182	0.172
			337.00	21.3	48.7	357.276	349.86			2.3104	3.471	129.99	0.910	3.159	4.140	0.184	0.174
			372.00	21.3	48.7	394.382	386.96			2.3104	3.471	129.99	0.917	3.183	4.172	0.185	0.178
			407.00	21.3	48.7	431.488	424.07			2.3104	3.471	129.99	0.923	3.204	4.200	0.186	0.179
			457.00	21.3	48.7	484.496	477.08			2.3104	3.471	129.99	0.930	3.228	4.231	0.187	0.181
			1000.0	21.3	48.7	1060.167	1052.75			2.3104	3.471	129.99	0.966	3.353	4.395	0.193	
			2500.0	21.3	48.7	2650.418	2643.00			2.3104	3.471	129.99	0.986	3.422	4.486	0.196	
			5000.0	21.3	48.7	5300.837	5293.42			2.3104	3.471	129.99	0.993	3.447	4.518	0.197	
			10000.0	21.3	48.7	10601.67	10594.25			2.3104	3.471	129.99	0.996	3.457	4.532	0.197	

CREEP CALCULATION ACCORDING TO EC2 - RAC28 - CALIBRATED

		t_0 (days)	t (days)	T (°C)	RH (%)	t_T (days)	$(t-t_0)_T$ (days)	$\beta\ (f_{cm})$	$\beta\ (t_0)$	β (RH)	φ_0	β_h	$\beta_c\ (t,t_0)$	$\varphi\ (t,t_0)$	$\varphi_k\ (t,t_0)$	$J\ (t,t_0)$ x 1E-9	$J_{exp}\ (t,t_0)$ x 1E-9
$f_c\ (t_0)$ =	28.1	28	28.000	21.3	48.7	29.685	–	3.7729	0.4705	–	–	–	–	–	–	0.000	–
f_{cm} =	28.1		28.000	21.3	48.7	29.685	0.000			2.3104	4.101	340.01	0.000	0.000	0.000	0.035	0.000
$E_c\ (t_0)$ =	27.0	α	28.003	21.3	48.7	29.688	0.003	**coeff.**	**H**	2.3104	4.101	340.01	0.030	0.123	0.124	0.040	0.046
E_{cm} =	27.0	1	28.042	21.3	48.7	29.729	0.044	20	1.5	2.3104	4.101	340.01	0.068	0.279	0.281	0.045	0.053
h_0 =	60		28.250	21.3	48.7	29.95	0.265			2.3104	4.101	340.01	0.117	0.480	0.483	0.052	0.062
α_1 =	1.166	$t_{0,T}$	29.00	21.3	48.7	30.745	1.06			2.3104	4.101	340.01	0.177	0.726	0.731	0.061	0.068
α_2 =	1.045	29.685	30.00	21.3	48.7	31.805	2.12			2.3104	4.101	340.01	0.218	0.894	0.900	0.067	0.076
α_3 =	1.116		31.00	21.3	48.7	32.865	3.18			2.3104	4.101	340.01	0.246	1.009	1.016	0.071	0.075
σ =	12.78	$t_{0,adj}$	32.00	21.3	48.7	33.925	4.24			2.3104	4.101	340.01	0.267	1.095	1.103	0.074	0.080
σ/f_{cm} =	0.455	34.102	33.00	21.3	48.7	34.986	5.30			2.3104	4.101	340.01	0.286	1.173	1.181	0.077	0.084
			34.00	21.3	48.7	36.046	6.36			2.3104	4.101	340.01	0.301	1.234	1.243	0.079	0.085
			35.00	21.3	48.7	37.106	7.42			2.3104	4.101	340.01	0.315	1.292	1.301	0.081	0.087
			42.00	21.3	48.7	44.527	14.84			2.3104	4.101	340.01	0.386	1.583	1.594	0.092	0.096
			49.00	21.3	48.7	51.948	22.26			2.3104	4.101	340.01	0.433	1.776	1.789	0.098	0.102
			56.00	21.3	48.7	59.369	29.68			2.3104	4.101	340.01	0.469	1.923	1.937	0.104	0.107
			84.00	21.3	48.7	89.054	59.37			2.3104	4.101	340.01	0.564	2.313	2.330	0.117	0.118
			118.00	21.3	48.7	125.1	95.42			2.3104	4.101	340.01	0.634	2.600	2.619	0.128	0.124
			148.00	21.3	48.7	156.905	127.22			2.3104	4.101	340.01	0.677	2.776	2.796	0.134	0.134
			178.00	21.3	48.7	188.71	159.03			2.3104	4.101	340.01	0.710	2.912	2.933	0.139	0.140
			208.00	21.3	48.7	220.515	190.83			2.3104	4.101	340.01	0.736	3.018	3.040	0.143	0.143
			238.00	21.3	48.7	252.32	222.64			2.3104	4.101	340.01	0.757	3.104	3.127	0.146	0.147
			268.00	21.3	48.7	284.125	254.44			2.3104	4.101	340.01	0.775	3.178	3.201	0.148	0.148
			298.00	21.3	48.7	315.93	286.25			2.3104	4.101	340.01	0.791	3.244	3.267	0.151	0.152
			328.00	21.3	48.7	347.735	318.05			2.3104	4.101	340.01	0.804	3.297	3.321	0.152	0.153
			358.00	21.3	48.7	379.54	349.86			2.3104	4.101	340.01	0.816	3.346	3.371	0.154	0.158
			393.00	21.3	48.7	416.646	386.96			2.3104	4.101	340.01	0.828	3.396	3.420	0.156	0.163
			428.00	21.3	48.7	453.752	424.07			2.3104	4.101	340.01	0.838	3.437	3.461	0.157	0.161
			478.00	21.3	48.7	506.76	477.08			2.3104	4.101	340.01	0.851	3.490	3.515	0.159	0.162
			1000.0	21.3	48.7	1060.167	1030.48			2.3104	4.101	340.01	0.918	3.765	3.792	0.169	
			2500.0	21.3	48.7	2650.418	2620.73			2.3104	4.101	340.01	0.964	3.953	3.982	0.176	
			5000.0	21.3	48.7	5300.837	5271.15			2.3104	4.101	340.01	0.981	4.023	4.052	0.178	
			10000.0	21.3	48.7	10601.67	10571.99			2.3104	4.101	340.01	0.991	4.064	4.093	0.180	

CREEP CALCULATION ACCORDING TO EC2 - HVFAC7 - CALIBRATED

		t_0 (days)	t (days)	T (°C)	RH (%)	t_T (days)	$(t-t_0)_T$ (days)	β (f_{cm})	β (t_0)	β (RH)	φ_0	β_h	β_c (t,t_0)	φ (t,t_0)	φ_k (t,t_0)	J (t,t_0) x 1E-9	J_{exp} (t,t_0) x 1E-9
f_c (t_0) =	18.5	7	7.000	21.3	48.7	7.421	–	3.1553	0.5688	–	–	–	–	–	–	0.000	–
f_{cm} =	22.6		7.000	21.3	48.7	7.421	0.000			2.3104	4.147	129.99	0.000	0.000	0.000	0.036	0.000
E_c (t_0) =	26.5	**α**	7.003	21.3	48.7	7.425	0.004	**coeff.**	**H**	2.3104	4.147	129.99	0.044	0.182	0.206	0.043	0.068
E_{cm} =	28.1	1	7.042	21.3	48.7	7.465	0.044	15	-2	2.3104	4.147	129.99	0.091	0.377	0.427	0.050	0.076
h_0 =	60		7.250	21.3	48.7	7.686	0.265			2.3104	4.147	129.99	0.156	0.647	0.731	0.061	0.091
α_1 =	1.358	$t_{0,T}$	8.00	21.3	48.7	8.481	1.06			2.3104	4.147	129.99	0.236	0.979	1.107	0.073	0.094
α_2 =	1.091	7.421	9.00	21.3	48.7	9.542	2.12			2.3104	4.147	129.99	0.290	1.203	1.360	0.082	0.103
α_3 =	1.244		10.00	21.3	48.7	10.602	3.18			2.3104	4.147	129.99	0.326	1.352	1.529	0.088	0.108
σ =	9.84	$t_{0,adj}$	11.00	21.3	48.7	11.662	4.24			2.3104	4.147	129.99	0.355	1.472	1.665	0.092	0.110
σ/f_{cm} =	0.532	12.527	12.00	21.3	48.7	12.722	5.30			2.3104	4.147	129.99	0.378	1.568	1.772	0.096	0.115
			13.00	21.3	48.7	13.782	6.36			2.3104	4.147	129.99	0.399	1.655	1.871	0.099	0.115
			14.00	21.3	48.7	14.842	7.42			2.3104	4.147	129.99	0.417	1.729	1.955	0.102	0.116
			21.00	21.3	48.7	22.264	14.84			2.3104	4.147	129.99	0.505	2.094	2.368	0.116	0.126
			28.00	21.3	48.7	29.685	22.26			2.3104	4.147	129.99	0.562	2.331	2.635	0.125	0.128
			35.00	21.3	48.7	37.106	29.69			2.3104	4.147	129.99	0.604	2.505	2.832	0.132	0.131
			63.00	21.3	48.7	66.791	59.37			2.3104	4.147	129.99	0.706	2.928	3.310	0.148	0.141
			97.00	21.3	48.7	102.836	95.42			2.3104	4.147	129.99	0.773	3.206	3.625	0.159	0.149
			127.00	21.3	48.7	134.641	127.22			2.3104	4.147	129.99	0.810	3.359	3.798	0.165	0.147
			157.00	21.3	48.7	166.446	159.03			2.3104	4.147	129.99	0.836	3.467	3.920	0.169	0.154
			187.00	21.3	48.7	198.251	190.83			2.3104	4.147	129.99	0.856	3.550	4.014	0.172	0.155
			217.00	21.3	48.7	230.056	222.64			2.3104	4.147	129.99	0.871	3.612	4.084	0.174	0.157
			247.00	21.3	48.7	261.861	254.44			2.3104	4.147	129.99	0.884	3.666	4.145	0.176	0.160
			277.00	21.3	48.7	293.666	286.25			2.3104	4.147	129.99	0.894	3.707	4.192	0.178	0.162
			307.00	21.3	48.7	325.471	318.05			2.3104	4.147	129.99	0.902	3.741	4.229	0.179	0.166
			337.00	21.3	48.7	357.276	349.86			2.3104	4.147	129.99	0.910	3.774	4.267	0.181	0.168
			372.00	21.3	48.7	394.382	386.96			2.3104	4.147	129.99	0.917	3.803	4.300	0.182	0.171
			407.00	21.3	48.7	431.488	424.07			2.3104	4.147	129.99	0.923	3.828	4.328	0.183	0.174
			457.00	21.3	48.7	484.496	477.08			2.3104	4.147	129.99	0.930	3.857	4.361	0.184	0.178
			1000.0	21.3	48.7	1060.167	1052.75			2.3104	4.147	129.99	0.966	4.006	4.530	0.189	
			2500.0	21.3	48.7	2650.418	2643.00			2.3104	4.147	129.99	0.986	4.089	4.623	0.193	
			5000.0	21.3	48.7	5300.837	5293.42			2.3104	4.147	129.99	0.993	4.118	4.656	0.194	
			10000.0	21.3	48.7	10601.67	10594.25			2.3104	4.147	129.99	0.996	4.130	4.670	0.194	

CREEP CALCULATION ACCORDING TO EC2 - HVFAC28 - CALIBRATED

		t_0 (days)	t (days)	T (°C)	RH (%)	t_T (days)	$(t\text{-}t_0)_T$ (days)	β (f_{cm})	β (t_0)	β (RH)	φ_0	β_h	β_c (t,t_0)	φ (t,t_0)	φ_k (t,t_0)	J (t,t_0) x 1E-9	J_{exp} (t,t_0) x 1E-9
f_c (t_0) =	22.6	28	28.000	21.3	48.7	29.685	–	3.5339	0.4705	–	–	–	–	–	–	0.000	–
f_{cm} =	22.6		28.000	21.3	48.7	29.685	0.000			2.3104	3.842	850.04	0.000	0.000	0.000	0.034	0.000
E_c (t_0) =	28.1	α	28.003	21.3	48.7	29.688	0.003	coeff.	H	2.3104	3.842	850.04	0.023	0.088	0.089	0.037	0.048
E_{cm} =	28.1	1	28.042	21.3	48.7	29.729	0.044	16.8	10	2.3104	3.842	850.04	0.052	0.200	0.200	0.041	0.052
h_0 =	60		28.250	21.3	48.7	29.95	0.265			2.3104	3.842	850.04	0.089	0.342	0.343	0.046	0.057
α_1 =	1.358	$t_{0,T}$	29.00	21.3	48.7	30.745	1.06			2.3104	3.842	850.04	0.134	0.515	0.516	0.051	0.062
α_2 =	1.091	29.685	30.00	21.3	48.7	31.805	2.12			2.3104	3.842	850.04	0.165	0.634	0.635	0.055	0.063
α_3 =	1.244		31.00	21.3	48.7	32.865	3.18			2.3104	3.842	850.04	0.187	0.718	0.720	0.058	0.067
σ =	10.2	$t_{0,adj}$	32.00	21.3	48.7	33.925	4.24			2.3104	3.842	850.04	0.204	0.784	0.785	0.061	0.068
σ/f_{cm} =	0.451	34.102	33.00	21.3	48.7	34.986	5.30			2.3104	3.842	850.04	0.218	0.838	0.839	0.062	0.069
			34.00	21.3	48.7	36.046	6.36			2.3104	3.842	850.04	0.230	0.884	0.885	0.064	0.069
			35.00	21.3	48.7	37.106	7.42			2.3104	3.842	850.04	0.241	0.926	0.928	0.065	0.071
			42.00	21.3	48.7	44.527	14.84			2.3104	3.842	850.04	0.295	1.133	1.136	0.072	0.077
			49.00	21.3	48.7	51.948	22.26			2.3104	3.842	850.04	0.333	1.279	1.282	0.077	0.082
			56.00	21.3	48.7	59.369	29.68			2.3104	3.842	850.04	0.362	1.391	1.394	0.081	0.082
			84.00	21.3	48.7	89.054	59.37			2.3104	3.842	850.04	0.441	1.694	1.698	0.091	0.089
			118.00	21.3	48.7	125.1	95.42			2.3104	3.842	850.04	0.503	1.933	1.936	0.100	0.098
			148.00	21.3	48.7	156.905	127.22			2.3104	3.842	850.04	0.542	2.082	2.087	0.105	0.100
			178.00	21.3	48.7	188.71	159.03			2.3104	3.842	850.04	0.574	2.205	2.210	0.109	0.100
			208.00	21.3	48.7	220.515	190.83			2.3104	3.842	850.04	0.601	2.309	2.314	0.112	0.108
			238.00	21.3	48.7	252.32	222.64			2.3104	3.842	850.04	0.624	2.397	2.402	0.115	0.108
			268.00	21.3	48.7	284.125	254.44			2.3104	3.842	850.04	0.644	2.474	2.479	0.118	0.114
			298.00	21.3	48.7	315.93	286.25			2.3104	3.842	850.04	0.661	2.540	2.545	0.120	0.109
			328.00	21.3	48.7	347.735	318.05			2.3104	3.842	850.04	0.677	2.601	2.606	0.122	0.115
			358.00	21.3	48.7	379.54	349.86			2.3104	3.842	850.04	0.691	2.655	2.660	0.124	0.121
			393.00	21.3	48.7	416.646	386.96			2.3104	3.842	850.04	0.706	2.712	2.718	0.126	0.116
			428.00	21.3	48.7	453.752	424.07			2.3104	3.842	850.04	0.719	2.762	2.768	0.128	0.125
			478.00	21.3	48.7	506.76	477.08			2.3104	3.842	850.04	0.736	2.828	2.833	0.130	0.124
			1000.0	21.3	48.7	1060.167	1030.48			2.3104	3.842	850.04	0.835	3.208	3.214	0.143	
			2500.0	21.3	48.7	2650.418	2620.73			2.3104	3.842	850.04	0.919	3.531	3.538	0.154	
			5000.0	21.3	48.7	5300.837	5271.15			2.3104	3.842	850.04	0.956	3.673	3.680	0.159	
			10000.0	21.3	48.7	10601.67	10571.99			2.3104	3.842	850.04	0.977	3.754	3.761	0.161	

CREEP CALCULATION ACCORDING TO ACI 209R - RAC7

		t_0 (days)	t (days)	T (ºC)	RH (%)	($t-t_0$) (days)	$\gamma_{c,t0}$	$\gamma_{c,RH}$	φ_u	φ (t,t_0)	J (t,t_0) x 1E-9	J_{exp} (t,t_0) x 1E-9
f_{cm} =	28.1	7	7.000	21.3	48.7	–	0.9935	–	–	–	0.000	–
E_c (t_0) =	22.2		7.000	21.3	48.7	0.000		0.9437	2.8	0.000	0.045	0.000
V/S (mm)=	30		7.003	21.3	48.7	0.003	**coeff.**	0.9437	2.8	0.000	0.045	0.053
d =	39.81		7.042	21.3	48.7	0.042	2.35	0.9437	2.8	0.003	0.045	0.067
ψ =	1.0		7.250	21.3	48.7	0.250		0.9437	2.8	0.017	0.046	0.076
$\gamma_{c,vs}$ =	1.064		8.00	21.3	48.7	1.000		0.9437	2.8	0.069	0.048	0.086
s =	110		9.00	21.3	48.7	2.000		0.9437	2.8	0.134	0.051	0.093
$\gamma_{c,s}$ =	1.11		10.00	21.3	48.7	3.000		0.9437	2.8	0.196	0.054	0.099
ψ =	81.8		11.00	21.3	48.7	4.000		0.9437	2.8	0.256	0.057	0.100
$\gamma_{c,\psi}$ =	1.076		12.00	21.3	48.7	5.000		0.9437	2.8	0.312	0.059	0.106
α_{air} =	4		13.00	21.3	48.7	6.000		0.9437	2.8	0.367	0.062	0.108
$\gamma_{c,\alpha}$ =	1.000		14.00	21.3	48.7	7.000		0.9437	2.8	0.419	0.064	0.107
			21.00	21.3	48.7	14.000		0.9437	2.8	0.729	0.078	0.122
			28.00	21.3	48.7	21.000		0.9437	2.8	0.967	0.089	0.123
			35.00	21.3	48.7	28.000		0.9437	2.8	1.156	0.097	0.132
			63.00	21.3	48.7	56.000		0.9437	2.8	1.637	0.119	0.145
			97.00	21.3	48.7	90.000		0.9437	2.8	1.941	0.132	0.152
			127.00	21.3	48.7	120.000		0.9437	2.8	2.103	0.140	0.156
			157.00	21.3	48.7	150.000		0.9437	2.8	2.213	0.145	0.160
			187.00	21.3	48.7	180.000		0.9437	2.8	2.293	0.148	0.163
			217.00	21.3	48.7	210.000		0.9437	2.8	2.354	0.151	0.168
			247.00	21.3	48.7	240.000		0.9437	2.8	2.402	0.153	0.170
			277.00	21.3	48.7	270.000		0.9437	2.8	2.440	0.155	0.172
			307.00	21.3	48.7	300.000		0.9437	2.8	2.472	0.156	0.172
			337.00	21.3	48.7	330.000		0.9437	2.8	2.499	0.158	0.174
			372.00	21.3	48.7	365.000		0.9437	2.8	2.525	0.159	0.178
			407.00	21.3	48.7	400.000		0.9437	2.8	2.547	0.160	0.179
			457.00	21.3	48.7	450.000		0.9437	2.8	2.572	0.161	0.181
			1000.0	21.3	48.7	993.000		0.9437	2.8	2.692	0.166	
			2500.0	21.3	48.7	2493.000		0.9437	2.8	2.756	0.169	
			5000.0	21.3	48.7	4993.000		0.9437	2.8	2.778	0.170	
			10000.0	21.3	48.7	9993.000		0.9437	2.8	2.789	0.171	

CREEP CALCULATION ACCORDING TO ACI 209R - RAC28

		t_0 (days)	t (days)	T (ºC)	RH (%)	$(t-t_0)$ (days)	$\gamma_{c,t0}$	$\gamma_{c,RH}$	φ_u	$\varphi(t,t_0)$	$J(t,t_0)$ x 1E-9	$J_{exp}(t,t_0)$ x 1E-9
f_{cm} =	28.1	28	28.000	21.3	48.7	–	0.8436	–	–	–	0.000	–
$E_c(t_0)$ =	26.5		28.000	21.3	48.7	0.000		0.9437	2.377	0.000	0.038	0.000
V/S (mm)=	30		28.003	21.3	48.7	0.003	**coeff.**	0.9437	2.377	0.000	0.038	0.046
d =	39.81		28.042	21.3	48.7	0.042	2.35	0.9437	2.377	0.002	0.038	0.053
ψ =	1.0		28.250	21.3	48.7	0.250		0.9437	2.377	0.015	0.038	0.062
$\gamma_{c,vs}$ =	1.064		29.00	21.3	48.7	1.000		0.9437	2.377	0.058	0.040	0.068
s =	110		30.00	21.3	48.7	2.000		0.9437	2.377	0.114	0.042	0.076
$\gamma_{c,s}$ =	1.11		31.00	21.3	48.7	3.000		0.9437	2.377	0.167	0.044	0.075
ψ =	81.8		32.00	21.3	48.7	4.000		0.9437	2.377	0.217	0.046	0.080
$\gamma_{c,\psi}$ =	1.076		33.00	21.3	48.7	5.000		0.9437	2.377	0.265	0.048	0.084
α_{air} =	4		34.00	21.3	48.7	6.000		0.9437	2.377	0.311	0.049	0.085
$\gamma_{c,\alpha}$ =	1.000		35.00	21.3	48.7	7.000		0.9437	2.377	0.355	0.051	0.087
			42.00	21.3	48.7	14.000		0.9437	2.377	0.618	0.061	0.096
			49.00	21.3	48.7	21.000		0.9437	2.377	0.821	0.069	0.102
			56.00	21.3	48.7	28.000		0.9437	2.377	0.982	0.075	0.107
			84.00	21.3	48.7	56.000		0.9437	2.377	1.389	0.090	0.118
			118.00	21.3	48.7	90.000		0.9437	2.377	1.648	0.100	0.124
			148.00	21.3	48.7	120.000		0.9437	2.377	1.785	0.105	0.134
			178.00	21.3	48.7	150.000		0.9437	2.377	1.878	0.109	0.140
			208.00	21.3	48.7	180.000		0.9437	2.377	1.947	0.111	0.143
			238.00	21.3	48.7	210.000		0.9437	2.377	1.998	0.113	0.147
			268.00	21.3	48.7	240.000		0.9437	2.377	2.039	0.115	0.148
			298.00	21.3	48.7	270.000		0.9437	2.377	2.072	0.116	0.152
			328.00	21.3	48.7	300.000		0.9437	2.377	2.099	0.117	0.153
			358.00	21.3	48.7	330.000		0.9437	2.377	2.121	0.118	0.158
			393.00	21.3	48.7	365.000		0.9437	2.377	2.143	0.119	0.163
			428.00	21.3	48.7	400.000		0.9437	2.377	2.162	0.119	0.161
			478.00	21.3	48.7	450.000		0.9437	2.377	2.184	0.120	0.162
			1000.0	21.3	48.7	972.000		0.9437	2.377	2.283	0.124	
			2500.0	21.3	48.7	2472.000		0.9437	2.377	2.339	0.126	
			5000.0	21.3	48.7	4972.000		0.9437	2.377	2.358	0.127	
			10000.0	21.3	48.7	9972.000		0.9437	2.377	2.368	0.127	

CREEP CALCULATION ACCORDING TO ACI 209R - HVFAC7

		t_0 (days)	t (days)	T (ºC)	RH (%)	$(t-t_0)$ (days)	$\gamma_{c,t0}$	$\gamma_{c,RH}$	φ_u	$\varphi\ (t,t_0)$	$J\ (t,t_0)$ x 1E-9	$J_{exp}\ (t,t_0)$ x 1E-9
f_{cm} =	22.6	7	7.000	21.3	48.7	–	0.9935	–	–	–	0.000	–
$E_c\ (t_0)$ =	19.9		7.000	21.3	48.7	0.000		0.9437	2.639	0.000	0.050	0.000
V/S (mm)=	30		7.003	21.3	48.7	0.003	**coeff.**	0.9437	2.639	0.000	0.050	0.068
d =	39.81		7.042	21.3	48.7	0.042	2.35	0.9437	2.639	0.003	0.050	0.076
ψ =	1.0		7.250	21.3	48.7	0.250		0.9437	2.639	0.016	0.051	0.091
$\gamma_{c,vs}$ =	1.064		8.00	21.3	48.7	1.000		0.9437	2.639	0.065	0.054	0.094
s =	70		9.00	21.3	48.7	2.000		0.9437	2.639	0.126	0.057	0.103
$\gamma_{c,s}$ =	1.005		10.00	21.3	48.7	3.000		0.9437	2.639	0.185	0.060	0.108
ψ =	100		11.00	21.3	48.7	4.000		0.9437	2.639	0.241	0.062	0.110
$\gamma_{c,\psi}$ =	1.12		12.00	21.3	48.7	5.000		0.9437	2.639	0.294	0.065	0.115
α_{air} =	1.5		13.00	21.3	48.7	6.000		0.9437	2.639	0.346	0.068	0.115
$\gamma_{c,\alpha}$ =	1.000		14.00	21.3	48.7	7.000		0.9437	2.639	0.395	0.070	0.116
			21.00	21.3	48.7	14.000		0.9437	2.639	0.687	0.085	0.126
			28.00	21.3	48.7	21.000		0.9437	2.639	0.911	0.096	0.128
			35.00	21.3	48.7	28.000		0.9437	2.639	1.090	0.105	0.131
			63.00	21.3	48.7	56.000		0.9437	2.639	1.542	0.128	0.141
			97.00	21.3	48.7	90.000		0.9437	2.639	1.830	0.142	0.149
			127.00	21.3	48.7	120.000		0.9437	2.639	1.982	0.150	0.147
			157.00	21.3	48.7	150.000		0.9437	2.639	2.086	0.155	0.154
			187.00	21.3	48.7	180.000		0.9437	2.639	2.161	0.159	0.155
			217.00	21.3	48.7	210.000		0.9437	2.639	2.218	0.162	0.157
			247.00	21.3	48.7	240.000		0.9437	2.639	2.264	0.164	0.160
			277.00	21.3	48.7	270.000		0.9437	2.639	2.300	0.166	0.162
			307.00	21.3	48.7	300.000		0.9437	2.639	2.330	0.167	0.166
			337.00	21.3	48.7	330.000		0.9437	2.639	2.355	0.169	0.168
			372.00	21.3	48.7	365.000		0.9437	2.639	2.379	0.170	0.171
			407.00	21.3	48.7	400.000		0.9437	2.639	2.400	0.171	0.174
			457.00	21.3	48.7	450.000		0.9437	2.639	2.425	0.172	0.178
			1000.0	21.3	48.7	993.000		0.9437	2.639	2.537	0.178	
			2500.0	21.3	48.7	2493.000		0.9437	2.639	2.598	0.181	
			5000.0	21.3	48.7	4993.000		0.9437	2.639	2.618	0.182	
			10000.0	21.3	48.7	9993.000		0.9437	2.639	2.629	0.182	

CREEP CALCULATION ACCORDING TO ACI 209R - HVFAC28

		t_0 (days)	t (days)	T (ºC)	RH (%)	$(t-t_0)$ (days)	$\gamma_{c,t0}$	$\gamma_{c,RH}$	φ_u	$\varphi(t,t_0)$	$J(t,t_0)$ x 1E-9	$J_{exp}(t,t_0)$ x 1E-9
f_{cm} =	22.6	28	28.000	21.3	48.7	–	0.8436	–	–	–	0.000	–
$E_c(t_0)$ =	23.8		28.000	21.3	48.7	0.000		0.9437	2.241	0.000	0.042	0.000
V/S (mm)=	30		28.003	21.3	48.7	0.003	**coeff.**	0.9437	2.241	0.000	0.042	0.048
d =	39.81		28.042	21.3	48.7	0.042	2.35	0.9437	2.241	0.002	0.042	0.052
ψ =	1.0		28.250	21.3	48.7	0.250		0.9437	2.241	0.014	0.043	0.057
$\gamma_{c,vs}$ =	1.064		29.00	21.3	48.7	1.000		0.9437	2.241	0.055	0.044	0.062
s =	70		30.00	21.3	48.7	2.000		0.9437	2.241	0.107	0.047	0.063
$\gamma_{c,s}$ =	1.005		31.00	21.3	48.7	3.000		0.9437	2.241	0.157	0.049	0.067
ψ =	100		32.00	21.3	48.7	4.000		0.9437	2.241	0.205	0.051	0.068
$\gamma_{c,\psi}$ =	1.12		33.00	21.3	48.7	5.000		0.9437	2.241	0.250	0.053	0.069
α_{air} =	1.5		34.00	21.3	48.7	6.000		0.9437	2.241	0.294	0.054	0.069
$\gamma_{c,\alpha}$ =	1.000		35.00	21.3	48.7	7.000		0.9437	2.241	0.335	0.056	0.071
			42.00	21.3	48.7	14.000		0.9437	2.241	0.583	0.067	0.077
			49.00	21.3	48.7	21.000		0.9437	2.241	0.774	0.075	0.082
			56.00	21.3	48.7	28.000		0.9437	2.241	0.925	0.081	0.082
			84.00	21.3	48.7	56.000		0.9437	2.241	1.310	0.097	0.089
			118.00	21.3	48.7	90.000		0.9437	2.241	1.554	0.107	0.098
			148.00	21.3	48.7	120.000		0.9437	2.241	1.683	0.113	0.100
			178.00	21.3	48.7	150.000		0.9437	2.241	1.771	0.116	0.100
			208.00	21.3	48.7	180.000		0.9437	2.241	1.835	0.119	0.108
			238.00	21.3	48.7	210.000		0.9437	2.241	1.884	0.121	0.108
			268.00	21.3	48.7	240.000		0.9437	2.241	1.922	0.123	0.114
			298.00	21.3	48.7	270.000		0.9437	2.241	1.953	0.124	0.109
			328.00	21.3	48.7	300.000		0.9437	2.241	1.978	0.125	0.115
			358.00	21.3	48.7	330.000		0.9437	2.241	2.000	0.126	0.121
			393.00	21.3	48.7	365.000		0.9437	2.241	2.021	0.127	0.116
			428.00	21.3	48.7	400.000		0.9437	2.241	2.038	0.128	0.125
			478.00	21.3	48.7	450.000		0.9437	2.241	2.059	0.129	0.124
			1000.0	21.3	48.7	972.000		0.9437	2.241	2.153	0.132	
			2500.0	21.3	48.7	2472.000		0.9437	2.241	2.205	0.135	
			5000.0	21.3	48.7	4972.000		0.9437	2.241	2.223	0.135	
			10000.0	21.3	48.7	9972.000		0.9437	2.241	2.232	0.136	

CREEP CALCULATION ACCORDING TO ACI 209R - RAC7 - CALIBRATED

		t_0 (days)	t (days)	T (ºC)	RH (%)	$(t-t_0)$ (days)	$\gamma_{c,t0}$	$\gamma_{c,RH}$	φ_u	$\varphi(t,t_0)$	$J(t,t_0)$ x 1E-9	$J_{exp}(t,t_0)$ x 1E-9
f_{cm} =	28.1	7	7.000	21.3	48.7	–	0.9935	–	–	–	0.000	–
$E_c(t_0)$ =	22.2		7.000	21.3	48.7	0.000		0.9437	3.574	0.000	0.045	0.000
V/S (mm)=	30		7.003	21.3	48.7	0.003	**coeff.**	0.9437	3.574	0.024	0.046	0.053
d =	5.00		7.042	21.3	48.7	0.042	3	0.9437	3.574	0.103	0.050	0.067
ψ =	0.6		7.250	21.3	48.7	0.250		0.9437	3.574	0.286	0.058	0.076
$\gamma_{c,vs}$ =	1.064		8.00	21.3	48.7	1.000		0.9437	3.574	0.596	0.072	0.086
s =	110		9.00	21.3	48.7	2.000		0.9437	3.574	0.831	0.082	0.093
$\gamma_{c,s}$ =	1.11		10.00	21.3	48.7	3.000		0.9437	3.574	0.997	0.090	0.099
ψ =	81.8		11.00	21.3	48.7	4.000		0.9437	3.574	1.125	0.096	0.100
$\gamma_{c,\psi}$ =	1.076		12.00	21.3	48.7	5.000		0.9437	3.574	1.231	0.100	0.106
α_{air} =	4		13.00	21.3	48.7	6.000		0.9437	3.574	1.321	0.105	0.108
$\gamma_{c,\alpha}$ =	1.000		14.00	21.3	48.7	7.000		0.9437	3.574	1.398	0.108	0.107
			21.00	21.3	48.7	14.000		0.9437	3.574	1.764	0.125	0.122
			28.00	21.3	48.7	21.000		0.9437	3.574	1.980	0.134	0.123
			35.00	21.3	48.7	28.000		0.9437	3.574	2.131	0.141	0.132
			63.00	21.3	48.7	56.000		0.9437	3.574	2.470	0.156	0.145
			97.00	21.3	48.7	90.000		0.9437	3.574	2.675	0.166	0.152
			127.00	21.3	48.7	120.000		0.9437	3.574	2.786	0.171	0.156
			157.00	21.3	48.7	150.000		0.9437	3.574	2.865	0.174	0.160
			187.00	21.3	48.7	180.000		0.9437	3.574	2.925	0.177	0.163
			217.00	21.3	48.7	210.000		0.9437	3.574	2.973	0.179	0.168
			247.00	21.3	48.7	240.000		0.9437	3.574	3.012	0.181	0.170
			277.00	21.3	48.7	270.000		0.9437	3.574	3.045	0.182	0.172
			307.00	21.3	48.7	300.000		0.9437	3.574	3.073	0.183	0.172
			337.00	21.3	48.7	330.000		0.9437	3.574	3.097	0.185	0.174
			372.00	21.3	48.7	365.000		0.9437	3.574	3.121	0.186	0.178
			407.00	21.3	48.7	400.000		0.9437	3.574	3.142	0.187	0.179
			457.00	21.3	48.7	450.000		0.9437	3.574	3.169	0.188	0.181
			1000.0	21.3	48.7	993.000		0.9437	3.574	3.311	0.194	
			2500.0	21.3	48.7	2493.000		0.9437	3.574	3.417	0.199	
			5000.0	21.3	48.7	4993.000		0.9437	3.574	3.469	0.201	
			10000.0	21.3	48.7	9993.000		0.9437	3.574	3.504	0.203	

CREEP CALCULATION ACCORDING TO ACI 209R - RAC28 - CALIBRATED

		t_0 (days)	t (days)	T (ºC)	RH (%)	$(t-t_0)$ (days)	$\gamma_{c,t0}$	$\gamma_{c,RH}$	φ_u	$\varphi(t,t_0)$	$J(t,t_0) \times$ 1E-9	$J_{exp}(t,t_0)$ x 1E-9
f_{cm} =	28.1	28	28.000	21.3	48.7	–	0.8436	–	–	–	0.000	–
$E_c(t_0)$ =	26.5		28.000	21.3	48.7	0.000		0.9437	4.047	0.000	0.038	0.000
V/S (mm)=	30		28.003	21.3	48.7	0.003	**coeff.**	0.9437	4.047	0.017	0.038	0.046
d =	8.00		28.042	21.3	48.7	0.042	4	0.9437	4.047	0.074	0.041	0.053
ψ =	0.6		28.250	21.3	48.7	0.250		0.9437	4.047	0.209	0.046	0.062
$\gamma_{c,vs}$ =	1.064		29.00	21.3	48.7	1.000		0.9437	4.047	0.450	0.055	0.068
s =	110		30.00	21.3	48.7	2.000		0.9437	4.047	0.645	0.062	0.076
$\gamma_{c,s}$ =	1.11		31.00	21.3	48.7	3.000		0.9437	4.047	0.788	0.067	0.075
ψ =	81.8		32.00	21.3	48.7	4.000		0.9437	4.047	0.903	0.072	0.080
$\gamma_{c,\psi}$ =	1.076		33.00	21.3	48.7	5.000		0.9437	4.047	1.000	0.075	0.084
α_{air} =	4		34.00	21.3	48.7	6.000		0.9437	4.047	1.085	0.079	0.085
$\gamma_{c,\alpha}$ =	1.000		35.00	21.3	48.7	7.000		0.9437	4.047	1.160	0.082	0.087
			42.00	21.3	48.7	14.000		0.9437	4.047	1.532	0.096	0.096
			49.00	21.3	48.7	21.000		0.9437	4.047	1.769	0.104	0.102
			56.00	21.3	48.7	28.000		0.9437	4.047	1.942	0.111	0.107
			84.00	21.3	48.7	56.000		0.9437	4.047	2.360	0.127	0.118
			118.00	21.3	48.7	90.000		0.9437	4.047	2.632	0.137	0.124
			148.00	21.3	48.7	120.000		0.9437	4.047	2.786	0.143	0.134
			178.00	21.3	48.7	150.000		0.9437	4.047	2.899	0.147	0.140
			208.00	21.3	48.7	180.000		0.9437	4.047	2.987	0.150	0.143
			238.00	21.3	48.7	210.000		0.9437	4.047	3.058	0.153	0.147
			268.00	21.3	48.7	240.000		0.9437	4.047	3.117	0.155	0.148
			298.00	21.3	48.7	270.000		0.9437	4.047	3.166	0.157	0.152
			328.00	21.3	48.7	300.000		0.9437	4.047	3.209	0.159	0.153
			358.00	21.3	48.7	330.000		0.9437	4.047	3.246	0.160	0.158
			393.00	21.3	48.7	365.000		0.9437	4.047	3.285	0.162	0.163
			428.00	21.3	48.7	400.000		0.9437	4.047	3.318	0.163	0.161
			478.00	21.3	48.7	450.000		0.9437	4.047	3.359	0.164	0.162
			1000.0	21.3	48.7	972.000		0.9437	4.047	3.585	0.173	
			2500.0	21.3	48.7	2472.000		0.9437	4.047	3.769	0.180	
			5000.0	21.3	48.7	4972.000		0.9437	4.047	3.860	0.183	
			10000.0	21.3	48.7	9972.000		0.9437	4.047	3.922	0.186	

CREEP CALCULATION ACCORDING TO ACI 209R - HVFAC7 - CALIBRATED

		t_0 (days)	t (days)	T (ºC)	RH (%)	$(t-t_0)$ (days)	$\gamma_{c,t0}$	$\gamma_{c,RH}$	φ_u	$\varphi\ (t,t_0)$	$J\ (t,t_0)$ x 1E-9	$J_{exp}\ (t,t_0)$ x 1E-9
f_{cm} =	22.6	7	7.000	21.3	48.7	–	0.9935	–	–	–	0.000	–
$E_c\ (t_0)$ =	19.9		7.000	21.3	48.7	0.000		0.9437	2.807	0.000	0.050	0.000
V/S (mm)=	30		7.003	21.3	48.7	0.003	**coeff.**	0.9437	2.807	0.019	0.051	0.068
d =	5.00		7.042	21.3	48.7	0.042	2.5	0.9437	2.807	0.081	0.054	0.076
ψ =	0.6		7.250	21.3	48.7	0.250		0.9437	2.807	0.225	0.062	0.091
$\gamma_{c,vs}$ =	1.064		8.00	21.3	48.7	1.000		0.9437	2.807	0.468	0.074	0.094
s =	70		9.00	21.3	48.7	2.000		0.9437	2.807	0.653	0.083	0.103
$\gamma_{c,s}$ =	1.005		10.00	21.3	48.7	3.000		0.9437	2.807	0.783	0.090	0.108
ψ =	100		11.00	21.3	48.7	4.000		0.9437	2.807	0.884	0.095	0.110
$\gamma_{c,\psi}$ =	1.12		12.00	21.3	48.7	5.000		0.9437	2.807	0.967	0.099	0.115
α_{air} =	1.5		13.00	21.3	48.7	6.000		0.9437	2.807	1.037	0.102	0.115
$\gamma_{c,\alpha}$ =	1.000		14.00	21.3	48.7	7.000		0.9437	2.807	1.098	0.105	0.116
			21.00	21.3	48.7	14.000		0.9437	2.807	1.385	0.120	0.126
			28.00	21.3	48.7	21.000		0.9437	2.807	1.555	0.128	0.128
			35.00	21.3	48.7	28.000		0.9437	2.807	1.674	0.134	0.131
			63.00	21.3	48.7	56.000		0.9437	2.807	1.940	0.148	0.141
			97.00	21.3	48.7	90.000		0.9437	2.807	2.101	0.156	0.149
			127.00	21.3	48.7	120.000		0.9437	2.807	2.188	0.160	0.147
			157.00	21.3	48.7	150.000		0.9437	2.807	2.250	0.163	0.154
			187.00	21.3	48.7	180.000		0.9437	2.807	2.298	0.166	0.155
			217.00	21.3	48.7	210.000		0.9437	2.807	2.335	0.168	0.157
			247.00	21.3	48.7	240.000		0.9437	2.807	2.366	0.169	0.160
			277.00	21.3	48.7	270.000		0.9437	2.807	2.391	0.170	0.162
			307.00	21.3	48.7	300.000		0.9437	2.807	2.413	0.172	0.166
			337.00	21.3	48.7	330.000		0.9437	2.807	2.432	0.172	0.168
			372.00	21.3	48.7	365.000		0.9437	2.807	2.451	0.173	0.171
			407.00	21.3	48.7	400.000		0.9437	2.807	2.468	0.174	0.174
			457.00	21.3	48.7	450.000		0.9437	2.807	2.489	0.175	0.178
			1000.0	21.3	48.7	993.000		0.9437	2.807	2.600	0.181	
			2500.0	21.3	48.7	2493.000		0.9437	2.807	2.684	0.185	
			5000.0	21.3	48.7	4993.000		0.9437	2.807	2.725	0.187	
			10000.0	21.3	48.7	9993.000		0.9437	2.807	2.752	0.189	

CREEP CALCULATION ACCORDING TO ACI 209R - HVFAC28 - CALIBRATED

		t_0 (days)	t (days)	T (ºC)	RH (%)	$(t-t_0)$ (days)	$\gamma_{c,t0}$	$\gamma_{c,RH}$	φ_u	$\varphi(t,t_0)$	$J(t,t_0)$ x 1E-9	$J_{exp}(t,t_0)$ x 1E-9
f_{cm} =	22.6	28	28.000	21.3	48.7	–	0.8436	–	–	–	0.000	–
$E_c(t_0)$ =	23.8		28.000	21.3	48.7	0.000		0.9437	2.86	0.000	0.042	0.000
V/S (mm)=	30		28.003	21.3	48.7	0.003	coeff.	0.9437	2.86	0.017	0.043	0.068
d =	10.00		28.042	21.3	48.7	0.042	3	0.9437	2.86	0.057	0.044	0.076
ψ =	0.5		28.250	21.3	48.7	0.250		0.9437	2.86	0.136	0.048	0.091
$\gamma_{c,vs}$ =	1.064		29.00	21.3	48.7	1.000		0.9437	2.86	0.260	0.053	0.094
s =	70		30.00	21.3	48.7	2.000		0.9437	2.86	0.354	0.057	0.103
$\gamma_{c,s}$ =	1.005		31.00	21.3	48.7	3.000		0.9437	2.86	0.422	0.060	0.108
ψ =	100		32.00	21.3	48.7	4.000		0.9437	2.86	0.477	0.062	0.110
$\gamma_{c,\psi}$ =	1.12		33.00	21.3	48.7	5.000		0.9437	2.86	0.523	0.064	0.115
α_{air} =	1.5		34.00	21.3	48.7	6.000		0.9437	2.86	0.563	0.066	0.115
$\gamma_{c,\alpha}$ =	1.000		35.00	21.3	48.7	7.000		0.9437	2.86	0.598	0.067	0.116
			42.00	21.3	48.7	14.000		0.9437	2.86	0.779	0.075	0.126
			49.00	21.3	48.7	21.000		0.9437	2.86	0.899	0.080	0.128
			56.00	21.3	48.7	28.000		0.9437	2.86	0.990	0.084	0.131
			84.00	21.3	48.7	56.000		0.9437	2.86	1.224	0.093	0.141
			118.00	21.3	48.7	90.000		0.9437	2.86	1.392	0.101	0.149
			148.00	21.3	48.7	120.000		0.9437	2.86	1.495	0.105	0.147
			178.00	21.3	48.7	150.000		0.9437	2.86	1.574	0.108	0.154
			208.00	21.3	48.7	180.000		0.9437	2.86	1.639	0.111	0.155
			238.00	21.3	48.7	210.000		0.9437	2.86	1.692	0.113	0.157
			268.00	21.3	48.7	240.000		0.9437	2.86	1.738	0.115	0.160
			298.00	21.3	48.7	270.000		0.9437	2.86	1.778	0.117	0.162
			328.00	21.3	48.7	300.000		0.9437	2.86	1.813	0.118	0.166
			358.00	21.3	48.7	330.000		0.9437	2.86	1.845	0.120	0.168
			393.00	21.3	48.7	365.000		0.9437	2.86	1.877	0.121	0.171
			428.00	21.3	48.7	400.000		0.9437	2.86	1.907	0.122	0.174
			478.00	21.3	48.7	450.000		0.9437	2.86	1.944	0.124	0.178
			1000.0	21.3	48.7	972.000		0.9437	2.86	2.165	0.133	
			2500.0	21.3	48.7	2472.000		0.9437	2.86	2.381	0.142	
			5000.0	21.3	48.7	4972.000		0.9437	2.86	2.505	0.147	
			10000.0	21.3	48.7	9972.000		0.9437	2.86	2.600	0.151	

CREEP CALCULATION ACCORDING TO GL2000 - RAC7

		t_0 (days)	t (days)	T (ºC)	RH (%)	$(t-t_0)$ (days)	$\Phi(t_c)$	$\varphi_1(t,t_0)$	$\varphi_2(t,t_0)$	$\varphi_3(t,t_0)$	$\varphi_{28}(t,t_0)$	$J(t,t_0)$ x 1E-9	$J_{exp}(t,t_0)$ x 1E-9
$f_c(t_0)$ =	19.7	7	7.000	21.3	48.7	–	0.8778	–	–	–	–	0.000	–
f_{cm} =	28.1		7.000	21.3	48.7	0.000		0.000	0.000	0.000	0.000	0.044	0.000
$E_c(t_0)$ =	22.6	t_c (days)	7.003	21.3	48.7	0.003		0.026	0.022	0.000	0.042	0.046	0.053
E_{cm} =	26.5	1	7.042	21.3	48.7	0.042		0.054	0.077	0.000	0.115	0.049	0.067
V/S =	30		7.250	21.3	48.7	0.250		0.090	0.186	0.000	0.242	0.053	0.076
			8.00	21.3	48.7	1.000		0.133	0.354	0.000	0.428	0.060	0.086
			9.00	21.3	48.7	2.000		0.162	0.471	0.001	0.556	0.065	0.093
			10.00	21.3	48.7	3.000		0.181	0.548	0.001	0.641	0.068	0.099
			11.00	21.3	48.7	4.000		0.195	0.603	0.002	0.703	0.071	0.100
			12.00	21.3	48.7	5.000		0.208	0.645	0.004	0.752	0.073	0.106
			13.00	21.3	48.7	6.000		0.218	0.679	0.005	0.792	0.074	0.108
			14.00	21.3	48.7	7.000		0.227	0.707	0.007	0.826	0.075	0.107
			21.00	21.3	48.7	14.000		0.272	0.816	0.024	0.977	0.081	0.122
			28.00	21.3	48.7	21.000		0.302	0.866	0.049	1.069	0.085	0.123
			35.00	21.3	48.7	28.000		0.325	0.894	0.079	1.140	0.087	0.132
			63.00	21.3	48.7	56.000		0.386	0.943	0.216	1.356	0.095	0.145
			97.00	21.3	48.7	90.000		0.432	0.963	0.383	1.561	0.103	0.152
			127.00	21.3	48.7	120.000		0.462	0.972	0.514	1.710	0.109	0.156
			157.00	21.3	48.7	150.000		0.486	0.977	0.627	1.835	0.114	0.160
			187.00	21.3	48.7	180.000		0.507	0.981	0.725	1.942	0.118	0.163
			217.00	21.3	48.7	210.000		0.524	0.984	0.809	2.034	0.121	0.168
			247.00	21.3	48.7	240.000		0.540	0.986	0.883	2.114	0.124	0.170
			277.00	21.3	48.7	270.000		0.554	0.987	0.947	2.184	0.127	0.172
			307.00	21.3	48.7	300.000		0.567	0.989	1.004	2.246	0.129	0.172
			337.00	21.3	48.7	330.000		0.578	0.990	1.054	2.301	0.131	0.174
			372.00	21.3	48.7	365.000		0.591	0.991	1.105	2.358	0.133	0.178
			407.00	21.3	48.7	400.000		0.602	0.991	1.151	2.409	0.135	0.179
			457.00	21.3	48.7	450.000		0.617	0.992	1.207	2.473	0.138	0.181
			1000.0	21.3	48.7	993.000		0.723	0.996	1.510	2.835	0.151	
			2500.0	21.3	48.7	2493.000		0.855	0.999	1.705	3.124	0.162	
			5000.0	21.3	48.7	4993.000		0.958	0.999	1.778	3.279	0.168	
			10000.0	21.3	48.7	9993.000		1.062	1.000	1.817	3.404	0.173	

CREEP CALCULATION ACCORDING TO GL2000 - RAC28

		t_0 (days)	t (days)	T (ºC)	RH (%)	$(t-t_0)$ (days)	$\Phi(t_c)$	$\varphi_1(t,t_0)$	$\varphi_2(t,t_0)$	$\varphi_3(t,t_0)$	$\varphi_{28}(t,t_0)$	$J(t,t_0)$ x 1E-9	$J_{exp}(t,t_0)$ x 1E-9
$f_c(t_0)$ =	28.1	28	28.000	21.3	48.7	–	0.7435	–	–	–	–	0.000	–
f_{cm} =	28.1		28.000	21.3	48.7	0.000		0.000	0.000	0.000	0.000	0.038	0.000
$E_c(t_0)$ =	26.5	t_c (days)	28.003	21.3	48.7	0.003		0.026	0.011	0.000	0.027	0.039	0.046
E_{cm} =	26.5	1	28.042	21.3	48.7	0.042		0.054	0.038	0.000	0.068	0.040	0.053
V/S =	30		28.250	21.3	48.7	0.250		0.090	0.093	0.000	0.136	0.043	0.062
			29.00	21.3	48.7	1.000		0.133	0.177	0.000	0.231	0.046	0.068
			30.00	21.3	48.7	2.000		0.162	0.236	0.001	0.296	0.049	0.076
			31.00	21.3	48.7	3.000		0.181	0.274	0.001	0.339	0.051	0.075
			32.00	21.3	48.7	4.000		0.195	0.302	0.002	0.371	0.052	0.080
			33.00	21.3	48.7	5.000		0.208	0.323	0.004	0.397	0.053	0.084
			34.00	21.3	48.7	6.000		0.218	0.340	0.005	0.418	0.054	0.085
			35.00	21.3	48.7	7.000		0.227	0.354	0.007	0.437	0.054	0.087
			42.00	21.3	48.7	14.000		0.272	0.408	0.024	0.524	0.058	0.096
			49.00	21.3	48.7	21.000		0.302	0.433	0.049	0.583	0.060	0.102
			56.00	21.3	48.7	28.000		0.325	0.447	0.079	0.633	0.062	0.107
			84.00	21.3	48.7	56.000		0.386	0.471	0.216	0.798	0.068	0.118
			118.00	21.3	48.7	90.000		0.432	0.482	0.383	0.964	0.074	0.124
			148.00	21.3	48.7	120.000		0.462	0.486	0.514	1.087	0.079	0.134
			178.00	21.3	48.7	150.000		0.486	0.489	0.627	1.191	0.083	0.140
			208.00	21.3	48.7	180.000		0.507	0.491	0.725	1.280	0.086	0.143
			238.00	21.3	48.7	210.000		0.524	0.492	0.809	1.357	0.089	0.147
			268.00	21.3	48.7	240.000		0.540	0.493	0.883	1.424	0.091	0.148
			298.00	21.3	48.7	270.000		0.554	0.494	0.947	1.483	0.094	0.152
			328.00	21.3	48.7	300.000		0.567	0.494	1.004	1.535	0.096	0.153
			358.00	21.3	48.7	330.000		0.578	0.495	1.054	1.581	0.097	0.158
			393.00	21.3	48.7	365.000		0.591	0.495	1.105	1.629	0.099	0.163
			428.00	21.3	48.7	400.000		0.602	0.496	1.151	1.672	0.101	0.161
			478.00	21.3	48.7	450.000		0.617	0.496	1.207	1.725	0.103	0.162
			1000.0	21.3	48.7	972.000		0.720	0.498	1.503	2.024	0.114	
			2500.0	21.3	48.7	2472.000		0.853	0.499	1.704	2.273	0.123	
			5000.0	21.3	48.7	4972.000		0.957	0.500	1.778	2.405	0.128	
			10000.0	21.3	48.7	9972.000		1.062	0.500	1.817	2.511	0.133	

CREEP CALCULATION ACCORDING TO GL2000 - HVFAC7

		t_0 (days)	t (days)	T (°C)	RH (%)	$(t-t_0)$ (days)	$\Phi(t_c)$	$\varphi_1(t,t_0)$	$\varphi_2(t,t_0)$	$\varphi_3(t,t_0)$	$\varphi_{28}(t,t_0)$	$J(t,t_0)$ x 1E-9	$J_{exp}(t,t_0)$ x 1E-9
$f_c(t_0)$ =	15.9	7	7.000	21.3	48.7	–	0.8778	–	–	–	–	0.000	–
f_{cm} =	22.6		7.000	21.3	48.7	0.000		0.000	0.000	0.000	0.000	0.050	0.000
$E_c(t_0)$ =	19.9	t_c (days)	7.003	21.3	48.7	0.003		0.026	0.022	0.000	0.042	0.052	0.068
E_{cm} =	23.8	1	7.042	21.3	48.7	0.042		0.054	0.077	0.000	0.115	0.055	0.076
V/S =	30		7.250	21.3	48.7	0.250		0.090	0.186	0.000	0.242	0.060	0.091
			8.00	21.3	48.7	1.000		0.133	0.354	0.000	0.428	0.068	0.094
			9.00	21.3	48.7	2.000		0.162	0.471	0.001	0.556	0.074	0.103
			10.00	21.3	48.7	3.000		0.181	0.548	0.001	0.641	0.077	0.108
			11.00	21.3	48.7	4.000		0.195	0.603	0.002	0.703	0.080	0.110
			12.00	21.3	48.7	5.000		0.208	0.645	0.004	0.752	0.082	0.115
			13.00	21.3	48.7	6.000		0.218	0.679	0.005	0.792	0.084	0.115
			14.00	21.3	48.7	7.000		0.227	0.707	0.007	0.826	0.085	0.116
			21.00	21.3	48.7	14.000		0.272	0.816	0.024	0.977	0.091	0.126
			28.00	21.3	48.7	21.000		0.302	0.866	0.049	1.069	0.095	0.128
			35.00	21.3	48.7	28.000		0.325	0.894	0.079	1.140	0.098	0.131
			63.00	21.3	48.7	56.000		0.386	0.943	0.216	1.356	0.107	0.141
			97.00	21.3	48.7	90.000		0.432	0.963	0.383	1.561	0.116	0.149
			127.00	21.3	48.7	120.000		0.462	0.972	0.514	1.710	0.122	0.147
			157.00	21.3	48.7	150.000		0.486	0.977	0.627	1.835	0.127	0.154
			187.00	21.3	48.7	180.000		0.507	0.981	0.725	1.942	0.132	0.155
			217.00	21.3	48.7	210.000		0.524	0.984	0.809	2.034	0.136	0.157
			247.00	21.3	48.7	240.000		0.540	0.986	0.883	2.114	0.139	0.160
			277.00	21.3	48.7	270.000		0.554	0.987	0.947	2.184	0.142	0.162
			307.00	21.3	48.7	300.000		0.567	0.989	1.004	2.246	0.145	0.166
			337.00	21.3	48.7	330.000		0.578	0.990	1.054	2.301	0.147	0.168
			372.00	21.3	48.7	365.000		0.591	0.991	1.105	2.358	0.149	0.171
			407.00	21.3	48.7	400.000		0.602	0.991	1.151	2.409	0.151	0.174
			457.00	21.3	48.7	450.000		0.617	0.992	1.207	2.473	0.154	0.178
			1000.0	21.3	48.7	993.000		0.723	0.996	1.510	2.835	0.169	
			2500.0	21.3	48.7	2493.000		0.855	0.999	1.705	3.124	0.181	
			5000.0	21.3	48.7	4993.000		0.958	0.999	1.778	3.279	0.188	
			10000.0	21.3	48.7	9993.000		1.062	1.000	1.817	3.404	0.193	

CREEP CALCULATION ACCORDING TO GL2000 - HVFAC28

		t_0 (days)	t (days)	T (ºC)	RH (%)	$(t-t_0)$ (days)	$\Phi(t_c)$	$\varphi_1(t,t_0)$	$\varphi_2(t,t_0)$	$\varphi_3(t,t_0)$	$\varphi_{28}(t,t_0)$	$J(t,t_0)$ x 1E-9	$J_{exp}(t,t_0)$ x 1E-9
$f_c(t_0)$ =	22.6	28	28.000	21.3	48.7	–	0.7435	–	–	–	–	0.000	–
f_{cm} =	22.6		28.000	21.3	48.7	0.000		0.000	0.000	0.000	0.000	0.042	0.000
$E_c(t_0)$ =	23.8	t_c (days)	28.003	21.3	48.7	0.003		0.026	0.011	0.000	0.027	0.043	0.048
E_{cm} =	23.8	1	28.042	21.3	48.7	0.042		0.054	0.038	0.000	0.068	0.045	0.052
V/S =	30		28.250	21.3	48.7	0.250		0.090	0.093	0.000	0.136	0.048	0.057
			29.00	21.3	48.7	1.000		0.133	0.177	0.000	0.231	0.052	0.062
			30.00	21.3	48.7	2.000		0.162	0.236	0.001	0.296	0.054	0.063
			31.00	21.3	48.7	3.000		0.181	0.274	0.001	0.339	0.056	0.067
			32.00	21.3	48.7	4.000		0.195	0.302	0.002	0.371	0.058	0.068
			33.00	21.3	48.7	5.000		0.208	0.323	0.004	0.397	0.059	0.069
			34.00	21.3	48.7	6.000		0.218	0.340	0.005	0.418	0.060	0.069
			35.00	21.3	48.7	7.000		0.227	0.354	0.007	0.437	0.060	0.071
			42.00	21.3	48.7	14.000		0.272	0.408	0.024	0.524	0.064	0.077
			49.00	21.3	48.7	21.000		0.302	0.433	0.049	0.583	0.067	0.082
			56.00	21.3	48.7	28.000		0.325	0.447	0.079	0.633	0.069	0.082
			84.00	21.3	48.7	56.000		0.386	0.471	0.216	0.798	0.076	0.089
			118.00	21.3	48.7	90.000		0.432	0.482	0.383	0.964	0.083	0.098
			148.00	21.3	48.7	120.000		0.462	0.486	0.514	1.087	0.088	0.100
			178.00	21.3	48.7	150.000		0.486	0.489	0.627	1.191	0.092	0.100
			208.00	21.3	48.7	180.000		0.507	0.491	0.725	1.280	0.096	0.108
			238.00	21.3	48.7	210.000		0.524	0.492	0.809	1.357	0.099	0.108
			268.00	21.3	48.7	240.000		0.540	0.493	0.883	1.424	0.102	0.114
			298.00	21.3	48.7	270.000		0.554	0.494	0.947	1.483	0.104	0.109
			328.00	21.3	48.7	300.000		0.567	0.494	1.004	1.535	0.107	0.115
			358.00	21.3	48.7	330.000		0.578	0.495	1.054	1.581	0.108	0.121
			393.00	21.3	48.7	365.000		0.591	0.495	1.105	1.629	0.110	0.116
			428.00	21.3	48.7	400.000		0.602	0.496	1.151	1.672	0.112	0.125
			478.00	21.3	48.7	450.000		0.617	0.496	1.207	1.725	0.115	0.124
			1000.0	21.3	48.7	972.000		0.720	0.498	1.503	2.024	0.127	
			2500.0	21.3	48.7	2472.000		0.853	0.499	1.704	2.273	0.138	
			5000.0	21.3	48.7	4972.000		0.957	0.500	1.778	2.405	0.143	
			10000.0	21.3	48.7	9972.000		1.062	0.500	1.817	2.511	0.148	

CREEP CALCULATION ACCORDING TO GL2000 - RAC7 - CALIBRATED

								coeff.	coeff.	coeff.			
								0.6	0.01	0.5			
		t_0 (days)	t (days)	T (ºC)	RH (%)	$(t-t_0)$ (days)	$\Phi(t_c)$	$\varphi_1(t,t_0)$	$\varphi_2(t,t_0)$	$\varphi_3(t,t_0)$	$\varphi_{28}(t,t_0)$	$J(t,t_0)$ x 1E-9	$J_{exp}(t,t_0)$ x 1E-9
$f_c(t_0)$ =	19.7	7	7.000	21.3	48.7	–	0.8778	–	–	–	–	0.000	–
f_{cm} =	28.1		7.000	21.3	48.7	0.000		0.000	0.000	0.000	0.000	0.044	0.000
$E_c(t_0)$ =	22.6	t_c (days)	7.003	21.3	48.7	0.003		0.005	0.927	0.011	0.827	0.075	0.053
E_{cm} =	26.5	1	7.042	21.3	48.7	0.042		0.021	0.950	0.036	0.884	0.078	0.067
V/S =	30		7.250	21.3	48.7	0.250		0.060	0.967	0.089	0.980	0.081	0.076
			8.00	21.3	48.7	1.000		0.133	0.979	0.178	1.133	0.087	0.086
			9.00	21.3	48.7	2.000		0.195	0.985	0.250	1.256	0.092	0.093
			10.00	21.3	48.7	3.000		0.243	0.988	0.305	1.348	0.095	0.099
			11.00	21.3	48.7	4.000		0.282	0.990	0.351	1.424	0.098	0.100
			12.00	21.3	48.7	5.000		0.316	0.991	0.390	1.490	0.100	0.106
			13.00	21.3	48.7	6.000		0.346	0.992	0.426	1.549	0.103	0.108
			14.00	21.3	48.7	7.000		0.373	0.993	0.458	1.602	0.105	0.107
			21.00	21.3	48.7	14.000		0.516	0.996	0.629	1.879	0.115	0.122
			28.00	21.3	48.7	21.000		0.615	0.997	0.749	2.072	0.122	0.123
			35.00	21.3	48.7	28.000		0.691	0.998	0.842	2.221	0.128	0.132
			63.00	21.3	48.7	56.000		0.889	0.999	1.085	2.609	0.143	0.145
			97.00	21.3	48.7	90.000		1.030	0.999	1.251	2.880	0.153	0.152
			127.00	21.3	48.7	120.000		1.116	0.999	1.347	3.039	0.159	0.156
			157.00	21.3	48.7	150.000		1.182	1.000	1.415	3.157	0.163	0.160
			187.00	21.3	48.7	180.000		1.234	1.000	1.467	3.249	0.167	0.163
			217.00	21.3	48.7	210.000		1.277	1.000	1.508	3.323	0.170	0.168
			247.00	21.3	48.7	240.000		1.314	1.000	1.541	3.384	0.172	0.170
			277.00	21.3	48.7	270.000		1.345	1.000	1.569	3.435	0.174	0.172
			307.00	21.3	48.7	300.000		1.373	1.000	1.592	3.480	0.176	0.172
			337.00	21.3	48.7	330.000		1.397	1.000	1.611	3.518	0.177	0.174
			372.00	21.3	48.7	365.000		1.422	1.000	1.630	3.557	0.178	0.178
			407.00	21.3	48.7	400.000		1.445	1.000	1.647	3.591	0.180	0.179
			457.00	21.3	48.7	450.000		1.472	1.000	1.667	3.633	0.181	0.181
			1000.0	21.3	48.7	993.000		1.636	1.000	1.763	3.861	0.190	
			2500.0	21.3	48.7	2493.000		1.773	1.000	1.817	4.029	0.196	
			5000.0	21.3	48.7	4993.000		1.844	1.000	1.836	4.108	0.199	
			10000.0	21.3	48.7	9993.000		1.894	1.000	1.846	4.161	0.201	

CREEP CALCULATION ACCORDING TO GL2000 - RAC28 - CALIBRATED

								coeff.	coeff.	coeff.			
								1	0.01	0.5			
		t_0 (days)	t (days)	T (ºC)	RH (%)	$(t-t_0)$ (days)	$\Phi(t_c)$	$\varphi_1(t,t_0)$	$\varphi_2(t,t_0)$	$\varphi_3(t,t_0)$	$\varphi_{28}(t,t_0)$	$J(t,t_0)$ x 1E-9	$J_{exp}(t,t_0)$ x 1E-9
$f_c(t_0)$ =	28.1	28	28.000	21.3	48.7	–	0.7435	–	–	–	–	0.000	–
f_{cm} =	28.1		28.000	21.3	48.7	0.000		0.000	0.000	0.000	0.000	0.038	0.000
$E_c(t_0)$ =	26.5	t_c (days)	28.003	21.3	48.7	0.003		0.000	0.463	0.011	0.353	0.051	0.046
E_{cm} =	26.5	1	28.042	21.3	48.7	0.042		0.006	0.475	0.036	0.385	0.052	0.053
V/S =	30		28.250	21.3	48.7	0.250		0.035	0.483	0.089	0.452	0.055	0.062
			29.00	21.3	48.7	1.000		0.133	0.490	0.178	0.595	0.060	0.068
			30.00	21.3	48.7	2.000		0.250	0.493	0.250	0.738	0.066	0.076
			31.00	21.3	48.7	3.000		0.353	0.494	0.305	0.857	0.070	0.075
			32.00	21.3	48.7	4.000		0.444	0.495	0.351	0.959	0.074	0.080
			33.00	21.3	48.7	5.000		0.526	0.496	0.390	1.050	0.077	0.084
			34.00	21.3	48.7	6.000		0.600	0.496	0.426	1.132	0.080	0.085
			35.00	21.3	48.7	7.000		0.667	0.497	0.458	1.205	0.083	0.087
			42.00	21.3	48.7	14.000		1.000	0.498	0.629	1.581	0.097	0.096
			49.00	21.3	48.7	21.000		1.200	0.499	0.749	1.820	0.106	0.102
			56.00	21.3	48.7	28.000		1.333	0.499	0.842	1.988	0.113	0.107
			84.00	21.3	48.7	56.000		1.600	0.499	1.085	2.367	0.127	0.118
			118.00	21.3	48.7	90.000		1.731	0.500	1.251	2.589	0.135	0.124
			148.00	21.3	48.7	120.000		1.791	0.500	1.347	2.704	0.140	0.134
			178.00	21.3	48.7	150.000		1.829	0.500	1.415	2.784	0.143	0.140
			208.00	21.3	48.7	180.000		1.856	0.500	1.467	2.842	0.145	0.143
			238.00	21.3	48.7	210.000		1.875	0.500	1.508	2.887	0.147	0.147
			268.00	21.3	48.7	240.000		1.890	0.500	1.541	2.923	0.148	0.148
			298.00	21.3	48.7	270.000		1.901	0.500	1.569	2.952	0.149	0.152
			328.00	21.3	48.7	300.000		1.911	0.500	1.592	2.976	0.150	0.153
			358.00	21.3	48.7	330.000		1.919	0.500	1.611	2.996	0.151	0.158
			393.00	21.3	48.7	365.000		1.926	0.500	1.630	3.016	0.152	0.163
			428.00	21.3	48.7	400.000		1.932	0.500	1.647	3.033	0.152	0.161
			478.00	21.3	48.7	450.000		1.940	0.500	1.667	3.053	0.153	0.162
			1000.0	21.3	48.7	972.000		1.972	0.500	1.761	3.147	0.156	
			2500.0	21.3	48.7	2472.000		1.989	0.500	1.817	3.201	0.159	
			5000.0	21.3	48.7	4972.000		1.994	0.500	1.836	3.220	0.159	
			10000.0	21.3	48.7	9972.000		1.997	0.500	1.846	3.229	0.160	

CREEP CALCULATION ACCORDING TO GL2000 - HVFAC7 - CALIBRATED

								coeff. 0.4	coeff. 0.01	coeff. 0.5			
		t_0 (days)	t (days)	T (ºC)	RH (%)	$(t\text{-}t_0)$ (days)	$\Phi(t_c)$	$\varphi_1(t,t_0)$	$\varphi_2(t,t_0)$	$\varphi_3(t,t_0)$	$\varphi_{28}(t,t_0)$	$J(t,t_0)$ x 1E-9	$J_{exp}(t,t_0)$ x 1E-9
$f_c(t_0)$ =	15.9	7	7.000	21.3	48.7	–	0.8778	–	–	–	–	0.000	–
f_{cm} =	22.6		7.000	21.3	48.7	0.000		0.000	0.000	0.000	0.000	0.050	0.000
$E_c(t_0)$ =	19.9	t_c (days)	7.003	21.3	48.7	0.003		0.015	0.927	0.011	0.836	0.085	0.068
E_{cm} =	23.8	1	7.042	21.3	48.7	0.042		0.039	0.950	0.036	0.900	0.088	0.076
V/S =	30		7.250	21.3	48.7	0.250		0.079	0.967	0.089	0.996	0.092	0.091
			8.00	21.3	48.7	1.000		0.133	0.979	0.178	1.133	0.098	0.094
			9.00	21.3	48.7	2.000		0.172	0.985	0.250	1.236	0.102	0.103
			10.00	21.3	48.7	3.000		0.200	0.988	0.305	1.310	0.105	0.108
			11.00	21.3	48.7	4.000		0.221	0.990	0.351	1.371	0.108	0.110
			12.00	21.3	48.7	5.000		0.239	0.991	0.390	1.423	0.110	0.115
			13.00	21.3	48.7	6.000		0.255	0.992	0.426	1.469	0.112	0.115
			14.00	21.3	48.7	7.000		0.269	0.993	0.458	1.510	0.114	0.116
			21.00	21.3	48.7	14.000		0.341	0.996	0.629	1.725	0.123	0.126
			28.00	21.3	48.7	21.000		0.389	0.997	0.749	1.874	0.129	0.128
			35.00	21.3	48.7	28.000		0.426	0.998	0.842	1.989	0.134	0.131
			63.00	21.3	48.7	56.000		0.527	0.999	1.085	2.291	0.147	0.141
			97.00	21.3	48.7	90.000		0.603	0.999	1.251	2.505	0.156	0.149
			127.00	21.3	48.7	120.000		0.653	0.999	1.347	2.633	0.161	0.147
			157.00	21.3	48.7	150.000		0.693	1.000	1.415	2.728	0.165	0.154
			187.00	21.3	48.7	180.000		0.726	1.000	1.467	2.803	0.168	0.155
			217.00	21.3	48.7	210.000		0.755	1.000	1.508	2.864	0.171	0.157
			247.00	21.3	48.7	240.000		0.780	1.000	1.541	2.915	0.173	0.160
			277.00	21.3	48.7	270.000		0.803	1.000	1.569	2.959	0.175	0.162
			307.00	21.3	48.7	300.000		0.823	1.000	1.592	2.997	0.176	0.166
			337.00	21.3	48.7	330.000		0.842	1.000	1.611	3.031	0.178	0.168
			372.00	21.3	48.7	365.000		0.861	1.000	1.630	3.065	0.179	0.171
			407.00	21.3	48.7	400.000		0.879	1.000	1.647	3.095	0.180	0.174
			457.00	21.3	48.7	450.000		0.903	1.000	1.667	3.133	0.182	0.178
			1000.0	21.3	48.7	993.000		1.061	1.000	1.763	3.356	0.191	
			2500.0	21.3	48.7	2493.000		1.240	1.000	1.817	3.561	0.200	
			5000.0	21.3	48.7	4993.000		1.366	1.000	1.836	3.689	0.205	
			10000.0	21.3	48.7	9993.000		1.480	1.000	1.846	3.797	0.210	

CREEP CALCULATION ACCORDING TO GL2000 - HVFAC28 - CALIBRATED

								coeff.	**coeff.**	**coeff.**			
								0.4	0.01	1.5			
		t_0 (days)	**t (days)**	**T (ºC)**	**RH (%)**	**$(t-t_0)$ (days)**	**$\Phi(t_c)$**	**$\varphi_1(t,t_0)$**	**$\varphi_2(t,t_0)$**	**$\varphi_3(t,t_0)$**	**$\varphi_{28}(t,t_0)$**	**$J(t,t_0)$ x 1E-9**	**$J_{exp}(t,t_0)$ x 1E-9**
$f_c(t_0)$ =	22.6	28	28.000	21.3	48.7	–	0.7435	–	–	–	–	0.000	–
f_{cm} =	22.6		28.000	21.3	48.7	0.000		0.000	0.000	0.000	0.000	0.042	0.000
$E_c(t_0)$ =	23.8	**t_c (days)**	28.003	21.3	48.7	0.003		0.015	0.463	0.000	0.355	0.057	0.048
E_{cm} =	23.8	1	28.042	21.3	48.7	0.042		0.039	0.475	0.000	0.382	0.058	0.052
V/S =	30		28.250	21.3	48.7	0.250		0.079	0.483	0.000	0.418	0.060	0.057
			29.00	21.3	48.7	1.000		0.133	0.490	0.002	0.464	0.062	0.062
			30.00	21.3	48.7	2.000		0.172	0.493	0.005	0.498	0.063	0.063
			31.00	21.3	48.7	3.000		0.200	0.494	0.008	0.522	0.064	0.067
			32.00	21.3	48.7	4.000		0.221	0.495	0.013	0.542	0.065	0.068
			33.00	21.3	48.7	5.000		0.239	0.496	0.017	0.559	0.066	0.069
			34.00	21.3	48.7	6.000		0.255	0.496	0.022	0.575	0.066	0.069
			35.00	21.3	48.7	7.000		0.269	0.497	0.028	0.590	0.067	0.071
			42.00	21.3	48.7	14.000		0.341	0.498	0.072	0.677	0.070	0.077
			49.00	21.3	48.7	21.000		0.389	0.499	0.122	0.750	0.074	0.082
			56.00	21.3	48.7	28.000		0.426	0.499	0.173	0.817	0.076	0.082
			84.00	21.3	48.7	56.000		0.527	0.499	0.370	1.038	0.086	0.089
			118.00	21.3	48.7	90.000		0.603	0.500	0.569	1.243	0.094	0.098
			148.00	21.3	48.7	120.000		0.653	0.500	0.709	1.384	0.100	0.100
			178.00	21.3	48.7	150.000		0.693	0.500	0.823	1.498	0.105	0.100
			208.00	21.3	48.7	180.000		0.726	0.500	0.917	1.593	0.109	0.108
			238.00	21.3	48.7	210.000		0.755	0.500	0.996	1.674	0.112	0.108
			268.00	21.3	48.7	240.000		0.780	0.500	1.063	1.742	0.115	0.114
			298.00	21.3	48.7	270.000		0.803	0.500	1.120	1.802	0.118	0.109
			328.00	21.3	48.7	300.000		0.823	0.500	1.170	1.854	0.120	0.115
			358.00	21.3	48.7	330.000		0.842	0.500	1.214	1.900	0.122	0.121
			393.00	21.3	48.7	365.000		0.861	0.500	1.258	1.948	0.124	0.116
			428.00	21.3	48.7	400.000		0.879	0.500	1.297	1.990	0.126	0.125
			478.00	21.3	48.7	450.000		0.903	0.500	1.344	2.042	0.128	0.124
			1000.0	21.3	48.7	972.000		1.056	0.500	1.585	2.335	0.140	
			2500.0	21.3	48.7	2472.000		1.238	0.500	1.741	2.587	0.151	
			5000.0	21.3	48.7	4972.000		1.365	0.500	1.797	2.723	0.156	
			10000.0	21.3	48.7	9972.000		1.479	0.500	1.826	2.829	0.161	

Appendix C

Assessment and Correction of MC10 model

Assessment and Correction of MC10 model: *Testing of Individual Deflection Curves*

	Study information		Cross-section		Reinforcement								Mechanical properties												Loading						Deflection		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21		22	23	24	25	26	27	28	29	30	31	32
	Author	Specimen	b (mm)	h (mm)	A_{s1} (mm^2)	d (mm)	ρ_1 (%)	A_{s2} (mm^2)	d' (mm)	d_2 (mm)	ρ_2 (%)	type	t_0 (days)	$f_{cm}(t_0)$ (MPa)	f_{cm} (MPa)	$f_{ct,sp}$ (t_0) (MPa)	$f_{ctm}(t_0)$ (MPa)	$E_{cm}(t_0)$ (MPa)	E_{cm} (MPa)	E_s (MPa)	φ (–)	$\Delta\varepsilon_{cs}$ (‰)	ε_{cs} (‰)	$E_{c,eff}$ (MPa)	L (mm)	L/d	M_{L1} (Nm)	K_{L1}	M_{L2} (Nm)	K_{L2}	a (t) (mm)	t (days)	t-t_0 (days)
1	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.000	0.000	0.000	22820	3500	11.7	3254	0.104	21646	0.107	4.95	14.1	0.1
2	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.011	0.000	0.000	22593	3500	11.7	3254	0.104	21646	0.107	5.55	15	1
3	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.138	0.014	0.014	20262	3500	11.7	3254	0.104	21646	0.107	5.96	16	2
4	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.161	0.039	0.039	19891	3500	11.7	3254	0.104	21646	0.107	6.15	17	3
5	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.184	0.052	0.052	19533	3500	11.7	3254	0.104	21646	0.107	6.27	18	4
6	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.195	0.065	0.065	19366	3500	11.7	3254	0.104	21646	0.107	6.39	19	5
7	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.264	0.072	0.072	18382	3500	11.7	3254	0.104	21646	0.107	6.47	20	6
8	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.362	0.109	0.109	17144	3500	11.7	3254	0.104	21646	0.107	6.67	21	7
9	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.431	0.129	0.129	16368	3500	11.7	3254	0.104	21646	0.107	6.80	22	8
10	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.442	0.159	0.159	16250	3500	11.7	3254	0.104	21646	0.107	7.16	24	10
11	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.471	0.167	0.167	15949	3500	11.7	3254	0.104	21646	0.107	7.19	25	11
12	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.483	0.180	0.180	15828	3500	11.7	3254	0.104	21646	0.107	7.28	27	13
13	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.592	0.228	0.228	14804	3500	11.7	3254	0.104	21646	0.107	7.47	30	16
14	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.667	0.266	0.266	14173	3500	11.7	3254	0.104	21646	0.107	7.61	32	18
15	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.718	0.294	0.294	13774	3500	11.7	3254	0.104	21646	0.107	7.78	34	20
16	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.782	0.329	0.329	13304	3500	11.7	3254	0.104	21646	0.107	8.10	37	23
17	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.816	0.341	0.341	13067	3500	11.7	3254	0.104	21646	0.107	8.17	39	25
18	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.833	0.340	0.340	12952	3500	11.7	3254	0.104	21646	0.107	8.22	42	28
19	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.833	0.346	0.346	12952	3500	11.7	3254	0.104	21646	0.107	8.32	45	31
20	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.862	0.367	0.367	12760	3500	11.7	3254	0.104	21646	0.107	8.34	48	34
21	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.919	0.403	0.403	12399	3500	11.7	3254	0.104	21646	0.107	8.51	53	39
22	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.973	0.468	0.468	12074	3500	11.7	3254	0.104	21646	0.107	8.84	61	47
23	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.057	0.512	0.512	11603	3500	11.7	3254	0.104	21646	0.107	9.06	68	54
24	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.103	0.531	0.531	11360	3500	11.7	3254	0.104	21646	0.107	9.20	76	62
25	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.138	0.561	0.561	11182	3500	11.7	3254	0.104	21646	0.107	9.47	87	73
26	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.149	0.591	0.591	11127	3500	11.7	3254	0.104	21646	0.107	9.47	96	82
27	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.155	0.655	0.655	11097	3500	11.7	3254	0.104	21646	0.107	9.78	109	95
28	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.247	0.718	0.718	10661	3500	11.7	3254	0.104	21646	0.107	10.03	122	108
29	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.293	0.731	0.731	10455	3500	11.7	3254	0.104	21646	0.107	10.34	136	122
30	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.368	0.762	0.762	10137	3500	11.7	3254	0.104	21646	0.107	10.59	166	152
31	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.397	0.772	0.772	10019	3500	11.7	3254	0.104	21646	0.107	10.88	200	186
32	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.506	0.784	0.784	9599	3500	11.7	3254	0.104	21646	0.107	11.38	242	228
33	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.569	0.800	0.800	9371	3500	11.7	3254	0.104	21646	0.107	11.63	286	272
34	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.644	0.816	0.816	9115	3500	11.7	3254	0.104	21646	0.107	11.82	332	318
35	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.713	0.825	0.825	8891	3500	11.7	3254	0.104	21646	0.107	12.06	394	380
36	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.000	0.000	0.000	22820	3500	11.7	3254	0.104	13746	0.107	1.98	14.1	0.1
37	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.011	0.000	0.000	22593	3500	11.7	3254	0.104	13746	0.107	2.21	15	1
38	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.138	0.014	0.014	20262	3500	11.7	3254	0.104	13746	0.107	2.44	16	2
39	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.161	0.039	0.039	19891	3500	11.7	3254	0.104	13746	0.107	2.54	17	3
40	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.184	0.052	0.052	19533	3500	11.7	3254	0.104	13746	0.107	2.62	18	4
41	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.195	0.065	0.065	19366	3500	11.7	3254	0.104	13746	0.107	2.72	19	5
42	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.264	0.072	0.072	18382	3500	11.7	3254	0.104	13746	0.107	2.82	20	6
43	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.362	0.109	0.109	17144	3500	11.7	3254	0.104	13746	0.107	3.02	21	7
44	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.431	0.129	0.129	16368	3500	11.7	3254	0.104	13746	0.107	3.12	22	8
45	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.442	0.159	0.159	16250	3500	11.7	3254	0.104	13746	0.107	3.30	24	10
46	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.471	0.167	0.167	15949	3500	11.7	3254	0.104	13746	0.107	3.33	25	11
47	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.483	0.180	0.180	15828	3500	11.7	3254	0.104	13746	0.107	3.38	27	13
48	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.592	0.228	0.228	14804	3500	11.7	3254	0.104	13746	0.107	3.63	30	16
49	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.667	0.266	0.266	14173	3500	11.7	3254	0.104	13746	0.107	3.76	32	18
50	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.718	0.294	0.294	13774	3500	11.7	3254	0.104	13746	0.107	3.89	34	20
51	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.782	0.329	0.329	13304	3500	11.7	3254	0.104	13746	0.107	4.11	37	23
52	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.816	0.341	0.341	13067	3500	11.7	3254	0.104	13746	0.107	4.17	39	25
53	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.833	0.340	0.340	12952	3500	11.7	3254	0.104	13746	0.107	4.17	42	28
54	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.833	0.346	0.346	12952	3500	11.7	3254	0.104	13746	0.107	4.27	45	31
55	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.862	0.367	0.367	12760	3500	11.7	3254	0.104	13746	0.107	4.29	48	34
56	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.919	0.403	0.403	12399	3500	11.7	3254	0.104	13746	0.107	4.45	53	39
57	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.973	0.468	0.468	12074	3500	11.7	3254	0.104	13746	0.107	4.78	61	47
58	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.057	0.512	0.512	11603	3500	11.7	3254	0.104	13746	0.107	4.88	68	54
59	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.103	0.531	0.531	11360	3500	11.7	3254	0.104	13746	0.107	4.98	76	62
60	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.138	0.561	0.561	11182	3500	11.7	3254	0.104	13746	0.107	5.26	87	73
61	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.149	0.591	0.591	11127	3500	11.7	3254	0.104	13746	0.107	5.28	96	82
62	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.155	0.655	0.655	11097	3500	11.7	3254	0.104	13746	0.107	5.54	109	95
63	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.247	0.718	0.718	10661	3500	11.7	3254	0.104	13746	0.107	5.74	122	108
64	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.293	0.731	0.731	10455	3500	11.7	3254	0.104	13746	0.107	5.94	136	122
65	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.368	0.762	0.762	10137	3500	11.7	3254	0.104	13746	0.107	6.25	166	152
66	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.397	0.772	0.772	10019	3500	11.7	3254	0.104	13746	0.107	6.48	200	186
67	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.506	0.784	0.784	9599	3500	11.7	3254	0.104	13746	0.107	6.91	242	228
68	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.569	0.800	0.800	9371	3500	11.7	3254	0.104	13746	0.107	7.14	286	272
69	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.644	0.816	0.816	9115	3500	11.7	3254	0.104	13746	0.107	7.34	332	318
70	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.713	0.825	0.825	8891	3500	11.7	3254	0.104	13746	0.107	7.44	394	380

	Study information		Cross-section					Reinforcement											Mechanical properties										Loading					Deflection	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21		22	23	24	25	26	27	28	29	30	31	32
	Author	Specimen	b (mm)	h (mm)	A_{s1} (mm^2)	d (mm)	ρ_1 (%)	A_{s2} (mm^2)	d' (mm)	d_2 (mm)	ρ_2 (%)	type	t_0 (days)	$f_{cm}(t_0)$ (MPa)	f_{cm} (MPa)	$f_{ct,sp}(t_0)$ (MPa)	$f_{ctm}(t_0)$ (MPa)	$E_{cm}(t_0)$ (MPa)	E_{cm} (MPa)	E_s (MPa)	φ (–)	$\Delta\varepsilon_{cs}$ (‰)	ε_{cs} (‰)	$E_{c,eff}$ (MPa)	L (mm)	L/d	M_{L1} (Nm)	K_{L1}	M_{L2} (Nm)	K_{L2}	a (t) (mm)	t (days)	t-t_0 (days)
71	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.000	0.000	0.000	22820	3500	11.7	3110	0.104	21690	0.107	5.03	14.1	0.1
72	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.011	0.000	0.000	22593	3500	11.7	3110	0.104	21690	0.107	5.61	15	1
73	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.138	0.014	0.014	20262	3500	11.7	3110	0.104	21690	0.107	5.97	16	2
74	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.161	0.039	0.039	19891	3500	11.7	3110	0.104	21690	0.107	6.12	17	3
75	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.184	0.052	0.052	19533	3500	11.7	3110	0.104	21690	0.107	6.25	18	4
76	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.195	0.065	0.065	19366	3500	11.7	3110	0.104	21690	0.107	6.40	19	5
77	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.264	0.072	0.072	18382	3500	11.7	3110	0.104	21690	0.107	6.55	20	6
78	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.362	0.109	0.109	17144	3500	11.7	3110	0.104	21690	0.107	6.81	21	7
79	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.431	0.129	0.129	16368	3500	11.7	3110	0.104	21690	0.107	6.96	22	8
80	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.442	0.159	0.159	16250	3500	11.7	3110	0.104	21690	0.107	7.24	24	10
81	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.471	0.167	0.167	15949	3500	11.7	3110	0.104	21690	0.107	7.26	25	11
82	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.483	0.180	0.180	15828	3500	11.7	3110	0.104	21690	0.107	7.34	27	13
83	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.592	0.228	0.228	14804	3500	11.7	3110	0.104	21690	0.107	7.64	30	16
84	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.667	0.266	0.266	14173	3500	11.7	3110	0.104	21690	0.107	7.85	32	18
85	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.718	0.294	0.294	13774	3500	11.7	3110	0.104	21690	0.107	8.00	34	20
86	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.782	0.329	0.329	13304	3500	11.7	3110	0.104	21690	0.107	8.26	37	23
87	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.816	0.341	0.341	13067	3500	11.7	3110	0.104	21690	0.107	8.36	39	25
88	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.833	0.340	0.340	12952	3500	11.7	3110	0.104	21690	0.107	8.38	42	28
89	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.833	0.346	0.346	12952	3500	11.7	3110	0.104	21690	0.107	8.51	45	31
90	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.862	0.367	0.367	12760	3500	11.7	3110	0.104	21690	0.107	8.56	48	34
91	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.919	0.403	0.403	12399	3500	11.7	3110	0.104	21690	0.107	8.79	53	39
92	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.973	0.468	0.468	12074	3500	11.7	3110	0.104	21690	0.107	9.14	61	47
93	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.057	0.512	0.512	11603	3500	11.7	3110	0.104	21690	0.107	9.30	68	54
94	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.103	0.531	0.531	11360	3500	11.7	3110	0.104	21690	0.107	9.47	76	62
95	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.138	0.561	0.561	11182	3500	11.7	3110	0.104	21690	0.107	9.80	87	73
96	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.149	0.591	0.591	11127	3500	11.7	3110	0.104	21690	0.107	9.80	96	82
97	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.155	0.655	0.655	11097	3500	11.7	3110	0.104	21690	0.107	10.14	109	95
98	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.247	0.718	0.718	10661	3500	11.7	3110	0.104	21690	0.107	10.36	122	108
99	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.293	0.731	0.731	10455	3500	11.7	3110	0.104	21690	0.107	10.64	136	122
100	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.368	0.762	0.762	10137	3500	11.7	3110	0.104	21690	0.107	11.00	166	152
101	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.397	0.772	0.772	10019	3500	11.7	3110	0.104	21690	0.107	11.30	200	186
102	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.506	0.784	0.784	9599	3500	11.7	3110	0.104	21690	0.107	11.81	242	228
103	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.569	0.800	0.800	9371	3500	11.7	3110	0.104	21690	0.107	12.17	286	272
104	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.644	0.816	0.816	9115	3500	11.7	3110	0.104	21690	0.107	12.34	332	318
105	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.713	0.825	0.825	8891	3500	11.7	3110	0.104	21690	0.107	12.42	394	380
106	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.000	0.000	0.000	22820	3500	11.7	3110	0.104	13690	0.107	2.06	14.1	0.1
107	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.011	0.000	0.000	22593	3500	11.7	3110	0.104	13690	0.107	2.26	15	1
108	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.138	0.014	0.014	20262	3500	11.7	3110	0.104	13690	0.107	2.52	16	2
109	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.161	0.039	0.039	19891	3500	11.7	3110	0.104	13690	0.107	2.62	17	3
110	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.184	0.052	0.052	19533	3500	11.7	3110	0.104	13690	0.107	2.72	18	4
111	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.195	0.065	0.065	19366	3500	11.7	3110	0.104	13690	0.107	2.79	19	5
112	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.264	0.072	0.072	18382	3500	11.7	3110	0.104	13690	0.107	2.92	20	6
113	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.362	0.109	0.109	17144	3500	11.7	3110	0.104	13690	0.107	3.12	21	7
114	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.431	0.129	0.129	16368	3500	11.7	3110	0.104	13690	0.107	3.23	22	8
115	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.442	0.159	0.159	16250	3500	11.7	3110	0.104	13690	0.107	3.43	24	10
116	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.471	0.167	0.167	15949	3500	11.7	3110	0.104	13690	0.107	3.45	25	11
117	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.483	0.180	0.180	15828	3500	11.7	3110	0.104	13690	0.107	3.53	27	13
118	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.592	0.228	0.228	14804	3500	11.7	3110	0.104	13690	0.107	3.76	30	16
119	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.667	0.266	0.266	14173	3500	11.7	3110	0.104	13690	0.107	3.91	32	18
120	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.718	0.294	0.294	13774	3500	11.7	3110	0.104	13690	0.107	4.06	34	20
121	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.782	0.329	0.329	13304	3500	11.7	3110	0.104	13690	0.107	4.27	37	23
122	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.816	0.341	0.341	13067	3500	11.7	3110	0.104	13690	0.107	4.34	39	25
123	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.833	0.340	0.340	12952	3500	11.7	3110	0.104	13690	0.107	4.37	42	28
124	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.833	0.346	0.346	12952	3500	11.7	3110	0.104	13690	0.107	4.47	45	31
125	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.862	0.367	0.367	12760	3500	11.7	3110	0.104	13690	0.107	4.52	48	34
126	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.919	0.403	0.403	12399	3500	11.7	3110	0.104	13690	0.107	4.67	53	39
127	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.973	0.468	0.468	12074	3500	11.7	3110	0.104	13690	0.107	4.98	61	47
128	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.057	0.512	0.512	11603	3500	11.7	3110	0.104	13690	0.107	5.11	68	54
129	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.103	0.531	0.531	11360	3500	11.7	3110	0.104	13690	0.107	5.26	76	62
130	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.138	0.561	0.561	11182	3500	11.7	3110	0.104	13690	0.107	5.54	87	73
131	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.149	0.591	0.591	11127	3500	11.7	3110	0.104	13690	0.107	5.54	96	82
132	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.155	0.655	0.655	11097	3500	11.7	3110	0.104	13690	0.107	5.82	109	95
133	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.247	0.718	0.718	10661	3500	11.7	3110	0.104	13690	0.107	6.02	122	108
134	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.293	0.731	0.731	10455	3500	11.7	3110	0.104	13690	0.107	6.25	136	122
135	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.368	0.762	0.762	10137	3500	11.7	3110	0.104	13690	0.107	6.58	166	152
136	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.397	0.772	0.772	10019	3500	11.7	3110	0.104	13690	0.107	6.86	200	186
137	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.506	0.784	0.784	9599	3500	11.7	3110	0.104	13690	0.107	7.26	242	228
138	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.569	0.800	0.800	9371	3500	11.7	3110	0.104	13690	0.107	7.52	286	272
139	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.644	0.816	0.816	9115	3500	11.7	3110	0.104	13690	0.107	7.72	332	318
140	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.713	0.825	0.825	8891	3500	11.7	3110	0.104	13690	0.107	7.87	394	380

	Study information		Cross-section		Reinforcement								Mechanical properties												Loading						Deflection		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21		22	23	24	25	26	27	28	29	30	31	32
	Author	Specimen	b (mm)	h (mm)	A_{s1} (mm^2)	d (mm)	ρ_1 (%)	A_{s2} (mm^2)	d' (mm)	d_2 (mm)	ρ_2 (%)	type	t_0 (days)	$f_{cm}(t_0)$ (MPa)	f_{cm} (MPa)	$f_{ct,sp}(t_0)$ (MPa)	$f_{ctm}(t_0)$ (MPa)	$E_{cm}(t_0)$ (MPa)	E_{cm} (MPa)	E_s (MPa)	φ (–)	$\Delta\varepsilon_{cs}$ (‰)	ε_{cs} (‰)	$E_{c,eff}$ (MPa)	L (mm)	L/d	M_{L1} (Nm)	K_{L1}	M_{L2} (Nm)	K_{L2}	a (t) (mm)	t (days)	t-t_0 (days)
141	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.000	0.000	0.000	22820	3500	11.7	3110	0.104	31490	0.107	5.81	14.1	0.1
142	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.011	0.000	0.000	22593	3500	11.7	3110	0.104	31490	0.107	6.31	15	1
143	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.138	0.014	0.014	20262	3500	11.7	3110	0.104	31490	0.107	6.71	16	2
144	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.161	0.039	0.039	19891	3500	11.7	3110	0.104	31490	0.107	6.87	17	3
145	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.184	0.052	0.052	19533	3500	11.7	3110	0.104	31490	0.107	7.00	18	4
146	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.195	0.065	0.065	19366	3500	11.7	3110	0.104	31490	0.107	7.16	19	5
147	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.264	0.072	0.072	18382	3500	11.7	3110	0.104	31490	0.107	7.34	20	6
148	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.362	0.109	0.109	17144	3500	11.7	3110	0.104	31490	0.107	7.58	21	7
149	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.431	0.129	0.129	16368	3500	11.7	3110	0.104	31490	0.107	7.72	22	8
150	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.442	0.159	0.159	16250	3500	11.7	3110	0.104	31490	0.107	7.99	24	10
151	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.471	0.167	0.167	15949	3500	11.7	3110	0.104	31490	0.107	8.02	25	11
152	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.483	0.180	0.180	15828	3500	11.7	3110	0.104	31490	0.107	8.12	27	13
153	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.592	0.228	0.228	14804	3500	11.7	3110	0.104	31490	0.107	8.43	30	16
154	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.667	0.266	0.266	14173	3500	11.7	3110	0.104	31490	0.107	8.62	32	18
155	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.718	0.294	0.294	13774	3500	11.7	3110	0.104	31490	0.107	8.78	34	20
156	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.782	0.329	0.329	13304	3500	11.7	3110	0.104	31490	0.107	9.04	37	23
157	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.816	0.341	0.341	13067	3500	11.7	3110	0.104	31490	0.107	9.12	39	25
158	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.833	0.340	0.340	12952	3500	11.7	3110	0.104	31490	0.107	9.16	42	28
159	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.833	0.346	0.346	12952	3500	11.7	3110	0.104	31490	0.107	9.29	45	31
160	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.862	0.367	0.367	12760	3500	11.7	3110	0.104	31490	0.107	9.33	48	34
161	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.919	0.403	0.403	12399	3500	11.7	3110	0.104	31490	0.107	9.57	53	39
162	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.973	0.468	0.468	12074	3500	11.7	3110	0.104	31490	0.107	9.92	61	47
163	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.057	0.512	0.512	11603	3500	11.7	3110	0.104	31490	0.107	10.10	68	54
164	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.103	0.531	0.531	11360	3500	11.7	3110	0.104	31490	0.107	10.20	76	62
165	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.138	0.561	0.561	11182	3500	11.7	3110	0.104	31490	0.107	10.60	87	73
166	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.149	0.591	0.591	11127	3500	11.7	3110	0.104	31490	0.107	10.60	96	82
167	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.155	0.655	0.655	11097	3500	11.7	3110	0.104	31490	0.107	10.90	109	95
168	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.247	0.718	0.718	10661	3500	11.7	3110	0.104	31490	0.107	11.10	122	108
169	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.293	0.731	0.731	10455	3500	11.7	3110	0.104	31490	0.107	11.40	136	122
170	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.368	0.762	0.762	10137	3500	11.7	3110	0.104	31490	0.107	11.80	166	152
171	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.397	0.772	0.772	10019	3500	11.7	3110	0.104	31490	0.107	12.10	200	186
172	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.506	0.784	0.784	9599	3500	11.7	3110	0.104	31490	0.107	12.60	242	228
173	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.569	0.800	0.800	9371	3500	11.7	3110	0.104	31490	0.107	13.00	286	272
174	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.644	0.816	0.816	9115	3500	11.7	3110	0.104	31490	0.107	13.20	332	318
175	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.713	0.825	0.825	8891	3500	11.7	3110	0.104	31490	0.107	13.30	394	380
176	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.000	0.000	0.000	22820	3500	11.7	3110	0.104	17690	0.107	1.97	14.1	0.1
177	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.011	0.000	0.000	22593	3500	11.7	3110	0.104	17690	0.107	2.31	15	1
178	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.138	0.014	0.014	20262	3500	11.7	3110	0.104	17690	0.107	2.55	16	2
179	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.161	0.039	0.039	19891	3500	11.7	3110	0.104	17690	0.107	2.65	17	3
180	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.184	0.052	0.052	19533	3500	11.7	3110	0.104	17690	0.107	2.73	18	4
181	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.195	0.065	0.065	19366	3500	11.7	3110	0.104	17690	0.107	2.84	19	5
182	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.264	0.072	0.072	18382	3500	11.7	3110	0.104	17690	0.107	2.96	20	6
183	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.362	0.109	0.109	17144	3500	11.7	3110	0.104	17690	0.107	3.15	21	7
184	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.431	0.129	0.129	16368	3500	11.7	3110	0.104	17690	0.107	3.25	22	8
185	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.442	0.159	0.159	16250	3500	11.7	3110	0.104	17690	0.107	3.45	24	10
186	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.471	0.167	0.167	15949	3500	11.7	3110	0.104	17690	0.107	3.46	25	11
187	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.483	0.180	0.180	15828	3500	11.7	3110	0.104	17690	0.107	3.53	27	13
188	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.592	0.228	0.228	14804	3500	11.7	3110	0.104	17690	0.107	3.76	30	16
189	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.667	0.266	0.266	14173	3500	11.7	3110	0.104	17690	0.107	3.90	32	18
190	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.718	0.294	0.294	13774	3500	11.7	3110	0.104	17690	0.107	4.04	34	20
191	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.782	0.329	0.329	13304	3500	11.7	3110	0.104	17690	0.107	4.24	37	23
192	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.816	0.341	0.341	13067	3500	11.7	3110	0.104	17690	0.107	4.30	39	25
193	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.833	0.340	0.340	12952	3500	11.7	3110	0.104	17690	0.107	4.38	42	28
194	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.833	0.346	0.346	12952	3500	11.7	3110	0.104	17690	0.107	4.47	45	31
195	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.862	0.367	0.367	12760	3500	11.7	3110	0.104	17690	0.107	4.51	48	34
196	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.919	0.403	0.403	12399	3500	11.7	3110	0.104	17690	0.107	4.69	53	39
197	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.973	0.468	0.468	12074	3500	11.7	3110	0.104	17690	0.107	5.20	61	47
198	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.057	0.512	0.512	11603	3500	11.7	3110	0.104	17690	0.107	5.33	68	54
199	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.103	0.531	0.531	11360	3500	11.7	3110	0.104	17690	0.107	5.42	76	62
200	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.138	0.561	0.561	11182	3500	11.7	3110	0.104	17690	0.107	5.69	87	73
201	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.149	0.591	0.591	11127	3500	11.7	3110	0.104	17690	0.107	5.69	96	82
202	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.155	0.655	0.655	11097	3500	11.7	3110	0.104	17690	0.107	5.97	109	95
203	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.247	0.718	0.718	10661	3500	11.7	3110	0.104	17690	0.107	6.17	122	108
204	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.293	0.731	0.731	10455	3500	11.7	3110	0.104	17690	0.107	6.37	136	122
205	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.368	0.762	0.762	10137	3500	11.7	3110	0.104	17690	0.107	6.67	166	152
206	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.397	0.772	0.772	10019	3500	11.7	3110	0.104	17690	0.107	6.92	200	186
207	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.506	0.784	0.784	9599	3500	11.7	3110	0.104	17690	0.107	7.34	242	228
208	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.569	0.800	0.800	9371	3500	11.7	3110	0.104	17690	0.107	7.64	286	272
209	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.644	0.816	0.816	9115	3500	11.7	3110	0.104	17690	0.107	7.81	332	318
210	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.713	0.825	0.825	8891	3500	11.7	3110	0.104	17690	0.107	7.90	394	380

	Study information		Cross-section		Reinforcement								Mechanical properties												Loading						Deflection		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21		22	23	24	25	26	27	28	29	30	31	32
	Author	Specimen	b (mm)	h (mm)	A_{s1} (mm^2)	d (mm)	ρ_1 (%)	A_{s2} (mm^2)	d' (mm)	d_2 (mm)	ρ_2 (%)	type	t_0 (days)	$f_{cm}(t_0)$ (MPa)	f_{cm} (MPa)	$f_{ct,sp}$ (t_0) (MPa)	$f_{ctm}(t_0)$ (MPa)	$E_{cm}(t_0)$ (MPa)	E_{cm} (MPa)	E_s (MPa)	φ (–)	$\Delta\varepsilon_{cs}$ (‰)	ε_{cs} (‰)	$E_{c,eff}$ (MPa)	L (mm)	L/d	M_{L1} (Nm)	K_{L1}	M_{L2} (Nm)	K_{L2}	a (t) (mm)	t (days)	t-t_0 (days)
211	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.000	0.000	0.000	22820	3500	26.9	2373	0.104	4437	0.104	7.14	14.1	0.1
212	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.011	0.000	0.000	22593	3500	26.9	2373	0.104	4437	0.104	9.53	15	1
213	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.138	0.014	0.014	20262	3500	26.9	2373	0.104	4437	0.104	10.50	16	2
214	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.161	0.039	0.039	19891	3500	26.9	2373	0.104	4437	0.104	10.90	17	3
215	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.184	0.052	0.052	19533	3500	26.9	2373	0.104	4437	0.104	11.20	18	4
216	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.195	0.065	0.065	19366	3500	26.9	2373	0.104	4437	0.104	11.60	19	5
217	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.264	0.072	0.072	18382	3500	26.9	2373	0.104	4437	0.104	12.10	20	6
218	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.362	0.109	0.109	17144	3500	26.9	2373	0.104	4437	0.104	12.90	21	7
219	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.431	0.129	0.129	16368	3500	26.9	2373	0.104	4437	0.104	13.00	22	8
220	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.442	0.159	0.159	16250	3500	26.9	2373	0.104	4437	0.104	14.00	24	10
221	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.471	0.167	0.167	15949	3500	26.9	2373	0.104	4437	0.104	14.00	25	11
222	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.483	0.180	0.180	15828	3500	26.9	2373	0.104	4437	0.104	14.10	27	13
223	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.592	0.228	0.228	14804	3500	26.9	2373	0.104	4437	0.104	14.90	30	16
224	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.667	0.266	0.266	14173	3500	26.9	2373	0.104	4437	0.104	15.40	32	18
225	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.718	0.294	0.294	13774	3500	26.9	2373	0.104	4437	0.104	15.50	34	20
226	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.782	0.329	0.329	13304	3500	26.9	2373	0.104	4437	0.104	16.40	37	23
227	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.816	0.341	0.341	13067	3500	26.9	2373	0.104	4437	0.104	16.60	39	25
228	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.833	0.340	0.340	12952	3500	26.9	2373	0.104	4437	0.104	16.60	42	28
229	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.833	0.346	0.346	12952	3500	26.9	2373	0.104	4437	0.104	16.90	45	31
230	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.862	0.367	0.367	12760	3500	26.9	2373	0.104	4437	0.104	16.80	48	34
231	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.919	0.403	0.403	12399	3500	26.9	2373	0.104	4437	0.104	17.40	53	39
232	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.973	0.468	0.468	12074	3500	26.9	2373	0.104	4437	0.104	18.30	61	47
233	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.057	0.512	0.512	11603	3500	26.9	2373	0.104	4437	0.104	18.60	68	54
234	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.103	0.531	0.531	11360	3500	26.9	2373	0.104	4437	0.104	18.70	76	62
235	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.138	0.561	0.561	11182	3500	26.9	2373	0.104	4437	0.104	19.20	87	73
236	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.149	0.591	0.591	11127	3500	26.9	2373	0.104	4437	0.104	19.20	96	82
237	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.155	0.655	0.655	11097	3500	26.9	2373	0.104	4437	0.104	19.20	109	95
238	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.247	0.718	0.718	10661	3500	26.9	2373	0.104	4437	0.104	19.60	122	108
239	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.293	0.731	0.731	10455	3500	26.9	2373	0.104	4437	0.104	20.40	136	122
240	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.368	0.762	0.762	10137	3500	26.9	2373	0.104	4437	0.104	21.50	166	152
241	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.397	0.772	0.772	10019	3500	26.9	2373	0.104	4437	0.104	22.30	200	186
242	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.506	0.784	0.784	9599	3500	26.9	2373	0.104	4437	0.104	23.50	242	228
243	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.569	0.800	0.800	9371	3500	26.9	2373	0.104	4437	0.104	24.20	286	272
244	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.644	0.816	0.816	9115	3500	26.9	2373	0.104	4437	0.104	25.00	332	318
245	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.713	0.825	0.825	8891	3500	26.9	2373	0.104	4437	0.104	25.10	394	380
246	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.000	0.000	0.000	22820	3500	26.9	2373	0.104	2907	0.104	2.72	14.1	0.1
247	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.011	0.000	0.000	22593	3500	26.9	2373	0.104	2907	0.104	4.78	15	1
248	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.138	0.014	0.014	20262	3500	26.9	2373	0.104	2907	0.104	5.66	16	2
249	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.161	0.039	0.039	19891	3500	26.9	2373	0.104	2907	0.104	6.05	17	3
250	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.184	0.052	0.052	19533	3500	26.9	2373	0.104	2907	0.104	6.25	18	4
251	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.195	0.065	0.065	19366	3500	26.9	2373	0.104	2907	0.104	6.58	19	5
252	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.264	0.072	0.072	18382	3500	26.9	2373	0.104	2907	0.104	6.99	20	6
253	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.362	0.109	0.109	17144	3500	26.9	2373	0.104	2907	0.104	7.72	21	7
254	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.431	0.129	0.129	16368	3500	26.9	2373	0.104	2907	0.104	8.08	22	8
255	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.442	0.159	0.159	16250	3500	26.9	2373	0.104	2907	0.104	8.76	24	10
256	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.471	0.167	0.167	15949	3500	26.9	2373	0.104	2907	0.104	8.76	25	11
257	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.483	0.180	0.180	15828	3500	26.9	2373	0.104	2907	0.104	8.89	27	13
258	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.592	0.228	0.228	14804	3500	26.9	2373	0.104	2907	0.104	9.47	30	16
259	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.667	0.266	0.266	14173	3500	26.9	2373	0.104	2907	0.104	9.86	32	18
260	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.718	0.294	0.294	13774	3500	26.9	2373	0.104	2907	0.104	10.20	34	20
261	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.782	0.329	0.329	13304	3500	26.9	2373	0.104	2907	0.104	10.80	37	23
262	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.816	0.341	0.341	13067	3500	26.9	2373	0.104	2907	0.104	10.90	39	25
263	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.833	0.340	0.340	12952	3500	26.9	2373	0.104	2907	0.104	10.90	42	28
264	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.833	0.346	0.346	12952	3500	26.9	2373	0.104	2907	0.104	11.20	45	31
265	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.862	0.367	0.367	12760	3500	26.9	2373	0.104	2907	0.104	11.10	48	34
266	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.919	0.403	0.403	12399	3500	26.9	2373	0.104	2907	0.104	11.60	53	39
267	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.973	0.468	0.468	12074	3500	26.9	2373	0.104	2907	0.104	12.40	61	47
268	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.057	0.512	0.512	11603	3500	26.9	2373	0.104	2907	0.104	12.60	68	54
269	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.103	0.531	0.531	11360	3500	26.9	2373	0.104	2907	0.104	12.70	76	62
270	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.138	0.561	0.561	11182	3500	26.9	2373	0.104	2907	0.104	13.50	87	73
271	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.149	0.591	0.591	11127	3500	26.9	2373	0.104	2907	0.104	13.50	96	82
272	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.155	0.655	0.655	11097	3500	26.9	2373	0.104	2907	0.104	14.40	109	95
273	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.247	0.718	0.718	10661	3500	26.9	2373	0.104	2907	0.104	14.90	122	108
274	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.293	0.731	0.731	10455	3500	26.9	2373	0.104	2907	0.104	15.50	136	122
275	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.368	0.762	0.762	10137	3500	26.9	2373	0.104	2907	0.104	16.50	166	152
276	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.397	0.772	0.772	10019	3500	26.9	2373	0.104	2907	0.104	17.20	200	186
277	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.506	0.784	0.784	9599	3500	26.9	2373	0.104	2907	0.104	18.40	242	228
278	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.569	0.800	0.800	9371	3500	26.9	2373	0.104	2907	0.104	19.00	286	272
279	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.644	0.816	0.816	9115	3500	26.9	2373	0.104	2907	0.104	19.80	332	318
280	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.713	0.825	0.825	8891	3500	26.9	2373	0.104	2907	0.104	19.90	394	380

	Study information		Cross-section		Reinforcement								Mechanical properties												Loading						Deflection		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21		22	23	24	25	26	27	28	29	30	31	32
	Author	Specimen	b (mm)	h (mm)	A_{s1} (mm^2)	d (mm)	ρ_1 (%)	A_{s2} (mm^2)	d' (mm)	d_2 (mm)	ρ_2 (%)	type	t_0 (days)	$f_{cm}(t_0)$ (MPa)	f_{cm} (MPa)	$f_{ct,sp}$ (t_0) (MPa)	$f_{ctm}(t_0)$ (MPa)	$E_{cm}(t_0)$ (MPa)	E_{cm} (MPa)	E_s (MPa)	φ (–)	$\Delta\varepsilon_{cs}$ (‰)	ε_{cs} (‰)	$E_{c,eff}$ (MPa)	L (mm)	L/d	M_{L1} (Nm)	K_{L1}	M_{L2} (Nm)	K_{L2}	a (t) (mm)	t (days)	t-t_0 (days)
281	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.000	0.000	0.000	22820	3500	26.9	2373	0.104	7497	0.104	11.80	14.1	0.1
282	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.011	0.000	0.000	22593	3500	26.9	2373	0.104	7497	0.104	13.70	15	1
283	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.138	0.014	0.014	20262	3500	26.9	2373	0.104	7497	0.104	14.70	16	2
284	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.161	0.039	0.039	19891	3500	26.9	2373	0.104	7497	0.104	15.10	17	3
285	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.184	0.052	0.052	19533	3500	26.9	2373	0.104	7497	0.104	15.50	18	4
286	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.195	0.065	0.065	19366	3500	26.9	2373	0.104	7497	0.104	16.00	19	5
287	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.264	0.072	0.072	18382	3500	26.9	2373	0.104	7497	0.104	16.40	20	6
288	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.362	0.109	0.109	17144	3500	26.9	2373	0.104	7497	0.104	17.20	21	7
289	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.431	0.129	0.129	16368	3500	26.9	2373	0.104	7497	0.104	17.60	22	8
290	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.442	0.159	0.159	16250	3500	26.9	2373	0.104	7497	0.104	18.40	24	10
291	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.471	0.167	0.167	15949	3500	26.9	2373	0.104	7497	0.104	18.40	25	11
292	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.483	0.180	0.180	15828	3500	26.9	2373	0.104	7497	0.104	18.60	27	13
293	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.592	0.228	0.228	14804	3500	26.9	2373	0.104	7497	0.104	19.40	30	16
294	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.667	0.266	0.266	14173	3500	26.9	2373	0.104	7497	0.104	19.90	32	18
295	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.718	0.294	0.294	13774	3500	26.9	2373	0.104	7497	0.104	20.40	34	20
296	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.782	0.329	0.329	13304	3500	26.9	2373	0.104	7497	0.104	21.10	37	23
297	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.816	0.341	0.341	13067	3500	26.9	2373	0.104	7497	0.104	21.30	39	25
298	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.833	0.340	0.340	12952	3500	26.9	2373	0.104	7497	0.104	21.30	42	28
299	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.833	0.346	0.346	12952	3500	26.9	2373	0.104	7497	0.104	21.70	45	31
300	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.862	0.367	0.367	12760	3500	26.9	2373	0.104	7497	0.104	21.70	48	34
301	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.919	0.403	0.403	12399	3500	26.9	2373	0.104	7497	0.104	22.30	53	39
302	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.973	0.468	0.468	12074	3500	26.9	2373	0.104	7497	0.104	23.30	61	47
303	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.057	0.512	0.512	11603	3500	26.9	2373	0.104	7497	0.104	23.60	68	54
304	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.103	0.531	0.531	11360	3500	26.9	2373	0.104	7497	0.104	23.80	76	62
305	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.138	0.561	0.561	11182	3500	26.9	2373	0.104	7497	0.104	24.80	87	73
306	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.149	0.591	0.591	11127	3500	26.9	2373	0.104	7497	0.104	24.80	96	82
307	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.155	0.655	0.655	11097	3500	26.9	2373	0.104	7497	0.104	25.90	109	95
308	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.247	0.718	0.718	10661	3500	26.9	2373	0.104	7497	0.104	26.60	122	108
309	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.293	0.731	0.731	10455	3500	26.9	2373	0.104	7497	0.104	27.30	136	122
310	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.368	0.762	0.762	10137	3500	26.9	2373	0.104	7497	0.104	28.40	166	152
311	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.397	0.772	0.772	10019	3500	26.9	2373	0.104	7497	0.104	29.30	200	186
312	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.506	0.784	0.784	9599	3500	26.9	2373	0.104	7497	0.104	30.60	242	228
313	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.569	0.800	0.800	9371	3500	26.9	2373	0.104	7497	0.104	32.10	286	272
314	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.644	0.816	0.816	9115	3500	26.9	2373	0.104	7497	0.104	32.10	332	318
315	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.713	0.825	0.825	8891	3500	26.9	2373	0.104	7497	0.104	32.50	394	380
316	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.000	0.000	0.000	22820	3500	26.9	2373	0.104	4437	0.104	4.43	14.1	0.1
317	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.011	0.000	0.000	22593	3500	26.9	2373	0.104	4437	0.104	5.99	15	1
318	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.138	0.014	0.014	20262	3500	26.9	2373	0.104	4437	0.104	6.83	16	2
319	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.161	0.039	0.039	19891	3500	26.9	2373	0.104	4437	0.104	7.18	17	3
320	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.184	0.052	0.052	19533	3500	26.9	2373	0.104	4437	0.104	7.42	18	4
321	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.195	0.065	0.065	19366	3500	26.9	2373	0.104	4437	0.104	7.80	19	5
322	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.264	0.072	0.072	18382	3500	26.9	2373	0.104	4437	0.104	8.16	20	6
323	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.362	0.109	0.109	17144	3500	26.9	2373	0.104	4437	0.104	8.43	21	7
324	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.431	0.129	0.129	16368	3500	26.9	2373	0.104	4437	0.104	9.26	22	8
325	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.442	0.159	0.159	16250	3500	26.9	2373	0.104	4437	0.104	10.00	24	10
326	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.471	0.167	0.167	15949	3500	26.9	2373	0.104	4437	0.104	10.00	25	11
327	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.483	0.180	0.180	15828	3500	26.9	2373	0.104	4437	0.104	10.20	27	13
328	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.592	0.228	0.228	14804	3500	26.9	2373	0.104	4437	0.104	10.80	30	16
329	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.667	0.266	0.266	14173	3500	26.9	2373	0.104	4437	0.104	11.30	32	18
330	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.718	0.294	0.294	13774	3500	26.9	2373	0.104	4437	0.104	11.70	34	20
331	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.782	0.329	0.329	13304	3500	26.9	2373	0.104	4437	0.104	12.30	37	23
332	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.816	0.341	0.341	13067	3500	26.9	2373	0.104	4437	0.104	12.40	39	25
333	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.833	0.340	0.340	12952	3500	26.9	2373	0.104	4437	0.104	12.50	42	28
334	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.833	0.346	0.346	12952	3500	26.9	2373	0.104	4437	0.104	12.70	45	31
335	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.862	0.367	0.367	12760	3500	26.9	2373	0.104	4437	0.104	12.70	48	34
336	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.919	0.403	0.403	12399	3500	26.9	2373	0.104	4437	0.104	13.20	53	39
337	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.973	0.468	0.468	12074	3500	26.9	2373	0.104	4437	0.104	14.10	61	47
338	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.057	0.512	0.512	11603	3500	26.9	2373	0.104	4437	0.104	14.30	68	54
339	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.103	0.531	0.531	11360	3500	26.9	2373	0.104	4437	0.104	14.70	76	62
340	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.138	0.561	0.561	11182	3500	26.9	2373	0.104	4437	0.104	15.50	87	73
341	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.149	0.591	0.591	11127	3500	26.9	2373	0.104	4437	0.104	15.50	96	82
342	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.155	0.655	0.655	11097	3500	26.9	2373	0.104	4437	0.104	16.20	109	95
343	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.247	0.718	0.718	10661	3500	26.9	2373	0.104	4437	0.104	16.90	122	108
344	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.293	0.731	0.731	10455	3500	26.9	2373	0.104	4437	0.104	17.50	136	122
345	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.368	0.762	0.762	10137	3500	26.9	2373	0.104	4437	0.104	18.50	166	152
346	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.397	0.772	0.772	10019	3500	26.9	2373	0.104	4437	0.104	19.20	200	186
347	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.506	0.784	0.784	9599	3500	26.9	2373	0.104	4437	0.104	20.40	242	228
348	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.569	0.800	0.800	9371	3500	26.9	2373	0.104	4437	0.104	21.60	286	272
349	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.644	0.816	0.816	9115	3500	26.9	2373	0.104	4437	0.104	21.80	332	318
350	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.713	0.825	0.825	8891	3500	26.9	2373	0.104	4437	0.104	21.90	394	380

	Study information		Cross-section				Reinforcement											Mechanical properties									Loading				Deflection	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21		22	23	24	25	26	27	28	29	30	31	32
	Author	Specimen	b (mm)	h (mm)	A_{s1} (mm^2)	d (mm)	ρ_1 (%)	A_{s2} (mm^2)	d' (mm)	d_2 (mm)	ρ_2 (%)	type	t_0 (days)	$f_{cm}(t_0)$ (MPa)	f_{cm} (MPa)	$f_{ct,sp}(t_0)$ (MPa)	$f_{ctm}(t_0)$ (MPa)	$E_{cm}(t_0)$ (MPa)	E_{cm} (MPa)	E_s (MPa)	φ (–)	$\Delta\varepsilon_{cs}$ (‰)	ε_{cs} (‰)	$E_{c,eff}$ (MPa)	L (mm)	L/d	M_{L1} (Nm)	K_{L1}	M_{L2} (Nm)	K_{L2}	a (t) (mm)	t (days)	t-t_0 (days)
351	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.000	0.000	0.000	22820	3500	26.9	2373	0.104	8977	0.104	10.70	14.1	0.1
352	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.011	0.000	0.000	22593	3500	26.9	2373	0.104	8977	0.104	13.00	15	1
353	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.138	0.014	0.014	20262	3500	26.9	2373	0.104	8977	0.104	14.00	16	2
354	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.161	0.039	0.039	19891	3500	26.9	2373	0.104	8977	0.104	14.50	17	3
355	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.184	0.052	0.052	19533	3500	26.9	2373	0.104	8977	0.104	14.70	18	4
356	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.195	0.065	0.065	19366	3500	26.9	2373	0.104	8977	0.104	15.20	19	5
357	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.264	0.072	0.072	18382	3500	26.9	2373	0.104	8977	0.104	15.70	20	6
358	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.362	0.109	0.109	17144	3500	26.9	2373	0.104	8977	0.104	16.50	21	7
359	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.431	0.129	0.129	16368	3500	26.9	2373	0.104	8977	0.104	16.90	22	8
360	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.442	0.159	0.159	16250	3500	26.9	2373	0.104	8977	0.104	17.60	24	10
361	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.471	0.167	0.167	15949	3500	26.9	2373	0.104	8977	0.104	17.70	25	11
362	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.483	0.180	0.180	15828	3500	26.9	2373	0.104	8977	0.104	17.90	27	13
363	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.592	0.228	0.228	14804	3500	26.9	2373	0.104	8977	0.104	18.70	30	16
364	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.667	0.266	0.266	14173	3500	26.9	2373	0.104	8977	0.104	19.20	32	18
365	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.718	0.294	0.294	13774	3500	26.9	2373	0.104	8977	0.104	19.70	34	20
366	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.782	0.329	0.329	13304	3500	26.9	2373	0.104	8977	0.104	20.40	37	23
367	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.816	0.341	0.341	13067	3500	26.9	2373	0.104	8977	0.104	20.60	39	25
368	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.833	0.340	0.340	12952	3500	26.9	2373	0.104	8977	0.104	20.70	42	28
369	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.833	0.346	0.346	12952	3500	26.9	2373	0.104	8977	0.104	21.00	45	31
370	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.862	0.367	0.367	12760	3500	26.9	2373	0.104	8977	0.104	21.00	48	34
371	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.919	0.403	0.403	12399	3500	26.9	2373	0.104	8977	0.104	21.60	53	39
372	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.973	0.468	0.468	12074	3500	26.9	2373	0.104	8977	0.104	22.50	61	47
373	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.057	0.512	0.512	11603	3500	26.9	2373	0.104	8977	0.104	22.90	68	54
374	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.103	0.531	0.531	11360	3500	26.9	2373	0.104	8977	0.104	23.20	76	62
375	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.138	0.561	0.561	11182	3500	26.9	2373	0.104	8977	0.104	24.20	87	73
376	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.149	0.591	0.591	11127	3500	26.9	2373	0.104	8977	0.104	24.10	96	82
377	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.155	0.655	0.655	11097	3500	26.9	2373	0.104	8977	0.104	25.10	109	95
378	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.247	0.718	0.718	10661	3500	26.9	2373	0.104	8977	0.104	25.70	122	108
379	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.293	0.731	0.731	10455	3500	26.9	2373	0.104	8977	0.104	26.50	136	122
380	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.368	0.762	0.762	10137	3500	26.9	2373	0.104	8977	0.104	27.60	166	152
381	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.397	0.772	0.772	10019	3500	26.9	2373	0.104	8977	0.104	27.90	200	186
382	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.506	0.784	0.784	9599	3500	26.9	2373	0.104	8977	0.104	28.80	242	228
383	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.569	0.800	0.800	9371	3500	26.9	2373	0.104	8977	0.104	29.10	286	272
384	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.644	0.816	0.816	9115	3500	26.9	2373	0.104	8977	0.104	29.60	332	318
385	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.713	0.825	0.825	8891	3500	26.9	2373	0.104	8977	0.104	29.80	394	380
386	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.000	0.000	0.000	22820	3500	26.9	2373	0.104	5967	0.104	5.04	14.1	0.1
387	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.011	0.000	0.000	22593	3500	26.9	2373	0.104	5967	0.104	6.98	15	1
388	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.138	0.014	0.014	20262	3500	26.9	2373	0.104	5967	0.104	7.80	16	2
389	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.161	0.039	0.039	19891	3500	26.9	2373	0.104	5967	0.104	8.18	17	3
390	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.184	0.052	0.052	19533	3500	26.9	2373	0.104	5967	0.104	8.42	18	4
391	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.195	0.065	0.065	19366	3500	26.9	2373	0.104	5967	0.104	8.80	19	5
392	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.264	0.072	0.072	18382	3500	26.9	2373	0.104	5967	0.104	9.23	20	6
393	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.362	0.109	0.109	17144	3500	26.9	2373	0.104	5967	0.104	9.87	21	7
394	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.431	0.129	0.129	16368	3500	26.9	2373	0.104	5967	0.104	10.23	22	8
395	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.442	0.159	0.159	16250	3500	26.9	2373	0.104	5967	0.104	10.87	24	10
396	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.471	0.167	0.167	15949	3500	26.9	2373	0.104	5967	0.104	10.89	25	11
397	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.483	0.180	0.180	15828	3500	26.9	2373	0.104	5967	0.104	11.03	27	13
398	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.592	0.228	0.228	14804	3500	26.9	2373	0.104	5967	0.104	11.71	30	16
399	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.667	0.266	0.266	14173	3500	26.9	2373	0.104	5967	0.104	12.14	32	18
400	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.718	0.294	0.294	13774	3500	26.9	2373	0.104	5967	0.104	12.53	34	20
401	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.782	0.329	0.329	13304	3500	26.9	2373	0.104	5967	0.104	13.11	37	23
402	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.816	0.341	0.341	13067	3500	26.9	2373	0.104	5967	0.104	13.27	39	25
403	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.833	0.340	0.340	12952	3500	26.9	2373	0.104	5967	0.104	13.32	42	28
404	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.833	0.346	0.346	12952	3500	26.9	2373	0.104	5967	0.104	13.58	45	31
405	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.862	0.367	0.367	12760	3500	26.9	2373	0.104	5967	0.104	13.59	48	34
406	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.919	0.403	0.403	12399	3500	26.9	2373	0.104	5967	0.104	14.12	53	39
407	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	0.973	0.468	0.468	12074	3500	26.9	2373	0.104	5967	0.104	14.92	61	47
408	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.057	0.512	0.512	11603	3500	26.9	2373	0.104	5967	0.104	15.22	68	54
409	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.103	0.531	0.531	11360	3500	26.9	2373	0.104	5967	0.104	15.38	76	62
410	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.138	0.561	0.561	11182	3500	26.9	2373	0.104	5967	0.104	16.19	87	73
411	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.149	0.591	0.591	11127	3500	26.9	2373	0.104	5967	0.104	16.20	96	82
412	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.155	0.655	0.655	11097	3500	26.9	2373	0.104	5967	0.104	17.06	109	95
413	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.247	0.718	0.718	10661	3500	26.9	2373	0.104	5967	0.104	17.64	122	108
414	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.293	0.731	0.731	10455	3500	26.9	2373	0.104	5967	0.104	18.30	136	122
415	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.368	0.762	0.762	10137	3500	26.9	2373	0.104	5967	0.104	19.30	166	152
416	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.397	0.772	0.772	10019	3500	26.9	2373	0.104	5967	0.104	20.06	200	186
417	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.506	0.784	0.784	9599	3500	26.9	2373	0.104	5967	0.104	21.24	242	228
418	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.569	0.800	0.800	9371	3500	26.9	2373	0.104	5967	0.104	21.94	286	272
419	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.644	0.816	0.816	9115	3500	26.9	2373	0.104	5967	0.104	22.44	332	318
420	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	2.00	2.00	22820	24950	200000	1.713	0.825	0.825	8891	3500	26.9	2373	0.104	5967	0.104	22.90	394	380

	Study information		Cracking moment							State I				State II							Deflection			
	1	2	3	4		5		6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
	Author	Specimen	W_I^* (t_0) (mm^3)	M_{SW} (Nm)		M_{cr} (Nm)		M_{max} (Nm)	M_{max}/M_{cr}	A_I^* (mm^2)	$z_{I,1}^*$ (mm)	I_I^* (mm^4)	S_I^* (mm^3)	A_{II}^* (mm^2)	A_{IIc} (mm^2)	$z_{IIc,1}$ (mm)	$z_{II,1}^*$ (mm)	I_{IIc} (mm^4)	I_{II}^* (mm^4)	S_{II}^* (mm^3)	t-t$_0$ (days)	$a_{num.int.}$ (mm)	a_{exp} (mm)	$a_{num.int.}/a_{exp}$ (%)
1	Gilbert and Nejadi (2004)	B1-a	5314442	3254	<	10629	<	24900	2.343	88522	164.83	875979477	439591	23255	19733	300.54	261.08	10244366	213089556	778538	0.1	5.39	4.95	108.8
2	Gilbert and Nejadi (2004)	B1-a	5314442	3254	<	10629	<	24900	2.343	88558	164.78	876543009	443930	23373	19815	300.37	260.73	10373396	214846601	785291	1	6.01	5.55	108.2
3	Gilbert and Nejadi (2004)	B1-a	5314442	3254	<	10629	<	24900	2.343	88968	164.20	882897662	492793	24713	20745	298.51	257	11903620	234485826	861000	2	6.22	5.96	104.4
4	Gilbert and Nejadi (2004)	B1-a	5314442	3254	<	10629	<	24900	2.343	89040	164.10	884012996	501376	24950	20910	298.18	256.37	12189919	237883419	874156	3	6.37	6.15	103.5
5	Gilbert and Nejadi (2004)	B1-a	5314442	3254	<	10629	<	24900	2.343	89116	164.00	885188330	510444	25184	21068	297.87	255.73	12467453	241458222	888048	4	6.45	6.27	102.9
6	Gilbert and Nejadi (2004)	B1-a	5314442	3254	<	10629	<	24900	2.343	89153	163.94	885744363	514681	25303	21150	297.7	255.4	12614495	243129609	894483	5	6.53	6.39	102.1
7	Gilbert and Nejadi (2004)	B1-a	5314442	3254	<	10629	<	24900	2.343	89374	163.64	889132561	540772	25982	21608	296.79	253.56	13450930	253310565	934060	6	6.64	6.47	102.6
8	Gilbert and Nejadi (2004)	B1-a	5314442	3254	<	10629	<	24900	2.343	89691	163.20	893970018	577973	26936	22245	295.51	251.01	14676955	267610562	989920	7	6.93	6.67	103.9
9	Gilbert and Nejadi (2004)	B1-a	5314442	3254	<	10629	<	24900	2.343	89912	162.90	897317691	603739	27585	22673	294.66	249.31	15539497	277386617	1028223	8	7.10	6.80	104.5
10	Gilbert and Nejadi (2004)	B1-a	5314442	3254	<	10629	<	24900	2.343	89949	162.85	897863925	607938	27689	22740	294.52	249.03	15678702	278958226	1034410	10	7.26	7.16	101.4
11	Gilbert and Nejadi (2004)	B1-a	5314442	3254	<	10629	<	24900	2.343	90041	162.72	899257862	618641	27954	22913	294.18	248.34	16038220	282996313	1050259	11	7.33	7.19	102.0
12	Gilbert and Nejadi (2004)	B1-a	5314442	3254	<	10629	<	24900	2.343	90081	162.67	899863030	623321	28069	22988	294.03	248.05	16196231	284738752	1057160	13	7.41	7.28	101.7
13	Gilbert and Nejadi (2004)	B1-a	5314442	3254	<	10629	<	24900	2.343	90431	162.19	905105282	663616	29056	23625	292.75	245.51	17581430	299679050	1116129	16	7.76	7.47	103.9
14	Gilbert and Nejadi (2004)	B1-a	5314442	3254	<	10629	<	24900	2.343	90672	161.87	908697065	691273	29717	24045	291.91	243.83	18535875	309782221	1156169	18	8.03	7.61	105.5
15	Gilbert and Nejadi (2004)	B1-a	5314442	3254	<	10629	<	24900	2.343	90837	161.65	911140481	710076	30160	24323	291.36	242.71	19185069	316605112	1183226	20	8.22	7.78	105.7
16	Gilbert and Nejadi (2004)	B1-a	5314442	3254	<	10629	<	24900	2.343	91042	161.37	914167504	733325	30702	24660	290.68	241.35	19994841	324959815	1216569	23	8.47	8.10	104.5
17	Gilbert and Nejadi (2004)	B1-a	5314442	3254	<	10629	<	24900	2.343	91155	161.22	915823609	746063	31003	24848	290.31	240.62	20454404	329520015	1234740	25	8.56	8.17	104.8
18	Gilbert and Nejadi (2004)	B1-a	5314442	3254	<	10629	<	24900	2.343	91207	161.15	916591125	751964	31137	24930	290.14	240.28	20658823	331606149	1243114	28	8.57	8.22	104.3
19	Gilbert and Nejadi (2004)	B1-a	5314442	3254	<	10629	<	24900	2.343	91207	161.15	916591125	751964	31137	24930	290.14	240.28	20658823	331606149	1243114	31	8.60	8.32	103.4
20	Gilbert and Nejadi (2004)	B1-a	5314442	3254	<	10629	<	24900	2.343	91299	161.03	917946886	762409	31379	25080	289.84	239.69	21033974	335303826	1257915	34	8.74	8.34	104.8
21	Gilbert and Nejadi (2004)	B1-a	5314442	3254	<	10629	<	24900	2.343	91484	160.79	920650188	783234	31857	25373	289.26	238.53	21778528	342648445	1287320	39	8.98	8.51	105.5
22	Gilbert and Nejadi (2004)	B1-a	5314442	3254	<	10629	<	24900	2.343	91657	160.56	923167322	802582	32292	25635	288.73	237.45	22461497	349410103	1314448	47	9.36	8.84	105.9
23	Gilbert and Nejadi (2004)	B1-a	5314442	3254	<	10629	<	24900	2.343	91930	160.20	927128586	833044	32978	26048	287.91	235.81	23563341	359993680	1357057	54	9.67	9.06	106.7
24	Gilbert and Nejadi (2004)	B1-a	5314442	3254	<	10629	<	24900	2.343	92079	160.01	929274101	849577	33344	26265	287.47	234.93	24158555	365655929	1379952	62	9.81	9.20	106.6
25	Gilbert and Nejadi (2004)	B1-a	5314442	3254	<	10629	<	24900	2.343	92192	159.86	930893128	862007	33622	26430	287.14	234.27	24616722	369918601	1397147	73	10.00	9.47	105.6
26	Gilbert and Nejadi (2004)	B1-a	5314442	3254	<	10629	<	24900	2.343	92224	159.82	931354983	865572	33699	26475	287.05	234.09	24742675	371131263	1402095	82	10.16	9.47	107.3
27	Gilbert and Nejadi (2004)	B1-a	5314442	3254	<	10629	<	24900	2.343	92244	159.79	931643478	867764	33749	26505	286.99	233.98	24826881	371888003	1405199	95	10.49	9.78	107.2
28	Gilbert and Nejadi (2004)	B1-a	5314442	3254	<	10629	<	24900	2.343	92542	159.41	935898556	900533	34467	26925	286.15	232.29	26025907	382983680	1450159	108	10.90	10.03	108.7
29	Gilbert and Nejadi (2004)	B1-a	5314442	3254	<	10629	<	24900	2.343	92690	159.21	938015852	916756	34825	27135	285.73	231.47	26639632	388459860	1472454	122	11.02	10.34	106.6
30	Gilbert and Nejadi (2004)	B1-a	5314442	3254	<	10629	<	24900	2.343	92931	158.91	941434899	943130	35389	27458	285.09	230.16	27600803	397258103	1508246	152	11.26	10.59	106.3
31	Gilbert and Nejadi (2004)	B1-a	5314442	3254	<	10629	<	24900	2.343	93024	158.79	942740831	953161	35609	27585	284.83	229.66	27987087	400576098	1521817	186	11.34	10.88	104.2
32	Gilbert and Nejadi (2004)	B1-a	5314442	3254	<	10629	<	24900	2.343	93378	158.34	947713569	991415	36428	28050	283.9	227.81	29426414	413176708	1573412	228	11.52	11.38	101.2
33	Gilbert and Nejadi (2004)	B1-a	5314442	3254	<	10629	<	24900	2.343	93579	158.08	950522238	1012971	36884	28305	283.39	226.78	30236270	420227502	1602326	272	11.67	11.63	100.3
34	Gilbert and Nejadi (2004)	B1-a	5314442	3254	<	10629	<	24900	2.343	93820	157.78	953876755	1038805	37425	28605	282.79	225.57	31207903	428587717	1636705	318	11.83	11.82	100.1
35	Gilbert and Nejadi (2004)	B1-a	5314442	3254	<	10629	<	24900	2.343	94045	157.50	956992115	1062788	37928	28883	282.24	224.47	32124996	436312279	1668531	380	11.95	12.06	99.1
36	Gilbert and Nejadi (2004)	B1-b	5314442	3254	<	10629	<	17000	1.599	88522	164.83	875979477	439591	23255	19733	300.54	261.08	10244366	213089556	778538	0.1	2.84	1.98	143.3
37	Gilbert and Nejadi (2004)	B1-b	5314442	3254	<	10629	<	17000	1.599	88558	164.78	876543009	443930	23373	19815	300.37	260.73	10373396	214846601	785291	1	3.62	2.21	163.8
38	Gilbert and Nejadi (2004)	B1-b	5314442	3254	<	10629	<	17000	1.599	88968	164.20	882897662	492793	24713	20745	298.51	257	11903620	234485826	861000	2	3.78	2.44	154.9
39	Gilbert and Nejadi (2004)	B1-b	5314442	3254	<	10629	<	17000	1.599	89040	164.10	884012996	501376	24950	20910	298.18	256.37	12189919	237883419	874156	3	3.90	2.54	153.6
40	Gilbert and Nejadi (2004)	B1-b	5314442	3254	<	10629	<	17000	1.599	89116	164.00	885188330	510444	25184	21068	297.87	255.73	12467453	241458222	888048	4	3.97	2.62	151.6
41	Gilbert and Nejadi (2004)	B1-b	5314442	3254	<	10629	<	17000	1.599	89153	163.94	885744363	514681	25303	21150	297.7	255.4	12614495	243129609	894483	5	4.03	2.72	148.2
42	Gilbert and Nejadi (2004)	B1-b	5314442	3254	<	10629	<	17000	1.599	89374	163.64	889132561	540772	25982	21608	296.79	253.56	13450930	253310565	934060	6	4.12	2.82	146.0
43	Gilbert and Nejadi (2004)	B1-b	5314442	3254	<	10629	<	17000	1.599	89691	163.20	893970018	577973	26936	22245	295.51	251.01	14676955	267610562	989920	7	4.35	3.02	144.0
44	Gilbert and Nejadi (2004)	B1-b	5314442	3254	<	10629	<	17000	1.599	89912	162.90	897317691	603739	27585	22673	294.66	249.31	15539497	277386617	1028223	8	4.49	3.12	143.8
45	Gilbert and Nejadi (2004)	B1-b	5314442	3254	<	10629	<	17000	1.599	89949	162.85	897863925	607938	27689	22740	294.52	249.03	15678702	278958226	1034410	10	4.62	3.30	140.0
46	Gilbert and Nejadi (2004)	B1-b	5314442	3254	<	10629	<	17000	1.599	90041	162.72	899257862	618641	27954	22913	294.18	248.34	16038220	282996313	1050259	11	4.68	3.33	140.4
47	Gilbert and Nejadi (2004)	B1-b	5314442	3254	<	10629	<	17000	1.599	90081	162.67	899863030	623321	28069	22988	294.03	248.05	16196231	284738752	1057160	13	4.74	3.38	140.2
48	Gilbert and Nejadi (2004)	B1-b	5314442	3254	<	10629	<	17000	1.599	90431	162.19	905105282	663616	29056	23625	292.75	245.51	17581430	299679050	1116129	16	5.03	3.63	138.5
49	Gilbert and Nejadi (2004)	B1-b	5314442	3254	<	10629	<	17000	1.599	90672	161.87	908697065	691273	29717	24045	291.91	243.83	18535875	309782221	1156169	18	5.25	3.76	139.6
50	Gilbert and Nejadi (2004)	B1-b	5314442	3254	<	10629	<	17000	1.599	90837	161.65	911140481	710076	30160	24323	291.36	242.71	19185069	316605112	1183226	20	5.41	3.89	139.0
51	Gilbert and Nejadi (2004)	B1-b	5314442	3254	<	10629	<	17000	1.599	91042	161.37	914167504	733325	30702	24660	290.68	241.35	19994841	324959815	1216569	23	5.61	4.11	136.4
52	Gilbert and Nejadi (2004)	B1-b	5314442	3254	<	10629	<	17000	1.599	91155	161.22	915823609	746063	31003	24848	290.31	240.62	20454404	329520015	1234740	25	5.68	4.17	136.3
53	Gilbert and Nejadi (2004)	B1-b	5314442	3254	<	10629	<	17000	1.599	91207	161.15	916591125	751964	31137	24930	290.14	240.28	20658823	331606149	1243114	28	5.70	4.17	136.6
54	Gilbert and Nejadi (2004)	B1-b	5314442	3254	<	10629	<	17000	1.599	91207	161.15	916591125	751964	31137	24930	290.14	240.28	20658823	331606149	1243114	31	5.72	4.27	134.0
55	Gilbert and Nejadi (2004)	B1-b	5314442	3254	<	10629	<	17000	1.599	91299	161.03	917946886	762409	31379	25080	289.84	239.69	21033974	335303826	1257915	34	5.83	4.29	136.0
56	Gilbert and Nejadi (2004)	B1-b	5314442	3254	<	10629	<	17000	1.599	91484	160.79	920650188	783234	31857	25373	289.26	238.53	21778528	342648445	1287320	39	6.03	4.45	135.6
57	Gilbert and Nejadi (2004)	B1-b	5314442	3254	<	10629	<	17000	1.599	91657	160.56	923167322	802582	32292	25635	288.73	237.45	22461497	349410103	1314448	47	6.36	4.78	133.0
58	Gilbert and Nejadi (2004)	B1-b	5314442	3254	<	10629	<	17000	1.599	91930	160.20	927128586	833044	32978	26048	287.91	235.81	23563341	359993680	1357057	54	6.61	4.88	135.5
59	Gilbert and Nejadi (2004)	B1-b	5314442	3254	<	10629	<	17000	1.599	92079	160.01	929274101	849577	33344	26265	287.47	234.93	24158555	365655929	1379952	62	6.73	4.98	135.2
60	Gilbert and Nejadi (2004)	B1-b	5314442	3254	<	10629	<	17000	1.599	92192	159.86	930893128	862007	33622	26430	287.14	234.27	24616722	369918601	1397147	73	6.89	5.26	131.1
61	Gilbert and Nejadi (2004)	B1-b	5314442	3254	<	10629	<	17000	1.599	92224	159.82	931354983	865572	33699	26475	287.05	234.09	24742675	371131263	1402095	82	7.03	5.28	133.2
62	Gilbert and Nejadi (2004)	B1-b	5314442	3254	<	10629	<	17000	1.599	92244	159.79	931643478	867764	33749	26505	286.99	233.98	24826881	371888003	1405199	95	7.32	5.54	132.0
63	Gilbert and Nejadi (2004)	B1-b	5314442	3254	<	10629	<	17000	1.599	92542	159.41	935898556	900533	34467	26925	286.15	232.29	26025907	382983680	1450159	108	7.67	5.74	133.6
64	Gilbert and Nejadi (2004)	B1-b	5314442	3254	<	10629	<	17000	1.599	92690	159.21	938015852	916756	34825	27135	285.73	231.47	26639632	388459860	1472454	122	7.76	5.94	130.7
65	Gilbert and Nejadi (2004)	B1-b	5314442	3254	<	10629	<	17000	1.599	92931	158.91	941434899	943130	35389	27458	285.09	230.16	27600803	397258103	1508246	152	7.96	6.25	127.4
66	Gilbert and Nejadi (2004)	B1-b	5314442	3254	<	10629	<	17000	1.599	93024	158.79	942740831	953161	35609	27585	284.83	229.66	27987087	400576098	1521817	186	8.03	6.48	124.0
67	Gilbert and Nejadi (2004)	B1-b	5314442	3254	<	10629	<	17000	1.599	93378	158.34	947713569	991415	36428	28050	283.9	227.81	29426414	413176708	1573412	228	8.18	6.91	118.4
68	Gilbert and Nejadi (2004)	B1-b	5314442	3254	<	10629	<	17000	1.599	93579	158.08	950522238	1012971	36884	28305	283.39	226.78	30236270	420227502	1602326	272	8.31	7.14	116.3
69	Gilbert and Nejadi (2004)	B1-b	5314442	3254	<	10629	<	17000	1.599	93820	157.78	953876755	1038805	37425	28605	282.79	225.57	31207903	428587717	1636705	318	8.44	7.34	115.0
70	Gilbert and Nejadi (2004)	B1-b	5314442	3254	<	10629	<	17000	1.599	94045	157.50	956992115	1062788	37928	28883	282.24	224.47	32124996	436312279	1668531	380	8.54	7.44	114.8

	Study information		Cracking moment							State I				State II							Deflection			
	1	2	3	4		5		6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
	Author	Specimen	W_I^* (t_0) (mm^3)	M_{SW} (Nm)		M_{cr} (Nm)		M_{max} (Nm)	M_{max}/M_{cr}	A_I^* (mm^2)	$z_{I,1}^*$ (mm)	I_I^* (mm^4)	S_I^* (mm^3)	A_{II}^* (mm^2)	A_{IIc} (mm^2)	$z_{IIc,1}$ (mm)	$z_{II,1}^*$ (mm)	I_{IIc} (mm^4)	I_{II}^* (mm^4)	S_{II}^* (mm^3)	t-t_0 (days)	$a_{num.int.}$ (mm)	a_{exp} (mm)	$a_{num.int.}/a_{exp}$ (%)
71	Gilbert and Nejadi (2004)	B2-a	4968316	3110	<	9937	<	24800	2.496	84772	156.79	778982241	464101	23255	19733	285.54	246.08	10244366	213089556	778538	0.1	5.55	5.03	110.4
72	Gilbert and Nejadi (2004)	B2-a	4968316	3110	<	9937	<	24800	2.496	84808	156.73	779610350	468656	23373	19815	285.37	245.73	10373396	214846601	785291	1	6.08	5.61	108.4
73	Gilbert and Nejadi (2004)	B2-a	4968316	3110	<	9937	<	24800	2.496	85218	156.10	786691651	520171	24713	20745	283.51	242	11903620	234485826	861000	2	6.30	5.97	105.5
74	Gilbert and Nejadi (2004)	B2-a	4968316	3110	<	9937	<	24800	2.496	85290	155.99	787934225	529213	24950	20910	283.18	241.37	12189919	237883419	874156	3	6.45	6.12	105.4
75	Gilbert and Nejadi (2004)	B2-a	4968316	3110	<	9937	<	24800	2.496	85366	155.87	789243544	538724	25184	21068	282.87	240.72	12467453	241458220	888007	4	6.54	6.25	104.6
76	Gilbert and Nejadi (2004)	B2-a	4968316	3110	<	9937	<	24800	2.496	85403	155.81	789862933	543209	25303	21150	282.7	240.4	12614495	243129609	894483	5	6.61	6.40	103.3
77	Gilbert and Nejadi (2004)	B2-a	4968316	3110	<	9937	<	24800	2.496	85624	155.48	793636700	570688	25982	21608	281.79	238.56	13450930	253310565	934060	6	6.73	6.55	102.7
78	Gilbert and Nejadi (2004)	B2-a	4968316	3110	<	9937	<	24800	2.496	85941	154.99	799023228	609827	26936	22245	280.51	236.01	14676955	267610562	989920	7	7.02	6.81	103.1
79	Gilbert and Nejadi (2004)	B2-a	4968316	3110	<	9937	<	24800	2.496	86162	154.66	802749895	636947	27585	22673	279.66	234.31	15539497	277386617	1028223	8	7.20	6.96	103.4
80	Gilbert and Nejadi (2004)	B2-a	4968316	3110	<	9937	<	24800	2.496	86199	154.61	803357895	641391	27689	22740	279.52	234.03	15678702	278958226	1034410	10	7.36	7.24	101.6
81	Gilbert and Nejadi (2004)	B2-a	4968316	3110	<	9937	<	24800	2.496	86291	154.47	804909351	652669	27954	22913	279.18	233.34	16038220	282996313	1050259	11	7.43	7.26	102.4
82	Gilbert and Nejadi (2004)	B2-a	4968316	3110	<	9937	<	24800	2.496	86331	154.41	805582861	657568	28069	22988	279.03	233.05	16196231	284738752	1057160	13	7.51	7.34	102.3
83	Gilbert and Nejadi (2004)	B2-a	4968316	3110	<	9937	<	24800	2.496	86681	153.88	811416041	699950	29056	23625	277.75	230.51	17581430	299679050	1116129	16	7.87	7.64	103.0
84	Gilbert and Nejadi (2004)	B2-a	4968316	3110	<	9937	<	24800	2.496	86922	153.53	815411572	729050	29717	24045	276.91	228.83	18535875	309782221	1156169	18	8.14	7.85	103.7
85	Gilbert and Nejadi (2004)	B2-a	4968316	3110	<	9937	<	24800	2.496	87087	153.28	818129123	748775	30160	24323	276.36	227.71	19185069	316605112	1183226	20	8.34	8.00	104.2
86	Gilbert and Nejadi (2004)	B2-a	4968316	3110	<	9937	<	24800	2.496	87292	152.98	821495169	773263	30702	24660	275.68	226.35	19994841	324959815	1216569	23	8.59	8.26	104.0
87	Gilbert and Nejadi (2004)	B2-a	4968316	3110	<	9937	<	24800	2.496	87405	152.82	823336479	786684	31003	24848	275.31	225.62	20454404	329520015	1234740	25	8.68	8.36	103.8
88	Gilbert and Nejadi (2004)	B2-a	4968316	3110	<	9937	<	24800	2.496	87457	152.74	824189762	792867	31137	24930	275.14	225.28	20658823	331606149	1243114	28	8.70	8.38	103.8
89	Gilbert and Nejadi (2004)	B2-a	4968316	3110	<	9937	<	24800	2.496	87457	152.74	824189762	792867	31137	24930	275.14	225.28	20658823	331606149	1243114	31	8.73	8.51	102.6
90	Gilbert and Nejadi (2004)	B2-a	4968316	3110	<	9937	<	24800	2.496	87549	152.61	825696923	803859	31379	25080	274.84	224.69	21033974	335303826	1257915	34	8.87	8.56	103.6
91	Gilbert and Nejadi (2004)	B2-a	4968316	3110	<	9937	<	24800	2.496	87734	152.34	828701711	825706	31857	25373	274.26	223.53	21778528	342648445	1287320	39	9.11	8.79	103.6
92	Gilbert and Nejadi (2004)	B2-a	4968316	3110	<	9937	<	24800	2.496	87907	152.09	831499103	846053	32292	25635	273.73	222.45	22461497	349410103	1314448	47	9.50	9.14	103.9
93	Gilbert and Nejadi (2004)	B2-a	4968316	3110	<	9937	<	24800	2.496	88180	151.69	835900501	878023	32978	26048	272.91	220.81	23563341	359993680	1357057	54	9.81	9.30	105.5
94	Gilbert and Nejadi (2004)	B2-a	4968316	3110	<	9937	<	24800	2.496	88329	151.48	838283934	895380	33344	26265	272.47	219.93	24158555	365655929	1379952	62	9.96	9.47	105.2
95	Gilbert and Nejadi (2004)	B2-a	4968316	3110	<	9937	<	24800	2.496	88442	151.32	840082284	908466	33622	26430	272.14	219.27	24616722	369918601	1397147	73	10.15	9.80	103.6
96	Gilbert and Nejadi (2004)	B2-a	4968316	3110	<	9937	<	24800	2.496	88474	151.27	840595259	912167	33699	26475	272.05	219.09	24742675	371131263	1402095	82	10.32	9.80	105.3
97	Gilbert and Nejadi (2004)	B2-a	4968316	3110	<	9937	<	24800	2.496	88494	151.24	840915679	914488	33749	26505	271.99	218.98	24826881	371888003	1405199	95	10.65	10.14	105.0
98	Gilbert and Nejadi (2004)	B2-a	4968316	3110	<	9937	<	24800	2.496	88792	150.82	845640923	948874	34467	26925	271.15	217.29	26025907	382983680	1450159	108	11.07	10.36	106.9
99	Gilbert and Nejadi (2004)	B2-a	4968316	3110	<	9937	<	24800	2.496	88940	150.61	847991693	965974	34825	27135	270.73	216.47	26639632	388459860	1472454	122	11.19	10.64	105.2
100	Gilbert and Nejadi (2004)	B2-a	4968316	3110	<	9937	<	24800	2.496	89181	150.27	851787083	993574	35389	27458	270.09	215.16	27600803	397258103	1508246	152	11.43	11.00	103.9
101	Gilbert and Nejadi (2004)	B2-a	4968316	3110	<	9937	<	24800	2.496	89274	150.14	853236545	1004113	35609	27585	269.83	214.66	27987087	400576098	1521817	186	11.52	11.30	101.9
102	Gilbert and Nejadi (2004)	B2-a	4968316	3110	<	9937	<	24800	2.496	89628	149.65	858754703	1044278	36428	28050	268.9	212.81	29426414	413176708	1573412	228	11.70	11.81	99.0
103	Gilbert and Nejadi (2004)	B2-a	4968316	3110	<	9937	<	24800	2.496	89829	149.37	861870657	1066930	36884	28305	268.39	211.78	30236270	420227502	1602326	272	11.85	12.17	97.4
104	Gilbert and Nejadi (2004)	B2-a	4968316	3110	<	9937	<	24800	2.496	90070	149.04	865591446	1094018	37425	28605	267.79	210.57	31207903	428587717	1636705	318	12.01	12.34	97.4
105	Gilbert and Nejadi (2004)	B2-a	4968316	3110	<	9937	<	24800	2.496	90295	148.73	869046245	1119138	37928	28883	267.24	209.47	32124996	436312279	1668531	380	12.13	12.42	97.7
106	Gilbert and Nejadi (2004)	B2-b	4968316	3110	<	9937	<	16800	1.691	84772	156.79	778982241	464101	23255	19733	285.54	246.08	10244366	213089556	778538	0.1	3.02	2.06	146.5
107	Gilbert and Nejadi (2004)	B2-b	4968316	3110	<	9937	<	16800	1.691	84808	156.73	779610350	468656	23373	19815	285.37	245.73	10373396	214846601	785291	1	3.70	2.26	163.8
108	Gilbert and Nejadi (2004)	B2-b	4968316	3110	<	9937	<	16800	1.691	85218	156.10	786691651	520171	24713	20745	283.51	242	11903620	234485826	861000	2	3.87	2.52	153.4
109	Gilbert and Nejadi (2004)	B2-b	4968316	3110	<	9937	<	16800	1.691	85290	155.99	787934225	529213	24950	20910	283.18	241.37	12189919	237883419	874156	3	3.99	2.62	152.3
110	Gilbert and Nejadi (2004)	B2-b	4968316	3110	<	9937	<	16800	1.691	85366	155.87	789243544	538724	25184	21068	282.87	240.72	12467453	241458220	888007	4	4.06	2.72	149.4
111	Gilbert and Nejadi (2004)	B2-b	4968316	3110	<	9937	<	16800	1.691	85403	155.81	789862933	543209	25303	21150	282.7	240.4	12614495	243129609	894483	5	4.13	2.79	147.9
112	Gilbert and Nejadi (2004)	B2-b	4968316	3110	<	9937	<	16800	1.691	85624	155.48	793636700	570688	25982	21608	281.79	238.56	13450930	253310565	934060	6	4.21	2.92	144.3
113	Gilbert and Nejadi (2004)	B2-b	4968316	3110	<	9937	<	16800	1.691	85941	154.99	799023228	609827	26936	22245	280.51	236.01	14676955	267610562	989920	7	4.45	3.12	142.7
114	Gilbert and Nejadi (2004)	B2-b	4968316	3110	<	9937	<	16800	1.691	86162	154.66	802749895	636947	27585	22673	279.66	234.31	15539497	277386617	1028223	8	4.59	3.23	142.2
115	Gilbert and Nejadi (2004)	B2-b	4968316	3110	<	9937	<	16800	1.691	86199	154.61	803357895	641391	27689	22740	279.52	234.03	15678702	278958226	1034410	10	4.73	3.43	138.0
116	Gilbert and Nejadi (2004)	B2-b	4968316	3110	<	9937	<	16800	1.691	86291	154.47	804909351	652669	27954	22913	279.18	233.34	16038220	282996313	1050259	11	4.79	3.45	138.9
117	Gilbert and Nejadi (2004)	B2-b	4968316	3110	<	9937	<	16800	1.691	86331	154.41	805582861	657568	28069	22988	279.03	233.05	16196231	284738752	1057160	13	4.86	3.53	137.6
118	Gilbert and Nejadi (2004)	B2-b	4968316	3110	<	9937	<	16800	1.691	86681	153.88	811416041	699950	29056	23625	277.75	230.51	17581430	299679050	1116129	16	5.16	3.76	137.1
119	Gilbert and Nejadi (2004)	B2-b	4968316	3110	<	9937	<	16800	1.691	86922	153.53	815411572	729050	29717	24045	276.91	228.83	18535875	309782221	1156169	18	5.38	3.91	137.7
120	Gilbert and Nejadi (2004)	B2-b	4968316	3110	<	9937	<	16800	1.691	87087	153.28	818129123	748775	30160	24323	276.36	227.71	19185069	316605112	1183226	20	5.55	4.06	136.7
121	Gilbert and Nejadi (2004)	B2-b	4968316	3110	<	9937	<	16800	1.691	87292	152.98	821495169	773263	30702	24660	275.68	226.35	19994841	324959815	1216569	23	5.76	4.27	134.8
122	Gilbert and Nejadi (2004)	B2-b	4968316	3110	<	9937	<	16800	1.691	87405	152.82	823336479	786684	31003	24848	275.31	225.62	20454404	329520015	1234740	25	5.84	4.34	134.5
123	Gilbert and Nejadi (2004)	B2-b	4968316	3110	<	9937	<	16800	1.691	87457	152.74	824189762	792867	31137	24930	275.14	225.28	20658823	331606149	1243114	28	5.85	4.37	133.8
124	Gilbert and Nejadi (2004)	B2-b	4968316	3110	<	9937	<	16800	1.691	87457	152.74	824189762	792867	31137	24930	275.14	225.28	20658823	331606149	1243114	31	5.87	4.47	131.4
125	Gilbert and Nejadi (2004)	B2-b	4968316	3110	<	9937	<	16800	1.691	87549	152.61	825696923	803859	31379	25080	274.84	224.69	21033974	335303826	1257915	34	5.99	4.52	132.5
126	Gilbert and Nejadi (2004)	B2-b	4968316	3110	<	9937	<	16800	1.691	87734	152.34	828701711	825706	31857	25373	274.26	223.53	21778528	342648445	1287320	39	6.20	4.67	132.7
127	Gilbert and Nejadi (2004)	B2-b	4968316	3110	<	9937	<	16800	1.691	87907	152.09	831499103	846053	32292	25635	273.73	222.45	22461497	349410103	1314448	47	6.53	4.98	131.2
128	Gilbert and Nejadi (2004)	B2-b	4968316	3110	<	9937	<	16800	1.691	88180	151.69	835900501	878023	32978	26048	272.91	220.81	23563341	359993680	1357057	54	6.80	5.11	133.1
129	Gilbert and Nejadi (2004)	B2-b	4968316	3110	<	9937	<	16800	1.691	88329	151.48	838283934	895380	33344	26265	272.47	219.93	24158555	365655929	1379952	62	6.92	5.26	131.6
130	Gilbert and Nejadi (2004)	B2-b	4968316	3110	<	9937	<	16800	1.691	88442	151.32	840082284	908466	33622	26430	272.14	219.27	24616722	369918601	1397147	73	7.09	5.54	128.0
131	Gilbert and Nejadi (2004)	B2-b	4968316	3110	<	9937	<	16800	1.691	88474	151.27	840595259	912167	33699	26475	272.05	219.09	24742675	371131263	1402095	82	7.24	5.54	130.6
132	Gilbert and Nejadi (2004)	B2-b	4968316	3110	<	9937	<	16800	1.691	88494	151.24	840915679	914488	33749	26505	271.99	218.98	24826881	371888003	1405199	95	7.53	5.82	129.4
133	Gilbert and Nejadi (2004)	B2-b	4968316	3110	<	9937	<	16800	1.691	88792	150.82	845640923	948874	34467	26925	271.15	217.29	26025907	382983680	1450159	108	7.89	6.02	131.1
134	Gilbert and Nejadi (2004)	B2-b	4968316	3110	<	9937	<	16800	1.691	88940	150.61	847991693	965974	34825	27135	270.73	216.47	26639632	388459860	1472454	122	7.99	6.25	127.9
135	Gilbert and Nejadi (2004)	B2-b	4968316	3110	<	9937	<	16800	1.691	89181	150.27	851787083	993574	35389	27458	270.09	215.16	27600803	397258103	1508246	152	8.20	6.58	124.6
136	Gilbert and Nejadi (2004)	B2-b	4968316	3110	<	9937	<	16800	1.691	89274	150.14	853236545	1004113	35609	27585	269.83	214.66	27987087	400576098	1521817	186	8.27	6.86	120.6
137	Gilbert and Nejadi (2004)	B2-b	4968316	3110	<	9937	<	16800	1.691	89628	149.65	858754703	1044278	36428	28050	268.9	212.81	29426414	413176708	1573412	228	8.42	7.26	116.0
138	Gilbert and Nejadi (2004)	B2-b	4968316	3110	<	9937	<	16800	1.691	89829	149.37	861870657	1066930	36884	28305	268.39	211.78	30236270	420227502	1602326	272	8.55	7.52	113.7
139	Gilbert and Nejadi (2004)	B2-b	4968316	3110	<	9937	<	16800	1.691	90070	149.04	865591446	1094018	37425	28605	267.79	210.57	31207903	428587717	1636705	318	8.69	7.72	112.6
140	Gilbert and Nejadi (2004)	B2-b	4968316	3110	<	9937	<	16800	1.691	90295	148.73	869046245	1119138	37928	28883	267.24	209.47	32124996	436312279	1668531	380	8.79	7.87	111.7

	Study information		Cracking moment							State I				State II							Deflection			
	1	2	3	4		5		6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
	Author	Specimen	$W_I^*(t_0)$ (mm^3)	M_{SW} (Nm)		M_{cr} (Nm)		M_{max} (Nm)	M_{max}/M_{cr}	A_I^* (mm^2)	$z_{I,1}^*$ (mm)	I_I^* (mm^4)	S_I^* (mm^3)	A_{II}^* (mm^2)	A_{IIc} (mm^2)	$z_{IIc,1}$ (mm)	$z_{II,1}^*$ (mm)	I_{IIc} (mm^4)	I_{II}^* (mm^4)	S_{II}^* (mm^3)	t-t$_0$ (days)	$a_{num.int.}$ (mm)	a_{exp} (mm)	$a_{num.int.}/a_{exp}$ (%)
141	Gilbert and Nejadi (2004)	B3-a	5249114	3110	<	10498	<	34600	3.296	86532	154.11	808941025	681995	28637	23355	278.29	231.57	16985501	293364864	1091161	0.1	6.16	5.81	106.0
142	Gilbert and Nejadi (2004)	B3-a	5249114	3110	<	10498	<	34600	3.296	86587	154.02	809845058	688522	28790	23453	278.1	231.18	17199118	295688346	1100290	1	6.46	6.31	102.3
143	Gilbert and Nejadi (2004)	B3-a	5249114	3110	<	10498	<	34600	3.296	87202	153.11	820012102	762461	30470	24518	275.97	226.95	19650214	321295284	1201928	2	6.71	6.71	100.0
144	Gilbert and Nejadi (2004)	B3-a	5249114	3110	<	10498	<	34600	3.296	87310	152.96	821791415	775457	30750	24690	275.62	226.23	20067904	325692763	1219484	3	6.88	6.87	100.1
145	Gilbert and Nejadi (2004)	B3-a	5249114	3110	<	10498	<	34600	3.296	87425	152.79	823664786	789067	31053	24878	275.25	225.49	20528582	330328471	1237970	4	6.98	7.00	99.7
146	Gilbert and Nejadi (2004)	B3-a	5249114	3110	<	10498	<	34600	3.296	87479	152.71	824550460	795504	31197	24968	275.07	225.14	20752189	332506081	1246670	5	7.06	7.16	98.6
147	Gilbert and Nejadi (2004)	B3-a	5249114	3110	<	10498	<	34600	3.296	87811	152.23	829939126	834710	32046	25485	274.03	223.04	22069508	345637262	1299269	6	7.20	7.34	98.0
148	Gilbert and Nejadi (2004)	B3-a	5249114	3110	<	10498	<	34600	3.296	88287	151.54	837608370	890463	33242	26205	272.59	220.18	23993369	364050007	1373484	7	7.53	7.58	99.3
149	Gilbert and Nejadi (2004)	B3-a	5249114	3110	<	10498	<	34600	3.296	88619	151.07	842899034	928967	34054	26685	271.63	218.26	25336135	376559772	1424067	8	7.73	7.72	100.1
150	Gilbert and Nejadi (2004)	B3-a	5249114	3110	<	10498	<	34600	3.296	88673	150.99	843761011	935215	34183	26760	271.48	217.96	25550362	378583571	1432329	10	7.90	7.99	98.9
151	Gilbert and Nejadi (2004)	B3-a	5249114	3110	<	10498	<	34600	3.296	88812	150.79	845959056	951176	34517	26955	271.09	217.18	26112999	383726459	1453192	11	7.99	8.02	99.6
152	Gilbert and Nejadi (2004)	B3-a	5249114	3110	<	10498	<	34600	3.296	88872	150.71	846912587	958152	34660	27038	270.93	216.85	26353502	385965699	1462265	13	8.07	8.12	99.4
153	Gilbert and Nejadi (2004)	B3-a	5249114	3110	<	10498	<	34600	3.296	89397	149.97	855154034	1018072	35897	27750	269.5	214.01	28492313	404971444	1539776	16	8.48	8.43	100.6
154	Gilbert and Nejadi (2004)	B3-a	5249114	3110	<	10498	<	34600	3.296	89758	149.47	860781661	1059032	36723	28215	268.57	212.14	29948764	417768510	1592249	18	8.79	8.62	101.9
155	Gilbert and Nejadi (2004)	B3-a	5249114	3110	<	10498	<	34600	3.296	90006	149.12	864601185	1086740	37286	28530	267.94	210.89	30963073	426368918	1627571	20	9.01	8.78	102.6
156	Gilbert and Nejadi (2004)	B3-a	5249114	3110	<	10498	<	34600	3.296	90313	148.70	869323114	1121104	37968	28905	267.19	209.38	32200132	436909196	1671053	23	9.28	9.04	102.7
157	Gilbert and Nejadi (2004)	B3-a	5249114	3110	<	10498	<	34600	3.296	90482	148.47	871901898	1139866	38340	29108	266.79	208.57	32881639	442642264	1694705	25	9.39	9.12	103.0
158	Gilbert and Nejadi (2004)	B3-a	5249114	3110	<	10498	<	34600	3.296	90560	148.36	873095923	1148521	38515	29205	266.59	208.19	33213173	445259660	1705558	28	9.41	9.16	102.8
159	Gilbert and Nejadi (2004)	B3-a	5249114	3110	<	10498	<	34600	3.296	90560	148.36	873095923	1148521	38515	29205	266.59	208.19	33213173	445259660	1705558	31	9.44	9.29	101.7
160	Gilbert and Nejadi (2004)	B3-a	5249114	3110	<	10498	<	34600	3.296	90699	148.18	875203371	1163929	38819	29370	266.26	207.53	33779295	449897242	1724728	34	9.60	9.33	102.9
161	Gilbert and Nejadi (2004)	B3-a	5249114	3110	<	10498	<	34600	3.296	90976	147.80	879398988	1194401	39419	29693	265.62	206.25	34904308	459093211	1762908	39	9.87	9.57	103.1
162	Gilbert and Nejadi (2004)	B3-a	5249114	3110	<	10498	<	34600	3.296	91236	147.45	883297910	1222747	39971	29985	265.03	205.06	35946027	467535867	1798022	47	10.30	9.92	103.8
163	Gilbert and Nejadi (2004)	B3-a	5249114	3110	<	10498	<	34600	3.296	91646	146.90	889418616	1267238	40831	30435	264.13	203.24	37588817	480696184	1852933	54	10.65	10.10	105.4
164	Gilbert and Nejadi (2004)	B3-a	5249114	3110	<	10498	<	34600	3.296	91869	146.61	892726047	1291356	41302	30683	263.64	202.28	38513321	487767034	1882506	62	10.82	10.20	106.0
165	Gilbert and Nejadi (2004)	B3-a	5249114	3110	<	10498	<	34600	3.296	92038	146.38	895218309	1309407	41651	30863	263.28	201.56	39195124	493052067	1904671	73	11.03	10.60	104.0
166	Gilbert and Nejadi (2004)	B3-a	5249114	3110	<	10498	<	34600	3.296	92086	146.32	895928704	1314613	41744	30908	263.19	201.36	39366823	494554207	1911021	82	11.21	10.60	105.8
167	Gilbert and Nejadi (2004)	B3-a	5249114	3110	<	10498	<	34600	3.296	92116	146.28	896372324	1317836	41811	30945	263.11	201.23	39510288	495470218	1914926	95	11.57	10.90	106.2
168	Gilbert and Nejadi (2004)	B3-a	5249114	3110	<	10498	<	34600	3.296	92562	145.70	902904109	1365392	42715	31403	262.2	199.38	41288719	509204182	1972635	108	12.04	11.10	108.5
169	Gilbert and Nejadi (2004)	B3-a	5249114	3110	<	10498	<	34600	3.296	92785	145.41	906146441	1388976	43170	31635	261.73	198.48	42212615	515931552	2001159	122	12.18	11.40	106.8
170	Gilbert and Nejadi (2004)	B3-a	5249114	3110	<	10498	<	34600	3.296	93147	144.94	911371260	1426949	43885	31988	261.03	197.04	43639487	526751587	2046793	152	12.45	11.80	105.5
171	Gilbert and Nejadi (2004)	B3-a	5249114	3110	<	10498	<	34600	3.296	93286	144.76	913363362	1441417	44159	32123	260.76	196.5	44194350	530843694	2064153	186	12.54	12.10	103.7
172	Gilbert and Nejadi (2004)	B3-a	5249114	3110	<	10498	<	34600	3.296	93817	144.08	920930940	1496421	45200	32633	259.74	194.47	46332931	546266624	2129648	228	12.75	12.60	101.2
173	Gilbert and Nejadi (2004)	B3-a	5249114	3110	<	10498	<	34600	3.296	94118	143.70	925192684	1527434	45778	32910	259.18	193.35	47525028	554845291	2166331	272	12.92	13.00	99.4
174	Gilbert and Nejadi (2004)	B3-a	5249114	3110	<	10498	<	34600	3.296	94480	143.25	930270874	1564426	46470	33240	258.52	192.04	48969062	565019468	2209909	318	13.11	13.20	99.3
175	Gilbert and Nejadi (2004)	B3-a	5249114	3110	<	10498	<	34600	3.296	94818	142.82	934975553	1598523	47108	33540	257.92	190.83	50306941	574373437	2249899	380	13.25	13.30	99.6
176	Gilbert and Nejadi (2004)	B3-b	5249114	3110	<	10498	<	20800	1.981	86532	154.11	808941025	681995	28637	23355	278.29	231.57	16985501	293364864	1091161	0.1	3.16	1.97	160.5
177	Gilbert and Nejadi (2004)	B3-b	5249114	3110	<	10498	<	20800	1.981	86587	154.02	809845058	688522	28790	23453	278.1	231.18	17199118	295688346	1100290	1	3.58	2.31	155.1
178	Gilbert and Nejadi (2004)	B3-b	5249114	3110	<	10498	<	20800	1.981	87202	153.11	820012102	762461	30470	24518	275.97	226.95	19650214	321295284	1201928	2	3.76	2.55	147.5
179	Gilbert and Nejadi (2004)	B3-b	5249114	3110	<	10498	<	20800	1.981	87310	152.96	821791415	775457	30750	24690	275.62	226.23	20067904	325692763	1219484	3	3.90	2.65	147.2
180	Gilbert and Nejadi (2004)	B3-b	5249114	3110	<	10498	<	20800	1.981	87425	152.79	823664786	789067	31053	24878	275.25	225.49	20528582	330328471	1237970	4	3.98	2.73	145.8
181	Gilbert and Nejadi (2004)	B3-b	5249114	3110	<	10498	<	20800	1.981	87479	152.71	824550460	795504	31197	24968	275.07	225.14	20752189	332506081	1246670	5	4.05	2.84	142.7
182	Gilbert and Nejadi (2004)	B3-b	5249114	3110	<	10498	<	20800	1.981	87811	152.23	829939126	834710	32046	25485	274.03	223.04	22069508	345637262	1299269	6	4.15	2.96	140.1
183	Gilbert and Nejadi (2004)	B3-b	5249114	3110	<	10498	<	20800	1.981	88287	151.54	837608370	890463	33242	26205	272.59	220.18	23993369	364050007	1373484	7	4.41	3.15	140.0
184	Gilbert and Nejadi (2004)	B3-b	5249114	3110	<	10498	<	20800	1.981	88619	151.07	842899034	928967	34054	26685	271.63	218.26	25336135	376559772	1424067	8	4.57	3.25	140.6
185	Gilbert and Nejadi (2004)	B3-b	5249114	3110	<	10498	<	20800	1.981	88673	150.99	843761011	935215	34183	26760	271.48	217.96	25550362	378583571	1432329	10	4.72	3.45	136.9
186	Gilbert and Nejadi (2004)	B3-b	5249114	3110	<	10498	<	20800	1.981	88812	150.79	845959056	951176	34517	26955	271.09	217.18	26112999	383726459	1453192	11	4.79	3.46	138.3
187	Gilbert and Nejadi (2004)	B3-b	5249114	3110	<	10498	<	20800	1.981	88872	150.71	846912587	958152	34660	27038	270.93	216.85	26353502	385965699	1462265	13	4.86	3.53	137.6
188	Gilbert and Nejadi (2004)	B3-b	5249114	3110	<	10498	<	20800	1.981	89397	149.97	855154034	1018072	35897	27750	269.5	214.01	28492313	404971444	1539776	16	5.19	3.76	138.0
189	Gilbert and Nejadi (2004)	B3-b	5249114	3110	<	10498	<	20800	1.981	89758	149.47	860781661	1059032	36723	28215	268.57	212.14	29948764	417768510	1592249	18	5.44	3.90	139.5
190	Gilbert and Nejadi (2004)	B3-b	5249114	3110	<	10498	<	20800	1.981	90006	149.12	864601185	1086740	37286	28530	267.94	210.89	30963073	426368918	1627571	20	5.62	4.04	139.2
191	Gilbert and Nejadi (2004)	B3-b	5249114	3110	<	10498	<	20800	1.981	90313	148.70	869323114	1121104	37968	28905	267.19	209.38	32200132	436909196	1671053	23	5.85	4.24	138.1
192	Gilbert and Nejadi (2004)	B3-b	5249114	3110	<	10498	<	20800	1.981	90482	148.47	871901898	1139866	38340	29108	266.79	208.57	32881639	442642264	1694705	25	5.94	4.30	138.2
193	Gilbert and Nejadi (2004)	B3-b	5249114	3110	<	10498	<	20800	1.981	90560	148.36	873095923	1148521	38515	29205	266.59	208.19	33213173	445259660	1705558	28	5.95	4.38	135.9
194	Gilbert and Nejadi (2004)	B3-b	5249114	3110	<	10498	<	20800	1.981	90560	148.36	873095923	1148521	38515	29205	266.59	208.19	33213173	445259660	1705558	31	5.98	4.47	133.8
195	Gilbert and Nejadi (2004)	B3-b	5249114	3110	<	10498	<	20800	1.981	90699	148.18	875203371	1163929	38819	29370	266.26	207.53	33779295	449897242	1724728	34	6.11	4.51	135.5
196	Gilbert and Nejadi (2004)	B3-b	5249114	3110	<	10498	<	20800	1.981	90976	147.80	879398988	1194401	39419	29693	265.62	206.25	34904308	459093211	1762908	39	6.34	4.69	135.2
197	Gilbert and Nejadi (2004)	B3-b	5249114	3110	<	10498	<	20800	1.981	91236	147.45	883297910	1222747	39971	29985	265.03	205.06	35946027	467535867	1798022	47	6.71	5.20	129.1
198	Gilbert and Nejadi (2004)	B3-b	5249114	3110	<	10498	<	20800	1.981	91646	146.90	889418616	1267238	40831	30435	264.13	203.24	37588817	480696184	1852933	54	7.01	5.33	131.5
199	Gilbert and Nejadi (2004)	B3-b	5249114	3110	<	10498	<	20800	1.981	91869	146.61	892726047	1291356	41302	30683	263.64	202.28	38513321	487767034	1882506	62	7.15	5.42	131.9
200	Gilbert and Nejadi (2004)	B3-b	5249114	3110	<	10498	<	20800	1.981	92038	146.38	895218309	1309407	41651	30863	263.28	201.56	39195124	493052067	1904671	73	7.33	5.69	128.8
201	Gilbert and Nejadi (2004)	B3-b	5249114	3110	<	10498	<	20800	1.981	92086	146.32	895928704	1314613	41744	30908	263.19	201.36	39366823	494554207	1911021	82	7.49	5.69	131.7
202	Gilbert and Nejadi (2004)	B3-b	5249114	3110	<	10498	<	20800	1.981	92116	146.28	896372324	1317836	41811	30945	263.11	201.23	39510288	495470218	1914926	95	7.82	5.97	131.0
203	Gilbert and Nejadi (2004)	B3-b	5249114	3110	<	10498	<	20800	1.981	92562	145.70	902904109	1365392	42715	31403	262.2	199.38	41288719	509204182	1972635	108	8.22	6.17	133.3
204	Gilbert and Nejadi (2004)	B3-b	5249114	3110	<	10498	<	20800	1.981	92785	145.41	906146441	1388976	43170	31635	261.73	198.48	42212615	515931552	2001159	122	8.33	6.37	130.8
205	Gilbert and Nejadi (2004)	B3-b	5249114	3110	<	10498	<	20800	1.981	93147	144.94	911371260	1426949	43885	31988	261.03	197.04	43639487	526751587	2046793	152	8.56	6.67	128.4
206	Gilbert and Nejadi (2004)	B3-b	5249114	3110	<	10498	<	20800	1.981	93286	144.76	913363362	1441417	44159	32123	260.76	196.5	44194350	530843694	2064153	186	8.64	6.92	124.9
207	Gilbert and Nejadi (2004)	B3-b	5249114	3110	<	10498	<	20800	1.981	93817	144.08	920930940	1496421	45200	32633	259.74	194.47	46332931	546266624	2129648	228	8.80	7.34	119.9
208	Gilbert and Nejadi (2004)	B3-b	5249114	3110	<	10498	<	20800	1.981	94118	143.70	925192684	1527434	45778	32910	259.18	193.35	47525028	554845291	2166331	272	8.94	7.64	117.1
209	Gilbert and Nejadi (2004)	B3-b	5249114	3110	<	10498	<	20800	1.981	94480	143.25	930270874	1564426	46470	33240	258.52	192.04	48969062	565019468	2209909	318	9.10	7.81	116.5
210	Gilbert and Nejadi (2004)	B3-b	5249114	3110	<	10498	<	20800	1.981	94818	142.82	934975553	1598523	47108	33540	257.92	190.83	50306941	574373437	2249899	380	9.21	7.90	116.5

	Study information			Cracking moment						State I				State II							Deflection			
	1	2	3	4		5		6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
	Author	Specimen	W_I^* (t_0) (mm^3)	M_{SW} (Nm)		M_{cr} (Nm)		M_{max} (Nm)	M_{max}/M_{cr}	A_I^* (mm^2)	$z_{I,1}^*$ (mm)	I_I^* (mm^4)	S_I^* (mm^3)	A_{II}^* (mm^2)	A_{IIc} (mm^2)	$z_{IIc,1}$ (mm)	$z_{II,1}^*$ (mm)	I_{IIc} (mm^4)	I_{II}^* (mm^4)	S_{II}^* (mm^3)	t-t$_0$ (days)	$a_{num.int.}$ (mm)	a_{exp} (mm)	$a_{num.int.}/a_{exp}$ (%)
211	Gilbert and Nejadi (2004)	S1-a	1705549	2373	<	3411	<	6810	1.996	63980	75.88	129417031	100730	14491	12511	139.36	123.73	1019989	23374322	195462	0.1	11.51	7.14	161.2
212	Gilbert and Nejadi (2004)	S1-a	1705549	2373	<	3411	<	6810	1.996	64000	75.86	129469660	101725	14563	12563	139.3	123.6	1032760	23574306	197210	1	13.79	9.53	144.7
213	Gilbert and Nejadi (2004)	S1-a	1705549	2373	<	3411	<	6810	1.996	64231	75.68	130063799	113048	15397	13166	138.54	122.09	1188776	25778397	216571	2	14.25	10.50	135.7
214	Gilbert and Nejadi (2004)	S1-a	1705549	2373	<	3411	<	6810	1.996	64271	75.65	130168206	115041	15541	13270	138.41	121.84	1217169	26160864	219953	3	14.57	10.90	133.6
215	Gilbert and Nejadi (2004)	S1-a	1705549	2373	<	3411	<	6810	1.996	64314	75.61	130278267	117124	15688	13374	138.28	121.57	1246010	26562411	223486	4	14.75	11.20	131.7
216	Gilbert and Nejadi (2004)	S1-a	1705549	2373	<	3411	<	6810	1.996	64335	75.59	130330352	118106	15761	13426	138.22	121.45	1260601	26754104	225170	5	14.91	11.60	128.5
217	Gilbert and Nejadi (2004)	S1-a	1705549	2373	<	3411	<	6810	1.996	64459	75.50	130647925	124173	16187	13728	137.84	120.7	1347475	27900109	235315	6	15.15	12.10	125.2
218	Gilbert and Nejadi (2004)	S1-a	1705549	2373	<	3411	<	6810	1.996	64637	75.36	131101941	132820	16776	14139	137.33	119.67	1472097	29519343	249685	7	15.77	12.90	122.2
219	Gilbert and Nejadi (2004)	S1-a	1705549	2373	<	3411	<	6810	1.996	64762	75.26	131416549	138804	17176	14414	136.98	118.97	1559870	30622181	259519	8	16.15	13.00	124.2
220	Gilbert and Nejadi (2004)	S1-a	1705549	2373	<	3411	<	6810	1.996	64782	75.25	131467917	139799	17243	14461	136.92	118.86	1575113	30800878	261124	10	16.48	14.00	117.7
221	Gilbert and Nejadi (2004)	S1-a	1705549	2373	<	3411	<	6810	1.996	64834	75.21	131599041	142297	17404	14570	136.79	118.59	1611065	31260838	265238	11	16.63	14.00	118.8
222	Gilbert and Nejadi (2004)	S1-a	1705549	2373	<	3411	<	6810	1.996	64857	75.19	131655984	143375	17479	14622	136.72	118.46	1628376	31455852	266982	13	16.80	14.10	119.1
223	Gilbert and Nejadi (2004)	S1-a	1705549	2373	<	3411	<	6810	1.996	65053	75.04	132149734	152785	18086	15033	136.21	117.44	1769510	33156406	282243	16	17.56	14.90	117.8
224	Gilbert and Nejadi (2004)	S1-a	1705549	2373	<	3411	<	6810	1.996	65189	74.93	132488514	159220	18493	15304	135.87	116.75	1866722	34305495	292578	18	18.13	15.40	117.8
225	Gilbert and Nejadi (2004)	S1-a	1705549	2373	<	3411	<	6810	1.996	65282	74.86	132719205	163617	18768	15486	135.64	116.29	1934118	35080167	299570	20	18.55	15.50	119.7
226	Gilbert and Nejadi (2004)	S1-a	1705549	2373	<	3411	<	6810	1.996	65397	74.77	133005250	169058	19106	15709	135.36	115.74	2019115	36034436	308224	23	19.07	16.40	116.3
227	Gilbert and Nejadi (2004)	S1-a	1705549	2373	<	3411	<	6810	1.996	65460	74.73	133161867	172069	19289	15829	135.21	115.44	2065583	36553586	312928	25	19.27	16.60	116.1
228	Gilbert and Nejadi (2004)	S1-a	1705549	2373	<	3411	<	6810	1.996	65489	74.70	133234478	173425	19370	15881	135.15	115.31	2086008	36796686	315131	28	19.30	16.60	116.3
229	Gilbert and Nejadi (2004)	S1-a	1705549	2373	<	3411	<	6810	1.996	65489	74.70	133234478	173425	19370	15881	135.15	115.31	2086008	36796686	315131	31	19.37	16.90	114.6
230	Gilbert and Nejadi (2004)	S1-a	1705549	2373	<	3411	<	6810	1.996	65541	74.66	133362785	175867	19521	15980	135.03	115.07	2125184	37221783	318976	34	19.66	16.80	117.0
231	Gilbert and Nejadi (2004)	S1-a	1705549	2373	<	3411	<	6810	1.996	65645	74.59	133618791	180774	19817	16172	134.79	114.6	2202876	38060861	326626	39	20.17	17.40	115.9
232	Gilbert and Nejadi (2004)	S1-a	1705549	2373	<	3411	<	6810	1.996	65743	74.51	133857366	185294	20087	16344	134.57	114.15	2273746	38833637	333649	47	20.98	18.30	114.7
233	Gilbert and Nejadi (2004)	S1-a	1705549	2373	<	3411	<	6810	1.996	65896	74.40	134233215	192474	20510	16614	134.23	113.48	2388479	40044379	344739	54	21.64	18.60	116.4
234	Gilbert and Nejadi (2004)	S1-a	1705549	2373	<	3411	<	6810	1.996	65980	74.33	134436984	196326	20734	16754	134.06	113.13	2449545	40700047	350745	62	21.95	18.70	117.4
235	Gilbert and Nejadi (2004)	S1-a	1705549	2373	<	3411	<	6810	1.996	66043	74.29	134590846	199286	20907	16864	133.92	112.86	2497754	41187868	355230	73	22.36	19.20	116.4
236	Gilbert and Nejadi (2004)	S1-a	1705549	2373	<	3411	<	6810	1.996	66061	74.27	134634752	200096	20956	16895	133.88	112.78	2511643	41326500	356494	82	22.71	19.20	118.3
237	Gilbert and Nejadi (2004)	S1-a	1705549	2373	<	3411	<	6810	1.996	66073	74.26	134662181	200612	20983	16910	133.86	112.73	2518607	41412897	357282	95	23.40	19.20	121.9
238	Gilbert and Nejadi (2004)	S1-a	1705549	2373	<	3411	<	6810	1.996	66240	74.14	135067038	208342	21426	17186	133.52	112.04	2643767	42693481	369029	108	24.29	19.60	123.9
239	Gilbert and Nejadi (2004)	S1-a	1705549	2373	<	3411	<	6810	1.996	66323	74.08	135268702	212191	21644	17321	133.35	111.71	2706654	43323767	374880	122	24.54	20.40	120.3
240	Gilbert and Nejadi (2004)	S1-a	1705549	2373	<	3411	<	6810	1.996	66459	73.98	135594645	218401	21999	17540	133.08	111.17	2810333	44339502	384230	152	25.05	21.50	116.5
241	Gilbert and Nejadi (2004)	S1-a	1705549	2373	<	3411	<	6810	1.996	66511	73.94	135719237	220766	22129	17618	132.98	110.97	2847994	44722647	387807	186	25.23	22.30	113.1
242	Gilbert and Nejadi (2004)	S1-a	1705549	2373	<	3411	<	6810	1.996	66710	73.79	136194146	229793	22634	17924	132.59	110.2	2999388	46173823	401278	228	25.61	23.50	109.0
243	Gilbert and Nejadi (2004)	S1-a	1705549	2373	<	3411	<	6810	1.996	66823	73.71	136462720	234921	22914	18091	132.39	109.79	3083700	46996915	408929	272	25.93	24.20	107.2
244	Gilbert and Nejadi (2004)	S1-a	1705549	2373	<	3411	<	6810	1.996	66958	73.61	136783814	241030	23252	18294	132.13	109.29	3188573	47960668	417947	318	26.28	25.00	105.1
245	Gilbert and Nejadi (2004)	S1-a	1705549	2373	<	3411	<	6810	1.996	67085	73.52	137082330	246724	23561	18476	131.91	108.84	3284690	48861283	426326	380	26.53	25.10	105.7
246	Gilbert and Nejadi (2004)	S1-b	1705549	2373	<	3411	<	5280	1.548	63980	75.88	129417031	100730	14491	12511	139.36	123.73	1019989	23374322	195462	0.1	6.85	2.72	251.9
247	Gilbert and Nejadi (2004)	S1-b	1705549	2373	<	3411	<	5280	1.548	64000	75.86	129469660	101725	14563	12563	139.3	123.6	1032760	23574306	197210	1	9.51	4.78	199.0
248	Gilbert and Nejadi (2004)	S1-b	1705549	2373	<	3411	<	5280	1.548	64231	75.68	130063799	113048	15397	13166	138.54	122.09	1188776	25778397	216571	2	9.88	5.66	174.6
249	Gilbert and Nejadi (2004)	S1-b	1705549	2373	<	3411	<	5280	1.548	64271	75.65	130168206	115041	15541	13270	138.41	121.84	1217169	26160864	219953	3	10.15	6.05	167.8
250	Gilbert and Nejadi (2004)	S1-b	1705549	2373	<	3411	<	5280	1.548	64314	75.61	130278267	117124	15688	13374	138.28	121.57	1246010	26562411	223486	4	10.31	6.25	164.9
251	Gilbert and Nejadi (2004)	S1-b	1705549	2373	<	3411	<	5280	1.548	64335	75.59	130330352	118106	15761	13426	138.22	121.45	1260601	26754104	225170	5	10.44	6.58	158.7
252	Gilbert and Nejadi (2004)	S1-b	1705549	2373	<	3411	<	5280	1.548	64459	75.50	130647925	124173	16187	13728	137.84	120.7	1347475	27900109	235315	6	10.64	6.99	152.2
253	Gilbert and Nejadi (2004)	S1-b	1705549	2373	<	3411	<	5280	1.548	64637	75.36	131101941	132820	16776	14139	137.33	119.67	1472097	29519343	249685	7	11.15	7.72	144.5
254	Gilbert and Nejadi (2004)	S1-b	1705549	2373	<	3411	<	5280	1.548	64762	75.26	131416549	138804	17176	14414	136.98	118.97	1559870	30622181	259519	8	11.47	8.08	141.9
255	Gilbert and Nejadi (2004)	S1-b	1705549	2373	<	3411	<	5280	1.548	64782	75.25	131467917	139799	17243	14461	136.92	118.86	1575113	30800878	261124	10	11.76	8.76	134.2
256	Gilbert and Nejadi (2004)	S1-b	1705549	2373	<	3411	<	5280	1.548	64834	75.21	131599041	142297	17404	14570	136.79	118.59	1611065	31260838	265238	11	11.89	8.76	135.7
257	Gilbert and Nejadi (2004)	S1-b	1705549	2373	<	3411	<	5280	1.548	64857	75.19	131655984	143375	17479	14622	136.72	118.46	1628376	31455852	266982	13	12.02	8.89	135.3
258	Gilbert and Nejadi (2004)	S1-b	1705549	2373	<	3411	<	5280	1.548	65053	75.04	132149734	152785	18086	15033	136.21	117.44	1769510	33156406	282243	16	12.67	9.47	133.8
259	Gilbert and Nejadi (2004)	S1-b	1705549	2373	<	3411	<	5280	1.548	65189	74.93	132488514	159220	18493	15304	135.87	116.75	1866722	34305495	292578	18	13.16	9.86	133.4
260	Gilbert and Nejadi (2004)	S1-b	1705549	2373	<	3411	<	5280	1.548	65282	74.86	132719205	163617	18768	15486	135.64	116.29	1934118	35080167	299570	20	13.51	10.20	132.4
261	Gilbert and Nejadi (2004)	S1-b	1705549	2373	<	3411	<	5280	1.548	65397	74.77	133005250	169058	19106	15709	135.36	115.74	2019115	36034436	308224	23	13.95	10.80	129.2
262	Gilbert and Nejadi (2004)	S1-b	1705549	2373	<	3411	<	5280	1.548	65460	74.73	133161867	172069	19289	15829	135.21	115.44	2065583	36553586	312928	25	14.12	10.90	129.6
263	Gilbert and Nejadi (2004)	S1-b	1705549	2373	<	3411	<	5280	1.548	65489	74.70	133234478	173425	19370	15881	135.15	115.31	2086008	36796686	315131	28	14.15	10.90	129.8
264	Gilbert and Nejadi (2004)	S1-b	1705549	2373	<	3411	<	5280	1.548	65489	74.70	133234478	173425	19370	15881	135.15	115.31	2086008	36796686	315131	31	14.20	11.20	126.8
265	Gilbert and Nejadi (2004)	S1-b	1705549	2373	<	3411	<	5280	1.548	65541	74.66	133362785	175867	19521	15980	135.03	115.07	2125184	37221783	318976	34	14.45	11.10	130.2
266	Gilbert and Nejadi (2004)	S1-b	1705549	2373	<	3411	<	5280	1.548	65645	74.59	133618791	180774	19817	16172	134.79	114.6	2202876	38060861	326626	39	14.89	11.60	128.4
267	Gilbert and Nejadi (2004)	S1-b	1705549	2373	<	3411	<	5280	1.548	65743	74.51	133857366	185294	20087	16344	134.57	114.15	2273746	38833637	333649	47	15.60	12.40	125.8
268	Gilbert and Nejadi (2004)	S1-b	1705549	2373	<	3411	<	5280	1.548	65896	74.40	134233215	192474	20510	16614	134.23	113.48	2388479	40044379	344739	54	16.17	12.60	128.3
269	Gilbert and Nejadi (2004)	S1-b	1705549	2373	<	3411	<	5280	1.548	65980	74.33	134436984	196326	20734	16754	134.06	113.13	2449545	40700047	350745	62	16.43	12.70	129.4
270	Gilbert and Nejadi (2004)	S1-b	1705549	2373	<	3411	<	5280	1.548	66043	74.29	134590846	199286	20907	16864	133.92	112.86	2497754	41187868	355230	73	16.78	13.50	124.3
271	Gilbert and Nejadi (2004)	S1-b	1705549	2373	<	3411	<	5280	1.548	66061	74.27	134634752	200096	20956	16895	133.88	112.78	2511643	41326500	356494	82	17.08	13.50	126.6
272	Gilbert and Nejadi (2004)	S1-b	1705549	2373	<	3411	<	5280	1.548	66073	74.26	134662181	200612	20983	16910	133.86	112.73	2518607	41412897	357282	95	17.69	14.40	122.9
273	Gilbert and Nejadi (2004)	S1-b	1705549	2373	<	3411	<	5280	1.548	66240	74.14	135067038	208342	21426	17186	133.52	112.04	2643767	42693481	369029	108	18.46	14.90	123.9
274	Gilbert and Nejadi (2004)	S1-b	1705549	2373	<	3411	<	5280	1.548	66323	74.08	135268702	212191	21644	17321	133.35	111.71	2706654	43323767	374880	122	18.68	15.50	120.5
275	Gilbert and Nejadi (2004)	S1-b	1705549	2373	<	3411	<	5280	1.548	66459	73.98	135594645	218401	21999	17540	133.08	111.17	2810333	44339502	384230	152	19.12	16.50	115.9
276	Gilbert and Nejadi (2004)	S1-b	1705549	2373	<	3411	<	5280	1.548	66511	73.94	135719237	220766	22129	17618	132.98	110.97	2847994	44722647	387807	186	19.27	17.20	112.1
277	Gilbert and Nejadi (2004)	S1-b	1705549	2373	<	3411	<	5280	1.548	66710	73.79	136194146	229793	22634	17924	132.59	110.2	2999388	46173823	401278	228	19.60	18.40	106.5
278	Gilbert and Nejadi (2004)	S1-b	1705549	2373	<	3411	<	5280	1.548	66823	73.71	136462720	234921	22914	18091	132.39	109.79	3083700	46996915	408929	272	19.88	19.00	104.6
279	Gilbert and Nejadi (2004)	S1-b	1705549	2373	<	3411	<	5280	1.548	66958	73.61	136783814	241030	23252	18294	132.13	109.29	3188573	47960668	417947	318	20.18	19.80	101.9
280	Gilbert and Nejadi (2004)	S1-b	1705549	2373	<	3411	<	5280	1.548	67085	73.52	137082330	246724	23561	18476	131.91	108.84	3284690	48861283	426326	380	20.40	19.90	102.5

	Study information			Cracking moment						State I				State II							Deflection			
	1	2	3	4		5		6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
	Author	Specimen	$W_I^*(t_0)$ (mm^3)	M_{SW} (Nm)		M_{cr} (Nm)		M_{max} (Nm)	M_{max}/M_{cr}	A_I^* (mm^2)	$z_{I,1}^*$ (mm)	I_I^* (mm^4)	S_I^* (mm^3)	A_{II}^* (mm^2)	A_{IIc} (mm^2)	$z_{IIc,1}$ (mm)	$z_{II,1}^*$ (mm)	I_{IIc} (mm^4)	I_{II}^* (mm^4)	S_{II}^* (mm^3)	t-t_0 (days)	$a_{num.int.}$ (mm)	a_{exp} (mm)	$a_{num.int.}/a_{exp}$ (%)
281	Gilbert and Nejadi (2004)	S2-a	1756859	2373	<	3514	<	9870	2.809	64970	75.10	131940113	148779	17826	14856	136.43	117.86	1707810	32437971	275761	0.1	14.56	11.80	123.4
282	Gilbert and Nejadi (2004)	S2-a	1756859	2373	<	3514	<	9870	2.809	65000	75.08	132016659	150248	17919	14919	136.35	117.71	1729420	32699742	278144	1	15.77	13.70	115.1
283	Gilbert and Nejadi (2004)	S2-a	1756859	2373	<	3514	<	9870	2.809	65346	74.81	132879178	166661	18951	15605	135.49	115.98	1979278	35614635	304413	2	16.35	14.70	111.2
284	Gilbert and Nejadi (2004)	S2-a	1756859	2373	<	3514	<	9870	2.809	65407	74.77	133030442	169564	19132	15725	135.34	115.69	2025136	36117973	308976	3	16.72	15.10	110.7
285	Gilbert and Nejadi (2004)	S2-a	1756859	2373	<	3514	<	9870	2.809	65471	74.72	133189802	172596	19315	15844	135.19	115.39	2071697	36645412	313776	4	16.93	15.50	109.3
286	Gilbert and Nejadi (2004)	S2-a	1756859	2373	<	3514	<	9870	2.809	65502	74.69	133265178	174008	19404	15902	135.12	115.25	2094215	36895543	316044	5	17.12	16.00	107.0
287	Gilbert and Nejadi (2004)	S2-a	1756859	2373	<	3514	<	9870	2.809	65688	74.55	133724294	182756	19928	16240	134.7	114.4	2230616	38401339	329736	6	17.42	16.40	106.2
288	Gilbert and Nejadi (2004)	S2-a	1756859	2373	<	3514	<	9870	2.809	65956	74.35	134379210	195235	20669	16713	134.11	113.23	2431344	40514408	349049	7	18.16	17.20	105.6
289	Gilbert and Nejadi (2004)	S2-a	1756859	2373	<	3514	<	9870	2.809	66143	74.21	134832032	203856	21168	17025	133.72	112.44	2570069	41952789	362227	8	18.61	17.60	105.7
290	Gilbert and Nejadi (2004)	S2-a	1756859	2373	<	3514	<	9870	2.809	66173	74.19	134905888	205274	21250	17077	133.65	112.31	2593691	42182097	364352	10	18.99	18.40	103.2
291	Gilbert and Nejadi (2004)	S2-a	1756859	2373	<	3514	<	9870	2.809	66251	74.13	135094320	208855	21453	17202	133.5	112	2650973	42778871	369842	11	19.18	18.40	104.2
292	Gilbert and Nejadi (2004)	S2-a	1756859	2373	<	3514	<	9870	2.809	66285	74.11	135176110	210434	21544	17259	133.43	111.86	2677507	43036079	372192	13	19.36	18.60	104.1
293	Gilbert and Nejadi (2004)	S2-a	1756859	2373	<	3514	<	9870	2.809	66580	73.89	135884157	223911	22302	17722	132.85	110.7	2898729	45230497	392497	16	20.27	19.40	104.5
294	Gilbert and Nejadi (2004)	S2-a	1756859	2373	<	3514	<	9870	2.809	66783	73.74	136368822	233138	22811	18028	132.46	109.93	3051900	46705302	406245	18	20.95	19.90	105.3
295	Gilbert and Nejadi (2004)	S2-a	1756859	2373	<	3514	<	9870	2.809	66922	73.64	136698316	239420	23153	18231	132.21	109.42	3156055	47704739	415539	20	21.44	20.40	105.1
296	Gilbert and Nejadi (2004)	S2-a	1756859	2373	<	3514	<	9870	2.809	67095	73.51	137106269	247167	23576	18481	131.9	108.8	3287465	48929637	426975	23	22.05	21.10	104.5
297	Gilbert and Nejadi (2004)	S2-a	1756859	2373	<	3514	<	9870	2.809	67190	73.44	137329351	251408	23806	18616	131.73	108.46	3360144	49592519	433165	25	22.29	21.30	104.6
298	Gilbert and Nejadi (2004)	S2-a	1756859	2373	<	3514	<	9870	2.809	67234	73.41	137432710	253386	23912	18678	131.65	108.31	3394046	49896972	436058	28	22.33	21.30	104.8
299	Gilbert and Nejadi (2004)	S2-a	1756859	2373	<	3514	<	9870	2.809	67234	73.41	137432710	253386	23912	18678	131.65	108.31	3394046	49896972	436058	31	22.40	21.70	103.2
300	Gilbert and Nejadi (2004)	S2-a	1756859	2373	<	3514	<	9870	2.809	67312	73.36	137615245	256895	24100	18788	131.52	108.04	3453923	50442487	441119	34	22.74	21.70	104.8
301	Gilbert and Nejadi (2004)	S2-a	1756859	2373	<	3514	<	9870	2.809	67468	73.25	137979050	263834	24469	19001	131.25	107.51	3572847	51507649	451170	39	23.34	22.30	104.7
302	Gilbert and Nejadi (2004)	S2-a	1756859	2373	<	3514	<	9870	2.809	67614	73.14	138317609	270250	24807	19193	131.01	107.02	3682485	52494318	460447	47	24.29	23.30	104.2
303	Gilbert and Nejadi (2004)	S2-a	1756859	2373	<	3514	<	9870	2.809	67844	72.98	138850038	280412	25339	19495	130.63	106.27	3858825	54028249	474971	54	25.07	23.60	106.2
304	Gilbert and Nejadi (2004)	S2-a	1756859	2373	<	3514	<	9870	2.809	67970	72.89	139138224	285893	25621	19651	130.44	105.87	3952205	54857386	482777	62	25.43	23.80	106.8
305	Gilbert and Nejadi (2004)	S2-a	1756859	2373	<	3514	<	9870	2.809	68065	72.82	139355606	290014	25835	19770	130.29	105.57	4024808	55475044	488634	73	25.90	24.80	104.4
306	Gilbert and Nejadi (2004)	S2-a	1756859	2373	<	3514	<	9870	2.809	68092	72.80	139417604	291189	25899	19807	130.24	105.49	4047079	55646879	490331	82	26.30	24.80	106.1
307	Gilbert and Nejadi (2004)	S2-a	1756859	2373	<	3514	<	9870	2.809	68109	72.79	139456326	291939	25937	19828	130.22	105.44	4059843	55762627	491390	95	27.09	25.90	104.6
308	Gilbert and Nejadi (2004)	S2-a	1756859	2373	<	3514	<	9870	2.809	68360	72.62	140027189	302846	26494	20134	129.83	104.66	4251232	57363170	506609	108	28.13	26.60	105.8
309	Gilbert and Nejadi (2004)	S2-a	1756859	2373	<	3514	<	9870	2.809	68485	72.53	140311050	308235	26770	20285	129.64	104.29	4347471	58154082	514201	122	28.43	27.30	104.1
310	Gilbert and Nejadi (2004)	S2-a	1756859	2373	<	3514	<	9870	2.809	68688	72.39	140769164	316967	27207	20519	129.35	103.7	4499664	59425886	526383	152	29.03	28.40	102.2
311	Gilbert and Nejadi (2004)	S2-a	1756859	2373	<	3514	<	9870	2.809	68766	72.33	140944056	320256	27379	20613	129.23	103.47	4561522	59904478	530963	186	29.24	29.30	99.8
312	Gilbert and Nejadi (2004)	S2-a	1756859	2373	<	3514	<	9870	2.809	69065	72.13	141609560	332962	28011	20946	128.82	102.63	4786050	61728438	548437	228	29.70	30.60	97.1
313	Gilbert and Nejadi (2004)	S2-a	1756859	2373	<	3514	<	9870	2.809	69234	72.01	141985134	340083	28367	21133	128.58	102.17	4915525	62737071	558268	272	30.09	32.10	93.7
314	Gilbert and Nejadi (2004)	S2-a	1756859	2373	<	3514	<	9870	2.809	69438	71.88	142433401	348678	28789	21351	128.31	101.62	5069506	63942729	569874	318	30.50	32.10	95.0
315	Gilbert and Nejadi (2004)	S2-a	1756859	2373	<	3514	<	9870	2.809	69628	71.75	142849420	356586	29182	21554	128.06	101.12	5215337	65054121	580605	380	30.80	32.50	94.8
316	Gilbert and Nejadi (2004)	S2-b	1756859	2373	<	3514	<	6810	1.938	64970	75.10	131940113	148779	17826	14856	136.43	117.86	1707810	32437971	275761	0.1	8.39	4.43	189.5
317	Gilbert and Nejadi (2004)	S2-b	1756859	2373	<	3514	<	6810	1.938	65000	75.08	132016659	150248	17919	14919	136.35	117.71	1729420	32699742	278144	1	9.99	5.99	166.7
318	Gilbert and Nejadi (2004)	S2-b	1756859	2373	<	3514	<	6810	1.938	65346	74.81	132879178	166661	18951	15605	135.49	115.98	1979278	35614635	304413	2	10.42	6.83	152.5
319	Gilbert and Nejadi (2004)	S2-b	1756859	2373	<	3514	<	6810	1.938	65407	74.77	133030442	169564	19132	15725	135.34	115.69	2025136	36117973	308976	3	10.73	7.18	149.5
320	Gilbert and Nejadi (2004)	S2-b	1756859	2373	<	3514	<	6810	1.938	65471	74.72	133189802	172596	19315	15844	135.19	115.39	2071697	36645412	313776	4	10.91	7.42	147.1
321	Gilbert and Nejadi (2004)	S2-b	1756859	2373	<	3514	<	6810	1.938	65502	74.69	133265178	174008	19404	15902	135.12	115.25	2094215	36895543	316044	5	11.07	7.80	142.0
322	Gilbert and Nejadi (2004)	S2-b	1756859	2373	<	3514	<	6810	1.938	65688	74.55	133724294	182756	19928	16240	134.7	114.4	2230616	38401339	329736	6	11.30	8.16	138.5
323	Gilbert and Nejadi (2004)	S2-b	1756859	2373	<	3514	<	6810	1.938	65956	74.35	134379210	195235	20669	16713	134.11	113.23	2431344	40514408	349049	7	11.90	8.43	141.2
324	Gilbert and Nejadi (2004)	S2-b	1756859	2373	<	3514	<	6810	1.938	66143	74.21	134832032	203856	21168	17025	133.72	112.44	2570069	41952789	362227	8	12.27	9.26	132.5
325	Gilbert and Nejadi (2004)	S2-b	1756859	2373	<	3514	<	6810	1.938	66173	74.19	134905888	205274	21250	17077	133.65	112.31	2593691	42182097	364352	10	12.61	10.00	126.1
326	Gilbert and Nejadi (2004)	S2-b	1756859	2373	<	3514	<	6810	1.938	66251	74.13	135094320	208855	21453	17202	133.5	112	2650973	42778871	369842	11	12.75	10.00	127.5
327	Gilbert and Nejadi (2004)	S2-b	1756859	2373	<	3514	<	6810	1.938	66285	74.11	135176110	210434	21544	17259	133.43	111.86	2677507	43036079	372192	13	12.92	10.20	126.6
328	Gilbert and Nejadi (2004)	S2-b	1756859	2373	<	3514	<	6810	1.938	66580	73.89	135884157	223911	22302	17722	132.85	110.7	2898729	45230497	392497	16	13.67	10.80	126.5
329	Gilbert and Nejadi (2004)	S2-b	1756859	2373	<	3514	<	6810	1.938	66783	73.74	136368822	233138	22811	18028	132.46	109.93	3051900	46705302	406245	18	14.24	11.30	126.0
330	Gilbert and Nejadi (2004)	S2-b	1756859	2373	<	3514	<	6810	1.938	66922	73.64	136698316	239420	23153	18231	132.21	109.42	3156055	47704739	415539	20	14.65	11.70	125.2
331	Gilbert and Nejadi (2004)	S2-b	1756859	2373	<	3514	<	6810	1.938	67095	73.51	137106269	247167	23576	18481	131.9	108.8	3287465	48929637	426975	23	15.16	12.30	123.3
332	Gilbert and Nejadi (2004)	S2-b	1756859	2373	<	3514	<	6810	1.938	67190	73.44	137329351	251408	23806	18616	131.73	108.46	3360144	49592519	433165	25	15.36	12.40	123.9
333	Gilbert and Nejadi (2004)	S2-b	1756859	2373	<	3514	<	6810	1.938	67234	73.41	137432710	253386	23912	18678	131.65	108.31	3394046	49896972	436058	28	15.39	12.50	123.1
334	Gilbert and Nejadi (2004)	S2-b	1756859	2373	<	3514	<	6810	1.938	67234	73.41	137432710	253386	23912	18678	131.65	108.31	3394046	49896972	436058	31	15.46	12.70	121.7
335	Gilbert and Nejadi (2004)	S2-b	1756859	2373	<	3514	<	6810	1.938	67312	73.36	137615245	256895	24100	18788	131.52	108.04	3453923	50442487	441119	34	15.75	12.70	124.0
336	Gilbert and Nejadi (2004)	S2-b	1756859	2373	<	3514	<	6810	1.938	67468	73.25	137979050	263834	24469	19001	131.25	107.51	3572847	51507649	451170	39	16.26	13.20	123.2
337	Gilbert and Nejadi (2004)	S2-b	1756859	2373	<	3514	<	6810	1.938	67614	73.14	138317609	270250	24807	19193	131.01	107.02	3682485	52494318	460447	47	17.09	14.10	121.2
338	Gilbert and Nejadi (2004)	S2-b	1756859	2373	<	3514	<	6810	1.938	67844	72.98	138850038	280412	25339	19495	130.63	106.27	3858825	54028249	474971	54	17.75	14.30	124.1
339	Gilbert and Nejadi (2004)	S2-b	1756859	2373	<	3514	<	6810	1.938	67970	72.89	139138224	285893	25621	19651	130.44	105.87	3952205	54857386	482777	62	18.05	14.70	122.8
340	Gilbert and Nejadi (2004)	S2-b	1756859	2373	<	3514	<	6810	1.938	68065	72.82	139355606	290014	25835	19770	130.29	105.57	4024808	55475044	488634	73	18.46	15.50	119.1
341	Gilbert and Nejadi (2004)	S2-b	1756859	2373	<	3514	<	6810	1.938	68092	72.80	139417604	291189	25899	19807	130.24	105.49	4047079	55646879	490331	82	18.82	15.50	121.4
342	Gilbert and Nejadi (2004)	S2-b	1756859	2373	<	3514	<	6810	1.938	68109	72.79	139456326	291939	25937	19828	130.22	105.44	4059843	55762627	491390	95	19.53	16.20	120.6
343	Gilbert and Nejadi (2004)	S2-b	1756859	2373	<	3514	<	6810	1.938	68360	72.62	140027189	302846	26494	20134	129.83	104.66	4251232	57363170	506609	108	20.43	16.90	120.9
344	Gilbert and Nejadi (2004)	S2-b	1756859	2373	<	3514	<	6810	1.938	68485	72.53	140311050	308235	26770	20285	129.64	104.29	4347471	58154082	514201	122	20.68	17.50	118.2
345	Gilbert and Nejadi (2004)	S2-b	1756859	2373	<	3514	<	6810	1.938	68688	72.39	140769164	316967	27207	20519	129.35	103.7	4499664	59425886	526383	152	21.19	18.50	114.5
346	Gilbert and Nejadi (2004)	S2-b	1756859	2373	<	3514	<	6810	1.938	68766	72.33	140944056	320256	27379	20613	129.23	103.47	4561522	59904478	530963	186	21.37	19.20	111.3
347	Gilbert and Nejadi (2004)	S2-b	1756859	2373	<	3514	<	6810	1.938	69065	72.13	141609560	332962	28011	20946	128.82	102.63	4786050	61728438	548437	228	21.74	20.40	106.6
348	Gilbert and Nejadi (2004)	S2-b	1756859	2373	<	3514	<	6810	1.938	69234	72.01	141985134	340083	28367	21133	128.58	102.17	4915525	62737071	558268	272	22.06	21.60	102.1
349	Gilbert and Nejadi (2004)	S2-b	1756859	2373	<	3514	<	6810	1.938	69438	71.88	142433401	348678	28789	21351	128.31	101.62	5069506	63942729	569874	318	22.41	21.80	102.8
350	Gilbert and Nejadi (2004)	S2-b	1756859	2373	<	3514	<	6810	1.938	69628	71.75	142849420	356586	29182	21554	128.06	101.12	5215337	65054121	580605	380	22.66	21.90	103.5

	Study information		Cracking moment							State I				State II							Deflection			
	1	2	3	4		5		6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
	Author	Specimen	$W_I^*(t_0)$ (mm^3)	M_{SW} (Nm)		M_{cr} (Nm)		M_{max} (Nm)	M_{max}/M_{cr}	A_I^* (mm^2)	$z_{I,1}^*$ (mm)	I_I^* (mm^4)	S_I^* (mm^3)	A_{II}^* (mm^2)	A_{IIc} (mm^2)	$z_{IIc,1}$ (mm)	$z_{II,1}^*$ (mm)	I_{IIc} (mm^4)	I_{II}^* (mm^4)	S_{II}^* (mm^3)	$t-t_0$ (days)	$a_{num.int.}$ (mm)	a_{exp} (mm)	$a_{num.int.}/a_{exp}$ (%)
351	Gilbert and Nejadi (2004)	S3-a	1807498	2373	<	3615	<	11350	3.140	65960	74.35	134387466	195402	20673	16713	134.11	113.21	2431344	40540791	349269	0.1	13.96	10.70	130.4
352	Gilbert and Nejadi (2004)	S3-a	1807498	2373	<	3615	<	11350	3.140	66000	74.32	134486472	197290	20786	16786	134.02	113.04	2463255	40857504	352178	1	14.81	13.00	113.9
353	Gilbert and Nejadi (2004)	S3-a	1807498	2373	<	3615	<	11350	3.140	66461	73.98	135600066	218512	21995	17534	133.08	111.16	2807834	44350901	384380	2	15.41	14.00	110.1
354	Gilbert and Nejadi (2004)	S3-a	1807498	2373	<	3615	<	11350	3.140	66543	73.92	135794981	222224	22202	17659	132.93	110.84	2868216	44957418	389937	3	15.80	14.50	108.9
355	Gilbert and Nejadi (2004)	S3-a	1807498	2373	<	3615	<	11350	3.140	66628	73.85	136000208	226101	22422	17794	132.76	110.52	2934599	45587002	395828	4	16.02	14.70	109.0
356	Gilbert and Nejadi (2004)	S3-a	1807498	2373	<	3615	<	11350	3.140	66669	73.82	136097236	227948	22526	17857	132.68	110.36	2965580	45882662	398559	5	16.22	15.20	106.7
357	Gilbert and Nejadi (2004)	S3-a	1807498	2373	<	3615	<	11350	3.140	66918	73.64	136687622	239200	23144	18226	132.22	109.44	3153355	47675531	415256	6	16.54	15.70	105.3
358	Gilbert and Nejadi (2004)	S3-a	1807498	2373	<	3615	<	11350	3.140	67275	73.38	137527999	255197	24005	18730	131.59	108.17	3422472	50183191	438708	7	17.31	16.50	104.9
359	Gilbert and Nejadi (2004)	S3-a	1807498	2373	<	3615	<	11350	3.140	67523	73.21	138107823	266285	24591	19068	131.16	107.32	3611117	51878377	454690	8	17.78	16.90	105.2
360	Gilbert and Nejadi (2004)	S3-a	1807498	2373	<	3615	<	11350	3.140	67564	73.18	138202296	268079	24690	19126	131.09	107.18	3643711	52155394	457259	10	18.18	17.60	103.3
361	Gilbert and Nejadi (2004)	S3-a	1807498	2373	<	3615	<	11350	3.140	67668	73.10	138443213	272635	24929	19261	130.92	106.84	3721532	52853538	463876	11	18.38	17.70	103.8
362	Gilbert and Nejadi (2004)	S3-a	1807498	2373	<	3615	<	11350	3.140	67713	73.07	138547729	274637	25036	19323	130.85	106.7	3757820	53162944	466775	13	18.57	17.90	103.8
363	Gilbert and Nejadi (2004)	S3-a	1807498	2373	<	3615	<	11350	3.140	68107	72.79	139451165	291831	25929	19822	130.22	105.44	4056649	55741126	491208	16	19.52	18.70	104.4
364	Gilbert and Nejadi (2004)	S3-a	1807498	2373	<	3615	<	11350	3.140	68378	72.60	140068170	303579	26528	20150	129.81	104.61	4261122	57477586	507730	18	20.23	19.20	105.4
365	Gilbert and Nejadi (2004)	S3-a	1807498	2373	<	3615	<	11350	3.140	68563	72.47	140486983	311548	26937	20374	129.53	104.06	4404556	58643770	518874	20	20.74	19.70	105.3
366	Gilbert and Nejadi (2004)	S3-a	1807498	2373	<	3615	<	11350	3.140	68794	72.32	141004795	321471	27433	20639	129.2	103.39	4578804	60073972	532547	23	21.39	20.40	104.8
367	Gilbert and Nejadi (2004)	S3-a	1807498	2373	<	3615	<	11350	3.140	68920	72.23	141287611	326837	27704	20784	129.02	103.04	4676396	60849976	540046	25	21.64	20.60	105.0
368	Gilbert and Nejadi (2004)	S3-a	1807498	2373	<	3615	<	11350	3.140	68979	72.19	141418566	329333	27826	20847	128.94	102.87	4718641	61205290	543445	28	21.68	20.70	104.8
369	Gilbert and Nejadi (2004)	S3-a	1807498	2373	<	3615	<	11350	3.140	68979	72.19	141418566	329333	27826	20847	128.94	102.87	4718641	61205290	543445	31	21.76	21.00	103.6
370	Gilbert and Nejadi (2004)	S3-a	1807498	2373	<	3615	<	11350	3.140	69083	72.12	141649709	333743	28049	20966	128.79	102.58	4800322	61832392	549487	34	22.12	21.00	105.3
371	Gilbert and Nejadi (2004)	S3-a	1807498	2373	<	3615	<	11350	3.140	69291	71.98	142109917	342520	28481	21190	128.51	102.01	4955547	63074369	561461	39	22.75	21.60	105.3
372	Gilbert and Nejadi (2004)	S3-a	1807498	2373	<	3615	<	11350	3.140	69485	71.84	142537619	350603	28883	21398	128.25	101.49	5102915	64219313	572537	47	23.73	22.50	105.5
373	Gilbert and Nejadi (2004)	S3-a	1807498	2373	<	3615	<	11350	3.140	69792	71.64	143209123	363441	29512	21720	127.85	100.7	5337062	66002091	589891	54	24.55	22.90	107.2
374	Gilbert and Nejadi (2004)	S3-a	1807498	2373	<	3615	<	11350	3.140	69960	71.53	143572022	370366	29852	21892	127.64	100.27	5464559	66960600	599128	62	24.93	23.20	107.5
375	Gilbert and Nejadi (2004)	S3-a	1807498	2373	<	3615	<	11350	3.140	70086	71.44	143845496	375527	30103	22017	127.48	99.95	5558548	67669950	606067	73	25.42	24.20	105.0
376	Gilbert and Nejadi (2004)	S3-a	1807498	2373	<	3615	<	11350	3.140	70122	71.42	143923450	377044	30175	22053	127.43	99.86	5586163	67867069	608046	82	25.84	24.10	107.2
377	Gilbert and Nejadi (2004)	S3-a	1807498	2373	<	3615	<	11350	3.140	70145	71.40	143972132	377930	30219	22074	127.41	99.81	5601984	68001085	609330	95	26.67	25.10	106.3
378	Gilbert and Nejadi (2004)	S3-a	1807498	2373	<	3615	<	11350	3.140	70480	71.18	144688955	391584	30882	22402	127	98.99	5855121	69852139	627400	108	27.76	25.70	108.0
379	Gilbert and Nejadi (2004)	S3-a	1807498	2373	<	3615	<	11350	3.140	70647	71.07	145044822	398356	31210	22563	126.8	98.6	5982432	70764585	636402	122	28.07	26.50	105.9
380	Gilbert and Nejadi (2004)	S3-a	1807498	2373	<	3615	<	11350	3.140	70918	70.90	145618334	409334	31730	22812	126.48	97.96	6183177	72209981	650654	152	28.71	27.60	104.0
381	Gilbert and Nejadi (2004)	S3-a	1807498	2373	<	3615	<	11350	3.140	71022	70.83	145837019	413475	31928	22906	126.37	97.73	6259599	72771062	656164	186	28.92	27.90	103.7
382	Gilbert and Nejadi (2004)	S3-a	1807498	2373	<	3615	<	11350	3.140	71420	70.58	146667852	429349	32685	23265	125.92	96.83	6558382	74847178	676616	228	29.41	28.80	102.1
383	Gilbert and Nejadi (2004)	S3-a	1807498	2373	<	3615	<	11350	3.140	71646	70.43	147135804	438203	33108	23462	125.67	96.34	6726917	76000758	688123	272	29.82	29.10	102.5
384	Gilbert and Nejadi (2004)	S3-a	1807498	2373	<	3615	<	11350	3.140	71917	70.26	147693465	448838	33608	23691	125.39	95.77	6925641	77378439	701818	318	30.26	29.60	102.2
385	Gilbert and Nejadi (2004)	S3-a	1807498	2373	<	3615	<	11350	3.140	72170	70.10	148210168	458667	34074	23904	125.12	95.24	7114302	78631435	714341	380	30.58	29.80	102.6
386	Gilbert and Nejadi (2004)	S3-b	1807498	2373	<	3615	<	8340	2.307	65960	74.35	134387466	195402	20673	16713	134.11	113.21	2431344	40540791	349269	0.1	9.29	5.04	184.3
387	Gilbert and Nejadi (2004)	S3-b	1807498	2373	<	3615	<	8340	2.307	66000	74.32	134486472	197290	20786	16786	134.02	113.04	2463255	40857504	352178	1	10.37	6.98	148.6
388	Gilbert and Nejadi (2004)	S3-b	1807498	2373	<	3615	<	8340	2.307	66461	73.98	135600066	218512	21995	17534	133.08	111.16	2807834	44350901	384380	2	10.85	7.80	139.1
389	Gilbert and Nejadi (2004)	S3-b	1807498	2373	<	3615	<	8340	2.307	66543	73.92	135794981	222224	22202	17659	132.93	110.84	2868216	44957418	389937	3	11.19	8.18	136.8
390	Gilbert and Nejadi (2004)	S3-b	1807498	2373	<	3615	<	8340	2.307	66628	73.85	136000208	226101	22422	17794	132.76	110.52	2934599	45587002	395828	4	11.39	8.42	135.3
391	Gilbert and Nejadi (2004)	S3-b	1807498	2373	<	3615	<	8340	2.307	66669	73.82	136097236	227948	22526	17857	132.68	110.36	2965580	45882662	398559	5	11.57	8.80	131.4
392	Gilbert and Nejadi (2004)	S3-b	1807498	2373	<	3615	<	8340	2.307	66918	73.64	136687622	239200	23144	18226	132.22	109.44	3153355	47675531	415256	6	11.82	9.23	128.1
393	Gilbert and Nejadi (2004)	S3-b	1807498	2373	<	3615	<	8340	2.307	67275	73.38	137527999	255197	24005	18730	131.59	108.17	3422472	50183191	438708	7	12.48	9.87	126.5
394	Gilbert and Nejadi (2004)	S3-b	1807498	2373	<	3615	<	8340	2.307	67523	73.21	138107823	266285	24591	19068	131.16	107.32	3611117	51878377	454690	8	12.88	10.23	126.0
395	Gilbert and Nejadi (2004)	S3-b	1807498	2373	<	3615	<	8340	2.307	67564	73.18	138202296	268079	24690	19126	131.09	107.18	3643711	52155394	457259	10	13.26	10.87	121.9
396	Gilbert and Nejadi (2004)	S3-b	1807498	2373	<	3615	<	8340	2.307	67668	73.10	138443213	272635	24929	19261	130.92	106.84	3721532	52853538	463876	11	13.42	10.89	123.2
397	Gilbert and Nejadi (2004)	S3-b	1807498	2373	<	3615	<	8340	2.307	67713	73.07	138547729	274637	25036	19323	130.85	106.7	3757820	53162944	466775	13	13.60	11.03	123.3
398	Gilbert and Nejadi (2004)	S3-b	1807498	2373	<	3615	<	8340	2.307	68107	72.79	139451165	291831	25929	19822	130.22	105.44	4056649	55741126	491208	16	14.42	11.71	123.2
399	Gilbert and Nejadi (2004)	S3-b	1807498	2373	<	3615	<	8340	2.307	68378	72.60	140068170	303579	26528	20150	129.81	104.61	4261122	57477586	507730	18	15.05	12.14	124.0
400	Gilbert and Nejadi (2004)	S3-b	1807498	2373	<	3615	<	8340	2.307	68563	72.47	140486983	311548	26937	20374	129.53	104.06	4404556	58643770	518874	20	15.50	12.53	123.7
401	Gilbert and Nejadi (2004)	S3-b	1807498	2373	<	3615	<	8340	2.307	68794	72.32	141004795	321471	27433	20639	129.2	103.39	4578804	60073972	532547	23	16.07	13.11	122.6
402	Gilbert and Nejadi (2004)	S3-b	1807498	2373	<	3615	<	8340	2.307	68920	72.23	141287611	326837	27704	20784	129.02	103.04	4676396	60849976	540046	25	16.29	13.27	122.7
403	Gilbert and Nejadi (2004)	S3-b	1807498	2373	<	3615	<	8340	2.307	68979	72.19	141418566	329333	27826	20847	128.94	102.87	4718641	61205290	543445	28	16.32	13.32	122.5
404	Gilbert and Nejadi (2004)	S3-b	1807498	2373	<	3615	<	8340	2.307	68979	72.19	141418566	329333	27826	20847	128.94	102.87	4718641	61205290	543445	31	16.39	13.58	120.7
405	Gilbert and Nejadi (2004)	S3-b	1807498	2373	<	3615	<	8340	2.307	69083	72.12	141649709	333743	28049	20966	128.79	102.58	4800322	61832392	549487	34	16.71	13.59	122.9
406	Gilbert and Nejadi (2004)	S3-b	1807498	2373	<	3615	<	8340	2.307	69291	71.98	142109917	342520	28481	21190	128.51	102.01	4955547	63074369	561461	39	17.27	14.12	122.3
407	Gilbert and Nejadi (2004)	S3-b	1807498	2373	<	3615	<	8340	2.307	69485	71.84	142537619	350603	28883	21398	128.25	101.49	5102915	64219313	572537	47	18.17	14.92	121.8
408	Gilbert and Nejadi (2004)	S3-b	1807498	2373	<	3615	<	8340	2.307	69792	71.64	143209123	363441	29512	21720	127.85	100.7	5337062	66002091	589891	54	18.90	15.22	124.2
409	Gilbert and Nejadi (2004)	S3-b	1807498	2373	<	3615	<	8340	2.307	69960	71.53	143572022	370366	29852	21892	127.64	100.27	5464559	66960600	599128	62	19.23	15.38	125.1
410	Gilbert and Nejadi (2004)	S3-b	1807498	2373	<	3615	<	8340	2.307	70086	71.44	143845496	375527	30103	22017	127.48	99.95	5558548	67669950	606067	73	19.68	16.19	121.6
411	Gilbert and Nejadi (2004)	S3-b	1807498	2373	<	3615	<	8340	2.307	70122	71.42	143923450	377044	30175	22053	127.43	99.86	5586163	67867069	608046	82	20.07	16.20	123.9
412	Gilbert and Nejadi (2004)	S3-b	1807498	2373	<	3615	<	8340	2.307	70145	71.40	143972132	377930	30219	22074	127.41	99.81	5601984	68001085	609330	95	20.85	17.06	122.2
413	Gilbert and Nejadi (2004)	S3-b	1807498	2373	<	3615	<	8340	2.307	70480	71.18	144688955	391584	30882	22402	127	98.99	5855121	69852139	627400	108	21.83	17.64	123.7
414	Gilbert and Nejadi (2004)	S3-b	1807498	2373	<	3615	<	8340	2.307	70647	71.07	145044822	398356	31210	22563	126.8	98.6	5982432	70764585	636402	122	22.10	18.30	120.8
415	Gilbert and Nejadi (2004)	S3-b	1807498	2373	<	3615	<	8340	2.307	70918	70.90	145618334	409334	31730	22812	126.48	97.96	6183177	72209981	650654	152	22.66	19.30	117.4
416	Gilbert and Nejadi (2004)	S3-b	1807498	2373	<	3615	<	8340	2.307	71022	70.83	145837019	413475	31928	22906	126.37	97.73	6259599	72771062	656164	186	22.85	20.06	113.9
417	Gilbert and Nejadi (2004)	S3-b	1807498	2373	<	3615	<	8340	2.307	71420	70.58	146667852	429349	32685	23265	125.92	96.83	6558382	74847178	676616	228	23.27	21.24	109.5
418	Gilbert and Nejadi (2004)	S3-b	1807498	2373	<	3615	<	8340	2.307	71646	70.43	147135804	438203	33108	23462	125.67	96.34	6726917	76000758	688123	272	23.62	21.94	107.7
419	Gilbert and Nejadi (2004)	S3-b	1807498	2373	<	3615	<	8340	2.307	71917	70.26	147693465	448838	33608	23691	125.39	95.77	6925641	77378439	701818	318	24.00	22.44	106.9
420	Gilbert and Nejadi (2004)	S3-b	1807498	2373	<	3615	<	8340	2.307	72170	70.10	148210168	458667	34074	23904	125.12	95.24	7114302	78631435	714341	380	24.27	22.90	106.0

Assessment and Correction of MC10 model:
Calculation of Deflections by Numerical Integration – Example

$E_{c,eff}(t_0)$ = 8411.35 MPa
I_I^* = 964057232 mm^4
S_I^* = 1117130 mm^3
I_{II}^* = 453589328 mm^4
S_{II}^* = 1740031 mm^3

M_{L1} = 3254 Nm
M_{L2} = 21646 Nm
ε_{cs} = 0.825 ‰
K_{L1} = 0.104
K_{L2} = 0.107

bars = deformed

M_{cr} = 10629 Nm

L = 3500 mm
t = 380
β = 0.5
α = 2

Fraction of span	M_{L1} (Nm)	M_{L2} (Nm)	M (Nm)	$(1/r_{I,L})\cdot10^6$	$(1/r_{I,cs})\cdot10^6$	$(1/r_{II,L})\cdot10^6$	$(1/r_{II,cs})\cdot10^6$	ζ	$(1/r_{tot})\cdot10^6$	Uncorrected rotation	Uncorrected deflection	Correction	Final deflection
0.00	0.00	0.00	0.00	0.0000	0.9560	0.0000	3.1648	0.0000	0.9560	0.00	0.00	0.00	0.00
0.02	255.11	1311.88	1566.99	0.1932	0.9560	0.4107	3.1648	-22.0049	1.1492	0.074	0.00	0.77	0.76
0.04	499.81	2623.76	3123.57	0.3852	0.9560	0.8187	3.1648	-4.7896	1.3412	0.161	0.01	1.53	1.52
0.06	734.10	3935.64	4669.74	0.5759	0.9560	1.2240	3.1648	-1.5904	1.5319	0.261	0.03	2.30	2.28
0.08	957.98	5247.52	6205.49	0.7653	0.9560	1.6265	3.1648	-0.4669	1.7213	0.375	0.05	3.07	3.02
0.10	1171.44	6559.39	7730.83	0.9534	0.9560	2.0263	3.1648	0.0548	2.0893	0.509	0.08	3.84	3.76
0.12	1374.49	7871.27	9245.76	1.1402	0.9560	2.4233	3.1648	0.3392	3.2807	0.697	0.12	4.60	4.48
0.14	1567.13	9183.15	10750.28	1.3257	0.9560	2.8177	3.1648	0.5112	4.1736	0.957	0.18	5.37	5.19
0.16	1749.35	10495.03	12244.38	1.5100	0.9560	3.2093	3.1648	0.6232	4.9016	1.275	0.26	6.14	5.88
0.18	1921.16	11806.91	13728.07	1.6929	0.9560	3.5982	3.1648	0.7003	5.5299	1.640	0.36	6.90	6.55
0.20	2082.56	13118.79	15201.35	1.8746	0.9560	3.9843	3.1648	0.7555	6.0935	2.047	0.49	7.67	7.18
0.22	2233.55	14430.67	16664.21	2.0550	0.9560	4.3677	3.1648	0.7966	6.6128	2.492	0.65	8.44	7.79
0.24	2374.12	15742.55	18116.66	2.2341	0.9560	4.7484	3.1648	0.8279	7.1004	2.972	0.84	9.21	8.37
0.26	2504.28	17054.42	19558.70	2.4120	0.9560	5.1264	3.1648	0.8523	7.5642	3.485	1.06	9.97	8.91
0.28	2624.03	18366.30	20990.33	2.5885	0.9560	5.5016	3.1648	0.8718	8.0098	4.030	1.33	10.74	9.41
0.30	2733.36	19678.18	22411.54	2.7638	0.9560	5.8741	3.1648	0.8875	8.4407	4.606	1.63	11.51	9.88
0.32	2832.28	20990.06	23822.34	2.9378	0.9560	6.2439	3.1648	0.9005	8.8598	5.211	1.97	12.27	10.30
0.34	2920.79	21646.00	24566.79	3.0296	0.9560	6.4390	3.1648	0.9064	9.0780	5.839	2.36	13.04	10.68
0.36	2998.89	21646.00	24644.89	3.0392	0.9560	6.4595	3.1648	0.9070	9.1008	6.475	2.79	13.81	11.02
0.38	3066.57	21646.00	24712.57	3.0475	0.9560	6.4772	3.1648	0.9075	9.1205	7.113	3.27	14.58	11.31
0.40	3123.84	21646.00	24769.84	3.0546	0.9560	6.4922	3.1648	0.9079	9.1372	7.752	3.79	15.34	11.56
0.42	3170.70	21646.00	24816.70	3.0604	0.9560	6.5045	3.1648	0.9083	9.1508	8.392	4.35	16.11	11.76
0.44	3207.14	21646.00	24853.14	3.0649	0.9560	6.5141	3.1648	0.9085	9.1615	9.033	4.96	16.88	11.92
0.46	3233.17	21646.00	24879.17	3.0681	0.9560	6.5209	3.1648	0.9087	9.1690	9.675	5.62	17.64	12.03
0.48	3248.79	21646.00	24894.79	3.0700	0.9560	6.5250	3.1648	0.9089	9.1736	10.317	6.32	18.41	12.09
0.50	**3254.00**	**21646.00**	**24900.00**	**3.0707**	**0.9560**	**6.5264**	**3.1648**	**0.9089**	**9.1751**	**10.959**	**7.06**	**19.18**	**12.12**
0.52	3248.79	21646.00	24894.79	3.0700	0.9560	6.5250	3.1648	0.9089	9.1736	11.601	7.85	19.95	12.09
0.54	3233.17	21646.00	24879.17	3.0681	0.9560	6.5209	3.1648	0.9087	9.1690	12.243	8.68	20.71	12.03
0.56	3207.14	21646.00	24853.14	3.0649	0.9560	6.5141	3.1648	0.9085	9.1615	12.885	9.56	21.48	11.92
0.58	3170.70	21646.00	24816.70	3.0604	0.9560	6.5045	3.1648	0.9083	9.1508	13.526	10.49	22.25	11.76
0.60	3123.84	21646.00	24769.84	3.0546	0.9560	6.4922	3.1648	0.9079	9.1372	14.166	11.46	23.01	11.56
0.62	3066.57	21646.00	24712.57	3.0475	0.9560	6.4772	3.1648	0.9075	9.1205	14.805	12.47	23.78	11.31
0.64	2998.89	21646.00	24644.89	3.0392	0.9560	6.4595	3.1648	0.9070	9.1008	15.442	13.53	24.55	11.02
0.66	2920.79	21646.00	24566.79	3.0296	0.9560	6.4390	3.1648	0.9064	9.0780	16.079	14.63	25.32	10.68
0.68	2832.28	20990.06	23822.34	2.9378	0.9560	6.2439	3.1648	0.9005	8.8598	16.707	15.78	26.08	10.30
0.70	2733.36	19678.18	22411.54	2.7638	0.9560	5.8741	3.1648	0.8875	8.4407	17.312	16.97	26.85	9.88
0.72	2624.03	18366.30	20990.33	2.5885	0.9560	5.5016	3.1648	0.8718	8.0098	17.888	18.20	27.62	9.41
0.74	2504.28	17054.42	19558.70	2.4120	0.9560	5.1264	3.1648	0.8523	7.5642	18.433	19.48	28.38	8.91
0.76	2374.12	15742.55	18116.66	2.2341	0.9560	4.7484	3.1648	0.8279	7.1004	18.946	20.78	29.15	8.37
0.78	2233.55	14430.67	16664.21	2.0550	0.9560	4.3677	3.1648	0.7966	6.6128	19.426	22.13	29.92	7.79
0.80	2082.56	13118.79	15201.35	1.8746	0.9560	3.9843	3.1648	0.7555	6.0935	19.871	23.50	30.69	7.18
0.82	1921.16	11806.91	13728.07	1.6929	0.9560	3.5982	3.1648	0.7003	5.5299	20.278	24.91	31.45	6.55
0.84	1749.35	10495.03	12244.38	1.5100	0.9560	3.2093	3.1648	0.6232	4.9016	20.643	26.34	32.22	5.88
0.86	1567.13	9183.15	10750.28	1.3257	0.9560	2.8177	3.1648	0.5112	4.1736	20.960	27.80	32.99	5.19
0.88	1374.49	7871.27	9245.76	1.1402	0.9560	2.4233	3.1648	0.3392	3.2807	21.221	29.27	33.75	4.48
0.90	1171.44	6559.39	7730.83	0.9534	0.9560	2.0263	3.1648	0.0548	2.0893	21.409	30.76	34.52	3.76
0.92	957.98	5247.52	6205.49	0.7653	0.9560	1.6265	3.1648	-0.4669	1.7213	21.543	32.27	35.29	3.02
0.94	734.10	3935.64	4669.74	0.5759	0.9560	1.2240	3.1648	-1.5904	1.5319	21.657	33.78	36.05	2.28
0.96	499.81	2623.76	3123.57	0.3852	0.9560	0.8187	3.1648	-4.7896	1.3412	21.757	35.30	36.82	1.52
0.98	255.11	1311.88	1566.99	0.1932	0.9560	0.4107	3.1648	-22.0049	1.1492	21.844	36.82	37.59	0.76
1.00	0.00	0.00	0.00	0.0000	0.9560	0.0000	3.1648	0.0000	0.9560	21.918	38.36	38.36	0.00

Assessment and Correction of MC10 model:
Database

		Study information		Cross-section		Reinforcement								Mechanical properties														Loading						Deflection		
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
		Author	Specimen	b (mm)	h (mm)	A_{s1} (mm^2)	d (mm)	ρ_1 (%)	A_{s2} (mm^2)	d' (mm)	d_2 (mm)	ρ_2 (%)	type	RH (%)	T (ºC)	t_{test} (days)	$f_{cm}(t_{test})$ (MPa)	f_{cm} (MPa)	f_{cm} (t_0) (MPa)	$f_{ctm}(t_0)$ (MPa)	$E_{cm}(t_0)$ (MPa)	E_{cm} (MPa)	E_s (MPa)	φ (–)	ε_{cs} (‰)	$E_{c,eff}$ (MPa)	L (mm)	L/d	M_{L1} (Nm)	K_{L1}	M_{L2} (Nm)	K_{L2}	a (t-t_0) (mm)	t_0 (days)	t-t_0 (days)
1	0	Washa and Fluck (1952)	A1/A4	203.2	304.8	852	257.2	1.63	852	257.2	47.6	1.63	deformed	50	21	14	25.00	27.73	25.00	1.98	28680	30206	200000	0.000	0.000	28680	6096	23.7	7192	0.104	18442	0.104	13.46	14	0
2	t	Washa and Fluck (1952)	A1/A4	203.2	304.8	852	257.2	1.63	852	257.2	47.6	1.63	deformed	50	21	14	25.00	27.73	25.00	1.98	28680	30206	200000	3.062	0.556	7340	6096	23.7	7192	0.104	18442	0.104	23.62	14	913
3	0	Washa and Fluck (1952)	A2/A5	203.2	304.8	852	257.2	1.63	400	258.7	46.1	0.77	deformed	50	21	14	25.00	27.73	25.00	1.98	28680	30206	200000	0.000	0.000	28680	6096	23.7	7192	0.104	18442	0.104	15.75	14	0
4	t	Washa and Fluck (1952)	A2/A5	203.2	304.8	852	257.2	1.63	400	258.7	46.1	0.77	deformed	50	21	14	25.00	27.73	25.00	1.98	28680	30206	200000	3.062	0.556	7340	6096	23.7	7192	0.104	18442	0.104	32.26	14	913
5	0	Washa and Fluck (1952)	A3/A6	203.2	304.8	852	257.2	1.63	0	0	0	0.00	deformed	50	21	14	25.00	27.73	25.00	1.98	28680	30206	200000	0.000	0.000	28680	6096	23.7	7192	0.104	18442	0.104	17.02	14	0
6	t	Washa and Fluck (1952)	A3/A6	203.2	304.8	852	257.2	1.63	0	0	0	0.00	deformed	50	21	14	25.00	27.73	25.00	1.98	28680	30206	200000	3.062	0.556	7340	6096	23.7	7192	0.104	18442	0.104	44.70	14	913
7	0	Washa and Fluck (1952)	B1/B4	152.4	203.2	400	157.2	1.67	400	157.2	46	1.67	deformed	50	21	14	20.80	23.07	20.80	1.64	26975	28409	200000	0.000	0.000	26975	6096	38.8	3596	0.104	3663	0.104	23.37	14	0
8	t	Washa and Fluck (1952)	B1/B4	152.4	203.2	400	157.2	1.67	400	157.2	46	1.67	deformed	50	21	14	20.80	23.07	20.80	1.64	26975	28409	200000	3.935	0.629	5695	6096	38.8	3596	0.104	3663	0.104	51.05	14	913
9	0	Washa and Fluck (1952)	B2/B5	152.4	203.2	400	157.2	1.67	200	157.2	46	0.84	deformed	50	21	14	20.80	23.07	20.80	1.64	26975	28409	200000	0.000	0.000	26975	6096	38.8	3596	0.104	3663	0.104	24.89	14	0
10	t	Washa and Fluck (1952)	B2/B5	152.4	203.2	400	157.2	1.67	200	157.2	46	0.84	deformed	50	21	14	20.80	23.07	20.80	1.64	26975	28409	200000	3.935	0.629	5695	6096	38.8	3596	0.104	3663	0.104	65.02	14	913
11	0	Washa and Fluck (1952)	B3/B6	152.4	203.2	400	157.2	1.67	0	0	0	0.00	deformed	50	21	14	20.80	23.07	20.80	1.64	26975	28409	200000	0.000	0.000	26975	6096	38.8	3596	0.104	3663	0.104	26.42	14	0
12	t	Washa and Fluck (1952)	B3/B6	152.4	203.2	400	157.2	1.67	0	0	0	0.00	deformed	50	21	14	20.80	23.07	20.80	1.64	26975	28409	200000	3.935	0.629	5695	6096	38.8	3596	0.104	3663	0.104	86.36	14	913
13	0	Washa and Fluck (1952)	D1/D4	304.8	127	516	101.6	1.67	516	101.6	25.4	1.67	deformed	50	21	14	22.10	24.51	22.10	1.75	27526	28988	200000	0.000	0.000	27526	3810	37.5	1756	0.104	4267	0.104	11.94	14	0
14	t	Washa and Fluck (1952)	D1/D4	304.8	127	516	101.6	1.67	516	101.6	25.4	1.67	deformed	50	21	14	22.10	24.51	22.10	1.75	27526	28988	200000	3.674	0.618	6132	3810	37.5	1756	0.104	4267	0.104	27.69	14	913
15	0	Washa and Fluck (1952)	D2/D5	304.8	127	516	101.6	1.67	258	101.6	25.4	0.83	deformed	50	21	14	22.10	24.51	22.10	1.75	27526	28988	200000	0.000	0.000	27526	3810	37.5	1756	0.104	4267	0.104	14.22	14	0
16	t	Washa and Fluck (1952)	D2/D5	304.8	127	516	101.6	1.67	258	101.6	25.4	0.83	deformed	50	21	14	22.10	24.51	22.10	1.75	27526	28988	200000	3.674	0.618	6132	3810	37.5	1756	0.104	4267	0.104	33.78	14	913
17	0	Washa and Fluck (1952)	D3/D6	304.8	127	516	101.6	1.67	0	0	0	0.00	deformed	50	21	14	22.10	24.51	22.10	1.75	27526	28988	200000	0.000	0.000	27526	3810	37.5	1756	0.104	4267	0.104	17.78	14	0
18	t	Washa and Fluck (1952)	D3/D6	304.8	127	516	101.6	1.67	0	0	0	0.00	deformed	50	21	14	22.10	24.51	22.10	1.75	27526	28988	200000	3.674	0.618	6132	3810	37.5	1756	0.104	4267	0.104	48.51	14	913
19	0	P.C.A. [18] in Espion (1988)	40NA	152	305	849	254	2.20	0	0	0	0.00	deformed	50	21	28	26.90	26.90	26.90	2.13	29901	29901	200000	0.000	0.000	29901	3048	12.0	1346	0.104	22267	0.107	4.25	28	0
20	t	P.C.A. [18] in Espion (1988)	40NA	152	305	849	254	2.20	0	0	0	0.00	deformed	50	21	28	26.90	26.90	26.90	2.13	29901	29901	200000	2.079	0.452	9711	3048	12.0	1346	0.104	22267	0.107	10.00	28	242
21	0	P.C.A. [18] in Espion (1988)	60NA	152	305	1019	254	2.64	0	0	0	0.00	deformed	50	21	28	37.40	37.40	37.40	2.86	33373	33373	200000	0.000	0.000	33373	3048	12.0	1346	0.104	29641	0.107	4.90	28	0
22	t	P.C.A. [18] in Espion (1988)	60NA	152	305	1019	254	2.64	0	0	0	0.00	deformed	50	21	28	37.40	37.40	37.40	2.86	33373	33373	200000	1.510	0.428	13296	3048	12.0	1346	0.104	29641	0.107	9.90	28	242
23	0	Sattler [11] in Espion (1988)	a1/a2	100	160	100	134	0.75	0	0	0	0.00	deformed	55	21	32	26.70	26.27	26.70	2.11	29908	29666	200000	0.000	0.000	29908	4000	29.9	800	0.104	1962	0.104	15.83	32	0
24	t	Sattler [11] in Espion (1988)	a1/a2	100	160	100	134	0.75	0	0	0	0.00	deformed	55	21	32	26.70	26.27	26.70	2.11	29908	29666	200000	1.599	0.423	11450	4000	29.9	800	0.104	1962	0.104	32.21	32	84
25	0	Hajnal-Konyi [22] in Espion (1988)	8	127	190.5	142	160.3	0.70	0	0	0	0.00	deformed	82	21	35	37.00	36.04	38.59	2.93	34110	32964	200000	0.000	0.000	34110	6400	39.9	3097	0.104	1612	0.104	20.60	53	0
26	t	Hajnal-Konyi [22] in Espion (1988)	8	127	190.5	142	160.3	0.70	0	0	0	0.00	deformed	82	21	35	37.00	36.04	38.59	2.93	34110	32964	200000	1.337	0.343	14311	6400	39.9	3097	0.104	1612	0.104	65.40	53	1734
27	0	Hajnal-Konyi [22] in Espion (1988)	10	127	190.5	142	160.3	0.70	0	0	0	0.00	deformed	82	21	35	37.00	36.04	38.59	2.93	34110	32964	200000	0.000	0.000	34110	4800	29.9	1742	0.104	2967	0.104	8.80	53	0
28	t	Hajnal-Konyi [22] in Espion (1988)	10	127	190.5	142	160.3	0.70	0	0	0	0.00	deformed	82	21	35	37.00	36.04	38.59	2.93	34110	32964	200000	1.337	0.343	14311	4800	29.9	1742	0.104	2967	0.104	29.70	53	1734
29	0	Hajnal-Konyi [22] in Espion (1988)	12	127	190.5	142	160.3	0.70	0	0	0	0.00	deformed	82	21	35	37.00	36.04	38.59	2.93	34110	32964	200000	0.000	0.000	34110	3200	20.0	774	0.104	3935	0.104	4.30	53	0
30	t	Hajnal-Konyi [22] in Espion (1988)	12	127	190.5	142	160.3	0.70	0	0	0	0.00	deformed	82	21	35	37.00	36.04	38.59	2.93	34110	32964	200000	1.337	0.343	14311	3200	20.0	774	0.104	3935	0.104	14.00	53	1734
31	0	Branson and Metz [23] in Espion (1988)	SB3/B	101.6	127	214	101.6	2.07	0	0	0	0.00	deformed	50	21	28	35.40	35.40	35.40	2.73	32767	32767	200000	0.000	0.000	32767	2743	27.0	303	0.104	935	0.104	3.89	28	0
32	t	Branson and Metz [23] in Espion (1988)	SB3/B	101.6	127	214	101.6	2.07	0	0	0	0.00	deformed	50	21	28	35.40	35.40	35.40	2.73	32767	32767	200000	1.226	0.397	14717	2743	27.0	303	0.104	935	0.104	7.70	28	60
33	0	Branson and Metz [23] in Espion (1988)	SB3/M	101.6	127	214	101.6	2.07	0	0	0	0.00	deformed	50	21	28	31.30	31.30	31.30	2.45	31450	31450	200000	0.000	0.000	31450	2743	27.0	303	0.104	935	0.104	3.99	28	0
34	t	Branson and Metz [23] in Espion (1988)	SB3/M	101.6	127	214	101.6	2.07	0	0	0	0.00	deformed	50	21	28	31.30	31.30	31.30	2.45	31450	31450	200000	1.381	0.407	13207	2743	27.0	303	0.104	935	0.104	7.50	28	60
35	0	Pauw and Meyers [26] in Espion (1988)	R1	177.8	216	400	165.1	1.36	0	0	0	0.00	deformed	50	21	28	33.80	33.80	33.80	2.62	32266	32266	200000	0.000	0.000	32266	2286	13.8	627	0.104	7176	0.107	2.44	28	0
36	t	Pauw and Meyers [26] in Espion (1988)	R1	177.8	216	400	165.1	1.36	0	0	0	0.00	deformed	50	21	28	33.80	33.80	33.80	2.62	32266	32266	200000	1.494	0.388	12940	2286	13.8	627	0.104	7176	0.107	4.89	28	150
37	0	Pauw and Meyers [26] in Espion (1988)	R2	177.8	216	568	165.1	1.94	0	0	0	0.00	deformed	50	21	28	33.60	33.60	33.60	2.61	32202	32202	200000	0.000	0.000	32202	2286	13.8	627	0.104	11228	0.107	3.22	28	0
38	t	Pauw and Meyers [26] in Espion (1988)	R2	177.8	216	568	165.1	1.94	0	0	0	0.00	deformed	50	21	28	33.60	33.60	33.60	2.61	32202	32202	200000	1.502	0.388	12869	2286	13.8	627	0.104	11228	0.107	6.16	28	150
39	0	Pauw and Meyers [26] in Espion (1988)	R3	177.8	216	568	165.1	1.94	0	0	0	0.00	deformed	50	21	28	38.90	38.90	38.90	2.95	33813	33813	200000	0.000	0.000	33813	2286	13.8	627	0.104	9643	0.107	3.71	28	0
40	t	Pauw and Meyers [26] in Espion (1988)	R3	177.8	216	568	165.1	1.94	0	0	0	0.00	deformed	50	21	28	38.90	38.90	38.90	2.95	33813	33813	200000	1.237	0.354	15116	2286	13.8	627	0.104	9643	0.107	6.64	28	120
41	0	Pauw and Meyers [26] in Espion (1988)	R4	177.8	216	774	165.1	2.64	0	0	0	0.00	deformed	50	21	28	38.70	38.70	38.70	2.94	33755	33755	200000	0.000	0.000	33755	2286	13.8	627	0.104	14607	0.107	4.66	28	0
42	t	Pauw and Meyers [26] in Espion (1988)	R4	177.8	216	774	165.1	2.64	0	0	0	0.00	deformed	50	21	28	38.70	38.70	38.70	2.94	33755	33755	200000	1.243	0.354	15049	2286	13.8	627	0.104	14607	0.107	7.89	28	120
43	0	Lutz et al. [29] in Espion (1988)	SR	101.6	203.2	258	171.5	1.48	0	0	0	0.00	deformed	40	21	28	34.10	34.10	34.10	2.64	32361	32361	200000	0.000	0.000	32361	1829	10.7	216	0.104	7963	0.107	4.10	28	0
44	t	Lutz et al. [29] in Espion (1988)	SR	101.6	203.2	258	171.5	1.48	0	0	0	0.00	deformed	40	21	28	34.10	34.10	34.10	2.64	32361	32361	200000	1.703	0.491	11972	1829	10.7	216	0.104	7963	0.107	8.80	28	142
45	0	Lutz et al. [29] in Espion (1988)	DR	101.6	203.2	258	171.5	1.48	258	177.8	25.4	1.48	deformed	40	21	28	34.10	34.10	34.10	2.64	32361	32361	200000	0.000	0.000	32361	1829	10.7	216	0.104	7963	0.107	4.20	28	0
46	t	Lutz et al. [29] in Espion (1988)	DR	101.6	203.2	258	171.5	1.48	258	177.8	25.4	1.48	deformed	40	21	28	34.10	34.10	34.10	2.64	32361	32361	200000	1.703	0.491	11972	1829	10.7	216	0.104	7963	0.107	6.80	28	142
47	0	Jaccoud and Favre (1982)	A1	600	120	314	95	0.55	57	100	20	0.10	deformed	60	21	15	20.49	22.45	20.49	1.61	26895	28152	200000	0.000	0.000	26895	3100	32.6	2162	0.104	2787	0.104	8.42	15	0
48	t	Jaccoud and Favre (1982)	A1	600	120	314	95	0.55	57	100	20	0.10	deformed	60	21	15	20.49	22.45	20.49	1.61	26895	28152	200000	2.906	0.469	7122	3100	32.6	2162	0.104	2787	0.104	18.40	15	365
49	0	Jaccoud and Favre (1982)	A2	600	120	314	95	0.55	57	100	20	0.10	deformed	60	21	15	24.14	26.45	24.14	1.92	28406	29734	200000	0.000	0.000	28406	3100	32.6	2162	0.104	2787	0.104	6.16	15	0
50	t	Jaccoud and Favre (1982)	A2	600	120	314	95	0.55	57	100	20	0.10	deformed	60	21	15	24.14	26.45	24.14	1.92	28406	29734	200000	2.478	0.457	8436	3100	32.6	2162	0.104	2787	0.104	17.50	15	365
51	0	Jaccoud and Favre (1982)	A3	600	120	314	95	0.55	57	100	20	0.10	deformed	60	21	15	19.64	21.52	19.64	1.54	26518	27758	200000	0.000	0.000	26518	3100	32.6	2162	0.104	2787	0.104	8.12	15	0
52	t	Jaccoud and Favre (1982)	A3	600	120	314	95	0.55	57	100	20	0.10	deformed	60	21	15	19.64	21.52	19.64	1.54	26518	27758	200000	3.029	0.472	6811	3100	32.6	2162	0.104	2787	0.104	17.50	15	365
53	0	Jaccoud and Favre (1982)	A4	600	120	314	95	0.55	57	100	20	0.10	deformed	60	21	15	36.13	39.59	36.13	2.77	32492	34012	200000	0.000	0.000	32492	3100	32.6	2162	0.104	2787	0.104	2.24	15	0
54	t	Jaccoud and Favre (1982)	A4	600	120	314	95	0.55	57	100	20	0.10	deformed	60	21	15	36.13	39.59	36.13	2.77	32492	34012	200000	1.689	0.428	12434	3100	32.6	2162	0.104	2787	0.104	8.05	15	365
55	0	Jaccoud and Favre (1982)	A5	600	120	314	95	0.55	57	100	20	0.10	deformed	60	21	15	32.47	35.58	32.47	2.53	31355	32823	200000	0.000	0.000	31355	3100	32.6	2162	0.104	2787	0.104	3.12	15	0
56	t	Jaccoud and Favre (1982)	A5	600	120	314	95	0.55	57	100	20	0.10	deformed	60	21	15	32.47	35.58	32.47	2.53	31355	32823	200000	1.867	0.436	11266	3100	32.6	2162	0.104	2787	0.104	9.55	15	365
57	0	Jaccoud and Favre (1982)	C12	750	160	565	131	0.58	57	134	26	0.06	deformed	60	21	28	29.40	29.40	29.40	2.31	30800	30800	200000	0.000	0.000	30800	3100	23.7	3604	0.104	6095	0.107	2.17	28	0
58	t	Jaccoud and Favre (1982)	C12	750	160	565	131	0.58	57	134	26	0.06	deformed	60	21	28	29.40	29.40	29.40	2.31	30800	30800	200000	1.937	0.428	10488	3100	23.7	3604	0.104	6095	0.107	8.29	28	510
59	0	Jaccoud and Favre (1982)	C22	750	160	565	131	0.58	57	134	26	0.06	deformed	60	21	28	32.89	32.89	32.89	2.56	31974	31974	200000	0.000	0.000	31974	3100	23.7	3604	0.104	6095	0.107	2.00	28	0
60	t	Jaccoud and Favre (1982)	C22	750	160	565	131	0.58	57	134	26	0.06	deformed	60	21	28	32.89	32.89	32.89	2.56	31974	31974	200000	1.627	0.387	12173	3100	23.7	3604	0.104	6095	0.107	7.00	28	365
61	0	Jaccoud and Favre (1982)	C13	750	160	565	131	0.58	57	134	26	0.06	deformed	60	21	28	30.93	30.93	30.93	2.42	31326	31326	200000	0.000	0.000	31326	3100	23.7	3604	0.104	9305	0.107	5.29	28	0
62	t	Jaccoud and Favre (1982)	C13	750	160	565	131	0.58	57	134	26	0.06	deformed	60	21	28	30.93	30.93	30.93	2.42	31326	31326	200000	1.845	0.425	11010	3100	23.7	3604	0.104	9305	0.107	13.28	28	510
63	0	Jaccoud and Favre (1982)	C14	750	160	565	131	0.58	57	134	26	0.06	deformed	60	21	28	29.40	29.40	29.40	2.31	30800	30800	200000	0.000	0.000	30800	3100	23.7	3604	0.104	12520	0.107	8.48	28	0
64	t	Jaccoud and Favre (1982)	C14	750	160	565	131	0.58	57	134	26	0.06	deformed	60	21	28	29.40	29.40	29.40	2.31	30800	30800	200000	1.937	0.428	10488	3100	23.7	3604	0.104	12520	0.107	18.15	28	510
65	0	Jaccoud and Favre (1982)	C24	750	160	565	131	0.58	57	134	26	0.06	deformed	60	21	28	31.97	31.97	31.97	2.49	31673	31673	200000	0.000	0.000	31673	3100	23.7	3604	0.104	12520	0.107	8.00	28	0
66	t	Jaccoud and Favre (1982)	C24	750	160	565	131	0.58	57	134	26	0.06	deformed	60	21	28	31.97	31.97	31.97	2.49	31673	31673	200000	1.789	0.423	11358	3100	23.7	3604	0.104	12520	0.107	17.52	28	510
67	0	Jaccoud and Favre (1982)	C15	750	160	565	131	0.58	57	134	26	0.06	deformed	60	21	28	29.29	29.29	29.29	2.30	30762	30762	200000	0.000	0.000	30762	3100	23.7	3604	0.104	15725	0.107	11.02	28	0
68	t	Jaccoud and Favre (1982)	C15	750	160	565	131	0.58	57	134	26	0.06	deformed	60	21	28	29.29	29.29	29.29	2.30	30762	30762	200000	1.944	0.428	10449	3100	23.7	3604	0.104	15725	0.107	20.83	28	510
69	0	Ding Dajung [44] in Espion (1988)	C-3	81	160	113	137	1.02	0	0	0	0.00	deformed	80	21	30	21.60	21.42	21.60	1.71	27831	27715	200000	0.000	0.000	27831	2880	21.0	336	0.104	2904	0.107	8.45	30	0
70	t	Ding Dajung [44] in Espion (1988)	C-3	81	160	113	137	1.02	0	0	0	0.00	deformed	80	21	30	21.60	21.42	21.60	1.71	27831	27715	200000	3.026	0.402	6891	2880	21.0	336	0.104	2904	0.107	16.62	30	2025
71	0	Ding Dajung [44] in Espion (1988)	L-1	62	152	154	117	2.12	0	0	0	0.00	deformed	80	21	30	25.40	25.19	25.40	2.01	29375	29254	200000	0.000	0.000	29375	2880	24.6	244	0.104	3280	0.107	15.53	30	0
72	t	Ding Dajung [44] in Espion (1988)	L-1	62	152	154	117	2.12	0	0	0	0.00	deformed	80	21	30	25.40	25.19	25.40	2.01	29375	29254	200000	2.985	0.381	7349	2880	24.6	244	0.104	3280	0.107	30.43	30	531

		Study information		Cross-section		Reinforcement								Mechanical properties													Loading						Deflection		
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
		Author	Specimen	b (mm)	h (mm)	A_{s1} (mm^2)	d (mm)	ρ_1 (%)	A_{s2} (mm^2)	d' (mm)	d_2 (mm)	ρ_2 (%)	type	RH (%)	T (°C)	t_{test} (days)	$f_{cm}(t_{test})$ (MPa)	f_{cm} (MPa)	$f_{cm}(t_0)$ (MPa)	$f_{ctm}(t_0)$ (MPa)	$E_{cm}(t_0)$ (MPa)	E_{cm} (MPa)	E_s (MPa)	φ (–)	ε_{cs} (‰)	$E_{c,eff}$ (MPa)	L (mm)	L/d	M_{L1} (Nm)	K_{L1}	M_{L2} (Nm)	K_{L2}	a (t-t_0) (mm)	t_0 (days)	t-t_0 (days)
73	0	F.R.F.C. [45] in Espion (1988)	I-72	150	280	308	250	0.82	0	0	0	0.00	deformed	60	21	28	33.50	33.50	33.50	2.60	32170	32170	200000	0.000	0.000	32170	2800	11.2	1029	0.104	21500	0.107	6.02	28	0
74	t	F.R.F.C. [45] in Espion (1988)	I-72	150	280	308	250	0.82	0	0	0	0.00	deformed	60	21	28	33.50	33.50	33.50	2.60	32170	32170	200000	2.182	0.544	10109	2800	11.2	1029	0.104	21500	0.107	10.29	28	1610
75	0	F.R.F.C. [45] in Espion (1988)	I-81	150	280	308	250	0.82	0	0	0	0.00	deformed	60	21	28	33.50	33.50	33.50	2.60	32170	32170	200000	0.000	0.000	32170	2800	11.2	1029	0.104	24250	0.107	7.39	28	0
76	t	F.R.F.C. [45] in Espion (1988)	I-81	150	280	308	250	0.82	0	0	0	0.00	deformed	60	21	28	33.50	33.50	33.50	2.60	32170	32170	200000	2.252	0.536	9892	2800	11.2	1029	0.104	24250	0.107	11.98	28	1344
77	0	F.R.F.C. [45] in Espion (1988)	I-91	150	280	308	250	0.82	0	0	0	0.00	deformed	60	21	28	33.50	33.50	33.50	2.60	32170	32170	200000	0.000	0.000	32170	2800	11.2	1029	0.104	27180	0.107	8.94	28	0
78	t	F.R.F.C. [45] in Espion (1988)	I-91	150	280	308	250	0.82	0	0	0	0.00	deformed	60	21	28	33.50	33.50	33.50	2.60	32170	32170	200000	2.426	0.535	9390	2800	11.2	1029	0.104	27180	0.107	15.02	28	1314
79	0	F.R.F.C. [45] in Espion (1988)	II-52	150	280	770	236	2.18	0	0	0	0.00	deformed	60	21	28	29.80	29.80	29.80	2.34	30939	30939	200000	0.000	0.000	30939	2800	11.9	1029	0.104	33950	0.107	7.27	28	0
80	t	F.R.F.C. [45] in Espion (1988)	II-52	150	280	770	236	2.18	0	0	0	0.00	deformed	60	21	28	29.80	29.80	29.80	2.34	30939	30939	200000	3.133	0.550	7486	2800	11.9	1029	0.104	33950	0.107	13.49	28	1398
81	0	F.R.F.C. [45] in Espion (1988)	II-59	150	280	770	236	2.18	0	0	0	0.00	deformed	60	21	28	29.80	29.80	29.80	2.34	30939	30939	200000	0.000	0.000	30939	2800	11.9	1029	0.104	38300	0.107	7.69	28	0
82	t	F.R.F.C. [45] in Espion (1988)	II-59	150	280	770	236	2.18	0	0	0	0.00	deformed	60	21	28	29.80	29.80	29.80	2.34	30939	30939	200000	3.532	0.555	6827	2800	11.9	1029	0.104	38300	0.107	14.10	28	1541
83	0	F.R.F.C. [45] in Espion (1988)	II-70	150	280	770	236	2.18	0	0	0	0.00	deformed	60	21	28	29.80	29.80	29.80	2.34	30939	30939	200000	0.000	0.000	30939	2800	11.9	1029	0.104	45850	0.107	9.36	28	0
84	t	F.R.F.C. [45] in Espion (1988)	II-70	150	280	770	236	2.18	0	0	0	0.00	deformed	60	21	28	29.80	29.80	29.80	2.34	30939	30939	200000	4.237	0.553	5908	2800	11.9	1029	0.104	45850	0.107	17.56	28	1471
85	0	F.R.F.C. [45] in Espion (1988)	II-80	150	280	770	236	2.18	0	0	0	0.00	deformed	60	21	28	29.80	29.80	29.80	2.34	30939	30939	200000	0.000	0.000	30939	2800	11.9	1029	0.104	52260	0.107	10.72	28	0
86	t	F.R.F.C. [45] in Espion (1988)	II-80	150	280	770	236	2.18	0	0	0	0.00	deformed	60	21	28	29.80	29.80	29.80	2.34	30939	30939	200000	4.974	0.553	5179	2800	11.9	1029	0.104	52260	0.107	20.24	28	1485
87	0	F.R.F.C. [45] in Espion (1988)	II-90	150	280	770	236	2.18	0	0	0	0.00	deformed	60	21	28	29.80	29.80	29.80	2.34	30939	30939	200000	0.000	0.000	30939	2800	11.9	1029	0.104	58660	0.107	13.10	28	0
88	t	F.R.F.C. [45] in Espion (1988)	II-90	150	280	770	236	2.18	0	0	0	0.00	deformed	60	21	28	29.80	29.80	29.80	2.34	30939	30939	200000	5.826	0.554	4533	2800	11.9	1029	0.104	58660	0.107	24.23	28	1491
89	0	F.R.F.C. [45] in Espion (1988)	III-43	150	280	1232	233	3.53	0	0	0	0.00	deformed	60	21	28	34.30	34.30	34.30	2.65	32424	32424	200000	0.000	0.000	32424	2800	12.0	1029	0.104	42190	0.107	7.08	28	0
90	t	F.R.F.C. [45] in Espion (1988)	III-43	150	280	1232	233	3.53	0	0	0	0.00	deformed	60	21	28	34.30	34.30	34.30	2.65	32424	32424	200000	2.846	0.541	8431	2800	12.0	1029	0.104	42190	0.107	14.51	28	1572
91	0	F.R.F.C. [45] in Espion (1988)	III-67	150	280	1232	233	3.53	0	0	0	0.00	deformed	60	21	28	34.30	34.30	34.30	2.65	32424	32424	200000	0.000	0.000	32424	2800	12.0	1029	0.104	65300	0.107	10.58	28	0
92	t	F.R.F.C. [45] in Espion (1988)	III-67	150	280	1232	233	3.53	0	0	0	0.00	deformed	60	21	28	34.30	34.30	34.30	2.65	32424	32424	200000	4.586	0.541	5805	2800	12.0	1029	0.104	65300	0.107	23.88	28	1572
93	0	F.R.F.C. [45] in Espion (1988)	III-77	150	280	1232	233	3.53	0	0	0	0.00	deformed	60	21	28	34.30	34.30	34.30	2.65	32424	32424	200000	0.000	0.000	32424	2800	12.0	1029	0.104	75490	0.107	13.84	28	0
94	t	F.R.F.C. [45] in Espion (1988)	III-77	150	280	1232	233	3.53	0	0	0	0.00	deformed	60	21	28	34.30	34.30	34.30	2.65	32424	32424	200000	5.658	0.541	4870	2800	12.0	1029	0.104	75490	0.107	28.74	28	1572
95	0	F.R.F.C. [45] in Espion (1988)	IV-52	150	280	770	236	2.18	462	248	32	1.31	deformed	60	21	28	32.00	32.00	32.00	2.50	31683	31683	200000	0.000	0.000	31683	2800	11.9	1029	0.104	37610	0.107	5.98	28	0
96	t	F.R.F.C. [45] in Espion (1988)	IV-52	150	280	770	236	2.18	462	248	32	1.31	deformed	60	21	28	32.00	32.00	32.00	2.50	31683	31683	200000	2.022	0.509	10483	2800	11.9	1029	0.104	37610	0.107	10.52	28	772
97	0	F.R.F.C. [45] in Espion (1988)	IV-70	150	280	770	236	2.18	462	248	32	1.31	deformed	60	21	28	32.00	32.00	32.00	2.50	31683	31683	200000	0.000	0.000	31683	2800	11.9	1029	0.104	51340	0.107	8.80	28	0
98	t	F.R.F.C. [45] in Espion (1988)	IV-70	150	280	770	236	2.18	462	248	32	1.31	deformed	60	21	28	32.00	32.00	32.00	2.50	31683	31683	200000	2.499	0.509	9055	2800	11.9	1029	0.104	51340	0.107	13.90	28	772
99	0	F.R.F.C. [45] in Espion (1988)	IV-80	150	280	770	236	2.18	462	248	32	1.31	deformed	60	21	28	32.00	32.00	32.00	2.50	31683	31683	200000	0.000	0.000	31683	2800	11.9	1029	0.104	58200	0.107	11.16	28	0
100	t	F.R.F.C. [45] in Espion (1988)	IV-80	150	280	770	236	2.18	462	248	32	1.31	deformed	60	21	28	32.00	32.00	32.00	2.50	31683	31683	200000	2.856	0.524	8217	2800	11.9	1029	0.104	58200	0.107	16.96	28	972
101	0	F.R.F.C. [45] in Espion (1988)	IV-90	150	280	770	236	2.18	462	248	32	1.31	deformed	60	21	28	32.00	32.00	32.00	2.50	31683	31683	200000	0.000	0.000	31683	2800	11.9	1029	0.104	65530	0.107	12.85	28	0
102	t	F.R.F.C. [45] in Espion (1988)	IV-90	150	280	770	236	2.18	462	248	32	1.31	deformed	60	21	28	32.00	32.00	32.00	2.50	31683	31683	200000	3.192	0.524	7558	2800	11.9	1029	0.104	65530	0.107	19.28	28	972
103	0	Bakoss et al. (1983)	1B2	100	150	226	130	1.74	0	0	0	0.00	deformed	60	21	28	39.00	39.00	39.00	2.96	33842	33842	200000	0.000	0.000	33842	3750	28.8	659	0.104	3250	0.107	8.94	28	0
104	t	Bakoss et al. (1983)	1B2	100	150	226	130	1.74	0	0	0	0.00	deformed	60	21	28	39.00	39.00	39.00	2.96	33842	33842	200000	1.657	0.518	12737	3750	28.8	659	0.104	3250	0.107	25.02	28	500
105	0	Clarke et al. [46] in Espion (1988)	A1	100	154	157.1	132	1.19	0	0	0	0.00	deformed	40	21	28	25.90	25.90	25.90	2.05	29526	29526	200000	0.000	0.000	29526	2100	15.9	212	0.104	3500	0.107	4.89	28	0
106	t	Clarke et al. [46] in Espion (1988)	A1	100	154	157.1	132	1.19	0	0	0	0.00	deformed	40	21	28	25.90	25.90	25.90	2.05	29526	29526	200000	2.441	0.574	8580	2100	15.9	212	0.104	3500	0.107	11.83	28	180
107	0	Clarke et al. [46] in Espion (1988)	A2	100	152	157.1	130	1.21	0	0	0	0.00	deformed	40	21	28	25.90	25.90	25.90	2.05	29526	29526	200000	0.000	0.000	29526	2100	16.2	209	0.104	3500	0.107	5.09	28	0
108	t	Clarke et al. [46] in Espion (1988)	A2	100	152	157.1	130	1.21	0	0	0	0.00	deformed	40	21	28	25.90	25.90	25.90	2.05	29526	29526	200000	2.444	0.574	8574	2100	16.2	209	0.104	3500	0.107	11.92	28	180
109	0	Clarke et al. [46] in Espion (1988)	B1	100	152	157.1	130	1.21	157.1	132	20	1.21	deformed	40	21	28	25.90	25.90	25.90	2.05	29526	29526	200000	0.000	0.000	29526	2100	16.2	209	0.104	3500	0.107	4.78	28	0
110	t	Clarke et al. [46] in Espion (1988)	B1	100	152	157.1	130	1.21	157.1	132	20	1.21	deformed	40	21	28	25.90	25.90	25.90	2.05	29526	29526	200000	2.444	0.574	8574	2100	16.2	209	0.104	3500	0.107	8.77	28	180
111	0	Clarke et al. [46] in Espion (1988)	B2	100	154	157.1	132	1.19	157.1	134	20	1.19	deformed	40	21	28	25.90	25.90	25.90	2.05	29526	29526	200000	0.000	0.000	29526	2100	15.9	212	0.104	3500	0.107	4.30	28	0
112	t	Clarke et al. [46] in Espion (1988)	B2	100	154	157.1	132	1.19	157.1	134	20	1.19	deformed	40	21	28	25.90	25.90	25.90	2.05	29526	29526	200000	2.441	0.574	8580	2100	15.9	212	0.104	3500	0.107	8.55	28	180
113	0	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	40	21	28	24.80	24.80	22.36	1.77	27633	29102	200000	0.000	0.000	27633	3500	11.7	3254	0.104	21646	0.107	4.95	14	0
114	t	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	40	22	28	24.80	24.80	22.36	1.77	27633	29102	200000	3.121	0.461	6972	3500	11.7	3254	0.104	21646	0.107	12.06	14	380
115	0	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	40	21	28	24.80	24.80	22.36	1.77	27633	29102	200000	0.000	0.000	27633	3500	11.7	3254	0.104	13746	0.107	1.98	14	0
116	t	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	40	22	28	24.80	24.80	22.36	1.77	27633	29102	200000	3.121	0.461	6972	3500	11.7	3254	0.104	13746	0.107	7.44	14	380
117	0	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	40	21	28	24.80	24.80	22.36	1.77	27633	29102	200000	0.000	0.000	27633	3500	11.7	3110	0.104	21690	0.107	5.03	14	0
118	t	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	40	22	28	24.80	24.80	22.36	1.77	27633	29102	200000	3.132	0.466	6953	3500	11.7	3110	0.104	21690	0.107	12.42	14	380
119	0	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	40	21	28	24.80	24.80	22.36	1.77	27633	29102	200000	0.000	0.000	27633	3500	11.7	3110	0.104	13690	0.107	2.06	14	0
120	t	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	40	22	28	24.80	24.80	22.36	1.77	27633	29102	200000	3.132	0.466	6953	3500	11.7	3110	0.104	13690	0.107	7.87	14	380
121	0	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	40	21	28	24.80	24.80	22.36	1.77	27633	29102	200000	0.000	0.000	27633	3500	11.7	3110	0.104	31490	0.107	5.81	14	0
122	t	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	40	22	28	24.80	24.80	22.36	1.77	27633	29102	200000	3.132	0.466	6953	3500	11.7	3110	0.104	31490	0.107	13.30	14	380
123	0	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	40	21	28	24.80	24.80	22.36	1.77	27633	29102	200000	0.000	0.000	27633	3500	11.7	3110	0.104	17690	0.107	1.97	14	0
124	t	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	40	22	28	24.80	24.80	22.36	1.77	27633	29102	200000	3.132	0.466	6953	3500	11.7	3110	0.104	17690	0.107	7.90	14	380
125	0	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	40	21	28	24.80	24.80	22.36	1.77	27633	29102	200000	0.000	0.000	27633	3500	26.9	2373	0.104	4437	0.104	7.14	14	0
126	t	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	40	22	28	24.80	24.80	22.36	1.77	27633	29102	200000	3.272	0.528	6728	3500	26.9	2373	0.104	4437	0.104	25.10	14	380
127	0	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	40	21	28	24.80	24.80	22.36	1.77	27633	29102	200000	0.000	0.000	27633	3500	26.9	2373	0.104	2907	0.104	2.72	14	0
128	t	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	40	22	28	24.80	24.80	22.36	1.77	27633	29102	200000	3.272	0.528	6728	3500	26.9	2373	0.104	2907	0.104	19.90	14	380
129	0	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	40	21	28	24.80	24.80	22.36	1.77	27633	29102	200000	0.000	0.000	27633	3500	26.9	2373	0.104	7497	0.104	11.80	14	0
130	t	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	40	22	28	24.80	24.80	22.36	1.77	27633	29102	200000	3.272	0.528	6728	3500	26.9	2373	0.104	7497	0.104	32.50	14	380
131	0	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	40	21	28	24.80	24.80	22.36	1.77	27633	29102	200000	0.000	0.000	27633	3500	26.9	2373	0.104	4437	0.104	4.43	14	0
132	t	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	40	22	28	24.80	24.80	22.36	1.77	27633	29102	200000	3.272	0.528	6728	3500	26.9	2373	0.104	4437	0.104	21.90	14	380
133	0	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	40	21	28	24.80	24.80	22.36	1.77	27633	29102	200000	0.000	0.000	27633	3500	26.9	2373	0.104	8977	0.104	10.70	14	0
134	t	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	40	22	28	24.80	24.80	22.36	1.77	27633	29102	200000	3.272	0.528	6728	3500	26.9	2373	0.104	8977	0.104	29.80	14	380
135	0	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	40	21	28	24.80	24.80	22.36	1.77	27633	29102	200000	0.000	0.000	27633	3500	26.9	2373	0.104	5967	0.104	5.04	14	0
136	t	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	40	22	28	24.80	24.80	22.36	1.77	27633	29102	200000	3.272	0.528	6728	3500	26.9	2373	0.104	5967	0.104	22.90	14	380
137	0	Tošić (2017)	NAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	28	30.50	30.50	24.97	1.98	28212	31180	200000	0.000	0.000	28212	3200	18.9	1024	0.104	6645	0.107	9.17	7	0
138	t	Tošić (2017)	NAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	28	30.50	30.50	24.97	1.98	28212	31180	200000	2.744	0.705	8100	3200	18.9	1024	0.104	6645	0.107	18.94	7	450
139	0	Tošić (2017)	NAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	28	30.50	30.50	30.50	2.39	31180	31180	200000	0.000	0.000	31180	3200	18.9	1024	0.104	5853	0.107	8.11	28	0
140	t	Tošić (2017)	NAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	28	30.50	30.50	30.50	2.39	31180	31180	200000	2.105	0.705	10042	3200	18.9	1024	0.104	5853	0.107	16.51	28	450

Assessment and Correction of MC10 model:

Database – Calculated Deflections

		Study information		Cracking moment							State I				State II							Deflections			
		1	2	3	4		5		6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
		Author	Specimen	W_I^* (t_0) (mm^3)	M_{SW} (Nm)		M_{cr} (Nm)		M_{max} (Nm)	M_{max}/M_{cr}	A_I^* (mm^2)	$z_{I,1}^*$ (mm)	I_I^* (mm^4)	S_I^* (mm^3)	A_{II}^* (mm^2)	A_{IIc} (mm^2)	$z_{IIc,1}$ (mm)	$z_{II,1}^*$ (mm)	I_{IIc} (mm^4)	I_{II}^* (mm^4)	S_{II}^* (mm^3)	t-t_0 (days)	$a_{num.int.}$ (mm)	a_{exp} (mm)	$a_{num.int.}/a_{exp}$
1	0	Washa and Fluck (1952)	A1/A4	4002250	7192	<	7924	<	25634	3.235	73812	152.40	609942850	0	29610	17733	261.17	217.54	11254000	225850587	773660	0	13.90	13.46	1.033
2	t	Washa and Fluck (1952)	A1/A4	4002250	7192	<	7924	<	25634	3.235	108369	152.40	989485082	0	70935	24501	244.51	184.21	29683709	675743484	1477066	913	24.58	23.62	1.041
3	0	Washa and Fluck (1952)	A2/A5	3888764	7192	<	7700	<	25634	3.329	70662	147.79	574720400	285755	27368	18642	258.93	213.06	13075692	220683692	855330	0	14.33	15.75	0.910
4	t	Washa and Fluck (1952)	A2/A5	3888764	7192	<	7700	<	25634	3.329	96052	139.13	840748125	821739	61602	27485	237.17	169.53	41904905	599487886	1858896	913	29.54	32.26	0.916
5	0	Washa and Fluck (1952)	A3/A6	3763278	7192	<	7451	<	25634	3.440	67874	143.23	539014288	567893	25610	19672	256.39	207.98	15363996	214212917	952407	0	14.88	17.02	0.874
6	t	Washa and Fluck (1952)	A3/A6	3763278	7192	<	7451	<	25634	3.440	85152	123.83	664967311	1769832	54460	31243	227.92	151.05	61549295	494630155	2401799	913	38.86	44.70	0.869
7	0	Washa and Fluck (1952)	B1/B4	1229142	3596	>	2016	<	7259	3.601	36896	101.60	124880827	0	14790	8862	174.13	145.06	2496976	39508161	257631	0	24.21	23.37	1.036
8	t	Washa and Fluck (1952)	B1/B4	1229142	3596	>	2016	<	7259	3.601	59064	101.60	193410096	0	40736	12640	161.73	120.26	7245623	125621155	524271	913	49.57	51.05	0.971
9	0	Washa and Fluck (1952)	B2/B5	1209909	3596	>	1984	<	7259	3.659	35414	99.27	120107709	72040	13511	9065	173.46	143.71	2673097	39263915	269620	0	24.45	24.89	0.982
10	t	Washa and Fluck (1952)	B2/B5	1209909	3596	>	1984	<	7259	3.659	52040	94.09	168765599	232284	34867	13795	157.94	112.69	9418383	114059304	624223	913	57.40	65.02	0.883
11	0	Washa and Fluck (1952)	B3/B6	1187902	3596	>	1948	<	7259	3.726	33932	96.74	114917648	150393	12281	9317	172.63	142.07	2901851	38959199	284751	0	24.75	26.42	0.937
12	t	Washa and Fluck (1952)	B3/B6	1187902	3596	>	1948	<	7259	3.726	45016	84.25	136430315	537336	29505	15457	152.49	101.79	13250871	96707673	783738	913	72.84	86.36	0.843
13	0	Washa and Fluck (1952)	D1/D4	990864	1756	>	1734	<	6023	3.473	46212	63.50	62919835	0	18620	11117	108.76	90.52	1232532	21299569	202721	0	14.21	11.94	1.190
14	t	Washa and Fluck (1952)	D1/D4	990864	1756	>	1734	<	6023	3.473	72363	63.50	100880714	0	49348	15694	101.25	75.5	3467565	67571561	403842	913	27.58	27.69	0.996
15	0	Washa and Fluck (1952)	D2/D5	970786	1756	>	1699	<	6023	3.545	44337	61.89	60081924	62403	17119	11492	108.15	89.3	1361406	21045968	216639	0	14.46	14.22	1.017
16	t	Washa and Fluck (1952)	D2/D5	970786	1756	>	1699	<	6023	3.545	63950	58.49	87061004	194097	42539	17299	98.62	70.25	4643203	60682688	490921	913	32.49	33.78	0.962
17	0	Washa and Fluck (1952)	D3/D6	947835	1756	>	1659	<	6023	3.631	42461	60.13	56993290	130283	15695	11944	107.41	87.81	1528494	20728323	234120	0	14.76	17.78	0.830
18	t	Washa and Fluck (1952)	D3/D6	947835	1756	>	1659	<	6023	3.631	55536	51.96	69054109	446919	36405	19578	94.88	62.77	6730980	50415773	628816	913	42.38	48.51	0.874
19	0	P.C.A. [18] in Espion (1988)	40NA	2909878	1346	<	6198	<	23613	3.810	52040	141.42	411514890	513568	21698	16018	252.31	199.61	14824969	184749818	844077	0	3.99	4.25	0.939
20	t	P.C.A. [18] in Espion (1988)	40NA	2909878	1346	<	6198	<	23613	3.810	63841	124.71	490166327	1288518	40688	23207	228.66	152.33	45082052	359782218	1771341	242	9.08	10.00	0.908
21	0	P.C.A. [18] in Espion (1988)	60NA	2949418	1346	<	8435	<	30987	3.674	52464	140.69	414953550	547451	22551	16447	250.9	196.79	16046942	193936781	889874	0	4.46	4.90	0.911
22	t	P.C.A. [18] in Espion (1988)	60NA	2949418	1346	<	8435	<	30987	3.674	61686	127.28	478048843	1169049	37661	22335	231.53	158.06	40185889	336408130	1640776	242	9.06	9.90	0.915
23	0	Sattler [11] in Espion (1988)	a1/a2	462622	800	<	976	<	2762	2.830	16669	77.83	36005843	34674	4286	3617	141.92	123.83	394223	7980684	65448	0	16.45	15.83	1.039
24	t	Sattler [11] in Espion (1988)	a1/a2	462622	800	<	976	<	2762	2.830	17747	74.68	38726112	85044	7061	5314	133.43	106.85	1250810	16424786	141245	84	29.67	32.21	0.921
25	0	Hajnal-Konyi [22] in Espion (1988)	8	822534	3097	>	2410	<	4709	1.954	25026	93.09	76569719	52332	5881	5049	170.62	150.76	664933	14750983	100320	0	27.93	20.60	1.356
26	t	Hajnal-Konyi [22] in Espion (1988)	8	822534	3097	>	2410	<	4709	1.954	26179	90.32	80928892	119348	9208	7223	162.06	133.64	1947036	29021909	205345	1734	52.28	65.40	0.799
27	0	Hajnal-Konyi [22] in Espion (1988)	10	822534	1742	<	2410	<	4709	1.954	25026	93.09	76569719	52332	5881	5049	170.62	150.76	664933	14750983	100320	0	15.71	8.80	1.785
28	t	Hajnal-Konyi [22] in Espion (1988)	10	822534	1742	<	2410	<	4709	1.954	26179	90.32	80928892	119348	9208	7223	162.06	133.64	1947036	29021909	205345	1734	29.41	29.70	0.990
29	0	Hajnal-Konyi [22] in Espion (1988)	12	822534	774	<	2410	<	4709	1.954	25026	93.09	76569719	52332	5881	5049	170.62	150.76	664933	14750983	100320	0	6.98	4.30	1.624
30	t	Hajnal-Konyi [22] in Espion (1988)	12	822534	774	<	2410	<	4709	1.954	26179	90.32	80928892	119348	9208	7223	162.06	133.64	1947036	29021909	205345	1734	13.07	14.00	0.934
31	0	Branson and Metz [23] in Espion (1988)	SB3/B	317730	303	<	867	<	1238	1.428	14209	60.00	19063813	45167	5352	4047	107.08	87.17	535284	7120344	80635	0	2.50	3.89	0.642
32	t	Branson and Metz [23] in Espion (1988)	SB3/B	317730	303	<	867	<	1238	1.428	15811	56.49	20788130	90418	8276	5368	100.58	74.16	1248543	11909993	141807	60	8.01	7.70	1.041
33	0	Branson and Metz [23] in Espion (1988)	SB3/M	319528	303	<	783	<	1238	1.581	14264	59.87	19130162	46915	5472	4111	106.77	86.53	561080	7331221	83200	0	2.81	3.99	0.704
34	t	Branson and Metz [23] in Espion (1988)	SB3/M	319528	303	<	783	<	1238	1.581	16143	55.85	21102203	98657	8797	5557	99.65	72.3	1385054	12668463	151954	60	8.75	7.50	1.167
35	0	Pauw and Meyers [26] in Espion (1988)	R1	1500987	627	<	3933	<	7803	1.984	40885	104.54	156913208	133027	12320	9840	188.33	160.67	2511330	39922317	272230	0	2.51	2.44	1.030
36	t	Pauw and Meyers [26] in Espion (1988)	R1	1500987	627	<	3933	<	7803	1.984	44589	100.08	166683927	304129	20034	13850	177.05	138.11	7002700	75036714	539307	150	5.52	4.89	1.128
37	0	Pauw and Meyers [26] in Espion (1988)	R2	1548942	627	<	4043	<	11855	2.932	41932	103.20	159850843	184477	14817	11290	184.25	152.51	3793321	51584906	358407	0	3.52	3.22	1.094
38	t	Pauw and Meyers [26] in Espion (1988)	R2	1548942	627	<	4043	<	11855	2.932	47232	97.33	172718363	409825	24417	15590	172.16	128.32	9988968	92858192	683365	150	7.00	6.16	1.137
39	0	Pauw and Meyers [26] in Espion (1988)	R3	1541272	627	<	4547	<	10270	2.259	41762	103.41	159382904	176270	14435	11078	184.85	153.7	3584243	49808446	345087	0	2.76	3.71	0.745
40	t	Pauw and Meyers [26] in Espion (1988)	R3	1541272	627	<	4547	<	10270	2.259	45919	98.66	169809154	358899	22310	14795	174.39	132.79	8536569	84533170	615374	120	5.60	6.64	0.843
41	0	Pauw and Meyers [26] in Espion (1988)	R4	1596516	627	<	4694	<	15234	3.245	42995	101.90	162685027	234081	17045	12455	180.97	145.94	5093436	61834993	436216	0	3.71	4.66	0.797
42	t	Pauw and Meyers [26] in Espion (1988)	R4	1596516	627	<	4694	<	15234	3.245	48691	95.94	175770724	463302	26640	16354	170.01	124.02	11528988	101115920	752146	120	7.01	7.89	0.888
43	0	Lutz et al. [29] in Espion (1988)	SR	810319	216	<	2139	<	8179	3.824	22240	96.59	78268752	103463	7623	6029	173.53	143.87	1769022	27134245	178848	0	3.10	4.10	0.756
44	t	Lutz et al. [29] in Espion (1988)	SR	810319	216	<	2139	<	8179	3.824	24956	89.53	88462430	249316	12994	8683	160.47	117.75	5284179	53053214	370977	142	5.86	8.80	0.666
45	0	Lutz et al. [29] in Espion (1988)	DR	863371	216	<	2279	<	8179	3.589	23834	102.02	88081066	-8706	8601	5412	176.57	149.94	1279703	28646615	144105	0	2.90	4.20	0.691
46	t	Lutz et al. [29] in Espion (1988)	DR	863371	216	<	2279	<	8179	3.589	29267	102.53	117108702	-19142	15710	7088	168.32	133.43	2875065	64607151	247289	142	4.38	6.80	0.644
47	0	Jaccoud and Favre (1982)	A1	1520111	2162	<	2447	<	4949	2.022	74760	59.13	89884154	62401	16856	14096	108.25	96.51	648355	14542713	165579	0	8.95	8.42	1.063
48	t	Jaccoud and Favre (1982)	A1	1520111	2162	<	2447	<	4949	2.022	82418	57.03	99036080	213636	33948	23530	100.39	80.79	3015504	40088933	461160	365	20.71	18.40	1.125
49	0	Jaccoud and Favre (1982)	A2	1515708	2162	<	2910	<	4949	1.701	74612	59.18	89699591	59177	16389	13777	108.52	97.05	605300	13896771	158087	0	7.50	6.16	1.218
50	t	Jaccoud and Favre (1982)	A2	1515708	2162	<	2910	<	4949	1.701	80796	57.44	97154559	183995	30963	22167	101.53	83.06	2521475	35567990	409359	365	18.54	17.50	1.060
51	0	Jaccoud and Favre (1982)	A3	1521148	2162	<	2343	<	4949	2.112	74797	59.12	89930247	63212	16973	14176	108.19	96.38	659429	14705240	167441	0	9.26	8.12	1.141
52	t	Jaccoud and Favre (1982)	A3	1521148	2162	<	2343	<	4949	2.112	82896	56.91	99586294	222143	34790	23894	100.09	80.18	3157946	41367350	475699	365	21.23	17.50	1.213
53	0	Jaccoud and Favre (1982)	A4	1506283	2162	<	4172	<	4949	1.186	74285	59.28	89292484	52008	15304	13019	109.15	98.31	510774	12436877	141206	0	3.37	2.24	1.506
54	t	Jaccoud and Favre (1982)	A4	1506283	2162	<	4172	<	4949	1.186	77966	58.20	93800072	129319	25164	19198	104	88	1637786	26724416	307096	365	12.83	8.05	1.593
55	0	Jaccoud and Favre (1982)	A5	1508766	2162	<	3817	<	4949	1.297	74367	59.25	89394400	53795	15580	13213	108.99	97.98	533926	12806934	145468	0	4.50	3.12	1.443
56	t	Jaccoud and Favre (1982)	A5	1508766	2162	<	3817	<	4949	1.297	78585	58.03	94542185	141630	26518	19933	103.39	86.79	1833275	28782213	331021	365	14.40	9.55	1.508
57	0	Jaccoud and Favre (1982)	C12	3387047	3604	<	7824	<	9699	1.240	124037	78.65	266391260	161583	27411	23374	144.42	128.84	1891809	44126634	364189	0	2.68	2.17	1.234
58	t	Jaccoud and Favre (1982)	C12	3387047	3604	<	7824	<	9699	1.240	131862	76.28	285367434	446680	47959	36097	135.94	111.87	6968052	102407268	868832	510	9.25	8.29	1.116
59	0	Jaccoud and Favre (1982)	C22	3380311	3604	<	8654	<	9699	1.121	123894	78.70	266030449	156052	26904	23010	144.66	129.31	1804906	42823056	353113	0	1.92	2.00	0.958
60	t	Jaccoud and Favre (1982)	C22	3380311	3604	<	8654	<	9699	1.121	130219	76.75	281502676	389646	44331	34112	137.26	114.52	5880755	91768144	775635	365	7.84	7.00	1.120
61	0	Jaccoud and Favre (1982)	C13	3383563	3604	<	8188	<	12909	1.577	123968	78.68	266218766	158964	27165	23197	144.54	129.07	1849191	43507040	358929	0	5.51	5.29	1.042
62	t	Jaccoud and Favre (1982)	C13	3383563	3604	<	8188	<	12909	1.577	131296	76.44	284041924	427172	46735	35439	136.37	112.74	6593748	98799830	837199	510	12.98	13.28	0.977
63	0	Jaccoud and Favre (1982)	C14	3387047	3604	<	7824	<	16124	2.061	124037	78.65	266391260	161583	27411	23374	144.42	128.84	1891809	44126634	364189	0	8.85	8.48	1.043
64	t	Jaccoud and Favre (1982)	C14	3387047	3604	<	7824	<	16124	2.061	131862	76.28	285367434	446680	47959	36097	135.94	111.87	6968052	102407268	868832	510	17.18	18.15	0.947
65	0	Jaccoud and Favre (1982)	C24	3381738	3604	<	8421	<	16124	1.915	123925	78.69	266108931	157259	27014	23089	144.61	129.21	1823465	43108898	355541	0	8.35	8.00	1.043
66	t	Jaccoud and Favre (1982)	C24	3381738	3604	<	8421	<	16124	1.915	130953	76.54	283237413	415330	45979	35026	136.65	113.3	6366086	96600243	817977	510	16.44	17.52	0.938
67	0	Jaccoud and Favre (1982)	C15	3387246	3604	<	7791	<	19329	2.481	124043	78.65	266406935	161832	27427	23384	144.41	128.82	1894195	44180482	364670	0	11.73	11.02	1.064
68	t	Jaccoud and Favre (1982)	C15	3387246	3604	<	7791	<	19329	2.481	131905	76.27	285469112	448200	48051	36146	135.9	111.8	6996539	102667915	871188	510	20.73	20.83	0.995
69	0	Ding Dajung [44] in Espion (1988)	C-3	393163	336	<	672	<	3240	4.821	13772	76.64	30131992	43581	4323	3511	138.33	116.67	549762	9325635	76104	0	10.52	8.45	1.245
70	t	Ding Dajung [44] in Espion (1988)	C-3	393163	336	<	672	<	3240	4.821	16239	68.49	36150846	149174	9139	5860	123.83	87.65	2556313	23933077	212004	2025	20.73	16.62	1.247

		Study information		Cracking moment							State I				State II							Deflections			
		1	2	3	4		5		6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
		Author	Specimen	$W_I^*(t_0)$ (mm^3)	M_{SW} (Nm)		M_{cr} (Nm)		M_{max} (Nm)	M_{max}/M_{cr}	A_I^* (mm^2)	$z_{I,1}^*$ (mm)	I_I^* (mm^4)	S_I^* (mm^3)	A_{II}^* (mm^2)	A_{IIc} (mm^2)	$z_{IIc,1}$ (mm)	$z_{II,1}^*$ (mm)	I_{IIc} (mm^4)	I_{II}^* (mm^4)	S_{II}^* (mm^3)	t-t$_0$ (days)	$a_{num.int.}$ (mm)	a_{exp} (mm)	$a_{num.int.}/a_{exp}$
71	0	Ding Dajung [44] in Espion (1988)	L-1	274457	244	<	552	<	3524	6.384	10473	71.89	19730733	38688	4039	2990	127.89	103.76	579551	7278876	72111	0	14.22	15.53	0.915
72	t	Ding Dajung [44] in Espion (1988)	L-1	274457	244	<	552	<	3524	6.384	13616	63.38	23021491	118966	8854	4662	114.4	76.81	2196812	16111981	175263	531	30.37	30.43	0.998
73	0	F.R.F.C. [45] in Espion (1988)	I-72	2193561	1029	<	5703	<	22529	3.950	43916	135.20	296569473	201538	12139	10223	245.93	211.85	3956467	79183010	348381	0	6.87	6.02	1.141
74	t	F.R.F.C. [45] in Espion (1988)	I-72	2193561	1029	<	5703	<	22529	3.950	48092	126.07	338777879	585281	22225	16133	226.23	172.44	15550389	185835425	867779	1610	12.16	10.29	1.182
75	0	F.R.F.C. [45] in Espion (1988)	I-81	2193561	1029	<	5703	<	25279	4.433	43916	135.20	296569473	201538	12139	10223	245.93	211.85	3956467	79183010	348381	0	7.83	7.39	1.059
76	t	F.R.F.C. [45] in Espion (1988)	I-81	2193561	1029	<	5703	<	25279	4.433	48228	125.79	340025020	596557	22488	16260	225.8	171.57	15922009	188558098	881664	1344	13.49	11.98	1.126
77	0	F.R.F.C. [45] in Espion (1988)	I-91	2193561	1029	<	5703	<	28209	4.946	43916	135.20	296569473	201538	12139	10223	245.93	211.85	3956467	79183010	348381	0	8.83	8.94	0.988
78	t	F.R.F.C. [45] in Espion (1988)	I-91	2193561	1029	<	5703	<	28209	4.946	48560	125.14	343056668	624156	23128	16568	224.78	169.53	16842524	195139320	915373	1314	15.07	15.02	1.003
79	0	F.R.F.C. [45] in Espion (1988)	II-52	2429237	1029	<	5684	<	34979	6.154	46974	129.83	315387895	426936	19414	14440	231.87	183.74	11150829	141733579	695095	0	6.52	7.27	0.897
80	t	F.R.F.C. [45] in Espion (1988)	II-52	2429237	1029	<	5684	<	34979	6.154	62574	108.44	401668887	1325814	43357	22783	204.06	128.11	43802019	320776963	1730513	1398	15.00	13.49	1.112
81	0	F.R.F.C. [45] in Espion (1988)	II-59	2429237	1029	<	5684	<	39329	6.919	46974	129.83	315387895	426936	19414	14440	231.87	183.74	11150829	141733579	695095	0	7.37	7.69	0.958
82	t	F.R.F.C. [45] in Espion (1988)	II-59	2429237	1029	<	5684	<	39329	6.919	64561	106.45	409663261	1408934	45893	23332	202.23	124.44	47043536	334215159	1814807	1541	17.29	14.10	1.226
83	0	F.R.F.C. [45] in Espion (1988)	II-70	2429237	1029	<	5684	<	46879	8.248	46974	129.83	315387895	426936	19414	14440	231.87	183.74	11150829	141733579	695095	0	8.83	9.36	0.943
84	t	F.R.F.C. [45] in Espion (1988)	II-70	2429237	1029	<	5684	<	46879	8.248	68065	103.24	422624672	1544061	50247	24182	199.39	118.78	52371966	355259873	1949103	1471	21.60	17.56	1.230
85	0	F.R.F.C. [45] in Espion (1988)	II-80	2429237	1029	<	5684	<	53289	9.375	46974	129.83	315387895	426936	19414	14440	231.87	183.74	11150829	141733579	695095	0	10.06	10.72	0.939
86	t	F.R.F.C. [45] in Espion (1988)	II-80	2429237	1029	<	5684	<	53289	9.375	71737	100.21	434853474	1671539	54676	24939	196.87	113.73	57449865	374426061	2073589	1485	25.95	20.24	1.282
87	0	F.R.F.C. [45] in Espion (1988)	II-90	2429237	1029	<	5684	<	59689	10.501	46974	129.83	315387895	426936	19414	14440	231.87	183.74	11150829	141733579	695095	0	11.30	13.10	0.862
88	t	F.R.F.C. [45] in Espion (1988)	II-90	2429237	1029	<	5684	<	59689	10.501	75980	97.07	447507766	1803324	59670	25690	194.37	108.74	62793890	393585428	2199872	1491	30.99	24.23	1.279
89	0	F.R.F.C. [45] in Espion (1988)	III-43	2624807	1029	<	6956	<	43219	6.213	49601	125.75	330069430	598613	24272	16671	224.43	168.87	17160618	181521398	926387	0	6.03	7.08	0.852
90	t	F.R.F.C. [45] in Espion (1988)	III-43	2624807	1029	<	6956	<	43219	6.213	71223	101.84	423445914	1602592	53821	24598	198.01	116.02	55122076	359690250	2016974	1572	14.82	14.51	1.021
91	0	F.R.F.C. [45] in Espion (1988)	III-67	2624807	1029	<	6956	<	66329	9.536	49601	125.75	330069430	598613	24272	16671	224.43	168.87	17160618	181521398	926387	0	9.35	10.58	0.884
92	t	F.R.F.C. [45] in Espion (1988)	III-67	2624807	1029	<	6956	<	66329	9.536	84455	93.25	457006925	1963531	69066	26611	191.3	102.6	69793728	410403650	2360482	1572	26.31	23.88	1.102
93	0	F.R.F.C. [45] in Espion (1988)	III-77	2624807	1029	<	6956	<	76519	11.000	49601	125.75	330069430	598613	24272	16671	224.43	168.87	17160618	181521398	926387	0	10.81	13.84	0.781
94	t	F.R.F.C. [45] in Espion (1988)	III-77	2624807	1029	<	6956	<	76519	11.000	92598	89.18	472894221	2134234	78083	27485	188.38	96.77	76896804	432896218	2518274	1572	33.43	28.74	1.163
95	0	F.R.F.C. [45] in Espion (1988)	IV-52	2575533	1029	<	6439	<	38639	6.001	49774	136.95	352719219	127881	20794	13020	236.6	193.19	8174876	149611121	565086	0	6.65	5.98	1.112
96	t	F.R.F.C. [45] in Espion (1988)	IV-52	2575533	1029	<	6439	<	38639	6.001	65507	133.00	509408010	293832	40956	17449	221.84	163.67	19675350	351803469	1014778	772	10.10	10.52	0.960
97	0	F.R.F.C. [45] in Espion (1988)	IV-70	2575533	1029	<	6439	<	52369	8.133	49774	136.95	352719219	127881	20794	13020	236.6	193.19	8174876	149611121	565086	0	9.11	8.80	1.036
98	t	F.R.F.C. [45] in Espion (1988)	IV-70	2575533	1029	<	6439	<	52369	8.133	69215	132.33	546126642	321952	45198	17983	220.06	160.11	21539576	394316502	1077981	772	13.57	13.90	0.976
99	0	F.R.F.C. [45] in Espion (1988)	IV-80	2575533	1029	<	6439	<	59229	9.198	49774	136.95	352719219	127881	20794	13020	236.6	193.19	8174876	149611121	565086	0	10.34	11.16	0.927
100	t	F.R.F.C. [45] in Espion (1988)	IV-80	2575533	1029	<	6439	<	59229	9.198	71987	131.88	573537209	341251	48314	18327	218.91	157.83	22797148	425443019	1119410	972	15.47	16.96	0.912
101	0	F.R.F.C. [45] in Espion (1988)	IV-90	2575533	1029	<	6439	<	66559	10.337	49774	136.95	352719219	127881	20794	13020	236.6	193.19	8174876	149611121	565086	0	11.65	12.85	0.906
102	t	F.R.F.C. [45] in Espion (1988)	IV-90	2575533	1029	<	6439	<	66559	10.337	74599	131.48	599338677	357934	51212	18613	217.96	155.92	23884039	454382111	1154647	972	17.48	19.28	0.906
103	0	Bakoss et al. (1983)	1B2	451561	659	<	1337	<	3909	2.924	16336	70.50	31835017	67451	6042	4706	126.47	102.93	868509	12662100	110766	0	12.24	8.94	1.369
104	t	Bakoss et al. (1983)	1B2	451561	659	<	1337	<	3909	2.924	18548	64.48	36805065	157824	10239	6691	116.54	83.09	2496384	24106032	223856	500	26.31	25.02	1.052
105	0	Clarke et al. [46] in Espion (1988)	A1	455406	212	<	934	<	3712	3.974	16464	73.44	33444983	54710	5404	4340	132.3	110.58	681296	11073917	94211	0	5.00	4.89	1.022
106	t	Clarke et al. [46] in Espion (1988)	A1	455406	212	<	934	<	3712	3.974	19062	66.43	39384978	162703	10492	6830	119.85	85.7	2654727	25479292	233269	180	10.61	11.83	0.897
107	0	Clarke et al. [46] in Espion (1988)	A2	443820	209	<	910	<	3709	4.076	16264	72.47	32163612	53678	5364	4300	130.5	108.98	662743	10700556	92509	0	5.18	5.09	1.018
108	t	Clarke et al. [46] in Espion (1988)	A2	443820	209	<	910	<	3709	4.076	18865	65.51	37876232	159470	10426	6761	118.19	84.38	2575784	24566432	228632	180	10.97	11.92	0.920
109	0	Clarke et al. [46] in Espion (1988)	B1	469016	209	<	961	<	3709	3.860	17327	76.12	35701513	-1872	6035	3908	132.46	112.92	497297	11168524	76407	0	4.92	4.78	1.029
110	t	Clarke et al. [46] in Espion (1988)	B1	469016	209	<	961	<	3709	3.860	22530	76.33	51444128	-4911	12794	5464	124.68	97.36	1359337	30650306	149245	180	7.91	8.77	0.901
111	0	Clarke et al. [46] in Espion (1988)	B2	481173	212	<	986	<	3712	3.765	17527	77.12	37108095	-1872	6071	3944	134.28	114.56	511308	11558935	77768	0	4.74	4.30	1.102
112	t	Clarke et al. [46] in Espion (1988)	B2	481173	212	<	986	<	3712	3.765	22724	77.32	53408567	-4980	12844	5520	126.4	98.8	1401821	31743463	152339	180	7.65	8.55	0.895
113	0	Gilbert and Nejadi (2004)	B1-a	5228678	3254	<	9255	<	24900	2.690	87910	165.70	866391993	365847	21098	18188	303.63	267.27	8021540	182398081	661465	0	5.43	4.95	1.097
114	t	Gilbert and Nejadi (2004)	B1-a	5228678	3254	<	9255	<	24900	2.690	96533	154.47	990459981	1320226	43161	31628	276.75	213.49	42182599	515893071	2000926	380	11.04	12.06	0.916
115	0	Gilbert and Nejadi (2004)	B1-b	5228678	3254	<	9255	<	17000	1.837	87910	165.70	866391993	365847	21098	18188	303.63	267.27	8021540	182398081	661465	0	3.03	1.98	1.529
116	t	Gilbert and Nejadi (2004)	B1-b	5228678	3254	<	9255	<	17000	1.837	96533	154.47	990459981	1320226	43161	31628	276.75	213.49	42182599	515893071	2000926	380	7.77	7.44	1.045
117	0	Gilbert and Nejadi (2004)	B2-a	4870318	3110	<	8620	<	24800	2.877	84160	157.75	768292590	386366	21098	18188	288.63	252.27	8021540	182398081	661465	0	5.56	5.03	1.105
118	t	Gilbert and Nejadi (2004)	B2-a	4870318	3110	<	8620	<	24800	2.877	92812	145.37	906525153	1391660	43220	31658	261.69	198.37	42302748	516739463	2004421	380	11.19	12.42	0.901
119	0	Gilbert and Nejadi (2004)	B2-b	4870318	3110	<	8620	<	16800	1.949	84160	157.75	768292590	386366	21098	18188	288.63	252.27	8021540	182398081	661465	0	3.17	2.06	1.537
120	t	Gilbert and Nejadi (2004)	B2-b	4870318	3110	<	8620	<	16800	1.949	92812	145.37	906525153	1391660	43220	31658	261.69	198.37	42302748	516739463	2004421	380	7.94	7.87	1.009
121	0	Gilbert and Nejadi (2004)	B3-a	5103221	3110	<	9033	<	34600	3.830	85616	155.49	793499813	569683	25959	21593	281.82	238.63	13422936	252943757	932649	0	6.01	5.81	1.034
122	t	Gilbert and Nejadi (2004)	B3-a	5103221	3110	<	9033	<	34600	3.830	98592	138.31	985373444	1965054	53875	36533	251.94	178.89	65009513	670662818	2668803	380	12.24	13.30	0.920
123	0	Gilbert and Nejadi (2004)	B3-b	5103221	3110	<	9033	<	20800	2.303	85616	155.49	793499813	569683	25959	21593	281.82	238.63	13422936	252943757	932649	0	3.18	1.97	1.615
124	t	Gilbert and Nejadi (2004)	B3-b	5103221	3110	<	9033	<	20800	2.303	98592	138.31	985373444	1965054	53875	36533	251.94	178.89	65009513	670662818	2668803	380	8.12	7.90	1.028
125	0	Gilbert and Nejadi (2004)	S1-a	1687762	2373	<	2987	<	6810	2.280	63636	76.15	128523093	83694	13149	11513	140.61	126.23	794770	19942869	165637	0	12.02	7.14	1.683
126	t	Gilbert and Nejadi (2004)	S1-a	1687762	2373	<	2987	<	6810	2.280	68719	72.37	140837647	318278	27280	20561	129.3	103.61	4527087	59617008	528179	380	25.98	25.10	1.035
127	0	Gilbert and Nejadi (2004)	S1-b	1687762	2373	<	2987	<	5280	1.768	63636	76.15	128523093	83694	13149	11513	140.61	126.23	794770	19942869	165637	0	7.63	2.72	2.807
128	t	Gilbert and Nejadi (2004)	S1-b	1687762	2373	<	2987	<	5280	1.768	68719	72.37	140837647	318278	27280	20561	129.3	103.61	4527087	59617008	528179	380	20.13	19.90	1.012
129	0	Gilbert and Nejadi (2004)	S2-a	1730283	2373	<	3063	<	9870	3.222	64454	75.50	130636398	123945	16166	13712	137.86	120.73	1342886	27858819	234956	0	14.46	11.80	1.225
130	t	Gilbert and Nejadi (2004)	S2-a	1730283	2373	<	3063	<	9870	3.222	72078	70.16	148023744	455144	33910	23832	125.21	95.43	7049501	78177962	709827	380	29.91	32.50	0.920
131	0	Gilbert and Nejadi (2004)	S2-b	1730283	2373	<	3063	<	6810	2.223	64454	75.50	130636398	123945	16166	13712	137.86	120.73	1342886	27858819	234956	0	8.67	4.43	1.957
132	t	Gilbert and Nejadi (2004)	S2-b	1730283	2373	<	3063	<	6810	2.223	72078	70.16	148023744	455144	33910	23832	125.21	95.43	7049501	78177962	709827	380	21.71	21.90	0.991
133	0	Gilbert and Nejadi (2004)	S3-a	1772362	2373	<	3137	<	11350	3.618	65272	74.87	132696728	163199	18732	15460	135.68	116.35	1924392	35009269	298941	0	13.66	10.70	1.277
134	t	Gilbert and Nejadi (2004)	S3-a	1772362	2373	<	3137	<	11350	3.618	75438	68.15	154569802	579848	39724	26286	122.14	89.28	9459589	93367230	863792	380	29.60	29.80	0.993
135	0	Gilbert and Nejadi (2004)	S3-b	1772362	2373	<	3137	<	8340	2.659	65272	74.87	132696728	163199	18732	15460	135.68	116.35	1924392	35009269	298941	0	9.28	5.04	1.842
136	t	Gilbert and Nejadi (2004)	S3-b	1772362	2373	<	3137	<	8340	2.659	75438	68.15	154569802	579848	39724	26286	122.14	89.28	9459589	93367230	863792	380	23.04	22.90	1.006
137	0	Tošić (2017)	NAC7	1155873	1024	<	2289	<	7669	3.350	33517	98.57	113934435	45943	8142	6625	179.3	158.62	946449	21971049	137055	0	12.04	9.17	1.313
138	t	Tošić (2017)	NAC7	1155873	1024	<	2289	<	7669	3.350	37284	95.51	131463301	143823	15832	10548	167.04	134.08	3820557	58385703	347613	450	21.91	18.94	1.157
139	0	Tošić (2017)	NAC28	1147347	1024	<	2742	<	6877	2.508	33372	98.70	113243127	41715	7729	6357	180.13	160.27	836290	20202862	126173	0	9.69	8.11	1.194
140	t	Tošić (2017)	NAC28	1147347	1024	<	2742	<	6877	2.508	36263	96.27	126776262	119277	14068	9805	169.36	138.73	3068190	49745900	300278	450	18.60	16.51	1.126

Assessment and Correction of MC10 model:
Database – Calculated Deflections
MC10 with corrections

		Study information		Cracking moment							State I				State II							Deflections									
		1	2	3	4		5		6	7	8	9	10	11	12	13	14	15	16	17	18	19		20	21	22	23	24	25	26	27	28
		Author	Specimen	W_I^* (t_0) (mm^3)	M_{SW} (Nm)		M_{cr} (Nm)		M_{max} (Nm)	M_{max}/M_{cr}	A_I^* (mm^2)	$z_{I,1}^*$ (mm)	I_I^* (mm^4)	S_I^* (mm^3)	A_{II}^* (mm^2)	A_{IIc} (mm^2)	$z_{IIc,1}$ (mm)	$z_{II,1}^*$ (mm)	I_{IIc} (mm^4)	I_{II}^* (mm^4)	S_{II}^* (mm^3)	$t-t_0$ (days)	β	α	ζ_s	γ	$a_{simp.}$ (mm)	$a_{simp.}/a_{exp}$	$a_{num.int.}$ (mm)	a_{exp} (mm)	$a_{num.int.}/a_{exp}$
1	0	Washa and Fluck (1952)	A1/A4	4002250	7192	<	7924	<	25634	3.235	73812	152.40	609942850	0	29610	17733	261.17	217.54	11254000	225850587	773660	0	1.000	1.836	0.884	1.000	14.17	1.053	13.68	13.46	1.017
2	t	Washa and Fluck (1952)	A1/A4	4002250	7192	<	7924	<	25634	3.235	108369	152.40	989485082	0	70935	24501	244.51	184.21	29683709	675743484	1477066	913	0.500	1.836	0.942	1.000	24.92	1.055	24.45	23.62	1.035
3	0	Washa and Fluck (1952)	A2/A5	3888764	7192	<	7700	<	25634	3.329	70662	147.79	574720400	285755	27368	18642	258.93	213.06	13075692	220683692	855330	0	1.000	1.836	0.890	1.000	14.59	0.926	14.12	15.75	0.896
4	t	Washa and Fluck (1952)	A2/A5	3888764	7192	<	7700	<	25634	3.329	96052	139.13	840748125	821739	61602	27485	237.17	169.53	41904905	599487886	1858896	913	0.500	1.836	0.945	1.000	29.87	0.926	29.41	32.26	0.912
5	0	Washa and Fluck (1952)	A3/A6	3763278	7192	<	7451	<	25634	3.440	67874	143.23	539014288	567893	25610	19672	256.39	207.98	15363996	214212917	952407	0	1.000	1.836	0.896	1.000	15.11	0.888	14.67	17.02	0.862
6	t	Washa and Fluck (1952)	A3/A6	3763278	7192	<	7451	<	25634	3.440	85152	123.83	664967311	1769832	54460	31243	227.92	151.05	61549295	494630155	2401799	913	0.500	1.836	0.948	1.000	39.17	0.876	38.72	44.70	0.866
7	0	Washa and Fluck (1952)	B1/B4	1229142	3596	>	2016	<	7259	3.601	36896	101.60	124880827	0	14790	8862	174.13	145.06	2496976	39508161	257631	0	1.000	1.840	0.905	1.000	24.62	1.053	23.84	23.37	1.020
8	t	Washa and Fluck (1952)	B1/B4	1229142	3596	>	2016	<	7259	3.601	59064	101.60	193410096	0	40736	12640	161.73	120.26	7245623	125621155	524271	913	0.500	1.840	0.953	1.000	50.18	0.983	49.31	51.05	0.966
9	0	Washa and Fluck (1952)	B2/B5	1209909	3596	>	1984	<	7259	3.659	35414	99.27	120107709	72040	13511	9065	173.46	143.71	2673097	39263915	269620	0	1.000	1.840	0.908	1.000	24.85	0.998	24.10	24.89	0.968
10	t	Washa and Fluck (1952)	B2/B5	1209909	3596	>	1984	<	7259	3.659	52040	94.09	168765599	232284	34867	13795	157.94	112.69	9418383	114059304	624223	913	0.500	1.840	0.954	1.000	57.97	0.892	57.14	65.02	0.879
11	0	Washa and Fluck (1952)	B3/B6	1187902	3596	>	1948	<	7259	3.726	33932	96.74	114917648	150393	12281	9317	172.63	142.07	2901851	38959199	284751	0	1.000	1.840	0.911	1.000	25.12	0.951	24.41	26.42	0.924
12	t	Washa and Fluck (1952)	B3/B6	1187902	3596	>	1948	<	7259	3.726	45016	84.25	136430315	537336	29505	15457	152.49	101.79	13250871	96707673	783738	913	0.500	1.840	0.956	1.000	73.40	0.850	72.58	86.36	0.840
13	0	Washa and Fluck (1952)	D1/D4	990864	1756	>	1734	<	6023	3.473	46212	63.50	62919835	0	18620	11117	108.76	90.52	1232532	21299569	202721	0	1.000	1.839	0.899	1.000	14.47	1.212	14.00	11.94	1.173
14	t	Washa and Fluck (1952)	D1/D4	990864	1756	>	1734	<	6023	3.473	72363	63.50	100880714	0	49348	15694	101.25	75.5	3467565	67571561	403842	913	0.500	1.839	0.949	1.000	27.94	1.009	27.44	27.69	0.991
15	0	Washa and Fluck (1952)	D2/D5	970786	1756	>	1699	<	6023	3.545	44337	61.89	60081924	62403	17119	11492	108.15	89.3	1361406	21045968	216639	0	1.000	1.839	0.902	1.000	14.71	1.034	14.25	14.22	1.002
16	t	Washa and Fluck (1952)	D2/D5	970786	1756	>	1699	<	6023	3.545	63950	58.49	87061004	194097	42539	17299	98.62	70.25	4643203	60682688	490921	913	0.500	1.839	0.951	1.000	32.82	0.972	32.34	33.78	0.957
17	0	Washa and Fluck (1952)	D3/D6	947835	1756	>	1659	<	6023	3.631	42461	60.13	56993290	130283	15695	11944	107.41	87.81	1528494	20728323	234120	0	1.000	1.839	0.907	1.000	14.99	0.843	14.56	17.78	0.819
18	t	Washa and Fluck (1952)	D3/D6	947835	1756	>	1659	<	6023	3.631	55536	51.96	69054109	446919	36405	19578	94.88	62.77	6730980	50415773	628816	913	0.500	1.839	0.953	1.000	42.71	0.880	42.23	48.51	0.871
19	0	P.C.A. [18] in Espion (1988)	40NA	2909878	1346	<	6198	<	23613	3.810	52040	141.42	411514890	513568	21698	16018	252.31	199.61	14824969	184749818	844077	0	1.000	1.888	0.920	1.000	4.06	0.956	3.96	4.25	0.932
20	t	P.C.A. [18] in Espion (1988)	40NA	2909878	1346	<	6198	<	23613	3.810	63841	124.71	490166327	1288518	40688	23207	228.66	152.33	45082052	359782218	1771341	242	0.512	1.888	0.959	1.000	9.17	0.917	9.06	10.00	0.906
21	0	P.C.A. [18] in Espion (1988)	60NA	2949418	1346	<	8435	<	30987	3.674	52464	140.69	414953550	547451	22551	16447	250.9	196.79	16046942	193936781	889874	0	1.000	1.920	0.918	1.000	4.54	0.927	4.44	4.90	0.906
22	t	P.C.A. [18] in Espion (1988)	60NA	2949418	1346	<	8435	<	30987	3.674	61686	127.28	478048843	1169049	37661	22335	231.53	158.06	40185889	336408130	1640776	242	0.512	1.920	0.958	1.000	9.17	0.926	9.04	9.90	0.913
23	0	Sattler [11] in Espion (1988)	a1/a2	462622	800	<	976	<	2762	2.830	16669	77.83	36005843	34674	4286	3617	141.92	123.83	394223	7980684	65448	0	1.000	1.699	0.829	1.000	16.70	1.055	15.71	15.83	0.993
24	t	Sattler [11] in Espion (1988)	a1/a2	462622	800	<	976	<	2762	2.830	17747	74.68	38726112	85044	7061	5314	133.43	106.85	1250810	16424786	141245	84	0.570	1.699	0.903	1.000	29.82	0.926	28.87	32.21	0.896
25	0	Hajnal-Konyi [22] in Espion (1988)	8	822534	3097	>	2410	<	4709	1.954	25026	93.09	76569719	52332	5881	5049	170.62	150.76	664933	14750983	100320	0	1.000	1.687	0.677	1.000	29.47	1.431	26.08	20.60	1.266
26	t	Hajnal-Konyi [22] in Espion (1988)	8	822534	3097	>	2410	<	4709	1.954	26179	90.32	80928892	119348	9208	7223	162.06	133.64	1947036	29021909	205345	1734	0.500	1.687	0.838	1.000	54.13	0.828	51.19	65.40	0.783
27	0	Hajnal-Konyi [22] in Espion (1988)	10	822534	1742	<	2410	<	4709	1.954	25026	93.09	76569719	52332	5881	5049	170.62	150.76	664933	14750983	100320	0	1.000	1.687	0.677	1.000	16.58	1.884	14.67	8.80	1.667
28	t	Hajnal-Konyi [22] in Espion (1988)	10	822534	1742	<	2410	<	4709	1.954	26179	90.32	80928892	119348	9208	7223	162.06	133.64	1947036	29021909	205345	1734	0.500	1.687	0.838	1.000	30.45	1.025	28.80	29.70	0.970
29	0	Hajnal-Konyi [22] in Espion (1988)	12	822534	774	<	2410	<	4709	1.954	25026	93.09	76569719	52332	5881	5049	170.62	150.76	664933	14750983	100320	0	1.000	1.687	0.677	1.000	7.37	1.714	6.52	4.30	1.516
30	t	Hajnal-Konyi [22] in Espion (1988)	12	822534	774	<	2410	<	4709	1.954	26179	90.32	80928892	119348	9208	7223	162.06	133.64	1947036	29021909	205345	1734	0.500	1.687	0.838	1.000	13.53	0.966	12.80	14.00	0.914
31	0	Branson and Metz [23] in Espion (1988)	SB3/B	317730	303	<	867	<	1238	1.428	14209	60.00	19063813	45167	5352	4047	107.08	87.17	535284	7120344	80635	0	1.000	1.878	0.488	0.971	2.74	0.705	2.45	3.89	0.631
32	t	Branson and Metz [23] in Espion (1988)	SB3/B	317730	303	<	867	<	1238	1.428	15811	56.49	20788130	90418	8276	5368	100.58	74.16	1248543	11909993	141807	60	0.601	1.878	0.692	0.971	8.13	1.056	7.65	7.70	0.993
33	0	Branson and Metz [23] in Espion (1988)	SB3/M	319528	303	<	783	<	1238	1.581	14264	59.87	19130162	46915	5472	4111	106.77	86.53	561080	7331221	83200	0	1.000	1.878	0.577	1.000	3.10	0.778	2.76	3.99	0.692
34	t	Branson and Metz [23] in Espion (1988)	SB3/M	319528	303	<	783	<	1238	1.581	16143	55.85	21102203	98657	8797	5557	99.65	72.3	1385054	12668463	151954	60	0.601	1.878	0.746	1.000	9.08	1.211	8.42	7.50	1.123
35	0	Pauw and Meyers [26] in Espion (1988)	R1	1500987	627	<	3933	<	7803	1.984	40885	104.54	156913208	133027	12320	9840	188.33	160.67	2511330	39922317	272230	0	1.000	1.804	0.709	1.000	2.64	1.082	2.43	2.44	0.995
36	t	Pauw and Meyers [26] in Espion (1988)	R1	1500987	627	<	3933	<	7803	1.984	44589	100.08	166683927	304129	20034	13850	177.05	138.11	7002700	75036714	539307	150	0.530	1.804	0.846	1.000	5.71	1.168	5.41	4.89	1.107
37	0	Pauw and Meyers [26] in Espion (1988)	R2	1548942	627	<	4043	<	11855	2.932	41932	103.20	159850843	184477	14817	11290	184.25	152.51	3793321	51584906	358407	0	1.000	1.866	0.866	1.000	3.63	1.126	3.47	3.22	1.078
38	t	Pauw and Meyers [26] in Espion (1988)	R2	1548942	627	<	4043	<	11855	2.932	47232	97.33	172718363	409825	24417	15590	172.16	128.32	9988968	92858192	683365	150	0.530	1.866	0.929	1.000	7.13	1.158	6.94	6.16	1.127
39	0	Pauw and Meyers [26] in Espion (1988)	R3	1541272	627	<	4547	<	10270	2.259	41762	103.41	159382904	176270	14435	11078	184.85	153.7	3584243	49808446	345087	0	1.000	1.866	0.781	1.000	2.89	0.778	2.71	3.71	0.731
40	t	Pauw and Meyers [26] in Espion (1988)	R3	1541272	627	<	4547	<	10270	2.259	45919	98.66	169809154	358899	22310	14795	174.39	132.79	8536569	84533170	615374	120	0.543	1.866	0.881	1.000	5.76	0.868	5.52	6.64	0.831
41	0	Pauw and Meyers [26] in Espion (1988)	R4	1596516	627	<	4694	<	15234	3.245	42995	101.90	162685027	234081	17045	12455	180.97	145.94	5093436	61834993	436216	0	1.000	1.920	0.896	1.000	3.81	0.817	3.69	4.66	0.792
42	t	Pauw and Meyers [26] in Espion (1988)	R4	1596516	627	<	4694	<	15234	3.245	48691	95.94	175770724	463302	26640	16354	170.01	124.02	11528988	101115920	752146	120	0.543	1.920	0.943	1.000	7.11	0.901	6.96	7.89	0.883
43	0	Lutz et al. [29] in Espion (1988)	SR	810319	216	<	2139	<	8179	3.824	22240	96.59	78268752	103463	7623	6029	173.53	143.87	1769022	27134245	178848	0	1.000	1.819	0.913	1.000	3.15	0.768	3.06	4.10	0.745
44	t	Lutz et al. [29] in Espion (1988)	SR	810319	216	<	2139	<	8179	3.824	24956	89.53	88462430	249316	12994	8683	160.47	117.75	5284179	53053214	370977	142	0.533	1.819	0.953	1.000	5.92	0.673	5.82	8.80	0.661
45	0	Lutz et al. [29] in Espion (1988)	DR	863371	216	<	2279	<	8179	3.589	23834	102.02	88081066	-8706	8601	5412	176.57	149.94	1279703	28646615	144105	0	1.000	1.819	0.902	1.000	2.94	0.701	2.86	4.20	0.680
46	t	Lutz et al. [29] in Espion (1988)	DR	863371	216	<	2279	<	8179	3.589	29267	102.53	117108702	-19142	15710	7088	168.32	133.43	2875065	64607151	247289	142	0.533	1.819	0.948	1.000	4.43	0.652	4.34	6.80	0.638
47	0	Jaccoud and Favre (1982)	A1	1520111	2162	<	2447	<	4949	2.022	74760	59.13	89884154	62401	16856	14096	108.25	96.51	648355	14542713	165579	0	1.000	1.646	0.686	1.000	9.31	1.106	8.25	8.42	0.980
48	t	Jaccoud and Favre (1982)	A1	1520111	2162	<	2447	<	4949	2.022	82418	57.03	99036080	213636	33948	23530	100.39	80.79	3015504	40088933	461160	365	0.504	1.646	0.842	1.000	21.34	1.160	20.20	18.40	1.098
49	0	Jaccoud and Favre (1982)	A2	1515708	2162	<	2910	<	4949	1.701	74612	59.18	89699591	59177	16389	13777	108.52	97.05	605300	13896771	158087	0	1.000	1.646	0.583	1.000	8.11	1.317	6.85	6.16	1.112
50	t	Jaccoud and Favre (1982)	A2	1515708	2162	<	2910	<	4949	1.701	80796	57.44	97154559	183995	30963	22167	101.53	83.06	2521475	35567990	409359	365	0.504	1.646	0.789	1.000	19.49	1.114	18.07	17.50	1.033
51	0	Jaccoud and Favre (1982)	A3	1521148	2162	<	2343	<	4949	2.112	74797	59.12	89930247	63212	16973	14176	108.19	96.38	659429	14705240	167441	0	1.000	1.646	0.708	1.000	9.58	1.180	8.56	8.12	1.055
52	t	Jaccoud and Favre (1982)	A3	1521148	2162	<	2343	<	4949	2.112	82896	56.91	99586294	222143	34790	23894	100.09	80.18	3157946	41367350	475699	365	0.504	1.646	0.853	1.000	21.79	1.245	20.72	17.50	1.184
53	0	Jaccoud and Favre (1982)	A4	1506283	2162	<	4172	<	4949	1.186	74285	59.28	89292484	52008	15304	13019	109.15	98.31	510774	12436877	141206	0	1.000	1.646	0.245	0.874	3.75	1.672	3.11	2.24	1.389
54	t	Jaccoud and Favre (1982)	A4	1506283	2162	<	4172	<	4949	1.186	77966	58.20	93800072	129319	25164	19198	104	88	1637786	26724416	307096	365	0.504	1.646	0.619	0.874	12.91	1.603	12.71	8.05	1.579
55	0	Jaccoud and Favre (1982)	A5	1508766	2162	<	3817	<	4949	1.297	74367	59.25	89394400	53795	15580	13213	108.99	97.98	533926	12806934	145468	0	1.000	1.646	0.348	0.919	4.99	1.600	4.10	3.12	1.314
56	t	Jaccoud and Favre (1982)	A5	1508766	2162	<	3817	<	4949	1.297	78585	58.03	94542185	141630	26518	19933	103.39	86.79	1833275	28782213	331021	365	0.504	1.646	0.671	0.919	14.75	1.545	14.16	9.55	1.482
57	0	Jaccoud and Favre (1982)	C12	3387047	3604	<	7824	<	9699	1.240	124037	78.65	266391260	161583	27411	23374	144.42	128.84	1891809	44126634	364189	0	1.000	1.653	0.299	0.896	2.70	1.243	2.46	2.17	1.134
58	t	Jaccoud and Favre (1982)	C12	3387047	3604	<	7824	<	9699	1.240	131862	76.28	285367434	446680	47959	36097	135.94	111.87	6968052	102407268	868832	510	0.502	1.653	0.648	0.896	9.16	1.105	9.14	8.29	1.102
59	0	Jaccoud and Favre (1982)	C22	3380311	3604	<	8654	<	9699	1.121	123894	78.70	266030449	156052	26904	23010	144.66	129.31	1804906	42823056	353113	0	1.000	1.653	0.172	0.848	1.87	0.933	1.79	2.00	0.897
60	t	Jaccoud and Favre (1982)	C22	3380311	3604	<	8654	<	9699	1.121	130219	76.75	281502676	389646	44331	34112	137.26	114.52	5880755	91768144	775635	365	0.504	1.653	0.582	0.848	7.55	1.078	7.80	7.00	1.114
61	0	Jaccoud and Favre (1982)	C13	3383563	3604	<	8188	<	12909	1.577	123968	78.68	266218766	158964	27165	23197	144.54	129.07	1849191	43507040	358929	0	1.000	1.653	0.529	1.000	5.85	1.106	5.04	5.29	0.953
62	t	Jaccoud and Favre (1982)	C13	3383563	3604	<	8188	<	12909	1.577	131296	76.44	284041924	427172	46735	35439	136.37	112.74	6593748	98799830	837199	510	0.502	1.653	0.764	1.000	13.72	1.033	12.68	13.28	0.955
63	0	Jaccoud and Favre (1982)	C14	3387047	3604	<	7824	<	16124	2.061	124037	78.65	266391260	161583	27411	23374	144.42	128.84	1891809	44126634	364189	0	1.000	1.653	0.697	1.000	9.06	1.069	8.21	8.48	0.968
64	t	Jaccoud and Favre (1982)	C14	3387047	3604	<	7824	<	16124	2.061	131862	76.28	285367434	446680	47959	36097	135.94	111.87	6968052	102407268	868832	510	0.502	1.653	0.848	1.000	17.67	0.973	16.77	18.15	0.924
65	0	Jaccoud and Favre (1982)	C24	3381738	3604	<	8421	<	16124	1.915	123925	78.69	266108931	157259	27014	23089	144.61	129.21	1823465	43108898	355541	0	1.000	1.653	0.658	1.000	8.62	1.077	7.70	8.00	0.963
66	t	Jaccoud and Favre (1982)	C24	3381738	3604	<	8421	<	16124	1.915	130953	76.54	283237413	415330	45979	35026	136.65	113.3	6366086	96600243	817977	510	0.502	1.653	0.829	1.000	17.00	0.970	16.04	17.52	0.916
67	0	Jaccoud and Favre (1982)	C15	3387246	3604	<	7791	<	19329	2.481	124043	78.65	266406935	161832	27427	23384	144.41	128.82	1894195	44180482	364670	0	1.000	1.653	0.777	1.000	11.85	1.075	11.00	11.02	0.998
68	t	Jaccoud and Favre (1982)	C15	3387246	3604	<	7791	<	19329	2.481	131905	76.27	285469112	448200	48051	36146	135.9	111.8	6996539	102667915	871188	510	0.502	1.653	0.888	1.000	21.08	1.012	20.28	20.83	0.974
69	0	Ding Dajung [44] in Espion (1988)	C-3	393163	336	<	672	<	3240	4.821	13772	76.64	30131992	43581	4323	3511	138.33	116.67	549762	9325635	76104	0	1.000	1.753	0.937	1.000	10.57	1.250	10.34	8.45	1.224
70	t	Ding Dajung [44] in Espion (1988)	C-3	393163	336	<	672	<	3240	4.821	16239	68.49	36150846	149174	9139	5860	123.83	87.65	2556313	23933077	212004	2025	0.500	1.753	0.968	1.000	20.83	1.253	20.64	16.62	1.242

		Study information		Cracking moment							State I				State II							Deflections									
		1	2	3	4		5		6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
		Author	Specimen	$W_I^*(t_0)$ (mm^3)	M_{SW} (Nm)		M_{cr} (Nm)		M_{max} (Nm)	M_{max}/M_{cr}	A_I^* (mm^2)	$z_{I,1}^*$ (mm)	I_I^* (mm^4)	S_I^* (mm^3)	A_{II}^* (mm^2)	A_{IIc} (mm^2)	$z_{IIc,1}$ (mm)	$z_{II,1}^*$ (mm)	I_{IIc} (mm^4)	I_{II}^* (mm^4)	S_{II}^* (mm^3)	$t-t_0$ (days)	β	α	ζ_s	γ	$a_{simp.}$ (mm)	$a_{simp.}/a_{exp}$	$a_{num.int.}$ (mm)	a_{exp} (mm)	$a_{num.int.}/a_{exp}$
71	0	Ding Dajung [44] in Espion (1988)	L-1	274457	244	<	552	<	3524	6.384	10473	71.89	19730733	38688	4039	2990	127.89	103.76	579551	7278876	72111	0	1.000	1.882	0.969	1.000	14.31	0.921	14.15	15.53	0.911
72	t	Ding Dajung [44] in Espion (1988)	L-1	274457	244	<	552	<	3524	6.384	13616	63.38	23021491	118966	8854	4662	114.4	76.81	2196812	16111981	175263	531	0.501	1.882	0.985	1.000	30.51	1.003	30.33	30.43	0.997
73	0	F.R.F.C. [45] in Espion (1988)	I-72	2193561	1029	<	5703	<	22529	3.950	43916	135.20	296569473	201538	12139	10223	245.93	211.85	3956467	79183010	348381	0	1.000	1.715	0.905	1.000	6.90	1.145	6.69	6.02	1.111
74	t	F.R.F.C. [45] in Espion (1988)	I-72	2193561	1029	<	5703	<	22529	3.950	48092	126.07	338777879	585281	22225	16133	226.23	172.44	15550389	185835425	867779	1610	0.500	1.715	0.953	1.000	12.25	1.191	12.06	10.29	1.172
75	0	F.R.F.C. [45] in Espion (1988)	I-81	2193561	1029	<	5703	<	25279	4.433	43916	135.20	296569473	201538	12139	10223	245.93	211.85	3956467	79183010	348381	0	1.000	1.715	0.922	1.000	7.85	1.062	7.64	7.39	1.034
76	t	F.R.F.C. [45] in Espion (1988)	I-81	2193561	1029	<	5703	<	25279	4.433	48228	125.79	340025020	596557	22488	16260	225.8	171.57	15922009	188558098	881664	1344	0.500	1.715	0.961	1.000	13.56	1.132	13.39	11.98	1.117
77	0	F.R.F.C. [45] in Espion (1988)	I-91	2193561	1029	<	5703	<	28209	4.946	43916	135.20	296569473	201538	12139	10223	245.93	211.85	3956467	79183010	348381	0	1.000	1.715	0.936	1.000	8.84	0.989	8.65	8.94	0.968
78	t	F.R.F.C. [45] in Espion (1988)	I-91	2193561	1029	<	5703	<	28209	4.946	48560	125.14	343056668	624156	23128	16568	224.78	169.53	16842524	195139320	915373	1314	0.500	1.715	0.968	1.000	15.13	1.007	14.98	15.02	0.997
79	0	F.R.F.C. [45] in Espion (1988)	II-52	2429237	1029	<	5684	<	34979	6.154	46974	129.83	315387895	426936	19414	14440	231.87	183.74	11150829	141733579	695095	0	1.000	1.886	0.968	1.000	6.56	0.902	6.49	7.27	0.893
80	t	F.R.F.C. [45] in Espion (1988)	II-52	2429237	1029	<	5684	<	34979	6.154	62574	108.44	401668887	1325814	43357	22783	204.06	128.11	43802019	320776963	1730513	1398	0.500	1.886	0.984	1.000	15.06	1.116	14.98	13.49	1.111
81	0	F.R.F.C. [45] in Espion (1988)	II-59	2429237	1029	<	5684	<	39329	6.919	46974	129.83	315387895	426936	19414	14440	231.87	183.74	11150829	141733579	695095	0	1.000	1.886	0.974	1.000	7.41	0.964	7.34	7.69	0.955
82	t	F.R.F.C. [45] in Espion (1988)	II-59	2429237	1029	<	5684	<	39329	6.919	64561	106.45	409663261	1408934	45893	23332	202.23	124.44	47043536	334215159	1814807	1541	0.500	1.886	0.987	1.000	17.35	1.231	17.28	14.10	1.226
83	0	F.R.F.C. [45] in Espion (1988)	II-70	2429237	1029	<	5684	<	46879	8.248	46974	129.83	315387895	426936	19414	14440	231.87	183.74	11150829	141733579	695095	0	1.000	1.886	0.981	1.000	8.87	0.947	8.80	9.36	0.941
84	t	F.R.F.C. [45] in Espion (1988)	II-70	2429237	1029	<	5684	<	46879	8.248	68065	103.24	422624672	1544061	50247	24182	199.39	118.78	52371966	355259873	1949103	1471	0.500	1.886	0.991	1.000	21.66	1.234	21.59	17.56	1.229
85	0	F.R.F.C. [45] in Espion (1988)	II-80	2429237	1029	<	5684	<	53289	9.375	46974	129.83	315387895	426936	19414	14440	231.87	183.74	11150829	141733579	695095	0	1.000	1.886	0.985	1.000	10.11	0.943	10.04	10.72	0.937
86	t	F.R.F.C. [45] in Espion (1988)	II-80	2429237	1029	<	5684	<	53289	9.375	71737	100.21	434853474	1671539	54676	24939	196.87	113.73	57449865	374426061	2073589	1485	0.500	1.886	0.993	1.000	26.01	1.285	25.94	20.24	1.282
87	0	F.R.F.C. [45] in Espion (1988)	II-90	2429237	1029	<	5684	<	59689	10.501	46974	129.83	315387895	426936	19414	14440	231.87	183.74	11150829	141733579	695095	0	1.000	1.886	0.988	1.000	11.34	0.865	11.27	13.10	0.861
88	t	F.R.F.C. [45] in Espion (1988)	II-90	2429237	1029	<	5684	<	59689	10.501	75980	97.07	447507766	1803324	59670	25690	194.37	108.74	62793890	393585428	2199872	1491	0.500	1.886	0.994	1.000	31.06	1.282	30.98	24.23	1.279
89	0	F.R.F.C. [45] in Espion (1988)	III-43	2624807	1029	<	6956	<	43219	6.213	49601	125.75	330069430	598613	24272	16671	224.43	168.87	17160618	181521398	926387	0	1.000	1.970	0.973	1.000	6.07	0.858	6.03	7.08	0.851
90	t	F.R.F.C. [45] in Espion (1988)	III-43	2624807	1029	<	6956	<	43219	6.213	71223	101.84	423445914	1602592	53821	24598	198.01	116.02	55122076	359690250	2016974	1572	0.500	1.970	0.986	1.000	14.88	1.026	14.82	14.51	1.021
91	0	F.R.F.C. [45] in Espion (1988)	III-67	2624807	1029	<	6956	<	66329	9.536	49601	125.75	330069430	598613	24272	16671	224.43	168.87	17160618	181521398	926387	0	1.000	1.970	0.988	1.000	9.40	0.888	9.35	10.58	0.884
92	t	F.R.F.C. [45] in Espion (1988)	III-67	2624807	1029	<	6956	<	66329	9.536	84455	93.25	457006925	1963531	69066	26611	191.3	102.6	69793728	410403650	2360482	1572	0.500	1.970	0.994	1.000	26.38	1.105	26.31	23.88	1.102
93	0	F.R.F.C. [45] in Espion (1988)	III-77	2624807	1029	<	6956	<	76519	11.000	49601	125.75	330069430	598613	24272	16671	224.43	168.87	17160618	181521398	926387	0	1.000	1.970	0.991	1.000	10.86	0.784	10.81	13.84	0.781
94	t	F.R.F.C. [45] in Espion (1988)	III-77	2624807	1029	<	6956	<	76519	11.000	92598	89.18	472894221	2134234	78083	27485	188.38	96.77	76896804	432896218	2518274	1572	0.500	1.970	0.996	1.000	33.51	1.166	33.42	28.74	1.163
95	0	F.R.F.C. [45] in Espion (1988)	IV-52	2575533	1029	<	6439	<	38639	6.001	49774	136.95	352719219	127881	20794	13020	236.6	193.19	8174876	149611121	565086	0	1.000	1.886	0.966	1.000	6.71	1.121	6.62	5.98	1.107
96	t	F.R.F.C. [45] in Espion (1988)	IV-52	2575533	1029	<	6439	<	38639	6.001	65507	133.00	509408010	293832	40956	17449	221.84	163.67	19675350	351803469	1014778	772	0.500	1.886	0.983	1.000	10.15	0.965	10.08	10.52	0.958
97	0	F.R.F.C. [45] in Espion (1988)	IV-70	2575533	1029	<	6439	<	52369	8.133	49774	136.95	352719219	127881	20794	13020	236.6	193.19	8174876	149611121	565086	0	1.000	1.886	0.981	1.000	9.17	1.042	9.09	8.80	1.033
98	t	F.R.F.C. [45] in Espion (1988)	IV-70	2575533	1029	<	6439	<	52369	8.133	69215	132.33	546126642	321952	45198	17983	220.06	160.11	21539576	394316502	1077981	772	0.500	1.886	0.990	1.000	13.61	0.979	13.56	13.90	0.975
99	0	F.R.F.C. [45] in Espion (1988)	IV-80	2575533	1029	<	6439	<	59229	9.198	49774	136.95	352719219	127881	20794	13020	236.6	193.19	8174876	149611121	565086	0	1.000	1.886	0.985	1.000	10.39	0.931	10.31	11.16	0.924
100	t	F.R.F.C. [45] in Espion (1988)	IV-80	2575533	1029	<	6439	<	59229	9.198	71987	131.88	573537209	341251	48314	18327	218.91	157.83	22797148	425443019	1119410	972	0.500	1.886	0.992	1.000	15.53	0.915	15.46	16.96	0.912
101	0	F.R.F.C. [45] in Espion (1988)	IV-90	2575533	1029	<	6439	<	66559	10.337	49774	136.95	352719219	127881	20794	13020	236.6	193.19	8174876	149611121	565086	0	1.000	1.886	0.988	1.000	11.70	0.910	11.62	12.85	0.904
102	t	F.R.F.C. [45] in Espion (1988)	IV-90	2575533	1029	<	6439	<	66559	10.337	74599	131.48	599338677	357934	51212	18613	217.96	155.92	23884039	454382111	1154647	972	0.500	1.886	0.994	1.000	17.52	0.909	17.47	19.28	0.906
103	0	Bakoss et al. (1983)	1B2	451561	659	<	1337	<	3909	2.924	16336	70.50	31835017	67451	6042	4706	126.47	102.93	868509	12662100	110766	0	1.000	1.847	0.862	1.000	12.53	1.401	12.06	8.94	1.349
104	t	Bakoss et al. (1983)	1B2	451561	659	<	1337	<	3909	2.924	18548	64.48	36805065	157824	10239	6691	116.54	83.09	2496384	24106032	223856	500	0.502	1.847	0.931	1.000	26.76	1.069	26.19	25.02	1.047
105	0	Clarke et al. [46] in Espion (1988)	A1	455406	212	<	934	<	3712	3.974	16464	73.44	33444983	54710	5404	4340	132.3	110.58	681296	11073917	94211	0	1.000	1.780	0.914	1.000	5.04	1.031	4.91	4.89	1.003
106	t	Clarke et al. [46] in Espion (1988)	A1	455406	212	<	934	<	3712	3.974	19062	66.43	39384978	162703	10492	6830	119.85	85.7	2654727	25479292	233269	180	0.522	1.780	0.955	1.000	10.69	0.904	10.55	11.83	0.891
107	0	Clarke et al. [46] in Espion (1988)	A2	443820	209	<	910	<	3709	4.076	16264	72.47	32163612	53678	5364	4300	130.5	108.98	662743	10700556	92509	0	1.000	1.783	0.918	1.000	5.23	1.027	5.09	5.09	1.001
108	t	Clarke et al. [46] in Espion (1988)	A2	443820	209	<	910	<	3709	4.076	18865	65.51	37876232	159470	10426	6761	118.19	84.38	2575784	24566432	228632	180	0.522	1.783	0.957	1.000	11.05	0.927	10.90	11.92	0.914
109	0	Clarke et al. [46] in Espion (1988)	B1	469016	209	<	961	<	3709	3.860	17327	76.12	35701513	-1872	6035	3908	132.46	112.92	497297	11168524	76407	0	1.000	1.783	0.910	1.000	4.97	1.040	4.83	4.78	1.010
110	t	Clarke et al. [46] in Espion (1988)	B1	469016	209	<	961	<	3709	3.860	22530	76.33	51444128	-4911	12794	5464	124.68	97.36	1359337	30650306	149245	180	0.522	1.783	0.953	1.000	7.98	0.910	7.84	8.77	0.894
111	0	Clarke et al. [46] in Espion (1988)	B2	481173	212	<	986	<	3712	3.765	17527	77.12	37108095	-1872	6071	3944	134.28	114.56	511308	11558935	77768	0	1.000	1.780	0.906	1.000	4.79	1.113	4.65	4.30	1.081
112	t	Clarke et al. [46] in Espion (1988)	B2	481173	212	<	986	<	3712	3.765	22724	77.32	53408567	-4980	12844	5520	126.4	98.8	1401821	31743463	152339	180	0.522	1.780	0.951	1.000	7.73	0.904	7.58	8.55	0.887
113	0	Gilbert and Nejadi (2004)	B1-a	5228678	3254	<	9255	<	24900	2.690	87910	165.70	866391993	365847	21098	18188	303.63	267.27	8021540	182398081	661465	0	1.000	1.641	0.803	1.000	5.45	1.100	5.12	4.95	1.035
114	t	Gilbert and Nejadi (2004)	B1-a	5228678	3254	<	9255	<	24900	2.690	96533	154.47	990459981	1320226	43161	31628	276.75	213.49	42182599	515893071	2000926	380	0.504	1.641	0.901	1.000	11.17	0.926	10.86	12.06	0.900
115	0	Gilbert and Nejadi (2004)	B1-b	5228678	3254	<	9255	<	17000	1.837	87910	165.70	866391993	365847	21098	18188	303.63	267.27	8021540	182398081	661465	0	1.000	1.641	0.631	1.000	3.11	1.571	2.80	1.98	1.414
116	t	Gilbert and Nejadi (2004)	B1-b	5228678	3254	<	9255	<	17000	1.837	96533	154.47	990459981	1320226	43161	31628	276.75	213.49	42182599	515893071	2000926	380	0.504	1.641	0.814	1.000	8.01	1.077	7.63	7.44	1.025
117	0	Gilbert and Nejadi (2004)	B2-a	4870318	3110	<	8620	<	24800	2.877	84160	157.75	768292590	386366	21098	18188	288.63	252.27	8021540	182398081	661465	0	1.000	1.641	0.823	1.000	5.56	1.106	5.28	5.03	1.049
118	t	Gilbert and Nejadi (2004)	B2-a	4870318	3110	<	8620	<	24800	2.877	92812	145.37	906525153	1391660	43220	31658	261.69	198.37	42302748	516739463	2004421	380	0.504	1.641	0.911	1.000	11.29	0.909	11.03	12.42	0.888
119	0	Gilbert and Nejadi (2004)	B2-b	4870318	3110	<	8620	<	16800	1.949	84160	157.75	768292590	386366	21098	18188	288.63	252.27	8021540	182398081	661465	0	1.000	1.641	0.665	1.000	3.24	1.574	2.95	2.06	1.430
120	t	Gilbert and Nejadi (2004)	B2-b	4870318	3110	<	8620	<	16800	1.949	92812	145.37	906525153	1391660	43220	31658	261.69	198.37	42302748	516739463	2004421	380	0.504	1.641	0.831	1.000	8.14	1.034	7.81	7.87	0.992
121	0	Gilbert and Nejadi (2004)	B3-a	5103221	3110	<	9033	<	34600	3.830	85616	155.49	793499813	569683	25959	21593	281.82	238.63	13422936	252943757	932649	0	1.000	1.712	0.900	1.000	6.04	1.039	5.85	5.81	1.007
122	t	Gilbert and Nejadi (2004)	B3-a	5103221	3110	<	9033	<	34600	3.830	98592	138.31	985373444	1965054	53875	36533	251.94	178.89	65009513	670662818	2668803	380	0.504	1.712	0.949	1.000	12.31	0.926	12.16	13.30	0.914
123	0	Gilbert and Nejadi (2004)	B3-b	5103221	3110	<	9033	<	20800	2.303	85616	155.49	793499813	569683	25959	21593	281.82	238.63	13422936	252943757	932649	0	1.000	1.712	0.760	1.000	3.25	1.652	3.05	1.97	1.547
124	t	Gilbert and Nejadi (2004)	B3-b	5103221	3110	<	9033	<	20800	2.303	98592	138.31	985373444	1965054	53875	36533	251.94	178.89	65009513	670662818	2668803	380	0.504	1.712	0.879	1.000	8.26	1.046	8.04	7.90	1.018
125	0	Gilbert and Nejadi (2004)	S1-a	1687762	2373	<	2987	<	6810	2.280	63636	76.15	128523093	83694	13149	11513	140.61	126.23	794770	19942869	165637	0	1.000	1.604	0.733	1.000	12.20	1.709	11.04	7.14	1.546
126	t	Gilbert and Nejadi (2004)	S1-a	1687762	2373	<	2987	<	6810	2.280	68719	72.37	140837647	318278	27280	20561	129.3	103.61	4527087	59617008	528179	380	0.504	1.604	0.866	1.000	26.40	1.052	25.33	25.10	1.009
127	0	Gilbert and Nejadi (2004)	S1-b	1687762	2373	<	2987	<	5280	1.768	63636	76.15	128523093	83694	13149	11513	140.61	126.23	794770	19942869	165637	0	1.000	1.604	0.599	1.000	8.07	2.968	6.90	2.72	2.535
128	t	Gilbert and Nejadi (2004)	S1-b	1687762	2373	<	2987	<	5280	1.768	68719	72.37	140837647	318278	27280	20561	129.3	103.61	4527087	59617008	528179	380	0.504	1.604	0.798	1.000	20.90	1.050	19.61	19.90	0.985
129	0	Gilbert and Nejadi (2004)	S2-a	1730283	2373	<	3063	<	9870	3.222	64454	75.50	130636398	123945	16166	13712	137.86	120.73	1342886	27858819	234956	0	1.000	1.675	0.859	1.000	14.53	1.231	13.83	11.80	1.172
130	t	Gilbert and Nejadi (2004)	S2-a	1730283	2373	<	3063	<	9870	3.222	72078	70.16	148023744	455144	33910	23832	125.21	95.43	7049501	78177962	709827	380	0.504	1.675	0.929	1.000	30.11	0.926	29.51	32.50	0.908
131	0	Gilbert and Nejadi (2004)	S2-b	1730283	2373	<	3063	<	6810	2.223	64454	75.50	130636398	123945	16166	13712	137.86	120.73	1342886	27858819	234956	0	1.000	1.675	0.738	1.000	8.95	2.020	8.14	4.43	1.838
132	t	Gilbert and Nejadi (2004)	S2-b	1730283	2373	<	3063	<	6810	2.223	72078	70.16	148023744	455144	33910	23832	125.21	95.43	7049501	78177962	709827	380	0.504	1.675	0.868	1.000	22.17	1.012	21.33	21.90	0.974
133	0	Gilbert and Nejadi (2004)	S3-a	1772362	2373	<	3137	<	11350	3.618	65272	74.87	132696728	163199	18732	15460	135.68	116.35	1924392	35009269	298941	0	1.000	1.725	0.891	1.000	13.75	1.285	13.26	10.70	1.239
134	t	Gilbert and Nejadi (2004)	S3-a	1772362	2373	<	3137	<	11350	3.618	75438	68.15	154569802	579848	39724	26286	122.14	89.28	9459589	93367230	863792	380	0.504	1.725	0.945	1.000	29.76	0.999	29.34	29.80	0.985
135	0	Gilbert and Nejadi (2004)	S3-b	1772362	2373	<	3137	<	8340	2.659	65272	74.87	132696728	163199	18732	15460	135.68	116.35	1924392	35009269	298941	0	1.000	1.725	0.815	1.000	9.49	1.883	8.91	5.04	1.768
136	t	Gilbert and Nejadi (2004)	S3-b	1772362	2373	<	3137	<	8340	2.659	75438	68.15	154569802	579848	39724	26286	122.14	89.28	9459589	93367230	863792	380	0.504	1.725	0.907	1.000	23.35	1.020	22.78	22.90	0.995
137	0	Tošić (2017)	NAC7	1155873	1024	<	2289	<	7669	3.350	33517	98.57	113934435	45943	8142	6625	179.3	158.62	946449	21971049	137055	0	1.000	1.655	0.865	1.000	12.04	1.313	11.51	9.17	1.255
138	t	Tošić (2017)	NAC7	1155873	1024	<	2289	<	7669	3.350	37284	95.51	131463301	143823	15832	10548	167.04	134.08	3820557	58385703	347613	450	0.502	1.655	0.932	1.000	22.11	1.167	21.56	18.94	1.138
139	0	Tošić (2017)	NAC28	1147347	1024	<	2742	<	6877	2.508	33372	98.70	113243127	41715	7729	6357	180.13	160.27	836290	20202862	126173	0	1.000	1.655	0.782	1.000	9.77	1.205	9.11	8.11	1.123
140	t	Tošić (2017)	NAC28	1147347	1024	<	2742	<	6877	2.508	36263	96.27	126776262	119277	14068	9805	169.36	138.73	3068190	49745900	300278	450	0.502	1.655	0.890	1.000	18.96	1.149	18.20	16.51	1.102

Assessment and Correction of MC10 model:
Database with B4s shrinkage and creep model

		Study information		Cross-section		Reinforcement								Mechanical properties													Loading						Deflection		
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
		Author	Specimen	b (mm)	h (mm)	A_{s1} (mm^2)	d (mm)	ρ_1 (%)	A_{s2} (mm^2)	d' (mm)	d_2 (mm)	ρ_2 (%)	type	RH (%)	T (ºC)	t_{test} (days)	$f_{cm}(t_{test})$ (MPa)	f_{cm} (MPa)	f_{cm} (t_0) (MPa)	$f_{ctm}(t_0)$ (MPa)	$E_{cm}(t_0)$ (MPa)	E_{cm} (MPa)	E_s (MPa)	φ (–)	ε_{cs} (‰)	$E_{c,eff}$ (MPa)	L (mm)	L/d	M_{L1} (Nm)	K_{L1}	M_{L2} (Nm)	K_{L2}	a (t-t_0) (mm)	t_0 (days)	t-t_0 (days)
1	0	Washa and Fluck [8]	A1/A4	203.2	304.8	852	257.2	1.63	852	257.2	47.6	1.63	deformed	50	21	14	25.00	27.73	25.00	1.98	28680	30206	200000	0.000	0.000	28680	6096	23.7	7192	0.104	18442	0.104	13.46	14	0
2	t	Washa and Fluck [8]	A1/A4	203.2	304.8	852	257.2	1.63	852	257.2	47.6	1.63	deformed	50	21	14	25.00	27.73	25.00	1.98	28680	30206	200000	4.282	0.742	5661	6096	23.7	7192	0.104	18442	0.104	23.62	14	913
3	0	Washa and Fluck [8]	A2/A5	203.2	304.8	852	257.2	1.63	400	258.7	46.1	0.77	deformed	50	21	14	25.00	27.73	25.00	1.98	28680	30206	200000	0.000	0.000	28680	6096	23.7	7192	0.104	18442	0.104	15.75	14	0
4	t	Washa and Fluck [8]	A2/A5	203.2	304.8	852	257.2	1.63	400	258.7	46.1	0.77	deformed	50	21	14	25.00	27.73	25.00	1.98	28680	30206	200000	4.282	0.742	5661	6096	23.7	7192	0.104	18442	0.104	32.26	14	913
5	0	Washa and Fluck [8]	A3/A6	203.2	304.8	852	257.2	1.63	0	0	0	0.00	deformed	50	21	14	25.00	27.73	25.00	1.98	28680	30206	200000	0.000	0.000	28680	6096	23.7	7192	0.104	18442	0.104	17.02	14	0
6	t	Washa and Fluck [8]	A3/A6	203.2	304.8	852	257.2	1.63	0	0	0	0.00	deformed	50	21	14	25.00	27.73	25.00	1.98	28680	30206	200000	4.282	0.742	5661	6096	23.7	7192	0.104	18442	0.104	44.70	14	913
7	0	Washa and Fluck [8]	B1/B4	152.4	203.2	400	157.2	1.67	400	157.2	46	1.67	deformed	50	21	14	20.80	23.07	20.80	1.64	26975	28409	200000	0.000	0.000	26975	6096	38.8	3596	0.104	3663	0.104	23.37	14	0
8	t	Washa and Fluck [8]	B1/B4	152.4	203.2	400	157.2	1.67	400	157.2	46	1.67	deformed	50	21	14	20.80	23.07	20.80	1.64	26975	28409	200000	6.886	0.881	3578	6096	38.8	3596	0.104	3663	0.104	51.05	14	913
9	0	Washa and Fluck [8]	B2/B5	152.4	203.2	400	157.2	1.67	200	157.2	46	0.84	deformed	50	21	14	20.80	23.07	20.80	1.64	26975	28409	200000	0.000	0.000	26975	6096	38.8	3596	0.104	3663	0.104	24.89	14	0
10	t	Washa and Fluck [8]	B2/B5	152.4	203.2	400	157.2	1.67	200	157.2	46	0.84	deformed	50	21	14	20.80	23.07	20.80	1.64	26975	28409	200000	6.886	0.881	3578	6096	38.8	3596	0.104	3663	0.104	65.02	14	913
11	0	Washa and Fluck [8]	B3/B6	152.4	203.2	400	157.2	1.67	0	0	0	0.00	deformed	50	21	14	20.80	23.07	20.80	1.64	26975	28409	200000	0.000	0.000	26975	6096	38.8	3596	0.104	3663	0.104	26.42	14	0
12	t	Washa and Fluck [8]	B3/B6	152.4	203.2	400	157.2	1.67	0	0	0	0.00	deformed	50	21	14	20.80	23.07	20.80	1.64	26975	28409	200000	6.886	0.881	3578	6096	38.8	3596	0.104	3663	0.104	86.36	14	913
13	0	Washa and Fluck [8]	D1/D4	304.8	127	516	101.6	1.67	516	101.6	25.4	1.67	deformed	50	21	14	22.10	24.51	22.10	1.75	27526	28988	200000	0.000	0.000	27526	3810	37.5	1756	0.104	4267	0.104	11.94	14	0
14	t	Washa and Fluck [8]	D1/D4	304.8	127	516	101.6	1.67	516	101.6	25.4	1.67	deformed	50	21	14	22.10	24.51	22.10	1.75	27526	28988	200000	5.885	0.838	4178	3810	37.5	1756	0.104	4267	0.104	27.69	14	913
15	0	Washa and Fluck [8]	D2/D5	304.8	127	516	101.6	1.67	258	101.6	25.4	0.83	deformed	50	21	14	22.10	24.51	22.10	1.75	27526	28988	200000	0.000	0.000	27526	3810	37.5	1756	0.104	4267	0.104	14.22	14	0
16	t	Washa and Fluck [8]	D2/D5	304.8	127	516	101.6	1.67	258	101.6	25.4	0.83	deformed	50	21	14	22.10	24.51	22.10	1.75	27526	28988	200000	5.885	0.838	4178	3810	37.5	1756	0.104	4267	0.104	33.78	14	913
17	0	Washa and Fluck [8]	D3/D6	304.8	127	516	101.6	1.67	0	0	0	0.00	deformed	50	21	14	22.10	24.51	22.10	1.75	27526	28988	200000	0.000	0.000	27526	3810	37.5	1756	0.104	4267	0.104	17.78	14	0
18	t	Washa and Fluck [8]	D3/D6	304.8	127	516	101.6	1.67	0	0	0	0.00	deformed	50	21	14	22.10	24.51	22.10	1.75	27526	28988	200000	5.885	0.838	4178	3810	37.5	1756	0.104	4267	0.104	48.51	14	913
19	0	P.C.A. [18]	40NA	152	305	849	254	2.20	0	0	0	0.00	deformed	50	21	28	26.90	26.90	26.90	2.13	29901	29901	200000	0.000	0.000	29901	3048	12.0	1346	0.104	22267	0.107	4.25	28	0
20	t	P.C.A. [18]	40NA	152	305	849	254	2.20	0	0	0	0.00	deformed	50	21	28	26.90	26.90	26.90	2.13	29901	29901	200000	3.679	0.686	6390	3048	12.0	1346	0.104	22267	0.107	10.00	28	242
21	0	P.C.A. [18]	60NA	152	305	1019	254	2.64	0	0	0	0.00	deformed	50	21	28	37.40	37.40	37.40	2.86	33373	33373	200000	0.000	0.000	33373	3048	12.0	1346	0.104	29641	0.107	4.90	28	0
22	t	P.C.A. [18]	60NA	152	305	1019	254	2.64	0	0	0	0.00	deformed	50	21	28	37.40	37.40	37.40	2.86	33373	33373	200000	1.485	0.503	13429	3048	12.0	1346	0.104	29641	0.107	9.90	28	242
23	0	Sattler [11]	a1/a2	100	160	100	134	0.75	0	0	0	0.00	deformed	55	21	32	26.70	26.27	26.70	2.11	29908	29666	200000	0.000	0.000	29908	4000	29.9	800	0.104	1962	0.104	15.83	32	0
24	t	Sattler [11]	a1/a2	100	160	100	134	0.75	0	0	0	0.00	deformed	55	21	32	26.70	26.27	26.70	2.11	29908	29666	200000	3.438	0.687	6697	4000	29.9	800	0.104	1962	0.104	32.21	32	84
25	0	Hajnal-Konyi [22]	8	127	190.5	142	160.3	0.70	0	0	0	0.00	deformed	82	21	35	37.00	36.04	38.59	2.93	34110	32964	200000	0.000	0.000	34110	6400	39.9	3097	0.104	1612	0.104	20.60	53	0
26	t	Hajnal-Konyi [22]	8	127	190.5	142	160.3	0.70	0	0	0	0.00	deformed	82	21	35	37.00	36.04	38.59	2.93	34110	32964	200000	1.931	0.363	11379	6400	39.9	3097	0.104	1612	0.104	65.40	53	1734
27	0	Hajnal-Konyi [22]	10	127	190.5	142	160.3	0.70	0	0	0	0.00	deformed	82	21	35	37.00	36.04	38.59	2.93	34110	32964	200000	0.000	0.000	34110	4800	29.9	1742	0.104	2967	0.104	8.80	53	0
28	t	Hajnal-Konyi [22]	10	127	190.5	142	160.3	0.70	0	0	0	0.00	deformed	82	21	35	37.00	36.04	38.59	2.93	34110	32964	200000	1.931	0.363	11379	4800	29.9	1742	0.104	2967	0.104	29.70	53	1734
29	0	Hajnal-Konyi [22]	12	127	190.5	142	160.3	0.70	0	0	0	0.00	deformed	82	21	35	37.00	36.04	38.59	2.93	34110	32964	200000	0.000	0.000	34110	3200	20.0	774	0.104	3935	0.104	4.30	53	0
30	t	Hajnal-Konyi [22]	12	127	190.5	142	160.3	0.70	0	0	0	0.00	deformed	82	21	35	37.00	36.04	38.59	2.93	34110	32964	200000	1.931	0.363	11379	3200	20.0	774	0.104	3935	0.104	14.00	53	1734
31	0	Branson and Metz [23]	SB3/B	101.6	127	214	101.6	2.07	0	0	0	0.00	deformed	50	21	28	35.40	35.40	35.40	2.73	32767	32767	200000	0.000	0.000	32767	2743	27.0	303	0.104	935	0.104	3.89	28	0
32	t	Branson and Metz [23]	SB3/B	101.6	127	214	101.6	2.07	0	0	0	0.00	deformed	50	21	28	35.40	35.40	35.40	2.73	32767	32767	200000	1.407	0.514	13613	2743	27.0	303	0.104	935	0.104	7.70	28	60
33	0	Branson and Metz [23]	SB3/M	101.6	127	214	101.6	2.07	0	0	0	0.00	deformed	50	21	28	31.30	31.30	31.30	2.45	31450	31450	200000	0.000	0.000	31450	2743	27.0	303	0.104	935	0.104	3.99	28	0
34	t	Branson and Metz [23]	SB3/M	101.6	127	214	101.6	2.07	0	0	0	0.00	deformed	50	21	28	31.30	31.30	31.30	2.45	31450	31450	200000	2.032	0.585	10372	2743	27.0	303	0.104	935	0.104	7.50	28	60
35	0	Pauw and Meyers [26]	R1	177.8	216	400	165.1	1.36	0	0	0	0.00	deformed	50	21	28	33.80	33.80	33.80	2.62	32266	32266	200000	0.000	0.000	32266	2286	13.8	627	0.104	7176	0.107	2.44	28	0
36	t	Pauw and Meyers [26]	R1	177.8	216	400	165.1	1.36	0	0	0	0.00	deformed	50	21	28	33.80	33.80	33.80	2.62	32266	32266	200000	1.833	0.502	11388	2286	13.8	627	0.104	7176	0.107	4.89	28	150
37	0	Pauw and Meyers [26]	R2	177.8	216	568	165.1	1.94	0	0	0	0.00	deformed	50	21	28	33.60	33.60	33.60	2.61	32202	32202	200000	0.000	0.000	32202	2286	13.8	627	0.104	11228	0.107	3.22	28	0
38	t	Pauw and Meyers [26]	R2	177.8	216	568	165.1	1.94	0	0	0	0.00	deformed	50	21	28	33.60	33.60	33.60	2.61	32202	32202	200000	1.864	0.504	11242	2286	13.8	627	0.104	11228	0.107	6.16	28	150
39	0	Pauw and Meyers [26]	R3	177.8	216	568	165.1	1.94	0	0	0	0.00	deformed	50	21	28	38.90	38.90	38.90	2.95	33813	33813	200000	0.000	0.000	33813	2286	13.8	627	0.104	9643	0.107	3.71	28	0
40	t	Pauw and Meyers [26]	R3	177.8	216	568	165.1	1.94	0	0	0	0.00	deformed	50	21	28	38.90	38.90	38.90	2.95	33813	33813	200000	1.169	0.411	15587	2286	13.8	627	0.104	9643	0.107	6.64	28	120
41	0	Pauw and Meyers [26]	R4	177.8	216	774	165.1	2.64	0	0	0	0.00	deformed	50	21	28	38.70	38.70	38.70	2.94	33755	33755	200000	0.000	0.000	33755	2286	13.8	627	0.104	14607	0.107	4.66	28	0
42	t	Pauw and Meyers [26]	R4	177.8	216	774	165.1	2.64	0	0	0	0.00	deformed	50	21	28	38.70	38.70	38.70	2.94	33755	33755	200000	1.187	0.412	15431	2286	13.8	627	0.104	14607	0.107	7.89	28	120
43	0	Lutz et al. [29]	SR	101.6	203.2	258	171.5	1.48	0	0	0	0.00	deformed	40	21	28	34.10	34.10	34.10	2.64	32361	32361	200000	0.000	0.000	32361	1829	10.7	216	0.104	7963	0.107	4.10	28	0
44	t	Lutz et al. [29]	SR	101.6	203.2	258	171.5	1.48	0	0	0	0.00	deformed	40	21	28	34.10	34.10	34.10	2.64	32361	32361	200000	1.820	0.621	11476	1829	10.7	216	0.104	7963	0.107	8.80	28	142
45	0	Lutz et al. [29]	DR	101.6	203.2	258	171.5	1.48	258	177.8	25.4	1.48	deformed	40	21	28	34.10	34.10	34.10	2.64	32361	32361	200000	0.000	0.000	32361	1829	10.7	216	0.104	7963	0.107	4.20	28	0
46	t	Lutz et al. [29]	DR	101.6	203.2	258	171.5	1.48	258	177.8	25.4	1.48	deformed	40	21	28	34.10	34.10	34.10	2.64	32361	32361	200000	1.820	0.621	11476	1829	10.7	216	0.104	7963	0.107	6.80	28	142
47	0	Jaccoud and Favre (1982)	A1	600	120	314	95	0.55	57	100	20	0.10	deformed	60	21	15	20.49	22.45	20.49	1.61	26895	28152	200000	0.000	0.000	26895	3100	32.6	2162	0.104	2787	0.104	8.42	15	0
48	t	Jaccoud and Favre (1982)	A1	600	120	314	95	0.55	57	100	20	0.10	deformed	60	21	15	20.49	22.45	20.49	1.61	26895	28152	200000	6.738	0.777	3616	3100	32.6	2162	0.104	2787	0.104	18.40	15	365
49	0	Jaccoud and Favre (1982)	A2	600	120	314	95	0.55	57	100	20	0.10	deformed	60	21	15	24.14	26.45	24.14	1.92	28406	29734	200000	0.000	0.000	28406	3100	32.6	2162	0.104	2787	0.104	6.16	15	0
50	t	Jaccoud and Favre (1982)	A2	600	120	314	95	0.55	57	100	20	0.10	deformed	60	21	15	24.14	26.45	24.14	1.92	28406	29734	200000	4.351	0.673	5508	3100	32.6	2162	0.104	2787	0.104	17.50	15	365
51	0	Jaccoud and Favre (1982)	A3	600	120	314	95	0.55	57	100	20	0.10	deformed	60	21	15	19.64	21.52	19.64	1.54	26518	27758	200000	0.000	0.000	26518	3100	32.6	2162	0.104	2787	0.104	8.12	15	0
52	t	Jaccoud and Favre (1982)	A3	600	120	314	95	0.55	57	100	20	0.10	deformed	60	21	15	19.64	21.52	19.64	1.54	26518	27758	200000	7.546	0.809	3230	3100	32.6	2162	0.104	2787	0.104	17.50	15	365
53	0	Jaccoud and Favre (1982)	A4	600	120	314	95	0.55	57	100	20	0.10	deformed	60	21	15	36.13	39.59	36.13	2.77	32492	34012	200000	0.000	0.000	32492	3100	32.6	2162	0.104	2787	0.104	2.24	15	0
54	t	Jaccoud and Favre (1982)	A4	600	120	314	95	0.55	57	100	20	0.10	deformed	60	21	15	36.13	39.59	36.13	2.77	32492	34012	200000	1.481	0.473	13454	3100	32.6	2162	0.104	2787	0.104	8.05	15	365
55	0	Jaccoud and Favre (1982)	A5	600	120	314	95	0.55	57	100	20	0.10	deformed	60	21	15	32.47	35.58	32.47	2.53	31355	32823	200000	0.000	0.000	31355	3100	32.6	2162	0.104	2787	0.104	3.12	15	0
56	t	Jaccoud and Favre (1982)	A5	600	120	314	95	0.55	57	100	20	0.10	deformed	60	21	15	32.47	35.58	32.47	2.53	31355	32823	200000	1.976	0.517	10858	3100	32.6	2162	0.104	2787	0.104	9.55	15	365
57	0	Jaccoud and Favre (1982)	C12	750	160	565	131	0.58	57	134	26	0.06	deformed	60	21	28	29.40	29.40	29.40	2.31	30800	30800	200000	0.000	0.000	30800	3100	23.7	3604	0.104	6095	0.107	2.17	28	0
58	t	Jaccoud and Favre (1982)	C12	750	160	565	131	0.58	57	134	26	0.06	deformed	60	21	28	29.40	29.40	29.40	2.31	30800	30800	200000	3.124	0.589	7468	3100	23.7	3604	0.104	6095	0.107	8.29	28	510
59	0	Jaccoud and Favre (1982)	C22	750	160	565	131	0.58	57	134	26	0.06	deformed	60	21	28	32.89	32.89	32.89	2.56	31974	31974	200000	0.000	0.000	31974	3100	23.7	3604	0.104	6095	0.107	2.00	28	0
60	t	Jaccoud and Favre (1982)	C22	750	160	565	131	0.58	57	134	26	0.06	deformed	60	21	28	32.89	32.89	32.89	2.56	31974	31974	200000	2.216	0.500	9942	3100	23.7	3604	0.104	6095	0.107	7.00	28	365
61	0	Jaccoud and Favre (1982)	C13	750	160	565	131	0.58	57	134	26	0.06	deformed	60	21	28	30.93	30.93	30.93	2.42	31326	31326	200000	0.000	0.000	31326	3100	23.7	3604	0.104	9305	0.107	5.29	28	0
62	t	Jaccoud and Favre (1982)	C13	750	160	565	131	0.58	57	134	26	0.06	deformed	60	21	28	30.93	30.93	30.93	2.42	31326	31326	200000	2.728	0.565	8402	3100	23.7	3604	0.104	9305	0.107	13.28	28	510
63	0	Jaccoud and Favre (1982)	C14	750	160	565	131	0.58	57	134	26	0.06	deformed	60	21	28	29.40	29.40	29.40	2.31	30800	30800	200000	0.000	0.000	30800	3100	23.7	3604	0.104	12520	0.107	8.48	28	0
64	t	Jaccoud and Favre (1982)	C14	750	160	565	131	0.58	57	134	26	0.06	deformed	60	21	28	29.40	29.40	29.40	2.31	30800	30800	200000	3.124	0.589	7468	3100	23.7	3604	0.104	12520	0.107	18.15	28	510
65	0	Jaccoud and Favre (1982)	C24	750	160	565	131	0.58	57	134	26	0.06	deformed	60	21	28	31.97	31.97	31.97	2.49	31673	31673	200000	0.000	0.000	31673	3100	23.7	3604	0.104	12520	0.107	8.00	28	0
66	t	Jaccoud and Favre (1982)	C24	750	160	565	131	0.58	57	134	26	0.06	deformed	60	21	28	31.97	31.97	31.97	2.49	31673	31673	200000	2.498	0.548	9054	3100	23.7	3604	0.104	12520	0.107	17.52	28	510
67	0	Jaccoud and Favre (1982)	C15	750	160	565	131	0.58	57	134	26	0.06	deformed	60	21	28	29.29	29.29	29.29	2.30	30762	30762	200000	0.000	0.000	30762	3100	23.7	3604	0.104	15725	0.107	11.02	28	0
68	t	Jaccoud and Favre (1982)	C15	750	160	565	131	0.58	57	134	26	0.06	deformed	60	21	28	29.29	29.29	29.29	2.30	30762	30762	200000	3.155	0.590	7403	3100	23.7	3604	0.104	15725	0.107	20.83	28	510
69	0	Ding Dajung [44]	C-3	81	160	113	137	1.02	0	0	0	0.00	deformed	80	21	30	21.60	21.42	21.60	1.71	27831	27715	200000	0.000	0.000	27831	2880	21.0	336	0.104	2904	0.107	8.45	30	0
70	t	Ding Dajung [44]	C-3	81	160	113	137	1.02	0	0	0	0.00	deformed	80	21	30	21.60	21.42	21.60	1.71	27831	27715	200000	8.121	0.566	3040	2880	21.0	336	0.104	2904	0.107	16.62	30	2025
71	0	Ding Dajung [44]	L-1	62	152	154	117	2.12	0	0	0	0.00	deformed	80	21	30	25.40	25.19	25.40	2.01	29375	29254	200000	0.000	0.000	29375	2880	24.6	244	0.104	3280	0.107	15.53	30	0
72	t	Ding Dajung [44]	L-1	62	152	154	117	2.12	0	0	0	0.00	deformed	80	21	30	25.40	25.19	25.40	2.01	29375	29254	200000	4.673	0.511	5161	2880	24.6	244	0.104	3280	0.107	30.43	30	531

		Study information		Cross-section		Reinforcement								Mechanical properties														Loading						Deflection		
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
		Author	Specimen	b (mm)	h (mm)	A_{s1} (mm^2)	d (mm)	ρ_1 (%)	A_{s2} (mm^2)	d' (mm)	d_2 (mm)	ρ_2 (%)	type	RH (%)	T (ºC)	t_{test} (days)	$f_{cm}(t_{test})$ (MPa)	f_{cm} (MPa)	f_{cm} (t_0) (MPa)	$f_{ctm}(t_0)$ (MPa)	$E_{cm}(t_0)$ (MPa)	E_{cm} (MPa)	E_s (MPa)	φ (–)	ε_{cs} (‰)	$E_{c,eff}$ (MPa)	L (mm)	L/d	M_{L1} (Nm)	K_{L1}	M_{L2} (Nm)	K_{L2}	a (t-t_0) (mm)	t_0 (days)	t-t_0 (days)
73	0	F.R.F.C. [45]	I-72	150	280	308	250	0.82	0	0	0	0.00	deformed	60	21	28	33.50	33.50	33.50	2.60	32170	32170	200000	0.000	0.000	32170	2800	11.2	1029	0.104	21500	0.107	6.02	28	0
74	t	F.R.F.C. [45]	I-72	150	280	308	250	0.82	0	0	0	0.00	deformed	60	21	28	33.50	33.50	33.50	2.60	32170	32170	200000	2.540	0.603	9086	2800	11.2	1029	0.104	21500	0.107	10.29	28	1610
75	0	F.R.F.C. [45]	I-81	150	280	308	250	0.82	0	0	0	0.00	deformed	60	21	28	33.50	33.50	33.50	2.60	32170	32170	200000	0.000	0.000	32170	2800	11.2	1029	0.104	24250	0.107	7.39	28	0
76	t	F.R.F.C. [45]	I-81	150	280	308	250	0.82	0	0	0	0.00	deformed	60	21	28	33.50	33.50	33.50	2.60	32170	32170	200000	2.490	0.602	9219	2800	11.2	1029	0.104	24250	0.107	11.98	28	1344
77	0	F.R.F.C. [45]	I-91	150	280	308	250	0.82	0	0	0	0.00	deformed	60	21	28	33.50	33.50	33.50	2.60	32170	32170	200000	0.000	0.000	32170	2800	11.2	1029	0.104	27180	0.107	8.94	28	0
78	t	F.R.F.C. [45]	I-91	150	280	308	250	0.82	0	0	0	0.00	deformed	60	21	28	33.50	33.50	33.50	2.60	32170	32170	200000	2.483	0.602	9237	2800	11.2	1029	0.104	27180	0.107	15.02	28	1314
79	0	F.R.F.C. [45]	II-52	150	280	770	236	2.18	0	0	0	0.00	deformed	60	21	28	29.80	29.80	29.80	2.34	30939	30939	200000	0.000	0.000	30939	2800	11.9	1029	0.104	33950	0.107	7.27	28	0
80	t	F.R.F.C. [45]	II-52	150	280	770	236	2.18	0	0	0	0.00	deformed	60	21	28	29.80	29.80	29.80	2.34	30939	30939	200000	3.368	0.654	7083	2800	11.9	1029	0.104	33950	0.107	13.49	28	1398
81	0	F.R.F.C. [45]	II-59	150	280	770	236	2.18	0	0	0	0.00	deformed	60	21	28	29.80	29.80	29.80	2.34	30939	30939	200000	0.000	0.000	30939	2800	11.9	1029	0.104	38300	0.107	7.69	28	0
82	t	F.R.F.C. [45]	II-59	150	280	770	236	2.18	0	0	0	0.00	deformed	60	21	28	29.80	29.80	29.80	2.34	30939	30939	200000	3.402	0.654	7029	2800	11.9	1029	0.104	38300	0.107	14.10	28	1541
83	0	F.R.F.C. [45]	II-70	150	280	770	236	2.18	0	0	0	0.00	deformed	60	21	28	29.80	29.80	29.80	2.34	30939	30939	200000	0.000	0.000	30939	2800	11.9	1029	0.104	45850	0.107	9.36	28	0
84	t	F.R.F.C. [45]	II-70	150	280	770	236	2.18	0	0	0	0.00	deformed	60	21	28	29.80	29.80	29.80	2.34	30939	30939	200000	3.386	0.654	7055	2800	11.9	1029	0.104	45850	0.107	17.56	28	1471
85	0	F.R.F.C. [45]	II-80	150	280	770	236	2.18	0	0	0	0.00	deformed	60	21	28	29.80	29.80	29.80	2.34	30939	30939	200000	0.000	0.000	30939	2800	11.9	1029	0.104	52260	0.107	10.72	28	0
86	t	F.R.F.C. [45]	II-80	150	280	770	236	2.18	0	0	0	0.00	deformed	60	21	28	29.80	29.80	29.80	2.34	30939	30939	200000	3.389	0.654	7049	2800	11.9	1029	0.104	52260	0.107	20.24	28	1485
87	0	F.R.F.C. [45]	II-90	150	280	770	236	2.18	0	0	0	0.00	deformed	60	21	28	29.80	29.80	29.80	2.34	30939	30939	200000	0.000	0.000	30939	2800	11.9	1029	0.104	58660	0.107	13.10	28	0
88	t	F.R.F.C. [45]	II-90	150	280	770	236	2.18	0	0	0	0.00	deformed	60	21	28	29.80	29.80	29.80	2.34	30939	30939	200000	3.390	0.654	7047	2800	11.9	1029	0.104	58660	0.107	24.23	28	1491
89	0	F.R.F.C. [45]	III-43	150	280	1232	233	3.53	0	0	0	0.00	deformed	60	21	28	34.30	34.30	34.30	2.65	32424	32424	200000	0.000	0.000	32424	2800	12.0	1029	0.104	42190	0.107	7.08	28	0
90	t	F.R.F.C. [45]	III-43	150	280	1232	233	3.53	0	0	0	0.00	deformed	60	21	28	34.30	34.30	34.30	2.65	32424	32424	200000	2.387	0.594	9572	2800	12.0	1029	0.104	42190	0.107	14.51	28	1572
91	0	F.R.F.C. [45]	III-67	150	280	1232	233	3.53	0	0	0	0.00	deformed	60	21	28	34.30	34.30	34.30	2.65	32424	32424	200000	0.000	0.000	32424	2800	12.0	1029	0.104	65300	0.107	10.58	28	0
92	t	F.R.F.C. [45]	III-67	150	280	1232	233	3.53	0	0	0	0.00	deformed	60	21	28	34.30	34.30	34.30	2.65	32424	32424	200000	2.387	0.594	9572	2800	12.0	1029	0.104	65300	0.107	23.88	28	1572
93	0	F.R.F.C. [45]	III-77	150	280	1232	233	3.53	0	0	0	0.00	deformed	60	21	28	34.30	34.30	34.30	2.65	32424	32424	200000	0.000	0.000	32424	2800	12.0	1029	0.104	75490	0.107	13.84	28	0
94	t	F.R.F.C. [45]	III-77	150	280	1232	233	3.53	0	0	0	0.00	deformed	60	21	28	34.30	34.30	34.30	2.65	32424	32424	200000	2.387	0.594	9572	2800	12.0	1029	0.104	75490	0.107	28.74	28	1572
95	0	F.R.F.C. [45]	IV-52	150	280	770	236	2.18	462	248	32	1.31	deformed	60	21	28	32.00	32.00	32.00	2.50	31683	31683	200000	0.000	0.000	31683	2800	11.9	1029	0.104	37610	0.107	5.98	28	0
96	t	F.R.F.C. [45]	IV-52	150	280	770	236	2.18	462	248	32	1.31	deformed	60	21	28	32.00	32.00	32.00	2.50	31683	31683	200000	2.626	0.611	8739	2800	11.9	1029	0.104	37610	0.107	10.52	28	772
97	0	F.R.F.C. [45]	IV-70	150	280	770	236	2.18	462	248	32	1.31	deformed	60	21	28	32.00	32.00	32.00	2.50	31683	31683	200000	0.000	0.000	31683	2800	11.9	1029	0.104	51340	0.107	8.80	28	0
98	t	F.R.F.C. [45]	IV-70	150	280	770	236	2.18	462	248	32	1.31	deformed	60	21	28	32.00	32.00	32.00	2.50	31683	31683	200000	2.626	0.611	8739	2800	11.9	1029	0.104	51340	0.107	13.90	28	772
99	0	F.R.F.C. [45]	IV-80	150	280	770	236	2.18	462	248	32	1.31	deformed	60	21	28	32.00	32.00	32.00	2.50	31683	31683	200000	0.000	0.000	31683	2800	11.9	1029	0.104	58200	0.107	11.16	28	0
100	t	F.R.F.C. [45]	IV-80	150	280	770	236	2.18	462	248	32	1.31	deformed	60	21	28	32.00	32.00	32.00	2.50	31683	31683	200000	2.697	0.617	8570	2800	11.9	1029	0.104	58200	0.107	16.96	28	972
101	0	F.R.F.C. [45]	IV-90	150	280	770	236	2.18	462	248	32	1.31	deformed	60	21	28	32.00	32.00	32.00	2.50	31683	31683	200000	0.000	0.000	31683	2800	11.9	1029	0.104	65530	0.107	12.85	28	0
102	t	F.R.F.C. [45]	IV-90	150	280	770	236	2.18	462	248	32	1.31	deformed	60	21	28	32.00	32.00	32.00	2.50	31683	31683	200000	2.697	0.617	8570	2800	11.9	1029	0.104	65530	0.107	19.28	28	972
103	0	Bakoss et al. [41]	1B2	100	150	226	130	1.74	0	0	0	0.00	deformed	60	21	28	39.00	39.00	39.00	2.96	33842	33842	200000	0.000	0.000	33842	3750	28.8	659	0.104	3250	0.107	8.94	28	0
104	t	Bakoss et al. [41]	1B2	100	150	226	130	1.74	0	0	0	0.00	deformed	60	21	28	39.00	39.00	39.00	2.96	33842	33842	200000	1.476	0.552	13667	3750	28.8	659	0.104	3250	0.107	25.02	28	500
105	0	Clarke et al. [46]	A1	100	154	157.1	132	1.19	0	0	0	0.00	deformed	40	21	28	25.90	25.90	25.90	2.05	29526	29526	200000	0.000	0.000	29526	2100	15.9	212	0.104	3500	0.107	4.89	28	0
106	t	Clarke et al. [46]	A1	100	154	157.1	132	1.19	0	0	0	0.00	deformed	40	21	28	25.90	25.90	25.90	2.05	29526	29526	200000	3.992	0.850	5915	2100	15.9	212	0.104	3500	0.107	11.83	28	180
107	0	Clarke et al. [46]	A2	100	152	157.1	130	1.21	0	0	0	0.00	deformed	40	21	28	25.90	25.90	25.90	2.05	29526	29526	200000	0.000	0.000	29526	2100	16.2	209	0.104	3500	0.107	5.09	28	0
108	t	Clarke et al. [46]	A2	100	152	157.1	130	1.21	0	0	0	0.00	deformed	40	21	28	25.90	25.90	25.90	2.05	29526	29526	200000	3.992	0.850	5915	2100	16.2	209	0.104	3500	0.107	11.92	28	180
109	0	Clarke et al. [46]	B1	100	152	157.1	130	1.21	157.1	132	20	1.21	deformed	40	21	28	25.90	25.90	25.90	2.05	29526	29526	200000	0.000	0.000	29526	2100	16.2	209	0.104	3500	0.107	4.78	28	0
110	t	Clarke et al. [46]	B1	100	152	157.1	130	1.21	157.1	132	20	1.21	deformed	40	21	28	25.90	25.90	25.90	2.05	29526	29526	200000	3.992	0.850	5915	2100	16.2	209	0.104	3500	0.107	8.77	28	180
111	0	Clarke et al. [46]	B2	100	154	157.1	132	1.19	157.1	134	20	1.19	deformed	40	21	28	25.90	25.90	25.90	2.05	29526	29526	200000	0.000	0.000	29526	2100	15.9	212	0.104	3500	0.107	4.30	28	0
112	t	Clarke et al. [46]	B2	100	154	157.1	132	1.19	157.1	134	20	1.19	deformed	40	21	28	25.90	25.90	25.90	2.05	29526	29526	200000	3.992	0.850	5915	2100	15.9	212	0.104	3500	0.107	8.55	28	180
113	0	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	40	21	28	24.80	24.80	22.36	1.77	27633	29102	200000	0.000	0.000	27633	3500	11.7	3254	0.104	21646	0.107	4.95	14	0
114	t	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	40	22	28	24.80	24.80	22.36	1.77	27633	29102	200000	5.536	0.760	4417	3500	11.7	3254	0.104	21646	0.107	12.06	14	380
115	0	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	40	21	28	24.80	24.80	22.36	1.77	27633	29102	200000	0.000	0.000	27633	3500	11.7	3254	0.104	13746	0.107	1.98	14	0
116	t	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	40	22	28	24.80	24.80	22.36	1.77	27633	29102	200000	5.536	0.760	4417	3500	11.7	3254	0.104	13746	0.107	7.44	14	380
117	0	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	40	21	28	24.80	24.80	22.36	1.77	27633	29102	200000	0.000	0.000	27633	3500	11.7	3110	0.104	21690	0.107	5.03	14	0
118	t	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	40	22	28	24.80	24.80	22.36	1.77	27633	29102	200000	5.538	0.766	4416	3500	11.7	3110	0.104	21690	0.107	12.42	14	380
119	0	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	40	21	28	24.80	24.80	22.36	1.77	27633	29102	200000	0.000	0.000	27633	3500	11.7	3110	0.104	13690	0.107	2.06	14	0
120	t	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	40	22	28	24.80	24.80	22.36	1.77	27633	29102	200000	5.538	0.766	4416	3500	11.7	3110	0.104	13690	0.107	7.87	14	380
121	0	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	40	21	28	24.80	24.80	22.36	1.77	27633	29102	200000	0.000	0.000	27633	3500	11.7	3110	0.104	31490	0.107	5.81	14	0
122	t	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	40	22	28	24.80	24.80	22.36	1.77	27633	29102	200000	5.538	0.766	4416	3500	11.7	3110	0.104	31490	0.107	13.30	14	380
123	0	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	40	21	28	24.80	24.80	22.36	1.77	27633	29102	200000	0.000	0.000	27633	3500	11.7	3110	0.104	17690	0.107	1.97	14	0
124	t	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	40	22	28	24.80	24.80	22.36	1.77	27633	29102	200000	5.538	0.766	4416	3500	11.7	3110	0.104	17690	0.107	7.90	14	380
125	0	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	40	21	28	24.80	24.80	22.36	1.77	27633	29102	200000	0.000	0.000	27633	3500	26.9	2373	0.104	4437	0.104	7.14	14	0
126	t	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	40	22	28	24.80	24.80	22.36	1.77	27633	29102	200000	5.554	0.824	4405	3500	26.9	2373	0.104	4437	0.104	25.10	14	380
127	0	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	40	21	28	24.80	24.80	22.36	1.77	27633	29102	200000	0.000	0.000	27633	3500	26.9	2373	0.104	2907	0.104	2.72	14	0
128	t	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	40	22	28	24.80	24.80	22.36	1.77	27633	29102	200000	5.554	0.824	4405	3500	26.9	2373	0.104	2907	0.104	19.90	14	380
129	0	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	40	21	28	24.80	24.80	22.36	1.77	27633	29102	200000	0.000	0.000	27633	3500	26.9	2373	0.104	7497	0.104	11.80	14	0
130	t	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	40	22	28	24.80	24.80	22.36	1.77	27633	29102	200000	5.554	0.824	4405	3500	26.9	2373	0.104	7497	0.104	32.50	14	380
131	0	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	40	21	28	24.80	24.80	22.36	1.77	27633	29102	200000	0.000	0.000	27633	3500	26.9	2373	0.104	4437	0.104	4.43	14	0
132	t	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	40	22	28	24.80	24.80	22.36	1.77	27633	29102	200000	5.554	0.824	4405	3500	26.9	2373	0.104	4437	0.104	21.90	14	380
133	0	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	40	21	28	24.80	24.80	22.36	1.77	27633	29102	200000	0.000	0.000	27633	3500	26.9	2373	0.104	8977	0.104	10.70	14	0
134	t	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	40	22	28	24.80	24.80	22.36	1.77	27633	29102	200000	5.554	0.824	4405	3500	26.9	2373	0.104	8977	0.104	29.80	14	380
135	0	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	40	21	28	24.80	24.80	22.36	1.77	27633	29102	200000	0.000	0.000	27633	3500	26.9	2373	0.104	5967	0.104	5.04	14	0
136	t	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	40	22	28	24.80	24.80	22.36	1.77	27633	29102	200000	5.554	0.824	4405	3500	26.9	2373	0.104	5967	0.104	22.90	14	380
137	0	Tošić (2017)	NAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	28	30.50	30.50	24.97	1.98	28212	31180	200000	0.000	0.000	28212	3200	18.9	1024	0.104	6645	0.107	9.17	7	0
138	t	Tošić (2017)	NAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	28	30.50	30.50	24.97	1.98	28212	31180	200000	3.668	0.694	6532	3200	18.9	1024	0.104	6645	0.107	18.94	7	450
139	0	Tošić (2017)	NAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	28	30.50	30.50	30.50	2.39	31180	31180	200000	0.000	0.000	31180	3200	18.9	1024	0.104	5853	0.107	8.11	28	0
140	t	Tošić (2017)	NAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	28	30.50	30.50	30.50	2.39	31180	31180	200000	2.871	0.694	8055	3200	18.9	1024	0.104	5853	0.107	16.51	28	450

Assessment and Correction of MC10 model:

Database – Calculated Deflections

With B4s shrinkage and creep model

		Study information		Cracking moment							State I				State II							Deflections			
		1	2	3	4		5		6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
		Author	Specimen	$W_I^* (t_0)$ (mm^3)	M_{SW} (Nm)		M_{cr} (Nm)		M_{max} (Nm)	M_{max}/M_{cr}	A_I^* (mm^2)	$z_{I,1}^*$ (mm)	I_I^* (mm^4)	S_I^* (mm^3)	A_{II}^* (mm^2)	A_{IIc} (mm^2)	$z_{IIc,1}$ (mm)	$z_{II,1}^*$ (mm)	I_{IIc} (mm^4)	I_{II}^* (mm^4)	S_{II}^* (mm^3)	t-t_0 (days)	$a_{num.int.cor}$ (mm)	a_{exp} (mm)	$a_{num.int.}/a_{exp}$
1	0	Washa and Fluck [8]	A1/A4	4002250	7192	<	7924	<	25634	3.235	73812	152.40	609942850	0	29610	17733	261.17	217.54	11254000	225850587	773660	0	13.90	13.46	1.033
2	t	Washa and Fluck [8]	A1/A4	4002250	7192	<	7924	<	25634	3.235	122138	152.40	1140703091	0	85748	25546	241.94	179.08	33647201	838646993	1606198	913	26.39	23.62	1.117
3	0	Washa and Fluck [8]	A2/A5	3888764	7192	<	7700	<	25634	3.329	70662	147.79	574720400	285755	27368	18642	258.93	213.06	13075692	220683692	855330	0	14.33	15.75	0.910
4	t	Washa and Fluck [8]	A2/A5	3888764	7192	<	7700	<	25634	3.329	106169	136.84	944071155	964102	73265	29032	233.36	161.93	49386419	723315723	2073912	913	33.07	32.26	1.025
5	0	Washa and Fluck [8]	A3/A6	3763278	7192	<	7451	<	25634	3.440	67874	143.23	539014288	567893	25610	19672	256.39	207.98	15363996	214212917	952407	0	14.88	17.02	0.874
6	t	Washa and Fluck [8]	A3/A6	3763278	7192	<	7451	<	25634	3.440	92037	118.12	701975171	2122734	63659	33558	222.23	139.66	76271688	560172228	2771113	913	47.29	44.70	1.058
7	0	Washa and Fluck [8]	B1/B4	1229142	3596	>	2016	<	7259	3.601	36896	101.60	124880827	0	14790	8862	174.13	145.06	2496976	39508161	257631	0	24.21	23.37	1.036
8	t	Washa and Fluck [8]	B1/B4	1229142	3596	>	2016	<	7259	3.601	75680	101.60	244776133	0	58171	13459	159.04	114.89	8747955	181100646	594222	913	54.93	51.05	1.076
9	0	Washa and Fluck [8]	B2/B5	1209909	3596	>	1984	<	7259	3.659	35414	99.27	120107709	72040	13511	9065	173.46	143.71	2673097	39263915	269620	0	24.45	24.89	0.982
10	t	Washa and Fluck [8]	B2/B5	1209909	3596	>	1984	<	7259	3.659	64502	91.96	204232568	298229	48503	14969	154.09	104.99	12033291	156385497	735177	913	67.63	65.02	1.040
11	0	Washa and Fluck [8]	B3/B6	1187902	3596	>	1948	<	7259	3.726	33932	96.74	114917648	150393	12281	9317	172.63	142.07	2901851	38959199	284751	0	24.75	26.42	0.937
12	t	Washa and Fluck [8]	B3/B6	1187902	3596	>	1948	<	7259	3.726	53324	78.29	146691074	721875	39636	17280	146.51	89.82	18514379	116975906	979640	913	99.45	86.36	1.152
13	0	Washa and Fluck [8]	D1/D4	990864	1756	>	1734	<	6023	3.473	46212	63.50	62919835	0	18620	11117	108.76	90.52	1232532	21299569	202721	0	14.21	11.94	1.190
14	t	Washa and Fluck [8]	D1/D4	990864	1756	>	1734	<	6023	3.473	88111	63.50	123741133	0	65976	16574	99.81	72.62	4083788	92158055	450545	913	30.00	27.69	1.083
15	0	Washa and Fluck [8]	D2/D5	970786	1756	>	1699	<	6023	3.545	44337	61.89	60081924	62403	17119	11492	108.15	89.3	1361406	21045968	216639	0	14.46	14.22	1.017
16	t	Washa and Fluck [8]	D2/D5	970786	1756	>	1699	<	6023	3.545	75761	57.29	102890474	240463	55622	18571	96.54	66.07	5745357	79434576	565775	913	37.22	33.78	1.102
17	0	Washa and Fluck [8]	D3/D6	947835	1756	>	1659	<	6023	3.631	42461	60.13	56993290	130283	15695	11944	107.41	87.81	1528494	20728323	234120	0	14.76	17.78	0.830
18	t	Washa and Fluck [8]	D3/D6	947835	1756	>	1659	<	6023	3.631	63411	48.66	73917653	574543	46261	21560	91.63	56.27	8989114	59485132	762517	913	55.04	48.51	1.135
19	0	P.C.A. [18]	40NA	2909878	1346	<	6198	<	23613	3.810	52040	141.42	411514890	513568	21698	16018	252.31	199.61	14824969	184749818	844077	0	3.99	4.25	0.939
20	t	P.C.A. [18]	40NA	2909878	1346	<	6198	<	23613	3.810	72934	115.52	533406635	1714535	52519	25945	219.66	134.32	62989957	436425738	2214121	242	12.22	10.00	1.222
21	0	P.C.A. [18]	60NA	2949418	1346	<	8435	<	30987	3.674	52464	140.69	414953550	547451	22551	16447	250.9	196.79	16046942	193936781	889874	0	4.46	4.90	0.911
22	t	P.C.A. [18]	60NA	2949418	1346	<	8435	<	30987	3.674	61533	127.47	477157198	1160272	37438	22265	231.76	158.5	39811940	334650751	1631088	242	9.43	9.90	0.953
23	0	Sattler [11]	a1/a2	462622	800	<	976	<	2762	2.830	16669	77.83	36005843	34674	4286	3617	141.92	123.83	394223	7980684	65448	0	16.45	15.83	1.039
24	t	Sattler [11]	a1/a2	462622	800	<	976	<	2762	2.830	18986	71.51	41471099	135893	9430	6444	127.78	95.55	2229962	23367701	207676	84	39.36	32.21	1.222
25	0	Hajnal-Konyi [22]	8	822534	3097	>	2410	<	4709	1.954	25026	93.09	76569719	52332	5881	5049	170.62	150.76	664933	14750983	100320	0	27.93	20.60	1.356
26	t	Hajnal-Konyi [22]	8	822534	3097	>	2410	<	4709	1.954	26690	89.17	82741021	147210	10389	7893	159.43	128.38	2540449	34213304	245093	1734	56.51	65.40	0.864
27	0	Hajnal-Konyi [22]	10	822534	1742	<	2410	<	4709	1.954	25026	93.09	76569719	52332	5881	5049	170.62	150.76	664933	14750983	100320	0	15.71	8.80	1.785
28	t	Hajnal-Konyi [22]	10	822534	1742	<	2410	<	4709	1.954	26690	89.17	82741021	147210	10389	7893	159.43	128.38	2540449	34213304	245093	1734	31.78	29.70	1.070
29	0	Hajnal-Konyi [22]	12	822534	774	<	2410	<	4709	1.954	25026	93.09	76569719	52332	5881	5049	170.62	150.76	664933	14750983	100320	0	6.98	4.30	1.624
30	t	Hajnal-Konyi [22]	12	822534	774	<	2410	<	4709	1.954	26690	89.17	82741021	147210	10389	7893	159.43	128.38	2540449	34213304	245093	1734	14.13	14.00	1.009
31	0	Branson and Metz [23]	SB3/B	317730	303	<	867	<	1238	1.428	14209	60.00	19063813	45167	5352	4047	107.08	87.17	535284	7120344	80635	0	2.50	3.89	0.642
32	t	Branson and Metz [23]	SB3/B	317730	303	<	867	<	1238	1.428	16047	56.04	21012358	96322	8648	5504	99.91	72.82	1346059	12454280	149072	60	9.25	7.70	1.201
33	0	Branson and Metz [23]	SB3/M	319528	303	<	783	<	1238	1.581	14264	59.87	19130162	46915	5472	4111	106.77	86.53	561080	7331221	83200	0	2.81	3.99	0.704
34	t	Branson and Metz [23]	SB3/M	319528	303	<	783	<	1238	1.581	17029	54.27	21881096	119115	10110	5984	97.55	68.1	1729830	14442517	176177	60	11.27	7.50	1.503
35	0	Pauw and Meyers [26]	R1	1500987	627	<	3933	<	7803	1.984	40885	104.54	156913208	133027	12320	9840	188.33	160.67	2511330	39922317	272230	0	2.51	2.44	1.030
36	t	Pauw and Meyers [26]	R1	1500987	627	<	3933	<	7803	1.984	45429	99.17	168678113	339048	21490	14466	175.32	134.65	7980017	81174263	588260	150	6.22	4.89	1.271
37	0	Pauw and Meyers [26]	R2	1548942	627	<	4043	<	11855	2.932	41932	103.20	159850843	184477	14817	11290	184.25	152.51	3793321	51584906	358407	0	3.52	3.22	1.094
38	t	Pauw and Meyers [26]	R2	1548942	627	<	4043	<	11855	2.932	48510	96.10	175400713	456733	26370	16265	170.26	124.52	11343738	100139135	743909	150	7.88	6.16	1.280
39	0	Pauw and Meyers [26]	R3	1541272	627	<	4547	<	10270	2.259	41762	103.41	159382904	176270	14435	11078	184.85	153.7	3584243	49808446	345087	0	2.76	3.71	0.745
40	t	Pauw and Meyers [26]	R3	1541272	627	<	4547	<	10270	2.259	45692	98.89	169288424	349724	21929	14642	174.82	133.64	8275058	82993991	602963	120	5.77	6.64	0.869
41	0	Pauw and Meyers [26]	R4	1596516	627	<	4694	<	15234	3.245	42995	101.90	162685027	234081	17045	12455	180.97	145.94	5093436	61834993	436216	0	3.71	4.66	0.797
42	t	Pauw and Meyers [26]	R4	1596516	627	<	4694	<	15234	3.245	48436	96.17	175249913	454105	26258	16227	170.37	124.73	11264083	99742964	740592	120	7.20	7.89	0.912
43	0	Lutz et al. [29]	SR	810319	216	<	2139	<	8179	3.824	22240	96.59	78268752	103463	7623	6029	173.53	143.87	1769022	27134245	178848	0	3.10	4.10	0.756
44	t	Lutz et al. [29]	SR	810319	216	<	2139	<	8179	3.824	25142	89.10	89078968	258124	13302	8805	159.87	116.54	5510014	54409494	381520	142	6.31	8.80	0.717
45	0	Lutz et al. [29]	DR	863371	216	<	2279	<	8179	3.589	23834	102.02	88081066	-8706	8601	5412	176.57	149.94	1279703	28646615	144105	0	2.90	4.20	0.691
46	t	Lutz et al. [29]	DR	863371	216	<	2279	<	8179	3.589	29639	102.56	119093056	-19697	16150	7156	167.98	132.77	2958550	66885502	252009	142	4.59	6.80	0.674
47	0	Jaccoud and Favre (1982)	A1	1520111	2162	<	2447	<	4949	2.022	74760	59.13	89884154	62401	16856	14096	108.25	96.51	648355	14542713	165579	0	8.95	8.42	1.063
48	t	Jaccoud and Favre (1982)	A1	1520111	2162	<	2447	<	4949	2.022	92516	54.79	110206848	374773	49763	29247	95.63	71.26	5790911	62923382	712677	365	28.91	18.40	1.571
49	0	Jaccoud and Favre (1982)	A2	1515708	2162	<	2910	<	4949	1.701	74612	59.18	89699591	59177	16389	13777	108.52	97.05	605300	13896771	158087	0	7.50	6.16	1.218
50	t	Jaccoud and Favre (1982)	A2	1515708	2162	<	2910	<	4949	1.701	85471	56.30	102507887	266417	39127	25656	98.62	77.24	3909020	47823073	548500	365	23.32	17.50	1.333
51	0	Jaccoud and Favre (1982)	A3	1521148	2162	<	2343	<	4949	2.112	74797	59.12	89930247	63212	16973	14176	108.19	96.38	659429	14705240	167441	0	9.26	8.12	1.141
52	t	Jaccoud and Favre (1982)	A3	1521148	2162	<	2343	<	4949	2.112	94969	54.32	112798067	408774	53185	30216	94.82	69.64	6385784	67534516	760654	365	30.52	17.50	1.744
53	0	Jaccoud and Favre (1982)	A4	1506283	2162	<	4172	<	4949	1.186	74285	59.28	89292484	52008	15304	13019	109.15	98.31	510774	12436877	141206	0	3.37	2.24	1.506
54	t	Jaccoud and Favre (1982)	A4	1506283	2162	<	4172	<	4949	1.186	77517	58.33	93259487	120305	24150	18633	104.47	88.95	1497565	25184286	289228	365	12.83	8.05	1.594
55	0	Jaccoud and Favre (1982)	A5	1508766	2162	<	3817	<	4949	1.297	74367	59.25	89394400	53795	15580	13213	108.99	97.98	533926	12806934	145468	0	4.50	3.12	1.443
56	t	Jaccoud and Favre (1982)	A5	1508766	2162	<	3817	<	4949	1.297	78834	57.96	94838644	146497	27046	20212	103.16	86.32	1911424	29587957	340304	365	15.23	9.55	1.595
57	0	Jaccoud and Favre (1982)	C12	3387047	3604	<	7824	<	9699	1.240	124037	78.65	266391260	161583	27411	23374	144.42	128.84	1891809	44126634	364189	0	2.68	2.17	1.234
58	t	Jaccoud and Favre (1982)	C12	3387047	3604	<	7824	<	9699	1.240	136657	74.96	296329911	605285	57529	40872	132.75	105.5	10115187	130253708	1113994	510	11.47	8.29	1.384
59	0	Jaccoud and Favre (1982)	C22	3380311	3604	<	8654	<	9699	1.121	123894	78.70	266030449	156052	26904	23010	144.66	129.31	1804906	42823056	353113	0	1.92	2.00	0.958
60	t	Jaccoud and Favre (1982)	C22	3380311	3604	<	8654	<	9699	1.121	132515	76.09	286888312	468896	49349	36834	135.44	110.89	7403554	106448143	904406	365	9.08	7.00	1.297
61	0	Jaccoud and Favre (1982)	C13	3383563	3604	<	8188	<	12909	1.577	123968	78.68	266218766	158964	27165	23197	144.54	129.07	1849191	43507040	358929	0	5.51	5.29	1.042
62	t	Jaccoud and Favre (1982)	C13	3383563	3604	<	8188	<	12909	1.577	134804	75.46	292148142	545332	53986	39182	133.88	107.76	8911675	119991428	1023489	510	15.12	13.28	1.139
63	0	Jaccoud and Favre (1982)	C14	3387047	3604	<	7824	<	16124	2.061	124037	78.65	266391260	161583	27411	23374	144.42	128.84	1891809	44126634	364189	0	8.85	8.48	1.043
64	t	Jaccoud and Favre (1982)	C14	3387047	3604	<	7824	<	16124	2.061	136657	74.96	296329911	605285	57529	40872	132.75	105.5	10115187	130253708	1113994	510	20.29	18.15	1.118
65	0	Jaccoud and Favre (1982)	C24	3381738	3604	<	8421	<	16124	1.915	123925	78.69	266108931	157259	27014	23089	144.61	129.21	1823465	43108898	355541	0	8.35	8.00	1.043
66	t	Jaccoud and Favre (1982)	C24	3381738	3604	<	8421	<	16124	1.915	133740	75.75	289717485	510135	51871	38131	134.58	109.16	8213435	113826972	969188	510	18.53	17.52	1.058
67	0	Jaccoud and Favre (1982)	C15	3387246	3604	<	7791	<	19329	2.481	124043	78.65	266406935	161832	27427	23384	144.41	128.82	1894195	44180482	364670	0	11.73	11.02	1.064
68	t	Jaccoud and Favre (1982)	C15	3387246	3604	<	7791	<	19329	2.481	136806	74.92	296663773	610037	57816	41010	132.66	105.33	10217655	131060725	1121121	510	24.25	20.83	1.164
69	0	Ding Dajung [44]	C-3	393163	336	<	672	<	3240	4.821	13772	76.64	30131992	43581	4323	3511	138.33	116.67	549762	9325635	76104	0	10.52	8.45	1.245
70	t	Ding Dajung [44]	C-3	393163	336	<	672	<	3240	4.821	20394	59.22	42997169	269269	14840	7406	114.28	68.55	5159696	36072009	338631	2025	31.36	16.62	1.887

		Study information			Cracking moment						State I				State II							Deflections			
		1	2	3	4		5		6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
		Author	Specimen	W_I^* (t_0) (mm^3)	M_{SW} (Nm)		M_{cr} (Nm)		M_{max} (Nm)	M_{max}/M_{cr}	A_I^* (mm^2)	$z_{I,1}^*$ (mm)	I_I^* (mm^4)	S_I^* (mm^3)	A_{II}^* (mm^2)	A_{IIc} (mm^2)	$z_{IIc,1}$ (mm)	$z_{II,1}^*$ (mm)	I_{IIc} (mm^4)	I_{II}^* (mm^4)	S_{II}^* (mm^3)	t-t_0 (days)	$a_{num.int.cor}$ (mm)	a_{exp} (mm)	$a_{num.int.}/a_{exp}$
71	0	Ding Dajung [44]	L-1	274457	244	<	552	<	3524	6.384	10473	71.89	19730733	38688	4039	2990	127.89	103.76	579551	7278876	72111	0	14.22	15.53	0.915
72	t	Ding Dajung [44]	L-1	274457	244	<	552	<	3524	6.384	15392	60.10	24286407	149784	11055	5087	110.98	69.96	2852947	18706027	208624	531	37.94	30.43	1.247
73	0	F.R.F.C. [45]	I-72	2193561	1029	<	5703	<	22529	3.950	43916	135.20	296569473	201538	12139	10223	245.93	211.85	3956467	79183010	348381	0	6.87	6.02	1.141
74	t	F.R.F.C. [45]	I-72	2193561	1029	<	5703	<	22529	3.950	48779	124.71	345027172	642047	23542	16763	224.13	168.23	17444262	199356946	937072	1610	12.82	10.29	1.246
75	0	F.R.F.C. [45]	I-81	2193561	1029	<	5703	<	25279	4.433	43916	135.20	296569473	201538	12139	10223	245.93	211.85	3956467	79183010	348381	0	7.83	7.39	1.059
76	t	F.R.F.C. [45]	I-81	2193561	1029	<	5703	<	25279	4.433	48681	124.90	344141250	633981	23357	16676	224.41	168.8	17176372	197449594	927256	1344	14.07	11.98	1.175
77	0	F.R.F.C. [45]	I-91	2193561	1029	<	5703	<	28209	4.946	43916	135.20	296569473	201538	12139	10223	245.93	211.85	3956467	79183010	348381	0	8.83	8.94	0.988
78	t	F.R.F.C. [45]	I-91	2193561	1029	<	5703	<	28209	4.946	48668	124.93	344030256	633012	23333	16665	224.45	168.88	17141633	197217505	926080	1314	15.45	15.02	1.029
79	0	F.R.F.C. [45]	II-52	2429237	1029	<	5684	<	34979	6.154	46974	129.83	315387895	426936	19414	14440	231.87	183.74	11150829	141733579	695095	0	6.52	7.27	0.897
80	t	F.R.F.C. [45]	II-52	2429237	1029	<	5684	<	34979	6.154	63745	107.25	406439056	1375359	44858	23113	202.96	125.9	45728402	328834664	1780899	1398	15.93	13.49	1.181
81	0	F.R.F.C. [45]	II-59	2429237	1029	<	5684	<	39329	6.919	46974	129.83	315387895	426936	19414	14440	231.87	183.74	11150829	141733579	695095	0	7.37	7.69	0.958
82	t	F.R.F.C. [45]	II-59	2429237	1029	<	5684	<	39329	6.919	63907	107.09	407084356	1382081	45066	23159	202.8	125.61	46002098	329891776	1787789	1541	17.58	14.10	1.246
83	0	F.R.F.C. [45]	II-70	2429237	1029	<	5684	<	46879	8.248	46974	129.83	315387895	426936	19414	14440	231.87	183.74	11150829	141733579	695095	0	8.83	9.36	0.943
84	t	F.R.F.C. [45]	II-70	2429237	1029	<	5684	<	46879	8.248	63830	107.17	406777478	1378970	44967	23137	202.88	125.75	45875642	329406422	1784562	1471	20.28	17.56	1.155
85	0	F.R.F.C. [45]	II-80	2429237	1029	<	5684	<	53289	9.375	46974	129.83	315387895	426936	19414	14440	231.87	183.74	11150829	141733579	695095	0	10.06	10.72	0.939
86	t	F.R.F.C. [45]	II-80	2429237	1029	<	5684	<	53289	9.375	63845	107.15	406838913	1379505	44986	23141	202.86	125.72	45896702	329482767	1785165	1485	22.61	20.24	1.117
87	0	F.R.F.C. [45]	II-90	2429237	1029	<	5684	<	59689	10.501	46974	129.83	315387895	426936	19414	14440	231.87	183.74	11150829	141733579	695095	0	11.30	13.10	0.862
88	t	F.R.F.C. [45]	II-90	2429237	1029	<	5684	<	59689	10.501	63853	107.14	406869621	1379773	44998	23145	202.85	125.71	45917768	329543343	1785576	1491	24.93	24.23	1.029
89	0	F.R.F.C. [45]	III-43	2624807	1029	<	6956	<	43219	6.213	49601	125.75	330069430	598613	24272	16671	224.43	168.87	17160618	181521398	926387	0	6.03	7.08	0.852
90	t	F.R.F.C. [45]	III-43	2624807	1029	<	6956	<	43219	6.213	67736	104.67	412419903	1484223	49610	23874	200.42	120.83	50400011	341917668	1900124	1572	14.20	14.51	0.979
91	0	F.R.F.C. [45]	III-67	2624807	1029	<	6956	<	66329	9.536	49601	125.75	330069430	598613	24272	16671	224.43	168.87	17160618	181521398	926387	0	9.35	10.58	0.884
92	t	F.R.F.C. [45]	III-67	2624807	1029	<	6956	<	66329	9.536	67736	104.67	412419903	1484223	49610	23874	200.42	120.83	50400011	341917668	1900124	1572	20.14	23.88	0.844
93	0	F.R.F.C. [45]	III-77	2624807	1029	<	6956	<	76519	11.000	49601	125.75	330069430	598613	24272	16671	224.43	168.87	17160618	181521398	926387	0	10.81	13.84	0.781
94	t	F.R.F.C. [45]	III-77	2624807	1029	<	6956	<	76519	11.000	67736	104.67	412419903	1484223	49610	23874	200.42	120.83	50400011	341917668	1900124	1572	22.76	28.74	0.792
95	0	F.R.F.C. [45]	IV-52	2575533	1029	<	6439	<	38639	6.001	49774	136.95	352719219	127881	20794	13020	236.6	193.19	8174876	149611121	565086	0	6.65	5.98	1.112
96	t	F.R.F.C. [45]	IV-52	2575533	1029	<	6439	<	38639	6.001	70200	132.17	555875998	329100	46311	18111	219.63	159.27	22000757	405434036	1093333	772	10.63	10.52	1.011
97	0	F.R.F.C. [45]	IV-70	2575533	1029	<	6439	<	52369	8.133	49774	136.95	352719219	127881	20794	13020	236.6	193.19	8174876	149611121	565086	0	9.11	8.80	1.036
98	t	F.R.F.C. [45]	IV-70	2575533	1029	<	6439	<	52369	8.133	70200	132.17	555875998	329100	46311	18111	219.63	159.27	22000757	405434036	1093333	772	13.91	13.90	1.001
99	0	F.R.F.C. [45]	IV-80	2575533	1029	<	6439	<	59229	9.198	49774	136.95	352719219	127881	20794	13020	236.6	193.19	8174876	149611121	565086	0	10.34	11.16	0.927
100	t	F.R.F.C. [45]	IV-80	2575533	1029	<	6439	<	59229	9.198	70755	132.07	561358346	332694	46933	18178	219.41	158.81	22246791	411673137	1101599	972	15.60	16.96	0.920
101	0	F.R.F.C. [45]	IV-90	2575533	1029	<	6439	<	66559	10.337	49774	136.95	352719219	127881	20794	13020	236.6	193.19	8174876	149611121	565086	0	11.65	12.85	0.906
102	t	F.R.F.C. [45]	IV-90	2575533	1029	<	6439	<	66559	10.337	70755	132.07	561358346	332694	46933	18178	219.41	158.81	22246791	411673137	1101599	972	17.35	19.28	0.900
103	0	Bakoss et al. [41]	1B2	451561	659	<	1337	<	3909	2.924	16336	70.50	31835017	67451	6042	4706	126.47	102.93	868509	12662100	110766	0	12.24	8.94	1.369
104	t	Bakoss et al. [41]	1B2	451561	659	<	1337	<	3909	2.924	18306	65.07	36320339	149019	9842	6536	117.32	84.63	2327205	23122682	213691	500	26.21	25.02	1.048
105	0	Clarke et al. [46]	A1	455406	212	<	934	<	3712	3.974	16464	73.44	33444983	54710	5404	4340	132.3	110.58	681296	11073917	94211	0	5.00	4.89	1.022
106	t	Clarke et al. [46]	A1	455406	212	<	934	<	3712	3.974	20712	62.89	42382423	217189	12979	7667	115.67	77.33	3755090	31286069	293888	180	13.55	11.83	1.146
107	0	Clarke et al. [46]	A2	443820	209	<	910	<	3709	4.076	16264	72.47	32163612	53678	5364	4300	130.5	108.98	662743	10700556	92509	0	5.18	5.09	1.018
108	t	Clarke et al. [46]	A2	443820	209	<	910	<	3709	4.076	20512	62.02	40742743	212568	12896	7584	114.08	76.15	3635366	30121002	287620	180	13.99	11.92	1.173
109	0	Clarke et al. [46]	B1	469016	209	<	961	<	3709	3.860	17327	76.12	35701513	-1872	6035	3908	132.46	112.92	497297	11168524	76407	0	4.92	4.78	1.029
110	t	Clarke et al. [46]	B1	469016	209	<	961	<	3709	3.860	25823	76.41	61406203	-6268	16498	5875	122.63	93.25	1689569	41700824	172625	180	8.72	8.77	0.995
111	0	Clarke et al. [46]	B2	481173	212	<	986	<	3712	3.765	17527	77.12	37108095	-1872	6071	3944	134.28	114.56	511308	11558935	77768	0	4.74	4.30	1.102
112	t	Clarke et al. [46]	B2	481173	212	<	986	<	3712	3.765	26023	77.41	63755868	-6268	16563	5940	124.3	94.61	1746538	43227503	176450	180	8.45	8.55	0.988
113	0	Gilbert and Nejadi (2004)	B1-a	5228678	3254	<	9255	<	24900	2.690	87910	165.70	866391993	365847	21098	18188	303.63	267.27	8021540	182398081	661465	0	5.43	4.95	1.097
114	t	Gilbert and Nejadi (2004)	B1-a	5228678	3254	<	9255	<	24900	2.690	103203	147.07	1072198923	1948948	55336	37133	265.74	191.48	68265505	690716609	2757324	380	14.52	12.06	1.204
115	0	Gilbert and Nejadi (2004)	B1-b	5228678	3254	<	9255	<	17000	1.837	87910	165.70	866391993	365847	21098	18188	303.63	267.27	8021540	182398081	661465	0	3.03	1.98	1.529
116	t	Gilbert and Nejadi (2004)	B1-b	5228678	3254	<	9255	<	17000	1.837	103203	147.07	1072198923	1948948	55336	37133	265.74	191.48	68265505	690716609	2757324	380	10.66	7.44	1.433
117	0	Gilbert and Nejadi (2004)	B2-a	4870318	3110	<	8620	<	24800	2.877	84160	157.75	768292590	386366	21098	18188	288.63	252.27	8021540	182398081	661465	0	5.56	5.03	1.105
118	t	Gilbert and Nejadi (2004)	B2-a	4870318	3110	<	8620	<	24800	2.877	99457	137.33	996374647	2045145	55340	37133	250.74	176.47	68265505	690808849	2757751	380	14.68	12.42	1.182
119	0	Gilbert and Nejadi (2004)	B2-b	4870318	3110	<	8620	<	16800	1.949	84160	157.75	768292590	386366	21098	18188	288.63	252.27	8021540	182398081	661465	0	3.17	2.06	1.537
120	t	Gilbert and Nejadi (2004)	B2-b	4870318	3110	<	8620	<	16800	1.949	99457	137.33	996374647	2045145	55340	37133	250.74	176.47	68265505	690808849	2757751	380	10.87	7.87	1.381
121	0	Gilbert and Nejadi (2004)	B3-a	5103221	3110	<	9033	<	34600	3.830	85616	155.49	793499813	569683	25959	21593	281.82	238.63	13422936	252943757	932649	0	6.01	5.81	1.034
122	t	Gilbert and Nejadi (2004)	B3-a	5103221	3110	<	9033	<	34600	3.830	108560	127.91	1101606611	2810459	69588	42278	240.45	155.9	100755006	870937284	3574862	380	16.27	13.30	1.223
123	0	Gilbert and Nejadi (2004)	B3-b	5103221	3110	<	9033	<	20800	2.303	85616	155.49	793499813	569683	25959	21593	281.82	238.63	13422936	252943757	932649	0	3.18	1.97	1.615
124	t	Gilbert and Nejadi (2004)	B3-b	5103221	3110	<	9033	<	20800	2.303	108560	127.91	1101606611	2810459	69588	42278	240.45	155.9	100755006	870937284	3574862	380	11.31	7.90	1.431
125	0	Gilbert and Nejadi (2004)	S1-a	1687762	2373	<	2987	<	6810	2.280	63636	76.15	128523093	83694	13149	11513	140.61	126.23	794770	19942869	165637	0	12.02	7.14	1.683
126	t	Gilbert and Nejadi (2004)	S1-a	1687762	2373	<	2987	<	6810	2.280	72260	70.05	148393829	462231	34248	23988	125.02	95.06	7188846	79082697	718844	380	33.28	25.10	1.326
127	0	Gilbert and Nejadi (2004)	S1-b	1687762	2373	<	2987	<	5280	1.768	63636	76.15	128523093	83694	13149	11513	140.61	126.23	794770	19942869	165637	0	7.63	2.72	2.807
128	t	Gilbert and Nejadi (2004)	S1-b	1687762	2373	<	2987	<	5280	1.768	72260	70.05	148393829	462231	34248	23988	125.02	95.06	7188846	79082697	718844	380	26.50	19.90	1.332
129	0	Gilbert and Nejadi (2004)	S2-a	1730283	2373	<	3063	<	9870	3.222	64454	75.50	130636398	123945	16166	13712	137.86	120.73	1342886	27858819	234956	0	14.46	11.80	1.225
130	t	Gilbert and Nejadi (2004)	S2-a	1730283	2373	<	3063	<	9870	3.222	77391	67.06	158113412	647329	42868	27477	120.65	86.31	10804315	101058146	943598	380	38.60	32.50	1.188
131	0	Gilbert and Nejadi (2004)	S2-b	1730283	2373	<	3063	<	6810	2.223	64454	75.50	130636398	123945	16166	13712	137.86	120.73	1342886	27858819	234956	0	8.67	4.43	1.957
132	t	Gilbert and Nejadi (2004)	S2-b	1730283	2373	<	3063	<	6810	2.223	77391	67.06	158113412	647329	42868	27477	120.65	86.31	10804315	101058146	943598	380	28.91	21.90	1.320
133	0	Gilbert and Nejadi (2004)	S3-a	1772362	2373	<	3137	<	11350	3.618	65272	74.87	132696728	163199	18732	15460	135.68	116.35	1924392	35009269	298941	0	13.66	10.70	1.277
134	t	Gilbert and Nejadi (2004)	S3-a	1772362	2373	<	3137	<	11350	3.618	82521	64.44	166624493	809340	50546	30025	117.47	79.93	14097404	118327694	1127208	380	38.80	29.80	1.302
135	0	Gilbert and Nejadi (2004)	S3-b	1772362	2373	<	3137	<	8340	2.659	65272	74.87	132696728	163199	18732	15460	135.68	116.35	1924392	35009269	298941	0	9.28	5.04	1.842
136	t	Gilbert and Nejadi (2004)	S3-b	1772362	2373	<	3137	<	8340	2.659	82521	64.44	166624493	809340	50546	30025	117.47	79.93	14097404	118327694	1127208	380	30.93	22.90	1.351
137	0	Tošić (2017)	NAC7	1155873	1024	<	2289	<	7669	3.350	33517	98.57	113934435	45943	8142	6625	179.3	158.62	946449	21971049	137055	0	12.04	9.17	1.313
138	t	Tošić (2017)	NAC7	1155873	1024	<	2289	<	7669	3.350	38553	94.61	137232760	172468	17867	11314	164.65	129.31	4713830	68339809	399846	450	22.85	18.94	1.206
139	0	Tošić (2017)	NAC28	1147347	1024	<	2742	<	6877	2.508	33372	98.70	113243127	41715	7729	6357	180.13	160.27	836290	20202862	126173	0	9.69	8.11	1.194
140	t	Tošić (2017)	NAC28	1147347	1024	<	2742	<	6877	2.508	37314	95.48	131600223	144479	15884	10570	166.97	133.95	3844110	58628624	348894	450	19.39	16.51	1.174

Assessment and Correction of MC10 model:

Simplified Procedure

Simplified Method - MC10+

α_s	β_s	ζ_s
2	1	0.960

$a_s{*}E{*}I_{II}/(M_{cr}{*}L^2)$

0.5042

Numerical Integration - MC10+

α	β	γ
2	1	1.000
		$\gamma > \sqrt{\beta}$

M_{max}/M_{cr}	I_I/I_{II}
5	5

$a{*}E{*}I_{II}/(M_{cr}{*}L^2)$

0.4947

ξ	M/M_{cr}	defl. coeff./L	ζ	only effective $E{*}I_{II}{*}(1/r_{eff})/M_{cr}$	State I $E{*}I_{II}{*}(1/r_I)/M_{cr}$	corresponding $E{*}I_{II}{*}(1/r)/M_{cr}$	defl. mult.
0.00	0.000	0.00	#DIV/0!	#DIV/0!	0.0000	0.0000	0.000
0.02	0.392	0.01	-5.508	-1.649	0.0784	0.0784	0.001
0.04	0.768	0.02	-0.695	-0.274	0.1536	0.1536	0.003
0.06	1.128	0.03	0.214	0.419	0.2256	0.4188	0.013
0.08	1.472	0.04	0.538	0.929	0.2944	0.9285	0.037
0.10	1.800	0.05	0.691	1.356	0.3600	1.3556	0.068
0.12	2.112	0.06	0.776	1.733	0.4224	1.7332	0.104
0.14	2.408	0.07	0.828	2.076	0.4816	2.0758	0.145
0.16	2.688	0.08	0.862	2.390	0.5376	2.3904	0.191
0.18	2.952	0.09	0.885	2.681	0.5904	2.6810	0.241
0.20	3.200	0.10	0.902	2.950	0.6400	2.9500	0.295
0.22	3.432	0.11	0.915	3.199	0.6864	3.1989	0.352
0.24	3.648	0.12	0.925	3.429	0.7296	3.4287	0.411
0.26	3.848	0.13	0.932	3.640	0.7696	3.6401	0.473
0.28	4.032	0.14	0.938	3.834	0.8064	3.8336	0.537
0.30	4.200	0.15	0.943	4.010	0.8400	4.0095	0.601
0.32	4.352	0.16	0.947	4.168	0.8704	4.1682	0.667
0.34	4.488	0.17	0.950	4.310	0.8976	4.3097	0.733
0.36	4.608	0.18	0.953	4.434	0.9216	4.4344	0.798
0.38	4.712	0.19	0.955	4.542	0.9424	4.5422	0.863
0.40	4.800	0.20	0.957	4.633	0.9600	4.6333	0.927
0.42	4.872	0.21	0.958	4.708	0.9744	4.7078	0.989
0.44	4.928	0.22	0.959	4.766	0.9856	4.7657	1.048
0.46	4.968	0.23	0.959	4.807	0.9936	4.8070	1.106
0.48	4.992	0.24	0.960	4.832	0.9984	4.8317	1.160
0.50	5.000	0.25	0.960	4.840	1.0000	4.8400	1.210
0.52	4.992	0.24	0.960	4.832	0.9984	4.8317	1.160
0.54	4.968	0.23	0.959	4.807	0.9936	4.8070	1.106
0.56	4.928	0.22	0.959	4.766	0.9856	4.7657	1.048
0.58	4.872	0.21	0.958	4.708	0.9744	4.7078	0.989
0.60	4.800	0.20	0.957	4.633	0.9600	4.6333	0.927
0.62	4.712	0.19	0.955	4.542	0.9424	4.5422	0.863
0.64	4.608	0.18	0.953	4.434	0.9216	4.4344	0.798
0.66	4.488	0.17	0.950	4.310	0.8976	4.3097	0.733
0.68	4.352	0.16	0.947	4.168	0.8704	4.1682	0.667
0.70	4.200	0.15	0.943	4.010	0.8400	4.0095	0.601
0.72	4.032	0.14	0.938	3.834	0.8064	3.8336	0.537
0.74	3.848	0.13	0.932	3.640	0.7696	3.6401	0.473
0.76	3.648	0.12	0.925	3.429	0.7296	3.4287	0.411
0.78	3.432	0.11	0.915	3.199	0.6864	3.1989	0.352
0.80	3.200	0.10	0.902	2.950	0.6400	2.9500	0.295
0.82	2.952	0.09	0.885	2.681	0.5904	2.6810	0.241
0.84	2.688	0.08	0.862	2.390	0.5376	2.3904	0.191
0.86	2.408	0.07	0.828	2.076	0.4816	2.0758	0.145
0.88	2.112	0.06	0.776	1.733	0.4224	1.7332	0.104
0.90	1.800	0.05	0.691	1.356	0.3600	1.3556	0.068
0.92	1.472	0.04	0.538	0.929	0.2944	0.9285	0.037
0.94	1.128	0.03	0.214	0.419	0.2256	0.4188	0.013
0.96	0.768	0.02	-0.695	-0.274	0.1536	0.1536	0.003
0.98	0.392	0.01	-5.508	-1.649	0.0784	0.0784	0.001
1.00	0.000	0.00	#DIV/0!	#DIV/0!	0.0000	0.0000	0.000
							24.735

M_{max}/M_{cr}	I_I/I_{II}	β =	**1**	α =	**1**							$a_{simp}/a_{num.int}$							
	1.1	**1.5**	**2.0**	**2.5**	**3.0**	**3.5**	**4.0**	**4.5**	**5.0**	**5.5**	**6.0**	**6.5**	**7.0**	**7.5**	**8.0**	**8.5**	**9.0**	**9.5**	**10.0**
1.1	1.005	1.025	1.050	1.073	1.096	1.118	1.139	1.160	1.179	1.198	1.217	1.235	1.252	1.269	1.285	1.301	1.316	1.331	1.346
1.2	1.007	1.035	1.068	1.098	1.125	1.151	1.175	1.197	1.217	1.236	1.254	1.271	1.287	1.302	1.316	1.330	1.342	1.354	1.366
1.3	1.008	1.040	1.074	1.105	1.132	1.156	1.178	1.198	1.216	1.232	1.247	1.261	1.274	1.285	1.296	1.306	1.316	1.325	1.333
1.4	1.009	1.041	1.075	1.104	1.129	1.151	1.170	1.187	1.202	1.216	1.228	1.239	1.249	1.258	1.266	1.274	1.281	1.288	1.294
1.5	1.009	1.041	1.074	1.101	1.124	1.143	1.160	1.174	1.187	1.198	1.208	1.217	1.225	1.232	1.239	1.245	1.251	1.256	1.261
2.0	1.008	1.035	1.059	1.077	1.092	1.103	1.112	1.120	1.126	1.132	1.136	1.141	1.144	1.148	1.150	1.153	1.155	1.158	1.160
2.5	1.007	1.028	1.047	1.060	1.070	1.078	1.084	1.089	1.093	1.096	1.099	1.102	1.104	1.106	1.108	1.109	1.110	1.112	1.113
3.0	1.006	1.024	1.039	1.049	1.056	1.062	1.066	1.070	1.073	1.075	1.077	1.079	1.081	1.082	1.083	1.084	1.085	1.086	1.087
3.5	1.005	1.020	1.033	1.041	1.047	1.051	1.055	1.057	1.060	1.061	1.063	1.064	1.066	1.067	1.068	1.068	1.069	1.070	1.070
4.0	1.004	1.018	1.028	1.035	1.040	1.043	1.046	1.048	1.050	1.052	1.053	1.054	1.055	1.056	1.057	1.057	1.058	1.059	1.059
4.5	1.004	1.016	1.025	1.031	1.035	1.038	1.040	1.042	1.044	1.045	1.046	1.047	1.048	1.048	1.049	1.050	1.050	1.050	1.051
5.0	1.003	1.014	1.022	1.027	1.031	1.033	1.035	1.037	1.038	1.039	1.040	1.041	1.042	1.042	1.043	1.043	1.044	1.044	1.045
5.5	1.003	1.012	1.020	1.024	1.027	1.030	1.032	1.033	1.034	1.035	1.036	1.037	1.037	1.038	1.038	1.039	1.039	1.039	1.040
6.0	1.003	1.011	1.018	1.022	1.025	1.027	1.029	1.030	1.031	1.032	1.032	1.033	1.034	1.034	1.034	1.035	1.035	1.035	1.036
6.5	1.002	1.010	1.016	1.020	1.023	1.025	1.026	1.027	1.028	1.029	1.030	1.030	1.031	1.031	1.031	1.032	1.032	1.032	1.032
7.0	1.002	1.010	1.015	1.019	1.021	1.023	1.024	1.025	1.026	1.027	1.027	1.028	1.028	1.028	1.029	1.029	1.029	1.030	1.030
7.5	1.002	1.009	1.014	1.017	1.019	1.021	1.022	1.023	1.024	1.025	1.025	1.026	1.026	1.026	1.027	1.027	1.027	1.027	1.027
8.0	1.002	1.008	1.013	1.016	1.018	1.019	1.021	1.021	1.022	1.023	1.023	1.024	1.024	1.024	1.025	1.025	1.025	1.025	1.025
8.5	1.002	1.008	1.012	1.015	1.017	1.018	1.019	1.020	1.021	1.021	1.022	1.022	1.022	1.023	1.023	1.023	1.023	1.024	1.024
9.0	1.002	1.007	1.011	1.014	1.016	1.017	1.018	1.019	1.019	1.020	1.020	1.021	1.021	1.021	1.022	1.022	1.022	1.022	1.022
9.5	1.002	1.007	1.011	1.013	1.015	1.016	1.017	1.018	1.018	1.019	1.019	1.019	1.020	1.020	1.020	1.020	1.021	1.021	1.021
10.0	1.002	1.007	1.010	1.013	1.014	1.015	1.016	1.017	1.017	1.018	1.018	1.018	1.019	1.019	1.019	1.019	1.019	1.020	1.020

M_{max}/M_{cr}	I_I/I_{II}	β =	**1**	α =	**2**							$a_{simp}/a_{num.int}$							
	1.1	**1.5**	**2.0**	**2.5**	**3.0**	**3.5**	**4.0**	**4.5**	**5.0**	**5.5**	**6.0**	**6.5**	**7.0**	**7.5**	**8.0**	**8.5**	**9.0**	**9.5**	**10.0**
1.1	1.009	1.047	1.091	1.132	1.171	1.207	1.241	1.273	1.303	1.331	1.358	1.383	1.407	1.430	1.452	1.472	1.492	1.511	1.529
1.2	1.013	1.061	1.114	1.160	1.199	1.234	1.265	1.293	1.318	1.340	1.360	1.379	1.396	1.412	1.426	1.439	1.452	1.463	1.474
1.3	1.014	1.064	1.116	1.157	1.192	1.221	1.246	1.267	1.286	1.302	1.317	1.329	1.341	1.352	1.361	1.370	1.378	1.385	1.392
1.4	1.014	1.062	1.109	1.145	1.174	1.198	1.217	1.234	1.248	1.260	1.271	1.280	1.289	1.296	1.303	1.309	1.314	1.319	1.324
1.5	1.013	1.059	1.101	1.132	1.157	1.176	1.192	1.205	1.216	1.225	1.233	1.240	1.247	1.252	1.257	1.262	1.266	1.270	1.273
2.0	1.010	1.040	1.064	1.081	1.093	1.102	1.109	1.114	1.119	1.123	1.126	1.129	1.131	1.133	1.135	1.137	1.138	1.140	1.141
2.5	1.007	1.028	1.043	1.053	1.061	1.066	1.070	1.073	1.076	1.078	1.080	1.081	1.082	1.084	1.085	1.085	1.086	1.087	1.088
3.0	1.005	1.020	1.031	1.038	1.043	1.046	1.049	1.051	1.053	1.054	1.055	1.056	1.057	1.058	1.058	1.059	1.059	1.060	1.060
3.5	1.004	1.015	1.023	1.028	1.032	1.034	1.036	1.038	1.039	1.040	1.041	1.041	1.042	1.042	1.043	1.043	1.044	1.044	1.044
4.0	1.003	1.012	1.018	1.022	1.024	1.026	1.028	1.029	1.030	1.030	1.031	1.032	1.032	1.032	1.033	1.033	1.033	1.034	1.034
4.5	1.002	1.009	1.014	1.017	1.019	1.021	1.022	1.023	1.024	1.024	1.025	1.025	1.026	1.026	1.026	1.026	1.027	1.027	1.027
5.0	1.002	1.008	1.012	1.014	1.016	1.017	1.018	1.019	1.019	1.020	1.020	1.020	1.021	1.021	1.021	1.021	1.021	1.022	1.022
5.5	1.001	1.006	1.010	1.012	1.013	1.014	1.015	1.015	1.016	1.016	1.017	1.017	1.017	1.017	1.017	1.018	1.018	1.018	1.018
6.0	1.001	1.005	1.008	1.010	1.011	1.012	1.012	1.013	1.013	1.014	1.014	1.014	1.014	1.015	1.015	1.015	1.015	1.015	1.015
6.5	1.001	1.004	1.007	1.008	1.009	1.010	1.011	1.011	1.011	1.012	1.012	1.012	1.012	1.012	1.013	1.013	1.013	1.013	1.013
7.0	1.001	1.004	1.006	1.007	1.008	1.009	1.009	1.010	1.010	1.010	1.010	1.010	1.011	1.011	1.011	1.011	1.011	1.011	1.011
7.5	1.001	1.003	1.005	1.006	1.007	1.008	1.008	1.008	1.009	1.009	1.009	1.009	1.009	1.009	1.009	1.009	1.010	1.010	1.010
8.0	1.001	1.003	1.005	1.005	1.006	1.007	1.007	1.007	1.007	1.008	1.008	1.008	1.008	1.008	1.008	1.008	1.008	1.008	1.008
8.5	1.000	1.003	1.004	1.005	1.005	1.006	1.006	1.006	1.007	1.007	1.007	1.007	1.007	1.007	1.007	1.007	1.007	1.007	1.007
9.0	1.000	1.002	1.004	1.004	1.005	1.005	1.005	1.006	1.006	1.006	1.006	1.006	1.006	1.006	1.006	1.006	1.007	1.007	1.007
9.5	1.000	1.002	1.003	1.004	1.004	1.005	1.005	1.005	1.005	1.005	1.005	1.006	1.006	1.006	1.006	1.006	1.006	1.006	1.006
10.0	1.000	1.002	1.003	1.003	1.004	1.004	1.004	1.005	1.005	1.005	1.005	1.005	1.005	1.005	1.005	1.005	1.005	1.005	1.005

M_{max}/M_{cr}	I_I/I_{II}	β =	**0.5**	α =	**1**							$a_{simp}/a_{num.int}$							
	1.1	**1.5**	**2.0**	**2.5**	**3.0**	**3.5**	**4.0**	**4.5**	**5.0**	**5.5**	**6.0**	**6.5**	**7.0**	**7.5**	**8.0**	**8.5**	**9.0**	**9.5**	**10.0**
1.1	1.002	1.013	1.026	1.039	1.051	1.063	1.075	1.087	1.098	1.110	1.121	1.132	1.143	1.153	1.163	1.174	1.184	1.194	1.203
1.2	1.004	1.019	1.037	1.055	1.071	1.087	1.103	1.117	1.131	1.145	1.158	1.171	1.183	1.194	1.206	1.216	1.227	1.237	1.247
1.3	1.004	1.022	1.043	1.062	1.080	1.097	1.113	1.127	1.141	1.154	1.167	1.179	1.190	1.200	1.210	1.220	1.229	1.238	1.246
1.4	1.005	1.023	1.045	1.065	1.083	1.099	1.114	1.128	1.141	1.153	1.164	1.175	1.184	1.194	1.202	1.210	1.218	1.225	1.232
1.5	1.005	1.024	1.046	1.065	1.083	1.098	1.112	1.125	1.137	1.148	1.158	1.167	1.176	1.183	1.191	1.198	1.204	1.210	1.216
2.0	1.005	1.024	1.043	1.059	1.072	1.084	1.093	1.102	1.109	1.116	1.122	1.127	1.132	1.136	1.140	1.144	1.147	1.150	1.153
2.5	1.005	1.022	1.038	1.051	1.062	1.070	1.077	1.084	1.089	1.094	1.098	1.101	1.104	1.107	1.110	1.112	1.114	1.116	1.118
3.0	1.004	1.020	1.034	1.045	1.054	1.061	1.066	1.071	1.075	1.079	1.082	1.085	1.087	1.089	1.091	1.093	1.094	1.096	1.097
3.5	1.004	1.018	1.031	1.040	1.048	1.054	1.058	1.062	1.066	1.069	1.071	1.073	1.075	1.077	1.078	1.080	1.081	1.082	1.083
4.0	1.004	1.017	1.028	1.037	1.043	1.048	1.052	1.056	1.059	1.061	1.063	1.065	1.066	1.068	1.069	1.070	1.071	1.072	1.073
4.5	1.003	1.016	1.026	1.034	1.040	1.044	1.048	1.051	1.053	1.055	1.057	1.059	1.060	1.061	1.062	1.063	1.064	1.065	1.066
5.0	1.003	1.015	1.025	1.032	1.037	1.041	1.044	1.047	1.049	1.051	1.052	1.054	1.055	1.056	1.057	1.058	1.058	1.059	1.060
5.5	1.003	1.014	1.023	1.030	1.034	1.038	1.041	1.043	1.045	1.047	1.048	1.050	1.051	1.052	1.052	1.053	1.054	1.055	1.055
6.0	1.003	1.013	1.022	1.028	1.032	1.036	1.038	1.041	1.042	1.044	1.045	1.046	1.047	1.048	1.049	1.050	1.050	1.051	1.051
6.5	1.003	1.013	1.021	1.026	1.031	1.034	1.036	1.038	1.040	1.041	1.043	1.044	1.044	1.045	1.046	1.047	1.047	1.048	1.048
7.0	1.003	1.012	1.020	1.025	1.029	1.032	1.034	1.036	1.038	1.039	1.040	1.041	1.042	1.043	1.043	1.044	1.044	1.045	1.045
7.5	1.003	1.012	1.019	1.024	1.028	1.030	1.033	1.034	1.036	1.037	1.038	1.039	1.040	1.040	1.041	1.042	1.042	1.043	1.043
8.0	1.002	1.011	1.018	1.023	1.026	1.029	1.031	1.033	1.034	1.035	1.036	1.037	1.038	1.039	1.039	1.040	1.040	1.040	1.041
8.5	1.002	1.011	1.018	1.022	1.025	1.028	1.030	1.031	1.033	1.034	1.035	1.036	1.036	1.037	1.037	1.038	1.038	1.039	1.039
9.0	1.002	1.010	1.017	1.021	1.024	1.027	1.029	1.030	1.031	1.032	1.033	1.034	1.035	1.035	1.036	1.036	1.037	1.037	1.037
9.5	1.002	1.010	1.016	1.021	1.024	1.026	1.028	1.029	1.030	1.031	1.032	1.033	1.033	1.034	1.034	1.035	1.035	1.036	1.036
10.0	1.002	1.010	1.016	1.020	1.023	1.025	1.027	1.028	1.029	1.030	1.031	1.032	1.032	1.033	1.033	1.034	1.034	1.034	1.035

M_{max}/M_{cr}	I_I/I_{II}	β =	**0.5**	α =	**2**							$a_{simp}/a_{num.int}$							
	1.1	**1.5**	**2.0**	**2.5**	**3.0**	**3.5**	**4.0**	**4.5**	**5.0**	**5.5**	**6.0**	**6.5**	**7.0**	**7.5**	**8.0**	**8.5**	**9.0**	**9.5**	**10.0**
1.1	1.002	1.013	1.026	1.039	1.051	1.063	1.075	1.087	1.098	1.110	1.121	1.132	1.143	1.153	1.163	1.174	1.184	1.194	1.203
1.2	1.004	1.019	1.037	1.055	1.071	1.087	1.103	1.117	1.131	1.145	1.158	1.171	1.183	1.194	1.206	1.216	1.227	1.237	1.247
1.3	1.004	1.022	1.043	1.062	1.080	1.097	1.113	1.127	1.141	1.154	1.167	1.179	1.190	1.200	1.210	1.220	1.229	1.238	1.246
1.4	1.005	1.023	1.045	1.065	1.083	1.099	1.114	1.128	1.141	1.153	1.164	1.175	1.184	1.194	1.202	1.210	1.218	1.225	1.232
1.5	1.005	1.024	1.046	1.065	1.083	1.098	1.112	1.125	1.137	1.148	1.158	1.167	1.176	1.183	1.191	1.198	1.204	1.210	1.216
2.0	1.005	1.024	1.043	1.059	1.072	1.084	1.093	1.102	1.109	1.116	1.122	1.127	1.132	1.136	1.140	1.144	1.147	1.150	1.153
2.5	1.005	1.022	1.038	1.051	1.062	1.070	1.077	1.084	1.089	1.094	1.098	1.101	1.104	1.107	1.110	1.112	1.114	1.116	1.118
3.0	1.004	1.020	1.034	1.045	1.054	1.061	1.066	1.071	1.075	1.079	1.082	1.085	1.087	1.089	1.091	1.093	1.094	1.096	1.097
3.5	1.004	1.018	1.031	1.040	1.048	1.054	1.058	1.062	1.066	1.069	1.071	1.073	1.075	1.077	1.078	1.080	1.081	1.082	1.083
4.0	1.004	1.017	1.028	1.037	1.043	1.048	1.052	1.056	1.059	1.061	1.063	1.065	1.066	1.068	1.069	1.070	1.071	1.072	1.073
4.5	1.003	1.016	1.026	1.034	1.040	1.044	1.048	1.051	1.053	1.055	1.057	1.059	1.060	1.061	1.062	1.063	1.064	1.065	1.066
5.0	1.003	1.015	1.025	1.032	1.037	1.041	1.044	1.047	1.049	1.051	1.052	1.054	1.055	1.056	1.057	1.058	1.058	1.059	1.060
5.5	1.003	1.014	1.023	1.030	1.034	1.038	1.041	1.043	1.045	1.047	1.048	1.050	1.051	1.052	1.052	1.053	1.054	1.055	1.055
6.0	1.003	1.013	1.022	1.028	1.032	1.036	1.038	1.041	1.042	1.044	1.045	1.046	1.047	1.048	1.049	1.050	1.050	1.051	1.051
6.5	1.003	1.013	1.021	1.026	1.031	1.034	1.036	1.038	1.040	1.041	1.043	1.044	1.044	1.045	1.046	1.047	1.047	1.048	1.048
7.0	1.003	1.012	1.020	1.025	1.029	1.032	1.034	1.036	1.038	1.039	1.040	1.041	1.042	1.043	1.043	1.044	1.044	1.045	1.045
7.5	1.003	1.012	1.019	1.024	1.028	1.030	1.033	1.034	1.036	1.037	1.038	1.039	1.040	1.040	1.041	1.042	1.042	1.043	1.043
8.0	1.002	1.011	1.018	1.023	1.026	1.029	1.031	1.033	1.034	1.035	1.036	1.037	1.038	1.039	1.039	1.040	1.040	1.040	1.041
8.5	1.002	1.011	1.018	1.022	1.025	1.028	1.030	1.031	1.033	1.034	1.035	1.036	1.036	1.037	1.037	1.038	1.038	1.039	1.039
9.0	1.002	1.010	1.017	1.021	1.024	1.027	1.029	1.030	1.031	1.032	1.033	1.034	1.035	1.035	1.036	1.036	1.037	1.037	1.037
9.5	1.002	1.010	1.016	1.021	1.024	1.026	1.028	1.029	1.030	1.031	1.032	1.033	1.033	1.034	1.034	1.035	1.035	1.036	1.036
10.0	1.002	1.010	1.016	1.020	1.023	1.025	1.027	1.028	1.029	1.030	1.031	1.032	1.032	1.033	1.033	1.034	1.034	1.034	1.035

M_{max}/M_{cr}	I_I/I_{II}	β =	1	α =	1							$a'_{simp}/a_{num.int}$							
	1.1	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5	10.0
1.1	0.844	0.861	0.882	0.902	0.921	0.939	0.957	0.974	0.991	1.007	1.022	1.037	1.052	1.066	1.080	1.093	1.106	1.118	1.130
1.2	0.886	0.911	0.940	0.966	0.990	1.013	1.034	1.053	1.071	1.088	1.104	1.119	1.133	1.146	1.158	1.170	1.181	1.192	1.202
1.3	0.927	0.956	0.988	1.017	1.042	1.064	1.084	1.102	1.119	1.134	1.147	1.160	1.172	1.182	1.193	1.202	1.211	1.219	1.226
1.4	0.968	0.999	1.032	1.060	1.084	1.105	1.123	1.140	1.154	1.167	1.179	1.189	1.199	1.208	1.216	1.223	1.230	1.236	1.242
1.5	1.009	1.041	1.074	1.101	1.124	1.143	1.160	1.174	1.187	1.198	1.208	1.217	1.225	1.232	1.239	1.245	1.251	1.256	1.261
2.0	1.008	1.035	1.059	1.077	1.092	1.103	1.112	1.120	1.126	1.132	1.136	1.141	1.144	1.148	1.150	1.153	1.155	1.158	1.160
2.5	1.007	1.028	1.047	1.060	1.070	1.078	1.084	1.089	1.093	1.096	1.099	1.102	1.104	1.106	1.108	1.109	1.110	1.112	1.113
3.0	1.006	1.024	1.039	1.049	1.056	1.062	1.066	1.070	1.073	1.075	1.077	1.079	1.081	1.082	1.083	1.084	1.085	1.086	1.087
3.5	1.005	1.020	1.033	1.041	1.047	1.051	1.055	1.057	1.060	1.061	1.063	1.064	1.066	1.067	1.068	1.068	1.069	1.070	1.070
4.0	1.004	1.018	1.028	1.035	1.040	1.043	1.046	1.048	1.050	1.052	1.053	1.054	1.055	1.056	1.057	1.057	1.058	1.059	1.059
4.5	1.004	1.016	1.025	1.031	1.035	1.038	1.040	1.042	1.044	1.045	1.046	1.047	1.048	1.048	1.049	1.050	1.050	1.050	1.051
5.0	1.003	1.014	1.022	1.027	1.031	1.033	1.035	1.037	1.038	1.039	1.040	1.041	1.042	1.042	1.043	1.043	1.044	1.044	1.045
5.5	1.003	1.012	1.020	1.024	1.027	1.030	1.032	1.033	1.034	1.035	1.036	1.037	1.037	1.038	1.038	1.039	1.039	1.039	1.040
6.0	1.003	1.011	1.018	1.022	1.025	1.027	1.029	1.030	1.031	1.032	1.032	1.033	1.034	1.034	1.034	1.035	1.035	1.035	1.036
6.5	1.002	1.010	1.016	1.020	1.023	1.025	1.026	1.027	1.028	1.029	1.030	1.030	1.031	1.031	1.031	1.032	1.032	1.032	1.032
7.0	1.002	1.010	1.015	1.019	1.021	1.023	1.024	1.025	1.026	1.027	1.027	1.028	1.028	1.028	1.029	1.029	1.029	1.030	1.030
7.5	1.002	1.009	1.014	1.017	1.019	1.021	1.022	1.023	1.024	1.025	1.025	1.026	1.026	1.026	1.027	1.027	1.027	1.027	1.027
8.0	1.002	1.008	1.013	1.016	1.018	1.019	1.021	1.021	1.022	1.023	1.023	1.024	1.024	1.024	1.025	1.025	1.025	1.025	1.025
8.5	1.002	1.008	1.012	1.015	1.017	1.018	1.019	1.020	1.021	1.021	1.022	1.022	1.022	1.023	1.023	1.023	1.023	1.024	1.024
9.0	1.002	1.007	1.011	1.014	1.016	1.017	1.018	1.019	1.019	1.020	1.020	1.021	1.021	1.021	1.022	1.022	1.022	1.022	1.022
9.5	1.002	1.007	1.011	1.013	1.015	1.016	1.017	1.018	1.018	1.019	1.019	1.019	1.020	1.020	1.020	1.020	1.021	1.021	1.021
10.0	1.002	1.007	1.010	1.013	1.014	1.015	1.016	1.017	1.017	1.018	1.018	1.018	1.019	1.019	1.019	1.019	1.019	1.020	1.020

M_{max}/M_{cr}	I_I/I_{II}	β =	1	α =	2							$a'_{simp}/a_{num.int}$							
	1.1	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5	10.0
1.1	0.848	0.880	0.917	0.951	0.984	1.014	1.042	1.069	1.094	1.118	1.141	1.162	1.182	1.201	1.219	1.237	1.253	1.269	1.284
1.2	0.891	0.934	0.980	1.020	1.055	1.086	1.113	1.138	1.160	1.179	1.197	1.214	1.228	1.242	1.255	1.267	1.278	1.288	1.297
1.3	0.933	0.979	1.026	1.065	1.096	1.123	1.146	1.166	1.183	1.198	1.211	1.223	1.234	1.244	1.252	1.260	1.268	1.274	1.281
1.4	0.973	1.020	1.065	1.100	1.127	1.150	1.169	1.184	1.198	1.210	1.220	1.229	1.237	1.244	1.251	1.256	1.262	1.267	1.271
1.5	1.013	1.059	1.101	1.132	1.157	1.176	1.192	1.205	1.216	1.225	1.233	1.240	1.247	1.252	1.257	1.262	1.266	1.270	1.273
2.0	1.010	1.040	1.064	1.081	1.093	1.102	1.109	1.114	1.119	1.123	1.126	1.129	1.131	1.133	1.135	1.137	1.138	1.140	1.141
2.5	1.007	1.028	1.043	1.053	1.061	1.066	1.070	1.073	1.076	1.078	1.080	1.081	1.082	1.084	1.085	1.085	1.086	1.087	1.088
3.0	1.005	1.020	1.031	1.038	1.043	1.046	1.049	1.051	1.053	1.054	1.055	1.056	1.057	1.058	1.058	1.059	1.059	1.060	1.060
3.5	1.004	1.015	1.023	1.028	1.032	1.034	1.036	1.038	1.039	1.040	1.041	1.041	1.042	1.042	1.043	1.043	1.044	1.044	1.044
4.0	1.003	1.012	1.018	1.022	1.024	1.026	1.028	1.029	1.030	1.030	1.031	1.032	1.032	1.032	1.033	1.033	1.033	1.034	1.034
4.5	1.002	1.009	1.014	1.017	1.019	1.021	1.022	1.023	1.024	1.024	1.025	1.025	1.026	1.026	1.026	1.026	1.027	1.027	1.027
5.0	1.002	1.008	1.012	1.014	1.016	1.017	1.018	1.019	1.019	1.020	1.020	1.020	1.021	1.021	1.021	1.021	1.021	1.022	1.022
5.5	1.001	1.006	1.010	1.012	1.013	1.014	1.015	1.015	1.016	1.016	1.017	1.017	1.017	1.017	1.017	1.018	1.018	1.018	1.018
6.0	1.001	1.005	1.008	1.010	1.011	1.012	1.012	1.013	1.013	1.014	1.014	1.014	1.014	1.015	1.015	1.015	1.015	1.015	1.015
6.5	1.001	1.004	1.007	1.008	1.009	1.010	1.011	1.011	1.011	1.012	1.012	1.012	1.012	1.012	1.013	1.013	1.013	1.013	1.013
7.0	1.001	1.004	1.006	1.007	1.008	1.009	1.009	1.010	1.010	1.010	1.010	1.010	1.011	1.011	1.011	1.011	1.011	1.011	1.011
7.5	1.001	1.003	1.005	1.006	1.007	1.008	1.008	1.008	1.009	1.009	1.009	1.009	1.009	1.009	1.009	1.009	1.010	1.010	1.010
8.0	1.001	1.003	1.005	1.005	1.006	1.007	1.007	1.007	1.007	1.008	1.008	1.008	1.008	1.008	1.008	1.008	1.008	1.008	1.008
8.5	1.000	1.003	1.004	1.005	1.005	1.006	1.006	1.006	1.007	1.007	1.007	1.007	1.007	1.007	1.007	1.007	1.007	1.007	1.007
9.0	1.000	1.002	1.004	1.004	1.005	1.005	1.005	1.006	1.006	1.006	1.006	1.006	1.006	1.006	1.006	1.006	1.007	1.007	1.007
9.5	1.000	1.002	1.003	1.004	1.004	1.005	1.005	1.005	1.005	1.005	1.005	1.006	1.006	1.006	1.006	1.006	1.006	1.006	1.006
10.0	1.000	1.002	1.003	1.003	1.004	1.004	1.004	1.005	1.005	1.005	1.005	1.005	1.005	1.005	1.005	1.005	1.005	1.005	1.005

M_{max}/M_{cr}	I_I/I_{II}	β =	0.5	α =	1							$a'_{simp}/a_{num.int}$							
	1.1	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5	10.0
1.1	0.842	0.851	0.862	0.872	0.883	0.893	0.903	0.913	0.923	0.932	0.942	0.951	0.960	0.969	0.977	0.986	0.994	1.003	1.011
1.2	0.883	0.897	0.913	0.928	0.943	0.957	0.970	0.983	0.996	1.008	1.019	1.030	1.041	1.051	1.061	1.070	1.080	1.088	1.097
1.3	0.924	0.940	0.959	0.977	0.994	1.009	1.024	1.037	1.050	1.062	1.074	1.084	1.095	1.104	1.114	1.122	1.131	1.139	1.146
1.4	0.964	0.983	1.003	1.022	1.039	1.055	1.070	1.083	1.095	1.107	1.118	1.128	1.137	1.146	1.154	1.162	1.169	1.176	1.183
1.5	1.005	1.024	1.046	1.065	1.083	1.098	1.112	1.125	1.137	1.148	1.158	1.167	1.176	1.183	1.191	1.198	1.204	1.210	1.216
2.0	1.005	1.024	1.043	1.059	1.072	1.084	1.093	1.102	1.109	1.116	1.122	1.127	1.132	1.136	1.140	1.144	1.147	1.150	1.153
2.5	1.005	1.022	1.038	1.051	1.062	1.070	1.077	1.084	1.089	1.094	1.098	1.101	1.104	1.107	1.110	1.112	1.114	1.116	1.118
3.0	1.004	1.020	1.034	1.045	1.054	1.061	1.066	1.071	1.075	1.079	1.082	1.085	1.087	1.089	1.091	1.093	1.094	1.096	1.097
3.5	1.004	1.018	1.031	1.040	1.048	1.054	1.058	1.062	1.066	1.069	1.071	1.073	1.075	1.077	1.078	1.080	1.081	1.082	1.083
4.0	1.004	1.017	1.028	1.037	1.043	1.048	1.052	1.056	1.059	1.061	1.063	1.065	1.066	1.068	1.069	1.070	1.071	1.072	1.073
4.5	1.003	1.016	1.026	1.034	1.040	1.044	1.048	1.051	1.053	1.055	1.057	1.059	1.060	1.061	1.062	1.063	1.064	1.065	1.066
5.0	1.003	1.015	1.025	1.032	1.037	1.041	1.044	1.047	1.049	1.051	1.052	1.054	1.055	1.056	1.057	1.058	1.058	1.059	1.060
5.5	1.003	1.014	1.023	1.030	1.034	1.038	1.041	1.043	1.045	1.047	1.048	1.050	1.051	1.052	1.052	1.053	1.054	1.055	1.055
6.0	1.003	1.013	1.022	1.028	1.032	1.036	1.038	1.041	1.042	1.044	1.045	1.046	1.047	1.048	1.049	1.050	1.050	1.051	1.051
6.5	1.003	1.013	1.021	1.026	1.031	1.034	1.036	1.038	1.040	1.041	1.043	1.044	1.044	1.045	1.046	1.047	1.047	1.048	1.048
7.0	1.003	1.012	1.020	1.025	1.029	1.032	1.034	1.036	1.038	1.039	1.040	1.041	1.042	1.043	1.043	1.044	1.044	1.045	1.045
7.5	1.003	1.012	1.019	1.024	1.028	1.030	1.033	1.034	1.036	1.037	1.038	1.039	1.040	1.040	1.041	1.042	1.042	1.043	1.043
8.0	1.002	1.011	1.018	1.023	1.026	1.029	1.031	1.033	1.034	1.035	1.036	1.037	1.038	1.039	1.039	1.040	1.040	1.040	1.041
8.5	1.002	1.011	1.018	1.022	1.025	1.028	1.030	1.031	1.033	1.034	1.035	1.036	1.036	1.037	1.037	1.038	1.038	1.039	1.039
9.0	1.002	1.010	1.017	1.021	1.024	1.027	1.029	1.030	1.031	1.032	1.033	1.034	1.035	1.035	1.036	1.036	1.037	1.037	1.037
9.5	1.002	1.010	1.016	1.021	1.024	1.026	1.028	1.029	1.030	1.031	1.032	1.033	1.033	1.034	1.034	1.035	1.035	1.036	1.036
10.0	1.002	1.010	1.016	1.020	1.023	1.025	1.027	1.028	1.029	1.030	1.031	1.032	1.032	1.033	1.033	1.034	1.034	1.034	1.035

M_{max}/M_{cr}	I_I/I_{II}	β =	0.5	α =	2							$a'_{simp}/a_{num.int}$							
	1.1	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5	10.0
1.1	0.842	0.851	0.862	0.872	0.883	0.893	0.903	0.913	0.923	0.932	0.942	0.951	0.960	0.969	0.977	0.986	0.994	1.003	1.011
1.2	0.883	0.897	0.913	0.928	0.943	0.957	0.970	0.983	0.996	1.008	1.019	1.030	1.041	1.051	1.061	1.070	1.080	1.088	1.097
1.3	0.924	0.940	0.959	0.977	0.994	1.009	1.024	1.037	1.050	1.062	1.074	1.084	1.095	1.104	1.114	1.122	1.131	1.139	1.146
1.4	0.964	0.983	1.003	1.022	1.039	1.055	1.070	1.083	1.095	1.107	1.118	1.128	1.137	1.146	1.154	1.162	1.169	1.176	1.183
1.5	1.005	1.024	1.046	1.065	1.083	1.098	1.112	1.125	1.137	1.148	1.158	1.167	1.176	1.183	1.191	1.198	1.204	1.210	1.216
2.0	1.005	1.024	1.043	1.059	1.072	1.084	1.093	1.102	1.109	1.116	1.122	1.127	1.132	1.136	1.140	1.144	1.147	1.150	1.153
2.5	1.005	1.022	1.038	1.051	1.062	1.070	1.077	1.084	1.089	1.094	1.098	1.101	1.104	1.107	1.110	1.112	1.114	1.116	1.118
3.0	1.004	1.020	1.034	1.045	1.054	1.061	1.066	1.071	1.075	1.079	1.082	1.085	1.087	1.089	1.091	1.093	1.094	1.096	1.097
3.5	1.004	1.018	1.031	1.040	1.048	1.054	1.058	1.062	1.066	1.069	1.071	1.073	1.075	1.077	1.078	1.080	1.081	1.082	1.083
4.0	1.004	1.017	1.028	1.037	1.043	1.048	1.052	1.056	1.059	1.061	1.063	1.065	1.066	1.068	1.069	1.070	1.071	1.072	1.073
4.5	1.003	1.016	1.026	1.034	1.040	1.044	1.048	1.051	1.053	1.055	1.057	1.059	1.060	1.061	1.062	1.063	1.064	1.065	1.066
5.0	1.003	1.015	1.025	1.032	1.037	1.041	1.044	1.047	1.049	1.051	1.052	1.054	1.055	1.056	1.057	1.058	1.058	1.059	1.060
5.5	1.003	1.014	1.023	1.030	1.034	1.038	1.041	1.043	1.045	1.047	1.048	1.050	1.051	1.052	1.052	1.053	1.054	1.055	1.055
6.0	1.003	1.013	1.022	1.028	1.032	1.036	1.038	1.041	1.042	1.044	1.045	1.046	1.047	1.048	1.049	1.050	1.050	1.051	1.051
6.5	1.003	1.013	1.021	1.026	1.031	1.034	1.036	1.038	1.040	1.041	1.043	1.044	1.044	1.045	1.046	1.047	1.047	1.048	1.048
7.0	1.003	1.012	1.020	1.025	1.029	1.032	1.034	1.036	1.038	1.039	1.040	1.041	1.042	1.043	1.043	1.044	1.044	1.045	1.045
7.5	1.003	1.012	1.019	1.024	1.028	1.030	1.033	1.034	1.036	1.037	1.038	1.039	1.040	1.040	1.041	1.042	1.042	1.043	1.043
8.0	1.002	1.011	1.018	1.023	1.026	1.029	1.031	1.033	1.034	1.035	1.036	1.037	1.038	1.039	1.039	1.040	1.040	1.040	1.041
8.5	1.002	1.011	1.018	1.022	1.025	1.028	1.030	1.031	1.033	1.034	1.035	1.036	1.036	1.037	1.037	1.038	1.038	1.039	1.039
9.0	1.002	1.010	1.017	1.021	1.024	1.027	1.029	1.030	1.031	1.032	1.033	1.034	1.035	1.035	1.036	1.036	1.037	1.037	1.037
9.5	1.002	1.010	1.016	1.021	1.024	1.026	1.028	1.029	1.030	1.031	1.032	1.033	1.033	1.034	1.034	1.035	1.035	1.036	1.036
10.0	1.002	1.010	1.016	1.020	1.023	1.025	1.027	1.028	1.029	1.030	1.031	1.032	1.032	1.033	1.033	1.034	1.034	1.034	1.035

Appendix D

Assessment and Correction of ACI model

Assessment and Correction of ACI model:

Testing of Individual Deflection Curves

	Study information		Cross-section		Reinforcement																				Loading				Deflection		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
	Author	Specimen	b (mm)	h (mm)	A_{s1} (mm^2)	d (mm)	ρ_1 (%)	A_{s2} (mm^2)	d' (mm)	d_2 (mm)	ρ_2 (%)	type	t_0 (days)	$f_{cm}(t_0)$ (MPa)	f_{cm} (MPa)	$f_r(t_0)$ (MPa)	$f_{r,red}(t_0)$ (MPa)	$E_{cm}(t_0)$ (MPa)	E_{cm} (MPa)	E_s (MPa)	φ (–)	ε_{cs} (‰)	L (mm)	L/d	M_{L1} (Nm)	K_{L1}	M_{L2} (Nm)	K_{L2}	a (t) (mm)	t (days)	t-t_0 (days)
1	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.000	0.000	3500	11.7	3254	0.104	21646	0.107	4.95	14.1	0.1
2	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.011	0.000	3500	11.7	3254	0.104	21646	0.107	5.55	15	1
3	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.138	0.014	3500	11.7	3254	0.104	21646	0.107	5.96	16	2
4	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.161	0.039	3500	11.7	3254	0.104	21646	0.107	6.15	17	3
5	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.184	0.052	3500	11.7	3254	0.104	21646	0.107	6.27	18	4
6	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.195	0.065	3500	11.7	3254	0.104	21646	0.107	6.39	19	5
7	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.264	0.072	3500	11.7	3254	0.104	21646	0.107	6.47	20	6
8	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.362	0.109	3500	11.7	3254	0.104	21646	0.107	6.67	21	7
9	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.431	0.129	3500	11.7	3254	0.104	21646	0.107	6.80	22	8
10	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.442	0.159	3500	11.7	3254	0.104	21646	0.107	7.16	24	10
11	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.471	0.167	3500	11.7	3254	0.104	21646	0.107	7.19	25	11
12	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.483	0.180	3500	11.7	3254	0.104	21646	0.107	7.28	27	13
13	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.592	0.228	3500	11.7	3254	0.104	21646	0.107	7.47	30	16
14	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.667	0.266	3500	11.7	3254	0.104	21646	0.107	7.61	32	18
15	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.718	0.294	3500	11.7	3254	0.104	21646	0.107	7.78	34	20
16	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.782	0.329	3500	11.7	3254	0.104	21646	0.107	8.10	37	23
17	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.816	0.341	3500	11.7	3254	0.104	21646	0.107	8.17	39	25
18	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.833	0.340	3500	11.7	3254	0.104	21646	0.107	8.22	42	28
19	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.833	0.346	3500	11.7	3254	0.104	21646	0.107	8.32	45	31
20	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.862	0.367	3500	11.7	3254	0.104	21646	0.107	8.34	48	34
21	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.919	0.403	3500	11.7	3254	0.104	21646	0.107	8.51	53	39
22	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.973	0.468	3500	11.7	3254	0.104	21646	0.107	8.84	61	47
23	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.057	0.512	3500	11.7	3254	0.104	21646	0.107	9.06	68	54
24	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.103	0.531	3500	11.7	3254	0.104	21646	0.107	9.20	76	62
25	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.138	0.561	3500	11.7	3254	0.104	21646	0.107	9.47	87	73
26	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.149	0.591	3500	11.7	3254	0.104	21646	0.107	9.47	96	82
27	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.155	0.655	3500	11.7	3254	0.104	21646	0.107	9.78	109	95
28	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.247	0.718	3500	11.7	3254	0.104	21646	0.107	10.03	122	108
29	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.293	0.731	3500	11.7	3254	0.104	21646	0.107	10.34	136	122
30	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.368	0.762	3500	11.7	3254	0.104	21646	0.107	10.59	166	152
31	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.397	0.772	3500	11.7	3254	0.104	21646	0.107	10.88	200	186
32	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.506	0.784	3500	11.7	3254	0.104	21646	0.107	11.38	242	228
33	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.569	0.800	3500	11.7	3254	0.104	21646	0.107	11.63	286	272
34	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.644	0.816	3500	11.7	3254	0.104	21646	0.107	11.82	332	318
35	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.713	0.825	3500	11.7	3254	0.104	21646	0.107	12.06	394	380
36	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.000	0.000	3500	11.7	3254	0.104	13746	0.107	1.98	14.1	0.1
37	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.011	0.000	3500	11.7	3254	0.104	13746	0.107	2.21	15	1
38	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.138	0.014	3500	11.7	3254	0.104	13746	0.107	2.44	16	2
39	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.161	0.039	3500	11.7	3254	0.104	13746	0.107	2.54	17	3
40	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.184	0.052	3500	11.7	3254	0.104	13746	0.107	2.62	18	4
41	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.195	0.065	3500	11.7	3254	0.104	13746	0.107	2.72	19	5
42	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.264	0.072	3500	11.7	3254	0.104	13746	0.107	2.82	20	6
43	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.362	0.109	3500	11.7	3254	0.104	13746	0.107	3.02	21	7
44	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.431	0.129	3500	11.7	3254	0.104	13746	0.107	3.12	22	8
45	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.442	0.159	3500	11.7	3254	0.104	13746	0.107	3.30	24	10
46	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.471	0.167	3500	11.7	3254	0.104	13746	0.107	3.33	25	11
47	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.483	0.180	3500	11.7	3254	0.104	13746	0.107	3.38	27	13
48	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.592	0.228	3500	11.7	3254	0.104	13746	0.107	3.63	30	16
49	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.667	0.266	3500	11.7	3254	0.104	13746	0.107	3.76	32	18
50	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.718	0.294	3500	11.7	3254	0.104	13746	0.107	3.89	34	20
51	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.782	0.329	3500	11.7	3254	0.104	13746	0.107	4.11	37	23
52	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.816	0.341	3500	11.7	3254	0.104	13746	0.107	4.17	39	25
53	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.833	0.340	3500	11.7	3254	0.104	13746	0.107	4.17	42	28
54	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.833	0.346	3500	11.7	3254	0.104	13746	0.107	4.27	45	31
55	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.862	0.367	3500	11.7	3254	0.104	13746	0.107	4.29	48	34
56	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.919	0.403	3500	11.7	3254	0.104	13746	0.107	4.45	53	39
57	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.973	0.468	3500	11.7	3254	0.104	13746	0.107	4.78	61	47
58	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.057	0.512	3500	11.7	3254	0.104	13746	0.107	4.88	68	54
59	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.103	0.531	3500	11.7	3254	0.104	13746	0.107	4.98	76	62
60	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.138	0.561	3500	11.7	3254	0.104	13746	0.107	5.26	87	73
61	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.149	0.591	3500	11.7	3254	0.104	13746	0.107	5.28	96	82
62	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.155	0.655	3500	11.7	3254	0.104	13746	0.107	5.54	109	95
63	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.247	0.718	3500	11.7	3254	0.104	13746	0.107	5.74	122	108
64	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.293	0.731	3500	11.7	3254	0.104	13746	0.107	5.94	136	122
65	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.368	0.762	3500	11.7	3254	0.104	13746	0.107	6.25	166	152
66	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.397	0.772	3500	11.7	3254	0.104	13746	0.107	6.48	200	186
67	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.506	0.784	3500	11.7	3254	0.104	13746	0.107	6.91	242	228
68	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.569	0.800	3500	11.7	3254	0.104	13746	0.107	7.14	286	272
69	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.644	0.816	3500	11.7	3254	0.104	13746	0.107	7.34	332	318
70	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.713	0.825	3500	11.7	3254	0.104	13746	0.107	7.44	394	380

	Study information		Cross-section		Reinforcement																		Loading						Deflection		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
	Author	Specimen	b (mm)	h (mm)	A_{s1} (mm^2)	d (mm)	ρ_1 (%)	A_{s2} (mm^2)	d' (mm)	d_2 (mm)	ρ_2 (%)	type	t_0 (days)	$f_{cm}(t_0)$ (MPa)	f_{cm} (MPa)	$f_r(t_0)$ (MPa)	$f_{r,red}(t_0)$ (MPa)	$E_{cm}(t_0)$ (MPa)	E_{cm} (MPa)	E_s (MPa)	φ (–)	ε_{cs} (‰)	L (mm)	L/d	M_{L1} (Nm)	K_{L1}	M_{L2} (Nm)	K_{L2}	a (t) (mm)	t (days)	t-t_0 (days)
71	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.000	0.000	3500	11.7	3110	0.104	21690	0.107	5.03	14.1	0.1
72	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.011	0.000	3500	11.7	3110	0.104	21690	0.107	5.61	15	1
73	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.138	0.014	3500	11.7	3110	0.104	21690	0.107	5.97	16	2
74	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.161	0.039	3500	11.7	3110	0.104	21690	0.107	6.12	17	3
75	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.184	0.052	3500	11.7	3110	0.104	21690	0.107	6.25	18	4
76	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.195	0.065	3500	11.7	3110	0.104	21690	0.107	6.40	19	5
77	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.264	0.072	3500	11.7	3110	0.104	21690	0.107	6.55	20	6
78	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.362	0.109	3500	11.7	3110	0.104	21690	0.107	6.81	21	7
79	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.431	0.129	3500	11.7	3110	0.104	21690	0.107	6.96	22	8
80	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.442	0.159	3500	11.7	3110	0.104	21690	0.107	7.24	24	10
81	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.471	0.167	3500	11.7	3110	0.104	21690	0.107	7.26	25	11
82	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.483	0.180	3500	11.7	3110	0.104	21690	0.107	7.34	27	13
83	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.592	0.228	3500	11.7	3110	0.104	21690	0.107	7.64	30	16
84	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.667	0.266	3500	11.7	3110	0.104	21690	0.107	7.85	32	18
85	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.718	0.294	3500	11.7	3110	0.104	21690	0.107	8.00	34	20
86	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.782	0.329	3500	11.7	3110	0.104	21690	0.107	8.26	37	23
87	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.816	0.341	3500	11.7	3110	0.104	21690	0.107	8.36	39	25
88	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.833	0.340	3500	11.7	3110	0.104	21690	0.107	8.38	42	28
89	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.833	0.346	3500	11.7	3110	0.104	21690	0.107	8.51	45	31
90	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.862	0.367	3500	11.7	3110	0.104	21690	0.107	8.56	48	34
91	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.919	0.403	3500	11.7	3110	0.104	21690	0.107	8.79	53	39
92	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.973	0.468	3500	11.7	3110	0.104	21690	0.107	9.14	61	47
93	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.057	0.512	3500	11.7	3110	0.104	21690	0.107	9.30	68	54
94	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.103	0.531	3500	11.7	3110	0.104	21690	0.107	9.47	76	62
95	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.138	0.561	3500	11.7	3110	0.104	21690	0.107	9.80	87	73
96	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.149	0.591	3500	11.7	3110	0.104	21690	0.107	9.80	96	82
97	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.155	0.655	3500	11.7	3110	0.104	21690	0.107	10.14	109	95
98	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.247	0.718	3500	11.7	3110	0.104	21690	0.107	10.36	122	108
99	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.293	0.731	3500	11.7	3110	0.104	21690	0.107	10.64	136	122
100	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.368	0.762	3500	11.7	3110	0.104	21690	0.107	11.00	166	152
101	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.397	0.772	3500	11.7	3110	0.104	21690	0.107	11.30	200	186
102	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.506	0.784	3500	11.7	3110	0.104	21690	0.107	11.81	242	228
103	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.569	0.800	3500	11.7	3110	0.104	21690	0.107	12.17	286	272
104	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.644	0.816	3500	11.7	3110	0.104	21690	0.107	12.34	332	318
105	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.713	0.825	3500	11.7	3110	0.104	21690	0.107	12.42	394	380
106	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.000	0.000	3500	11.7	3110	0.104	13690	0.107	2.06	14.1	0.1
107	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.011	0.000	3500	11.7	3110	0.104	13690	0.107	2.26	15	1
108	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.138	0.014	3500	11.7	3110	0.104	13690	0.107	2.52	16	2
109	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.161	0.039	3500	11.7	3110	0.104	13690	0.107	2.62	17	3
110	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.184	0.052	3500	11.7	3110	0.104	13690	0.107	2.72	18	4
111	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.195	0.065	3500	11.7	3110	0.104	13690	0.107	2.79	19	5
112	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.264	0.072	3500	11.7	3110	0.104	13690	0.107	2.92	20	6
113	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.362	0.109	3500	11.7	3110	0.104	13690	0.107	3.12	21	7
114	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.431	0.129	3500	11.7	3110	0.104	13690	0.107	3.23	22	8
115	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.442	0.159	3500	11.7	3110	0.104	13690	0.107	3.43	24	10
116	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.471	0.167	3500	11.7	3110	0.104	13690	0.107	3.45	25	11
117	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.483	0.180	3500	11.7	3110	0.104	13690	0.107	3.53	27	13
118	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.592	0.228	3500	11.7	3110	0.104	13690	0.107	3.76	30	16
119	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.667	0.266	3500	11.7	3110	0.104	13690	0.107	3.91	32	18
120	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.718	0.294	3500	11.7	3110	0.104	13690	0.107	4.06	34	20
121	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.782	0.329	3500	11.7	3110	0.104	13690	0.107	4.27	37	23
122	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.816	0.341	3500	11.7	3110	0.104	13690	0.107	4.34	39	25
123	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.833	0.340	3500	11.7	3110	0.104	13690	0.107	4.37	42	28
124	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.833	0.346	3500	11.7	3110	0.104	13690	0.107	4.47	45	31
125	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.862	0.367	3500	11.7	3110	0.104	13690	0.107	4.52	48	34
126	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.919	0.403	3500	11.7	3110	0.104	13690	0.107	4.67	53	39
127	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.973	0.468	3500	11.7	3110	0.104	13690	0.107	4.98	61	47
128	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.057	0.512	3500	11.7	3110	0.104	13690	0.107	5.11	68	54
129	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.103	0.531	3500	11.7	3110	0.104	13690	0.107	5.26	76	62
130	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.138	0.561	3500	11.7	3110	0.104	13690	0.107	5.54	87	73
131	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.149	0.591	3500	11.7	3110	0.104	13690	0.107	5.54	96	82
132	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.155	0.655	3500	11.7	3110	0.104	13690	0.107	5.82	109	95
133	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.247	0.718	3500	11.7	3110	0.104	13690	0.107	6.02	122	108
134	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.293	0.731	3500	11.7	3110	0.104	13690	0.107	6.25	136	122
135	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.368	0.762	3500	11.7	3110	0.104	13690	0.107	6.58	166	152
136	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.397	0.772	3500	11.7	3110	0.104	13690	0.107	6.86	200	186
137	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.506	0.784	3500	11.7	3110	0.104	13690	0.107	7.26	242	228
138	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.569	0.800	3500	11.7	3110	0.104	13690	0.107	7.52	286	272
139	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.644	0.816	3500	11.7	3110	0.104	13690	0.107	7.72	332	318
140	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.713	0.825	3500	11.7	3110	0.104	13690	0.107	7.87	394	380

	Study information		Cross-section		Reinforcement																		Loading						Deflection		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
	Author	Specimen	b (mm)	h (mm)	A_{s1} (mm^2)	d (mm)	ρ_1 (%)	A_{s2} (mm^2)	d' (mm)	d_2 (mm)	ρ_2 (%)	type	t_0 (days)	$f_{cm}(t_0)$ (MPa)	f_{cm} (MPa)	$f_r(t_0)$ (MPa)	$f_{r,red}(t_0)$ (MPa)	$E_{cm}(t_0)$ (MPa)	E_{cm} (MPa)	E_s (MPa)	φ (–)	ε_{cs} (‰)	L (mm)	L/d	M_{L1} (Nm)	K_{L1}	M_{L2} (Nm)	K_{L2}	a (t) (mm)	t (days)	t-t_0 (days)
141	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.000	0.000	3500	11.7	3110	0.104	31490	0.107	5.81	14.1	0.1
142	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.011	0.000	3500	11.7	3110	0.104	31490	0.107	6.31	15	1
143	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.138	0.014	3500	11.7	3110	0.104	31490	0.107	6.71	16	2
144	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.161	0.039	3500	11.7	3110	0.104	31490	0.107	6.87	17	3
145	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.184	0.052	3500	11.7	3110	0.104	31490	0.107	7.00	18	4
146	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.195	0.065	3500	11.7	3110	0.104	31490	0.107	7.16	19	5
147	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.264	0.072	3500	11.7	3110	0.104	31490	0.107	7.34	20	6
148	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.362	0.109	3500	11.7	3110	0.104	31490	0.107	7.58	21	7
149	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.431	0.129	3500	11.7	3110	0.104	31490	0.107	7.72	22	8
150	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.442	0.159	3500	11.7	3110	0.104	31490	0.107	7.99	24	10
151	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.471	0.167	3500	11.7	3110	0.104	31490	0.107	8.02	25	11
152	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.483	0.180	3500	11.7	3110	0.104	31490	0.107	8.12	27	13
153	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.592	0.228	3500	11.7	3110	0.104	31490	0.107	8.43	30	16
154	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.667	0.266	3500	11.7	3110	0.104	31490	0.107	8.62	32	18
155	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.718	0.294	3500	11.7	3110	0.104	31490	0.107	8.78	34	20
156	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.782	0.329	3500	11.7	3110	0.104	31490	0.107	9.04	37	23
157	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.816	0.341	3500	11.7	3110	0.104	31490	0.107	9.12	39	25
158	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.833	0.340	3500	11.7	3110	0.104	31490	0.107	9.16	42	28
159	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.833	0.346	3500	11.7	3110	0.104	31490	0.107	9.29	45	31
160	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.862	0.367	3500	11.7	3110	0.104	31490	0.107	9.33	48	34
161	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.919	0.403	3500	11.7	3110	0.104	31490	0.107	9.57	53	39
162	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.973	0.468	3500	11.7	3110	0.104	31490	0.107	9.92	61	47
163	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.057	0.512	3500	11.7	3110	0.104	31490	0.107	10.10	68	54
164	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.103	0.531	3500	11.7	3110	0.104	31490	0.107	10.20	76	62
165	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.138	0.561	3500	11.7	3110	0.104	31490	0.107	10.60	87	73
166	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.149	0.591	3500	11.7	3110	0.104	31490	0.107	10.60	96	82
167	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.155	0.655	3500	11.7	3110	0.104	31490	0.107	10.90	109	95
168	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.247	0.718	3500	11.7	3110	0.104	31490	0.107	11.10	122	108
169	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.293	0.731	3500	11.7	3110	0.104	31490	0.107	11.40	136	122
170	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.368	0.762	3500	11.7	3110	0.104	31490	0.107	11.80	166	152
171	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.397	0.772	3500	11.7	3110	0.104	31490	0.107	12.10	200	186
172	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.506	0.784	3500	11.7	3110	0.104	31490	0.107	12.60	242	228
173	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.569	0.800	3500	11.7	3110	0.104	31490	0.107	13.00	286	272
174	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.644	0.816	3500	11.7	3110	0.104	31490	0.107	13.20	332	318
175	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.713	0.825	3500	11.7	3110	0.104	31490	0.107	13.30	394	380
176	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.000	0.000	3500	11.7	3110	0.104	17690	0.107	1.97	14.1	0.1
177	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.011	0.000	3500	11.7	3110	0.104	17690	0.107	2.31	15	1
178	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.138	0.014	3500	11.7	3110	0.104	17690	0.107	2.55	16	2
179	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.161	0.039	3500	11.7	3110	0.104	17690	0.107	2.65	17	3
180	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.184	0.052	3500	11.7	3110	0.104	17690	0.107	2.73	18	4
181	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.195	0.065	3500	11.7	3110	0.104	17690	0.107	2.84	19	5
182	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.264	0.072	3500	11.7	3110	0.104	17690	0.107	2.96	20	6
183	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.362	0.109	3500	11.7	3110	0.104	17690	0.107	3.15	21	7
184	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.431	0.129	3500	11.7	3110	0.104	17690	0.107	3.25	22	8
185	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.442	0.159	3500	11.7	3110	0.104	17690	0.107	3.45	24	10
186	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.471	0.167	3500	11.7	3110	0.104	17690	0.107	3.46	25	11
187	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.483	0.180	3500	11.7	3110	0.104	17690	0.107	3.53	27	13
188	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.592	0.228	3500	11.7	3110	0.104	17690	0.107	3.76	30	16
189	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.667	0.266	3500	11.7	3110	0.104	17690	0.107	3.90	32	18
190	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.718	0.294	3500	11.7	3110	0.104	17690	0.107	4.04	34	20
191	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.782	0.329	3500	11.7	3110	0.104	17690	0.107	4.24	37	23
192	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.816	0.341	3500	11.7	3110	0.104	17690	0.107	4.30	39	25
193	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.833	0.340	3500	11.7	3110	0.104	17690	0.107	4.38	42	28
194	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.833	0.346	3500	11.7	3110	0.104	17690	0.107	4.47	45	31
195	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.862	0.367	3500	11.7	3110	0.104	17690	0.107	4.51	48	34
196	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.919	0.403	3500	11.7	3110	0.104	17690	0.107	4.69	53	39
197	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.973	0.468	3500	11.7	3110	0.104	17690	0.107	5.20	61	47
198	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.057	0.512	3500	11.7	3110	0.104	17690	0.107	5.33	68	54
199	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.103	0.531	3500	11.7	3110	0.104	17690	0.107	5.42	76	62
200	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.138	0.561	3500	11.7	3110	0.104	17690	0.107	5.69	87	73
201	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.149	0.591	3500	11.7	3110	0.104	17690	0.107	5.69	96	82
202	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.155	0.655	3500	11.7	3110	0.104	17690	0.107	5.97	109	95
203	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.247	0.718	3500	11.7	3110	0.104	17690	0.107	6.17	122	108
204	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.293	0.731	3500	11.7	3110	0.104	17690	0.107	6.37	136	122
205	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.368	0.762	3500	11.7	3110	0.104	17690	0.107	6.67	166	152
206	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.397	0.772	3500	11.7	3110	0.104	17690	0.107	6.92	200	186
207	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.506	0.784	3500	11.7	3110	0.104	17690	0.107	7.34	242	228
208	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.569	0.800	3500	11.7	3110	0.104	17690	0.107	7.64	286	272
209	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.644	0.816	3500	11.7	3110	0.104	17690	0.107	7.81	332	318
210	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.713	0.825	3500	11.7	3110	0.104	17690	0.107	7.90	394	380

	Study information		Cross-section				Reinforcement																		Loading					Deflection	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
	Author	Specimen	b (mm)	h (mm)	A_{s1} (mm^2)	d (mm)	ρ_1 (%)	A_{s2} (mm^2)	d' (mm)	d_2 (mm)	ρ_2 (%)	type	t_0 (days)	$f_{cm}(t_0)$ (MPa)	f_{cm} (MPa)	$f_r(t_0)$ (MPa)	$f_{r,red}(t_0)$ (MPa)	$E_{cm}(t_0)$ (MPa)	E_{cm} (MPa)	E_s (MPa)	φ (–)	ε_{cs} (‰)	L (mm)	L/d	M_{L1} (Nm)	K_{L1}	M_{L2} (Nm)	K_{L2}	a (t) (mm)	t (days)	t-t_0 (days)
211	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.000	0.000	3500	26.9	2373	0.104	4437	0.104	7.14	14.1	0.1
212	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.011	0.000	3500	26.9	2373	0.104	4437	0.104	9.53	15	1
213	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.138	0.014	3500	26.9	2373	0.104	4437	0.104	10.50	16	2
214	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.161	0.039	3500	26.9	2373	0.104	4437	0.104	10.90	17	3
215	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.184	0.052	3500	26.9	2373	0.104	4437	0.104	11.20	18	4
216	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.195	0.065	3500	26.9	2373	0.104	4437	0.104	11.60	19	5
217	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.264	0.072	3500	26.9	2373	0.104	4437	0.104	12.10	20	6
218	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.362	0.109	3500	26.9	2373	0.104	4437	0.104	12.90	21	7
219	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.431	0.129	3500	26.9	2373	0.104	4437	0.104	13.00	22	8
220	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.442	0.159	3500	26.9	2373	0.104	4437	0.104	14.00	24	10
221	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.471	0.167	3500	26.9	2373	0.104	4437	0.104	14.00	25	11
222	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.483	0.180	3500	26.9	2373	0.104	4437	0.104	14.10	27	13
223	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.592	0.228	3500	26.9	2373	0.104	4437	0.104	14.90	30	16
224	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.667	0.266	3500	26.9	2373	0.104	4437	0.104	15.40	32	18
225	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.718	0.294	3500	26.9	2373	0.104	4437	0.104	15.50	34	20
226	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.782	0.329	3500	26.9	2373	0.104	4437	0.104	16.40	37	23
227	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.816	0.341	3500	26.9	2373	0.104	4437	0.104	16.60	39	25
228	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.833	0.340	3500	26.9	2373	0.104	4437	0.104	16.60	42	28
229	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.833	0.346	3500	26.9	2373	0.104	4437	0.104	16.90	45	31
230	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.862	0.367	3500	26.9	2373	0.104	4437	0.104	16.80	48	34
231	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.919	0.403	3500	26.9	2373	0.104	4437	0.104	17.40	53	39
232	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.973	0.468	3500	26.9	2373	0.104	4437	0.104	18.30	61	47
233	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.057	0.512	3500	26.9	2373	0.104	4437	0.104	18.60	68	54
234	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.103	0.531	3500	26.9	2373	0.104	4437	0.104	18.70	76	62
235	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.138	0.561	3500	26.9	2373	0.104	4437	0.104	19.20	87	73
236	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.149	0.591	3500	26.9	2373	0.104	4437	0.104	19.20	96	82
237	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.155	0.655	3500	26.9	2373	0.104	4437	0.104	19.20	109	95
238	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.247	0.718	3500	26.9	2373	0.104	4437	0.104	19.60	122	108
239	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.293	0.731	3500	26.9	2373	0.104	4437	0.104	20.40	136	122
240	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.368	0.762	3500	26.9	2373	0.104	4437	0.104	21.50	166	152
241	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.397	0.772	3500	26.9	2373	0.104	4437	0.104	22.30	200	186
242	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.506	0.784	3500	26.9	2373	0.104	4437	0.104	23.50	242	228
243	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.569	0.800	3500	26.9	2373	0.104	4437	0.104	24.20	286	272
244	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.644	0.816	3500	26.9	2373	0.104	4437	0.104	25.00	332	318
245	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.713	0.825	3500	26.9	2373	0.104	4437	0.104	25.10	394	380
246	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.000	0.000	3500	26.9	2373	0.104	2907	0.104	2.72	14.1	0.1
247	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.011	0.000	3500	26.9	2373	0.104	2907	0.104	4.78	15	1
248	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.138	0.014	3500	26.9	2373	0.104	2907	0.104	5.66	16	2
249	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.161	0.039	3500	26.9	2373	0.104	2907	0.104	6.05	17	3
250	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.184	0.052	3500	26.9	2373	0.104	2907	0.104	6.25	18	4
251	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.195	0.065	3500	26.9	2373	0.104	2907	0.104	6.58	19	5
252	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.264	0.072	3500	26.9	2373	0.104	2907	0.104	6.99	20	6
253	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.362	0.109	3500	26.9	2373	0.104	2907	0.104	7.72	21	7
254	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.431	0.129	3500	26.9	2373	0.104	2907	0.104	8.08	22	8
255	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.442	0.159	3500	26.9	2373	0.104	2907	0.104	8.76	24	10
256	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.471	0.167	3500	26.9	2373	0.104	2907	0.104	8.76	25	11
257	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.483	0.180	3500	26.9	2373	0.104	2907	0.104	8.89	27	13
258	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.592	0.228	3500	26.9	2373	0.104	2907	0.104	9.47	30	16
259	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.667	0.266	3500	26.9	2373	0.104	2907	0.104	9.86	32	18
260	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.718	0.294	3500	26.9	2373	0.104	2907	0.104	10.20	34	20
261	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.782	0.329	3500	26.9	2373	0.104	2907	0.104	10.80	37	23
262	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.816	0.341	3500	26.9	2373	0.104	2907	0.104	10.90	39	25
263	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.833	0.340	3500	26.9	2373	0.104	2907	0.104	10.90	42	28
264	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.833	0.346	3500	26.9	2373	0.104	2907	0.104	11.20	45	31
265	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.862	0.367	3500	26.9	2373	0.104	2907	0.104	11.10	48	34
266	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.919	0.403	3500	26.9	2373	0.104	2907	0.104	11.60	53	39
267	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.973	0.468	3500	26.9	2373	0.104	2907	0.104	12.40	61	47
268	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.057	0.512	3500	26.9	2373	0.104	2907	0.104	12.60	68	54
269	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.103	0.531	3500	26.9	2373	0.104	2907	0.104	12.70	76	62
270	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.138	0.561	3500	26.9	2373	0.104	2907	0.104	13.50	87	73
271	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.149	0.591	3500	26.9	2373	0.104	2907	0.104	13.50	96	82
272	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.155	0.655	3500	26.9	2373	0.104	2907	0.104	14.40	109	95
273	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.247	0.718	3500	26.9	2373	0.104	2907	0.104	14.90	122	108
274	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.293	0.731	3500	26.9	2373	0.104	2907	0.104	15.50	136	122
275	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.368	0.762	3500	26.9	2373	0.104	2907	0.104	16.50	166	152
276	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.397	0.772	3500	26.9	2373	0.104	2907	0.104	17.20	200	186
277	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.506	0.784	3500	26.9	2373	0.104	2907	0.104	18.40	242	228
278	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.569	0.800	3500	26.9	2373	0.104	2907	0.104	19.00	286	272
279	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.644	0.816	3500	26.9	2373	0.104	2907	0.104	19.80	332	318
280	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.713	0.825	3500	26.9	2373	0.104	2907	0.104	19.90	394	380

	Study information		Cross-section		Reinforcement																			Loading					Deflection		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
	Author	Specimen	b (mm)	h (mm)	A_{s1} (mm^2)	d (mm)	ρ_1 (%)	A_{s2} (mm^2)	d' (mm)	d_2 (mm)	ρ_2 (%)	type	t_0 (days)	$f_{cm}(t_0)$ (MPa)	f_{cm} (MPa)	$f_r(t_0)$ (MPa)	$f_{r,red}(t_0)$ (MPa)	$E_{cm}(t_0)$ (MPa)	E_{cm} (MPa)	E_s (MPa)	φ (–)	ε_{cs} (‰)	L (mm)	L/d	M_{L1} (Nm)	K_{L1}	M_{L2} (Nm)	K_{L2}	a (t) (mm)	t (days)	t-t_0 (days)
281	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.000	0.000	3500	26.9	2373	0.104	7497	0.104	11.80	14.1	0.1
282	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.011	0.000	3500	26.9	2373	0.104	7497	0.104	13.70	15	1
283	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.138	0.014	3500	26.9	2373	0.104	7497	0.104	14.70	16	2
284	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.161	0.039	3500	26.9	2373	0.104	7497	0.104	15.10	17	3
285	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.184	0.052	3500	26.9	2373	0.104	7497	0.104	15.50	18	4
286	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.195	0.065	3500	26.9	2373	0.104	7497	0.104	16.00	19	5
287	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.264	0.072	3500	26.9	2373	0.104	7497	0.104	16.40	20	6
288	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.362	0.109	3500	26.9	2373	0.104	7497	0.104	17.20	21	7
289	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.431	0.129	3500	26.9	2373	0.104	7497	0.104	17.60	22	8
290	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.442	0.159	3500	26.9	2373	0.104	7497	0.104	18.40	24	10
291	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.471	0.167	3500	26.9	2373	0.104	7497	0.104	18.40	25	11
292	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.483	0.180	3500	26.9	2373	0.104	7497	0.104	18.60	27	13
293	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.592	0.228	3500	26.9	2373	0.104	7497	0.104	19.40	30	16
294	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.667	0.266	3500	26.9	2373	0.104	7497	0.104	19.90	32	18
295	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.718	0.294	3500	26.9	2373	0.104	7497	0.104	20.40	34	20
296	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.782	0.329	3500	26.9	2373	0.104	7497	0.104	21.10	37	23
297	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.816	0.341	3500	26.9	2373	0.104	7497	0.104	21.30	39	25
298	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.833	0.340	3500	26.9	2373	0.104	7497	0.104	21.30	42	28
299	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.833	0.346	3500	26.9	2373	0.104	7497	0.104	21.70	45	31
300	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.862	0.367	3500	26.9	2373	0.104	7497	0.104	21.70	48	34
301	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.919	0.403	3500	26.9	2373	0.104	7497	0.104	22.30	53	39
302	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.973	0.468	3500	26.9	2373	0.104	7497	0.104	23.30	61	47
303	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.057	0.512	3500	26.9	2373	0.104	7497	0.104	23.60	68	54
304	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.103	0.531	3500	26.9	2373	0.104	7497	0.104	23.80	76	62
305	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.138	0.561	3500	26.9	2373	0.104	7497	0.104	24.80	87	73
306	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.149	0.591	3500	26.9	2373	0.104	7497	0.104	24.80	96	82
307	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.155	0.655	3500	26.9	2373	0.104	7497	0.104	25.90	109	95
308	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.247	0.718	3500	26.9	2373	0.104	7497	0.104	26.60	122	108
309	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.293	0.731	3500	26.9	2373	0.104	7497	0.104	27.30	136	122
310	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.368	0.762	3500	26.9	2373	0.104	7497	0.104	28.40	166	152
311	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.397	0.772	3500	26.9	2373	0.104	7497	0.104	29.30	200	186
312	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.506	0.784	3500	26.9	2373	0.104	7497	0.104	30.60	242	228
313	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.569	0.800	3500	26.9	2373	0.104	7497	0.104	32.10	286	272
314	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.644	0.816	3500	26.9	2373	0.104	7497	0.104	32.10	332	318
315	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.713	0.825	3500	26.9	2373	0.104	7497	0.104	32.50	394	380
316	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.000	0.000	3500	26.9	2373	0.104	4437	0.104	4.43	14.1	0.1
317	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.011	0.000	3500	26.9	2373	0.104	4437	0.104	5.99	15	1
318	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.138	0.014	3500	26.9	2373	0.104	4437	0.104	6.83	16	2
319	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.161	0.039	3500	26.9	2373	0.104	4437	0.104	7.18	17	3
320	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.184	0.052	3500	26.9	2373	0.104	4437	0.104	7.42	18	4
321	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.195	0.065	3500	26.9	2373	0.104	4437	0.104	7.80	19	5
322	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.264	0.072	3500	26.9	2373	0.104	4437	0.104	8.16	20	6
323	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.362	0.109	3500	26.9	2373	0.104	4437	0.104	8.43	21	7
324	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.431	0.129	3500	26.9	2373	0.104	4437	0.104	9.26	22	8
325	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.442	0.159	3500	26.9	2373	0.104	4437	0.104	10.00	24	10
326	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.471	0.167	3500	26.9	2373	0.104	4437	0.104	10.00	25	11
327	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.483	0.180	3500	26.9	2373	0.104	4437	0.104	10.20	27	13
328	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.592	0.228	3500	26.9	2373	0.104	4437	0.104	10.80	30	16
329	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.667	0.266	3500	26.9	2373	0.104	4437	0.104	11.30	32	18
330	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.718	0.294	3500	26.9	2373	0.104	4437	0.104	11.70	34	20
331	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.782	0.329	3500	26.9	2373	0.104	4437	0.104	12.30	37	23
332	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.816	0.341	3500	26.9	2373	0.104	4437	0.104	12.40	39	25
333	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.833	0.340	3500	26.9	2373	0.104	4437	0.104	12.50	42	28
334	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.833	0.346	3500	26.9	2373	0.104	4437	0.104	12.70	45	31
335	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.862	0.367	3500	26.9	2373	0.104	4437	0.104	12.70	48	34
336	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.919	0.403	3500	26.9	2373	0.104	4437	0.104	13.20	53	39
337	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.973	0.468	3500	26.9	2373	0.104	4437	0.104	14.10	61	47
338	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.057	0.512	3500	26.9	2373	0.104	4437	0.104	14.30	68	54
339	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.103	0.531	3500	26.9	2373	0.104	4437	0.104	14.70	76	62
340	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.138	0.561	3500	26.9	2373	0.104	4437	0.104	15.50	87	73
341	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.149	0.591	3500	26.9	2373	0.104	4437	0.104	15.50	96	82
342	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.155	0.655	3500	26.9	2373	0.104	4437	0.104	16.20	109	95
343	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.247	0.718	3500	26.9	2373	0.104	4437	0.104	16.90	122	108
344	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.293	0.731	3500	26.9	2373	0.104	4437	0.104	17.50	136	122
345	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.368	0.762	3500	26.9	2373	0.104	4437	0.104	18.50	166	152
346	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.397	0.772	3500	26.9	2373	0.104	4437	0.104	19.20	200	186
347	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.506	0.784	3500	26.9	2373	0.104	4437	0.104	20.40	242	228
348	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.569	0.800	3500	26.9	2373	0.104	4437	0.104	21.60	286	272
349	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.644	0.816	3500	26.9	2373	0.104	4437	0.104	21.80	332	318
350	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.713	0.825	3500	26.9	2373	0.104	4437	0.104	21.90	394	380

	Study information		Cross-section		Reinforcement																		Loading						Deflection		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
	Author	Specimen	b (mm)	h (mm)	A_{s1} (mm^2)	d (mm)	ρ_1 (%)	A_{s2} (mm^2)	d' (mm)	d_2 (mm)	ρ_2 (%)	type	t_0 (days)	$f_{cm}(t_0)$ (MPa)	f_{cm} (MPa)	$f_r(t_0)$ (MPa)	$f_{r,red}(t_0)$ (MPa)	$E_{cm}(t_0)$ (MPa)	E_{cm} (MPa)	E_s (MPa)	φ (–)	ε_{cs} (‰)	L (mm)	L/d	M_{L1} (Nm)	K_{L1}	M_{L2} (Nm)	K_{L2}	a (t) (mm)	t (days)	t-t_0 (days)
351	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.000	0.000	3500	26.9	2373	0.104	8977	0.104	10.70	14.1	0.1
352	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.011	0.000	3500	26.9	2373	0.104	8977	0.104	13.00	15	1
353	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.138	0.014	3500	26.9	2373	0.104	8977	0.104	14.00	16	2
354	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.161	0.039	3500	26.9	2373	0.104	8977	0.104	14.50	17	3
355	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.184	0.052	3500	26.9	2373	0.104	8977	0.104	14.70	18	4
356	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.195	0.065	3500	26.9	2373	0.104	8977	0.104	15.20	19	5
357	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.264	0.072	3500	26.9	2373	0.104	8977	0.104	15.70	20	6
358	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.362	0.109	3500	26.9	2373	0.104	8977	0.104	16.50	21	7
359	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.431	0.129	3500	26.9	2373	0.104	8977	0.104	16.90	22	8
360	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.442	0.159	3500	26.9	2373	0.104	8977	0.104	17.60	24	10
361	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.471	0.167	3500	26.9	2373	0.104	8977	0.104	17.70	25	11
362	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.483	0.180	3500	26.9	2373	0.104	8977	0.104	17.90	27	13
363	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.592	0.228	3500	26.9	2373	0.104	8977	0.104	18.70	30	16
364	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.667	0.266	3500	26.9	2373	0.104	8977	0.104	19.20	32	18
365	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.718	0.294	3500	26.9	2373	0.104	8977	0.104	19.70	34	20
366	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.782	0.329	3500	26.9	2373	0.104	8977	0.104	20.40	37	23
367	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.816	0.341	3500	26.9	2373	0.104	8977	0.104	20.60	39	25
368	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.833	0.340	3500	26.9	2373	0.104	8977	0.104	20.70	42	28
369	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.833	0.346	3500	26.9	2373	0.104	8977	0.104	21.00	45	31
370	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.862	0.367	3500	26.9	2373	0.104	8977	0.104	21.00	48	34
371	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.919	0.403	3500	26.9	2373	0.104	8977	0.104	21.60	53	39
372	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.973	0.468	3500	26.9	2373	0.104	8977	0.104	22.50	61	47
373	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.057	0.512	3500	26.9	2373	0.104	8977	0.104	22.90	68	54
374	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.103	0.531	3500	26.9	2373	0.104	8977	0.104	23.20	76	62
375	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.138	0.561	3500	26.9	2373	0.104	8977	0.104	24.20	87	73
376	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.149	0.591	3500	26.9	2373	0.104	8977	0.104	24.10	96	82
377	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.155	0.655	3500	26.9	2373	0.104	8977	0.104	25.10	109	95
378	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.247	0.718	3500	26.9	2373	0.104	8977	0.104	25.70	122	108
379	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.293	0.731	3500	26.9	2373	0.104	8977	0.104	26.50	136	122
380	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.368	0.762	3500	26.9	2373	0.104	8977	0.104	27.60	166	152
381	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.397	0.772	3500	26.9	2373	0.104	8977	0.104	27.90	200	186
382	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.506	0.784	3500	26.9	2373	0.104	8977	0.104	28.80	242	228
383	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.569	0.800	3500	26.9	2373	0.104	8977	0.104	29.10	286	272
384	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.644	0.816	3500	26.9	2373	0.104	8977	0.104	29.60	332	318
385	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.713	0.825	3500	26.9	2373	0.104	8977	0.104	29.80	394	380
386	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.000	0.000	3500	26.9	2373	0.104	5967	0.104	5.04	14.1	0.1
387	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.011	0.000	3500	26.9	2373	0.104	5967	0.104	6.98	15	1
388	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.138	0.014	3500	26.9	2373	0.104	5967	0.104	7.80	16	2
389	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.161	0.039	3500	26.9	2373	0.104	5967	0.104	8.18	17	3
390	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.184	0.052	3500	26.9	2373	0.104	5967	0.104	8.42	18	4
391	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.195	0.065	3500	26.9	2373	0.104	5967	0.104	8.80	19	5
392	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.264	0.072	3500	26.9	2373	0.104	5967	0.104	9.23	20	6
393	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.362	0.109	3500	26.9	2373	0.104	5967	0.104	9.87	21	7
394	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.431	0.129	3500	26.9	2373	0.104	5967	0.104	10.23	22	8
395	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.442	0.159	3500	26.9	2373	0.104	5967	0.104	10.87	24	10
396	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.471	0.167	3500	26.9	2373	0.104	5967	0.104	10.89	25	11
397	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.483	0.180	3500	26.9	2373	0.104	5967	0.104	11.03	27	13
398	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.592	0.228	3500	26.9	2373	0.104	5967	0.104	11.71	30	16
399	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.667	0.266	3500	26.9	2373	0.104	5967	0.104	12.14	32	18
400	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.718	0.294	3500	26.9	2373	0.104	5967	0.104	12.53	34	20
401	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.782	0.329	3500	26.9	2373	0.104	5967	0.104	13.11	37	23
402	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.816	0.341	3500	26.9	2373	0.104	5967	0.104	13.27	39	25
403	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.833	0.340	3500	26.9	2373	0.104	5967	0.104	13.32	42	28
404	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.833	0.346	3500	26.9	2373	0.104	5967	0.104	13.58	45	31
405	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.862	0.367	3500	26.9	2373	0.104	5967	0.104	13.59	48	34
406	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.919	0.403	3500	26.9	2373	0.104	5967	0.104	14.12	53	39
407	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	0.973	0.468	3500	26.9	2373	0.104	5967	0.104	14.92	61	47
408	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.057	0.512	3500	26.9	2373	0.104	5967	0.104	15.22	68	54
409	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.103	0.531	3500	26.9	2373	0.104	5967	0.104	15.38	76	62
410	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.138	0.561	3500	26.9	2373	0.104	5967	0.104	16.19	87	73
411	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.149	0.591	3500	26.9	2373	0.104	5967	0.104	16.20	96	82
412	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.155	0.655	3500	26.9	2373	0.104	5967	0.104	17.06	109	95
413	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.247	0.718	3500	26.9	2373	0.104	5967	0.104	17.64	122	108
414	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.293	0.731	3500	26.9	2373	0.104	5967	0.104	18.30	136	122
415	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.368	0.762	3500	26.9	2373	0.104	5967	0.104	19.30	166	152
416	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.397	0.772	3500	26.9	2373	0.104	5967	0.104	20.06	200	186
417	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.506	0.784	3500	26.9	2373	0.104	5967	0.104	21.24	242	228
418	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.569	0.800	3500	26.9	2373	0.104	5967	0.104	21.94	286	272
419	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.644	0.816	3500	26.9	2373	0.104	5967	0.104	22.44	332	318
420	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	14	18.30	24.80	3.70	2.47	22820	24950	200000	1.713	0.825	3500	26.9	2373	0.104	5967	0.104	22.90	394	380

	Study information		Cracking moment							Uncracked cross-section		Fully cracked cross-section							Deflection			
	1	2	3	4		5		6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	Author	Specimen	W_c (mm^3)	M_{SW} (Nm)		M_{cr} (Nm)		M_{max} (Nm)	M_{cr}/M_{max} (%)	I_c (mm^4)	S_c (mm^3)	A_{II}^* (mm^2)	A_{IIc} (mm^2)	$z_{IIc,1}$ (mm)	$z_{II,1}^*$ (mm)	I_{IIc} (mm^4)	I_{II}^* (mm^4)	S_{II}^* (mm^3)	t-t_0 (days)	$a_{num.int.}$ (mm)	a_{exp} (mm)	$a_{num.int.}/a_{exp}$ (%)
1	Gilbert and Nejadi (2004)	B1-a	4816667	3254	<	11887	<	24900	47.7	818833333	458019	23255	19733	300.54	261.08	10244366	213089556	778538	0.1	4.63	4.95	93.5
2	Gilbert and Nejadi (2004)	B1-a	4816667	3254	<	11887	<	24900	47.7	818833333	458019	23255	19733	300.54	261.08	10244366	213089556	778538	1	4.67	5.55	84.1
3	Gilbert and Nejadi (2004)	B1-a	4816667	3254	<	11887	<	24900	47.7	818833333	458019	23255	19733	300.54	261.08	10244366	213089556	778538	2	5.18	5.96	86.9
4	Gilbert and Nejadi (2004)	B1-a	4816667	3254	<	11887	<	24900	47.7	818833333	458019	23255	19733	300.54	261.08	10244366	213089556	778538	3	5.29	6.15	86.0
5	Gilbert and Nejadi (2004)	B1-a	4816667	3254	<	11887	<	24900	47.7	818833333	458019	23255	19733	300.54	261.08	10244366	213089556	778538	4	5.38	6.27	85.8
6	Gilbert and Nejadi (2004)	B1-a	4816667	3254	<	11887	<	24900	47.7	818833333	458019	23255	19733	300.54	261.08	10244366	213089556	778538	5	5.43	6.39	85.0
7	Gilbert and Nejadi (2004)	B1-a	4816667	3254	<	11887	<	24900	47.7	818833333	458019	23255	19733	300.54	261.08	10244366	213089556	778538	6	5.71	6.47	88.3
8	Gilbert and Nejadi (2004)	B1-a	4816667	3254	<	11887	<	24900	47.7	818833333	458019	23255	19733	300.54	261.08	10244366	213089556	778538	7	6.11	6.67	91.6
9	Gilbert and Nejadi (2004)	B1-a	4816667	3254	<	11887	<	24900	47.7	818833333	458019	23255	19733	300.54	261.08	10244366	213089556	778538	8	6.40	6.80	94.1
10	Gilbert and Nejadi (2004)	B1-a	4816667	3254	<	11887	<	24900	47.7	818833333	458019	23255	19733	300.54	261.08	10244366	213089556	778538	10	6.46	7.16	90.2
11	Gilbert and Nejadi (2004)	B1-a	4816667	3254	<	11887	<	24900	47.7	818833333	458019	23255	19733	300.54	261.08	10244366	213089556	778538	11	6.58	7.19	91.5
12	Gilbert and Nejadi (2004)	B1-a	4816667	3254	<	11887	<	24900	47.7	818833333	458019	23255	19733	300.54	261.08	10244366	213089556	778538	13	6.63	7.28	91.1
13	Gilbert and Nejadi (2004)	B1-a	4816667	3254	<	11887	<	24900	47.7	818833333	458019	23255	19733	300.54	261.08	10244366	213089556	778538	16	7.09	7.47	94.9
14	Gilbert and Nejadi (2004)	B1-a	4816667	3254	<	11887	<	24900	47.7	818833333	458019	23255	19733	300.54	261.08	10244366	213089556	778538	18	7.40	7.61	97.2
15	Gilbert and Nejadi (2004)	B1-a	4816667	3254	<	11887	<	24900	47.7	818833333	458019	23255	19733	300.54	261.08	10244366	213089556	778538	20	7.62	7.78	97.9
16	Gilbert and Nejadi (2004)	B1-a	4816667	3254	<	11887	<	24900	47.7	818833333	458019	23255	19733	300.54	261.08	10244366	213089556	778538	23	7.89	8.10	97.4
17	Gilbert and Nejadi (2004)	B1-a	4816667	3254	<	11887	<	24900	47.7	818833333	458019	23255	19733	300.54	261.08	10244366	213089556	778538	25	8.03	8.17	98.3
18	Gilbert and Nejadi (2004)	B1-a	4816667	3254	<	11887	<	24900	47.7	818833333	458019	23255	19733	300.54	261.08	10244366	213089556	778538	28	8.10	8.22	98.5
19	Gilbert and Nejadi (2004)	B1-a	4816667	3254	<	11887	<	24900	47.7	818833333	458019	23255	19733	300.54	261.08	10244366	213089556	778538	31	8.10	8.32	97.4
20	Gilbert and Nejadi (2004)	B1-a	4816667	3254	<	11887	<	24900	47.7	818833333	458019	23255	19733	300.54	261.08	10244366	213089556	778538	34	8.23	8.34	98.7
21	Gilbert and Nejadi (2004)	B1-a	4816667	3254	<	11887	<	24900	47.7	818833333	458019	23255	19733	300.54	261.08	10244366	213089556	778538	39	8.47	8.51	99.5
22	Gilbert and Nejadi (2004)	B1-a	4816667	3254	<	11887	<	24900	47.7	818833333	458019	23255	19733	300.54	261.08	10244366	213089556	778538	47	8.72	8.84	98.6
23	Gilbert and Nejadi (2004)	B1-a	4816667	3254	<	11887	<	24900	47.7	818833333	458019	23255	19733	300.54	261.08	10244366	213089556	778538	54	9.07	9.06	100.1
24	Gilbert and Nejadi (2004)	B1-a	4816667	3254	<	11887	<	24900	47.7	818833333	458019	23255	19733	300.54	261.08	10244366	213089556	778538	62	9.26	9.20	100.7
25	Gilbert and Nejadi (2004)	B1-a	4816667	3254	<	11887	<	24900	47.7	818833333	458019	23255	19733	300.54	261.08	10244366	213089556	778538	73	9.42	9.47	99.5
26	Gilbert and Nejadi (2004)	B1-a	4816667	3254	<	11887	<	24900	47.7	818833333	458019	23255	19733	300.54	261.08	10244366	213089556	778538	82	9.48	9.47	100.1
27	Gilbert and Nejadi (2004)	B1-a	4816667	3254	<	11887	<	24900	47.7	818833333	458019	23255	19733	300.54	261.08	10244366	213089556	778538	95	9.54	9.78	97.5
28	Gilbert and Nejadi (2004)	B1-a	4816667	3254	<	11887	<	24900	47.7	818833333	458019	23255	19733	300.54	261.08	10244366	213089556	778538	108	9.93	10.03	99.0
29	Gilbert and Nejadi (2004)	B1-a	4816667	3254	<	11887	<	24900	47.7	818833333	458019	23255	19733	300.54	261.08	10244366	213089556	778538	122	10.12	10.34	97.9
30	Gilbert and Nejadi (2004)	B1-a	4816667	3254	<	11887	<	24900	47.7	818833333	458019	23255	19733	300.54	261.08	10244366	213089556	778538	152	10.43	10.59	98.5
31	Gilbert and Nejadi (2004)	B1-a	4816667	3254	<	11887	<	24900	47.7	818833333	458019	23255	19733	300.54	261.08	10244366	213089556	778538	186	10.55	10.88	97.0
32	Gilbert and Nejadi (2004)	B1-a	4816667	3254	<	11887	<	24900	47.7	818833333	458019	23255	19733	300.54	261.08	10244366	213089556	778538	228	10.99	11.38	96.6
33	Gilbert and Nejadi (2004)	B1-a	4816667	3254	<	11887	<	24900	47.7	818833333	458019	23255	19733	300.54	261.08	10244366	213089556	778538	272	11.25	11.63	96.7
34	Gilbert and Nejadi (2004)	B1-a	4816667	3254	<	11887	<	24900	47.7	818833333	458019	23255	19733	300.54	261.08	10244366	213089556	778538	318	11.55	11.82	97.7
35	Gilbert and Nejadi (2004)	B1-a	4816667	3254	<	11887	<	24900	47.7	818833333	458019	23255	19733	300.54	261.08	10244366	213089556	778538	380	11.83	12.06	98.1
36	Gilbert and Nejadi (2004)	B1-b	4816667	3254	<	11887	<	17000	69.9	818833333	458019	23255	19733	300.54	261.08	10244366	213089556	778538	0.1	2.04	1.98	103.0
37	Gilbert and Nejadi (2004)	B1-b	4816667	3254	<	11887	<	17000	69.9	818833333	458019	23255	19733	300.54	261.08	10244366	213089556	778538	1	2.06	2.21	93.2
38	Gilbert and Nejadi (2004)	B1-b	4816667	3254	<	11887	<	17000	69.9	818833333	458019	23255	19733	300.54	261.08	10244366	213089556	778538	2	2.29	2.44	93.9
39	Gilbert and Nejadi (2004)	B1-b	4816667	3254	<	11887	<	17000	69.9	818833333	458019	23255	19733	300.54	261.08	10244366	213089556	778538	3	2.34	2.54	92.1
40	Gilbert and Nejadi (2004)	B1-b	4816667	3254	<	11887	<	17000	69.9	818833333	458019	23255	19733	300.54	261.08	10244366	213089556	778538	4	2.39	2.62	91.2
41	Gilbert and Nejadi (2004)	B1-b	4816667	3254	<	11887	<	17000	69.9	818833333	458019	23255	19733	300.54	261.08	10244366	213089556	778538	5	2.42	2.72	89.0
42	Gilbert and Nejadi (2004)	B1-b	4816667	3254	<	11887	<	17000	69.9	818833333	458019	23255	19733	300.54	261.08	10244366	213089556	778538	6	2.54	2.82	90.1
43	Gilbert and Nejadi (2004)	B1-b	4816667	3254	<	11887	<	17000	69.9	818833333	458019	23255	19733	300.54	261.08	10244366	213089556	778538	7	2.73	3.02	90.4
44	Gilbert and Nejadi (2004)	B1-b	4816667	3254	<	11887	<	17000	69.9	818833333	458019	23255	19733	300.54	261.08	10244366	213089556	778538	8	2.86	3.12	91.7
45	Gilbert and Nejadi (2004)	B1-b	4816667	3254	<	11887	<	17000	69.9	818833333	458019	23255	19733	300.54	261.08	10244366	213089556	778538	10	2.90	3.30	87.9
46	Gilbert and Nejadi (2004)	B1-b	4816667	3254	<	11887	<	17000	69.9	818833333	458019	23255	19733	300.54	261.08	10244366	213089556	778538	11	2.95	3.33	88.6
47	Gilbert and Nejadi (2004)	B1-b	4816667	3254	<	11887	<	17000	69.9	818833333	458019	23255	19733	300.54	261.08	10244366	213089556	778538	13	2.98	3.38	88.2
48	Gilbert and Nejadi (2004)	B1-b	4816667	3254	<	11887	<	17000	69.9	818833333	458019	23255	19733	300.54	261.08	10244366	213089556	778538	16	3.20	3.63	88.2
49	Gilbert and Nejadi (2004)	B1-b	4816667	3254	<	11887	<	17000	69.9	818833333	458019	23255	19733	300.54	261.08	10244366	213089556	778538	18	3.35	3.76	89.1
50	Gilbert and Nejadi (2004)	B1-b	4816667	3254	<	11887	<	17000	69.9	818833333	458019	23255	19733	300.54	261.08	10244366	213089556	778538	20	3.45	3.89	88.7
51	Gilbert and Nejadi (2004)	B1-b	4816667	3254	<	11887	<	17000	69.9	818833333	458019	23255	19733	300.54	261.08	10244366	213089556	778538	23	3.58	4.11	87.1
52	Gilbert and Nejadi (2004)	B1-b	4816667	3254	<	11887	<	17000	69.9	818833333	458019	23255	19733	300.54	261.08	10244366	213089556	778538	25	3.65	4.17	87.5
53	Gilbert and Nejadi (2004)	B1-b	4816667	3254	<	11887	<	17000	69.9	818833333	458019	23255	19733	300.54	261.08	10244366	213089556	778538	28	3.68	4.17	88.2
54	Gilbert and Nejadi (2004)	B1-b	4816667	3254	<	11887	<	17000	69.9	818833333	458019	23255	19733	300.54	261.08	10244366	213089556	778538	31	3.68	4.27	86.2
55	Gilbert and Nejadi (2004)	B1-b	4816667	3254	<	11887	<	17000	69.9	818833333	458019	23255	19733	300.54	261.08	10244366	213089556	778538	34	3.74	4.29	87.2
56	Gilbert and Nejadi (2004)	B1-b	4816667	3254	<	11887	<	17000	69.9	818833333	458019	23255	19733	300.54	261.08	10244366	213089556	778538	39	3.86	4.45	86.7
57	Gilbert and Nejadi (2004)	B1-b	4816667	3254	<	11887	<	17000	69.9	818833333	458019	23255	19733	300.54	261.08	10244366	213089556	778538	47	3.99	4.78	83.5
58	Gilbert and Nejadi (2004)	B1-b	4816667	3254	<	11887	<	17000	69.9	818833333	458019	23255	19733	300.54	261.08	10244366	213089556	778538	54	4.16	4.88	85.2
59	Gilbert and Nejadi (2004)	B1-b	4816667	3254	<	11887	<	17000	69.9	818833333	458019	23255	19733	300.54	261.08	10244366	213089556	778538	62	4.25	4.98	85.3
60	Gilbert and Nejadi (2004)	B1-b	4816667	3254	<	11887	<	17000	69.9	818833333	458019	23255	19733	300.54	261.08	10244366	213089556	778538	73	4.33	5.26	82.3
61	Gilbert and Nejadi (2004)	B1-b	4816667	3254	<	11887	<	17000	69.9	818833333	458019	23255	19733	300.54	261.08	10244366	213089556	778538	82	4.36	5.28	82.6
62	Gilbert and Nejadi (2004)	B1-b	4816667	3254	<	11887	<	17000	69.9	818833333	458019	23255	19733	300.54	261.08	10244366	213089556	778538	95	4.41	5.54	79.6
63	Gilbert and Nejadi (2004)	B1-b	4816667	3254	<	11887	<	17000	69.9	818833333	458019	23255	19733	300.54	261.08	10244366	213089556	778538	108	4.60	5.74	80.1
64	Gilbert and Nejadi (2004)	B1-b	4816667	3254	<	11887	<	17000	69.9	818833333	458019	23255	19733	300.54	261.08	10244366	213089556	778538	122	4.69	5.94	79.0
65	Gilbert and Nejadi (2004)	B1-b	4816667	3254	<	11887	<	17000	69.9	818833333	458019	23255	19733	300.54	261.08	10244366	213089556	778538	152	4.84	6.25	77.4
66	Gilbert and Nejadi (2004)	B1-b	4816667	3254	<	11887	<	17000	69.9	818833333	458019	23255	19733	300.54	261.08	10244366	213089556	778538	186	4.89	6.48	75.5
67	Gilbert and Nejadi (2004)	B1-b	4816667	3254	<	11887	<	17000	69.9	818833333	458019	23255	19733	300.54	261.08	10244366	213089556	778538	228	5.09	6.91	73.7
68	Gilbert and Nejadi (2004)	B1-b	4816667	3254	<	11887	<	17000	69.9	818833333	458019	23255	19733	300.54	261.08	10244366	213089556	778538	272	5.21	7.14	73.0
69	Gilbert and Nejadi (2004)	B1-b	4816667	3254	<	11887	<	17000	69.9	818833333	458019	23255	19733	300.54	261.08	10244366	213089556	778538	318	5.35	7.34	72.9
70	Gilbert and Nejadi (2004)	B1-b	4816667	3254	<	11887	<	17000	69.9	818833333	458019	23255	19733	300.54	261.08	10244366	213089556	778538	380	5.47	7.44	73.5

	Study information		Cracking moment							Uncracked cross-section		Fully cracked cross-section							Deflection			
	1	2	3	4		5		6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	Author	Specimen	W_c (mm^3)	M_{SW} (Nm)		M_{cr} (Nm)		M_{max} (Nm)	M_{cr}/M_{max} (%)	I_c (mm^4)	S_c (mm^3)	A_{II}^* (mm^2)	A_{IIc} (mm^2)	$z_{IIc,1}$ (mm)	$z_{II,1}^*$ (mm)	I_{IIc} (mm^4)	I_{II}^* (mm^4)	S_{II}^* (mm^3)	$t-t_0$ (days)	$a_{num.int.}$ (mm)	a_{exp} (mm)	$a_{num.int.}/a_{exp}$ (%)
71	Gilbert and Nejadi (2004)	B2-a	4401042	3110	<	10861	<	24800	43.8	715169271	484443	23255	19733	285.54	246.08	10244366	213089556	778538	0.1	5.13	5.03	102.0
72	Gilbert and Nejadi (2004)	B2-a	4401042	3110	<	10861	<	24800	43.8	715169271	484443	23255	19733	285.54	246.08	10244366	213089556	778538	1	5.18	5.61	92.3
73	Gilbert and Nejadi (2004)	B2-a	4401042	3110	<	10861	<	24800	43.8	715169271	484443	23255	19733	285.54	246.08	10244366	213089556	778538	2	5.74	5.97	96.1
74	Gilbert and Nejadi (2004)	B2-a	4401042	3110	<	10861	<	24800	43.8	715169271	484443	23255	19733	285.54	246.08	10244366	213089556	778538	3	5.85	6.12	95.6
75	Gilbert and Nejadi (2004)	B2-a	4401042	3110	<	10861	<	24800	43.8	715169271	484443	23255	19733	285.54	246.08	10244366	213089556	778538	4	5.96	6.25	95.4
76	Gilbert and Nejadi (2004)	B2-a	4401042	3110	<	10861	<	24800	43.8	715169271	484443	23255	19733	285.54	246.08	10244366	213089556	778538	5	6.02	6.40	94.1
77	Gilbert and Nejadi (2004)	B2-a	4401042	3110	<	10861	<	24800	43.8	715169271	484443	23255	19733	285.54	246.08	10244366	213089556	778538	6	6.32	6.55	96.5
78	Gilbert and Nejadi (2004)	B2-a	4401042	3110	<	10861	<	24800	43.8	715169271	484443	23255	19733	285.54	246.08	10244366	213089556	778538	7	6.77	6.81	99.4
79	Gilbert and Nejadi (2004)	B2-a	4401042	3110	<	10861	<	24800	43.8	715169271	484443	23255	19733	285.54	246.08	10244366	213089556	778538	8	7.08	6.96	101.7
80	Gilbert and Nejadi (2004)	B2-a	4401042	3110	<	10861	<	24800	43.8	715169271	484443	23255	19733	285.54	246.08	10244366	213089556	778538	10	7.15	7.24	98.8
81	Gilbert and Nejadi (2004)	B2-a	4401042	3110	<	10861	<	24800	43.8	715169271	484443	23255	19733	285.54	246.08	10244366	213089556	778538	11	7.28	7.26	100.3
82	Gilbert and Nejadi (2004)	B2-a	4401042	3110	<	10861	<	24800	43.8	715169271	484443	23255	19733	285.54	246.08	10244366	213089556	778538	13	7.34	7.34	100.0
83	Gilbert and Nejadi (2004)	B2-a	4401042	3110	<	10861	<	24800	43.8	715169271	484443	23255	19733	285.54	246.08	10244366	213089556	778538	16	7.84	7.64	102.6
84	Gilbert and Nejadi (2004)	B2-a	4401042	3110	<	10861	<	24800	43.8	715169271	484443	23255	19733	285.54	246.08	10244366	213089556	778538	18	8.19	7.85	104.3
85	Gilbert and Nejadi (2004)	B2-a	4401042	3110	<	10861	<	24800	43.8	715169271	484443	23255	19733	285.54	246.08	10244366	213089556	778538	20	8.43	8.00	105.4
86	Gilbert and Nejadi (2004)	B2-a	4401042	3110	<	10861	<	24800	43.8	715169271	484443	23255	19733	285.54	246.08	10244366	213089556	778538	23	8.73	8.26	105.8
87	Gilbert and Nejadi (2004)	B2-a	4401042	3110	<	10861	<	24800	43.8	715169271	484443	23255	19733	285.54	246.08	10244366	213089556	778538	25	8.88	8.36	106.2
88	Gilbert and Nejadi (2004)	B2-a	4401042	3110	<	10861	<	24800	43.8	715169271	484443	23255	19733	285.54	246.08	10244366	213089556	778538	28	8.96	8.38	106.9
89	Gilbert and Nejadi (2004)	B2-a	4401042	3110	<	10861	<	24800	43.8	715169271	484443	23255	19733	285.54	246.08	10244366	213089556	778538	31	8.96	8.51	105.3
90	Gilbert and Nejadi (2004)	B2-a	4401042	3110	<	10861	<	24800	43.8	715169271	484443	23255	19733	285.54	246.08	10244366	213089556	778538	34	9.10	8.56	106.3
91	Gilbert and Nejadi (2004)	B2-a	4401042	3110	<	10861	<	24800	43.8	715169271	484443	23255	19733	285.54	246.08	10244366	213089556	778538	39	9.37	8.79	106.6
92	Gilbert and Nejadi (2004)	B2-a	4401042	3110	<	10861	<	24800	43.8	715169271	484443	23255	19733	285.54	246.08	10244366	213089556	778538	47	9.64	9.14	105.5
93	Gilbert and Nejadi (2004)	B2-a	4401042	3110	<	10861	<	24800	43.8	715169271	484443	23255	19733	285.54	246.08	10244366	213089556	778538	54	10.03	9.30	107.8
94	Gilbert and Nejadi (2004)	B2-a	4401042	3110	<	10861	<	24800	43.8	715169271	484443	23255	19733	285.54	246.08	10244366	213089556	778538	62	10.24	9.47	108.1
95	Gilbert and Nejadi (2004)	B2-a	4401042	3110	<	10861	<	24800	43.8	715169271	484443	23255	19733	285.54	246.08	10244366	213089556	778538	73	10.41	9.80	106.2
96	Gilbert and Nejadi (2004)	B2-a	4401042	3110	<	10861	<	24800	43.8	715169271	484443	23255	19733	285.54	246.08	10244366	213089556	778538	82	10.48	9.80	106.9
97	Gilbert and Nejadi (2004)	B2-a	4401042	3110	<	10861	<	24800	43.8	715169271	484443	23255	19733	285.54	246.08	10244366	213089556	778538	95	10.54	10.14	103.9
98	Gilbert and Nejadi (2004)	B2-a	4401042	3110	<	10861	<	24800	43.8	715169271	484443	23255	19733	285.54	246.08	10244366	213089556	778538	108	10.98	10.36	106.0
99	Gilbert and Nejadi (2004)	B2-a	4401042	3110	<	10861	<	24800	43.8	715169271	484443	23255	19733	285.54	246.08	10244366	213089556	778538	122	11.19	10.64	105.2
100	Gilbert and Nejadi (2004)	B2-a	4401042	3110	<	10861	<	24800	43.8	715169271	484443	23255	19733	285.54	246.08	10244366	213089556	778538	152	11.53	11.00	104.8
101	Gilbert and Nejadi (2004)	B2-a	4401042	3110	<	10861	<	24800	43.8	715169271	484443	23255	19733	285.54	246.08	10244366	213089556	778538	186	11.66	11.30	103.2
102	Gilbert and Nejadi (2004)	B2-a	4401042	3110	<	10861	<	24800	43.8	715169271	484443	23255	19733	285.54	246.08	10244366	213089556	778538	228	12.15	11.81	102.9
103	Gilbert and Nejadi (2004)	B2-a	4401042	3110	<	10861	<	24800	43.8	715169271	484443	23255	19733	285.54	246.08	10244366	213089556	778538	272	12.43	12.17	102.1
104	Gilbert and Nejadi (2004)	B2-a	4401042	3110	<	10861	<	24800	43.8	715169271	484443	23255	19733	285.54	246.08	10244366	213089556	778538	318	12.77	12.34	103.5
105	Gilbert and Nejadi (2004)	B2-a	4401042	3110	<	10861	<	24800	43.8	715169271	484443	23255	19733	285.54	246.08	10244366	213089556	778538	380	13.07	12.42	105.2
106	Gilbert and Nejadi (2004)	B2-b	4401042	3110	<	10861	<	16800	64.6	715169271	484443	23255	19733	285.54	246.08	10244366	213089556	778538	0.1	2.45	2.06	118.9
107	Gilbert and Nejadi (2004)	B2-b	4401042	3110	<	10861	<	16800	64.6	715169271	484443	23255	19733	285.54	246.08	10244366	213089556	778538	1	2.48	2.26	109.7
108	Gilbert and Nejadi (2004)	B2-b	4401042	3110	<	10861	<	16800	64.6	715169271	484443	23255	19733	285.54	246.08	10244366	213089556	778538	2	2.75	2.52	109.1
109	Gilbert and Nejadi (2004)	B2-b	4401042	3110	<	10861	<	16800	64.6	715169271	484443	23255	19733	285.54	246.08	10244366	213089556	778538	3	2.81	2.62	107.3
110	Gilbert and Nejadi (2004)	B2-b	4401042	3110	<	10861	<	16800	64.6	715169271	484443	23255	19733	285.54	246.08	10244366	213089556	778538	4	2.87	2.72	105.5
111	Gilbert and Nejadi (2004)	B2-b	4401042	3110	<	10861	<	16800	64.6	715169271	484443	23255	19733	285.54	246.08	10244366	213089556	778538	5	2.90	2.79	103.9
112	Gilbert and Nejadi (2004)	B2-b	4401042	3110	<	10861	<	16800	64.6	715169271	484443	23255	19733	285.54	246.08	10244366	213089556	778538	6	3.05	2.92	104.5
113	Gilbert and Nejadi (2004)	B2-b	4401042	3110	<	10861	<	16800	64.6	715169271	484443	23255	19733	285.54	246.08	10244366	213089556	778538	7	3.27	3.12	104.8
114	Gilbert and Nejadi (2004)	B2-b	4401042	3110	<	10861	<	16800	64.6	715169271	484443	23255	19733	285.54	246.08	10244366	213089556	778538	8	3.43	3.23	106.2
115	Gilbert and Nejadi (2004)	B2-b	4401042	3110	<	10861	<	16800	64.6	715169271	484443	23255	19733	285.54	246.08	10244366	213089556	778538	10	3.47	3.43	101.2
116	Gilbert and Nejadi (2004)	B2-b	4401042	3110	<	10861	<	16800	64.6	715169271	484443	23255	19733	285.54	246.08	10244366	213089556	778538	11	3.53	3.45	102.3
117	Gilbert and Nejadi (2004)	B2-b	4401042	3110	<	10861	<	16800	64.6	715169271	484443	23255	19733	285.54	246.08	10244366	213089556	778538	13	3.56	3.53	100.8
118	Gilbert and Nejadi (2004)	B2-b	4401042	3110	<	10861	<	16800	64.6	715169271	484443	23255	19733	285.54	246.08	10244366	213089556	778538	16	3.82	3.76	101.6
119	Gilbert and Nejadi (2004)	B2-b	4401042	3110	<	10861	<	16800	64.6	715169271	484443	23255	19733	285.54	246.08	10244366	213089556	778538	18	4.00	3.91	102.3
120	Gilbert and Nejadi (2004)	B2-b	4401042	3110	<	10861	<	16800	64.6	715169271	484443	23255	19733	285.54	246.08	10244366	213089556	778538	20	4.12	4.06	101.5
121	Gilbert and Nejadi (2004)	B2-b	4401042	3110	<	10861	<	16800	64.6	715169271	484443	23255	19733	285.54	246.08	10244366	213089556	778538	23	4.27	4.27	100.0
122	Gilbert and Nejadi (2004)	B2-b	4401042	3110	<	10861	<	16800	64.6	715169271	484443	23255	19733	285.54	246.08	10244366	213089556	778538	25	4.35	4.34	100.2
123	Gilbert and Nejadi (2004)	B2-b	4401042	3110	<	10861	<	16800	64.6	715169271	484443	23255	19733	285.54	246.08	10244366	213089556	778538	28	4.39	4.37	100.5
124	Gilbert and Nejadi (2004)	B2-b	4401042	3110	<	10861	<	16800	64.6	715169271	484443	23255	19733	285.54	246.08	10244366	213089556	778538	31	4.39	4.47	98.2
125	Gilbert and Nejadi (2004)	B2-b	4401042	3110	<	10861	<	16800	64.6	715169271	484443	23255	19733	285.54	246.08	10244366	213089556	778538	34	4.46	4.52	98.7
126	Gilbert and Nejadi (2004)	B2-b	4401042	3110	<	10861	<	16800	64.6	715169271	484443	23255	19733	285.54	246.08	10244366	213089556	778538	39	4.60	4.67	98.5
127	Gilbert and Nejadi (2004)	B2-b	4401042	3110	<	10861	<	16800	64.6	715169271	484443	23255	19733	285.54	246.08	10244366	213089556	778538	47	4.75	4.98	95.4
128	Gilbert and Nejadi (2004)	B2-b	4401042	3110	<	10861	<	16800	64.6	715169271	484443	23255	19733	285.54	246.08	10244366	213089556	778538	54	4.95	5.11	96.9
129	Gilbert and Nejadi (2004)	B2-b	4401042	3110	<	10861	<	16800	64.6	715169271	484443	23255	19733	285.54	246.08	10244366	213089556	778538	62	5.06	5.26	96.2
130	Gilbert and Nejadi (2004)	B2-b	4401042	3110	<	10861	<	16800	64.6	715169271	484443	23255	19733	285.54	246.08	10244366	213089556	778538	73	5.15	5.54	93.0
131	Gilbert and Nejadi (2004)	B2-b	4401042	3110	<	10861	<	16800	64.6	715169271	484443	23255	19733	285.54	246.08	10244366	213089556	778538	82	5.19	5.54	93.7
132	Gilbert and Nejadi (2004)	B2-b	4401042	3110	<	10861	<	16800	64.6	715169271	484443	23255	19733	285.54	246.08	10244366	213089556	778538	95	5.24	5.82	90.0
133	Gilbert and Nejadi (2004)	B2-b	4401042	3110	<	10861	<	16800	64.6	715169271	484443	23255	19733	285.54	246.08	10244366	213089556	778538	108	5.47	6.02	90.9
134	Gilbert and Nejadi (2004)	B2-b	4401042	3110	<	10861	<	16800	64.6	715169271	484443	23255	19733	285.54	246.08	10244366	213089556	778538	122	5.57	6.25	89.1
135	Gilbert and Nejadi (2004)	B2-b	4401042	3110	<	10861	<	16800	64.6	715169271	484443	23255	19733	285.54	246.08	10244366	213089556	778538	152	5.75	6.58	87.4
136	Gilbert and Nejadi (2004)	B2-b	4401042	3110	<	10861	<	16800	64.6	715169271	484443	23255	19733	285.54	246.08	10244366	213089556	778538	186	5.81	6.86	84.7
137	Gilbert and Nejadi (2004)	B2-b	4401042	3110	<	10861	<	16800	64.6	715169271	484443	23255	19733	285.54	246.08	10244366	213089556	778538	228	6.05	7.26	83.3
138	Gilbert and Nejadi (2004)	B2-b	4401042	3110	<	10861	<	16800	64.6	715169271	484443	23255	19733	285.54	246.08	10244366	213089556	778538	272	6.19	7.52	82.3
139	Gilbert and Nejadi (2004)	B2-b	4401042	3110	<	10861	<	16800	64.6	715169271	484443	23255	19733	285.54	246.08	10244366	213089556	778538	318	6.35	7.72	82.3
140	Gilbert and Nejadi (2004)	B2-b	4401042	3110	<	10861	<	16800	64.6	715169271	484443	23255	19733	285.54	246.08	10244366	213089556	778538	380	6.50	7.87	82.6

	Study information		Cracking moment							Uncracked cross-section		Fully cracked cross-section							Deflection			
	1	2	3	4		5		6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	Author	Specimen	W_c (mm^3)	M_{SW} (Nm)		M_{cr} (Nm)		M_{max} (Nm)	M_{cr}/M_{max} (%)	I_c (mm^4)	S_c (mm^3)	A_{II}^* (mm^2)	A_{IIc} (mm^2)	$z_{IIc,1}$ (mm)	$z_{II,1}^*$ (mm)	I_{IIc} (mm^4)	I_{II}^* (mm^4)	S_{II}^* (mm^3)	t-t_0 (days)	$a_{num.int.}$ (mm)	a_{exp} (mm)	$a_{num.int.}/a_{exp}$ (%)
141	Gilbert and Nejadi (2004)	B3-a	4401042	3110	<	10861	<	34600	31.4	715169271	726665	28637	23355	278.29	231.57	16985501	293364864	1091161	0.1	6.24	5.81	107.4
142	Gilbert and Nejadi (2004)	B3-a	4401042	3110	<	10861	<	34600	31.4	715169271	726665	28637	23355	278.29	231.57	16985501	293364864	1091161	1	6.30	6.31	99.8
143	Gilbert and Nejadi (2004)	B3-a	4401042	3110	<	10861	<	34600	31.4	715169271	726665	28637	23355	278.29	231.57	16985501	293364864	1091161	2	6.98	6.71	104.0
144	Gilbert and Nejadi (2004)	B3-a	4401042	3110	<	10861	<	34600	31.4	715169271	726665	28637	23355	278.29	231.57	16985501	293364864	1091161	3	7.12	6.87	103.6
145	Gilbert and Nejadi (2004)	B3-a	4401042	3110	<	10861	<	34600	31.4	715169271	726665	28637	23355	278.29	231.57	16985501	293364864	1091161	4	7.25	7.00	103.6
146	Gilbert and Nejadi (2004)	B3-a	4401042	3110	<	10861	<	34600	31.4	715169271	726665	28637	23355	278.29	231.57	16985501	293364864	1091161	5	7.32	7.16	102.2
147	Gilbert and Nejadi (2004)	B3-a	4401042	3110	<	10861	<	34600	31.4	715169271	726665	28637	23355	278.29	231.57	16985501	293364864	1091161	6	7.69	7.34	104.8
148	Gilbert and Nejadi (2004)	B3-a	4401042	3110	<	10861	<	34600	31.4	715169271	726665	28637	23355	278.29	231.57	16985501	293364864	1091161	7	8.24	7.58	108.7
149	Gilbert and Nejadi (2004)	B3-a	4401042	3110	<	10861	<	34600	31.4	715169271	726665	28637	23355	278.29	231.57	16985501	293364864	1091161	8	8.61	7.72	111.5
150	Gilbert and Nejadi (2004)	B3-a	4401042	3110	<	10861	<	34600	31.4	715169271	726665	28637	23355	278.29	231.57	16985501	293364864	1091161	10	8.69	7.99	108.8
151	Gilbert and Nejadi (2004)	B3-a	4401042	3110	<	10861	<	34600	31.4	715169271	726665	28637	23355	278.29	231.57	16985501	293364864	1091161	11	8.85	8.02	110.3
152	Gilbert and Nejadi (2004)	B3-a	4401042	3110	<	10861	<	34600	31.4	715169271	726665	28637	23355	278.29	231.57	16985501	293364864	1091161	13	8.92	8.12	109.9
153	Gilbert and Nejadi (2004)	B3-a	4401042	3110	<	10861	<	34600	31.4	715169271	726665	28637	23355	278.29	231.57	16985501	293364864	1091161	16	9.53	8.43	113.0
154	Gilbert and Nejadi (2004)	B3-a	4401042	3110	<	10861	<	34600	31.4	715169271	726665	28637	23355	278.29	231.57	16985501	293364864	1091161	18	9.96	8.62	115.5
155	Gilbert and Nejadi (2004)	B3-a	4401042	3110	<	10861	<	34600	31.4	715169271	726665	28637	23355	278.29	231.57	16985501	293364864	1091161	20	10.25	8.78	116.7
156	Gilbert and Nejadi (2004)	B3-a	4401042	3110	<	10861	<	34600	31.4	715169271	726665	28637	23355	278.29	231.57	16985501	293364864	1091161	23	10.61	9.04	117.4
157	Gilbert and Nejadi (2004)	B3-a	4401042	3110	<	10861	<	34600	31.4	715169271	726665	28637	23355	278.29	231.57	16985501	293364864	1091161	25	10.80	9.12	118.4
158	Gilbert and Nejadi (2004)	B3-a	4401042	3110	<	10861	<	34600	31.4	715169271	726665	28637	23355	278.29	231.57	16985501	293364864	1091161	28	10.89	9.16	118.9
159	Gilbert and Nejadi (2004)	B3-a	4401042	3110	<	10861	<	34600	31.4	715169271	726665	28637	23355	278.29	231.57	16985501	293364864	1091161	31	10.89	9.29	117.2
160	Gilbert and Nejadi (2004)	B3-a	4401042	3110	<	10861	<	34600	31.4	715169271	726665	28637	23355	278.29	231.57	16985501	293364864	1091161	34	11.06	9.33	118.5
161	Gilbert and Nejadi (2004)	B3-a	4401042	3110	<	10861	<	34600	31.4	715169271	726665	28637	23355	278.29	231.57	16985501	293364864	1091161	39	11.38	9.57	118.9
162	Gilbert and Nejadi (2004)	B3-a	4401042	3110	<	10861	<	34600	31.4	715169271	726665	28637	23355	278.29	231.57	16985501	293364864	1091161	47	11.71	9.92	118.0
163	Gilbert and Nejadi (2004)	B3-a	4401042	3110	<	10861	<	34600	31.4	715169271	726665	28637	23355	278.29	231.57	16985501	293364864	1091161	54	12.19	10.10	120.7
164	Gilbert and Nejadi (2004)	B3-a	4401042	3110	<	10861	<	34600	31.4	715169271	726665	28637	23355	278.29	231.57	16985501	293364864	1091161	62	12.45	10.20	122.1
165	Gilbert and Nejadi (2004)	B3-a	4401042	3110	<	10861	<	34600	31.4	715169271	726665	28637	23355	278.29	231.57	16985501	293364864	1091161	73	12.65	10.60	119.3
166	Gilbert and Nejadi (2004)	B3-a	4401042	3110	<	10861	<	34600	31.4	715169271	726665	28637	23355	278.29	231.57	16985501	293364864	1091161	82	12.73	10.60	120.1
167	Gilbert and Nejadi (2004)	B3-a	4401042	3110	<	10861	<	34600	31.4	715169271	726665	28637	23355	278.29	231.57	16985501	293364864	1091161	95	12.80	10.90	117.4
168	Gilbert and Nejadi (2004)	B3-a	4401042	3110	<	10861	<	34600	31.4	715169271	726665	28637	23355	278.29	231.57	16985501	293364864	1091161	108	13.33	11.10	120.1
169	Gilbert and Nejadi (2004)	B3-a	4401042	3110	<	10861	<	34600	31.4	715169271	726665	28637	23355	278.29	231.57	16985501	293364864	1091161	122	13.59	11.40	119.2
170	Gilbert and Nejadi (2004)	B3-a	4401042	3110	<	10861	<	34600	31.4	715169271	726665	28637	23355	278.29	231.57	16985501	293364864	1091161	152	14.00	11.80	118.6
171	Gilbert and Nejadi (2004)	B3-a	4401042	3110	<	10861	<	34600	31.4	715169271	726665	28637	23355	278.29	231.57	16985501	293364864	1091161	186	14.16	12.10	117.0
172	Gilbert and Nejadi (2004)	B3-a	4401042	3110	<	10861	<	34600	31.4	715169271	726665	28637	23355	278.29	231.57	16985501	293364864	1091161	228	14.75	12.60	117.1
173	Gilbert and Nejadi (2004)	B3-a	4401042	3110	<	10861	<	34600	31.4	715169271	726665	28637	23355	278.29	231.57	16985501	293364864	1091161	272	15.10	13.00	116.2
174	Gilbert and Nejadi (2004)	B3-a	4401042	3110	<	10861	<	34600	31.4	715169271	726665	28637	23355	278.29	231.57	16985501	293364864	1091161	318	15.50	13.20	117.4
175	Gilbert and Nejadi (2004)	B3-a	4401042	3110	<	10861	<	34600	31.4	715169271	726665	28637	23355	278.29	231.57	16985501	293364864	1091161	380	15.88	13.30	119.4
176	Gilbert and Nejadi (2004)	B3-b	4401042	3110	<	10861	<	20800	52.2	715169271	726665	28637	23355	278.29	231.57	16985501	293364864	1091161	0.1	3.12	1.97	158.4
177	Gilbert and Nejadi (2004)	B3-b	4401042	3110	<	10861	<	20800	52.2	715169271	726665	28637	23355	278.29	231.57	16985501	293364864	1091161	1	3.15	2.31	136.4
178	Gilbert and Nejadi (2004)	B3-b	4401042	3110	<	10861	<	20800	52.2	715169271	726665	28637	23355	278.29	231.57	16985501	293364864	1091161	2	3.49	2.55	136.9
179	Gilbert and Nejadi (2004)	B3-b	4401042	3110	<	10861	<	20800	52.2	715169271	726665	28637	23355	278.29	231.57	16985501	293364864	1091161	3	3.57	2.65	134.7
180	Gilbert and Nejadi (2004)	B3-b	4401042	3110	<	10861	<	20800	52.2	715169271	726665	28637	23355	278.29	231.57	16985501	293364864	1091161	4	3.64	2.73	133.3
181	Gilbert and Nejadi (2004)	B3-b	4401042	3110	<	10861	<	20800	52.2	715169271	726665	28637	23355	278.29	231.57	16985501	293364864	1091161	5	3.68	2.84	129.6
182	Gilbert and Nejadi (2004)	B3-b	4401042	3110	<	10861	<	20800	52.2	715169271	726665	28637	23355	278.29	231.57	16985501	293364864	1091161	6	3.86	2.96	130.4
183	Gilbert and Nejadi (2004)	B3-b	4401042	3110	<	10861	<	20800	52.2	715169271	726665	28637	23355	278.29	231.57	16985501	293364864	1091161	7	4.15	3.15	131.7
184	Gilbert and Nejadi (2004)	B3-b	4401042	3110	<	10861	<	20800	52.2	715169271	726665	28637	23355	278.29	231.57	16985501	293364864	1091161	8	4.34	3.25	133.5
185	Gilbert and Nejadi (2004)	B3-b	4401042	3110	<	10861	<	20800	52.2	715169271	726665	28637	23355	278.29	231.57	16985501	293364864	1091161	10	4.39	3.45	127.2
186	Gilbert and Nejadi (2004)	B3-b	4401042	3110	<	10861	<	20800	52.2	715169271	726665	28637	23355	278.29	231.57	16985501	293364864	1091161	11	4.48	3.46	129.5
187	Gilbert and Nejadi (2004)	B3-b	4401042	3110	<	10861	<	20800	52.2	715169271	726665	28637	23355	278.29	231.57	16985501	293364864	1091161	13	4.52	3.53	128.0
188	Gilbert and Nejadi (2004)	B3-b	4401042	3110	<	10861	<	20800	52.2	715169271	726665	28637	23355	278.29	231.57	16985501	293364864	1091161	16	4.84	3.76	128.7
189	Gilbert and Nejadi (2004)	B3-b	4401042	3110	<	10861	<	20800	52.2	715169271	726665	28637	23355	278.29	231.57	16985501	293364864	1091161	18	5.06	3.90	129.7
190	Gilbert and Nejadi (2004)	B3-b	4401042	3110	<	10861	<	20800	52.2	715169271	726665	28637	23355	278.29	231.57	16985501	293364864	1091161	20	5.21	4.04	129.0
191	Gilbert and Nejadi (2004)	B3-b	4401042	3110	<	10861	<	20800	52.2	715169271	726665	28637	23355	278.29	231.57	16985501	293364864	1091161	23	5.41	4.24	127.6
192	Gilbert and Nejadi (2004)	B3-b	4401042	3110	<	10861	<	20800	52.2	715169271	726665	28637	23355	278.29	231.57	16985501	293364864	1091161	25	5.50	4.30	127.9
193	Gilbert and Nejadi (2004)	B3-b	4401042	3110	<	10861	<	20800	52.2	715169271	726665	28637	23355	278.29	231.57	16985501	293364864	1091161	28	5.55	4.38	126.7
194	Gilbert and Nejadi (2004)	B3-b	4401042	3110	<	10861	<	20800	52.2	715169271	726665	28637	23355	278.29	231.57	16985501	293364864	1091161	31	5.55	4.47	124.2
195	Gilbert and Nejadi (2004)	B3-b	4401042	3110	<	10861	<	20800	52.2	715169271	726665	28637	23355	278.29	231.57	16985501	293364864	1091161	34	5.64	4.51	125.1
196	Gilbert and Nejadi (2004)	B3-b	4401042	3110	<	10861	<	20800	52.2	715169271	726665	28637	23355	278.29	231.57	16985501	293364864	1091161	39	5.82	4.69	124.1
197	Gilbert and Nejadi (2004)	B3-b	4401042	3110	<	10861	<	20800	52.2	715169271	726665	28637	23355	278.29	231.57	16985501	293364864	1091161	47	6.00	5.20	115.4
198	Gilbert and Nejadi (2004)	B3-b	4401042	3110	<	10861	<	20800	52.2	715169271	726665	28637	23355	278.29	231.57	16985501	293364864	1091161	54	6.26	5.33	117.4
199	Gilbert and Nejadi (2004)	B3-b	4401042	3110	<	10861	<	20800	52.2	715169271	726665	28637	23355	278.29	231.57	16985501	293364864	1091161	62	6.39	5.42	117.9
200	Gilbert and Nejadi (2004)	B3-b	4401042	3110	<	10861	<	20800	52.2	715169271	726665	28637	23355	278.29	231.57	16985501	293364864	1091161	73	6.50	5.69	114.2
201	Gilbert and Nejadi (2004)	B3-b	4401042	3110	<	10861	<	20800	52.2	715169271	726665	28637	23355	278.29	231.57	16985501	293364864	1091161	82	6.55	5.69	115.1
202	Gilbert and Nejadi (2004)	B3-b	4401042	3110	<	10861	<	20800	52.2	715169271	726665	28637	23355	278.29	231.57	16985501	293364864	1091161	95	6.61	5.97	110.7
203	Gilbert and Nejadi (2004)	B3-b	4401042	3110	<	10861	<	20800	52.2	715169271	726665	28637	23355	278.29	231.57	16985501	293364864	1091161	108	6.89	6.17	111.7
204	Gilbert and Nejadi (2004)	B3-b	4401042	3110	<	10861	<	20800	52.2	715169271	726665	28637	23355	278.29	231.57	16985501	293364864	1091161	122	7.03	6.37	110.4
205	Gilbert and Nejadi (2004)	B3-b	4401042	3110	<	10861	<	20800	52.2	715169271	726665	28637	23355	278.29	231.57	16985501	293364864	1091161	152	7.24	6.67	108.5
206	Gilbert and Nejadi (2004)	B3-b	4401042	3110	<	10861	<	20800	52.2	715169271	726665	28637	23355	278.29	231.57	16985501	293364864	1091161	186	7.33	6.92	105.9
207	Gilbert and Nejadi (2004)	B3-b	4401042	3110	<	10861	<	20800	52.2	715169271	726665	28637	23355	278.29	231.57	16985501	293364864	1091161	228	7.62	7.34	103.8
208	Gilbert and Nejadi (2004)	B3-b	4401042	3110	<	10861	<	20800	52.2	715169271	726665	28637	23355	278.29	231.57	16985501	293364864	1091161	272	7.80	7.64	102.1
209	Gilbert and Nejadi (2004)	B3-b	4401042	3110	<	10861	<	20800	52.2	715169271	726665	28637	23355	278.29	231.57	16985501	293364864	1091161	318	8.01	7.81	102.6
210	Gilbert and Nejadi (2004)	B3-b	4401042	3110	<	10861	<	20800	52.2	715169271	726665	28637	23355	278.29	231.57	16985501	293364864	1091161	380	8.20	7.90	103.8

	Study information		Cracking moment							Uncracked cross-section		Fully cracked cross-section							Deflection			
	1	2	3	4		5		6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	Author	Specimen	W_c (mm^3)	M_{SW} (Nm)		M_{cr} (Nm)		M_{max} (Nm)	M_{cr}/M_{max} (%)	I_c (mm^4)	S_c (mm^3)	A_{II}^* (mm^2)	A_{IIc} (mm^2)	$z_{IIc,1}$ (mm)	$z_{II,1}^*$ (mm)	I_{IIc} (mm^4)	I_{II}^* (mm^4)	S_{II}^* (mm^3)	$t\text{-}t_0$ (days)	$a_{num.int.}$ (mm)	a_{exp} (mm)	$a_{num.int.}/a_{exp}$ (%)
211	Gilbert and Nejadi (2004)	S1-a	1601667	2373	<	3953	<	6810	58.0	124129167	103988	14491	12511	139.36	123.73	1019989	23374322	195462	0.1	7.33	7.14	102.7
212	Gilbert and Nejadi (2004)	S1-a	1601667	2373	<	3953	<	6810	58.0	124129167	103988	14491	12511	139.36	123.73	1019989	23374322	195462	1	7.40	9.53	77.6
213	Gilbert and Nejadi (2004)	S1-a	1601667	2373	<	3953	<	6810	58.0	124129167	103988	14491	12511	139.36	123.73	1019989	23374322	195462	2	8.21	10.50	78.2
214	Gilbert and Nejadi (2004)	S1-a	1601667	2373	<	3953	<	6810	58.0	124129167	103988	14491	12511	139.36	123.73	1019989	23374322	195462	3	8.38	10.90	76.9
215	Gilbert and Nejadi (2004)	S1-a	1601667	2373	<	3953	<	6810	58.0	124129167	103988	14491	12511	139.36	123.73	1019989	23374322	195462	4	8.54	11.20	76.3
216	Gilbert and Nejadi (2004)	S1-a	1601667	2373	<	3953	<	6810	58.0	124129167	103988	14491	12511	139.36	123.73	1019989	23374322	195462	5	8.62	11.60	74.3
217	Gilbert and Nejadi (2004)	S1-a	1601667	2373	<	3953	<	6810	58.0	124129167	103988	14491	12511	139.36	123.73	1019989	23374322	195462	6	9.06	12.10	74.9
218	Gilbert and Nejadi (2004)	S1-a	1601667	2373	<	3953	<	6810	58.0	124129167	103988	14491	12511	139.36	123.73	1019989	23374322	195462	7	9.71	12.90	75.3
219	Gilbert and Nejadi (2004)	S1-a	1601667	2373	<	3953	<	6810	58.0	124129167	103988	14491	12511	139.36	123.73	1019989	23374322	195462	8	10.16	13.00	78.2
220	Gilbert and Nejadi (2004)	S1-a	1601667	2373	<	3953	<	6810	58.0	124129167	103988	14491	12511	139.36	123.73	1019989	23374322	195462	10	10.26	14.00	73.3
221	Gilbert and Nejadi (2004)	S1-a	1601667	2373	<	3953	<	6810	58.0	124129167	103988	14491	12511	139.36	123.73	1019989	23374322	195462	11	10.45	14.00	74.6
222	Gilbert and Nejadi (2004)	S1-a	1601667	2373	<	3953	<	6810	58.0	124129167	103988	14491	12511	139.36	123.73	1019989	23374322	195462	13	10.54	14.10	74.8
223	Gilbert and Nejadi (2004)	S1-a	1601667	2373	<	3953	<	6810	58.0	124129167	103988	14491	12511	139.36	123.73	1019989	23374322	195462	16	11.28	14.90	75.7
224	Gilbert and Nejadi (2004)	S1-a	1601667	2373	<	3953	<	6810	58.0	124129167	103988	14491	12511	139.36	123.73	1019989	23374322	195462	18	11.79	15.40	76.6
225	Gilbert and Nejadi (2004)	S1-a	1601667	2373	<	3953	<	6810	58.0	124129167	103988	14491	12511	139.36	123.73	1019989	23374322	195462	20	12.14	15.50	78.3
226	Gilbert and Nejadi (2004)	S1-a	1601667	2373	<	3953	<	6810	58.0	124129167	103988	14491	12511	139.36	123.73	1019989	23374322	195462	23	12.57	16.40	76.6
227	Gilbert and Nejadi (2004)	S1-a	1601667	2373	<	3953	<	6810	58.0	124129167	103988	14491	12511	139.36	123.73	1019989	23374322	195462	25	12.80	16.60	77.1
228	Gilbert and Nejadi (2004)	S1-a	1601667	2373	<	3953	<	6810	58.0	124129167	103988	14491	12511	139.36	123.73	1019989	23374322	195462	28	12.91	16.60	77.8
229	Gilbert and Nejadi (2004)	S1-a	1601667	2373	<	3953	<	6810	58.0	124129167	103988	14491	12511	139.36	123.73	1019989	23374322	195462	31	12.91	16.90	76.4
230	Gilbert and Nejadi (2004)	S1-a	1601667	2373	<	3953	<	6810	58.0	124129167	103988	14491	12511	139.36	123.73	1019989	23374322	195462	34	13.12	16.80	78.1
231	Gilbert and Nejadi (2004)	S1-a	1601667	2373	<	3953	<	6810	58.0	124129167	103988	14491	12511	139.36	123.73	1019989	23374322	195462	39	13.51	17.40	77.6
232	Gilbert and Nejadi (2004)	S1-a	1601667	2373	<	3953	<	6810	58.0	124129167	103988	14491	12511	139.36	123.73	1019989	23374322	195462	47	13.92	18.30	76.1
233	Gilbert and Nejadi (2004)	S1-a	1601667	2373	<	3953	<	6810	58.0	124129167	103988	14491	12511	139.36	123.73	1019989	23374322	195462	54	14.50	18.60	78.0
234	Gilbert and Nejadi (2004)	S1-a	1601667	2373	<	3953	<	6810	58.0	124129167	103988	14491	12511	139.36	123.73	1019989	23374322	195462	62	14.80	18.70	79.1
235	Gilbert and Nejadi (2004)	S1-a	1601667	2373	<	3953	<	6810	58.0	124129167	103988	14491	12511	139.36	123.73	1019989	23374322	195462	73	15.06	19.20	78.4
236	Gilbert and Nejadi (2004)	S1-a	1601667	2373	<	3953	<	6810	58.0	124129167	103988	14491	12511	139.36	123.73	1019989	23374322	195462	82	15.16	19.20	79.0
237	Gilbert and Nejadi (2004)	S1-a	1601667	2373	<	3953	<	6810	58.0	124129167	103988	14491	12511	139.36	123.73	1019989	23374322	195462	95	15.27	19.20	79.5
238	Gilbert and Nejadi (2004)	S1-a	1601667	2373	<	3953	<	6810	58.0	124129167	103988	14491	12511	139.36	123.73	1019989	23374322	195462	108	15.91	19.60	81.2
239	Gilbert and Nejadi (2004)	S1-a	1601667	2373	<	3953	<	6810	58.0	124129167	103988	14491	12511	139.36	123.73	1019989	23374322	195462	122	16.21	20.40	79.5
240	Gilbert and Nejadi (2004)	S1-a	1601667	2373	<	3953	<	6810	58.0	124129167	103988	14491	12511	139.36	123.73	1019989	23374322	195462	152	16.72	21.50	77.8
241	Gilbert and Nejadi (2004)	S1-a	1601667	2373	<	3953	<	6810	58.0	124129167	103988	14491	12511	139.36	123.73	1019989	23374322	195462	186	16.91	22.30	75.8
242	Gilbert and Nejadi (2004)	S1-a	1601667	2373	<	3953	<	6810	58.0	124129167	103988	14491	12511	139.36	123.73	1019989	23374322	195462	228	17.60	23.50	74.9
243	Gilbert and Nejadi (2004)	S1-a	1601667	2373	<	3953	<	6810	58.0	124129167	103988	14491	12511	139.36	123.73	1019989	23374322	195462	272	18.01	24.20	74.4
244	Gilbert and Nejadi (2004)	S1-a	1601667	2373	<	3953	<	6810	58.0	124129167	103988	14491	12511	139.36	123.73	1019989	23374322	195462	318	18.50	25.00	74.0
245	Gilbert and Nejadi (2004)	S1-a	1601667	2373	<	3953	<	6810	58.0	124129167	103988	14491	12511	139.36	123.73	1019989	23374322	195462	380	18.94	25.10	75.5
246	Gilbert and Nejadi (2004)	S1-b	1601667	2373	<	3953	<	5280	74.9	124129167	103988	14491	12511	139.36	123.73	1019989	23374322	195462	0.1	3.69	2.72	135.7
247	Gilbert and Nejadi (2004)	S1-b	1601667	2373	<	3953	<	5280	74.9	124129167	103988	14491	12511	139.36	123.73	1019989	23374322	195462	1	3.72	4.78	77.8
248	Gilbert and Nejadi (2004)	S1-b	1601667	2373	<	3953	<	5280	74.9	124129167	103988	14491	12511	139.36	123.73	1019989	23374322	195462	2	4.13	5.66	73.0
249	Gilbert and Nejadi (2004)	S1-b	1601667	2373	<	3953	<	5280	74.9	124129167	103988	14491	12511	139.36	123.73	1019989	23374322	195462	3	4.24	6.05	70.1
250	Gilbert and Nejadi (2004)	S1-b	1601667	2373	<	3953	<	5280	74.9	124129167	103988	14491	12511	139.36	123.73	1019989	23374322	195462	4	4.32	6.25	69.1
251	Gilbert and Nejadi (2004)	S1-b	1601667	2373	<	3953	<	5280	74.9	124129167	103988	14491	12511	139.36	123.73	1019989	23374322	195462	5	4.37	6.58	66.4
252	Gilbert and Nejadi (2004)	S1-b	1601667	2373	<	3953	<	5280	74.9	124129167	103988	14491	12511	139.36	123.73	1019989	23374322	195462	6	4.60	6.99	65.8
253	Gilbert and Nejadi (2004)	S1-b	1601667	2373	<	3953	<	5280	74.9	124129167	103988	14491	12511	139.36	123.73	1019989	23374322	195462	7	4.94	7.72	64.0
254	Gilbert and Nejadi (2004)	S1-b	1601667	2373	<	3953	<	5280	74.9	124129167	103988	14491	12511	139.36	123.73	1019989	23374322	195462	8	5.18	8.08	64.1
255	Gilbert and Nejadi (2004)	S1-b	1601667	2373	<	3953	<	5280	74.9	124129167	103988	14491	12511	139.36	123.73	1019989	23374322	195462	10	5.25	8.76	59.9
256	Gilbert and Nejadi (2004)	S1-b	1601667	2373	<	3953	<	5280	74.9	124129167	103988	14491	12511	139.36	123.73	1019989	23374322	195462	11	5.35	8.76	61.1
257	Gilbert and Nejadi (2004)	S1-b	1601667	2373	<	3953	<	5280	74.9	124129167	103988	14491	12511	139.36	123.73	1019989	23374322	195462	13	5.40	8.89	60.7
258	Gilbert and Nejadi (2004)	S1-b	1601667	2373	<	3953	<	5280	74.9	124129167	103988	14491	12511	139.36	123.73	1019989	23374322	195462	16	5.80	9.47	61.2
259	Gilbert and Nejadi (2004)	S1-b	1601667	2373	<	3953	<	5280	74.9	124129167	103988	14491	12511	139.36	123.73	1019989	23374322	195462	18	6.08	9.86	61.7
260	Gilbert and Nejadi (2004)	S1-b	1601667	2373	<	3953	<	5280	74.9	124129167	103988	14491	12511	139.36	123.73	1019989	23374322	195462	20	6.27	10.20	61.5
261	Gilbert and Nejadi (2004)	S1-b	1601667	2373	<	3953	<	5280	74.9	124129167	103988	14491	12511	139.36	123.73	1019989	23374322	195462	23	6.51	10.80	60.3
262	Gilbert and Nejadi (2004)	S1-b	1601667	2373	<	3953	<	5280	74.9	124129167	103988	14491	12511	139.36	123.73	1019989	23374322	195462	25	6.63	10.90	60.8
263	Gilbert and Nejadi (2004)	S1-b	1601667	2373	<	3953	<	5280	74.9	124129167	103988	14491	12511	139.36	123.73	1019989	23374322	195462	28	6.68	10.90	61.3
264	Gilbert and Nejadi (2004)	S1-b	1601667	2373	<	3953	<	5280	74.9	124129167	103988	14491	12511	139.36	123.73	1019989	23374322	195462	31	6.69	11.20	59.7
265	Gilbert and Nejadi (2004)	S1-b	1601667	2373	<	3953	<	5280	74.9	124129167	103988	14491	12511	139.36	123.73	1019989	23374322	195462	34	6.80	11.10	61.3
266	Gilbert and Nejadi (2004)	S1-b	1601667	2373	<	3953	<	5280	74.9	124129167	103988	14491	12511	139.36	123.73	1019989	23374322	195462	39	7.02	11.60	60.5
267	Gilbert and Nejadi (2004)	S1-b	1601667	2373	<	3953	<	5280	74.9	124129167	103988	14491	12511	139.36	123.73	1019989	23374322	195462	47	7.26	12.40	58.5
268	Gilbert and Nejadi (2004)	S1-b	1601667	2373	<	3953	<	5280	74.9	124129167	103988	14491	12511	139.36	123.73	1019989	23374322	195462	54	7.58	12.60	60.2
269	Gilbert and Nejadi (2004)	S1-b	1601667	2373	<	3953	<	5280	74.9	124129167	103988	14491	12511	139.36	123.73	1019989	23374322	195462	62	7.74	12.70	60.9
270	Gilbert and Nejadi (2004)	S1-b	1601667	2373	<	3953	<	5280	74.9	124129167	103988	14491	12511	139.36	123.73	1019989	23374322	195462	73	7.89	13.50	58.4
271	Gilbert and Nejadi (2004)	S1-b	1601667	2373	<	3953	<	5280	74.9	124129167	103988	14491	12511	139.36	123.73	1019989	23374322	195462	82	7.95	13.50	58.9
272	Gilbert and Nejadi (2004)	S1-b	1601667	2373	<	3953	<	5280	74.9	124129167	103988	14491	12511	139.36	123.73	1019989	23374322	195462	95	8.05	14.40	55.9
273	Gilbert and Nejadi (2004)	S1-b	1601667	2373	<	3953	<	5280	74.9	124129167	103988	14491	12511	139.36	123.73	1019989	23374322	195462	108	8.41	14.90	56.4
274	Gilbert and Nejadi (2004)	S1-b	1601667	2373	<	3953	<	5280	74.9	124129167	103988	14491	12511	139.36	123.73	1019989	23374322	195462	122	8.56	15.50	55.2
275	Gilbert and Nejadi (2004)	S1-b	1601667	2373	<	3953	<	5280	74.9	124129167	103988	14491	12511	139.36	123.73	1019989	23374322	195462	152	8.83	16.50	53.5
276	Gilbert and Nejadi (2004)	S1-b	1601667	2373	<	3953	<	5280	74.9	124129167	103988	14491	12511	139.36	123.73	1019989	23374322	195462	186	8.94	17.20	52.0
277	Gilbert and Nejadi (2004)	S1-b	1601667	2373	<	3953	<	5280	74.9	124129167	103988	14491	12511	139.36	123.73	1019989	23374322	195462	228	9.29	18.40	50.5
278	Gilbert and Nejadi (2004)	S1-b	1601667	2373	<	3953	<	5280	74.9	124129167	103988	14491	12511	139.36	123.73	1019989	23374322	195462	272	9.51	19.00	50.1
279	Gilbert and Nejadi (2004)	S1-b	1601667	2373	<	3953	<	5280	74.9	124129167	103988	14491	12511	139.36	123.73	1019989	23374322	195462	318	9.76	19.80	49.3
280	Gilbert and Nejadi (2004)	S1-b	1601667	2373	<	3953	<	5280	74.9	124129167	103988	14491	12511	139.36	123.73	1019989	23374322	195462	380	9.99	19.90	50.2

	Study information		Cracking moment							Uncracked cross-section		Fully cracked cross-section							Deflection			
	1	2	3	4		5		6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	Author	Specimen	W_c (mm^3)	M_{SW} (Nm)		M_{cr} (Nm)		M_{max} (Nm)	M_{cr}/M_{max} (%)	I_c (mm^4)	S_c (mm^3)	A_{II}^* (mm^2)	A_{IIc} (mm^2)	$z_{IIc,1}$ (mm)	$z_{II,1}^*$ (mm)	I_{IIc} (mm^4)	I_{II}^* (mm^4)	S_{II}^* (mm^3)	t-t_0 (days)	$a_{num.int.}$ (mm)	a_{exp} (mm)	$a_{num.int.}/a_{exp}$ (%)
281	Gilbert and Nejadi (2004)	S2-a	1601667	2373	<	3953	<	9870	40.1	124129167	155982	17826	14856	136.43	117.86	1707810	32437971	275761	0.1	13.08	11.80	110.8
282	Gilbert and Nejadi (2004)	S2-a	1601667	2373	<	3953	<	9870	40.1	124129167	155982	17826	14856	136.43	117.86	1707810	32437971	275761	1	13.20	13.70	96.4
283	Gilbert and Nejadi (2004)	S2-a	1601667	2373	<	3953	<	9870	40.1	124129167	155982	17826	14856	136.43	117.86	1707810	32437971	275761	2	14.63	14.70	99.5
284	Gilbert and Nejadi (2004)	S2-a	1601667	2373	<	3953	<	9870	40.1	124129167	155982	17826	14856	136.43	117.86	1707810	32437971	275761	3	14.91	15.10	98.7
285	Gilbert and Nejadi (2004)	S2-a	1601667	2373	<	3953	<	9870	40.1	124129167	155982	17826	14856	136.43	117.86	1707810	32437971	275761	4	15.19	15.50	98.0
286	Gilbert and Nejadi (2004)	S2-a	1601667	2373	<	3953	<	9870	40.1	124129167	155982	17826	14856	136.43	117.86	1707810	32437971	275761	5	15.33	16.00	95.8
287	Gilbert and Nejadi (2004)	S2-a	1601667	2373	<	3953	<	9870	40.1	124129167	155982	17826	14856	136.43	117.86	1707810	32437971	275761	6	16.10	16.40	98.2
288	Gilbert and Nejadi (2004)	S2-a	1601667	2373	<	3953	<	9870	40.1	124129167	155982	17826	14856	136.43	117.86	1707810	32437971	275761	7	17.24	17.20	100.2
289	Gilbert and Nejadi (2004)	S2-a	1601667	2373	<	3953	<	9870	40.1	124129167	155982	17826	14856	136.43	117.86	1707810	32437971	275761	8	18.03	17.60	102.4
290	Gilbert and Nejadi (2004)	S2-a	1601667	2373	<	3953	<	9870	40.1	124129167	155982	17826	14856	136.43	117.86	1707810	32437971	275761	10	18.19	18.40	98.9
291	Gilbert and Nejadi (2004)	S2-a	1601667	2373	<	3953	<	9870	40.1	124129167	155982	17826	14856	136.43	117.86	1707810	32437971	275761	11	18.53	18.40	100.7
292	Gilbert and Nejadi (2004)	S2-a	1601667	2373	<	3953	<	9870	40.1	124129167	155982	17826	14856	136.43	117.86	1707810	32437971	275761	13	18.68	18.60	100.4
293	Gilbert and Nejadi (2004)	S2-a	1601667	2373	<	3953	<	9870	40.1	124129167	155982	17826	14856	136.43	117.86	1707810	32437971	275761	16	19.95	19.40	102.8
294	Gilbert and Nejadi (2004)	S2-a	1601667	2373	<	3953	<	9870	40.1	124129167	155982	17826	14856	136.43	117.86	1707810	32437971	275761	18	20.83	19.90	104.7
295	Gilbert and Nejadi (2004)	S2-a	1601667	2373	<	3953	<	9870	40.1	124129167	155982	17826	14856	136.43	117.86	1707810	32437971	275761	20	21.43	20.40	105.0
296	Gilbert and Nejadi (2004)	S2-a	1601667	2373	<	3953	<	9870	40.1	124129167	155982	17826	14856	136.43	117.86	1707810	32437971	275761	23	22.19	21.10	105.2
297	Gilbert and Nejadi (2004)	S2-a	1601667	2373	<	3953	<	9870	40.1	124129167	155982	17826	14856	136.43	117.86	1707810	32437971	275761	25	22.58	21.30	106.0
298	Gilbert and Nejadi (2004)	S2-a	1601667	2373	<	3953	<	9870	40.1	124129167	155982	17826	14856	136.43	117.86	1707810	32437971	275761	28	22.77	21.30	106.9
299	Gilbert and Nejadi (2004)	S2-a	1601667	2373	<	3953	<	9870	40.1	124129167	155982	17826	14856	136.43	117.86	1707810	32437971	275761	31	22.78	21.70	105.0
300	Gilbert and Nejadi (2004)	S2-a	1601667	2373	<	3953	<	9870	40.1	124129167	155982	17826	14856	136.43	117.86	1707810	32437971	275761	34	23.13	21.70	106.6
301	Gilbert and Nejadi (2004)	S2-a	1601667	2373	<	3953	<	9870	40.1	124129167	155982	17826	14856	136.43	117.86	1707810	32437971	275761	39	23.81	22.30	106.8
302	Gilbert and Nejadi (2004)	S2-a	1601667	2373	<	3953	<	9870	40.1	124129167	155982	17826	14856	136.43	117.86	1707810	32437971	275761	47	24.49	23.30	105.1
303	Gilbert and Nejadi (2004)	S2-a	1601667	2373	<	3953	<	9870	40.1	124129167	155982	17826	14856	136.43	117.86	1707810	32437971	275761	54	25.48	23.60	108.0
304	Gilbert and Nejadi (2004)	S2-a	1601667	2373	<	3953	<	9870	40.1	124129167	155982	17826	14856	136.43	117.86	1707810	32437971	275761	62	26.02	23.80	109.3
305	Gilbert and Nejadi (2004)	S2-a	1601667	2373	<	3953	<	9870	40.1	124129167	155982	17826	14856	136.43	117.86	1707810	32437971	275761	73	26.45	24.80	106.7
306	Gilbert and Nejadi (2004)	S2-a	1601667	2373	<	3953	<	9870	40.1	124129167	155982	17826	14856	136.43	117.86	1707810	32437971	275761	82	26.61	24.80	107.3
307	Gilbert and Nejadi (2004)	S2-a	1601667	2373	<	3953	<	9870	40.1	124129167	155982	17826	14856	136.43	117.86	1707810	32437971	275761	95	26.76	25.90	103.3
308	Gilbert and Nejadi (2004)	S2-a	1601667	2373	<	3953	<	9870	40.1	124129167	155982	17826	14856	136.43	117.86	1707810	32437971	275761	108	27.86	26.60	104.7
309	Gilbert and Nejadi (2004)	S2-a	1601667	2373	<	3953	<	9870	40.1	124129167	155982	17826	14856	136.43	117.86	1707810	32437971	275761	122	28.39	27.30	104.0
310	Gilbert and Nejadi (2004)	S2-a	1601667	2373	<	3953	<	9870	40.1	124129167	155982	17826	14856	136.43	117.86	1707810	32437971	275761	152	29.26	28.40	103.0
311	Gilbert and Nejadi (2004)	S2-a	1601667	2373	<	3953	<	9870	40.1	124129167	155982	17826	14856	136.43	117.86	1707810	32437971	275761	186	29.60	29.30	101.0
312	Gilbert and Nejadi (2004)	S2-a	1601667	2373	<	3953	<	9870	40.1	124129167	155982	17826	14856	136.43	117.86	1707810	32437971	275761	228	30.83	30.60	100.8
313	Gilbert and Nejadi (2004)	S2-a	1601667	2373	<	3953	<	9870	40.1	124129167	155982	17826	14856	136.43	117.86	1707810	32437971	275761	272	31.55	32.10	98.3
314	Gilbert and Nejadi (2004)	S2-a	1601667	2373	<	3953	<	9870	40.1	124129167	155982	17826	14856	136.43	117.86	1707810	32437971	275761	318	32.40	32.10	100.9
315	Gilbert and Nejadi (2004)	S2-a	1601667	2373	<	3953	<	9870	40.1	124129167	155982	17826	14856	136.43	117.86	1707810	32437971	275761	380	33.18	32.50	102.1
316	Gilbert and Nejadi (2004)	S2-b	1601667	2373	<	3953	<	6810	58.0	124129167	155982	17826	14856	136.43	117.86	1707810	32437971	275761	0.1	6.45	4.43	145.6
317	Gilbert and Nejadi (2004)	S2-b	1601667	2373	<	3953	<	6810	58.0	124129167	155982	17826	14856	136.43	117.86	1707810	32437971	275761	1	6.51	5.99	108.7
318	Gilbert and Nejadi (2004)	S2-b	1601667	2373	<	3953	<	6810	58.0	124129167	155982	17826	14856	136.43	117.86	1707810	32437971	275761	2	7.23	6.83	105.9
319	Gilbert and Nejadi (2004)	S2-b	1601667	2373	<	3953	<	6810	58.0	124129167	155982	17826	14856	136.43	117.86	1707810	32437971	275761	3	7.39	7.18	102.9
320	Gilbert and Nejadi (2004)	S2-b	1601667	2373	<	3953	<	6810	58.0	124129167	155982	17826	14856	136.43	117.86	1707810	32437971	275761	4	7.53	7.42	101.5
321	Gilbert and Nejadi (2004)	S2-b	1601667	2373	<	3953	<	6810	58.0	124129167	155982	17826	14856	136.43	117.86	1707810	32437971	275761	5	7.61	7.80	97.6
322	Gilbert and Nejadi (2004)	S2-b	1601667	2373	<	3953	<	6810	58.0	124129167	155982	17826	14856	136.43	117.86	1707810	32437971	275761	6	7.99	8.16	97.9
323	Gilbert and Nejadi (2004)	S2-b	1601667	2373	<	3953	<	6810	58.0	124129167	155982	17826	14856	136.43	117.86	1707810	32437971	275761	7	8.58	8.43	101.8
324	Gilbert and Nejadi (2004)	S2-b	1601667	2373	<	3953	<	6810	58.0	124129167	155982	17826	14856	136.43	117.86	1707810	32437971	275761	8	8.98	9.26	97.0
325	Gilbert and Nejadi (2004)	S2-b	1601667	2373	<	3953	<	6810	58.0	124129167	155982	17826	14856	136.43	117.86	1707810	32437971	275761	10	9.08	10.00	90.8
326	Gilbert and Nejadi (2004)	S2-b	1601667	2373	<	3953	<	6810	58.0	124129167	155982	17826	14856	136.43	117.86	1707810	32437971	275761	11	9.25	10.00	92.5
327	Gilbert and Nejadi (2004)	S2-b	1601667	2373	<	3953	<	6810	58.0	124129167	155982	17826	14856	136.43	117.86	1707810	32437971	275761	13	9.34	10.20	91.6
328	Gilbert and Nejadi (2004)	S2-b	1601667	2373	<	3953	<	6810	58.0	124129167	155982	17826	14856	136.43	117.86	1707810	32437971	275761	16	10.00	10.80	92.6
329	Gilbert and Nejadi (2004)	S2-b	1601667	2373	<	3953	<	6810	58.0	124129167	155982	17826	14856	136.43	117.86	1707810	32437971	275761	18	10.46	11.30	92.6
330	Gilbert and Nejadi (2004)	S2-b	1601667	2373	<	3953	<	6810	58.0	124129167	155982	17826	14856	136.43	117.86	1707810	32437971	275761	20	10.77	11.70	92.1
331	Gilbert and Nejadi (2004)	S2-b	1601667	2373	<	3953	<	6810	58.0	124129167	155982	17826	14856	136.43	117.86	1707810	32437971	275761	23	11.17	12.30	90.8
332	Gilbert and Nejadi (2004)	S2-b	1601667	2373	<	3953	<	6810	58.0	124129167	155982	17826	14856	136.43	117.86	1707810	32437971	275761	25	11.37	12.40	91.7
333	Gilbert and Nejadi (2004)	S2-b	1601667	2373	<	3953	<	6810	58.0	124129167	155982	17826	14856	136.43	117.86	1707810	32437971	275761	28	11.46	12.50	91.7
334	Gilbert and Nejadi (2004)	S2-b	1601667	2373	<	3953	<	6810	58.0	124129167	155982	17826	14856	136.43	117.86	1707810	32437971	275761	31	11.47	12.70	90.3
335	Gilbert and Nejadi (2004)	S2-b	1601667	2373	<	3953	<	6810	58.0	124129167	155982	17826	14856	136.43	117.86	1707810	32437971	275761	34	11.66	12.70	91.8
336	Gilbert and Nejadi (2004)	S2-b	1601667	2373	<	3953	<	6810	58.0	124129167	155982	17826	14856	136.43	117.86	1707810	32437971	275761	39	12.02	13.20	91.1
337	Gilbert and Nejadi (2004)	S2-b	1601667	2373	<	3953	<	6810	58.0	124129167	155982	17826	14856	136.43	117.86	1707810	32437971	275761	47	12.40	14.10	87.9
338	Gilbert and Nejadi (2004)	S2-b	1601667	2373	<	3953	<	6810	58.0	124129167	155982	17826	14856	136.43	117.86	1707810	32437971	275761	54	12.91	14.30	90.3
339	Gilbert and Nejadi (2004)	S2-b	1601667	2373	<	3953	<	6810	58.0	124129167	155982	17826	14856	136.43	117.86	1707810	32437971	275761	62	13.19	14.70	89.7
340	Gilbert and Nejadi (2004)	S2-b	1601667	2373	<	3953	<	6810	58.0	124129167	155982	17826	14856	136.43	117.86	1707810	32437971	275761	73	13.42	15.50	86.6
341	Gilbert and Nejadi (2004)	S2-b	1601667	2373	<	3953	<	6810	58.0	124129167	155982	17826	14856	136.43	117.86	1707810	32437971	275761	82	13.52	15.50	87.2
342	Gilbert and Nejadi (2004)	S2-b	1601667	2373	<	3953	<	6810	58.0	124129167	155982	17826	14856	136.43	117.86	1707810	32437971	275761	95	13.64	16.20	84.2
343	Gilbert and Nejadi (2004)	S2-b	1601667	2373	<	3953	<	6810	58.0	124129167	155982	17826	14856	136.43	117.86	1707810	32437971	275761	108	14.22	16.90	84.1
344	Gilbert and Nejadi (2004)	S2-b	1601667	2373	<	3953	<	6810	58.0	124129167	155982	17826	14856	136.43	117.86	1707810	32437971	275761	122	14.49	17.50	82.8
345	Gilbert and Nejadi (2004)	S2-b	1601667	2373	<	3953	<	6810	58.0	124129167	155982	17826	14856	136.43	117.86	1707810	32437971	275761	152	14.94	18.50	80.8
346	Gilbert and Nejadi (2004)	S2-b	1601667	2373	<	3953	<	6810	58.0	124129167	155982	17826	14856	136.43	117.86	1707810	32437971	275761	186	15.11	19.20	78.7
347	Gilbert and Nejadi (2004)	S2-b	1601667	2373	<	3953	<	6810	58.0	124129167	155982	17826	14856	136.43	117.86	1707810	32437971	275761	228	15.73	20.40	77.1
348	Gilbert and Nejadi (2004)	S2-b	1601667	2373	<	3953	<	6810	58.0	124129167	155982	17826	14856	136.43	117.86	1707810	32437971	275761	272	16.09	21.60	74.5
349	Gilbert and Nejadi (2004)	S2-b	1601667	2373	<	3953	<	6810	58.0	124129167	155982	17826	14856	136.43	117.86	1707810	32437971	275761	318	16.53	21.80	75.8
350	Gilbert and Nejadi (2004)	S2-b	1601667	2373	<	3953	<	6810	58.0	124129167	155982	17826	14856	136.43	117.86	1707810	32437971	275761	380	16.92	21.90	77.3

	Study information		Cracking moment							Uncracked cross-section		Fully cracked cross-section							Deflection			
	1	2	3	4		5		6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	Author	Specimen	W_c (mm^3)	M_{SW} (Nm)		M_{cr} (Nm)		M_{max} (Nm)	M_{cr}/M_{max} (%)	I_c (mm^4)	S_c (mm^3)	A_{II}^* (mm^2)	A_{IIc} (mm^2)	$z_{IIc,1}$ (mm)	$z_{II,1}^*$ (mm)	I_{IIc} (mm^4)	I_{II}^* (mm^4)	S_{II}^* (mm^3)	t-t_0 (days)	$a_{num.int.}$ (mm)	a_{exp} (mm)	$a_{num.int.}/a_{exp}$ (%)
351	Gilbert and Nejadi (2004)	S3-a	1601667	2373	<	3953	<	11350	34.8	124129167	207975	20673	16713	134.11	113.21	2431344	40540791	349269	0.1	13.54	10.70	126.5
352	Gilbert and Nejadi (2004)	S3-a	1601667	2373	<	3953	<	11350	34.8	124129167	207975	20673	16713	134.11	113.21	2431344	40540791	349269	1	13.67	13.00	105.2
353	Gilbert and Nejadi (2004)	S3-a	1601667	2373	<	3953	<	11350	34.8	124129167	207975	20673	16713	134.11	113.21	2431344	40540791	349269	2	15.15	14.00	108.2
354	Gilbert and Nejadi (2004)	S3-a	1601667	2373	<	3953	<	11350	34.8	124129167	207975	20673	16713	134.11	113.21	2431344	40540791	349269	3	15.45	14.50	106.6
355	Gilbert and Nejadi (2004)	S3-a	1601667	2373	<	3953	<	11350	34.8	124129167	207975	20673	16713	134.11	113.21	2431344	40540791	349269	4	15.74	14.70	107.1
356	Gilbert and Nejadi (2004)	S3-a	1601667	2373	<	3953	<	11350	34.8	124129167	207975	20673	16713	134.11	113.21	2431344	40540791	349269	5	15.88	15.20	104.5
357	Gilbert and Nejadi (2004)	S3-a	1601667	2373	<	3953	<	11350	34.8	124129167	207975	20673	16713	134.11	113.21	2431344	40540791	349269	6	16.69	15.70	106.3
358	Gilbert and Nejadi (2004)	S3-a	1601667	2373	<	3953	<	11350	34.8	124129167	207975	20673	16713	134.11	113.21	2431344	40540791	349269	7	17.87	16.50	108.3
359	Gilbert and Nejadi (2004)	S3-a	1601667	2373	<	3953	<	11350	34.8	124129167	207975	20673	16713	134.11	113.21	2431344	40540791	349269	8	18.69	16.90	110.6
360	Gilbert and Nejadi (2004)	S3-a	1601667	2373	<	3953	<	11350	34.8	124129167	207975	20673	16713	134.11	113.21	2431344	40540791	349269	10	18.86	17.60	107.2
361	Gilbert and Nejadi (2004)	S3-a	1601667	2373	<	3953	<	11350	34.8	124129167	207975	20673	16713	134.11	113.21	2431344	40540791	349269	11	19.20	17.70	108.5
362	Gilbert and Nejadi (2004)	S3-a	1601667	2373	<	3953	<	11350	34.8	124129167	207975	20673	16713	134.11	113.21	2431344	40540791	349269	13	19.36	17.90	108.2
363	Gilbert and Nejadi (2004)	S3-a	1601667	2373	<	3953	<	11350	34.8	124129167	207975	20673	16713	134.11	113.21	2431344	40540791	349269	16	20.68	18.70	110.6
364	Gilbert and Nejadi (2004)	S3-a	1601667	2373	<	3953	<	11350	34.8	124129167	207975	20673	16713	134.11	113.21	2431344	40540791	349269	18	21.60	19.20	112.5
365	Gilbert and Nejadi (2004)	S3-a	1601667	2373	<	3953	<	11350	34.8	124129167	207975	20673	16713	134.11	113.21	2431344	40540791	349269	20	22.23	19.70	112.8
366	Gilbert and Nejadi (2004)	S3-a	1601667	2373	<	3953	<	11350	34.8	124129167	207975	20673	16713	134.11	113.21	2431344	40540791	349269	23	23.01	20.40	112.8
367	Gilbert and Nejadi (2004)	S3-a	1601667	2373	<	3953	<	11350	34.8	124129167	207975	20673	16713	134.11	113.21	2431344	40540791	349269	25	23.42	20.60	113.7
368	Gilbert and Nejadi (2004)	S3-a	1601667	2373	<	3953	<	11350	34.8	124129167	207975	20673	16713	134.11	113.21	2431344	40540791	349269	28	23.62	20.70	114.1
369	Gilbert and Nejadi (2004)	S3-a	1601667	2373	<	3953	<	11350	34.8	124129167	207975	20673	16713	134.11	113.21	2431344	40540791	349269	31	23.63	21.00	112.5
370	Gilbert and Nejadi (2004)	S3-a	1601667	2373	<	3953	<	11350	34.8	124129167	207975	20673	16713	134.11	113.21	2431344	40540791	349269	34	23.99	21.00	114.2
371	Gilbert and Nejadi (2004)	S3-a	1601667	2373	<	3953	<	11350	34.8	124129167	207975	20673	16713	134.11	113.21	2431344	40540791	349269	39	24.70	21.60	114.4
372	Gilbert and Nejadi (2004)	S3-a	1601667	2373	<	3953	<	11350	34.8	124129167	207975	20673	16713	134.11	113.21	2431344	40540791	349269	47	25.41	22.50	112.9
373	Gilbert and Nejadi (2004)	S3-a	1601667	2373	<	3953	<	11350	34.8	124129167	207975	20673	16713	134.11	113.21	2431344	40540791	349269	54	26.44	22.90	115.5
374	Gilbert and Nejadi (2004)	S3-a	1601667	2373	<	3953	<	11350	34.8	124129167	207975	20673	16713	134.11	113.21	2431344	40540791	349269	62	27.00	23.20	116.4
375	Gilbert and Nejadi (2004)	S3-a	1601667	2373	<	3953	<	11350	34.8	124129167	207975	20673	16713	134.11	113.21	2431344	40540791	349269	73	27.44	24.20	113.4
376	Gilbert and Nejadi (2004)	S3-a	1601667	2373	<	3953	<	11350	34.8	124129167	207975	20673	16713	134.11	113.21	2431344	40540791	349269	82	27.61	24.10	114.6
377	Gilbert and Nejadi (2004)	S3-a	1601667	2373	<	3953	<	11350	34.8	124129167	207975	20673	16713	134.11	113.21	2431344	40540791	349269	95	27.77	25.10	110.6
378	Gilbert and Nejadi (2004)	S3-a	1601667	2373	<	3953	<	11350	34.8	124129167	207975	20673	16713	134.11	113.21	2431344	40540791	349269	108	28.92	25.70	112.5
379	Gilbert and Nejadi (2004)	S3-a	1601667	2373	<	3953	<	11350	34.8	124129167	207975	20673	16713	134.11	113.21	2431344	40540791	349269	122	29.47	26.50	111.2
380	Gilbert and Nejadi (2004)	S3-a	1601667	2373	<	3953	<	11350	34.8	124129167	207975	20673	16713	134.11	113.21	2431344	40540791	349269	152	30.38	27.60	110.1
381	Gilbert and Nejadi (2004)	S3-a	1601667	2373	<	3953	<	11350	34.8	124129167	207975	20673	16713	134.11	113.21	2431344	40540791	349269	186	30.72	27.90	110.1
382	Gilbert and Nejadi (2004)	S3-a	1601667	2373	<	3953	<	11350	34.8	124129167	207975	20673	16713	134.11	113.21	2431344	40540791	349269	228	32.00	28.80	111.1
383	Gilbert and Nejadi (2004)	S3-a	1601667	2373	<	3953	<	11350	34.8	124129167	207975	20673	16713	134.11	113.21	2431344	40540791	349269	272	32.74	29.10	112.5
384	Gilbert and Nejadi (2004)	S3-a	1601667	2373	<	3953	<	11350	34.8	124129167	207975	20673	16713	134.11	113.21	2431344	40540791	349269	318	33.63	29.60	113.6
385	Gilbert and Nejadi (2004)	S3-a	1601667	2373	<	3953	<	11350	34.8	124129167	207975	20673	16713	134.11	113.21	2431344	40540791	349269	380	34.44	29.80	115.6
386	Gilbert and Nejadi (2004)	S3-b	1601667	2373	<	3953	<	8340	47.4	124129167	207975	20673	16713	134.11	113.21	2431344	40540791	349269	0.1	8.50	5.04	168.7
387	Gilbert and Nejadi (2004)	S3-b	1601667	2373	<	3953	<	8340	47.4	124129167	207975	20673	16713	134.11	113.21	2431344	40540791	349269	1	8.57	6.98	122.8
388	Gilbert and Nejadi (2004)	S3-b	1601667	2373	<	3953	<	8340	47.4	124129167	207975	20673	16713	134.11	113.21	2431344	40540791	349269	2	9.51	7.80	121.9
389	Gilbert and Nejadi (2004)	S3-b	1601667	2373	<	3953	<	8340	47.4	124129167	207975	20673	16713	134.11	113.21	2431344	40540791	349269	3	9.71	8.18	118.7
390	Gilbert and Nejadi (2004)	S3-b	1601667	2373	<	3953	<	8340	47.4	124129167	207975	20673	16713	134.11	113.21	2431344	40540791	349269	4	9.90	8.42	117.6
391	Gilbert and Nejadi (2004)	S3-b	1601667	2373	<	3953	<	8340	47.4	124129167	207975	20673	16713	134.11	113.21	2431344	40540791	349269	5	10.00	8.80	113.6
392	Gilbert and Nejadi (2004)	S3-b	1601667	2373	<	3953	<	8340	47.4	124129167	207975	20673	16713	134.11	113.21	2431344	40540791	349269	6	10.50	9.23	113.8
393	Gilbert and Nejadi (2004)	S3-b	1601667	2373	<	3953	<	8340	47.4	124129167	207975	20673	16713	134.11	113.21	2431344	40540791	349269	7	11.26	9.87	114.1
394	Gilbert and Nejadi (2004)	S3-b	1601667	2373	<	3953	<	8340	47.4	124129167	207975	20673	16713	134.11	113.21	2431344	40540791	349269	8	11.79	10.23	115.2
395	Gilbert and Nejadi (2004)	S3-b	1601667	2373	<	3953	<	8340	47.4	124129167	207975	20673	16713	134.11	113.21	2431344	40540791	349269	10	11.91	10.87	109.6
396	Gilbert and Nejadi (2004)	S3-b	1601667	2373	<	3953	<	8340	47.4	124129167	207975	20673	16713	134.11	113.21	2431344	40540791	349269	11	12.13	10.89	111.4
397	Gilbert and Nejadi (2004)	S3-b	1601667	2373	<	3953	<	8340	47.4	124129167	207975	20673	16713	134.11	113.21	2431344	40540791	349269	13	12.24	11.03	111.0
398	Gilbert and Nejadi (2004)	S3-b	1601667	2373	<	3953	<	8340	47.4	124129167	207975	20673	16713	134.11	113.21	2431344	40540791	349269	16	13.09	11.71	111.8
399	Gilbert and Nejadi (2004)	S3-b	1601667	2373	<	3953	<	8340	47.4	124129167	207975	20673	16713	134.11	113.21	2431344	40540791	349269	18	13.69	12.14	112.8
400	Gilbert and Nejadi (2004)	S3-b	1601667	2373	<	3953	<	8340	47.4	124129167	207975	20673	16713	134.11	113.21	2431344	40540791	349269	20	14.10	12.53	112.5
401	Gilbert and Nejadi (2004)	S3-b	1601667	2373	<	3953	<	8340	47.4	124129167	207975	20673	16713	134.11	113.21	2431344	40540791	349269	23	14.61	13.11	111.4
402	Gilbert and Nejadi (2004)	S3-b	1601667	2373	<	3953	<	8340	47.4	124129167	207975	20673	16713	134.11	113.21	2431344	40540791	349269	25	14.87	13.27	112.1
403	Gilbert and Nejadi (2004)	S3-b	1601667	2373	<	3953	<	8340	47.4	124129167	207975	20673	16713	134.11	113.21	2431344	40540791	349269	28	14.99	13.32	112.5
404	Gilbert and Nejadi (2004)	S3-b	1601667	2373	<	3953	<	8340	47.4	124129167	207975	20673	16713	134.11	113.21	2431344	40540791	349269	31	15.00	13.58	110.5
405	Gilbert and Nejadi (2004)	S3-b	1601667	2373	<	3953	<	8340	47.4	124129167	207975	20673	16713	134.11	113.21	2431344	40540791	349269	34	15.24	13.59	112.1
406	Gilbert and Nejadi (2004)	S3-b	1601667	2373	<	3953	<	8340	47.4	124129167	207975	20673	16713	134.11	113.21	2431344	40540791	349269	39	15.70	14.12	111.2
407	Gilbert and Nejadi (2004)	S3-b	1601667	2373	<	3953	<	8340	47.4	124129167	207975	20673	16713	134.11	113.21	2431344	40540791	349269	47	16.19	14.92	108.5
408	Gilbert and Nejadi (2004)	S3-b	1601667	2373	<	3953	<	8340	47.4	124129167	207975	20673	16713	134.11	113.21	2431344	40540791	349269	54	16.86	15.22	110.8
409	Gilbert and Nejadi (2004)	S3-b	1601667	2373	<	3953	<	8340	47.4	124129167	207975	20673	16713	134.11	113.21	2431344	40540791	349269	62	17.21	15.38	111.9
410	Gilbert and Nejadi (2004)	S3-b	1601667	2373	<	3953	<	8340	47.4	124129167	207975	20673	16713	134.11	113.21	2431344	40540791	349269	73	17.51	16.19	108.2
411	Gilbert and Nejadi (2004)	S3-b	1601667	2373	<	3953	<	8340	47.4	124129167	207975	20673	16713	134.11	113.21	2431344	40540791	349269	82	17.63	16.20	108.8
412	Gilbert and Nejadi (2004)	S3-b	1601667	2373	<	3953	<	8340	47.4	124129167	207975	20673	16713	134.11	113.21	2431344	40540791	349269	95	17.77	17.06	104.2
413	Gilbert and Nejadi (2004)	S3-b	1601667	2373	<	3953	<	8340	47.4	124129167	207975	20673	16713	134.11	113.21	2431344	40540791	349269	108	18.52	17.64	105.0
414	Gilbert and Nejadi (2004)	S3-b	1601667	2373	<	3953	<	8340	47.4	124129167	207975	20673	16713	134.11	113.21	2431344	40540791	349269	122	18.87	18.30	103.1
415	Gilbert and Nejadi (2004)	S3-b	1601667	2373	<	3953	<	8340	47.4	124129167	207975	20673	16713	134.11	113.21	2431344	40540791	349269	152	19.46	19.30	100.8
416	Gilbert and Nejadi (2004)	S3-b	1601667	2373	<	3953	<	8340	47.4	124129167	207975	20673	16713	134.11	113.21	2431344	40540791	349269	186	19.68	20.06	98.1
417	Gilbert and Nejadi (2004)	S3-b	1601667	2373	<	3953	<	8340	47.4	124129167	207975	20673	16713	134.11	113.21	2431344	40540791	349269	228	20.48	21.24	96.4
418	Gilbert and Nejadi (2004)	S3-b	1601667	2373	<	3953	<	8340	47.4	124129167	207975	20673	16713	134.11	113.21	2431344	40540791	349269	272	20.96	21.94	95.5
419	Gilbert and Nejadi (2004)	S3-b	1601667	2373	<	3953	<	8340	47.4	124129167	207975	20673	16713	134.11	113.21	2431344	40540791	349269	318	21.53	22.44	95.9
420	Gilbert and Nejadi (2004)	S3-b	1601667	2373	<	3953	<	8340	47.4	124129167	207975	20673	16713	134.11	113.21	2431344	40540791	349269	380	22.04	22.90	96.2

Assessment and Correction of ACI model:

Calculation of Deflections by Numerical Integration – Example

$E_c(t_0)$ = 22820 MPa

I_c = 818833333 mm^4

I_{II}^* = 213089556 mm^4

M_{L1} = 3254 Nm
M_{L2} = 21646 Nm
ε_{cs} = 0.825 ‰
ϕ = 1.713
K_{L1} = 0.104
K_{L2} = 0.107
A_{sh} = 0.1225
ρ' = 0
bars = deformed

M_{cr} = 11887 Nm
h = 340 mm
L = 3500 mm

m = 3

Fraction of span	M_{L1} (Nm)	M_{L2} (Nm)	M (Nm)	I_e (mm^4)	$(1/r_L)\cdot 10^6$	Uncorrected rotation	Uncorrected deflection	Correction	Shrinkage deflection	Final deflection
0.00	0.00	0.00	0.00	**0.0000**	0.0000	0.00	0.00	0.00	0.00	0.00
0.02	255.11	1311.88	1566.99	818833333	0.0839	0.003	0.00	0.27	0.04	0.69
0.04	499.81	2623.76	3123.57	818833333	0.1672	0.012	0.00	0.53	0.07	1.37
0.06	734.10	3935.64	4669.74	818833333	0.2499	0.026	0.00	0.80	0.10	2.05
0.08	957.98	5247.52	6205.49	818833333	0.3321	0.047	0.00	1.06	0.13	2.73
0.10	1171.44	6559.39	7730.83	818833333	0.4137	0.073	0.01	1.33	0.16	3.40
0.12	1374.49	7871.27	9245.76	818833333	0.4948	0.105	0.01	1.59	0.19	4.07
0.14	1567.13	9183.15	10750.28	818833333	0.5753	0.142	0.02	1.86	0.22	4.73
0.16	1749.35	10495.03	12244.38	767326251	0.6993	0.187	0.04	2.12	0.24	5.38
0.18	1921.16	11806.91	13728.07	606347250	0.9921	0.246	0.05	2.39	0.27	6.02
0.20	2082.56	13118.79	15201.35	502730168	1.3250	0.327	0.07	2.66	0.29	6.64
0.22	2233.55	14430.67	16664.21	432952168	1.6867	0.432	0.10	2.92	0.31	7.25
0.24	2374.12	15742.55	18116.66	384197854	2.0664	0.564	0.13	3.19	0.33	7.84
0.26	2504.28	17054.42	19558.70	349072869	2.4553	0.722	0.18	3.45	0.35	8.40
0.28	2624.03	18366.30	20990.33	323103576	2.8468	0.908	0.23	3.72	0.37	8.93
0.30	2733.36	19678.18	22411.54	303473345	3.2362	1.120	0.30	3.98	0.38	9.42
0.32	2832.28	20990.06	23822.34	288347504	3.6204	1.360	0.39	4.25	0.40	9.87
0.34	2920.79	21646.00	24566.79	281711100	3.8215	1.621	0.50	4.52	0.41	10.28
0.36	2998.89	21646.00	24644.89	281060811	3.8425	1.889	0.62	4.78	0.42	10.64
0.38	3066.57	21646.00	24712.57	280503857	3.8607	2.159	0.76	5.05	0.43	10.96
0.40	3123.84	21646.00	24769.84	280037331	3.8761	2.430	0.92	5.31	0.44	11.22
0.42	3170.70	21646.00	24816.70	279658824	3.8887	2.701	1.10	5.58	0.44	11.44
0.44	3207.14	21646.00	24853.14	279366401	3.8984	2.974	1.30	5.84	0.45	11.61
0.46	3233.17	21646.00	24879.17	279158575	3.9054	3.247	1.52	6.11	0.45	11.73
0.48	3248.79	21646.00	24894.79	279034296	3.9096	3.521	1.75	6.37	0.45	11.80
0.50	**3254.00**	**21646.00**	**24900.00**	**278992939**	**3.9110**	**3.794**	**2.01**	**6.64**	**0.46**	**11.83**
0.52	3248.79	21646.00	24894.79	279034296	3.9096	4.068	2.28	6.91	0.45	11.80
0.54	3233.17	21646.00	24879.17	279158575	3.9054	4.341	2.58	7.17	0.45	11.73
0.56	3207.14	21646.00	24853.14	279366401	3.8984	4.615	2.89	7.44	0.45	11.61
0.58	3170.70	21646.00	24816.70	279658824	3.8887	4.887	3.23	7.70	0.44	11.44
0.60	3123.84	21646.00	24769.84	280037331	3.8761	5.159	3.58	7.97	0.44	11.22
0.62	3066.57	21646.00	24712.57	280503857	3.8607	5.430	3.95	8.23	0.43	10.96
0.64	2998.89	21646.00	24644.89	281060811	3.8425	5.699	4.34	8.50	0.42	10.64
0.66	2920.79	21646.00	24566.79	281711100	3.8215	5.968	4.75	8.76	0.41	10.28
0.68	2832.28	20990.06	23822.34	288347504	3.6204	6.228	5.17	9.03	0.40	9.87
0.70	2733.36	19678.18	22411.54	303473345	3.2362	6.468	5.62	9.30	0.38	9.42
0.72	2624.03	18366.30	20990.33	323103576	2.8468	6.681	6.08	9.56	0.37	8.93
0.74	2504.28	17054.42	19558.70	349072869	2.4553	6.866	6.55	9.83	0.35	8.40
0.76	2374.12	15742.55	18116.66	384197854	2.0664	7.025	7.04	10.09	0.33	7.84
0.78	2233.55	14430.67	16664.21	432952168	1.6867	7.156	7.53	10.36	0.31	7.25
0.80	2082.56	13118.79	15201.35	502730168	1.3250	7.262	8.04	10.62	0.29	6.64
0.82	1921.16	11806.91	13728.07	606347250	0.9921	7.343	8.55	10.89	0.27	6.02
0.84	1749.35	10495.03	12244.38	767326251	0.6993	7.402	9.07	11.16	0.24	5.38
0.86	1567.13	9183.15	10750.28	818833333	0.5753	7.446	9.59	11.42	0.22	4.73
0.88	1374.49	7871.27	9245.76	818833333	0.4948	7.484	10.11	11.69	0.19	4.07
0.90	1171.44	6559.39	7730.83	818833333	0.4137	7.516	10.63	11.95	0.16	3.40
0.92	957.98	5247.52	6205.49	818833333	0.3321	7.542	11.16	12.22	0.13	2.73
0.94	734.10	3935.64	4669.74	818833333	0.2499	7.562	11.69	12.48	0.10	2.05
0.96	499.81	2623.76	3123.57	818833333	0.1672	7.577	12.22	12.75	0.07	1.37
0.98	255.11	1311.88	1566.99	818833333	0.0839	7.586	12.75	13.01	0.04	0.69
1.00	0.00	0.00	0.00	**0.0000**	0.0000	7.588	13.28	13.28	0.00	0.00

Assessment and Correction of ACI model:
Database

		Study information		Cross-section					Reinforcement																			Loading					Deflection	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
		Author	Specimen	b (mm)	h (mm)	A_{s1} (mm^2)	d (mm)	ρ_1 (%)	A_{s2} (mm^2)	d' (mm)	d_2 (mm)	ρ_2 (%)	type	RH (%)	T (ºC)	t_{test} (days)	$f_{cm}(t_{test})$ (MPa)	f_{cm} (MPa)	$f_{cm}(t_0)$ (MPa)	f_r (t_0) (MPa)	$f_{r,red}$ (t_0) (MPa)	$E_{cm}(t_0)$ (MPa)	E_s (MPa)	φ (–)	ε_{cs} (‰)	L (mm)	L/d	M_{L1} (Nm)	K_{L1}	M_{L2} (Nm)	K_{L2}	a (t-t_0) (mm)	t_0 (days)	t-t_0 (days)
1	0	Washa and Fluck [8]	A1/A4	203.2	304.8	852	257.2	1.63	852	257.2	47.6	1.63	deformed	50	21	14	25.00	28.39	25.00	3.10	2.07	25000	200000	0.000	0.000	6096	23.7	7192	0.104	18442	0.104	13.46	14	0
2	t	Washa and Fluck [8]	A1/A4	203.2	304.8	852	257.2	1.63	852	257.2	47.6	1.63	deformed	50	21	14	25.00	28.39	25.00	3.10	2.07	25000	200000	1.643	0.608	6096	23.7	7192	0.104	18442	0.104	23.62	14	913
3	0	Washa and Fluck [8]	A2/A5	203.2	304.8	852	257.2	1.63	400	258.7	46.1	0.77	deformed	50	21	14	25.00	28.39	25.00	3.10	2.07	25000	200000	0.000	0.000	6096	23.7	7192	0.104	18442	0.104	15.75	14	0
4	t	Washa and Fluck [8]	A2/A5	203.2	304.8	852	257.2	1.63	400	258.7	46.1	0.77	deformed	50	21	14	25.00	28.39	25.00	3.10	2.07	25000	200000	1.643	0.608	6096	23.7	7192	0.104	18442	0.104	32.26	14	913
5	0	Washa and Fluck [8]	A3/A6	203.2	304.8	852	257.2	1.63	0	0	0	0.00	deformed	50	21	14	25.00	28.39	25.00	3.10	2.07	25000	200000	0.000	0.000	6096	23.7	7192	0.104	18442	0.104	17.02	14	0
6	t	Washa and Fluck [8]	A3/A6	203.2	304.8	852	257.2	1.63	0	0	0	0.00	deformed	50	21	14	25.00	28.39	25.00	3.10	2.07	25000	200000	1.643	0.608	6096	23.7	7192	0.104	18442	0.104	44.70	14	913
7	0	Washa and Fluck [8]	B1/B4	152.4	203.2	400	157.2	1.67	400	157.2	46	1.67	deformed	50	21	14	20.80	23.62	20.80	2.83	1.89	22804	200000	0.000	0.000	6096	38.8	3596	0.104	3663	0.104	23.37	14	0
8	t	Washa and Fluck [8]	B1/B4	152.4	203.2	400	157.2	1.67	400	157.2	46	1.67	deformed	50	21	14	20.80	23.62	20.80	2.83	1.89	22804	200000	1.844	0.669	6096	38.8	3596	0.104	3663	0.104	51.05	14	913
9	0	Washa and Fluck [8]	B2/B5	152.4	203.2	400	157.2	1.67	200	157.2	46	0.84	deformed	50	21	14	20.80	23.62	20.80	2.83	1.89	22804	200000	0.000	0.000	6096	38.8	3596	0.104	3663	0.104	24.89	14	0
10	t	Washa and Fluck [8]	B2/B5	152.4	203.2	400	157.2	1.67	200	157.2	46	0.84	deformed	50	21	14	20.80	23.62	20.80	2.83	1.89	22804	200000	1.844	0.669	6096	38.8	3596	0.104	3663	0.104	65.02	14	913
11	0	Washa and Fluck [8]	B3/B6	152.4	203.2	400	157.2	1.67	0	0	0	0.00	deformed	50	21	14	20.80	23.62	20.80	2.83	1.89	22804	200000	0.000	0.000	6096	38.8	3596	0.104	3663	0.104	26.42	14	0
12	t	Washa and Fluck [8]	B3/B6	152.4	203.2	400	157.2	1.67	0	0	0	0.00	deformed	50	21	14	20.80	23.62	20.80	2.83	1.89	22804	200000	1.844	0.669	6096	38.8	3596	0.104	3663	0.104	86.36	14	913
13	0	Washa and Fluck [8]	D1/D4	304.8	127	516	101.6	1.67	516	101.6	25.4	1.67	deformed	50	21	14	22.10	25.10	22.10	2.91	1.94	23505	200000	0.000	0.000	3810	37.5	1756	0.104	4267	0.104	11.94	14	0
14	t	Washa and Fluck [8]	D1/D4	304.8	127	516	101.6	1.67	516	101.6	25.4	1.67	deformed	50	21	14	22.10	25.10	22.10	2.91	1.94	23505	200000	1.827	0.665	3810	37.5	1756	0.104	4267	0.104	27.69	14	913
15	0	Washa and Fluck [8]	D2/D5	304.8	127	516	101.6	1.67	258	101.6	25.4	0.83	deformed	50	21	14	22.10	25.10	22.10	2.91	1.94	23505	200000	0.000	0.000	3810	37.5	1756	0.104	4267	0.104	14.22	14	0
16	t	Washa and Fluck [8]	D2/D5	304.8	127	516	101.6	1.67	258	101.6	25.4	0.83	deformed	50	21	14	22.10	25.10	22.10	2.91	1.94	23505	200000	1.827	0.665	3810	37.5	1756	0.104	4267	0.104	33.78	14	913
17	0	Washa and Fluck [8]	D3/D6	304.8	127	516	101.6	1.67	0	0	0	0.00	deformed	50	21	14	22.10	25.10	22.10	2.91	1.94	23505	200000	0.000	0.000	3810	37.5	1756	0.104	4267	0.104	17.78	14	0
18	t	Washa and Fluck [8]	D3/D6	304.8	127	516	101.6	1.67	0	0	0	0.00	deformed	50	21	14	22.10	25.10	22.10	2.91	1.94	23505	200000	1.827	0.665	3810	37.5	1756	0.104	4267	0.104	48.51	14	913
19	0	P.C.A. [18]	40NA	152	305	849	254	2.20	0	0	0	0.00	deformed	50	21	28	26.90	26.71	26.90	3.22	2.15	25933	200000	0.000	0.000	3048	12.0	1346	0.104	22267	0.107	4.25	28	0
20	t	P.C.A. [18]	40NA	152	305	849	254	2.20	0	0	0	0.00	deformed	50	21	28	26.90	26.71	26.90	3.22	2.15	25933	200000	1.400	0.540	3048	12.0	1346	0.104	22267	0.107	10.00	28	242
21	0	P.C.A. [18]	60NA	152	305	1019	254	2.64	0	0	0	0.00	deformed	50	21	28	37.40	37.13	37.40	3.79	2.53	30578	200000	0.000	0.000	3048	12.0	1346	0.104	29641	0.107	4.90	28	0
22	t	P.C.A. [18]	60NA	152	305	1019	254	2.64	0	0	0	0.00	deformed	50	21	28	37.40	37.13	37.40	3.79	2.53	30578	200000	1.400	0.540	3048	12.0	1346	0.104	29641	0.107	9.90	28	242
23	0	Sattler [11]	a1/a2	100	160	100	134	0.75	0	0	0	0.00	deformed	55	21	32	26.70	26.03	26.70	3.20	2.13	25836	200000	0.000	0.000	4000	29.9	800	0.104	1962	0.104	15.83	32	0
24	t	Sattler [11]	a1/a2	100	160	100	134	0.75	0	0	0	0.00	deformed	55	21	32	26.70	26.03	26.70	3.20	2.13	25836	200000	1.258	0.461	4000	29.9	800	0.104	1962	0.104	32.21	32	84
25	0	Hajnal-Konyi [22]	8	127	190.5	142	160.3	0.70	0	0	0	0.00	deformed	82	21	35	37.00	35.68	38.55	3.85	2.57	31044	200000	0.000	0.000	6400	39.9	3097	0.104	1612	0.104	20.60	53	0
26	t	Hajnal-Konyi [22]	8	127	190.5	142	160.3	0.70	0	0	0	0.00	deformed	82	21	35	37.00	35.68	38.55	3.85	2.57	31044	200000	1.293	0.414	6400	39.9	3097	0.104	1612	0.104	65.40	53	1734
27	0	Hajnal-Konyi [22]	10	127	190.5	142	160.3	0.70	0	0	0	0.00	deformed	82	21	35	37.00	35.68	38.55	3.85	2.57	31044	200000	0.000	0.000	4800	29.9	1742	0.104	2967	0.104	8.80	53	0
28	t	Hajnal-Konyi [22]	10	127	190.5	142	160.3	0.70	0	0	0	0.00	deformed	82	21	35	37.00	35.68	38.55	3.85	2.57	31044	200000	1.293	0.414	4800	29.9	1742	0.104	2967	0.104	29.70	53	1734
29	0	Hajnal-Konyi [22]	12	127	190.5	142	160.3	0.70	0	0	0	0.00	deformed	82	21	35	37.00	35.68	38.55	3.85	2.57	31044	200000	0.000	0.000	3200	20.0	774	0.104	3935	0.104	4.30	53	0
30	t	Hajnal-Konyi [22]	12	127	190.5	142	160.3	0.70	0	0	0	0.00	deformed	82	21	35	37.00	35.68	38.55	3.85	2.57	31044	200000	1.293	0.414	3200	20.0	774	0.104	3935	0.104	14.00	53	1734
31	0	Branson and Metz [23]	SB3/B	101.6	127	214	101.6	2.07	0	0	0	0.00	deformed	50	21	28	35.40	35.15	35.40	3.69	2.46	29749	200000	0.000	0.000	2743	27.0	303	0.104	935	0.104	3.89	28	0
32	t	Branson and Metz [23]	SB3/B	101.6	127	214	101.6	2.07	0	0	0	0.00	deformed	50	21	28	35.40	35.15	35.40	3.69	2.46	29749	200000	1.216	0.445	2743	27.0	303	0.104	935	0.104	7.70	28	60
33	0	Branson and Metz [23]	SB3/M	101.6	127	214	101.6	2.07	0	0	0	0.00	deformed	50	21	28	31.30	31.08	31.30	3.47	2.31	27973	200000	0.000	0.000	2743	27.0	303	0.104	935	0.104	3.99	28	0
34	t	Branson and Metz [23]	SB3/M	101.6	127	214	101.6	2.07	0	0	0	0.00	deformed	50	21	28	31.30	31.08	31.30	3.47	2.31	27973	200000	1.216	0.445	2743	27.0	303	0.104	935	0.104	7.50	28	60
35	0	Pauw and Meyers [26]	R1	177.8	216	400	165.1	1.36	0	0	0	0.00	deformed	50	21	28	33.80	33.56	33.80	3.60	2.40	29069	200000	0.000	0.000	2286	13.8	627	0.104	7176	0.107	2.44	28	0
36	t	Pauw and Meyers [26]	R1	177.8	216	400	165.1	1.36	0	0	0	0.00	deformed	50	21	28	33.80	33.56	33.80	3.60	2.40	29069	200000	1.284	0.494	2286	13.8	627	0.104	7176	0.107	4.89	28	150
37	0	Pauw and Meyers [26]	R2	177.8	216	568	165.1	1.94	0	0	0	0.00	deformed	50	21	28	33.60	33.36	33.60	3.59	2.39	28983	200000	0.000	0.000	2286	13.8	627	0.104	11228	0.107	3.22	28	0
38	t	Pauw and Meyers [26]	R2	177.8	216	568	165.1	1.94	0	0	0	0.00	deformed	50	21	28	33.60	33.36	33.60	3.59	2.39	28983	200000	1.284	0.494	2286	13.8	627	0.104	11228	0.107	6.16	28	150
39	0	Pauw and Meyers [26]	R3	177.8	216	568	165.1	1.94	0	0	0	0.00	deformed	50	21	28	38.90	38.62	38.90	3.87	2.58	31185	200000	0.000	0.000	2286	13.8	627	0.104	9643	0.107	3.71	28	0
40	t	Pauw and Meyers [26]	R3	177.8	216	568	165.1	1.94	0	0	0	0.00	deformed	50	21	28	38.90	38.62	38.90	3.87	2.58	31185	200000	1.207	0.464	2286	13.8	627	0.104	9643	0.107	6.64	28	120
41	0	Pauw and Meyers [26]	R4	177.8	216	774	165.1	2.64	0	0	0	0.00	deformed	50	21	28	38.70	38.42	38.70	3.86	2.57	31105	200000	0.000	0.000	2286	13.8	627	0.104	14607	0.107	4.66	28	0
42	t	Pauw and Meyers [26]	R4	177.8	216	774	165.1	2.64	0	0	0	0.00	deformed	50	21	28	38.70	38.42	38.70	3.86	2.57	31105	200000	1.207	0.464	2286	13.8	627	0.104	14607	0.107	7.89	28	120
43	0	Lutz et al. [29]	SR	101.6	203.2	258	171.5	1.48	0	0	0	0.00	deformed	40	21	28	34.10	33.86	34.10	3.62	2.41	29198	200000	0.000	0.000	1829	10.7	216	0.104	7963	0.107	4.10	28	0
44	t	Lutz et al. [29]	SR	101.6	203.2	258	171.5	1.48	0	0	0	0.00	deformed	40	21	28	34.10	33.86	34.10	3.62	2.41	29198	200000	1.580	0.614	1829	10.7	216	0.104	7963	0.107	8.80	28	142
45	0	Lutz et al. [29]	DR	101.6	203.2	258	171.5	1.48	258	177.8	25.4	1.48	deformed	40	21	28	34.10	33.86	34.10	3.62	2.41	29198	200000	0.000	0.000	1829	10.7	216	0.104	7963	0.107	4.20	28	0
46	t	Lutz et al. [29]	DR	101.6	203.2	258	171.5	1.48	258	177.8	25.4	1.48	deformed	40	21	28	34.10	33.86	34.10	3.62	2.41	29198	200000	1.580	0.614	1829	10.7	216	0.104	7963	0.107	6.80	28	142
47	0	Jaccoud and Favre (1982)	A1	600	120	314	95	0.55	57	100	20	0.10	deformed	60	21	15	20.49	22.88	20.49	2.81	1.87	22633	200000	0.000	0.000	3100	32.6	2162	0.104	2787	0.104	8.42	15	0
48	t	Jaccoud and Favre (1982)	A1	600	120	314	95	0.55	57	100	20	0.10	deformed	60	21	15	20.49	22.88	20.49	2.81	1.87	22633	200000	1.498	0.511	3100	32.6	2162	0.104	2787	0.104	18.40	15	365
49	0	Jaccoud and Favre (1982)	A2	600	120	314	95	0.55	57	100	20	0.10	deformed	60	21	15	24.14	26.96	24.14	3.05	2.03	24566	200000	0.000	0.000	3100	32.6	2162	0.104	2787	0.104	6.16	15	0
50	t	Jaccoud and Favre (1982)	A2	600	120	314	95	0.55	57	100	20	0.10	deformed	60	21	15	24.14	26.96	24.14	3.05	2.03	24566	200000	1.498	0.511	3100	32.6	2162	0.104	2787	0.104	17.50	15	365
51	0	Jaccoud and Favre (1982)	A3	600	120	314	95	0.55	57	100	20	0.10	deformed	60	21	15	19.64	21.93	19.64	2.75	1.83	22159	200000	0.000	0.000	3100	32.6	2162	0.104	2787	0.104	8.12	15	0
52	t	Jaccoud and Favre (1982)	A3	600	120	314	95	0.55	57	100	20	0.10	deformed	60	21	15	19.64	21.93	19.64	2.75	1.83	22159	200000	1.498	0.511	3100	32.6	2162	0.104	2787	0.104	17.50	15	365
53	0	Jaccoud and Favre (1982)	A4	600	120	314	95	0.55	57	100	20	0.10	deformed	60	21	15	36.13	40.35	36.13	3.73	2.49	30054	200000	0.000	0.000	3100	32.6	2162	0.104	2787	0.104	2.24	15	0
54	t	Jaccoud and Favre (1982)	A4	600	120	314	95	0.55	57	100	20	0.10	deformed	60	21	15	36.13	40.35	36.13	3.73	2.49	30054	200000	1.498	0.511	3100	32.6	2162	0.104	2787	0.104	8.05	15	365
55	0	Jaccoud and Favre (1982)	A5	600	120	314	95	0.55	57	100	20	0.10	deformed	60	21	15	32.47	36.26	32.47	3.53	2.35	28491	200000	0.000	0.000	3100	32.6	2162	0.104	2787	0.104	3.12	15	0
56	t	Jaccoud and Favre (1982)	A5	600	120	314	95	0.55	57	100	20	0.10	deformed	60	21	15	32.47	36.26	32.47	3.53	2.35	28491	200000	1.498	0.511	3100	32.6	2162	0.104	2787	0.104	9.55	15	365
57	0	Jaccoud and Favre (1982)	C12	750	160	565	131	0.58	57	134	26	0.06	deformed	60	21	28	29.40	29.19	29.40	3.36	2.24	27111	200000	0.000	0.000	3100	23.7	3604	0.104	6095	0.107	2.17	28	0
58	t	Jaccoud and Favre (1982)	C12	750	160	565	131	0.58	57	134	26	0.06	deformed	60	21	28	29.40	29.19	29.40	3.36	2.24	27111	200000	1.297	0.480	3100	23.7	3604	0.104	6095	0.107	8.29	28	510
59	0	Jaccoud and Favre (1982)	C22	750	160	565	131	0.58	57	134	26	0.06	deformed	60	21	28	32.89	32.66	32.89	3.56	2.37	28675	200000	0.000	0.000	3100	23.7	3604	0.104	6095	0.107	2.00	28	0
60	t	Jaccoud and Favre (1982)	C22	750	160	565	131	0.58	57	134	26	0.06	deformed	60	21	28	32.89	32.66	32.89	3.56	2.37	28675	200000	1.241	0.459	3100	23.7	3604	0.104	6095	0.107	7.00	28	365
61	0	Jaccoud and Favre (1982)	C13	750	160	565	131	0.58	57	134	26	0.06	deformed	60	21	28	30.93	30.71	30.93	3.45	2.30	27807	200000	0.000	0.000	3100	23.7	3604	0.104	9305	0.107	5.29	28	0
62	t	Jaccoud and Favre (1982)	C13	750	160	565	131	0.58	57	134	26	0.06	deformed	60	21	28	30.93	30.71	30.93	3.45	2.30	27807	200000	1.297	0.480	3100	23.7	3604	0.104	9305	0.107	13.28	28	510
63	0	Jaccoud and Favre (1982)	C14	750	160	565	131	0.58	57	134	26	0.06	deformed	60	21	28	29.40	29.19	29.40	3.36	2.24	27111	200000	0.000	0.000	3100	23.7	3604	0.104	12520	0.107	8.48	28	0
64	t	Jaccoud and Favre (1982)	C14	750	160	565	131	0.58	57	134	26	0.06	deformed	60	21	28	29.40	29.19	29.40	3.36	2.24	27111	200000	1.297	0.480	3100	23.7	3604	0.104	12520	0.107	18.15	28	510
65	0	Jaccoud and Favre (1982)	C24	750	160	565	131	0.58	57	134	26	0.06	deformed	60	21	28	31.97	31.74	31.97	3.51	2.34	28271	200000	0.000	0.000	3100	23.7	3604	0.104	12520	0.107	8.00	28	0
66	t	Jaccoud and Favre (1982)	C24	750	160	565	131	0.58	57	134	26	0.06	deformed	60	21	28	31.97	31.74	31.97	3.51	2.34	28271	200000	1.297	0.480	3100	23.7	3604	0.104	12520	0.107	17.52	28	510
67	0	Jaccoud and Favre (1982)	C15	750	160	565	131	0.58	57	134	26	0.06	deformed	60	21	28	29.29	29.08	29.29	3.36	2.24	27060	200000	0.000	0.000	3100	23.7	3604	0.104	15725	0.107	11.02	28	0
68	t	Jaccoud and Favre (1982)	C15	750	160	565	131	0.58	57	134	26	0.06	deformed	60	21	28	29.29	29.08	29.29	3.36	2.24	27060	200000	1.297	0.480	3100	23.7	3604	0.104	15725	0.107	20.83	28	510
69	0	Ding Dajung [44]	C-3	81	160	113	137	1.02	0	0	0	0.00	deformed	80	21	30	21.60	21.24	21.60	2.88	1.92	23238	200000	0.000	0.000	2880	21.0	336	0.104	2904	0.107	8.45	30	0
70	t	Ding Dajung [44]	C-3	81	160	113	137	1.02	0	0	0	0.00	deformed	80	21	30	21.60	21.24	21.60	2.88	1.92	23238	200000	1.547	0.488	2880	21.0	336	0.104	2904	0.107	16.62	30	2025
71	0	Ding Dajung [44]	L-1	62	152	154	117	2.12	0	0	0	0.00	deformed	80	21	30	25.40	24.98	25.40	3.12	2.08	25199	200000	0.000	0.000	2880	24.6	244	0.104	3280	0.107	15.53	30	0
72	t	Ding Dajung [44]	L-1	62	152	154	117	2.12	0	0	0	0.00	deformed	80	21	30	25.40	24.98	25.40	3.12	2.08	25199	200000	1.540	0.477	2880	24.6	244	0.104	3280	0.107	30.43	30	531

		Study information		Cross-section		Reinforcement																				Loading						Deflection		
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
		Author	Specimen	b (mm)	h (mm)	A_{s1} (mm^2)	d (mm)	ρ_1 (%)	A_{s2} (mm^2)	d' (mm)	d_2 (mm)	ρ_2 (%)	type	RH (%)	T (ºC)	t_{test} (days)	$f_{cm}(t_{test})$ (MPa)	f_{cm} (MPa)	$f_{cm}(t_0)$ (MPa)	$f_r(t_0)$ (MPa)	$f_{r,red}(t_0)$ (MPa)	$E_{cm}(t_0)$ (MPa)	E_s (MPa)	φ (–)	ε_{cs} (‰)	L (mm)	L/d	M_{L1} (Nm)	K_{L1}	M_{L2} (Nm)	K_{L2}	a (t-t_0) (mm)	t_0 (days)	t-t_0 (days)
73	0	F.R.F.C. [45]	I-72	150	280	308	250	0.82	0	0	0	0.00	deformed	60	21	28	33.50	33.26	33.50	3.59	2.39	28940	200000	0.000	0.000	2800	11.2	1029	0.104	21500	0.107	6.02	28	0
74	t	F.R.F.C. [45]	I-72	150	280	308	250	0.82	0	0	0	0.00	deformed	60	21	28	33.50	33.26	33.50	3.59	2.39	28940	200000	1.555	0.570	2800	11.2	1029	0.104	21500	0.107	10.29	28	1610
75	0	F.R.F.C. [45]	I-81	150	280	308	250	0.82	0	0	0	0.00	deformed	60	21	28	33.50	33.26	33.50	3.59	2.39	28940	200000	0.000	0.000	2800	11.2	1029	0.104	24250	0.107	7.39	28	0
76	t	F.R.F.C. [45]	I-81	150	280	308	250	0.82	0	0	0	0.00	deformed	60	21	28	33.50	33.26	33.50	3.59	2.39	28940	200000	1.545	0.566	2800	11.2	1029	0.104	24250	0.107	11.98	28	1344
77	0	F.R.F.C. [45]	I-91	150	280	308	250	0.82	0	0	0	0.00	deformed	60	21	28	33.50	33.26	33.50	3.59	2.39	28940	200000	0.000	0.000	2800	11.2	1029	0.104	27180	0.107	8.94	28	0
78	t	F.R.F.C. [45]	I-91	150	280	308	250	0.82	0	0	0	0.00	deformed	60	21	28	33.50	33.26	33.50	3.59	2.39	28940	200000	1.544	0.566	2800	11.2	1029	0.104	27180	0.107	15.02	28	1314
79	0	F.R.F.C. [45]	II-52	150	280	770	236	2.18	0	0	0	0.00	deformed	60	21	28	29.80	29.59	29.80	3.38	2.25	27295	200000	0.000	0.000	2800	11.9	1029	0.104	33950	0.107	7.27	28	0
80	t	F.R.F.C. [45]	II-52	150	280	770	236	2.18	0	0	0	0.00	deformed	60	21	28	29.80	29.59	29.80	3.38	2.25	27295	200000	1.547	0.567	2800	11.9	1029	0.104	33950	0.107	13.49	28	1398
81	0	F.R.F.C. [45]	II-59	150	280	770	236	2.18	0	0	0	0.00	deformed	60	21	28	29.80	29.59	29.80	3.38	2.25	27295	200000	0.000	0.000	2800	11.9	1029	0.104	38300	0.107	7.69	28	0
82	t	F.R.F.C. [45]	II-59	150	280	770	236	2.18	0	0	0	0.00	deformed	60	21	28	29.80	29.59	29.80	3.38	2.25	27295	200000	1.553	0.569	2800	11.9	1029	0.104	38300	0.107	14.10	28	1541
83	0	F.R.F.C. [45]	II-70	150	280	770	236	2.18	0	0	0	0.00	deformed	60	21	28	29.80	29.59	29.80	3.38	2.25	27295	200000	0.000	0.000	2800	11.9	1029	0.104	45850	0.107	9.36	28	0
84	t	F.R.F.C. [45]	II-70	150	280	770	236	2.18	0	0	0	0.00	deformed	60	21	28	29.80	29.59	29.80	3.38	2.25	27295	200000	1.550	0.568	2800	11.9	1029	0.104	45850	0.107	17.56	28	1471
85	0	F.R.F.C. [45]	II-80	150	280	770	236	2.18	0	0	0	0.00	deformed	60	21	28	29.80	29.59	29.80	3.38	2.25	27295	200000	0.000	0.000	2800	11.9	1029	0.104	52260	0.107	10.72	28	0
86	t	F.R.F.C. [45]	II-80	150	280	770	236	2.18	0	0	0	0.00	deformed	60	21	28	29.80	29.59	29.80	3.38	2.25	27295	200000	1.551	0.568	2800	11.9	1029	0.104	52260	0.107	20.24	28	1485
87	0	F.R.F.C. [45]	II-90	150	280	770	236	2.18	0	0	0	0.00	deformed	60	21	28	29.80	29.59	29.80	3.38	2.25	27295	200000	0.000	0.000	2800	11.9	1029	0.104	58660	0.107	13.10	28	0
88	t	F.R.F.C. [45]	II-90	150	280	770	236	2.18	0	0	0	0.00	deformed	60	21	28	29.80	29.59	29.80	3.38	2.25	27295	200000	1.551	0.568	2800	11.9	1029	0.104	58660	0.107	24.23	28	1491
89	0	F.R.F.C. [45]	III-43	150	280	1232	233	3.53	0	0	0	0.00	deformed	60	21	28	34.30	34.06	34.31	3.63	2.42	29287	200000	0.000	0.000	2800	12.0	1029	0.104	42190	0.107	7.08	28	0
90	t	F.R.F.C. [45]	III-43	150	280	1232	233	3.53	0	0	0	0.00	deformed	60	21	28	34.30	34.06	34.31	3.63	2.42	29287	200000	1.554	0.569	2800	12.0	1029	0.104	42190	0.107	14.51	28	1572
91	0	F.R.F.C. [45]	III-67	150	280	1232	233	3.53	0	0	0	0.00	deformed	60	21	28	34.30	34.06	34.31	3.63	2.42	29287	200000	0.000	0.000	2800	12.0	1029	0.104	65300	0.107	10.58	28	0
92	t	F.R.F.C. [45]	III-67	150	280	1232	233	3.53	0	0	0	0.00	deformed	60	21	28	34.30	34.06	34.31	3.63	2.42	29287	200000	1.554	0.569	2800	12.0	1029	0.104	65300	0.107	23.88	28	1572
93	0	F.R.F.C. [45]	III-77	150	280	1232	233	3.53	0	0	0	0.00	deformed	60	21	28	34.30	34.06	34.31	3.63	2.42	29287	200000	0.000	0.000	2800	12.0	1029	0.104	75490	0.107	13.84	28	0
94	t	F.R.F.C. [45]	III-77	150	280	1232	233	3.53	0	0	0	0.00	deformed	60	21	28	34.30	34.06	34.31	3.63	2.42	29287	200000	1.554	0.569	2800	12.0	1029	0.104	75490	0.107	28.74	28	1572
95	0	F.R.F.C. [45]	IV-52	150	280	770	236	2.18	462	248	32	1.31	deformed	60	21	28	32.00	31.77	32.00	3.51	2.34	28284	200000	0.000	0.000	2800	11.9	1029	0.104	37610	0.107	5.98	28	0
96	t	F.R.F.C. [45]	IV-52	150	280	770	236	2.18	462	248	32	1.31	deformed	60	21	28	32.00	31.77	32.00	3.51	2.34	28284	200000	1.504	0.551	2800	11.9	1029	0.104	37610	0.107	10.52	28	772
97	0	F.R.F.C. [45]	IV-70	150	280	770	236	2.18	462	248	32	1.31	deformed	60	21	28	32.00	31.77	32.00	3.51	2.34	28284	200000	0.000	0.000	2800	11.9	1029	0.104	51340	0.107	8.80	28	0
98	t	F.R.F.C. [45]	IV-70	150	280	770	236	2.18	462	248	32	1.31	deformed	60	21	28	32.00	31.77	32.00	3.51	2.34	28284	200000	1.504	0.551	2800	11.9	1029	0.104	51340	0.107	13.90	28	772
99	0	F.R.F.C. [45]	IV-80	150	280	770	236	2.18	462	248	32	1.31	deformed	60	21	28	32.00	31.77	32.00	3.51	2.34	28284	200000	0.000	0.000	2800	11.9	1029	0.104	58200	0.107	11.16	28	0
100	t	F.R.F.C. [45]	IV-80	150	280	770	236	2.18	462	248	32	1.31	deformed	60	21	28	32.00	31.77	32.00	3.51	2.34	28284	200000	1.523	0.558	2800	11.9	1029	0.104	58200	0.107	16.96	28	972
101	0	F.R.F.C. [45]	IV-90	150	280	770	236	2.18	462	248	32	1.31	deformed	60	21	28	32.00	31.77	32.00	3.51	2.34	28284	200000	0.000	0.000	2800	11.9	1029	0.104	65530	0.107	12.85	28	0
102	t	F.R.F.C. [45]	IV-90	150	280	770	236	2.18	462	248	32	1.31	deformed	60	21	28	32.00	31.77	32.00	3.51	2.34	28284	200000	1.523	0.558	2800	11.9	1029	0.104	65530	0.107	19.28	28	972
103	0	Bakoss et al. [41]	1B2	100	150	226	130	1.74	0	0	0	0.00	deformed	60	21	28	39.00	38.72	39.00	3.87	2.58	31225	200000	0.000	0.000	3750	28.8	659	0.104	3250	0.107	8.94	28	0
104	t	Bakoss et al. [41]	1B2	100	150	226	130	1.74	0	0	0	0.00	deformed	60	21	28	39.00	38.72	39.00	3.87	2.58	31225	200000	1.696	0.554	3750	28.8	659	0.104	3250	0.107	25.02	28	500
105	0	Clarke et al. [46]	A1	100	154	157.1	132	1.19	0	0	0	0.00	deformed	40	21	28	25.90	25.72	25.91	3.16	2.11	25451	200000	0.000	0.000	2100	15.9	212	0.104	3500	0.107	4.89	28	0
106	t	Clarke et al. [46]	A1	100	154	157.1	132	1.19	0	0	0	0.00	deformed	40	21	28	25.90	25.72	25.91	3.16	2.11	25451	200000	1.722	0.661	2100	15.9	212	0.104	3500	0.107	11.83	28	180
107	0	Clarke et al. [46]	A2	100	152	157.1	130	1.21	0	0	0	0.00	deformed	40	21	28	25.90	25.72	25.91	3.16	2.11	25451	200000	0.000	0.000	2100	16.2	209	0.104	3500	0.107	5.09	28	0
108	t	Clarke et al. [46]	A2	100	152	157.1	130	1.21	0	0	0	0.00	deformed	40	21	28	25.90	25.72	25.91	3.16	2.11	25451	200000	1.725	0.662	2100	16.2	209	0.104	3500	0.107	11.92	28	180
109	0	Clarke et al. [46]	B1	100	152	157.1	130	1.21	157.1	132	20	1.21	deformed	40	21	28	25.90	25.72	25.91	3.16	2.11	25451	200000	0.000	0.000	2100	16.2	209	0.104	3500	0.107	4.78	28	0
110	t	Clarke et al. [46]	B1	100	152	157.1	130	1.21	157.1	132	20	1.21	deformed	40	21	28	25.90	25.72	25.91	3.16	2.11	25451	200000	1.725	0.662	2100	16.2	209	0.104	3500	0.107	8.77	28	180
111	0	Clarke et al. [46]	B2	100	154	157.1	132	1.19	157.1	134	20	1.19	deformed	40	21	28	25.90	25.72	25.91	3.16	2.11	25451	200000	0.000	0.000	2100	15.9	212	0.104	3500	0.107	4.30	28	0
112	t	Clarke et al. [46]	B2	100	154	157.1	132	1.19	157.1	134	20	1.19	deformed	40	21	28	25.90	25.72	25.91	3.16	2.11	25451	200000	1.722	0.661	2100	15.9	212	0.104	3500	0.107	8.55	28	180
113	0	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	40	21	28	24.80	24.62	21.68	2.89	1.93	23281	200000	0.000	0.000	3500	11.7	3254	0.104	21646	0.107	4.95	14	0
114	t	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	40	22	28	24.80	24.62	21.68	2.89	1.93	23281	200000	1.499	0.518	3500	11.7	3254	0.104	21646	0.107	12.06	14	380
115	0	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	40	21	28	24.80	24.62	21.68	2.89	1.93	23281	200000	0.000	0.000	3500	11.7	3254	0.104	13746	0.107	1.98	14	0
116	t	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	40	22	28	24.80	24.62	21.68	2.89	1.93	23281	200000	1.499	0.518	3500	11.7	3254	0.104	13746	0.107	7.44	14	380
117	0	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	40	21	28	24.80	24.62	21.68	2.89	1.93	23281	200000	0.000	0.000	3500	11.7	3110	0.104	21690	0.107	5.03	14	0
118	t	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	40	22	28	24.80	24.62	21.68	2.89	1.93	23281	200000	1.512	0.524	3500	11.7	3110	0.104	21690	0.107	12.42	14	380
119	0	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	40	21	28	24.80	24.62	21.68	2.89	1.93	23281	200000	0.000	0.000	3500	11.7	3110	0.104	13690	0.107	2.06	14	0
120	t	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	40	22	28	24.80	24.62	21.68	2.89	1.93	23281	200000	1.512	0.524	3500	11.7	3110	0.104	13690	0.107	7.87	14	380
121	0	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	40	21	28	24.80	24.62	21.68	2.89	1.93	23281	200000	0.000	0.000	3500	11.7	3110	0.104	31490	0.107	5.81	14	0
122	t	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	40	22	28	24.80	24.62	21.68	2.89	1.93	23281	200000	1.512	0.524	3500	11.7	3110	0.104	31490	0.107	13.30	14	380
123	0	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	40	21	28	24.80	24.62	21.68	2.89	1.93	23281	200000	0.000	0.000	3500	11.7	3110	0.104	17690	0.107	1.97	14	0
124	t	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	40	22	28	24.80	24.62	21.68	2.89	1.93	23281	200000	1.512	0.524	3500	11.7	3110	0.104	17690	0.107	7.90	14	380
125	0	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	40	21	28	24.80	24.62	21.68	2.89	1.93	23281	200000	0.000	0.000	3500	26.9	2373	0.104	4437	0.104	7.14	14	0
126	t	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	40	22	28	24.80	24.62	21.68	2.89	1.93	23281	200000	1.675	0.579	3500	26.9	2373	0.104	4437	0.104	25.10	14	380
127	0	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	40	21	28	24.80	24.62	21.68	2.89	1.93	23281	200000	0.000	0.000	3500	26.9	2373	0.104	2907	0.104	2.72	14	0
128	t	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	40	22	28	24.80	24.62	21.68	2.89	1.93	23281	200000	1.675	0.579	3500	26.9	2373	0.104	2907	0.104	19.90	14	380
129	0	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	40	21	28	24.80	24.62	21.68	2.89	1.93	23281	200000	0.000	0.000	3500	26.9	2373	0.104	7497	0.104	11.80	14	0
130	t	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	40	22	28	24.80	24.62	21.68	2.89	1.93	23281	200000	1.675	0.579	3500	26.9	2373	0.104	7497	0.104	32.50	14	380
131	0	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	40	21	28	24.80	24.62	21.68	2.89	1.93	23281	200000	0.000	0.000	3500	26.9	2373	0.104	4437	0.104	4.43	14	0
132	t	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	40	22	28	24.80	24.62	21.68	2.89	1.93	23281	200000	1.675	0.579	3500	26.9	2373	0.104	4437	0.104	21.90	14	380
133	0	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	40	21	28	24.80	24.62	21.68	2.89	1.93	23281	200000	0.000	0.000	3500	26.9	2373	0.104	8977	0.104	10.70	14	0
134	t	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	40	22	28	24.80	24.62	21.68	2.89	1.93	23281	200000	1.675	0.579	3500	26.9	2373	0.104	8977	0.104	29.80	14	380
135	0	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	40	21	28	24.80	24.62	21.68	2.89	1.93	23281	200000	0.000	0.000	3500	26.9	2373	0.104	5967	0.104	5.04	14	0
136	t	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	40	22	28	24.80	24.62	21.68	2.89	1.93	23281	200000	1.675	0.579	3500	26.9	2373	0.104	5967	0.104	22.90	14	380
137	0	Tošić (2017)	NAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	28	30.50	30.28	21.30	2.86	1.91	23076	200000	0.000	0.000	3200	18.9	1024	0.104	6645	0.107	9.17	7	0
138	t	Tošić (2017)	NAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	28	30.50	30.28	21.30	2.86	1.91	23076	200000	1.906	0.743	3200	18.9	1024	0.104	6645	0.107	18.94	7	450
139	0	Tošić (2017)	NAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	28	30.50	30.28	30.50	3.42	2.28	27613	200000	0.000	0.000	3200	18.9	1024	0.104	5853	0.107	8.11	28	0
140	t	Tošić (2017)	NAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	28	30.50	30.28	30.50	3.42	2.28	27613	200000	1.618	0.743	3200	18.9	1024	0.104	5853	0.107	16.51	28	450

Assessment and Correction of ACI model:
Database – Calculated Deflections

		Study information		Cracking moment							Uncracked cross-section		Fully cracked cross-section								Shrinkage deflection	Deflections for uncracked cross-section				Deflections for fully cracked cross-section				Deflection			
		1	2	3	4		5		6	7	8	9	10	11	12	13	14	15	16											17	18	19	20
		Author	Specimen	W_c (mm^3)	M_{SW} (Nm)		M_{cr} (Nm)		M_{max} (Nm)	M_{max}/M_{cr}	I_c (mm^4)	S_c (mm^3)	A_{II}^* (mm^2)	A_{IIc} (mm^2)	$z_{IIc,1}$ (mm)	$z_{II,1}^*$ (mm)	I_{IIc} (mm^4)	I_{II}^* (mm^4)	S_{II}^* (mm^3)	I_c/I_{II}^*	A_{sh}	$a_{c,L1}$ (mm)	$a_{c,L2}$ (mm)	$a_{c,cs}$ (mm)	a_c (mm)	$a_{II,L1}$ (mm)	$a_{II,L2}$ (mm)	$a_{II,cs}$ (mm)	a_{II} (mm)	$t-t_0$ (days)	$a_{num.int.}$ (mm)	a_{exp} (mm)	$a_{num.int.}/a_{exp}$ (%)
1	0	Washa and Fluck [8]	A1/A4	3146316	7192	>	6506	<	25634	3.940	479498602	1428634	32097	18465	259.37	213.94	12705339	252162498	838913	1.902	0	2.32	5.95	0.00	8.27	4.41	11.31	0.00	15.72	0	15.25	13.46	1.133
2	t	Washa and Fluck [8]	A1/A4	3146316	7192	>	6506	<	25634	3.940	479498602	1428634	32097	18465	259.37	213.94	12705339	252162498	838913	1.902	0	4.10	10.52	0.00	14.62	7.80	20.01	0.00	27.81	913	26.99	23.62	1.143
3	0	Washa and Fluck [8]	A2/A5	3146316	7192	>	6506	<	25634	3.940	479498602	1054477	29541	19525	256.76	208.71	15023667	245018877	938158	1.957	0.1047	2.32	5.95	0.00	8.27	4.54	11.64	0.00	16.18	0	15.67	15.75	0.995
4	t	Washa and Fluck [8]	A2/A5	3146316	7192	>	6506	<	25634	3.940	479498602	1054477	29541	19525	256.76	208.71	15023667	245018877	938158	1.957	0.1047	4.66	11.95	0.97	17.58	9.12	23.39	0.97	33.48	913	32.47	32.26	1.007
7	0	Washa and Fluck [8]	B1/B4	1048772	3596	>	1980	<	7259	3.666	106555245	390107	16326	9310	172.66	142.12	2895141	44786844	284288	2.379	0	5.72	5.83	0.00	11.55	13.61	13.86	0.00	27.47	0	26.04	23.37	1.114
9	0	Washa and Fluck [8]	B2/B5	1048772	3596	>	1980	<	7259	3.666	106555245	292580	14845	9583	171.76	140.32	3157485	44337891	301267	2.403	0.1004	5.72	5.83	0.00	11.55	13.75	14.00	0.00	27.75	0	26.28	24.89	1.056
11	0	Washa and Fluck [8]	B3/B6	1048772	3596	>	1980	<	7259	3.666	106555245	195053	13431	9923	170.64	138.09	3505836	43769112	323052	2.434	0.1789	5.72	5.83	0.00	11.55	13.92	14.18	0.00	28.10	0	26.59	26.42	1.006
13	0	Washa and Fluck [8]	D1/D4	819353	1756	>	1590	<	6023	3.788	52028928	334560	20423	11641	107.9	88.81	1414920	24031651	222281	2.165	0	2.17	5.27	0.00	7.44	4.69	11.40	0.00	16.09	0	15.43	11.94	1.292
14	t	Washa and Fluck [8]	D1/D4	819353	1756	>	1590	<	6023	3.788	52028928	334560	20423	11641	107.9	88.81	1414920	24031651	222281	2.165	0	4.00	9.73	0.00	13.73	8.67	21.07	0.00	29.74	913	28.51	27.69	1.030
15	0	Washa and Fluck [8]	D2/D5	819353	1756	>	1590	<	6023	3.788	52028928	250920	18689	12102	107.15	87.29	1589932	23632577	240350	2.202	0.1003	2.17	5.27	0.00	7.44	4.77	11.60	0.00	16.37	0	15.68	14.22	1.103
16	t	Washa and Fluck [8]	D2/D5	819353	1756	>	1590	<	6023	3.788	52028928	250920	18689	12102	107.15	87.29	1589932	23632577	240350	2.202	0.1003	4.54	11.04	0.95	16.53	10.00	24.31	0.95	35.26	913	33.81	33.78	1.001
19	0	P.C.A. [18]	40NA	2356633	1346	<	5061	<	23613	4.666	359386583	664586	23414	16868	249.51	194.01	17310501	203141739	936113	1.769	0.1961	0.14	2.37	0.00	2.51	0.25	4.20	0.00	4.45	0	4.36	4.25	1.026
20	t	P.C.A. [18]	40NA	2356633	1346	<	5061	<	23613	4.666	359386583	664586	23414	16868	249.51	194.01	17310501	203141739	936113	1.769	0.1961	0.31	5.20	0.40	5.91	0.54	9.20	0.40	10.14	242	9.96	10.00	0.996
21	0	P.C.A. [18]	60NA	2356633	1346	<	5957	<	30987	5.202	359386583	676490	23644	16980	249.15	193.3	17657498	205568429	948324	1.748	0.2084	0.12	2.68	0.00	2.80	0.21	4.69	0.00	4.90	0	4.82	4.90	0.984
22	t	P.C.A. [18]	60NA	2356633	1346	<	5957	<	30987	5.202	359386583	676490	23644	16980	249.15	193.3	17657498	205568429	948324	1.748	0.2084	0.26	5.87	0.43	6.56	0.45	10.27	0.43	11.15	242	10.99	9.90	1.110
23	0	Sattler [11]	a1/a2	426667	800	<	911	<	2762	3.032	34133333	41802	4620	3846	140.77	121.54	474001	8961213	73948	3.809	0.1368	1.51	3.70	0.00	5.21	5.75	14.10	0.00	19.85	0	16.87	15.83	1.066
24	t	Sattler [11]	a1/a2	426667	800	<	911	<	2762	3.032	34133333	41802	4620	3846	140.77	121.54	474001	8961213	73948	3.809	0.1368	3.12	7.66	0.79	11.57	11.90	29.18	0.79	41.87	84	35.71	32.21	1.109
25	0	Hajnal-Konyi [22]	8	768144	3097	>	1973	<	4709	2.387	73165680	59510	6170	5256	169.81	149.13	750398	15932912	108759	4.592	0.1338	5.81	3.02	0.00	8.83	26.67	13.88	0.00	40.55	0	28.53	20.60	1.385
26	t	Hajnal-Konyi [22]	8	768144	3097	>	1973	<	4709	2.387	73165680	59510	6170	5256	169.81	149.13	750398	15932912	108759	4.592	0.1338	12.19	6.35	1.49	20.03	55.99	29.14	1.49	86.62	1734	61.38	65.40	0.939
27	0	Hajnal-Konyi [22]	10	768144	1742	<	1973	<	4709	2.387	73165680	59510	6170	5256	169.81	149.13	750398	15932912	108759	4.592	0.1338	1.84	3.13	0.00	4.97	8.44	14.37	0.00	22.81	0	16.05	8.80	1.824
28	t	Hajnal-Konyi [22]	10	768144	1742	<	1973	<	4709	2.387	73165680	59510	6170	5256	169.81	149.13	750398	15932912	108759	4.592	0.1338	3.86	6.57	0.84	11.27	17.71	30.17	0.84	48.72	1734	34.53	29.70	1.163
29	0	Hajnal-Konyi [22]	12	768144	774	<	1973	<	4709	2.387	73165680	59510	6170	5256	169.81	149.13	750398	15932912	108759	4.592	0.1338	0.36	1.84	0.00	2.20	1.67	8.47	0.00	10.14	0	7.13	4.30	1.658
30	t	Hajnal-Konyi [22]	12	768144	774	<	1973	<	4709	2.387	73165680	59510	6170	5256	169.81	149.13	750398	15932912	108759	4.592	0.1338	0.76	3.87	0.37	5.00	3.50	17.78	0.37	21.65	1734	15.35	14.00	1.096
31	0	Branson and Metz [23]	SB3/B	273118	303	<	672	<	1238	1.842	17342976	54815	5635	4197	106.34	85.69	596892	7613841	86702	2.278	0.1923	0.46	1.42	0.00	1.88	1.05	3.23	0.00	4.28	0	3.23	3.89	0.830
32	t	Branson and Metz [23]	SB3/B	273118	303	<	672	<	1238	1.842	17342976	54815	5635	4197	106.34	85.69	596892	7613841	86702	2.278	0.1923	0.93	2.88	0.63	4.44	2.13	6.57	0.63	9.33	60	7.21	7.70	0.936
33	0	Branson and Metz [23]	SB3/M	273118	303	<	632	<	1238	1.959	17342976	58295	5825	4295	105.86	84.73	639715	7943360	90781	2.183	0.1923	0.49	1.51	0.00	2.00	1.07	3.29	0.00	4.36	0	3.47	3.99	0.870
34	t	Branson and Metz [23]	SB3/M	273118	303	<	632	<	1238	1.959	17342976	58295	5825	4295	105.86	84.73	639715	7943360	90781	2.183	0.1923	0.99	3.07	0.63	4.69	2.17	6.70	0.63	9.50	60	7.70	7.50	1.027
35	0	Pauw and Meyers [26]	R1	1382573	627	<	3320	<	7803	2.350	149317862	157143	13006	10254	187.17	158.34	2841761	43131876	295675	3.462	0.1672	0.08	0.92	0.00	1.00	0.27	3.20	0.00	3.47	0	2.70	2.44	1.107
36	t	Pauw and Meyers [26]	R1	1382573	627	<	3320	<	7803	2.350	149317862	157143	13006	10254	187.17	158.34	2841761	43131876	295675	3.462	0.1672	0.16	1.93	0.25	2.34	0.57	6.69	0.25	7.51	150	5.89	4.89	1.204
37	0	Pauw and Meyers [26]	R2	1382573	627	<	3311	<	11855	3.580	149317862	223806	15667	11748	182.96	149.93	4273886	55526092	388118	2.689	0.1879	0.08	1.45	0.00	1.53	0.21	3.90	0.00	4.11	0	3.84	3.22	1.193
38	t	Pauw and Meyers [26]	R2	1382573	627	<	3311	<	11855	3.580	149317862	223806	15667	11748	182.96	149.93	4273886	55526092	388118	2.689	0.1879	0.16	3.03	0.28	3.47	0.44	8.16	0.28	8.88	150	8.31	6.16	1.349
40	t	Pauw and Meyers [26]	R3	1382573	627	<	3569	<	10270	2.878	149317862	208003	15066	11425	183.87	151.73	3931065	52748551	367110	2.831	0.1879	0.15	2.35	0.26	2.76	0.42	6.64	0.26	7.32	120	6.50	6.64	0.979
42	t	Pauw and Meyers [26]	R4	1382573	627	<	3560	<	15234	4.279	149317862	284169	17805	12828	179.93	143.86	5564627	65261928	462645	2.288	0.2084	0.15	3.56	0.29	4.00	0.34	8.15	0.29	8.78	120	8.49	7.89	1.076
47	0	Jaccoud and Favre (1982)	A1	1440000	2162	<	2699	<	4949	1.834	86400000	117262	18419	15139	107.38	94.76	803202	16736259	190997	5.162	0.1046	1.10	1.42	0.00	2.52	5.70	7.35	0.00	13.05	0	6.55	8.42	0.778
48	t	Jaccoud and Favre (1982)	A1	1440000	2162	<	2699	<	4949	1.834	86400000	117262	18419	15139	107.38	94.76	803202	16736259	190997	5.162	0.1046	2.44	3.15	0.53	6.12	12.62	16.27	0.53	29.42	365	15.03	18.40	0.817
49	0	Jaccoud and Favre (1982)	A2	1440000	2162	<	2929	<	4949	1.690	86400000	108035	17652	14632	107.81	95.61	725134	15655337	178439	5.519	0.1046	1.02	1.31	0.00	2.33	5.62	7.24	0.00	12.86	0	5.48	6.16	0.890
50	t	Jaccoud and Favre (1982)	A2	1440000	2162	<	2929	<	4949	1.690	86400000	108035	17652	14632	107.81	95.61	725134	15655337	178439	5.519	0.1046	2.25	2.90	0.53	5.68	12.43	16.03	0.53	28.99	365	12.67	17.50	0.724
51	0	Jaccoud and Favre (1982)	A3	1440000	2162	<	2641	<	4949	1.874	86400000	119771	18626	15276	107.27	94.55	825173	17027594	194398	5.074	0.1046	1.13	1.45	0.00	2.58	5.73	7.38	0.00	13.11	0	6.84	8.12	0.842
52	t	Jaccoud and Favre (1982)	A3	1440000	2162	<	2641	<	4949	1.874	86400000	119771	18626	15276	107.27	94.55	825173	17027594	194398	5.074	0.1046	2.50	3.22	0.53	6.25	12.67	16.33	0.53	29.53	365	15.67	17.50	0.895
53	0	Jaccoud and Favre (1982)	A4	1440000	2162	<	3583	<	4949	1.381	86400000	88308	15913	13446	108.79	97.59	562762	13254472	150662	6.519	0.1046	0.83	1.07	0.00	1.90	5.42	6.99	0.00	12.41	0	3.25	2.24	1.451
54	t	Jaccoud and Favre (1982)	A4	1440000	2162	<	3583	<	4949	1.381	86400000	88308	15913	13446	108.79	97.59	562762	13254472	150662	6.519	0.1046	1.84	2.37	0.53	4.74	12.00	15.47	0.53	28.00	365	7.72	8.05	0.959
55	0	Jaccoud and Favre (1982)	A5	1440000	2162	<	3390	<	4949	1.460	86400000	93152	16364	13760	108.53	97.07	603049	13862824	157690	6.232	0.1046	0.88	1.13	0.00	2.01	5.47	7.05	0.00	12.52	0	3.78	3.12	1.212
56	t	Jaccoud and Favre (1982)	A5	1440000	2162	<	3390	<	4949	1.460	86400000	93152	16364	13760	108.53	97.07	603049	13862824	157690	6.232	0.1046	1.94	2.50	0.53	4.97	12.11	15.60	0.53	28.24	365	8.90	9.55	0.932
57	0	Jaccoud and Favre (1982)	C12	3200000	3604	<	7172	<	9699	1.352	256000000	235277	29270	24680	143.55	127.1	2227167	49053231	406145	5.219	0.1148	0.52	0.90	0.00	1.42	2.71	4.71	0.00	7.42	0	2.36	2.17	1.088
58	t	Jaccoud and Favre (1982)	C12	3200000	3604	<	7172	<	9699	1.352	256000000	235277	29270	24680	143.55	127.1	2227167	49053231	406145	5.219	0.1148	1.08	1.87	0.41	3.36	5.61	9.76	0.41	15.78	510	5.31	8.29	0.641
59	0	Jaccoud and Favre (1982)	C22	3200000	3604	<	7598	<	9699	1.277	256000000	222445	28426	24091	143.94	127.88	2071359	46803193	386963	5.470	0.1148	0.49	0.85	0.00	1.34	2.68	4.67	0.00	7.35	0	2.02	2.00	1.010
60	t	Jaccoud and Favre (1982)	C22	3200000	3604	<	7598	<	9699	1.277	256000000	222445	28426	24091	143.94	127.88	2071359	46803193	386963	5.470	0.1148	0.99	1.73	0.40	3.12	5.44	9.46	0.40	15.30	365	4.49	7.00	0.641
61	0	Jaccoud and Favre (1982)	C13	3200000	3604	<	7364	<	12909	1.753	256000000	229388	28877	24405	143.73	127.45	2153519	48013295	397254	5.332	0.1148	0.51	1.34	0.00	1.85	2.70	7.17	0.00	9.87	0	4.75	5.29	0.898
62	t	Jaccoud and Favre (1982)	C13	3200000	3604	<	7364	<	12909	1.753	256000000	229388	28877	24405	143.73	127.45	2153519	48013295	397254	5.332	0.1148	1.05	2.78	0.41	4.24	5.59	14.84	0.41	20.84	510	10.25	13.28	0.772
63	0	Jaccoud and Favre (1982)	C14	3200000	3604	<	7172	<	16124	2.248	256000000	235277	29270	24680	143.55	127.1	2227167	49053231	406145	5.219	0.1148	0.52	1.85	0.00	2.37	2.71	9.68	0.00	12.39	0	8.08	8.48	0.953
64	t	Jaccoud and Favre (1982)	C14	3200000	3604	<	7172	<	16124	2.248	256000000	235277	29270	24680	143.55	127.1	2227167	49053231	406145	5.219	0.1148	1.08	3.84	0.41	5.33	5.61	20.05	0.41	26.07	510	17.16	18.15	0.945
65	0	Jaccoud and Favre (1982)	C24	3200000	3604	<	7492	<	16124	2.152	256000000	225623	28636	24238	143.84	127.68	2109606	47353248	391635	5.406	0.1148	0.50	1.78	0.00	2.28	2.69	9.62	0.00	12.31	0	7.58	8.00	0.948
66	t	Jaccoud and Favre (1982)	C24	3200000	3604	<	7492	<	16124	2.152	256000000	225623	28636	24238	143.84	127.68	2109606	47353248	391635	5.406	0.1148	1.03	3.68	0.41	5.12	5.57	19.92	0.41	25.90	510	16.12	17.52	0.920
67	0	Jaccoud and Favre (1982)	C15	3200000	3604	<	7172	<	19329	2.695	256000000	235721	29287	24690	143.54	127.07	2229828	49104857	406557	5.213	0.1148	0.52	2.33	0.00	2.85	2.71	12.17	0.00	14.88	0	11.21	11.02	1.017
68	t	Jaccoud and Favre (1982)	C15	3200000	3604	<	7172	<	19329	2.695	256000000	235721	29287	24690	143.54	127.07	2229828	49104857	406557	5.213	0.1148	1.08	4.83	0.41	6.32	5.61	25.21	0.41	31.23	510	23.63	20.83	1.134
69	0	Ding Dajung [44]	C-3	345600	336	<	664	<	3240	4.880	27648000	55435	4747	3774	136.7	113.39	682787	10682594	87943	2.588	0.1517	0.45	4.01	0.00	4.46	1.17	10.38	0.00	11.55	0	11.20	8.45	1.325
70	t	Ding Dajung [44]	C-3	345600	336	<	664	<	3240	4.880	27648000	55435	4747	3774	136.7	113.39	682787	10682594	87943	2.588	0.1517	1.04	9.29	0.48	10.81	2.70	24.03	0.48	27.21	2025	26.41	16.62	1.589

		Study information				Cracking moment					Uncracked cross-section		Fully cracked cross-section								Shrinkage deflection	Deflections for uncracked cross-section				Deflections for fully cracked cross-section				Deflection			
		1	2	3	4		5		6	7	8	9	10	11	12	13	14	15	16											17	18	19	20
		Author	Specimen	W_c (mm^3)	M_{SW} (Nm)		M_{cr} (Nm)		M_{max} (Nm)	M_{max}/M_{cr}	I_c (mm^4)	S_c (mm^3)	A_{II}^* (mm^2)	A_{IIc} (mm^2)	$z_{IIc,1}$ (mm)	$z_{II,1}^*$ (mm)	I_{IIc} (mm^4)	I_{II}^* (mm^4)	S_{II}^* (mm^3)	I_c/I_{II}^*	A_{sh}	$a_{c,L1}$ (mm)	$a_{c,L2}$ (mm)	$a_{c,cs}$ (mm)	a_c (mm)	$a_{II,L1}$ (mm)	$a_{II,L2}$ (mm)	$a_{II,cs}$ (mm)	a_{II} (mm)	t-t_0 (days)	$a_{num.int.}$ (mm)	a_{exp} (mm)	$a_{num.int.}/a_{exp}$ (%)
72	t	Ding Dajung [44]	L-1	238741	244	<	497	<	3524	7.091	18144341	50113	4386	3163	126.49	100.98	685847	8067316	80678	2.249	0.1938	1.06	14.70	0.63	16.39	2.39	33.06	0.63	36.08	531	35.70	30.43	1.173
73	0	F.R.F.C. [45]	I-72	1960000	1029	<	4693	<	22529	4.801	274400000	234140	12812	10684	244.39	208.78	4516556	86089337	380494	3.187	0.1412	0.11	2.27	0.00	2.38	0.34	7.24	0.00	7.58	0	7.27	6.02	1.208
74	t	F.R.F.C. [45]	I-72	1960000	1029	<	4693	<	22529	4.801	274400000	234140	12812	10684	244.39	208.78	4516556	86089337	380494	3.187	0.1412	0.25	5.27	0.28	5.80	0.78	16.81	0.28	17.87	1610	17.15	10.29	1.667
75	0	F.R.F.C. [45]	I-81	1960000	1029	<	4693	<	25279	5.387	274400000	234140	12812	10684	244.39	208.78	4516556	86089337	380494	3.187	0.1412	0.11	2.56	0.00	2.67	0.34	8.17	0.00	8.51	0	8.24	7.39	1.115
76	t	F.R.F.C. [45]	I-81	1960000	1029	<	4693	<	25279	5.387	274400000	234140	12812	10684	244.39	208.78	4516556	86089337	380494	3.187	0.1412	0.24	5.93	0.28	6.45	0.78	18.89	0.28	19.95	1344	19.33	11.98	1.614
77	0	F.R.F.C. [45]	I-91	1960000	1029	<	4693	<	28209	6.011	274400000	234140	12812	10684	244.39	208.78	4516556	86089337	380494	3.187	0.1412	0.11	2.87	0.00	2.98	0.34	9.15	0.00	9.49	0	9.26	8.94	1.036
78	t	F.R.F.C. [45]	I-91	1960000	1029	<	4693	<	28209	6.011	274400000	234140	12812	10684	244.39	208.78	4516556	86089337	380494	3.187	0.1412	0.24	6.64	0.28	7.16	0.78	21.16	0.28	22.22	1314	21.69	15.02	1.444
80	t	F.R.F.C. [45]	II-52	1960000	1029	<	4419	<	34979	7.916	274400000	541638	20770	15126	229.58	179.15	12818721	154379371	762800	1.777	0.1954	0.26	8.80	0.39	9.45	0.46	15.65	0.39	16.50	1398	16.39	13.49	1.215
81	0	F.R.F.C. [45]	II-59	1960000	1029	<	4419	<	39329	8.900	274400000	541638	20770	15126	229.58	179.15	12818721	154379371	762800	1.777	0.1954	0.11	4.29	0.00	4.40	0.20	7.62	0.00	7.82	0	7.78	7.69	1.012
82	t	F.R.F.C. [45]	II-59	1960000	1029	<	4419	<	39329	8.900	274400000	541638	20770	15126	229.58	179.15	12818721	154379371	762800	1.777	0.1954	0.26	9.95	0.39	10.60	0.46	17.69	0.39	18.54	1541	18.44	14.10	1.308
84	t	F.R.F.C. [45]	II-70	1960000	1029	<	4419	<	46879	10.609	274400000	541638	20770	15126	229.58	179.15	12818721	154379371	762800	1.777	0.1954	0.26	11.90	0.39	12.55	0.46	21.15	0.39	22.00	1471	21.92	17.56	1.248
86	t	F.R.F.C. [45]	II-80	1960000	1029	<	4419	<	53289	12.059	274400000	541638	20770	15126	229.58	179.15	12818721	154379371	762800	1.777	0.1954	0.26	13.57	0.39	14.22	0.46	24.12	0.39	24.97	1485	24.88	20.24	1.229
88	t	F.R.F.C. [45]	II-90	1960000	1029	<	4419	<	59689	13.507	274400000	541638	20770	15126	229.58	179.15	12818721	154379371	762800	1.777	0.1954	0.26	15.23	0.39	15.88	0.46	27.07	0.39	27.92	1491	27.84	24.23	1.149
90	t	F.R.F.C. [45]	III-43	1960000	1029	<	4746	<	43219	9.106	274400000	782436	25670	17255	222.48	164.95	19026862	193200814	992497	1.420	0.2295	0.24	10.22	0.46	10.92	0.34	14.52	0.46	15.32	1572	15.26	14.51	1.052
95	0	F.R.F.C. [45]	IV-52	1960000	1029	<	4589	<	38639	8.420	274400000	875520	22194	13484	235.05	190.1	9079856	163475611	606233	1.679	0.0911	0.11	4.07	0.00	4.18	0.18	6.82	0.00	7.00	0	6.97	5.98	1.166
96	t	F.R.F.C. [45]	IV-52	1960000	1029	<	4589	<	38639	8.420	274400000	875520	22194	13484	235.05	190.1	9079856	163475611	606233	1.679	0.0911	0.19	7.21	0.18	7.58	0.32	12.10	0.18	12.60	772	12.53	10.52	1.191
97	0	F.R.F.C. [45]	IV-70	1960000	1029	<	4589	<	52369	11.412	274400000	875520	22194	13484	235.05	190.1	9079856	163475611	606233	1.679	0.0911	0.11	5.55	0.00	5.66	0.18	9.31	0.00	9.49	0	9.46	8.80	1.075
98	t	F.R.F.C. [45]	IV-70	1960000	1029	<	4589	<	52369	11.412	274400000	875520	22194	13484	235.05	190.1	9079856	163475611	606233	1.679	0.0911	0.19	9.84	0.18	10.21	0.32	16.52	0.18	17.02	772	16.96	13.90	1.220
100	t	F.R.F.C. [45]	IV-80	1960000	1029	<	4589	<	59229	12.907	274400000	875520	22194	13484	235.05	190.1	9079856	163475611	606233	1.679	0.0911	0.19	11.22	0.18	11.59	0.32	18.83	0.18	19.33	972	19.27	16.96	1.136
102	t	F.R.F.C. [45]	IV-90	1960000	1029	<	4589	<	66559	14.504	274400000	875520	22194	13484	235.05	190.1	9079856	163475611	606233	1.679	0.0911	0.19	12.63	0.18	13.00	0.32	21.20	0.18	21.70	972	21.64	19.28	1.122
103	0	Bakoss et al. [41]	1B2	375000	659	<	968	<	3909	4.038	28125000	79616	6306	4857	125.72	101.43	954705	13426195	117964	2.095	0.1813	1.10	5.57	0.00	6.67	2.30	11.66	0.00	13.96	0	13.48	8.94	1.508
104	t	Bakoss et al. [41]	1B2	375000	659	<	968	<	3909	4.038	28125000	79616	6306	4857	125.72	101.43	954705	13426195	117964	2.095	0.1813	2.68	13.60	1.18	17.46	5.61	28.48	1.18	35.27	500	34.08	25.02	1.362
105	0	Clarke et al. [46]	A1	395267	212	<	833	<	3712	4.456	30435533	67899	5842	4607	130.97	107.93	814736	12378087	106107	2.459	0.1598	0.13	2.13	0.00	2.26	0.31	5.24	0.00	5.55	0	5.36	4.89	1.096
106	t	Clarke et al. [46]	A1	395267	212	<	833	<	3712	4.456	30435533	67899	5842	4607	130.97	107.93	814736	12378087	106107	2.459	0.1598	0.31	5.25	0.38	5.94	0.76	12.92	0.38	14.06	180	13.57	11.83	1.147
107	0	Clarke et al. [46]	A2	385067	209	<	812	<	3709	4.568	29265067	66665	5798	4563	129.19	106.36	791717	11957625	104168	2.447	0.1606	0.13	2.22	0.00	2.35	0.31	5.43	0.00	5.74	0	5.55	5.09	1.090
108	t	Clarke et al. [46]	A2	385067	209	<	812	<	3709	4.568	29265067	66665	5798	4563	129.19	106.36	791717	11957625	104168	2.447	0.1606	0.32	5.47	0.39	6.18	0.78	13.38	0.39	14.55	180	14.08	11.92	1.181
109	0	Clarke et al. [46]	B1	385067	209	<	812	<	3709	4.568	29265067	135798	6568	4098	131.51	111.01	573334	12622646	83992	2.318	0	0.13	2.22	0.00	2.35	0.30	5.14	0.00	5.44	0	5.27	4.78	1.103
110	t	Clarke et al. [46]	B1	385067	209	<	812	<	3709	4.568	29265067	135798	6568	4098	131.51	111.01	573334	12622646	83992	2.318	0	0.25	4.24	0.00	4.49	0.57	9.84	0.00	10.41	180	10.09	8.77	1.151
111	0	Clarke et al. [46]	B2	395267	212	<	833	<	3712	4.456	30435533	138267	6606	4136	133.32	112.63	589416	13066292	85523	2.329	0	0.13	2.13	0.00	2.26	0.29	4.97	0.00	5.26	0	5.09	4.30	1.184
112	t	Clarke et al. [46]	B2	395267	212	<	833	<	3712	4.456	30435533	138267	6606	4136	133.32	112.63	589416	13066292	85523	2.329	0	0.24	4.09	0.00	4.33	0.56	9.52	0.00	10.08	180	9.76	8.55	1.142
113	0	Gilbert and Nejadi (2004)	B1-a	4816667	3254	<	9285	<	24900	2.682	818833333	448950	23021	19568	300.87	261.74	9989523	209739323	765708	3.904	0.1225	0.22	1.49	0.00	1.71	0.85	5.81	0.00	6.66	0	5.38	4.95	1.087
114	t	Gilbert and Nejadi (2004)	B1-a	4816667	3254	<	9285	<	24900	2.682	818833333	448950	23021	19568	300.87	261.74	9989523	209739323	765708	3.904	0.1225	0.49	3.38	0.29	4.16	1.93	13.21	0.29	15.43	380	12.53	12.06	1.039
115	0	Gilbert and Nejadi (2004)	B1-b	4816667	3254	<	9285	<	17000	1.831	818833333	448950	23021	19568	300.87	261.74	9989523	209739323	765708	3.904	0.1225	0.22	0.95	0.00	1.17	0.85	3.69	0.00	4.54	0	2.75	1.98	1.389
116	t	Gilbert and Nejadi (2004)	B1-b	4816667	3254	<	9285	<	17000	1.831	818833333	448950	23021	19568	300.87	261.74	9989523	209739323	765708	3.904	0.1225	0.49	2.15	0.29	2.93	1.93	8.39	0.29	10.61	380	6.53	7.44	0.878
117	0	Gilbert and Nejadi (2004)	B2-a	4401042	3110	<	8484	<	24800	2.923	715169271	474851	23021	19568	285.87	246.74	9989523	209739323	765708	3.410	0.1225	0.24	1.71	0.00	1.95	0.81	5.82	0.00	6.63	0	5.71	5.03	1.135
118	t	Gilbert and Nejadi (2004)	B2-a	4401042	3110	<	8484	<	24800	2.923	715169271	474851	23021	19568	285.87	246.74	9989523	209739323	765708	3.410	0.1225	0.54	3.90	0.30	4.74	1.85	13.31	0.30	15.46	380	13.36	12.42	1.076
119	0	Gilbert and Nejadi (2004)	B2-b	4401042	3110	<	8484	<	16800	1.980	715169271	474851	23021	19568	285.87	246.74	9989523	209739323	765708	3.410	0.1225	0.24	1.08	0.00	1.32	0.81	3.67	0.00	4.48	0	3.10	2.06	1.505
120	t	Gilbert and Nejadi (2004)	B2-b	4401042	3110	<	8484	<	16800	1.980	715169271	474851	23021	19568	285.87	246.74	9989523	209739323	765708	3.410	0.1225	0.54	2.46	0.30	3.30	1.85	8.40	0.30	10.55	380	7.40	7.87	0.940
121	0	Gilbert and Nejadi (2004)	B3-a	4401042	3110	<	8484	<	34600	4.078	715169271	712276	28355	23175	278.65	232.31	16595791	288974918	1073818	2.475	0.1402	0.24	2.48	0.00	2.72	0.59	6.14	0.00	6.73	0	6.43	5.81	1.107
122	t	Gilbert and Nejadi (2004)	B3-a	4401042	3110	<	8484	<	34600	4.078	715169271	712276	28355	23175	278.65	232.31	16595791	288974918	1073818	2.475	0.1402	0.54	5.67	0.35	6.56	1.35	14.02	0.35	15.72	380	15.04	13.30	1.131
123	0	Gilbert and Nejadi (2004)	B3-b	4401042	3110	<	8484	<	20800	2.452	715169271	712276	28355	23175	278.65	232.31	16595791	288974918	1073818	2.475	0.1402	0.24	1.39	0.00	1.63	0.59	3.45	0.00	4.04	0	3.47	1.97	1.761
124	t	Gilbert and Nejadi (2004)	B3-b	4401042	3110	<	8484	<	20800	2.452	715169271	712276	28355	23175	278.65	232.31	16595791	288974918	1073818	2.475	0.1402	0.54	3.18	0.35	4.07	1.35	7.88	0.35	9.58	380	8.27	7.90	1.047
125	0	Gilbert and Nejadi (2004)	S1-a	1601667	2373	<	3087	<	6810	2.206	124129167	101929	14343	12402	139.5	124.01	993514	23000169	192212	5.397	0.1143	1.05	1.96	0.00	3.01	5.65	10.56	0.00	16.21	0	9.94	7.14	1.392
126	t	Gilbert and Nejadi (2004)	S1-a	1601667	2373	<	3087	<	6810	2.206	124129167	101929	14343	12402	139.5	124.01	993514	23000169	192212	5.397	0.1143	2.54	4.74	0.65	7.93	13.68	25.59	0.65	39.92	380	24.76	25.10	0.986
127	0	Gilbert and Nejadi (2004)	S1-b	1601667	2373	<	3087	<	5280	1.710	124129167	101929	14343	12402	139.5	124.01	993514	23000169	192212	5.397	0.1143	1.05	1.28	0.00	2.33	5.65	6.92	0.00	12.57	0	5.54	2.72	2.037
128	t	Gilbert and Nejadi (2004)	S1-b	1601667	2373	<	3087	<	5280	1.710	124129167	101929	14343	12402	139.5	124.01	993514	23000169	192212	5.397	0.1143	2.54	3.11	0.65	6.30	13.68	16.76	0.65	31.09	380	14.08	19.90	0.708
129	0	Gilbert and Nejadi (2004)	S2-a	1601667	2373	<	3087	<	9870	3.197	124129167	152893	17644	14732	136.59	118.17	1665131	31941782	271312	3.886	0.1308	1.05	3.31	0.00	4.36	4.07	12.84	0.00	16.91	0	14.62	11.80	1.239
130	t	Gilbert and Nejadi (2004)	S2-a	1601667	2373	<	3087	<	9870	3.197	124129167	152893	17644	14732	136.59	118.17	1665131	31941782	271312	3.886	0.1308	2.54	8.01	0.75	11.30	9.85	31.13	0.75	41.73	380	36.18	32.50	1.113
131	0	Gilbert and Nejadi (2004)	S2-b	1601667	2373	<	3087	<	6810	2.206	124129167	152893	17644	14732	136.59	118.17	1665131	31941782	271312	3.886	0.1308	1.05	1.96	0.00	3.01	4.07	7.60	0.00	11.67	0	8.18	4.43	1.847
132	t	Gilbert and Nejadi (2004)	S2-b	1601667	2373	<	3087	<	6810	2.206	124129167	152893	17644	14732	136.59	118.17	1665131	31941782	271312	3.886	0.1308	2.54	4.74	0.75	8.03	9.85	18.42	0.75	29.02	380	20.58	21.90	0.940
133	0	Gilbert and Nejadi (2004)	S3-a	1601667	2373	<	3087	<	11350	3.677	124129167	203857	20466	16583	134.27	113.54	2375048	39938925	343772	3.108	0.1439	1.05	3.96	0.00	5.01	3.25	12.30	0.00	15.55	0	14.39	10.70	1.345
134	t	Gilbert and Nejadi (2004)	S3-a	1601667	2373	<	3087	<	11350	3.677	124129167	203857	20466	16583	134.27	113.54	2375048	39938925	343772	3.108	0.1439	2.54	9.59	0.82	12.95	7.88	29.81	0.82	38.51	380	35.70	29.80	1.198
135	0	Gilbert and Nejadi (2004)	S3-b	1601667	2373	<	3087	<	8340	2.702	124129167	203857	20466	16583	134.27	113.54	2375048	39938925	343772	3.108	0.1439	1.05	2.63	0.00	3.68	3.25	8.18	0.00	11.43	0	9.64	5.04	1.913
136	t	Gilbert and Nejadi (2004)	S3-b	1601667	2373	<	3087	<	8340	2.702	124129167	203857	20466	16583	134.27	113.54	2375048	39938925	343772	3.108	0.1439	2.54	6.38	0.82	9.74	7.88	19.82	0.82	28.52	380	24.19	22.90	1.056
137	0	Tošić (2017)	NAC7	1066667	1024	<	2035	<	7669	3.769	106666667	128965	9037	7182	177.56	155.13	1205822	25917152	161122	4.116	0.0864	0.44	2.96	0.00	3.40	1.82	12.17	0.00	13.99	0	12.66	9.17	1.381
138	t	Tošić (2017)	NAC7	1066667	1024	<	2035	<	7669	3.769	106666667	128965	9037	7182	177.56	155.13	1205822	25917152	161122	4.116	0.0864	1.09	7.29	0.41	8.79	4.50	30.01	0.41	34.92	450	31.63	18.94	1.670
139	0	Tošić (2017)	NAC28	1066667	1024	<	2433	<	6877	2.827	106666667	107775	8231	6682	179.12	158.27	970995	22354235	139412	4.772	0.0864	0.37	2.18	0.00	2.55	1.77	10.39	0.00	12.16	0	9.64	8.11	1.189
140	t	Tošić (2017)	NAC28	1066667	1024	<	2433	<	6877	2.827	106666667	107775	8231	6682	179.12	158.27	970995	22354235	139412	4.772	0.0864	0.83	4.89	0.41	6.13	3.96	23.31	0.41	27.68	450	22.04	16.51	1.335

Assessment and Correction of ACI model:
Database with B4s shrinkage and creep model

		Study information		Cross-section					Reinforcement																			Loading					Deflection	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
		Author	Specimen	b (mm)	h (mm)	A_{s1} (mm^2)	d (mm)	ρ_1 (%)	A_{s2} (mm^2)	d' (mm)	d_2 (mm)	ρ_2 (%)	type	RH (%)	T (ºC)	t_{test} (days)	$f_{cm}(t_{test})$ (MPa)	f_{cm} (MPa)	$f_{cm}(t_0)$ (MPa)	$f_r(t_0)$ (MPa)	$f_{r,red}(t_0)$ (MPa)	$E_{cm}(t_0)$ (MPa)	E_s (MPa)	φ (–)	ε_{cs} (‰)	L (mm)	L/d	M_{L1} (Nm)	K_{L1}	M_{L2} (Nm)	K_{L2}	a (t-t$_0$) (mm)	t_0 (days)	t-t$_0$ (days)
1	0	Washa and Fluck [8]	A1/A4	203.2	304.8	852	257.2	1.63	852	257.2	47.6	1.63	deformed	50	21	14	25.00	28.39	25.00	3.10	2.07	25000	200000	0.000	0.000	6096	23.7	7192	0.104	18442	0.104	13.46	14	0
2	t	Washa and Fluck [8]	A1/A4	203.2	304.8	852	257.2	1.63	852	257.2	47.6	1.63	deformed	50	21	14	25.00	28.39	25.00	3.10	2.07	25000	200000	4.282	0.742	6096	23.7	7192	0.104	18442	0.104	23.62	14	913
3	0	Washa and Fluck [8]	A2/A5	203.2	304.8	852	257.2	1.63	400	258.7	46.1	0.77	deformed	50	21	14	25.00	28.39	25.00	3.10	2.07	25000	200000	0.000	0.000	6096	23.7	7192	0.104	18442	0.104	15.75	14	0
4	t	Washa and Fluck [8]	A2/A5	203.2	304.8	852	257.2	1.63	400	258.7	46.1	0.77	deformed	50	21	14	25.00	28.39	25.00	3.10	2.07	25000	200000	4.282	0.742	6096	23.7	7192	0.104	18442	0.104	32.26	14	913
5	0	Washa and Fluck [8]	A3/A6	203.2	304.8	852	257.2	1.63	0	0	0	0.00	deformed	50	21	14	25.00	28.39	25.00	3.10	2.07	25000	200000	0.000	0.000	6096	23.7	7192	0.104	18442	0.104	17.02	14	0
6	t	Washa and Fluck [8]	A3/A6	203.2	304.8	852	257.2	1.63	0	0	0	0.00	deformed	50	21	14	25.00	28.39	25.00	3.10	2.07	25000	200000	4.282	0.742	6096	23.7	7192	0.104	18442	0.104	44.70	14	913
7	0	Washa and Fluck [8]	B1/B4	152.4	203.2	400	157.2	1.67	400	157.2	46	1.67	deformed	50	21	14	20.80	23.62	20.80	2.83	1.89	22804	200000	0.000	0.000	6096	38.8	3596	0.104	3663	0.104	23.37	14	0
8	t	Washa and Fluck [8]	B1/B4	152.4	203.2	400	157.2	1.67	400	157.2	46	1.67	deformed	50	21	14	20.80	23.62	20.80	2.83	1.89	22804	200000	6.886	0.881	6096	38.8	3596	0.104	3663	0.104	51.05	14	913
9	0	Washa and Fluck [8]	B2/B5	152.4	203.2	400	157.2	1.67	200	157.2	46	0.84	deformed	50	21	14	20.80	23.62	20.80	2.83	1.89	22804	200000	0.000	0.000	6096	38.8	3596	0.104	3663	0.104	24.89	14	0
10	t	Washa and Fluck [8]	B2/B5	152.4	203.2	400	157.2	1.67	200	157.2	46	0.84	deformed	50	21	14	20.80	23.62	20.80	2.83	1.89	22804	200000	6.886	0.881	6096	38.8	3596	0.104	3663	0.104	65.02	14	913
11	0	Washa and Fluck [8]	B3/B6	152.4	203.2	400	157.2	1.67	0	0	0	0.00	deformed	50	21	14	20.80	23.62	20.80	2.83	1.89	22804	200000	0.000	0.000	6096	38.8	3596	0.104	3663	0.104	26.42	14	0
12	t	Washa and Fluck [8]	B3/B6	152.4	203.2	400	157.2	1.67	0	0	0	0.00	deformed	50	21	14	20.80	23.62	20.80	2.83	1.89	22804	200000	6.886	0.881	6096	38.8	3596	0.104	3663	0.104	86.36	14	913
13	0	Washa and Fluck [8]	D1/D4	304.8	127	516	101.6	1.67	516	101.6	25.4	1.67	deformed	50	21	14	22.10	25.10	22.10	2.91	1.94	23505	200000	0.000	0.000	3810	37.5	1756	0.104	4267	0.104	11.94	14	0
14	t	Washa and Fluck [8]	D1/D4	304.8	127	516	101.6	1.67	516	101.6	25.4	1.67	deformed	50	21	14	22.10	25.10	22.10	2.91	1.94	23505	200000	5.885	0.838	3810	37.5	1756	0.104	4267	0.104	27.69	14	913
15	0	Washa and Fluck [8]	D2/D5	304.8	127	516	101.6	1.67	258	101.6	25.4	0.83	deformed	50	21	14	22.10	25.10	22.10	2.91	1.94	23505	200000	0.000	0.000	3810	37.5	1756	0.104	4267	0.104	14.22	14	0
16	t	Washa and Fluck [8]	D2/D5	304.8	127	516	101.6	1.67	258	101.6	25.4	0.83	deformed	50	21	14	22.10	25.10	22.10	2.91	1.94	23505	200000	5.885	0.838	3810	37.5	1756	0.104	4267	0.104	33.78	14	913
17	0	Washa and Fluck [8]	D3/D6	304.8	127	516	101.6	1.67	0	0	0	0.00	deformed	50	21	14	22.10	25.10	22.10	2.91	1.94	23505	200000	0.000	0.000	3810	37.5	1756	0.104	4267	0.104	17.78	14	0
18	t	Washa and Fluck [8]	D3/D6	304.8	127	516	101.6	1.67	0	0	0	0.00	deformed	50	21	14	22.10	25.10	22.10	2.91	1.94	23505	200000	5.885	0.838	3810	37.5	1756	0.104	4267	0.104	48.51	14	913
19	0	P.C.A. [18]	40NA	152	305	849	254	2.20	0	0	0	0.00	deformed	50	21	28	26.90	26.71	26.90	3.22	2.15	25933	200000	0.000	0.000	3048	12.0	1346	0.104	22267	0.107	4.25	28	0
20	t	P.C.A. [18]	40NA	152	305	849	254	2.20	0	0	0	0.00	deformed	50	21	28	26.90	26.71	26.90	3.22	2.15	25933	200000	3.679	0.686	3048	12.0	1346	0.104	22267	0.107	10.00	28	242
21	0	P.C.A. [18]	60NA	152	305	1019	254	2.64	0	0	0	0.00	deformed	50	21	28	37.40	37.13	37.40	3.79	2.53	30578	200000	0.000	0.000	3048	12.0	1346	0.104	29641	0.107	4.90	28	0
22	t	P.C.A. [18]	60NA	152	305	1019	254	2.64	0	0	0	0.00	deformed	50	21	28	37.40	37.13	37.40	3.79	2.53	30578	200000	1.485	0.503	3048	12.0	1346	0.104	29641	0.107	9.90	28	242
23	0	Sattler [11]	a1/a2	100	160	100	134	0.75	0	0	0	0.00	deformed	55	21	32	26.70	26.03	26.70	3.20	2.13	25836	200000	0.000	0.000	4000	29.9	800	0.104	1962	0.104	15.83	32	0
24	t	Sattler [11]	a1/a2	100	160	100	134	0.75	0	0	0	0.00	deformed	55	21	32	26.70	26.03	26.70	3.20	2.13	25836	200000	3.438	0.687	4000	29.9	800	0.104	1962	0.104	32.21	32	84
25	0	Hajnal-Konyi [22]	8	127	190.5	142	160.3	0.70	0	0	0	0.00	deformed	82	21	35	37.00	35.68	38.55	3.85	2.57	31044	200000	0.000	0.000	6400	39.9	3097	0.104	1612	0.104	20.60	53	0
26	t	Hajnal-Konyi [22]	8	127	190.5	142	160.3	0.70	0	0	0	0.00	deformed	82	21	35	37.00	35.68	38.55	3.85	2.57	31044	200000	1.931	0.363	6400	39.9	3097	0.104	1612	0.104	65.40	53	1734
27	0	Hajnal-Konyi [22]	10	127	190.5	142	160.3	0.70	0	0	0	0.00	deformed	82	21	35	37.00	35.68	38.55	3.85	2.57	31044	200000	0.000	0.000	4800	29.9	1742	0.104	2967	0.104	8.80	53	0
28	t	Hajnal-Konyi [22]	10	127	190.5	142	160.3	0.70	0	0	0	0.00	deformed	82	21	35	37.00	35.68	38.55	3.85	2.57	31044	200000	1.931	0.363	4800	29.9	1742	0.104	2967	0.104	29.70	53	1734
29	0	Hajnal-Konyi [22]	12	127	190.5	142	160.3	0.70	0	0	0	0.00	deformed	82	21	35	37.00	35.68	38.55	3.85	2.57	31044	200000	0.000	0.000	3200	20.0	774	0.104	3935	0.104	4.30	53	0
30	t	Hajnal-Konyi [22]	12	127	190.5	142	160.3	0.70	0	0	0	0.00	deformed	82	21	35	37.00	35.68	38.55	3.85	2.57	31044	200000	1.931	0.363	3200	20.0	774	0.104	3935	0.104	14.00	53	1734
31	0	Branson and Metz [23]	SB3/B	101.6	127	214	101.6	2.07	0	0	0	0.00	deformed	50	21	28	35.40	35.15	35.40	3.69	2.46	29749	200000	0.000	0.000	2743	27.0	303	0.104	935	0.104	3.89	28	0
32	t	Branson and Metz [23]	SB3/B	101.6	127	214	101.6	2.07	0	0	0	0.00	deformed	50	21	28	35.40	35.15	35.40	3.69	2.46	29749	200000	1.407	0.514	2743	27.0	303	0.104	935	0.104	7.70	28	60
33	0	Branson and Metz [23]	SB3/M	101.6	127	214	101.6	2.07	0	0	0	0.00	deformed	50	21	28	31.30	31.08	31.30	3.47	2.31	27973	200000	0.000	0.000	2743	27.0	303	0.104	935	0.104	3.99	28	0
34	t	Branson and Metz [23]	SB3/M	101.6	127	214	101.6	2.07	0	0	0	0.00	deformed	50	21	28	31.30	31.08	31.30	3.47	2.31	27973	200000	2.032	0.585	2743	27.0	303	0.104	935	0.104	7.50	28	60
35	0	Pauw and Meyers [26]	R1	177.8	216	400	165.1	1.36	0	0	0	0.00	deformed	50	21	28	33.80	33.56	33.80	3.60	2.40	29069	200000	0.000	0.000	2286	13.8	627	0.104	7176	0.107	2.44	28	0
36	t	Pauw and Meyers [26]	R1	177.8	216	400	165.1	1.36	0	0	0	0.00	deformed	50	21	28	33.80	33.56	33.80	3.60	2.40	29069	200000	1.833	0.502	2286	13.8	627	0.104	7176	0.107	4.89	28	150
37	0	Pauw and Meyers [26]	R2	177.8	216	568	165.1	1.94	0	0	0	0.00	deformed	50	21	28	33.60	33.36	33.60	3.59	2.39	28983	200000	0.000	0.000	2286	13.8	627	0.104	11228	0.107	3.22	28	0
38	t	Pauw and Meyers [26]	R2	177.8	216	568	165.1	1.94	0	0	0	0.00	deformed	50	21	28	33.60	33.36	33.60	3.59	2.39	28983	200000	1.864	0.504	2286	13.8	627	0.104	11228	0.107	6.16	28	150
39	0	Pauw and Meyers [26]	R3	177.8	216	568	165.1	1.94	0	0	0	0.00	deformed	50	21	28	38.90	38.62	38.90	3.87	2.58	31185	200000	0.000	0.000	2286	13.8	627	0.104	9643	0.107	3.71	28	0
40	t	Pauw and Meyers [26]	R3	177.8	216	568	165.1	1.94	0	0	0	0.00	deformed	50	21	28	38.90	38.62	38.90	3.87	2.58	31185	200000	1.169	0.411	2286	13.8	627	0.104	9643	0.107	6.64	28	120
41	0	Pauw and Meyers [26]	R4	177.8	216	774	165.1	2.64	0	0	0	0.00	deformed	50	21	28	38.70	38.42	38.70	3.86	2.57	31105	200000	0.000	0.000	2286	13.8	627	0.104	14607	0.107	4.66	28	0
42	t	Pauw and Meyers [26]	R4	177.8	216	774	165.1	2.64	0	0	0	0.00	deformed	50	21	28	38.70	38.42	38.70	3.86	2.57	31105	200000	1.187	0.412	2286	13.8	627	0.104	14607	0.107	7.89	28	120
43	0	Lutz et al. [29]	SR	101.6	203.2	258	171.5	1.48	0	0	0	0.00	deformed	40	21	28	34.10	33.86	34.10	3.62	2.41	29198	200000	0.000	0.000	1829	10.7	216	0.104	7963	0.107	4.10	28	0
44	t	Lutz et al. [29]	SR	101.6	203.2	258	171.5	1.48	0	0	0	0.00	deformed	40	21	28	34.10	33.86	34.10	3.62	2.41	29198	200000	1.820	0.621	1829	10.7	216	0.104	7963	0.107	8.80	28	142
45	0	Lutz et al. [29]	DR	101.6	203.2	258	171.5	1.48	258	177.8	25.4	1.48	deformed	40	21	28	34.10	33.86	34.10	3.62	2.41	29198	200000	0.000	0.000	1829	10.7	216	0.104	7963	0.107	4.20	28	0
46	t	Lutz et al. [29]	DR	101.6	203.2	258	171.5	1.48	258	177.8	25.4	1.48	deformed	40	21	28	34.10	33.86	34.10	3.62	2.41	29198	200000	1.820	0.621	1829	10.7	216	0.104	7963	0.107	6.80	28	142
47	0	Jaccoud and Favre (1982)	A1	600	120	314	95	0.55	57	100	20	0.10	deformed	60	21	15	20.49	22.88	20.49	2.81	1.87	22633	200000	0.000	0.000	3100	32.6	2162	0.104	2787	0.104	8.42	15	0
48	t	Jaccoud and Favre (1982)	A1	600	120	314	95	0.55	57	100	20	0.10	deformed	60	21	15	20.49	22.88	20.49	2.81	1.87	22633	200000	6.738	0.777	3100	32.6	2162	0.104	2787	0.104	18.40	15	365
49	0	Jaccoud and Favre (1982)	A2	600	120	314	95	0.55	57	100	20	0.10	deformed	60	21	15	24.14	26.96	24.14	3.05	2.03	24566	200000	0.000	0.000	3100	32.6	2162	0.104	2787	0.104	6.16	15	0
50	t	Jaccoud and Favre (1982)	A2	600	120	314	95	0.55	57	100	20	0.10	deformed	60	21	15	24.14	26.96	24.14	3.05	2.03	24566	200000	4.351	0.673	3100	32.6	2162	0.104	2787	0.104	17.50	15	365
51	0	Jaccoud and Favre (1982)	A3	600	120	314	95	0.55	57	100	20	0.10	deformed	60	21	15	19.64	21.93	19.64	2.75	1.83	22159	200000	0.000	0.000	3100	32.6	2162	0.104	2787	0.104	8.12	15	0
52	t	Jaccoud and Favre (1982)	A3	600	120	314	95	0.55	57	100	20	0.10	deformed	60	21	15	19.64	21.93	19.64	2.75	1.83	22159	200000	7.546	0.809	3100	32.6	2162	0.104	2787	0.104	17.50	15	365
53	0	Jaccoud and Favre (1982)	A4	600	120	314	95	0.55	57	100	20	0.10	deformed	60	21	15	36.13	40.35	36.13	3.73	2.49	30054	200000	0.000	0.000	3100	32.6	2162	0.104	2787	0.104	2.24	15	0
54	t	Jaccoud and Favre (1982)	A4	600	120	314	95	0.55	57	100	20	0.10	deformed	60	21	15	36.13	40.35	36.13	3.73	2.49	30054	200000	1.481	0.473	3100	32.6	2162	0.104	2787	0.104	8.05	15	365
55	0	Jaccoud and Favre (1982)	A5	600	120	314	95	0.55	57	100	20	0.10	deformed	60	21	15	32.47	36.26	32.47	3.53	2.35	28491	200000	0.000	0.000	3100	32.6	2162	0.104	2787	0.104	3.12	15	0
56	t	Jaccoud and Favre (1982)	A5	600	120	314	95	0.55	57	100	20	0.10	deformed	60	21	15	32.47	36.26	32.47	3.53	2.35	28491	200000	1.976	0.517	3100	32.6	2162	0.104	2787	0.104	9.55	15	365
57	0	Jaccoud and Favre (1982)	C12	750	160	565	131	0.58	57	134	26	0.06	deformed	60	21	28	29.40	29.19	29.40	3.36	2.24	27111	200000	0.000	0.000	3100	23.7	3604	0.104	6095	0.107	2.17	28	0
58	t	Jaccoud and Favre (1982)	C12	750	160	565	131	0.58	57	134	26	0.06	deformed	60	21	28	29.40	29.19	29.40	3.36	2.24	27111	200000	3.124	0.589	3100	23.7	3604	0.104	6095	0.107	8.29	28	510
59	0	Jaccoud and Favre (1982)	C22	750	160	565	131	0.58	57	134	26	0.06	deformed	60	21	28	32.89	32.66	32.89	3.56	2.37	28675	200000	0.000	0.000	3100	23.7	3604	0.104	6095	0.107	2.00	28	0
60	t	Jaccoud and Favre (1982)	C22	750	160	565	131	0.58	57	134	26	0.06	deformed	60	21	28	32.89	32.66	32.89	3.56	2.37	28675	200000	2.216	0.500	3100	23.7	3604	0.104	6095	0.107	7.00	28	365
61	0	Jaccoud and Favre (1982)	C13	750	160	565	131	0.58	57	134	26	0.06	deformed	60	21	28	30.93	30.71	30.93	3.45	2.30	27807	200000	0.000	0.000	3100	23.7	3604	0.104	9305	0.107	5.29	28	0
62	t	Jaccoud and Favre (1982)	C13	750	160	565	131	0.58	57	134	26	0.06	deformed	60	21	28	30.93	30.71	30.93	3.45	2.30	27807	200000	2.728	0.565	3100	23.7	3604	0.104	9305	0.107	13.28	28	510
63	0	Jaccoud and Favre (1982)	C14	750	160	565	131	0.58	57	134	26	0.06	deformed	60	21	28	29.40	29.19	29.40	3.36	2.24	27111	200000	0.000	0.000	3100	23.7	3604	0.104	12520	0.107	8.48	28	0
64	t	Jaccoud and Favre (1982)	C14	750	160	565	131	0.58	57	134	26	0.06	deformed	60	21	28	29.40	29.19	29.40	3.36	2.24	27111	200000	3.124	0.589	3100	23.7	3604	0.104	12520	0.107	18.15	28	510
65	0	Jaccoud and Favre (1982)	C24	750	160	565	131	0.58	57	134	26	0.06	deformed	60	21	28	31.97	31.74	31.97	3.51	2.34	28271	200000	0.000	0.000	3100	23.7	3604	0.104	12520	0.107	8.00	28	0
66	t	Jaccoud and Favre (1982)	C24	750	160	565	131	0.58	57	134	26	0.06	deformed	60	21	28	31.97	31.74	31.97	3.51	2.34	28271	200000	2.498	0.548	3100	23.7	3604	0.104	12520	0.107	17.52	28	510
67	0	Jaccoud and Favre (1982)	C15	750	160	565	131	0.58	57	134	26	0.06	deformed	60	21	28	29.29	29.08	29.29	3.36	2.24	27060	200000	0.000	0.000	3100	23.7	3604	0.104	15725	0.107	11.02	28	0
68	t	Jaccoud and Favre (1982)	C15	750	160	565	131	0.58	57	134	26	0.06	deformed	60	21	28	29.29	29.08	29.29	3.36	2.24	27060	200000	3.155	0.590	3100	23.7	3604	0.104	15725	0.107	20.83	28	510
69	0	Ding Dajung [44]	C-3	81	160	113	137	1.02	0	0	0	0.00	deformed	80	21	30	21.60	21.24	21.60	2.88	1.92	23238	200000	0.000	0.000	2880	21.0	336	0.104	2904	0.107	8.45	30	0
70	t	Ding Dajung [44]	C-3	81	160	113	137	1.02	0	0	0	0.00	deformed	80	21	30	21.60	21.24	21.60	2.88	1.92	23238	200000	8.121	0.566	2880	21.0	336	0.104	2904	0.107	16.62	30	2025
71	0	Ding Dajung [44]	L-1	62	152	154	117	2.12	0	0	0	0.00	deformed	80	21	30	25.40	24.98	25.40	3.12	2.08	25199	200000	0.000	0.000	2880	24.6	244	0.104	3280	0.107	15.53	30	0
72	t	Ding Dajung [44]	L-1	62	152	154	117	2.12	0	0	0	0.00	deformed	80	21	30	25.40	24.98	25.40	3.12	2.08	25199	200000	4.673	0.511	2880	24.6	244	0.104	3280	0.107	30.43	30	531

		Study information		Cross-section		Reinforcement																						Loading					Deflection	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
		Author	Specimen	b (mm)	h (mm)	A_{s1} (mm^2)	d (mm)	ρ_1 (%)	A_{s2} (mm^2)	d' (mm)	d_2 (mm)	ρ_2 (%)	type	RH (%)	T (ºC)	t_{test} (days)	$f_{cm}(t_{test})$ (MPa)	f_{cm} (MPa)	$f_{cm}(t_0)$ (MPa)	$f_r(t_0)$ (MPa)	$f_{r,red}(t_0)$ (MPa)	$E_{cm}(t_0)$ (MPa)	E_s (MPa)	φ (–)	ε_{cs} (‰)	L (mm)	L/d	M_{L1} (Nm)	K_{L1}	M_{L2} (Nm)	K_{L2}	a (t-t_0) (mm)	t_0 (days)	t-t_0 (days)
73	0	F.R.F.C. [45]	I-72	150	280	308	250	0.82	0	0	0	0.00	deformed	60	21	28	33.50	33.26	33.50	3.59	2.39	28940	200000	0.000	0.000	2800	11.2	1029	0.104	21500	0.107	6.02	28	0
74	t	F.R.F.C. [45]	I-72	150	280	308	250	0.82	0	0	0	0.00	deformed	60	21	28	33.50	33.26	33.50	3.59	2.39	28940	200000	2.540	0.603	2800	11.2	1029	0.104	21500	0.107	10.29	28	1610
75	0	F.R.F.C. [45]	I-81	150	280	308	250	0.82	0	0	0	0.00	deformed	60	21	28	33.50	33.26	33.50	3.59	2.39	28940	200000	0.000	0.000	2800	11.2	1029	0.104	24250	0.107	7.39	28	0
76	t	F.R.F.C. [45]	I-81	150	280	308	250	0.82	0	0	0	0.00	deformed	60	21	28	33.50	33.26	33.50	3.59	2.39	28940	200000	2.490	0.602	2800	11.2	1029	0.104	24250	0.107	11.98	28	1344
77	0	F.R.F.C. [45]	I-91	150	280	308	250	0.82	0	0	0	0.00	deformed	60	21	28	33.50	33.26	33.50	3.59	2.39	28940	200000	0.000	0.000	2800	11.2	1029	0.104	27180	0.107	8.94	28	0
78	t	F.R.F.C. [45]	I-91	150	280	308	250	0.82	0	0	0	0.00	deformed	60	21	28	33.50	33.26	33.50	3.59	2.39	28940	200000	2.483	0.602	2800	11.2	1029	0.104	27180	0.107	15.02	28	1314
79	0	F.R.F.C. [45]	II-52	150	280	770	236	2.18	0	0	0	0.00	deformed	60	21	28	29.80	29.59	29.80	3.38	2.25	27295	200000	0.000	0.000	2800	11.9	1029	0.104	33950	0.107	7.27	28	0
80	t	F.R.F.C. [45]	II-52	150	280	770	236	2.18	0	0	0	0.00	deformed	60	21	28	29.80	29.59	29.80	3.38	2.25	27295	200000	3.368	0.654	2800	11.9	1029	0.104	33950	0.107	13.49	28	1398
81	0	F.R.F.C. [45]	II-59	150	280	770	236	2.18	0	0	0	0.00	deformed	60	21	28	29.80	29.59	29.80	3.38	2.25	27295	200000	0.000	0.000	2800	11.9	1029	0.104	38300	0.107	7.69	28	0
82	t	F.R.F.C. [45]	II-59	150	280	770	236	2.18	0	0	0	0.00	deformed	60	21	28	29.80	29.59	29.80	3.38	2.25	27295	200000	3.402	0.654	2800	11.9	1029	0.104	38300	0.107	14.10	28	1541
83	0	F.R.F.C. [45]	II-70	150	280	770	236	2.18	0	0	0	0.00	deformed	60	21	28	29.80	29.59	29.80	3.38	2.25	27295	200000	0.000	0.000	2800	11.9	1029	0.104	45850	0.107	9.36	28	0
84	t	F.R.F.C. [45]	II-70	150	280	770	236	2.18	0	0	0	0.00	deformed	60	21	28	29.80	29.59	29.80	3.38	2.25	27295	200000	3.386	0.654	2800	11.9	1029	0.104	45850	0.107	17.56	28	1471
85	0	F.R.F.C. [45]	II-80	150	280	770	236	2.18	0	0	0	0.00	deformed	60	21	28	29.80	29.59	29.80	3.38	2.25	27295	200000	0.000	0.000	2800	11.9	1029	0.104	52260	0.107	10.72	28	0
86	t	F.R.F.C. [45]	II-80	150	280	770	236	2.18	0	0	0	0.00	deformed	60	21	28	29.80	29.59	29.80	3.38	2.25	27295	200000	3.389	0.654	2800	11.9	1029	0.104	52260	0.107	20.24	28	1485
87	0	F.R.F.C. [45]	II-90	150	280	770	236	2.18	0	0	0	0.00	deformed	60	21	28	29.80	29.59	29.80	3.38	2.25	27295	200000	0.000	0.000	2800	11.9	1029	0.104	58660	0.107	13.10	28	0
88	t	F.R.F.C. [45]	II-90	150	280	770	236	2.18	0	0	0	0.00	deformed	60	21	28	29.80	29.59	29.80	3.38	2.25	27295	200000	3.390	0.654	2800	11.9	1029	0.104	58660	0.107	24.23	28	1491
89	0	F.R.F.C. [45]	III-43	150	280	1232	233	3.53	0	0	0	0.00	deformed	60	21	28	34.30	34.06	34.31	3.63	2.42	29287	200000	0.000	0.000	2800	12.0	1029	0.104	42190	0.107	7.08	28	0
90	t	F.R.F.C. [45]	III-43	150	280	1232	233	3.53	0	0	0	0.00	deformed	60	21	28	34.30	34.06	34.31	3.63	2.42	29287	200000	2.387	0.594	2800	12.0	1029	0.104	42190	0.107	14.51	28	1572
91	0	F.R.F.C. [45]	III-67	150	280	1232	233	3.53	0	0	0	0.00	deformed	60	21	28	34.30	34.06	34.31	3.63	2.42	29287	200000	0.000	0.000	2800	12.0	1029	0.104	65300	0.107	10.58	28	0
92	t	F.R.F.C. [45]	III-67	150	280	1232	233	3.53	0	0	0	0.00	deformed	60	21	28	34.30	34.06	34.31	3.63	2.42	29287	200000	2.387	0.594	2800	12.0	1029	0.104	65300	0.107	23.88	28	1572
93	0	F.R.F.C. [45]	III-77	150	280	1232	233	3.53	0	0	0	0.00	deformed	60	21	28	34.30	34.06	34.31	3.63	2.42	29287	200000	0.000	0.000	2800	12.0	1029	0.104	75490	0.107	13.84	28	0
94	t	F.R.F.C. [45]	III-77	150	280	1232	233	3.53	0	0	0	0.00	deformed	60	21	28	34.30	34.06	34.31	3.63	2.42	29287	200000	2.387	0.594	2800	12.0	1029	0.104	75490	0.107	28.74	28	1572
95	0	F.R.F.C. [45]	IV-52	150	280	770	236	2.18	462	248	32	1.31	deformed	60	21	28	32.00	31.77	32.00	3.51	2.34	28284	200000	0.000	0.000	2800	11.9	1029	0.104	37610	0.107	5.98	28	0
96	t	F.R.F.C. [45]	IV-52	150	280	770	236	2.18	462	248	32	1.31	deformed	60	21	28	32.00	31.77	32.00	3.51	2.34	28284	200000	2.626	0.611	2800	11.9	1029	0.104	37610	0.107	10.52	28	772
97	0	F.R.F.C. [45]	IV-70	150	280	770	236	2.18	462	248	32	1.31	deformed	60	21	28	32.00	31.77	32.00	3.51	2.34	28284	200000	0.000	0.000	2800	11.9	1029	0.104	51340	0.107	8.80	28	0
98	t	F.R.F.C. [45]	IV-70	150	280	770	236	2.18	462	248	32	1.31	deformed	60	21	28	32.00	31.77	32.00	3.51	2.34	28284	200000	2.626	0.611	2800	11.9	1029	0.104	51340	0.107	13.90	28	772
99	0	F.R.F.C. [45]	IV-80	150	280	770	236	2.18	462	248	32	1.31	deformed	60	21	28	32.00	31.77	32.00	3.51	2.34	28284	200000	0.000	0.000	2800	11.9	1029	0.104	58200	0.107	11.16	28	0
100	t	F.R.F.C. [45]	IV-80	150	280	770	236	2.18	462	248	32	1.31	deformed	60	21	28	32.00	31.77	32.00	3.51	2.34	28284	200000	2.697	0.617	2800	11.9	1029	0.104	58200	0.107	16.96	28	972
101	0	F.R.F.C. [45]	IV-90	150	280	770	236	2.18	462	248	32	1.31	deformed	60	21	28	32.00	31.77	32.00	3.51	2.34	28284	200000	0.000	0.000	2800	11.9	1029	0.104	65530	0.107	12.85	28	0
102	t	F.R.F.C. [45]	IV-90	150	280	770	236	2.18	462	248	32	1.31	deformed	60	21	28	32.00	31.77	32.00	3.51	2.34	28284	200000	2.697	0.617	2800	11.9	1029	0.104	65530	0.107	19.28	28	972
103	0	Bakoss et al. [41]	1B2	100	150	226	130	1.74	0	0	0	0.00	deformed	60	21	28	39.00	38.72	39.00	3.87	2.58	31225	200000	0.000	0.000	3750	28.8	659	0.104	3250	0.107	8.94	28	0
104	t	Bakoss et al. [41]	1B2	100	150	226	130	1.74	0	0	0	0.00	deformed	60	21	28	39.00	38.72	39.00	3.87	2.58	31225	200000	1.476	0.552	3750	28.8	659	0.104	3250	0.107	25.02	28	500
105	0	Clarke et al. [46]	A1	100	154	157.1	132	1.19	0	0	0	0.00	deformed	40	21	28	25.90	25.72	25.91	3.16	2.11	25451	200000	0.000	0.000	2100	15.9	212	0.104	3500	0.107	4.89	28	0
106	t	Clarke et al. [46]	A1	100	154	157.1	132	1.19	0	0	0	0.00	deformed	40	21	28	25.90	25.72	25.91	3.16	2.11	25451	200000	3.992	0.850	2100	15.9	212	0.104	3500	0.107	11.83	28	180
107	0	Clarke et al. [46]	A2	100	152	157.1	130	1.21	0	0	0	0.00	deformed	40	21	28	25.90	25.72	25.91	3.16	2.11	25451	200000	0.000	0.000	2100	16.2	209	0.104	3500	0.107	5.09	28	0
108	t	Clarke et al. [46]	A2	100	152	157.1	130	1.21	0	0	0	0.00	deformed	40	21	28	25.90	25.72	25.91	3.16	2.11	25451	200000	3.992	0.850	2100	16.2	209	0.104	3500	0.107	11.92	28	180
109	0	Clarke et al. [46]	B1	100	152	157.1	130	1.21	157.1	132	20	1.21	deformed	40	21	28	25.90	25.72	25.91	3.16	2.11	25451	200000	0.000	0.000	2100	16.2	209	0.104	3500	0.107	4.78	28	0
110	t	Clarke et al. [46]	B1	100	152	157.1	130	1.21	157.1	132	20	1.21	deformed	40	21	28	25.90	25.72	25.91	3.16	2.11	25451	200000	3.992	0.850	2100	16.2	209	0.104	3500	0.107	8.77	28	180
111	0	Clarke et al. [46]	B2	100	154	157.1	132	1.19	157.1	134	20	1.19	deformed	40	21	28	25.90	25.72	25.91	3.16	2.11	25451	200000	0.000	0.000	2100	15.9	212	0.104	3500	0.107	4.30	28	0
112	t	Clarke et al. [46]	B2	100	154	157.1	132	1.19	157.1	134	20	1.19	deformed	40	21	28	25.90	25.72	25.91	3.16	2.11	25451	200000	3.992	0.850	2100	15.9	212	0.104	3500	0.107	8.55	28	180
113	0	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	40	21	28	24.80	24.62	21.68	2.89	1.93	23281	200000	0.000	0.000	3500	11.7	3254	0.104	21646	0.107	4.95	14	0
114	t	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	40	22	28	24.80	24.62	21.68	2.89	1.93	23281	200000	5.536	0.760	3500	11.7	3254	0.104	21646	0.107	12.06	14	380
115	0	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	40	21	28	24.80	24.62	21.68	2.89	1.93	23281	200000	0.000	0.000	3500	11.7	3254	0.104	13746	0.107	1.98	14	0
116	t	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	40	22	28	24.80	24.62	21.68	2.89	1.93	23281	200000	5.536	0.760	3500	11.7	3254	0.104	13746	0.107	7.44	14	380
117	0	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	40	21	28	24.80	24.62	21.68	2.89	1.93	23281	200000	0.000	0.000	3500	11.7	3110	0.104	21690	0.107	5.03	14	0
118	t	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	40	22	28	24.80	24.62	21.68	2.89	1.93	23281	200000	5.538	0.766	3500	11.7	3110	0.104	21690	0.107	12.42	14	380
119	0	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	40	21	28	24.80	24.62	21.68	2.89	1.93	23281	200000	0.000	0.000	3500	11.7	3110	0.104	13690	0.107	2.06	14	0
120	t	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	40	22	28	24.80	24.62	21.68	2.89	1.93	23281	200000	5.538	0.766	3500	11.7	3110	0.104	13690	0.107	7.87	14	380
121	0	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	40	21	28	24.80	24.62	21.68	2.89	1.93	23281	200000	0.000	0.000	3500	11.7	3110	0.104	31490	0.107	5.81	14	0
122	t	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	40	22	28	24.80	24.62	21.68	2.89	1.93	23281	200000	5.538	0.766	3500	11.7	3110	0.104	31490	0.107	13.30	14	380
123	0	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	40	21	28	24.80	24.62	21.68	2.89	1.93	23281	200000	0.000	0.000	3500	11.7	3110	0.104	17690	0.107	1.97	14	0
124	t	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	40	22	28	24.80	24.62	21.68	2.89	1.93	23281	200000	5.538	0.766	3500	11.7	3110	0.104	17690	0.107	7.90	14	380
125	0	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	40	21	28	24.80	24.62	21.68	2.89	1.93	23281	200000	0.000	0.000	3500	26.9	2373	0.104	4437	0.104	7.14	14	0
126	t	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	40	22	28	24.80	24.62	21.68	2.89	1.93	23281	200000	5.554	0.824	3500	26.9	2373	0.104	4437	0.104	25.10	14	380
127	0	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	40	21	28	24.80	24.62	21.68	2.89	1.93	23281	200000	0.000	0.000	3500	26.9	2373	0.104	2907	0.104	2.72	14	0
128	t	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	40	22	28	24.80	24.62	21.68	2.89	1.93	23281	200000	5.554	0.824	3500	26.9	2373	0.104	2907	0.104	19.90	14	380
129	0	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	40	21	28	24.80	24.62	21.68	2.89	1.93	23281	200000	0.000	0.000	3500	26.9	2373	0.104	7497	0.104	11.80	14	0
130	t	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	40	22	28	24.80	24.62	21.68	2.89	1.93	23281	200000	5.554	0.824	3500	26.9	2373	0.104	7497	0.104	32.50	14	380
131	0	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	40	21	28	24.80	24.62	21.68	2.89	1.93	23281	200000	0.000	0.000	3500	26.9	2373	0.104	4437	0.104	4.43	14	0
132	t	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	40	22	28	24.80	24.62	21.68	2.89	1.93	23281	200000	5.554	0.824	3500	26.9	2373	0.104	4437	0.104	21.90	14	380
133	0	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	40	21	28	24.80	24.62	21.68	2.89	1.93	23281	200000	0.000	0.000	3500	26.9	2373	0.104	8977	0.104	10.70	14	0
134	t	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	40	22	28	24.80	24.62	21.68	2.89	1.93	23281	200000	5.554	0.824	3500	26.9	2373	0.104	8977	0.104	29.80	14	380
135	0	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	40	21	28	24.80	24.62	21.68	2.89	1.93	23281	200000	0.000	0.000	3500	26.9	2373	0.104	5967	0.104	5.04	14	0
136	t	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	40	22	28	24.80	24.62	21.68	2.89	1.93	23281	200000	5.554	0.824	3500	26.9	2373	0.104	5967	0.104	22.90	14	380
137	0	Tošić (2017)	NAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	28	30.50	30.28	21.30	2.86	1.91	23076	200000	0.000	0.000	3200	18.9	1024	0.104	6645	0.107	9.17	7	0
138	t	Tošić (2017)	NAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	28	30.50	30.28	21.30	2.86	1.91	23076	200000	3.668	0.694	3200	18.9	1024	0.104	6645	0.107	18.94	7	450
139	0	Tošić (2017)	NAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	28	30.50	30.28	30.50	3.42	2.28	27613	200000	0.000	0.000	3200	18.9	1024	0.104	5853	0.107	8.11	28	0
140	t	Tošić (2017)	NAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	28	30.50	30.28	30.50	3.42	2.28	27613	200000	2.871	0.694	3200	18.9	1024	0.104	5853	0.107	16.51	28	450

Assessment and Correction of ACI model:

Database – Calculated Deflections
With B4s shrinkage and creep model

		Study information		Cracking moment							Uncracked cross-section		Fully cracked cross-section							Deflection			
		1	2	3	4		5		6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
		Author	Specimen	W_c (mm^3)	M_{SW} (Nm)		M_{cr} (Nm)		M_{max} (Nm)	M_{max}/M_{cr}	I_c (mm^4)	S_c (mm^3)	A_{II}^* (mm^2)	A_{IIc} (mm^2)	$z_{IIc,1}$ (mm)	$z_{II,1}^*$ (mm)	I_{IIc} (mm^4)	I_{II}^* (mm^4)	S_{II}^* (mm^3)	t-t_0 (days)	$a_{num.int.}$ (mm)	a_{exp} (mm)	$a_{num.int.}/a_{exp}$ (%)
1	0	Washa and Fluck [8]	A1/A4	3146316	7192	>	6506	<	25634	3.940	479498602	1428634	32097	18465	259.37	213.94	12705339	252162498	838913	0	15.25	13.46	1.133
2	t	Washa and Fluck [8]	A1/A4	3146316	7192	>	6506	<	25634	3.940	479498602	1428634	32097	18465	259.37	213.94	12705339	252162498	838913	913	45.85	23.62	1.941
3	0	Washa and Fluck [8]	A2/A5	3146316	7192	>	6506	<	25634	3.940	479498602	1054477	29541	19525	256.76	208.71	15023667	245018877	938158	0	15.67	15.75	0.995
4	t	Washa and Fluck [8]	A2/A5	3146316	7192	>	6506	<	25634	3.940	479498602	1054477	29541	19525	256.76	208.71	15023667	245018877	938158	913	58.12	32.26	1.802
5	0	Washa and Fluck [8]	A3/A6	3146316	7192	>	6506	<	25634	3.940	479498602	714317	27549	20733	253.78	202.77	17986305	236047788	1057639	0	16.23	17.02	0.954
6	t	Washa and Fluck [8]	A3/A6	3146316	7192	>	6506	<	25634	3.940	479498602	714317	27549	20733	253.78	202.77	17986305	236047788	1057639	913	77.32	44.70	1.730
7	0	Washa and Fluck [8]	B1/B4	1048772	3596	>	1980	<	7259	3.666	106555245	390107	16326	9310	172.66	142.12	2895141	44786844	284288	0	26.04	23.37	1.114
8	t	Washa and Fluck [8]	B1/B4	1048772	3596	>	1980	<	7259	3.666	106555245	390107	16326	9310	172.66	142.12	2895141	44786844	284288	913	109.09	51.05	2.137
9	0	Washa and Fluck [8]	B2/B5	1048772	3596	>	1980	<	7259	3.666	106555245	292580	14845	9583	171.76	140.32	3157485	44337891	301267	0	26.28	24.89	1.056
10	t	Washa and Fluck [8]	B2/B5	1048772	3596	>	1980	<	7259	3.666	106555245	292580	14845	9583	171.76	140.32	3157485	44337891	301267	913	136.81	65.02	2.104
11	0	Washa and Fluck [8]	B3/B6	1048772	3596	>	1980	<	7259	3.666	106555245	195053	13431	9923	170.64	138.09	3505836	43769112	323052	0	26.59	26.42	1.006
12	t	Washa and Fluck [8]	B3/B6	1048772	3596	>	1980	<	7259	3.666	106555245	195053	13431	9923	170.64	138.09	3505836	43769112	323052	913	185.83	86.36	2.152
13	0	Washa and Fluck [8]	D1/D4	819353	1756	>	1590	<	6023	3.788	52028928	334560	20423	11641	107.9	88.81	1414920	24031651	222281	0	15.43	11.94	1.292
14	t	Washa and Fluck [8]	D1/D4	819353	1756	>	1590	<	6023	3.788	52028928	334560	20423	11641	107.9	88.81	1414920	24031651	222281	913	57.55	27.69	2.078
15	0	Washa and Fluck [8]	D2/D5	819353	1756	>	1590	<	6023	3.788	52028928	250920	18689	12102	107.15	87.29	1589932	23632577	240350	0	15.68	14.22	1.103
16	t	Washa and Fluck [8]	D2/D5	819353	1756	>	1590	<	6023	3.788	52028928	250920	18689	12102	107.15	87.29	1589932	23632577	240350	913	72.23	33.78	2.138
17	0	Washa and Fluck [8]	D3/D6	819353	1756	>	1590	<	6023	3.788	52028928	167280	17066	12675	106.21	85.42	1826586	23123743	263557	0	16.00	17.78	0.900
18	t	Washa and Fluck [8]	D3/D6	819353	1756	>	1590	<	6023	3.788	52028928	167280	17066	12675	106.21	85.42	1826586	23123743	263557	913	98.15	48.51	2.023
19	0	P.C.A. [18]	40NA	2356633	1346	<	5061	<	23613	4.666	359386583	664586	23414	16868	249.51	194.01	17310501	203141739	936113	0	4.36	4.25	1.026
20	t	P.C.A. [18]	40NA	2356633	1346	<	5061	<	23613	4.666	359386583	664586	23414	16868	249.51	194.01	17310501	203141739	936113	242	18.53	10.00	1.853
21	0	P.C.A. [18]	60NA	2356633	1346	<	5957	<	30987	5.202	359386583	676490	23644	16980	249.15	193.3	17657498	205568429	948324	0	4.82	4.90	0.984
22	t	P.C.A. [18]	60NA	2356633	1346	<	5957	<	30987	5.202	359386583	676490	23644	16980	249.15	193.3	17657498	205568429	948324	242	11.31	9.90	1.142
23	0	Sattler [11]	a1/a2	426667	800	<	911	<	2762	3.032	34133333	41802	4620	3846	140.77	121.54	474001	8961213	73948	0	16.87	15.83	1.066
24	t	Sattler [11]	a1/a2	426667	800	<	911	<	2762	3.032	34133333	41802	4620	3846	140.77	121.54	474001	8961213	73948	84	67.36	32.21	2.091
25	0	Hajnal-Konyi [22]	8	768144	3097	>	1973	<	4709	2.387	73165680	59510	6170	5256	169.81	149.13	750398	15932912	108759	0	28.53	20.60	1.385
26	t	Hajnal-Konyi [22]	8	768144	3097	>	1973	<	4709	2.387	73165680	59510	6170	5256	169.81	149.13	750398	15932912	108759	1734	76.66	65.40	1.172
27	0	Hajnal-Konyi [22]	10	768144	1742	<	1973	<	4709	2.387	73165680	59510	6170	5256	169.81	149.13	750398	15932912	108759	0	16.05	8.80	1.824
28	t	Hajnal-Konyi [22]	10	768144	1742	<	1973	<	4709	2.387	73165680	59510	6170	5256	169.81	149.13	750398	15932912	108759	1734	43.12	29.70	1.452
29	0	Hajnal-Konyi [22]	12	768144	774	<	1973	<	4709	2.387	73165680	59510	6170	5256	169.81	149.13	750398	15932912	108759	0	7.13	4.30	1.658
30	t	Hajnal-Konyi [22]	12	768144	774	<	1973	<	4709	2.387	73165680	59510	6170	5256	169.81	149.13	750398	15932912	108759	1734	19.17	14.00	1.369
31	0	Branson and Metz [23]	SB3/B	273118	303	<	672	<	1238	1.842	17342976	54815	5635	4197	106.34	85.69	596892	7613841	86702	0	3.23	3.89	0.830
32	t	Branson and Metz [23]	SB3/B	273118	303	<	672	<	1238	1.842	17342976	54815	5635	4197	106.34	85.69	596892	7613841	86702	60	7.83	7.70	1.017
33	0	Branson and Metz [23]	SB3/M	273118	303	<	632	<	1238	1.959	17342976	58295	5825	4295	105.86	84.73	639715	7943360	90781	0	3.47	3.99	0.870
34	t	Branson and Metz [23]	SB3/M	273118	303	<	632	<	1238	1.959	17342976	58295	5825	4295	105.86	84.73	639715	7943360	90781	60	10.30	7.50	1.373
35	0	Pauw and Meyers [26]	R1	1382573	627	<	3320	<	7803	2.350	149317862	157143	13006	10254	187.17	158.34	2841761	43131876	295675	0	2.70	2.44	1.107
36	t	Pauw and Meyers [26]	R1	1382573	627	<	3320	<	7803	2.350	149317862	157143	13006	10254	187.17	158.34	2841761	43131876	295675	150	7.15	4.89	1.462
37	0	Pauw and Meyers [26]	R2	1382573	627	<	3311	<	11855	3.580	149317862	223806	15667	11748	182.96	149.93	4273886	55526092	388118	0	3.84	3.22	1.193
38	t	Pauw and Meyers [26]	R2	1382573	627	<	3311	<	11855	3.580	149317862	223806	15667	11748	182.96	149.93	4273886	55526092	388118	150	10.21	6.16	1.657
39	0	Pauw and Meyers [26]	R3	1382573	627	<	3569	<	10270	2.878	149317862	208003	15066	11425	183.87	151.73	3931065	52748551	367110	0	3.08	3.71	0.830
40	t	Pauw and Meyers [26]	R3	1382573	627	<	3569	<	10270	2.878	149317862	208003	15066	11425	183.87	151.73	3931065	52748551	367110	120	6.38	6.64	0.961
41	0	Pauw and Meyers [26]	R4	1382573	627	<	3560	<	15234	4.279	149317862	284169	17805	12828	179.93	143.86	5564627	65261928	462645	0	4.04	4.66	0.867
42	t	Pauw and Meyers [26]	R4	1382573	627	<	3560	<	15234	4.279	149317862	284169	17805	12828	179.93	143.86	5564627	65261928	462645	120	8.39	7.89	1.063
43	0	Lutz et al. [29]	SR	699181	216	<	1688	<	8179	4.845	71036830	123530	8045	6278	172.3	141.42	1997550	29259693	193908	0	3.33	4.10	0.812
44	t	Lutz et al. [29]	SR	699181	216	<	1688	<	8179	4.845	71036830	123530	8045	6278	172.3	141.42	1997550	29259693	193908	142	8.69	8.80	0.988
45	0	Lutz et al. [29]	DR	699181	216	<	1688	<	8179	4.845	71036830	258194	9123	5588	175.7	148.2	1408646	31169246	153578	0	3.13	4.20	0.745
46	t	Lutz et al. [29]	DR	699181	216	<	1688	<	8179	4.845	71036830	258194	9123	5588	175.7	148.2	1408646	31169246	153578	142	5.91	6.80	0.869
47	0	Jaccoud and Favre (1982)	A1	1440000	2162	<	2699	<	4949	1.834	86400000	117262	18419	15139	107.38	94.76	803202	16736259	190997	0	6.55	8.42	0.778
48	t	Jaccoud and Favre (1982)	A1	1440000	2162	<	2699	<	4949	1.834	86400000	117262	18419	15139	107.38	94.76	803202	16736259	190997	365	43.10	18.40	2.342
49	0	Jaccoud and Favre (1982)	A2	1440000	2162	<	2929	<	4949	1.690	86400000	108035	17652	14632	107.81	95.61	725134	15655337	178439	0	5.48	6.16	0.890
50	t	Jaccoud and Favre (1982)	A2	1440000	2162	<	2929	<	4949	1.690	86400000	108035	17652	14632	107.81	95.61	725134	15655337	178439	365	25.51	17.50	1.458
51	0	Jaccoud and Favre (1982)	A3	1440000	2162	<	2641	<	4949	1.874	86400000	119771	18626	15276	107.27	94.55	825173	17027594	194398	0	6.84	8.12	0.842
52	t	Jaccoud and Favre (1982)	A3	1440000	2162	<	2641	<	4949	1.874	86400000	119771	18626	15276	107.27	94.55	825173	17027594	194398	365	49.46	17.50	2.826
53	0	Jaccoud and Favre (1982)	A4	1440000	2162	<	3583	<	4949	1.381	86400000	88308	15913	13446	108.79	97.59	562762	13254472	150662	0	3.25	2.24	1.451
54	t	Jaccoud and Favre (1982)	A4	1440000	2162	<	3583	<	4949	1.381	86400000	88308	15913	13446	108.79	97.59	562762	13254472	150662	365	7.63	8.05	0.948
55	0	Jaccoud and Favre (1982)	A5	1440000	2162	<	3390	<	4949	1.460	86400000	93152	16364	13760	108.53	97.07	603049	13862824	157690	0	3.78	3.12	1.212
56	t	Jaccoud and Favre (1982)	A5	1440000	2162	<	3390	<	4949	1.460	86400000	93152	16364	13760	108.53	97.07	603049	13862824	157690	365	10.37	9.55	1.086
57	0	Jaccoud and Favre (1982)	C12	3200000	3604	<	7172	<	9699	1.352	256000000	235277	29270	24680	143.55	127.1	2227167	49053231	406145	0	2.36	2.17	1.088
58	t	Jaccoud and Favre (1982)	C12	3200000	3604	<	7172	<	9699	1.352	256000000	235277	29270	24680	143.55	127.1	2227167	49053231	406145	510	8.97	8.29	1.082
59	0	Jaccoud and Favre (1982)	C22	3200000	3604	<	7598	<	9699	1.277	256000000	222445	28426	24091	143.94	127.88	2071359	46803193	386963	0	2.02	2.00	1.010
60	t	Jaccoud and Favre (1982)	C22	3200000	3604	<	7598	<	9699	1.277	256000000	222445	28426	24091	143.94	127.88	2071359	46803193	386963	365	6.16	7.00	0.880
61	0	Jaccoud and Favre (1982)	C13	3200000	3604	<	7364	<	12909	1.753	256000000	229388	28877	24405	143.73	127.45	2153519	48013295	397254	0	4.75	5.29	0.898
62	t	Jaccoud and Favre (1982)	C13	3200000	3604	<	7364	<	12909	1.753	256000000	229388	28877	24405	143.73	127.45	2153519	48013295	397254	510	15.94	13.28	1.200
63	0	Jaccoud and Favre (1982)	C14	3200000	3604	<	7172	<	16124	2.248	256000000	235277	29270	24680	143.55	127.1	2227167	49053231	406145	0	8.08	8.48	0.953
64	t	Jaccoud and Favre (1982)	C14	3200000	3604	<	7172	<	16124	2.248	256000000	235277	29270	24680	143.55	127.1	2227167	49053231	406145	510	29.45	18.15	1.623
65	0	Jaccoud and Favre (1982)	C24	3200000	3604	<	7492	<	16124	2.152	256000000	225623	28636	24238	143.84	127.68	2109606	47353248	391635	0	7.58	8.00	0.948
66	t	Jaccoud and Favre (1982)	C24	3200000	3604	<	7492	<	16124	2.152	256000000	225623	28636	24238	143.84	127.68	2109606	47353248	391635	510	23.70	17.52	1.353
67	0	Jaccoud and Favre (1982)	C15	3200000	3604	<	7172	<	19329	2.695	256000000	235721	29287	24690	143.54	127.07	2229828	49104857	406557	0	11.21	11.02	1.017
68	t	Jaccoud and Favre (1982)	C15	3200000	3604	<	7172	<	19329	2.695	256000000	235721	29287	24690	143.54	127.07	2229828	49104857	406557	510	40.93	20.83	1.965
69	0	Ding Dajung [44]	C-3	345600	336	<	664	<	3240	4.880	27648000	55435	4747	3774	136.7	113.39	682787	10682594	87943	0	11.20	8.45	1.325
70	t	Ding Dajung [44]	C-3	345600	336	<	664	<	3240	4.880	27648000	55435	4747	3774	136.7	113.39	682787	10682594	87943	2025	89.07	16.62	5.359

		Study information		Cracking moment							Uncracked cross-section		Fully cracked cross-section							Deflection			
		1	2	3	4		5		6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
		Author	Specimen	W_c (mm^3)	M_{SW} (Nm)		M_{cr} (Nm)		M_{max} (Nm)	M_{max}/M_{cr}	I_c (mm^4)	S_c (mm^3)	A_{II}^* (mm^2)	A_{IIc} (mm^2)	$z_{IIc,1}$ (mm)	$z_{II,1}^*$ (mm)	I_{IIc} (mm^4)	I_{II}^* (mm^4)	S_{II}^* (mm^3)	t-t_0 (days)	$a_{num.int.}$ (mm)	a_{exp} (mm)	$a_{num.int.}/a_{exp}$ (%)
71	0	Ding Dajung [44]	L-1	238741	244	<	497	<	3524	7.091	18144341	50113	4386	3163	126.49	100.98	685847	8067316	80678	0	15.19	15.53	0.978
72	t	Ding Dajung [44]	L-1	238741	244	<	497	<	3524	7.091	18144341	50113	4386	3163	126.49	100.98	685847	8067316	80678	531	76.19	30.43	2.504
73	0	F.R.F.C. [45]	I-72	1960000	1029	<	4693	<	22529	4.801	274400000	234140	12812	10684	244.39	208.78	4516556	86089337	380494	0	7.27	6.02	1.208
74	t	F.R.F.C. [45]	I-72	1960000	1029	<	4693	<	22529	4.801	274400000	234140	12812	10684	244.39	208.78	4516556	86089337	380494	1610	23.26	10.29	2.260
75	0	F.R.F.C. [45]	I-81	1960000	1029	<	4693	<	25279	5.387	274400000	234140	12812	10684	244.39	208.78	4516556	86089337	380494	0	8.24	7.39	1.115
76	t	F.R.F.C. [45]	I-81	1960000	1029	<	4693	<	25279	5.387	274400000	234140	12812	10684	244.39	208.78	4516556	86089337	380494	1344	25.96	11.98	2.167
77	0	F.R.F.C. [45]	I-91	1960000	1029	<	4693	<	28209	6.011	274400000	234140	12812	10684	244.39	208.78	4516556	86089337	380494	0	9.26	8.94	1.036
78	t	F.R.F.C. [45]	I-91	1960000	1029	<	4693	<	28209	6.011	274400000	234140	12812	10684	244.39	208.78	4516556	86089337	380494	1314	29.10	15.02	1.937
79	0	F.R.F.C. [45]	II-52	1960000	1029	<	4419	<	34979	7.916	274400000	541638	20770	15126	229.58	179.15	12818721	154379371	762800	0	6.91	7.27	0.950
80	t	F.R.F.C. [45]	II-52	1960000	1029	<	4419	<	34979	7.916	274400000	541638	20770	15126	229.58	179.15	12818721	154379371	762800	1398	27.15	13.49	2.013
81	0	F.R.F.C. [45]	II-59	1960000	1029	<	4419	<	39329	8.900	274400000	541638	20770	15126	229.58	179.15	12818721	154379371	762800	0	7.78	7.69	1.012
82	t	F.R.F.C. [45]	II-59	1960000	1029	<	4419	<	39329	8.900	274400000	541638	20770	15126	229.58	179.15	12818721	154379371	762800	1541	30.73	14.10	2.179
83	0	F.R.F.C. [45]	II-70	1960000	1029	<	4419	<	46879	10.609	274400000	541638	20770	15126	229.58	179.15	12818721	154379371	762800	0	9.29	9.36	0.993
84	t	F.R.F.C. [45]	II-70	1960000	1029	<	4419	<	46879	10.609	274400000	541638	20770	15126	229.58	179.15	12818721	154379371	762800	1471	36.47	17.56	2.077
85	0	F.R.F.C. [45]	II-80	1960000	1029	<	4419	<	53289	12.059	274400000	541638	20770	15126	229.58	179.15	12818721	154379371	762800	0	10.57	10.72	0.986
86	t	F.R.F.C. [45]	II-80	1960000	1029	<	4419	<	53289	12.059	274400000	541638	20770	15126	229.58	179.15	12818721	154379371	762800	1485	41.45	20.24	2.048
87	0	F.R.F.C. [45]	II-90	1960000	1029	<	4419	<	59689	13.507	274400000	541638	20770	15126	229.58	179.15	12818721	154379371	762800	0	11.84	13.10	0.904
88	t	F.R.F.C. [45]	II-90	1960000	1029	<	4419	<	59689	13.507	274400000	541638	20770	15126	229.58	179.15	12818721	154379371	762800	1491	46.40	24.23	1.915
89	0	F.R.F.C. [45]	III-43	1960000	1029	<	4746	<	43219	9.106	274400000	782436	25670	17255	222.48	164.95	19026862	193200814	992497	0	6.38	7.08	0.901
90	t	F.R.F.C. [45]	III-43	1960000	1029	<	4746	<	43219	9.106	274400000	782436	25670	17255	222.48	164.95	19026862	193200814	992497	1572	19.80	14.51	1.365
91	0	F.R.F.C. [45]	III-67	1960000	1029	<	4746	<	66329	13.976	274400000	782436	25670	17255	222.48	164.95	19026862	193200814	992497	0	9.80	10.58	0.926
92	t	F.R.F.C. [45]	III-67	1960000	1029	<	4746	<	66329	13.976	274400000	782436	25670	17255	222.48	164.95	19026862	193200814	992497	1572	30.17	23.88	1.263
93	0	F.R.F.C. [45]	III-77	1960000	1029	<	4746	<	76519	16.123	274400000	782436	25670	17255	222.48	164.95	19026862	193200814	992497	0	11.31	13.84	0.817
94	t	F.R.F.C. [45]	III-77	1960000	1029	<	4746	<	76519	16.123	274400000	782436	25670	17255	222.48	164.95	19026862	193200814	992497	1572	34.74	28.74	1.209
95	0	F.R.F.C. [45]	IV-52	1960000	1029	<	4589	<	38639	8.420	274400000	875520	22194	13484	235.05	190.1	9079856	163475611	606233	0	6.97	5.98	1.166
96	t	F.R.F.C. [45]	IV-52	1960000	1029	<	4589	<	38639	8.420	274400000	875520	22194	13484	235.05	190.1	9079856	163475611	606233	772	16.57	10.52	1.575
97	0	F.R.F.C. [45]	IV-70	1960000	1029	<	4589	<	52369	11.412	274400000	875520	22194	13484	235.05	190.1	9079856	163475611	606233	0	9.46	8.80	1.075
98	t	F.R.F.C. [45]	IV-70	1960000	1029	<	4589	<	52369	11.412	274400000	875520	22194	13484	235.05	190.1	9079856	163475611	606233	772	22.44	13.90	1.614
99	0	F.R.F.C. [45]	IV-80	1960000	1029	<	4589	<	59229	12.907	274400000	875520	22194	13484	235.05	190.1	9079856	163475611	606233	0	10.71	11.16	0.960
100	t	F.R.F.C. [45]	IV-80	1960000	1029	<	4589	<	59229	12.907	274400000	875520	22194	13484	235.05	190.1	9079856	163475611	606233	972	25.76	16.96	1.519
101	0	F.R.F.C. [45]	IV-90	1960000	1029	<	4589	<	66559	14.504	274400000	875520	22194	13484	235.05	190.1	9079856	163475611	606233	0	12.04	12.85	0.937
102	t	F.R.F.C. [45]	IV-90	1960000	1029	<	4589	<	66559	14.504	274400000	875520	22194	13484	235.05	190.1	9079856	163475611	606233	972	28.93	19.28	1.501
103	0	Bakoss et al. [41]	1B2	375000	659	<	968	<	3909	4.038	28125000	79616	6306	4857	125.72	101.43	954705	13426195	117964	0	13.48	8.94	1.508
104	t	Bakoss et al. [41]	1B2	375000	659	<	968	<	3909	4.038	28125000	79616	6306	4857	125.72	101.43	954705	13426195	117964	500	31.56	25.02	1.261
105	0	Clarke et al. [46]	A1	395267	212	<	833	<	3712	4.456	30435533	67899	5842	4607	130.97	107.93	814736	12378087	106107	0	5.36	4.89	1.096
106	t	Clarke et al. [46]	A1	395267	212	<	833	<	3712	4.456	30435533	67899	5842	4607	130.97	107.93	814736	12378087	106107	180	24.02	11.83	2.030
107	0	Clarke et al. [46]	A2	385067	209	<	812	<	3709	4.568	29265067	66665	5798	4563	129.19	106.36	791717	11957625	104168	0	5.55	5.09	1.090
108	t	Clarke et al. [46]	A2	385067	209	<	812	<	3709	4.568	29265067	66665	5798	4563	129.19	106.36	791717	11957625	104168	180	24.89	11.92	2.088
109	0	Clarke et al. [46]	B1	385067	209	<	812	<	3709	4.568	29265067	135798	6568	4098	131.51	111.01	573334	12622646	83992	0	5.27	4.78	1.103
110	t	Clarke et al. [46]	B1	385067	209	<	812	<	3709	4.568	29265067	135798	6568	4098	131.51	111.01	573334	12622646	83992	180	16.43	8.77	1.873
111	0	Clarke et al. [46]	B2	395267	212	<	833	<	3712	4.456	30435533	138267	6606	4136	133.32	112.63	589416	13066292	85523	0	5.09	4.30	1.184
112	t	Clarke et al. [46]	B2	395267	212	<	833	<	3712	4.456	30435533	138267	6606	4136	133.32	112.63	589416	13066292	85523	180	15.91	8.55	1.861
113	0	Gilbert and Nejadi (2004)	B1-a	4816667	3254	<	9285	<	24900	2.682	818833333	448950	23021	19568	300.87	261.74	9989523	209739323	765708	0	5.38	4.95	1.087
114	t	Gilbert and Nejadi (2004)	B1-a	4816667	3254	<	9285	<	24900	2.682	818833333	448950	23021	19568	300.87	261.74	9989523	209739323	765708	380	31.13	12.06	2.581
115	0	Gilbert and Nejadi (2004)	B1-b	4816667	3254	<	9285	<	17000	1.831	818833333	448950	23021	19568	300.87	261.74	9989523	209739323	765708	0	2.75	1.98	1.389
116	t	Gilbert and Nejadi (2004)	B1-b	4816667	3254	<	9285	<	17000	1.831	818833333	448950	23021	19568	300.87	261.74	9989523	209739323	765708	380	16.10	7.44	2.164
117	0	Gilbert and Nejadi (2004)	B2-a	4401042	3110	<	8484	<	24800	2.923	715169271	474851	23021	19568	285.87	246.74	9989523	209739323	765708	0	5.71	5.03	1.135
118	t	Gilbert and Nejadi (2004)	B2-a	4401042	3110	<	8484	<	24800	2.923	715169271	474851	23021	19568	285.87	246.74	9989523	209739323	765708	380	33.05	12.42	2.661
119	0	Gilbert and Nejadi (2004)	B2-b	4401042	3110	<	8484	<	16800	1.980	715169271	474851	23021	19568	285.87	246.74	9989523	209739323	765708	0	3.10	2.06	1.505
120	t	Gilbert and Nejadi (2004)	B2-b	4401042	3110	<	8484	<	16800	1.980	715169271	474851	23021	19568	285.87	246.74	9989523	209739323	765708	380	18.16	7.87	2.307
121	0	Gilbert and Nejadi (2004)	B3-a	4401042	3110	<	8484	<	34600	4.078	715169271	712276	28355	23175	278.65	232.31	16595791	288974918	1073818	0	6.43	5.81	1.107
122	t	Gilbert and Nejadi (2004)	B3-a	4401042	3110	<	8484	<	34600	4.078	715169271	712276	28355	23175	278.65	232.31	16595791	288974918	1073818	380	37.21	13.30	2.798
123	0	Gilbert and Nejadi (2004)	B3-b	4401042	3110	<	8484	<	20800	2.452	715169271	712276	28355	23175	278.65	232.31	16595791	288974918	1073818	0	3.47	1.97	1.761
124	t	Gilbert and Nejadi (2004)	B3-b	4401042	3110	<	8484	<	20800	2.452	715169271	712276	28355	23175	278.65	232.31	16595791	288974918	1073818	380	20.29	7.90	2.568
125	0	Gilbert and Nejadi (2004)	S1-a	1601667	2373	<	3087	<	6810	2.206	124129167	101929	14343	12402	139.5	124.01	993514	23000169	192212	0	9.94	7.14	1.392
126	t	Gilbert and Nejadi (2004)	S1-a	1601667	2373	<	3087	<	6810	2.206	124129167	101929	14343	12402	139.5	124.01	993514	23000169	192212	380	57.82	25.10	2.304
127	0	Gilbert and Nejadi (2004)	S1-b	1601667	2373	<	3087	<	5280	1.710	124129167	101929	14343	12402	139.5	124.01	993514	23000169	192212	0	5.54	2.72	2.037
128	t	Gilbert and Nejadi (2004)	S1-b	1601667	2373	<	3087	<	5280	1.710	124129167	101929	14343	12402	139.5	124.01	993514	23000169	192212	380	32.63	19.90	1.640
129	0	Gilbert and Nejadi (2004)	S2-a	1601667	2373	<	3087	<	9870	3.197	124129167	152893	17644	14732	136.59	118.17	1665131	31941782	271312	0	14.62	11.80	1.239
130	t	Gilbert and Nejadi (2004)	S2-a	1601667	2373	<	3087	<	9870	3.197	124129167	152893	17644	14732	136.59	118.17	1665131	31941782	271312	380	84.69	32.50	2.606
131	0	Gilbert and Nejadi (2004)	S2-b	1601667	2373	<	3087	<	6810	2.206	124129167	152893	17644	14732	136.59	118.17	1665131	31941782	271312	0	8.18	4.43	1.847
132	t	Gilbert and Nejadi (2004)	S2-b	1601667	2373	<	3087	<	6810	2.206	124129167	152893	17644	14732	136.59	118.17	1665131	31941782	271312	380	47.87	21.90	2.186
133	0	Gilbert and Nejadi (2004)	S3-a	1601667	2373	<	3087	<	11350	3.677	124129167	203857	20466	16583	134.27	113.54	2375048	39938925	343772	0	14.39	10.70	1.345
134	t	Gilbert and Nejadi (2004)	S3-a	1601667	2373	<	3087	<	11350	3.677	124129167	203857	20466	16583	134.27	113.54	2375048	39938925	343772	380	83.49	29.80	2.802
135	0	Gilbert and Nejadi (2004)	S3-b	1601667	2373	<	3087	<	8340	2.702	124129167	203857	20466	16583	134.27	113.54	2375048	39938925	343772	0	9.64	5.04	1.913
136	t	Gilbert and Nejadi (2004)	S3-b	1601667	2373	<	3087	<	8340	2.702	124129167	203857	20466	16583	134.27	113.54	2375048	39938925	343772	380	56.33	22.90	2.460
137	0	Tošić (2017)	NAC7	1066667	1024	<	2035	<	7669	3.769	106666667	128965	9037	7182	177.56	155.13	1205822	25917152	161122	0	12.66	9.17	1.381
138	t	Tošić (2017)	NAC7	1066667	1024	<	2035	<	7669	3.769	106666667	128965	9037	7182	177.56	155.13	1205822	25917152	161122	450	48.76	18.94	2.574
139	0	Tošić (2017)	NAC28	1066667	1024	<	2433	<	6877	2.827	106666667	107775	8231	6682	179.12	158.27	970995	22354235	139412	0	9.64	8.11	1.189
140	t	Tošić (2017)	NAC28	1066667	1024	<	2433	<	6877	2.827	106666667	107775	8231	6682	179.12	158.27	970995	22354235	139412	450	31.30	16.51	1.896

Assessment and Correction of ACI model:
Database with GL2000 shrinkage and creep model

		Study information		Cross-section					Reinforcement																				Loading					Deflection	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
		Author	Specimen	b (mm)	h (mm)	A_{s1} (mm^2)	d (mm)	ρ_1 (%)	A_{s2} (mm^2)	d' (mm)	d_2 (mm)	ρ_2 (%)	type	RH (%)	T (ºC)	t_{test} (days)	$f_{cm}(t_{test})$ (MPa)	f_{cm} (MPa)	$f_{cm}(t_0)$ (MPa)	$f_r(t_0)$ (MPa)	$f_{r,red}(t_0)$ (MPa)	$E_{cm}(t_0)$ (MPa)	E_s (MPa)	φ (–)	ε_{cs} (‰)	L (mm)	L/d	M_{L1} (Nm)	K_{L1}	M_{L2} (Nm)	K_{L2}	a (t-t_0) (mm)	t_0 (days)	t-t_0 (days)
1	0	Washa and Fluck [8]	A1/A4	203.2	304.8	852	257.2	1.63	852	257.2	47.6	1.63	deformed	50	21	14	25.00	28.39	25.00	3.10	2.07	25000	200000	0.000	0.000	6096	23.7	7192	0.104	18442	0.104	13.46	14	0
2	t	Washa and Fluck [8]	A1/A4	203.2	304.8	852	257.2	1.63	852	257.2	47.6	1.63	deformed	50	21	14	25.00	28.39	25.00	3.10	2.07	25000	200000	2.238	0.432	6096	23.7	7192	0.104	18442	0.104	23.62	14	913
3	0	Washa and Fluck [8]	A2/A5	203.2	304.8	852	257.2	1.63	400	258.7	46.1	0.77	deformed	50	21	14	25.00	28.39	25.00	3.10	2.07	25000	200000	0.000	0.000	6096	23.7	7192	0.104	18442	0.104	15.75	14	0
4	t	Washa and Fluck [8]	A2/A5	203.2	304.8	852	257.2	1.63	400	258.7	46.1	0.77	deformed	50	21	14	25.00	28.39	25.00	3.10	2.07	25000	200000	2.238	0.432	6096	23.7	7192	0.104	18442	0.104	32.26	14	913
5	0	Washa and Fluck [8]	A3/A6	203.2	304.8	852	257.2	1.63	0	0	0	0.00	deformed	50	21	14	25.00	28.39	25.00	3.10	2.07	25000	200000	0.000	0.000	6096	23.7	7192	0.104	18442	0.104	17.02	14	0
6	t	Washa and Fluck [8]	A3/A6	203.2	304.8	852	257.2	1.63	0	0	0	0.00	deformed	50	21	14	25.00	28.39	25.00	3.10	2.07	25000	200000	2.238	0.432	6096	23.7	7192	0.104	18442	0.104	44.70	14	913
7	0	Washa and Fluck [8]	B1/B4	152.4	203.2	400	157.2	1.67	400	157.2	46	1.67	deformed	50	21	14	20.80	23.62	20.80	2.83	1.89	22804	200000	0.000	0.000	6096	38.8	3596	0.104	3663	0.104	23.37	14	0
8	t	Washa and Fluck [8]	B1/B4	152.4	203.2	400	157.2	1.67	400	157.2	46	1.67	deformed	50	21	14	20.80	23.62	20.80	2.83	1.89	22804	200000	2.583	0.564	6096	38.8	3596	0.104	3663	0.104	51.05	14	913
9	0	Washa and Fluck [8]	B2/B5	152.4	203.2	400	157.2	1.67	200	157.2	46	0.84	deformed	50	21	14	20.80	23.62	20.80	2.83	1.89	22804	200000	0.000	0.000	6096	38.8	3596	0.104	3663	0.104	24.89	14	0
10	t	Washa and Fluck [8]	B2/B5	152.4	203.2	400	157.2	1.67	200	157.2	46	0.84	deformed	50	21	14	20.80	23.62	20.80	2.83	1.89	22804	200000	2.583	0.564	6096	38.8	3596	0.104	3663	0.104	65.02	14	913
11	0	Washa and Fluck [8]	B3/B6	152.4	203.2	400	157.2	1.67	0	0	0	0.00	deformed	50	21	14	20.80	23.62	20.80	2.83	1.89	22804	200000	0.000	0.000	6096	38.8	3596	0.104	3663	0.104	26.42	14	0
12	t	Washa and Fluck [8]	B3/B6	152.4	203.2	400	157.2	1.67	0	0	0	0.00	deformed	50	21	14	20.80	23.62	20.80	2.83	1.89	22804	200000	2.583	0.564	6096	38.8	3596	0.104	3663	0.104	86.36	14	913
13	0	Washa and Fluck [8]	D1/D4	304.8	127	516	101.6	1.67	516	101.6	25.4	1.67	deformed	50	21	14	22.10	25.10	22.10	2.91	1.94	23505	200000	0.000	0.000	3810	37.5	1756	0.104	4267	0.104	11.94	14	0
14	t	Washa and Fluck [8]	D1/D4	304.8	127	516	101.6	1.67	516	101.6	25.4	1.67	deformed	50	21	14	22.10	25.10	22.10	2.91	1.94	23505	200000	2.556	0.541	3810	37.5	1756	0.104	4267	0.104	27.69	14	913
15	0	Washa and Fluck [8]	D2/D5	304.8	127	516	101.6	1.67	258	101.6	25.4	0.83	deformed	50	21	14	22.10	25.10	22.10	2.91	1.94	23505	200000	0.000	0.000	3810	37.5	1756	0.104	4267	0.104	14.22	14	0
16	t	Washa and Fluck [8]	D2/D5	304.8	127	516	101.6	1.67	258	101.6	25.4	0.83	deformed	50	21	14	22.10	25.10	22.10	2.91	1.94	23505	200000	2.556	0.541	3810	37.5	1756	0.104	4267	0.104	33.78	14	913
17	0	Washa and Fluck [8]	D3/D6	304.8	127	516	101.6	1.67	0	0	0	0.00	deformed	50	21	14	22.10	25.10	22.10	2.91	1.94	23505	200000	0.000	0.000	3810	37.5	1756	0.104	4267	0.104	17.78	14	0
18	t	Washa and Fluck [8]	D3/D6	304.8	127	516	101.6	1.67	0	0	0	0.00	deformed	50	21	14	22.10	25.10	22.10	2.91	1.94	23505	200000	2.556	0.541	3810	37.5	1756	0.104	4267	0.104	48.51	14	913
19	0	P.C.A. [18]	40NA	152	305	849	254	2.20	0	0	0	0.00	deformed	50	21	28	26.90	26.71	26.90	3.22	2.15	25933	200000	0.000	0.000	3048	12.0	1346	0.104	22267	0.107	4.25	28	0
20	t	P.C.A. [18]	40NA	152	305	849	254	2.20	0	0	0	0.00	deformed	50	21	28	26.90	26.71	26.90	3.22	2.15	25933	200000	1.385	0.291	3048	12.0	1346	0.104	22267	0.107	10.00	28	242
21	0	P.C.A. [18]	60NA	152	305	1019	254	2.64	0	0	0	0.00	deformed	50	21	28	37.40	37.13	37.40	3.79	2.53	30578	200000	0.000	0.000	3048	12.0	1346	0.104	29641	0.107	4.90	28	0
22	t	P.C.A. [18]	60NA	152	305	1019	254	2.64	0	0	0	0.00	deformed	50	21	28	37.40	37.13	37.40	3.79	2.53	30578	200000	1.385	0.247	3048	12.0	1346	0.104	29641	0.107	9.90	28	242
23	0	Sattler [11]	a1/a2	100	160	100	134	0.75	0	0	0	0.00	deformed	55	21	32	26.70	26.03	26.70	3.20	2.13	25836	200000	0.000	0.000	4000	29.9	800	0.104	1962	0.104	15.83	32	0
24	t	Sattler [11]	a1/a2	100	160	100	134	0.75	0	0	0	0.00	deformed	55	21	32	26.70	26.03	26.70	3.20	2.13	25836	200000	1.178	0.275	4000	29.9	800	0.104	1962	0.104	32.21	32	84
25	0	Hajnal-Konyi [22]	8	127	190.5	142	160.3	0.70	0	0	0	0.00	deformed	82	21	35	37.00	35.68	38.55	3.85	2.57	31044	200000	0.000	0.000	6400	39.9	3097	0.104	1612	0.104	20.60	53	0
26	t	Hajnal-Konyi [22]	8	127	190.5	142	160.3	0.70	0	0	0	0.00	deformed	82	21	35	37.00	35.68	38.55	3.85	2.57	31044	200000	1.721	0.262	6400	39.9	3097	0.104	1612	0.104	65.40	53	1734
27	0	Hajnal-Konyi [22]	10	127	190.5	142	160.3	0.70	0	0	0	0.00	deformed	82	21	35	37.00	35.68	38.55	3.85	2.57	31044	200000	0.000	0.000	4800	29.9	1742	0.104	2967	0.104	8.80	53	0
28	t	Hajnal-Konyi [22]	10	127	190.5	142	160.3	0.70	0	0	0	0.00	deformed	82	21	35	37.00	35.68	38.55	3.85	2.57	31044	200000	1.721	0.262	4800	29.9	1742	0.104	2967	0.104	29.70	53	1734
29	0	Hajnal-Konyi [22]	12	127	190.5	142	160.3	0.70	0	0	0	0.00	deformed	82	21	35	37.00	35.68	38.55	3.85	2.57	31044	200000	0.000	0.000	3200	20.0	774	0.104	3935	0.104	4.30	53	0
30	t	Hajnal-Konyi [22]	12	127	190.5	142	160.3	0.70	0	0	0	0.00	deformed	82	21	35	37.00	35.68	38.55	3.85	2.57	31044	200000	1.721	0.262	3200	20.0	774	0.104	3935	0.104	14.00	53	1734
31	0	Branson and Metz [23]	SB3/B	101.6	127	214	101.6	2.07	0	0	0	0.00	deformed	50	21	28	35.40	35.15	35.40	3.69	2.46	29749	200000	0.000	0.000	2743	27.0	303	0.104	935	0.104	3.89	28	0
32	t	Branson and Metz [23]	SB3/B	101.6	127	214	101.6	2.07	0	0	0	0.00	deformed	50	21	28	35.40	35.15	35.40	3.69	2.46	29749	200000	1.136	0.223	2743	27.0	303	0.104	935	0.104	7.70	28	60
33	0	Branson and Metz [23]	SB3/M	101.6	127	214	101.6	2.07	0	0	0	0.00	deformed	50	21	28	31.30	31.08	31.30	3.47	2.31	27973	200000	0.000	0.000	2743	27.0	303	0.104	935	0.104	3.99	28	0
34	t	Branson and Metz [23]	SB3/M	101.6	127	214	101.6	2.07	0	0	0	0.00	deformed	50	21	28	31.30	31.08	31.30	3.47	2.31	27973	200000	1.136	0.237	2743	27.0	303	0.104	935	0.104	7.50	28	60
35	0	Pauw and Meyers [26]	R1	177.8	216	400	165.1	1.36	0	0	0	0.00	deformed	50	21	28	33.80	33.56	33.80	3.60	2.40	29069	200000	0.000	0.000	2286	13.8	627	0.104	7176	0.107	2.44	28	0
36	t	Pauw and Meyers [26]	R1	177.8	216	400	165.1	1.36	0	0	0	0.00	deformed	50	21	28	33.80	33.56	33.80	3.60	2.40	29069	200000	1.191	0.204	2286	13.8	627	0.104	7176	0.107	4.89	28	150
37	0	Pauw and Meyers [26]	R2	177.8	216	568	165.1	1.94	0	0	0	0.00	deformed	50	21	28	33.60	33.36	33.60	3.59	2.39	28983	200000	0.000	0.000	2286	13.8	627	0.104	11228	0.107	3.22	28	0
38	t	Pauw and Meyers [26]	R2	177.8	216	568	165.1	1.94	0	0	0	0.00	deformed	50	21	28	33.60	33.36	33.60	3.59	2.39	28983	200000	1.191	0.204	2286	13.8	627	0.104	11228	0.107	6.16	28	150
39	0	Pauw and Meyers [26]	R3	177.8	216	568	165.1	1.94	0	0	0	0.00	deformed	50	21	28	38.90	38.62	38.90	3.87	2.58	31185	200000	0.000	0.000	2286	13.8	627	0.104	9643	0.107	3.71	28	0
40	t	Pauw and Meyers [26]	R3	177.8	216	568	165.1	1.94	0	0	0	0.00	deformed	50	21	28	38.90	38.62	38.90	3.87	2.58	31185	200000	1.108	0.163	2286	13.8	627	0.104	9643	0.107	6.64	28	120
41	0	Pauw and Meyers [26]	R4	177.8	216	774	165.1	2.64	0	0	0	0.00	deformed	50	21	28	38.70	38.42	38.70	3.86	2.57	31105	200000	0.000	0.000	2286	13.8	627	0.104	14607	0.107	4.66	28	0
42	t	Pauw and Meyers [26]	R4	177.8	216	774	165.1	2.64	0	0	0	0.00	deformed	50	21	28	38.70	38.42	38.70	3.86	2.57	31105	200000	1.108	0.163	2286	13.8	627	0.104	14607	0.107	7.89	28	120
43	0	Lutz et al. [29]	SR	101.6	203.2	258	171.5	1.48	0	0	0	0.00	deformed	40	21	28	34.10	33.86	34.10	3.62	2.41	29198	200000	0.000	0.000	1829	10.7	216	0.104	7963	0.107	4.10	28	0
44	t	Lutz et al. [29]	SR	101.6	203.2	258	171.5	1.48	0	0	0	0.00	deformed	40	21	28	34.10	33.86	34.10	3.62	2.41	29198	200000	1.501	0.313	1829	10.7	216	0.104	7963	0.107	8.80	28	142
45	0	Lutz et al. [29]	DR	101.6	203.2	258	171.5	1.48	258	177.8	25.4	1.48	deformed	40	21	28	34.10	33.86	34.10	3.62	2.41	29198	200000	0.000	0.000	1829	10.7	216	0.104	7963	0.107	4.20	28	0
46	t	Lutz et al. [29]	DR	101.6	203.2	258	171.5	1.48	258	177.8	25.4	1.48	deformed	40	21	28	34.10	33.86	34.10	3.62	2.41	29198	200000	1.501	0.313	1829	10.7	216	0.104	7963	0.107	6.80	28	142
47	0	Jaccoud and Favre (1982)	A1	600	120	314	95	0.55	57	100	20	0.10	deformed	60	21	15	20.49	22.88	20.49	2.81	1.87	22633	200000	0.000	0.000	3100	32.6	2162	0.104	2787	0.104	8.42	15	0
48	t	Jaccoud and Favre (1982)	A1	600	120	314	95	0.55	57	100	20	0.10	deformed	60	21	15	20.49	22.88	20.49	2.81	1.87	22633	200000	1.726	0.359	3100	32.6	2162	0.104	2787	0.104	18.40	15	365
49	0	Jaccoud and Favre (1982)	A2	600	120	314	95	0.55	57	100	20	0.10	deformed	60	21	15	24.14	26.96	24.14	3.05	2.03	24566	200000	0.000	0.000	3100	32.6	2162	0.104	2787	0.104	6.16	15	0
50	t	Jaccoud and Favre (1982)	A2	600	120	314	95	0.55	57	100	20	0.10	deformed	60	21	15	24.14	26.96	24.14	3.05	2.03	24566	200000	1.726	0.331	3100	32.6	2162	0.104	2787	0.104	17.50	15	365
51	0	Jaccoud and Favre (1982)	A3	600	120	314	95	0.55	57	100	20	0.10	deformed	60	21	15	19.64	21.93	19.64	2.75	1.83	22159	200000	0.000	0.000	3100	32.6	2162	0.104	2787	0.104	8.12	15	0
52	t	Jaccoud and Favre (1982)	A3	600	120	314	95	0.55	57	100	20	0.10	deformed	60	21	15	19.64	21.93	19.64	2.75	1.83	22159	200000	1.726	0.367	3100	32.6	2162	0.104	2787	0.104	17.50	15	365
53	0	Jaccoud and Favre (1982)	A4	600	120	314	95	0.55	57	100	20	0.10	deformed	60	21	15	36.13	40.35	36.13	3.73	2.49	30054	200000	0.000	0.000	3100	32.6	2162	0.104	2787	0.104	2.24	15	0
54	t	Jaccoud and Favre (1982)	A4	600	120	314	95	0.55	57	100	20	0.10	deformed	60	21	15	36.13	40.35	36.13	3.73	2.49	30054	200000	1.726	0.271	3100	32.6	2162	0.104	2787	0.104	8.05	15	365
55	0	Jaccoud and Favre (1982)	A5	600	120	314	95	0.55	57	100	20	0.10	deformed	60	21	15	32.47	36.26	32.47	3.53	2.35	28491	200000	0.000	0.000	3100	32.6	2162	0.104	2787	0.104	3.12	15	0
56	t	Jaccoud and Favre (1982)	A5	600	120	314	95	0.55	57	100	20	0.10	deformed	60	21	15	32.47	36.26	32.47	3.53	2.35	28491	200000	1.726	0.286	3100	32.6	2162	0.104	2787	0.104	9.55	15	365
57	0	Jaccoud and Favre (1982)	C12	750	160	565	131	0.58	57	134	26	0.06	deformed	60	21	28	29.40	29.19	29.40	3.36	2.24	27111	200000	0.000	0.000	3100	23.7	3604	0.104	6095	0.107	2.17	28	0
58	t	Jaccoud and Favre (1982)	C12	750	160	565	131	0.58	57	134	26	0.06	deformed	60	21	28	29.40	29.19	29.40	3.36	2.24	27111	200000	1.502	0.286	3100	23.7	3604	0.104	6095	0.107	8.29	28	510
59	0	Jaccoud and Favre (1982)	C22	750	160	565	131	0.58	57	134	26	0.06	deformed	60	21	28	32.89	32.66	32.89	3.56	2.37	28675	200000	0.000	0.000	3100	23.7	3604	0.104	6095	0.107	2.00	28	0
60	t	Jaccoud and Favre (1982)	C22	750	160	565	131	0.58	57	134	26	0.06	deformed	60	21	28	32.89	32.66	32.89	3.56	2.37	28675	200000	1.344	0.226	3100	23.7	3604	0.104	6095	0.107	7.00	28	365
61	0	Jaccoud and Favre (1982)	C13	750	160	565	131	0.58	57	134	26	0.06	deformed	60	21	28	30.93	30.71	30.93	3.45	2.30	27807	200000	0.000	0.000	3100	23.7	3604	0.104	9305	0.107	5.29	28	0
62	t	Jaccoud and Favre (1982)	C13	750	160	565	131	0.58	57	134	26	0.06	deformed	60	21	28	30.93	30.71	30.93	3.45	2.30	27807	200000	1.502	0.279	3100	23.7	3604	0.104	9305	0.107	13.28	28	510
63	0	Jaccoud and Favre (1982)	C14	750	160	565	131	0.58	57	134	26	0.06	deformed	60	21	28	29.40	29.19	29.40	3.36	2.24	27111	200000	0.000	0.000	3100	23.7	3604	0.104	12520	0.107	8.48	28	0
64	t	Jaccoud and Favre (1982)	C14	750	160	565	131	0.58	57	134	26	0.06	deformed	60	21	28	29.40	29.19	29.40	3.36	2.24	27111	200000	1.502	0.286	3100	23.7	3604	0.104	12520	0.107	18.15	28	510
65	0	Jaccoud and Favre (1982)	C24	750	160	565	131	0.58	57	134	26	0.06	deformed	60	21	28	31.97	31.74	31.97	3.51	2.34	28271	200000	0.000	0.000	3100	23.7	3604	0.104	12520	0.107	8.00	28	0
66	t	Jaccoud and Favre (1982)	C24	750	160	565	131	0.58	57	134	26	0.06	deformed	60	21	28	31.97	31.74	31.97	3.51	2.34	28271	200000	1.502	0.275	3100	23.7	3604	0.104	12520	0.107	17.52	28	510
67	0	Jaccoud and Favre (1982)	C15	750	160	565	131	0.58	57	134	26	0.06	deformed	60	21	28	29.29	29.08	29.29	3.36	2.24	27060	200000	0.000	0.000	3100	23.7	3604	0.104	15725	0.107	11.02	28	0
68	t	Jaccoud and Favre (1982)	C15	750	160	565	131	0.58	57	134	26	0.06	deformed	60	21	28	29.29	29.08	29.29	3.36	2.24	27060	200000	1.502	0.287	3100	23.7	3604	0.104	15725	0.107	20.83	28	510
69	0	Ding Dajung [44]	C-3	81	160	113	137	1.02	0	0	0	0.00	deformed	80	21	30	21.60	21.24	21.60	2.88	1.92	23238	200000	0.000	0.000	2880	21.0	336	0.104	2904	0.107	8.45	30	0
70	t	Ding Dajung [44]	C-3	81	160	113	137	1.02	0	0	0	0.00	deformed	80	21	30	21.60	21.24	21.60	2.88	1.92	23238	200000	2.008	0.398	2880	21.0	336	0.104	2904	0.107	16.62	30	2025
71	0	Ding Dajung [44]	L-1	62	152	154	117	2.12	0	0	0	0.00	deformed	80	21	30	25.40	24.98	25.40	3.12	2.08	25199	200000	0.000	0.000	2880	24.6	244	0.104	3280	0.107	15.53	30	0
72	t	Ding Dajung [44]	L-1	62	152	154	117	2.12	0	0	0	0.00	deformed	80	21	30	25.40	24.98	25.40	3.12	2.08	25199	200000	1.738	0.345	2880	24.6	244	0.104	3280	0.107	30.43	30	531

		Study information		Cross-section					Reinforcement																			Loading					Deflection	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
		Author	Specimen	b (mm)	h (mm)	A_{s1} (mm^2)	d (mm)	ρ_1 (%)	A_{s2} (mm^2)	d' (mm)	d_2 (mm)	ρ_2 (%)	type	RH (%)	T (ºC)	t_{test} (days)	$f_{cm}(t_{test})$ (MPa)	f_{cm} (MPa)	$f_{cm}(t_0)$ (MPa)	$f_r(t_0)$ (MPa)	$f_{r,red}(t_0)$ (MPa)	$E_{cm}(t_0)$ (MPa)	E_s (MPa)	φ (–)	ε_{cs} (‰)	L (mm)	L/d	M_{L1} (Nm)	K_{L1}	M_{L2} (Nm)	K_{L2}	a (t-t_0) (mm)	t_0 (days)	t-t_0 (days)
73	0	F.R.F.C. [45]	I-72	150	280	308	250	0.82	0	0	0	0.00	deformed	60	21	28	33.50	33.26	33.50	3.59	2.39	28940	200000	0.000	0.000	2800	11.2	1029	0.104	21500	0.107	6.02	28	0
74	t	F.R.F.C. [45]	I-72	150	280	308	250	0.82	0	0	0	0.00	deformed	60	21	28	33.50	33.26	33.50	3.59	2.39	28940	200000	2.388	0.461	2800	11.2	1029	0.104	21500	0.107	10.29	28	1610
75	0	F.R.F.C. [45]	I-81	150	280	308	250	0.82	0	0	0	0.00	deformed	60	21	28	33.50	33.26	33.50	3.59	2.39	28940	200000	0.000	0.000	2800	11.2	1029	0.104	24250	0.107	7.39	28	0
76	t	F.R.F.C. [45]	I-81	150	280	308	250	0.82	0	0	0	0.00	deformed	60	21	28	33.50	33.26	33.50	3.59	2.39	28940	200000	2.299	0.447	2800	11.2	1029	0.104	24250	0.107	11.98	28	1344
77	0	F.R.F.C. [45]	I-91	150	280	308	250	0.82	0	0	0	0.00	deformed	60	21	28	33.50	33.26	33.50	3.59	2.39	28940	200000	0.000	0.000	2800	11.2	1029	0.104	27180	0.107	8.94	28	0
78	t	F.R.F.C. [45]	I-91	150	280	308	250	0.82	0	0	0	0.00	deformed	60	21	28	33.50	33.26	33.50	3.59	2.39	28940	200000	2.288	0.446	2800	11.2	1029	0.104	27180	0.107	15.02	28	1314
79	0	F.R.F.C. [45]	II-52	150	280	770	236	2.18	0	0	0	0.00	deformed	60	21	28	29.80	29.59	29.80	3.38	2.25	27295	200000	0.000	0.000	2800	11.9	1029	0.104	33950	0.107	7.27	28	0
80	t	F.R.F.C. [45]	II-52	150	280	770	236	2.18	0	0	0	0.00	deformed	60	21	28	29.80	29.59	29.80	3.38	2.25	27295	200000	2.319	0.478	2800	11.9	1029	0.104	33950	0.107	13.49	28	1398
81	0	F.R.F.C. [45]	II-59	150	280	770	236	2.18	0	0	0	0.00	deformed	60	21	28	29.80	29.59	29.80	3.38	2.25	27295	200000	0.000	0.000	2800	11.9	1029	0.104	38300	0.107	7.69	28	0
82	t	F.R.F.C. [45]	II-59	150	280	770	236	2.18	0	0	0	0.00	deformed	60	21	28	29.80	29.59	29.80	3.38	2.25	27295	200000	2.367	0.485	2800	11.9	1029	0.104	38300	0.107	14.10	28	1541
83	0	F.R.F.C. [45]	II-70	150	280	770	236	2.18	0	0	0	0.00	deformed	60	21	28	29.80	29.59	29.80	3.38	2.25	27295	200000	0.000	0.000	2800	11.9	1029	0.104	45850	0.107	9.36	28	0
84	t	F.R.F.C. [45]	II-70	150	280	770	236	2.18	0	0	0	0.00	deformed	60	21	28	29.80	29.59	29.80	3.38	2.25	27295	200000	2.344	0.482	2800	11.9	1029	0.104	45850	0.107	17.56	28	1471
85	0	F.R.F.C. [45]	II-80	150	280	770	236	2.18	0	0	0	0.00	deformed	60	21	28	29.80	29.59	29.80	3.38	2.25	27295	200000	0.000	0.000	2800	11.9	1029	0.104	52260	0.107	10.72	28	0
86	t	F.R.F.C. [45]	II-80	150	280	770	236	2.18	0	0	0	0.00	deformed	60	21	28	29.80	29.59	29.80	3.38	2.25	27295	200000	2.349	0.482	2800	11.9	1029	0.104	52260	0.107	20.24	28	1485
87	0	F.R.F.C. [45]	II-90	150	280	770	236	2.18	0	0	0	0.00	deformed	60	21	28	29.80	29.59	29.80	3.38	2.25	27295	200000	0.000	0.000	2800	11.9	1029	0.104	58660	0.107	13.10	28	0
88	t	F.R.F.C. [45]	II-90	150	280	770	236	2.18	0	0	0	0.00	deformed	60	21	28	29.80	29.59	29.80	3.38	2.25	27295	200000	2.351	0.483	2800	11.9	1029	0.104	58660	0.107	24.23	28	1491
89	0	F.R.F.C. [45]	III-43	150	280	1232	233	3.53	0	0	0	0.00	deformed	60	21	28	34.30	34.06	34.31	3.63	2.42	29287	200000	0.000	0.000	2800	12.0	1029	0.104	42190	0.107	7.08	28	0
90	t	F.R.F.C. [45]	III-43	150	280	1232	233	3.53	0	0	0	0.00	deformed	60	21	28	34.30	34.06	34.31	3.63	2.42	29287	200000	2.376	0.454	2800	12.0	1029	0.104	42190	0.107	14.51	28	1572
91	0	F.R.F.C. [45]	III-67	150	280	1232	233	3.53	0	0	0	0.00	deformed	60	21	28	34.30	34.06	34.31	3.63	2.42	29287	200000	0.000	0.000	2800	12.0	1029	0.104	65300	0.107	10.58	28	0
92	t	F.R.F.C. [45]	III-67	150	280	1232	233	3.53	0	0	0	0.00	deformed	60	21	28	34.30	34.06	34.31	3.63	2.42	29287	200000	2.376	0.454	2800	12.0	1029	0.104	65300	0.107	23.88	28	1572
93	0	F.R.F.C. [45]	III-77	150	280	1232	233	3.53	0	0	0	0.00	deformed	60	21	28	34.30	34.06	34.31	3.63	2.42	29287	200000	0.000	0.000	2800	12.0	1029	0.104	75490	0.107	13.84	28	0
94	t	F.R.F.C. [45]	III-77	150	280	1232	233	3.53	0	0	0	0.00	deformed	60	21	28	34.30	34.06	34.31	3.63	2.42	29287	200000	2.376	0.454	2800	12.0	1029	0.104	75490	0.107	28.74	28	1572
95	0	F.R.F.C. [45]	IV-52	150	280	770	236	2.18	462	248	32	1.31	deformed	60	21	28	32.00	31.77	32.00	3.51	2.34	28284	200000	0.000	0.000	2800	11.9	1029	0.104	37610	0.107	5.98	28	0
96	t	F.R.F.C. [45]	IV-52	150	280	770	236	2.18	462	248	32	1.31	deformed	60	21	28	32.00	31.77	32.00	3.51	2.34	28284	200000	1.997	0.406	2800	11.9	1029	0.104	37610	0.107	10.52	28	772
97	0	F.R.F.C. [45]	IV-70	150	280	770	236	2.18	462	248	32	1.31	deformed	60	21	28	32.00	31.77	32.00	3.51	2.34	28284	200000	0.000	0.000	2800	11.9	1029	0.104	51340	0.107	8.80	28	0
98	t	F.R.F.C. [45]	IV-70	150	280	770	236	2.18	462	248	32	1.31	deformed	60	21	28	32.00	31.77	32.00	3.51	2.34	28284	200000	1.997	0.406	2800	11.9	1029	0.104	51340	0.107	13.90	28	772
99	0	F.R.F.C. [45]	IV-80	150	280	770	236	2.18	462	248	32	1.31	deformed	60	21	28	32.00	31.77	32.00	3.51	2.34	28284	200000	0.000	0.000	2800	11.9	1029	0.104	58200	0.107	11.16	28	0
100	t	F.R.F.C. [45]	IV-80	150	280	770	236	2.18	462	248	32	1.31	deformed	60	21	28	32.00	31.77	32.00	3.51	2.34	28284	200000	2.127	0.429	2800	11.9	1029	0.104	58200	0.107	16.96	28	972
101	0	F.R.F.C. [45]	IV-90	150	280	770	236	2.18	462	248	32	1.31	deformed	60	21	28	32.00	31.77	32.00	3.51	2.34	28284	200000	0.000	0.000	2800	11.9	1029	0.104	65530	0.107	12.85	28	0
102	t	F.R.F.C. [45]	IV-90	150	280	770	236	2.18	462	248	32	1.31	deformed	60	21	28	32.00	31.77	32.00	3.51	2.34	28284	200000	2.127	0.429	2800	11.9	1029	0.104	65530	0.107	19.28	28	972
103	0	Bakoss et al. [41]	1B2	100	150	226	130	1.74	0	0	0	0.00	deformed	60	21	28	39.00	38.72	39.00	3.87	2.58	31225	200000	0.000	0.000	3750	28.8	659	0.104	3250	0.107	8.94	28	0
104	t	Bakoss et al. [41]	1B2	100	150	226	130	1.74	0	0	0	0.00	deformed	60	21	28	39.00	38.72	39.00	3.87	2.58	31225	200000	2.157	0.414	3750	28.8	659	0.104	3250	0.107	25.02	28	500
105	0	Clarke et al. [46]	A1	100	154	157.1	132	1.19	0	0	0	0.00	deformed	40	21	28	25.90	25.72	25.91	3.16	2.11	25451	200000	0.000	0.000	2100	15.9	212	0.104	3500	0.107	4.89	28	0
106	t	Clarke et al. [46]	A1	100	154	157.1	132	1.19	0	0	0	0.00	deformed	40	21	28	25.90	25.72	25.91	3.16	2.11	25451	200000	1.791	0.438	2100	15.9	212	0.104	3500	0.107	11.83	28	180
107	0	Clarke et al. [46]	A2	100	152	157.1	130	1.21	0	0	0	0.00	deformed	40	21	28	25.90	25.72	25.91	3.16	2.11	25451	200000	0.000	0.000	2100	16.2	209	0.104	3500	0.107	5.09	28	0
108	t	Clarke et al. [46]	A2	100	152	157.1	130	1.21	0	0	0	0.00	deformed	40	21	28	25.90	25.72	25.91	3.16	2.11	25451	200000	1.798	0.441	2100	16.2	209	0.104	3500	0.107	11.92	28	180
109	0	Clarke et al. [46]	B1	100	152	157.1	130	1.21	157.1	132	20	1.21	deformed	40	21	28	25.90	25.72	25.91	3.16	2.11	25451	200000	0.000	0.000	2100	16.2	209	0.104	3500	0.107	4.78	28	0
110	t	Clarke et al. [46]	B1	100	152	157.1	130	1.21	157.1	132	20	1.21	deformed	40	21	28	25.90	25.72	25.91	3.16	2.11	25451	200000	1.798	0.441	2100	16.2	209	0.104	3500	0.107	8.77	28	180
111	0	Clarke et al. [46]	B2	100	154	157.1	132	1.19	157.1	134	20	1.19	deformed	40	21	28	25.90	25.72	25.91	3.16	2.11	25451	200000	0.000	0.000	2100	15.9	212	0.104	3500	0.107	4.30	28	0
112	t	Clarke et al. [46]	B2	100	154	157.1	132	1.19	157.1	134	20	1.19	deformed	40	21	28	25.90	25.72	25.91	3.16	2.11	25451	200000	1.791	0.438	2100	15.9	212	0.104	3500	0.107	8.55	28	180
113	0	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	40	21	28	24.80	24.62	21.68	2.89	1.93	23281	200000	0.000	0.000	3500	11.7	3254	0.104	21646	0.107	4.95	14	0
114	t	Gilbert and Nejadi (2004)	B1-a	250	340	402	300	0.54	0	0	0	0.00	deformed	40	22	28	24.80	24.62	21.68	2.89	1.93	23281	200000	1.593	0.274	3500	11.7	3254	0.104	21646	0.107	12.06	14	380
115	0	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	40	21	28	24.80	24.62	21.68	2.89	1.93	23281	200000	0.000	0.000	3500	11.7	3254	0.104	13746	0.107	1.98	14	0
116	t	Gilbert and Nejadi (2004)	B1-b	250	340	402	300	0.54	0	0	0	0.00	deformed	40	22	28	24.80	24.62	21.68	2.89	1.93	23281	200000	1.593	0.274	3500	11.7	3254	0.104	13746	0.107	7.44	14	380
117	0	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	40	21	28	24.80	24.62	21.68	2.89	1.93	23281	200000	0.000	0.000	3500	11.7	3110	0.104	21690	0.107	5.03	14	0
118	t	Gilbert and Nejadi (2004)	B2-a	250	325	402	300	0.54	0	0	0	0.00	deformed	40	22	28	24.80	24.62	21.68	2.89	1.93	23281	200000	1.608	0.280	3500	11.7	3110	0.104	21690	0.107	12.42	14	380
119	0	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	40	21	28	24.80	24.62	21.68	2.89	1.93	23281	200000	0.000	0.000	3500	11.7	3110	0.104	13690	0.107	2.06	14	0
120	t	Gilbert and Nejadi (2004)	B2-b	250	325	402	300	0.54	0	0	0	0.00	deformed	40	22	28	24.80	24.62	21.68	2.89	1.93	23281	200000	1.608	0.280	3500	11.7	3110	0.104	13690	0.107	7.87	14	380
121	0	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	40	21	28	24.80	24.62	21.68	2.89	1.93	23281	200000	0.000	0.000	3500	11.7	3110	0.104	31490	0.107	5.81	14	0
122	t	Gilbert and Nejadi (2004)	B3-a	250	325	603	300	0.80	0	0	0	0.00	deformed	40	22	28	24.80	24.62	21.68	2.89	1.93	23281	200000	1.608	0.280	3500	11.7	3110	0.104	31490	0.107	13.30	14	380
123	0	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	40	21	28	24.80	24.62	21.68	2.89	1.93	23281	200000	0.000	0.000	3500	11.7	3110	0.104	17690	0.107	1.97	14	0
124	t	Gilbert and Nejadi (2004)	B3-b	250	325	603	300	0.80	0	0	0	0.00	deformed	40	22	28	24.80	24.62	21.68	2.89	1.93	23281	200000	1.608	0.280	3500	11.7	3110	0.104	17690	0.107	7.90	14	380
125	0	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	40	21	28	24.80	24.62	21.68	2.89	1.93	23281	200000	0.000	0.000	3500	26.9	2373	0.104	4437	0.104	7.14	14	0
126	t	Gilbert and Nejadi (2004)	S1-a	400	155	226	130	0.44	0	0	0	0.00	deformed	40	22	28	24.80	24.62	21.68	2.89	1.93	23281	200000	1.821	0.364	3500	26.9	2373	0.104	4437	0.104	25.10	14	380
127	0	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	40	21	28	24.80	24.62	21.68	2.89	1.93	23281	200000	0.000	0.000	3500	26.9	2373	0.104	2907	0.104	2.72	14	0
128	t	Gilbert and Nejadi (2004)	S1-b	400	155	226	130	0.44	0	0	0	0.00	deformed	40	22	28	24.80	24.62	21.68	2.89	1.93	23281	200000	1.821	0.364	3500	26.9	2373	0.104	2907	0.104	19.90	14	380
129	0	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	40	21	28	24.80	24.62	21.68	2.89	1.93	23281	200000	0.000	0.000	3500	26.9	2373	0.104	7497	0.104	11.80	14	0
130	t	Gilbert and Nejadi (2004)	S2-a	400	155	339	130	0.65	0	0	0	0.00	deformed	40	22	28	24.80	24.62	21.68	2.89	1.93	23281	200000	1.821	0.364	3500	26.9	2373	0.104	7497	0.104	32.50	14	380
131	0	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	40	21	28	24.80	24.62	21.68	2.89	1.93	23281	200000	0.000	0.000	3500	26.9	2373	0.104	4437	0.104	4.43	14	0
132	t	Gilbert and Nejadi (2004)	S2-b	400	155	339	130	0.65	0	0	0	0.00	deformed	40	22	28	24.80	24.62	21.68	2.89	1.93	23281	200000	1.821	0.364	3500	26.9	2373	0.104	4437	0.104	21.90	14	380
133	0	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	40	21	28	24.80	24.62	21.68	2.89	1.93	23281	200000	0.000	0.000	3500	26.9	2373	0.104	8977	0.104	10.70	14	0
134	t	Gilbert and Nejadi (2004)	S3-a	400	155	452	130	0.87	0	0	0	0.00	deformed	40	22	28	24.80	24.62	21.68	2.89	1.93	23281	200000	1.821	0.364	3500	26.9	2373	0.104	8977	0.104	29.80	14	380
135	0	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	40	21	28	24.80	24.62	21.68	2.89	1.93	23281	200000	0.000	0.000	3500	26.9	2373	0.104	5967	0.104	5.04	14	0
136	t	Gilbert and Nejadi (2004)	S3-b	400	155	452	130	0.87	0	0	0	0.00	deformed	40	22	28	24.80	24.62	21.68	2.89	1.93	23281	200000	1.821	0.364	3500	26.9	2373	0.104	5967	0.104	22.90	14	380
137	0	Tošić (2017)	NAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	28	30.50	30.28	21.30	2.86	1.91	23076	200000	0.000	0.000	3200	18.9	1024	0.104	6645	0.107	9.17	7	0
138	t	Tošić (2017)	NAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	28	30.50	30.28	21.30	2.86	1.91	23076	200000	2.406	0.411	3200	18.9	1024	0.104	6645	0.107	18.94	7	450
139	0	Tošić (2017)	NAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	28	30.50	30.28	30.50	3.42	2.28	27613	200000	0.000	0.000	3200	18.9	1024	0.104	5853	0.107	8.11	28	0
140	t	Tošić (2017)	NAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	28	30.50	30.28	30.50	3.42	2.28	27613	200000	1.910	0.411	3200	18.9	1024	0.104	5853	0.107	16.51	28	450

Assessment and Correction of ACI model:

Database – Calculated Deflections
With GL2000 shrinkage and creep model

		Study information		Cracking moment							Uncracked cross-section		Fully cracked cross-section							Deflection			
		1	2	3	4		5		6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
		Author	Specimen	W_c (mm^3)	M_{SW} (Nm)		M_{cr} (Nm)		M_{max} (Nm)	M_{max}/M_{cr}	I_c (mm^4)	S_c (mm^3)	A_{II}^* (mm^2)	A_{IIc} (mm^2)	$z_{IIc,1}$ (mm)	$z_{II,1}^*$ (mm)	I_{IIc} (mm^4)	I_{II}^* (mm^4)	S_{II}^* (mm^3)	t-t_0 (days)	$a_{num.int.}$ (mm)	a_{exp} (mm)	$a_{num.int.}/a_{exp}$ (%)
1	0	Washa and Fluck [8]	A1/A4	3146316	7192	>	6506	<	25634	3.940	479498602	1428634	32097	18465	259.37	213.94	12705339	252162498	838913	0	15.25	13.46	1.133
2	t	Washa and Fluck [8]	A1/A4	3146316	7192	>	6506	<	25634	3.940	479498602	1428634	32097	18465	259.37	213.94	12705339	252162498	838913	913	31.24	23.62	1.323
3	0	Washa and Fluck [8]	A2/A5	3146316	7192	>	6506	<	25634	3.940	479498602	1054477	29541	19525	256.76	208.71	15023667	245018877	938158	0	15.67	15.75	0.995
4	t	Washa and Fluck [8]	A2/A5	3146316	7192	>	6506	<	25634	3.940	479498602	1054477	29541	19525	256.76	208.71	15023667	245018877	938158	913	37.92	32.26	1.175
5	0	Washa and Fluck [8]	A3/A6	3146316	7192	>	6506	<	25634	3.940	479498602	714317	27549	20733	253.78	202.77	17986305	236047788	1057639	0	16.23	17.02	0.954
6	t	Washa and Fluck [8]	A3/A6	3146316	7192	>	6506	<	25634	3.940	479498602	714317	27549	20733	253.78	202.77	17986305	236047788	1057639	913	48.27	44.70	1.080
7	0	Washa and Fluck [8]	B1/B4	1048772	3596	>	1980	<	7259	3.666	106555245	390107	16326	9310	172.66	142.12	2895141	44786844	284288	0	26.04	23.37	1.114
8	t	Washa and Fluck [8]	B1/B4	1048772	3596	>	1980	<	7259	3.666	106555245	390107	16326	9310	172.66	142.12	2895141	44786844	284288	913	57.19	51.05	1.120
9	0	Washa and Fluck [8]	B2/B5	1048772	3596	>	1980	<	7259	3.666	106555245	292580	14845	9583	171.76	140.32	3157485	44337891	301267	0	26.28	24.89	1.056
10	t	Washa and Fluck [8]	B2/B5	1048772	3596	>	1980	<	7259	3.666	106555245	292580	14845	9583	171.76	140.32	3157485	44337891	301267	913	68.27	65.02	1.050
11	0	Washa and Fluck [8]	B3/B6	1048772	3596	>	1980	<	7259	3.666	106555245	195053	13431	9923	170.64	138.09	3505836	43769112	323052	0	26.59	26.42	1.006
12	t	Washa and Fluck [8]	B3/B6	1048772	3596	>	1980	<	7259	3.666	106555245	195053	13431	9923	170.64	138.09	3505836	43769112	323052	913	87.28	86.36	1.011
13	0	Washa and Fluck [8]	D1/D4	819353	1756	>	1590	<	6023	3.788	52028928	334560	20423	11641	107.9	88.81	1414920	24031651	222281	0	15.43	11.94	1.292
14	t	Washa and Fluck [8]	D1/D4	819353	1756	>	1590	<	6023	3.788	52028928	334560	20423	11641	107.9	88.81	1414920	24031651	222281	913	33.73	27.69	1.218
15	0	Washa and Fluck [8]	D2/D5	819353	1756	>	1590	<	6023	3.788	52028928	250920	18689	12102	107.15	87.29	1589932	23632577	240350	0	15.68	14.22	1.103
16	t	Washa and Fluck [8]	D2/D5	819353	1756	>	1590	<	6023	3.788	52028928	250920	18689	12102	107.15	87.29	1589932	23632577	240350	913	40.49	33.78	1.199
17	0	Washa and Fluck [8]	D3/D6	819353	1756	>	1590	<	6023	3.788	52028928	167280	17066	12675	106.21	85.42	1826586	23123743	263557	0	16.00	17.78	0.900
18	t	Washa and Fluck [8]	D3/D6	819353	1756	>	1590	<	6023	3.788	52028928	167280	17066	12675	106.21	85.42	1826586	23123743	263557	913	52.12	48.51	1.074
19	0	P.C.A. [18]	40NA	2356633	1346	<	5061	<	23613	4.666	359386583	664586	23414	16868	249.51	194.01	17310501	203141739	936113	0	4.36	4.25	1.026
20	t	P.C.A. [18]	40NA	2356633	1346	<	5061	<	23613	4.666	359386583	664586	23414	16868	249.51	194.01	17310501	203141739	936113	242	9.72	10.00	0.972
21	0	P.C.A. [18]	60NA	2356633	1346	<	5957	<	30987	5.202	359386583	676490	23644	16980	249.15	193.3	17657498	205568429	948324	0	4.82	4.90	0.984
22	t	P.C.A. [18]	60NA	2356633	1346	<	5957	<	30987	5.202	359386583	676490	23644	16980	249.15	193.3	17657498	205568429	948324	242	10.70	9.90	1.081
23	0	Sattler [11]	a1/a2	426667	800	<	911	<	2762	3.032	34133333	41802	4620	3846	140.77	121.54	474001	8961213	73948	0	16.87	15.83	1.066
24	t	Sattler [11]	a1/a2	426667	800	<	911	<	2762	3.032	34133333	41802	4620	3846	140.77	121.54	474001	8961213	73948	84	34.24	32.21	1.063
25	0	Hajnal-Konyi [22]	8	768144	3097	>	1973	<	4709	2.387	73165680	59510	6170	5256	169.81	149.13	750398	15932912	108759	0	28.53	20.60	1.385
26	t	Hajnal-Konyi [22]	8	768144	3097	>	1973	<	4709	2.387	73165680	59510	6170	5256	169.81	149.13	750398	15932912	108759	1734	71.23	65.40	1.089
27	0	Hajnal-Konyi [22]	10	768144	1742	<	1973	<	4709	2.387	73165680	59510	6170	5256	169.81	149.13	750398	15932912	108759	0	16.05	8.80	1.824
28	t	Hajnal-Konyi [22]	10	768144	1742	<	1973	<	4709	2.387	73165680	59510	6170	5256	169.81	149.13	750398	15932912	108759	1734	40.07	29.70	1.349
29	0	Hajnal-Konyi [22]	12	768144	774	<	1973	<	4709	2.387	73165680	59510	6170	5256	169.81	149.13	750398	15932912	108759	0	7.13	4.30	1.658
30	t	Hajnal-Konyi [22]	12	768144	774	<	1973	<	4709	2.387	73165680	59510	6170	5256	169.81	149.13	750398	15932912	108759	1734	17.81	14.00	1.272
31	0	Branson and Metz [23]	SB3/B	273118	303	<	672	<	1238	1.842	17342976	54815	5635	4197	106.34	85.69	596892	7613841	86702	0	3.23	3.89	0.830
32	t	Branson and Metz [23]	SB3/B	273118	303	<	672	<	1238	1.842	17342976	54815	5635	4197	106.34	85.69	596892	7613841	86702	60	6.67	7.70	0.866
33	0	Branson and Metz [23]	SB3/M	273118	303	<	632	<	1238	1.959	17342976	58295	5825	4295	105.86	84.73	639715	7943360	90781	0	3.47	3.99	0.870
34	t	Branson and Metz [23]	SB3/M	273118	303	<	632	<	1238	1.959	17342976	58295	5825	4295	105.86	84.73	639715	7943360	90781	60	7.16	7.50	0.955
35	0	Pauw and Meyers [26]	R1	1382573	627	<	3320	<	7803	2.350	149317862	157143	13006	10254	187.17	158.34	2841761	43131876	295675	0	2.70	2.44	1.107
36	t	Pauw and Meyers [26]	R1	1382573	627	<	3320	<	7803	2.350	149317862	157143	13006	10254	187.17	158.34	2841761	43131876	295675	150	5.53	4.89	1.131
37	0	Pauw and Meyers [26]	R2	1382573	627	<	3311	<	11855	3.580	149317862	223806	15667	11748	182.96	149.93	4273886	55526092	388118	0	3.84	3.22	1.193
38	t	Pauw and Meyers [26]	R2	1382573	627	<	3311	<	11855	3.580	149317862	223806	15667	11748	182.96	149.93	4273886	55526092	388118	150	7.85	6.16	1.274
39	0	Pauw and Meyers [26]	R3	1382573	627	<	3569	<	10270	2.878	149317862	208003	15066	11425	183.87	151.73	3931065	52748551	367110	0	3.08	3.71	0.830
40	t	Pauw and Meyers [26]	R3	1382573	627	<	3569	<	10270	2.878	149317862	208003	15066	11425	183.87	151.73	3931065	52748551	367110	120	6.07	6.64	0.914
41	0	Pauw and Meyers [26]	R4	1382573	627	<	3560	<	15234	4.279	149317862	284169	17805	12828	179.93	143.86	5564627	65261928	462645	0	4.04	4.66	0.867
42	t	Pauw and Meyers [26]	R4	1382573	627	<	3560	<	15234	4.279	149317862	284169	17805	12828	179.93	143.86	5564627	65261928	462645	120	7.96	7.89	1.009
43	0	Lutz et al. [29]	SR	699181	216	<	1688	<	8179	4.845	71036830	123530	8045	6278	172.3	141.42	1997550	29259693	193908	0	3.33	4.10	0.812
44	t	Lutz et al. [29]	SR	699181	216	<	1688	<	8179	4.845	71036830	123530	8045	6278	172.3	141.42	1997550	29259693	193908	142	7.68	8.80	0.873
45	0	Lutz et al. [29]	DR	699181	216	<	1688	<	8179	4.845	71036830	258194	9123	5588	175.7	148.2	1408646	31169246	153578	0	3.13	4.20	0.745
46	t	Lutz et al. [29]	DR	699181	216	<	1688	<	8179	4.845	71036830	258194	9123	5588	175.7	148.2	1408646	31169246	153578	142	5.43	6.80	0.799
47	0	Jaccoud and Favre (1982)	A1	1440000	2162	<	2699	<	4949	1.834	86400000	117262	18419	15139	107.38	94.76	803202	16736259	190997	0	6.55	8.42	0.778
48	t	Jaccoud and Favre (1982)	A1	1440000	2162	<	2699	<	4949	1.834	86400000	117262	18419	15139	107.38	94.76	803202	16736259	190997	365	16.08	18.40	0.874
49	0	Jaccoud and Favre (1982)	A2	1440000	2162	<	2929	<	4949	1.690	86400000	108035	17652	14632	107.81	95.61	725134	15655337	178439	0	5.48	6.16	0.890
50	t	Jaccoud and Favre (1982)	A2	1440000	2162	<	2929	<	4949	1.690	86400000	108035	17652	14632	107.81	95.61	725134	15655337	178439	365	13.49	17.50	0.771
51	0	Jaccoud and Favre (1982)	A3	1440000	2162	<	2641	<	4949	1.874	86400000	119771	18626	15276	107.27	94.55	825173	17027594	194398	0	6.84	8.12	0.842
52	t	Jaccoud and Favre (1982)	A3	1440000	2162	<	2641	<	4949	1.874	86400000	119771	18626	15276	107.27	94.55	825173	17027594	194398	365	16.78	17.50	0.959
53	0	Jaccoud and Favre (1982)	A4	1440000	2162	<	3583	<	4949	1.381	86400000	88308	15913	13446	108.79	97.59	562762	13254472	150662	0	3.25	2.24	1.451
54	t	Jaccoud and Favre (1982)	A4	1440000	2162	<	3583	<	4949	1.381	86400000	88308	15913	13446	108.79	97.59	562762	13254472	150662	365	8.06	8.05	1.001
55	0	Jaccoud and Favre (1982)	A5	1440000	2162	<	3390	<	4949	1.460	86400000	93152	16364	13760	108.53	97.07	603049	13862824	157690	0	3.78	3.12	1.212
56	t	Jaccoud and Favre (1982)	A5	1440000	2162	<	3390	<	4949	1.460	86400000	93152	16364	13760	108.53	97.07	603049	13862824	157690	365	9.36	9.55	0.980
57	0	Jaccoud and Favre (1982)	C12	3200000	3604	<	7172	<	9699	1.352	256000000	235277	29270	24680	143.55	127.1	2227167	49053231	406145	0	2.36	2.17	1.088
58	t	Jaccoud and Favre (1982)	C12	3200000	3604	<	7172	<	9699	1.352	256000000	235277	29270	24680	143.55	127.1	2227167	49053231	406145	510	5.54	8.29	0.668
59	0	Jaccoud and Favre (1982)	C22	3200000	3604	<	7598	<	9699	1.277	256000000	222445	28426	24091	143.94	127.88	2071359	46803193	386963	0	2.02	2.00	1.010
60	t	Jaccoud and Favre (1982)	C22	3200000	3604	<	7598	<	9699	1.277	256000000	222445	28426	24091	143.94	127.88	2071359	46803193	386963	365	4.47	7.00	0.639
61	0	Jaccoud and Favre (1982)	C13	3200000	3604	<	7364	<	12909	1.753	256000000	229388	28877	24405	143.73	127.45	2153519	48013295	397254	0	4.75	5.29	0.898
62	t	Jaccoud and Favre (1982)	C13	3200000	3604	<	7364	<	12909	1.753	256000000	229388	28877	24405	143.73	127.45	2153519	48013295	397254	510	10.88	13.28	0.819
63	0	Jaccoud and Favre (1982)	C14	3200000	3604	<	7172	<	16124	2.248	256000000	235277	29270	24680	143.55	127.1	2227167	49053231	406145	0	8.08	8.48	0.953
64	t	Jaccoud and Favre (1982)	C14	3200000	3604	<	7172	<	16124	2.248	256000000	235277	29270	24680	143.55	127.1	2227167	49053231	406145	510	18.36	18.15	1.012
65	0	Jaccoud and Favre (1982)	C24	3200000	3604	<	7492	<	16124	2.152	256000000	225623	28636	24238	143.84	127.68	2109606	47353248	391635	0	7.58	8.00	0.948
66	t	Jaccoud and Favre (1982)	C24	3200000	3604	<	7492	<	16124	2.152	256000000	225623	28636	24238	143.84	127.68	2109606	47353248	391635	510	17.23	17.52	0.983
67	0	Jaccoud and Favre (1982)	C15	3200000	3604	<	7172	<	19329	2.695	256000000	235721	29287	24690	143.54	127.07	2229828	49104857	406557	0	11.21	11.02	1.017
68	t	Jaccoud and Favre (1982)	C15	3200000	3604	<	7172	<	19329	2.695	256000000	235721	29287	24690	143.54	127.07	2229828	49104857	406557	510	25.36	20.83	1.217
69	0	Ding Dajung [44]	C-3	345600	336	<	664	<	3240	4.880	27648000	55435	4747	3774	136.7	113.39	682787	10682594	87943	0	11.20	8.45	1.325
70	t	Ding Dajung [44]	C-3	345600	336	<	664	<	3240	4.880	27648000	55435	4747	3774	136.7	113.39	682787	10682594	87943	2025	30.70	16.62	1.847

		Study information		Cracking moment							Uncracked cross-section		Fully cracked cross-section							Deflection			
		1	2	3	4		5		6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
		Author	Specimen	W_c (mm^3)	M_{SW} (Nm)		M_{cr} (Nm)		M_{max} (Nm)	M_{max}/M_{cr}	I_c (mm^4)	S_c (mm^3)	A_{II}^* (mm^2)	A_{IIc} (mm^2)	$z_{IIc,1}$ (mm)	$z_{II,1}^*$ (mm)	I_{IIc} (mm^4)	I_{II}^* (mm^4)	S_{II}^* (mm^3)	t-t_0 (days)	$a_{num.int.}$ (mm)	a_{exp} (mm)	$a_{num.int.}/a_{exp}$ (%)
71	0	Ding Dajung [44]	L-1	238741	244	<	497	<	3524	7.091	18144341	50113	4386	3163	126.49	100.98	685847	8067316	80678	0	15.19	15.53	0.978
72	t	Ding Dajung [44]	L-1	238741	244	<	497	<	3524	7.091	18144341	50113	4386	3163	126.49	100.98	685847	8067316	80678	531	38.08	30.43	1.251
73	0	F.R.F.C. [45]	I-72	1960000	1029	<	4693	<	22529	4.801	274400000	234140	12812	10684	244.39	208.78	4516556	86089337	380494	0	7.27	6.02	1.208
74	t	F.R.F.C. [45]	I-72	1960000	1029	<	4693	<	22529	4.801	274400000	234140	12812	10684	244.39	208.78	4516556	86089337	380494	1610	22.24	10.29	2.161
75	0	F.R.F.C. [45]	I-81	1960000	1029	<	4693	<	25279	5.387	274400000	234140	12812	10684	244.39	208.78	4516556	86089337	380494	0	8.24	7.39	1.115
76	t	F.R.F.C. [45]	I-81	1960000	1029	<	4693	<	25279	5.387	274400000	234140	12812	10684	244.39	208.78	4516556	86089337	380494	1344	24.55	11.98	2.049
77	0	F.R.F.C. [45]	I-91	1960000	1029	<	4693	<	28209	6.011	274400000	234140	12812	10684	244.39	208.78	4516556	86089337	380494	0	9.26	8.94	1.036
78	t	F.R.F.C. [45]	I-91	1960000	1029	<	4693	<	28209	6.011	274400000	234140	12812	10684	244.39	208.78	4516556	86089337	380494	1314	27.48	15.02	1.830
79	0	F.R.F.C. [45]	II-52	1960000	1029	<	4419	<	34979	7.916	274400000	541638	20770	15126	229.58	179.15	12818721	154379371	762800	0	6.91	7.27	0.950
80	t	F.R.F.C. [45]	II-52	1960000	1029	<	4419	<	34979	7.916	274400000	541638	20770	15126	229.58	179.15	12818721	154379371	762800	1398	20.87	13.49	1.547
81	0	F.R.F.C. [45]	II-59	1960000	1029	<	4419	<	39329	8.900	274400000	541638	20770	15126	229.58	179.15	12818721	154379371	762800	0	7.78	7.69	1.012
82	t	F.R.F.C. [45]	II-59	1960000	1029	<	4419	<	39329	8.900	274400000	541638	20770	15126	229.58	179.15	12818721	154379371	762800	1541	23.77	14.10	1.686
83	0	F.R.F.C. [45]	II-70	1960000	1029	<	4419	<	46879	10.609	274400000	541638	20770	15126	229.58	179.15	12818721	154379371	762800	0	9.29	9.36	0.993
84	t	F.R.F.C. [45]	II-70	1960000	1029	<	4419	<	46879	10.609	274400000	541638	20770	15126	229.58	179.15	12818721	154379371	762800	1471	28.13	17.56	1.602
85	0	F.R.F.C. [45]	II-80	1960000	1029	<	4419	<	53289	12.059	274400000	541638	20770	15126	229.58	179.15	12818721	154379371	762800	0	10.57	10.72	0.986
86	t	F.R.F.C. [45]	II-80	1960000	1029	<	4419	<	53289	12.059	274400000	541638	20770	15126	229.58	179.15	12818721	154379371	762800	1485	31.99	20.24	1.581
87	0	F.R.F.C. [45]	II-90	1960000	1029	<	4419	<	59689	13.507	274400000	541638	20770	15126	229.58	179.15	12818721	154379371	762800	0	11.84	13.10	0.904
88	t	F.R.F.C. [45]	II-90	1960000	1029	<	4419	<	59689	13.507	274400000	541638	20770	15126	229.58	179.15	12818721	154379371	762800	1491	35.83	24.23	1.479
89	0	F.R.F.C. [45]	III-43	1960000	1029	<	4746	<	43219	9.106	274400000	782436	25670	17255	222.48	164.95	19026862	193200814	992497	0	6.38	7.08	0.901
90	t	F.R.F.C. [45]	III-43	1960000	1029	<	4746	<	43219	9.106	274400000	782436	25670	17255	222.48	164.95	19026862	193200814	992497	1572	19.63	14.51	1.353
91	0	F.R.F.C. [45]	III-67	1960000	1029	<	4746	<	66329	13.976	274400000	782436	25670	17255	222.48	164.95	19026862	193200814	992497	0	9.80	10.58	0.926
92	t	F.R.F.C. [45]	III-67	1960000	1029	<	4746	<	66329	13.976	274400000	782436	25670	17255	222.48	164.95	19026862	193200814	992497	1572	29.97	23.88	1.255
93	0	F.R.F.C. [45]	III-77	1960000	1029	<	4746	<	76519	16.123	274400000	782436	25670	17255	222.48	164.95	19026862	193200814	992497	0	11.31	13.84	0.817
94	t	F.R.F.C. [45]	III-77	1960000	1029	<	4746	<	76519	16.123	274400000	782436	25670	17255	222.48	164.95	19026862	193200814	992497	1572	34.52	28.74	1.201
95	0	F.R.F.C. [45]	IV-52	1960000	1029	<	4589	<	38639	8.420	274400000	875520	22194	13484	235.05	190.1	9079856	163475611	606233	0	6.97	5.98	1.166
96	t	F.R.F.C. [45]	IV-52	1960000	1029	<	4589	<	38639	8.420	274400000	875520	22194	13484	235.05	190.1	9079856	163475611	606233	772	14.25	10.52	1.355
97	0	F.R.F.C. [45]	IV-70	1960000	1029	<	4589	<	52369	11.412	274400000	875520	22194	13484	235.05	190.1	9079856	163475611	606233	0	9.46	8.80	1.075
98	t	F.R.F.C. [45]	IV-70	1960000	1029	<	4589	<	52369	11.412	274400000	875520	22194	13484	235.05	190.1	9079856	163475611	606233	772	19.31	13.90	1.389
99	0	F.R.F.C. [45]	IV-80	1960000	1029	<	4589	<	59229	12.907	274400000	875520	22194	13484	235.05	190.1	9079856	163475611	606233	0	10.71	11.16	0.960
100	t	F.R.F.C. [45]	IV-80	1960000	1029	<	4589	<	59229	12.907	274400000	875520	22194	13484	235.05	190.1	9079856	163475611	606233	972	22.56	16.96	1.330
101	0	F.R.F.C. [45]	IV-90	1960000	1029	<	4589	<	66559	14.504	274400000	875520	22194	13484	235.05	190.1	9079856	163475611	606233	0	12.04	12.85	0.937
102	t	F.R.F.C. [45]	IV-90	1960000	1029	<	4589	<	66559	14.504	274400000	875520	22194	13484	235.05	190.1	9079856	163475611	606233	972	25.34	19.28	1.314
103	0	Bakoss et al. [41]	1B2	375000	659	<	968	<	3909	4.038	28125000	79616	6306	4857	125.72	101.43	954705	13426195	117964	0	13.48	8.94	1.508
104	t	Bakoss et al. [41]	1B2	375000	659	<	968	<	3909	4.038	28125000	79616	6306	4857	125.72	101.43	954705	13426195	117964	500	39.07	25.02	1.562
105	0	Clarke et al. [46]	A1	395267	212	<	833	<	3712	4.456	30435533	67899	5842	4607	130.97	107.93	814736	12378087	106107	0	5.36	4.89	1.096
106	t	Clarke et al. [46]	A1	395267	212	<	833	<	3712	4.456	30435533	67899	5842	4607	130.97	107.93	814736	12378087	106107	180	13.76	11.83	1.163
107	0	Clarke et al. [46]	A2	385067	209	<	812	<	3709	4.568	29265067	66665	5798	4563	129.19	106.36	791717	11957625	104168	0	5.55	5.09	1.090
108	t	Clarke et al. [46]	A2	385067	209	<	812	<	3709	4.568	29265067	66665	5798	4563	129.19	106.36	791717	11957625	104168	180	14.29	11.92	1.199
109	0	Clarke et al. [46]	B1	385067	209	<	812	<	3709	4.568	29265067	135798	6568	4098	131.51	111.01	573334	12622646	83992	0	5.27	4.78	1.103
110	t	Clarke et al. [46]	B1	385067	209	<	812	<	3709	4.568	29265067	135798	6568	4098	131.51	111.01	573334	12622646	83992	180	10.30	8.77	1.174
111	0	Clarke et al. [46]	B2	395267	212	<	833	<	3712	4.456	30435533	138267	6606	4136	133.32	112.63	589416	13066292	85523	0	5.09	4.30	1.184
112	t	Clarke et al. [46]	B2	395267	212	<	833	<	3712	4.456	30435533	138267	6606	4136	133.32	112.63	589416	13066292	85523	180	9.94	8.55	1.163
113	0	Gilbert and Nejadi (2004)	B1-a	4816667	3254	<	9285	<	24900	2.682	818833333	448950	23021	19568	300.87	261.74	9989523	209739323	765708	0	5.38	4.95	1.087
114	t	Gilbert and Nejadi (2004)	B1-a	4816667	3254	<	9285	<	24900	2.682	818833333	448950	23021	19568	300.87	261.74	9989523	209739323	765708	380	12.82	12.06	1.063
115	0	Gilbert and Nejadi (2004)	B1-b	4816667	3254	<	9285	<	17000	1.831	818833333	448950	23021	19568	300.87	261.74	9989523	209739323	765708	0	2.75	1.98	1.389
116	t	Gilbert and Nejadi (2004)	B1-b	4816667	3254	<	9285	<	17000	1.831	818833333	448950	23021	19568	300.87	261.74	9989523	209739323	765708	380	6.62	7.44	0.890
117	0	Gilbert and Nejadi (2004)	B2-a	4401042	3110	<	8484	<	24800	2.923	715169271	474851	23021	19568	285.87	246.74	9989523	209739323	765708	0	5.71	5.03	1.135
118	t	Gilbert and Nejadi (2004)	B2-a	4401042	3110	<	8484	<	24800	2.923	715169271	474851	23021	19568	285.87	246.74	9989523	209739323	765708	380	13.68	12.42	1.101
119	0	Gilbert and Nejadi (2004)	B2-b	4401042	3110	<	8484	<	16800	1.980	715169271	474851	23021	19568	285.87	246.74	9989523	209739323	765708	0	3.10	2.06	1.505
120	t	Gilbert and Nejadi (2004)	B2-b	4401042	3110	<	8484	<	16800	1.980	715169271	474851	23021	19568	285.87	246.74	9989523	209739323	765708	380	7.51	7.87	0.954
121	0	Gilbert and Nejadi (2004)	B3-a	4401042	3110	<	8484	<	34600	4.078	715169271	712276	28355	23175	278.65	232.31	16595791	288974918	1073818	0	6.43	5.81	1.107
122	t	Gilbert and Nejadi (2004)	B3-a	4401042	3110	<	8484	<	34600	4.078	715169271	712276	28355	23175	278.65	232.31	16595791	288974918	1073818	380	15.40	13.30	1.158
123	0	Gilbert and Nejadi (2004)	B3-b	4401042	3110	<	8484	<	20800	2.452	715169271	712276	28355	23175	278.65	232.31	16595791	288974918	1073818	0	3.47	1.97	1.761
124	t	Gilbert and Nejadi (2004)	B3-b	4401042	3110	<	8484	<	20800	2.452	715169271	712276	28355	23175	278.65	232.31	16595791	288974918	1073818	380	8.39	7.90	1.062
125	0	Gilbert and Nejadi (2004)	S1-a	1601667	2373	<	3087	<	6810	2.206	124129167	101929	14343	12402	139.5	124.01	993514	23000169	192212	0	9.94	7.14	1.392
126	t	Gilbert and Nejadi (2004)	S1-a	1601667	2373	<	3087	<	6810	2.206	124129167	101929	14343	12402	139.5	124.01	993514	23000169	192212	380	25.75	25.10	1.026
127	0	Gilbert and Nejadi (2004)	S1-b	1601667	2373	<	3087	<	5280	1.710	124129167	101929	14343	12402	139.5	124.01	993514	23000169	192212	0	5.54	2.72	2.037
128	t	Gilbert and Nejadi (2004)	S1-b	1601667	2373	<	3087	<	5280	1.710	124129167	101929	14343	12402	139.5	124.01	993514	23000169	192212	380	14.53	19.90	0.730
129	0	Gilbert and Nejadi (2004)	S2-a	1601667	2373	<	3087	<	9870	3.197	124129167	152893	17644	14732	136.59	118.17	1665131	31941782	271312	0	14.62	11.80	1.239
130	t	Gilbert and Nejadi (2004)	S2-a	1601667	2373	<	3087	<	9870	3.197	124129167	152893	17644	14732	136.59	118.17	1665131	31941782	271312	380	37.71	32.50	1.160
131	0	Gilbert and Nejadi (2004)	S2-b	1601667	2373	<	3087	<	6810	2.206	124129167	152893	17644	14732	136.59	118.17	1665131	31941782	271312	0	8.18	4.43	1.847
132	t	Gilbert and Nejadi (2004)	S2-b	1601667	2373	<	3087	<	6810	2.206	124129167	152893	17644	14732	136.59	118.17	1665131	31941782	271312	380	21.31	21.90	0.973
133	0	Gilbert and Nejadi (2004)	S3-a	1601667	2373	<	3087	<	11350	3.677	124129167	203857	20466	16583	134.27	113.54	2375048	39938925	343772	0	14.39	10.70	1.345
134	t	Gilbert and Nejadi (2004)	S3-a	1601667	2373	<	3087	<	11350	3.677	124129167	203857	20466	16583	134.27	113.54	2375048	39938925	343772	380	37.18	29.80	1.248
135	0	Gilbert and Nejadi (2004)	S3-b	1601667	2373	<	3087	<	8340	2.702	124129167	203857	20466	16583	134.27	113.54	2375048	39938925	343772	0	9.64	5.04	1.913
136	t	Gilbert and Nejadi (2004)	S3-b	1601667	2373	<	3087	<	8340	2.702	124129167	203857	20466	16583	134.27	113.54	2375048	39938925	343772	380	25.08	22.90	1.095
137	0	Tošić (2017)	NAC7	1066667	1024	<	2035	<	7669	3.769	106666667	128965	9037	7182	177.56	155.13	1205822	25917152	161122	0	12.66	9.17	1.381
138	t	Tošić (2017)	NAC7	1066667	1024	<	2035	<	7669	3.769	106666667	128965	9037	7182	177.56	155.13	1205822	25917152	161122	450	36.32	18.94	1.918
139	0	Tošić (2017)	NAC28	1066667	1024	<	2433	<	6877	2.827	106666667	107775	8231	6682	179.12	158.27	970995	22354235	139412	0	9.64	8.11	1.189
140	t	Tošić (2017)	NAC28	1066667	1024	<	2433	<	6877	2.827	106666667	107775	8231	6682	179.12	158.27	970995	22354235	139412	450	24.02	16.51	1.455

Assessment and Correction of ACI model:

Database – Calculated Deflections
ACI with corrections

		Study information		Cracking moment							Uncracked cross-section		Fully cracked cross-section							Effective moment of inertia		Simplified method			Deflection					
		1	2	3	4		5		6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
		Author	Specimen	W_c (mm^3)	M_{SW} (Nm)		M_{cr} (Nm)		M_{max} (Nm)	M_{max}/M_{cr}	I_c (mm^4)	S_c (mm^3)	A_{II}^* (mm^2)	A_{IIc} (mm^2)	$z_{IIc,1}$ (mm)	$z_{II,1}^*$ (mm)	I_{IIc} (mm^4)	I_{II}^* (mm^4)	S_{II}^* (mm^3)	I_{eff}	$I_{eff,max}$	$a_{eff,L1}$ (mm)	$a_{eff,L2}$ (mm)	$a_{eff,cs}$ (mm)	a_{simp} (mm)	a_{simp}/ a_{exp} (%)	t-t_0 (days)	$a_{num.int.}$ (mm)	a_{exp} (mm)	$a_{num.int.}/a_{exp}$ (%)
1	0	Washa and Fluck [8]	A1/A4	3146316	7192	>	6506	<	25634	3.940	479498602	1428634	32097	18465	259.37	213.94	12705339	252162498	838913	255879232	255879232	4.35	11.14	0.00	15.49	1.151	0	15.25	13.46	1.133
2	t	Washa and Fluck [8]	A1/A4	3146316	7192	>	6506	<	25634	3.940	479498602	1428634	32097	18465	259.37	213.94	12705339	252162498	838913	255879232	255879232	7.69	19.71	0.00	27.40	1.16	913	26.99	23.62	1.143
3	0	Washa and Fluck [8]	A2/A5	3146316	7192	>	6506	<	25634	3.940	479498602	1054477	29541	19525	256.76	208.71	15023667	245018877	938158	248852402	248852402	4.47	11.46	0.00	15.92	1.011	0	15.67	15.75	0.995
4	t	Washa and Fluck [8]	A2/A5	3146316	7192	>	6506	<	25634	3.940	479498602	1054477	29541	19525	256.76	208.71	15023667	245018877	938158	248852402	248852402	8.98	23.03	0.97	32.98	1.022	913	32.47	32.26	1.007
5	0	Washa and Fluck [8]	A3/A6	3146316	7192	>	6506	<	25634	3.940	479498602	714317	27549	20733	253.78	202.77	17986305	236047788	1057639	240027982	240027982	4.63	11.88	0.00	16.51	0.97	0	16.23	17.02	0.954
6	t	Washa and Fluck [8]	A3/A6	3146316	7192	>	6506	<	25634	3.940	479498602	714317	27549	20733	253.78	202.77	17986305	236047788	1057639	240027982	240027982	11.10	28.47	1.65	41.21	0.922	913	40.54	44.70	0.907
7	0	Washa and Fluck [8]	B1/B4	1048772	3596	>	1980	<	7259	3.666	106555245	390107	16326	9310	172.66	142.12	2895141	44786844	284288	46040365	46040365	13.24	13.48	0.00	26.72	1.143	0	26.04	23.37	1.114
8	t	Washa and Fluck [8]	B1/B4	1048772	3596	>	1980	<	7259	3.666	106555245	390107	16326	9310	172.66	142.12	2895141	44786844	284288	46040365	46040365	24.54	25.00	0.00	49.54	0.971	913	48.28	51.05	0.946
9	0	Washa and Fluck [8]	B2/B5	1048772	3596	>	1980	<	7259	3.666	106555245	292580	14845	9583	171.76	140.32	3157485	44337891	301267	45600523	45600523	13.36	13.61	0.00	26.98	1.084	0	26.28	24.89	1.056
10	t	Washa and Fluck [8]	B2/B5	1048772	3596	>	1980	<	7259	3.666	106555245	292580	14845	9583	171.76	140.32	3157485	44337891	301267	45600523	45600523	28.14	28.67	1.54	58.35	0.897	913	56.87	65.02	0.875
11	0	Washa and Fluck [8]	B3/B6	1048772	3596	>	1980	<	7259	3.666	106555245	195053	13431	9923	170.64	138.09	3505836	43769112	323052	45043287	45043287	13.53	13.78	0.00	27.31	1.034	0	26.59	26.42	1.006
12	t	Washa and Fluck [8]	B3/B6	1048772	3596	>	1980	<	7259	3.666	106555245	195053	13431	9923	170.64	138.09	3505836	43769112	323052	45043287	45043287	34.74	35.38	2.74	72.86	0.844	913	71.00	86.36	0.822
13	0	Washa and Fluck [8]	D1/D4	819353	1756	>	1590	<	6023	3.788	52028928	334560	20423	11641	107.9	88.81	1414920	24031651	222281	24546724	24546724	4.59	11.16	0.00	15.76	1.32	0	15.43	11.94	1.292
14	t	Washa and Fluck [8]	D1/D4	819353	1756	>	1590	<	6023	3.788	52028928	334560	20423	11641	107.9	88.81	1414920	24031651	222281	24546724	24546724	8.49	20.62	0.00	29.11	1.051	913	28.51	27.69	1.030
15	0	Washa and Fluck [8]	D2/D5	819353	1756	>	1590	<	6023	3.788	52028928	250920	18689	12102	107.15	87.29	1589932	23632577	240350	24154992	24154992	4.67	11.35	0.00	16.02	1.126	0	15.68	14.22	1.103
16	t	Washa and Fluck [8]	D2/D5	819353	1756	>	1590	<	6023	3.788	52028928	250920	18689	12102	107.15	87.29	1589932	23632577	240350	24154992	24154992	9.79	23.78	0.95	34.53	1.022	913	33.81	33.78	1.001
17	0	Washa and Fluck [8]	D3/D6	819353	1756	>	1590	<	6023	3.788	52028928	167280	17066	12675	106.21	85.42	1826586	23123743	263557	23655519	23655519	4.77	11.59	0.00	16.35	0.92	0	16.00	17.78	0.900
18	t	Washa and Fluck [8]	D3/D6	819353	1756	>	1590	<	6023	3.788	52028928	167280	17066	12675	106.21	85.42	1826586	23123743	263557	23655519	23655519	12.17	29.58	1.70	43.45	0.896	913	42.53	48.51	0.877
19	0	P.C.A. [18]	40NA	2356633	1346	<	5061	<	23613	4.666	359386583	664586	23414	16868	249.51	194.01	17310501	203141739	936113	204680110	204680110	0.25	4.17	0.00	4.42	1.039	0	4.36	4.25	1.026
20	t	P.C.A. [18]	40NA	2356633	1346	<	5061	<	23613	4.666	359386583	664586	23414	16868	249.51	194.01	17310501	203141739	936113	204680110	204680110	0.54	9.13	0.40	10.07	1.007	242	9.96	10.00	0.996
21	0	P.C.A. [18]	60NA	2356633	1346	<	5957	<	30987	5.202	359386583	676490	23644	16980	249.15	193.3	17657498	205568429	948324	206661257	206661257	0.21	4.66	0.00	4.87	0.994	0	4.82	4.90	0.984
22	t	P.C.A. [18]	60NA	2356633	1346	<	5957	<	30987	5.202	359386583	676490	23644	16980	249.15	193.3	17657498	205568429	948324	206661257	206661257	0.45	10.21	0.43	11.09	1.12	242	10.99	9.90	1.110
23	0	Sattler [11]	a1/a2	426667	800	<	911	<	2762	3.032	34133333	41802	4620	3846	140.77	121.54	474001	8961213	73948	9864455	9864455	5.22	12.81	0.00	18.03	1.139	0	16.89	15.83	1.067
24	t	Sattler [11]	a1/a2	426667	800	<	911	<	2762	3.032	34133333	41802	4620	3846	140.77	121.54	474001	8961213	73948	9864455	9864455	10.81	26.51	0.79	38.11	1.183	84	35.75	32.21	1.110
25	0	Hajnal-Konyi [22]	8	768144	3097	>	1973	<	4709	2.387	73165680	59510	6170	5256	169.81	149.13	750398	15932912	108759	20142503	20142503	21.10	10.98	0.00	28.87	1.402	0	28.64	20.60	1.390
26	t	Hajnal-Konyi [22]	8	768144	3097	>	1973	<	4709	2.387	73165680	59510	6170	5256	169.81	149.13	750398	15932912	108759	20142503	20142503	44.29	23.05	1.49	61.94	0.947	1734	61.60	65.40	0.942
27	0	Hajnal-Konyi [22]	10	768144	1742	<	1973	<	4709	2.387	73165680	59510	6170	5256	169.81	149.13	750398	15932912	108759	20142503	20142503	6.68	11.37	0.00	16.24	1.845	0	16.11	8.80	1.831
28	t	Hajnal-Konyi [22]	10	768144	1742	<	1973	<	4709	2.387	73165680	59510	6170	5256	169.81	149.13	750398	15932912	108759	20142503	20142503	14.01	23.87	0.84	34.84	1.173	1734	34.65	29.70	1.167
29	0	Hajnal-Konyi [22]	12	768144	774	<	1973	<	4709	2.387	73165680	59510	6170	5256	169.81	149.13	750398	15932912	108759	20142503	20142503	1.32	6.70	0.00	7.22	1.679	0	7.16	4.30	1.665
30	t	Hajnal-Konyi [22]	12	768144	774	<	1973	<	4709	2.387	73165680	59510	6170	5256	169.81	149.13	750398	15932912	108759	20142503	20142503	2.77	14.07	0.37	15.49	1.106	1734	15.40	14.00	1.100
31	0	Branson and Metz [23]	SB3/B	273118	303	<	672	<	1238	1.842	17342976	54815	5635	4197	106.34	85.69	596892	7613841	86702	9169879	9169879	0.87	2.68	0.00	3.20	0.822	0	3.23	3.89	0.830
32	t	Branson and Metz [23]	SB3/B	273118	303	<	672	<	1238	1.842	17342976	54815	5635	4197	106.34	85.69	596892	7613841	86702	9169879	9169879	1.77	5.45	0.63	7.07	0.918	60	7.21	7.70	0.936
33	0	Branson and Metz [23]	SB3/M	273118	303	<	632	<	1238	1.959	17342976	58295	5825	4295	105.86	84.73	639715	7943360	90781	9193905	9193905	0.92	2.84	0.00	3.39	0.85	0	3.47	3.99	0.870
34	t	Branson and Metz [23]	SB3/M	273118	303	<	632	<	1238	1.959	17342976	58295	5825	4295	105.86	84.73	639715	7943360	90781	9193905	9193905	1.87	5.79	0.63	7.46	0.995	60	7.70	7.50	1.027
35	0	Pauw and Meyers [26]	R1	1382573	627	<	3320	<	7803	2.350	149317862	157143	13006	10254	187.17	158.34	2841761	43131876	295675	51310809	51310809	0.23	2.69	0.00	2.63	1.077	0	2.70	2.44	1.107
36	t	Pauw and Meyers [26]	R1	1382573	627	<	3320	<	7803	2.350	149317862	157143	13006	10254	187.17	158.34	2841761	43131876	295675	51310809	51310809	0.48	5.63	0.25	5.72	1.169	150	5.89	4.89	1.204
37	0	Pauw and Meyers [26]	R2	1382573	627	<	3311	<	11855	3.580	149317862	223806	15667	11748	182.96	149.93	4273886	55526092	388118	57569418	57569418	0.20	3.76	0.00	3.97	1.232	0	3.84	3.22	1.193
38	t	Pauw and Meyers [26]	R2	1382573	627	<	3311	<	11855	3.580	149317862	223806	15667	11748	182.96	149.93	4273886	55526092	388118	57569418	57569418	0.43	7.87	0.28	8.58	1.392	150	8.31	6.16	1.349
39	0	Pauw and Meyers [26]	R3	1382573	627	<	3569	<	10270	2.878	149317862	208003	15066	11425	183.87	151.73	3931065	52748551	367110	56801466	56801466	0.19	3.04	0.00	2.91	0.785	0	3.08	3.71	0.830
40	t	Pauw and Meyers [26]	R3	1382573	627	<	3569	<	10270	2.878	149317862	208003	15066	11425	183.87	151.73	3931065	52748551	367110	56801466	56801466	0.39	6.17	0.26	6.14	0.924	120	6.50	6.64	0.979
41	0	Pauw and Meyers [26]	R4	1382573	627	<	3560	<	15234	4.279	149317862	284169	17805	12828	179.93	143.86	5564627	65261928	462645	66334624	66334624	0.17	3.96	0.00	4.12	0.885	0	4.04	4.66	0.867
42	t	Pauw and Meyers [26]	R4	1382573	627	<	3560	<	15234	4.279	149317862	284169	17805	12828	179.93	143.86	5564627	65261928	462645	66334624	66334624	0.33	8.02	0.29	8.65	1.096	120	8.49	7.89	1.076
43	0	Lutz et al. [29]	SR	699181	216	<	1688	<	8179	4.845	71036830	123530	8045	6278	172.3	141.42	1997550	29259693	193908	29626938	29626938	0.09	3.29	0.00	3.38	0.825	0	3.33	4.10	0.812
44	t	Lutz et al. [29]	SR	699181	216	<	1688	<	8179	4.845	71036830	123530	8045	6278	172.3	141.42	1997550	29259693	193908	29626938	29626938	0.20	7.72	0.22	8.14	0.925	142	8.01	8.80	0.910
45	0	Lutz et al. [29]	DR	699181	216	<	1688	<	8179	4.845	71036830	258194	9123	5588	175.7	148.2	1408646	31169246	153578	31519705	31519705	0.08	3.10	0.00	3.18	0.757	0	3.13	4.20	0.745
46	t	Lutz et al. [29]	DR	699181	216	<	1688	<	8179	4.845	71036830	258194	9123	5588	175.7	148.2	1408646	31169246	153578	31519705	31519705	0.14	5.49	0.00	5.63	0.828	142	5.55	6.80	0.816
47	0	Jaccoud and Favre (1982)	A1	1440000	2162	<	2699	<	4949	1.834	86400000	117262	18419	15139	107.38	94.76	803202	16736259	190997	28035859	28035859	3.41	4.39	0.00	7.02	0.833	0	6.73	8.42	0.799
48	t	Jaccoud and Favre (1982)	A1	1440000	2162	<	2699	<	4949	1.834	86400000	117262	18419	15139	107.38	94.76	803202	16736259	190997	28035859	28035859	7.53	9.71	0.53	16.00	0.87	365	15.42	18.40	0.838
49	0	Jaccoud and Favre (1982)	A2	1440000	2162	<	2929	<	4949	1.690	86400000	108035	17652	14632	107.81	95.61	725134	15655337	178439	30320923	30320923	2.90	3.74	0.00	5.98	0.97	0	5.71	6.16	0.927
50	t	Jaccoud and Favre (1982)	A2	1440000	2162	<	2929	<	4949	1.690	86400000	108035	17652	14632	107.81	95.61	725134	15655337	178439	30320923	30320923	6.42	8.27	0.53	13.71	0.783	365	13.16	17.50	0.752
51	0	Jaccoud and Favre (1982)	A3	1440000	2162	<	2641	<	4949	1.874	86400000	119771	18626	15276	107.27	94.55	825173	17027594	194398	27569997	27569997	3.54	4.56	0.00	7.29	0.897	0	7.01	8.12	0.863
52	t	Jaccoud and Favre (1982)	A3	1440000	2162	<	2641	<	4949	1.874	86400000	119771	18626	15276	107.27	94.55	825173	17027594	194398	27569997	27569997	7.83	10.09	0.53	16.60	0.949	365	16.04	17.50	0.917
53	0	Jaccoud and Favre (1982)	A4	1440000	2162	<	3583	<	4949	1.381	86400000	88308	15913	13446	108.79	97.59	562762	13254472	150662	41011684	41011684	1.75	2.26	0.00	3.61	1.612	0	3.67	2.24	1.638
54	t	Jaccoud and Favre (1982)	A4	1440000	2162	<	3583	<	4949	1.381	86400000	88308	15913	13446	108.79	97.59	562762	13254472	150662	41011684	41011684	3.88	5.00	0.53	8.47	1.053	365	8.65	8.05	1.075
55	0	Jaccoud and Favre (1982)	A5	1440000	2162	<	3390	<	4949	1.460	86400000	93152	16364	13760	108.53	97.07	603049	13862824	157690	37176319	37176319	2.04	2.63	0.00	4.20	1.347	0	4.13	3.12	1.324
56	t	Jaccoud and Favre (1982)	A5	1440000	2162	<	3390	<	4949	1.460	86400000	93152	16364	13760	108.53	97.07	603049	13862824	157690	37176319	37176319	4.51	5.82	0.53	9.78	1.024	365	9.67	9.55	1.013
57	0	Jaccoud and Favre (1982)	C12	3200000	3604	<	7172	<	9699	1.352	256000000	235277	29270	24680	143.55	127.1	2227167	49053231	406145	132728789	132728789	1.00	1.74	0.00	2.47	1.138	0	2.60	2.17	1.198
58	t	Jaccoud and Favre (1982)	C12	3200000	3604	<	7172	<	9699	1.352	256000000	235277	29270	24680	143.55	127.1	2227167	49053231	406145	132728789	132728789	2.07	3.61	0.41	5.49	0.662	510	5.81	8.29	0.701
59	0	Jaccoud and Favre (1982)	C22	3200000	3604	<	7598	<	9699	1.277	256000000	222445	28426	24091	143.94	127.88	2071359	46803193	386963	147374025	147200000	0.85	1.48	0.00	2.10	1.052	0	2.34	2.00	1.170
60	t	Jaccoud and Favre (1982)	C22	3200000	3604	<	7598	<	9699	1.277	256000000	222445	28426	24091	143.94	127.88	2071359	46803193	386963	147374025	147200000	1.73	3.01	0.40	4.62	0.66	365	5.13	7.00	0.733
61	0	Jaccoud and Favre (1982)	C13	3200000	3604	<	7364	<	12909	1.753	256000000	229388	28877	24405	143.73	127.45	2153519	48013295	397254	86623234	86623234	1.50	3.97	0.00	4.92	0.93	0	4.88	5.29	0.922
62	t	Jaccoud and Favre (1982)	C13	3200000	3604	<	7364	<	12909	1.753	256000000	229388	28877	24405	143.73	127.45	2153519	48013295	397254	86623234	86623234	3.10	8.23	0.41	10.57	0.796	510	10.52	13.28	0.792
63	0	Jaccoud and Favre (1982)	C14	3200000	3604	<	7172	<	16124	2.248	256000000	235277	29270	24680	143.55	127.1	2227167	49053231	406145	67265377	67265377	1.98	7.06	0.00	8.13	0.959	0	8.16	8.48	0.962
64	t	Jaccoud and Favre (1982)	C14	3200000	3604	<	7172	<	16124	2.248	256000000	235277	29270	24680	143.55	127.1	2227167	49053231	406145	67265377	67265377	4.09	14.62	0.41	17.22	0.949	510	17.32	18.15	0.954
65	0	Jaccoud and Favre (1982)	C24	3200000	3604	<	7492	<	16124	2.152	256000000	225623	28636	24238	143.84	127.68	2109606	47353248	391635	68284084	68284084	1.87	6.67	0.00	7.68	0.96	0	7.67	8.00	0.959
66	t	Jaccoud and Favre (1982)	C24	3200000	3604	<	7492	<	16124	2.152	256000000	225623	28636	24238	143.84	127.68	2109606	47353248	391635	68284084	68284084	3.86	13.81	0.41	16.28	0.929	510	16.29	17.52	0.930
67	0	Jaccoud and Favre (1982)	C15	3200000	3604	<	7172	<	19329	2.695	256000000	235721	29287	24690	143.54	127.07	2229828	49104857	406557	59674078	59674078	2.23	10.01	0.00	11.02	1	0	11.26	11.02	1.022
68	t	Jaccoud and Favre (1982)	C15	3200000	3604	<	7172	<	19329	2.695	256000000	235721	29287	24690	143.54	127.07	2229828	49104857	406557	59674078	59674078	4.62	20.74	0.41	23.20	1.114	510	23.74	20.83	1.140
69	0	Ding Dajung [44]	C-3	345600	336	<	664	<	3240	4.880	27648000	55435	4747	3774	136.7	113.39	682787	10682594	87943	10828621	10828621	1.15	10.24	0.00	11.39	1.348	0	11.20	8.45	1.325
70	t	Ding Dajung [44]	C-3	345600	336	<	664	<	3240	4.880	27648000	55435	4747	3774	136.7	113.39	682787	10682594	87943	10828621	10828621	2.67	23.71	0.48	26.86	1.616	2025	26.41	16.62	1.589
71	0	Ding Dajung [44]	L-1	238741	244	<	497	<	3524	7.091	18144341	50113	4386	3163	126.49	100.98	685847	8067316	80678	8095584	8095584	1.03	14.27	0.00	15.30	0.985	0	15.19	15.53	0.978
72	t	Ding Dajung [44]	L-1	238741	244	<	497	<	3524	7.091	18144341	50113	4386	3163	126.49	100.98	685847	8067316	80678	8095584	8095584	2.38	32.95	0.63	35.96	1.182	531	35.70	30.43	1.173

	Study information		Cracking moment							Uncracked cross-section		Fully cracked cross-section							Effective moment of inertia		Simplified method			Deflection					
	1	2	3	4		5		6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
	Author	Specimen	W_c (mm^3)	M_{SW} (Nm)		M_{cr} (Nm)		M_{max} (Nm)	M_{max}/M_{cr}	I_c (mm^4)	S_c (mm^3)	A_{II}^* (mm^2)	A_{IIc} (mm^2)	$z_{IIc,1}$ (mm)	$z_{II,1}^*$ (mm)	I_{IIc} (mm^4)	I_{II}^* (mm^4)	S_{II}^* (mm^3)	I_{eff}	$I_{eff,max}$	$a_{eff,L1}$ (mm)	$a_{eff,L2}$ (mm)	$a_{eff,cs}$ (mm)	a_{simp} (mm)	a_{simp}/ a_{exp} (%)	t-t_0 (days)	$a_{num.int.}$ (mm)	a_{exp} (mm)	$a_{num.int.}/a_{exp}$ (%)
73	0 F.R.F.C. [45]	I-72	1960000	1029	<	4693	<	22529	4.801	274400000	234140	12812	10684	244.39	208.78	4516556	86089337	380494	87791499	87791499	0.33	7.10	0.00	7.43	1.234	0	7.27	6.02	1.208
74	t F.R.F.C. [45]	I-72	1960000	1029	<	4693	<	22529	4.801	274400000	234140	12812	10684	244.39	208.78	4516556	86089337	380494	87791499	87791499	0.77	16.48	0.28	17.53	1.704	1610	17.16	10.29	1.668
75	0 F.R.F.C. [45]	I-81	1960000	1029	<	4693	<	25279	5.387	274400000	234140	12812	10684	244.39	208.78	4516556	86089337	380494	87294226	87294226	0.33	8.05	0.00	8.38	1.135	0	8.24	7.39	1.115
76	t F.R.F.C. [45]	I-81	1960000	1029	<	4693	<	25279	5.387	274400000	234140	12812	10684	244.39	208.78	4516556	86089337	380494	87294226	87294226	0.77	18.63	0.28	19.68	1.642	1344	19.34	11.98	1.614
77	0 F.R.F.C. [45]	I-91	1960000	1029	<	4693	<	28209	6.011	274400000	234140	12812	10684	244.39	208.78	4516556	86089337	380494	86956426	86956426	0.33	9.06	0.00	9.39	1.051	0	9.26	8.94	1.036
78	t F.R.F.C. [45]	I-91	1960000	1029	<	4693	<	28209	6.011	274400000	234140	12812	10684	244.39	208.78	4516556	86089337	380494	86956426	86956426	0.77	20.95	0.28	22.00	1.465	1314	21.69	15.02	1.444
79	0 F.R.F.C. [45]	II-52	1960000	1029	<	4419	<	34979	7.916	274400000	541638	20770	15126	229.58	179.15	12818721	154379371	762800	154621366	154621366	0.20	6.75	0.00	6.95	0.956	0	6.91	7.27	0.950
80	t F.R.F.C. [45]	II-52	1960000	1029	<	4419	<	34979	7.916	274400000	541638	20770	15126	229.58	179.15	12818721	154379371	762800	154621366	154621366	0.46	15.62	0.39	16.47	1.221	1398	16.39	13.49	1.215
81	0 F.R.F.C. [45]	II-59	1960000	1029	<	4419	<	39329	8.900	274400000	541638	20770	15126	229.58	179.15	12818721	154379371	762800	154549622	154549622	0.20	7.62	0.00	7.82	1.016	0	7.78	7.69	1.012
82	t F.R.F.C. [45]	II-59	1960000	1029	<	4419	<	39329	8.900	274400000	541638	20770	15126	229.58	179.15	12818721	154379371	762800	154549622	154549622	0.46	17.67	0.39	18.52	1.314	1541	18.44	14.10	1.308
83	0 F.R.F.C. [45]	II-70	1960000	1029	<	4419	<	46879	10.609	274400000	541638	20770	15126	229.58	179.15	12818721	154379371	762800	154479900	154479900	0.20	9.12	0.00	9.32	0.996	0	9.29	9.36	0.993
84	t F.R.F.C. [45]	II-70	1960000	1029	<	4419	<	46879	10.609	274400000	541638	20770	15126	229.58	179.15	12818721	154379371	762800	154479900	154479900	0.46	21.14	0.39	21.99	1.252	1471	21.92	17.56	1.248
85	0 F.R.F.C. [45]	II-80	1960000	1029	<	4419	<	53289	12.059	274400000	541638	20770	15126	229.58	179.15	12818721	154379371	762800	154447812	154447812	0.20	10.40	0.00	10.60	0.989	0	10.57	10.72	0.986
86	t F.R.F.C. [45]	II-80	1960000	1029	<	4419	<	53289	12.059	274400000	541638	20770	15126	229.58	179.15	12818721	154379371	762800	154447812	154447812	0.46	24.11	0.39	24.96	1.233	1485	24.88	20.24	1.229
87	0 F.R.F.C. [45]	II-90	1960000	1029	<	4419	<	59689	13.507	274400000	541638	20770	15126	229.58	179.15	12818721	154379371	762800	154428073	154428073	0.20	11.67	0.00	11.87	0.906	0	11.84	13.10	0.904
88	t F.R.F.C. [45]	II-90	1960000	1029	<	4419	<	59689	13.507	274400000	541638	20770	15126	229.58	179.15	12818721	154379371	762800	154428073	154428073	0.46	27.07	0.39	27.92	1.152	1491	27.84	24.23	1.149
89	0 F.R.F.C. [45]	III-43	1960000	1029	<	4746	<	43219	9.106	274400000	782436	25670	17255	222.48	164.95	19026862	193200814	992497	193308339	193308339	0.15	6.25	0.00	6.40	0.904	0	6.38	7.08	0.901
90	t F.R.F.C. [45]	III-43	1960000	1029	<	4746	<	43219	9.106	274400000	782436	25670	17255	222.48	164.95	19026862	193200814	992497	193308339	193308339	0.34	14.51	0.46	15.31	1.055	1572	15.26	14.51	1.052
91	0 F.R.F.C. [45]	III-67	1960000	1029	<	4746	<	66329	13.976	274400000	782436	25670	17255	222.48	164.95	19026862	193200814	992497	193230560	193230560	0.15	9.68	0.00	9.83	0.929	0	9.80	10.58	0.926
92	t F.R.F.C. [45]	III-67	1960000	1029	<	4746	<	66329	13.976	274400000	782436	25670	17255	222.48	164.95	19026862	193200814	992497	193230560	193230560	0.34	22.47	0.46	23.27	0.974	1572	23.21	23.88	0.972
93	0 F.R.F.C. [45]	III-77	1960000	1029	<	4746	<	76519	16.123	274400000	782436	25670	17255	222.48	164.95	19026862	193200814	992497	193220188	193220188	0.15	11.19	0.00	11.34	0.819	0	11.31	13.84	0.817
94	t F.R.F.C. [45]	III-77	1960000	1029	<	4746	<	76519	16.123	274400000	782436	25670	17255	222.48	164.95	19026862	193200814	992497	193220188	193220188	0.34	25.97	0.46	26.77	0.932	1572	26.71	28.74	0.929
95	0 F.R.F.C. [45]	IV-52	1960000	1029	<	4589	<	38639	8.420	274400000	875520	22194	13484	235.05	190.1	9079856	163475611	606233	163661436	163661436	0.18	6.82	0.00	7.00	1.17	0	6.97	5.98	1.166
96	t F.R.F.C. [45]	IV-52	1960000	1029	<	4589	<	38639	8.420	274400000	875520	22194	13484	235.05	190.1	9079856	163475611	606233	163661436	163661436	0.32	12.09	0.18	12.59	1.196	772	12.53	10.52	1.191
97	0 F.R.F.C. [45]	IV-70	1960000	1029	<	4589	<	52369	11.412	274400000	875520	22194	13484	235.05	190.1	9079856	163475611	606233	163550249	163550249	0.18	9.31	0.00	9.49	1.079	0	9.46	8.80	1.075
98	t F.R.F.C. [45]	IV-70	1960000	1029	<	4589	<	52369	11.412	274400000	875520	22194	13484	235.05	190.1	9079856	163475611	606233	163550249	163550249	0.32	16.51	0.18	17.01	1.224	772	16.96	13.90	1.220
99	0 F.R.F.C. [45]	IV-80	1960000	1029	<	4589	<	59229	12.907	274400000	875520	22194	13484	235.05	190.1	9079856	163475611	606233	163527202	163527202	0.18	10.56	0.00	10.74	0.962	0	10.71	11.16	0.960
100	t F.R.F.C. [45]	IV-80	1960000	1029	<	4589	<	59229	12.907	274400000	875520	22194	13484	235.05	190.1	9079856	163475611	606233	163527202	163527202	0.32	18.83	0.18	19.33	1.14	972	19.27	16.96	1.136
101	0 F.R.F.C. [45]	IV-90	1960000	1029	<	4589	<	66559	14.504	274400000	875520	22194	13484	235.05	190.1	9079856	163475611	606233	163511966	163511966	0.18	11.89	0.00	12.07	0.939	0	12.04	12.85	0.937
102	t F.R.F.C. [45]	IV-90	1960000	1029	<	4589	<	66559	14.504	274400000	875520	22194	13484	235.05	190.1	9079856	163475611	606233	163511966	163511966	0.32	21.20	0.18	21.70	1.125	972	21.64	19.28	1.122
103	0 Bakoss et al. [41]	1B2	375000	659	<	968	<	3909	4.038	28125000	79616	6306	4857	125.72	101.43	954705	13426195	117964	13649404	13649404	2.26	11.47	0.00	13.74	1.536	0	13.48	8.94	1.508
104	t Bakoss et al. [41]	1B2	375000	659	<	968	<	3909	4.038	28125000	79616	6306	4857	125.72	101.43	954705	13426195	117964	13649404	13649404	5.52	28.01	1.18	34.71	1.387	500	34.08	25.02	1.362
105	0 Clarke et al. [46]	A1	395267	212	<	833	<	3712	4.456	30435533	67899	5842	4607	130.97	107.93	814736	12378087	106107	12582151	12582151	0.30	5.16	0.00	5.46	1.117	0	5.36	4.89	1.096
106	t Clarke et al. [46]	A1	395267	212	<	833	<	3712	4.456	30435533	67899	5842	4607	130.97	107.93	814736	12378087	106107	12582151	12582151	0.75	12.71	0.38	13.83	1.169	180	13.57	11.83	1.147
107	0 Clarke et al. [46]	A2	385067	209	<	812	<	3709	4.568	29265067	66665	5798	4563	129.19	106.36	791717	11957625	104168	12139231	12139231	0.31	5.35	0.00	5.66	1.111	0	5.55	5.09	1.090
108	t Clarke et al. [46]	A2	385067	209	<	812	<	3709	4.568	29265067	66665	5798	4563	129.19	106.36	791717	11957625	104168	12139231	12139231	0.77	13.18	0.39	14.33	1.203	180	14.08	11.92	1.181
109	0 Clarke et al. [46]	B1	385067	209	<	812	<	3709	4.568	29265067	135798	6568	4098	131.51	111.01	573334	12622646	83992	12797274	12797274	0.29	5.07	0.00	5.37	1.122	0	5.27	4.78	1.103
110	t Clarke et al. [46]	B1	385067	209	<	812	<	3709	4.568	29265067	135798	6568	4098	131.51	111.01	573334	12622646	83992	12797274	12797274	0.56	9.71	0.00	10.27	1.171	180	10.09	8.77	1.151
111	0 Clarke et al. [46]	B2	395267	212	<	833	<	3712	4.456	30435533	138267	6606	4136	133.32	112.63	589416	13066292	85523	13262579	13262579	0.29	4.89	0.00	5.18	1.205	0	5.09	4.30	1.184
112	t Clarke et al. [46]	B2	395267	212	<	833	<	3712	4.456	30435533	138267	6606	4136	133.32	112.63	589416	13066292	85523	13262579	13262579	0.55	9.38	0.00	9.94	1.162	180	9.76	8.55	1.142
113	0 Gilbert and Nejadi (2004)	B1-a	4816667	3254	<	9285	<	24900	2.682	818833333	448950	23021	19568	300.87	261.74	9989523	209739323	765708	241320769	241320769	0.74	5.05	0.00	5.21	1.052	0	5.43	4.95	1.097
114	t Gilbert and Nejadi (2004)	B1-a	4816667	3254	<	9285	<	24900	2.682	818833333	448950	23021	19568	300.87	261.74	9989523	209739323	765708	241320769	241320769	1.68	11.48	0.29	12.10	1.004	380	12.63	12.06	1.047
115	0 Gilbert and Nejadi (2004)	B1-b	4816667	3254	<	9285	<	17000	1.831	818833333	448950	23021	19568	300.87	261.74	9989523	209739323	765708	308978531	308978531	0.58	2.50	0.00	2.77	1.4	0	2.85	1.98	1.439
116	t Gilbert and Nejadi (2004)	B1-b	4816667	3254	<	9285	<	17000	1.831	818833333	448950	23021	19568	300.87	261.74	9989523	209739323	765708	308978531	308978531	1.31	5.70	0.29	6.56	0.882	380	6.76	7.44	0.909
117	0 Gilbert and Nejadi (2004)	B2-a	4401042	3110	<	8484	<	24800	2.923	715169271	474851	23021	19568	285.87	246.74	9989523	209739323	765708	229974542	229974542	0.74	5.31	0.00	5.45	1.083	0	5.75	5.03	1.143
118	t Gilbert and Nejadi (2004)	B2-a	4401042	3110	<	8484	<	24800	2.923	715169271	474851	23021	19568	285.87	246.74	9989523	209739323	765708	229974542	229974542	1.69	12.13	0.30	12.72	1.024	380	13.45	12.42	1.083
119	0 Gilbert and Nejadi (2004)	B2-b	4401042	3110	<	8484	<	16800	1.980	715169271	474851	23021	19568	285.87	246.74	9989523	209739323	765708	274832446	274832446	0.62	2.80	0.00	3.08	1.496	0	3.19	2.06	1.549
120	t Gilbert and Nejadi (2004)	B2-b	4401042	3110	<	8484	<	16800	1.980	715169271	474851	23021	19568	285.87	246.74	9989523	209739323	765708	274832446	274832446	1.42	6.41	0.30	7.31	0.929	380	7.60	7.87	0.966
121	0 Gilbert and Nejadi (2004)	B3-a	4401042	3110	<	8484	<	34600	4.078	715169271	712276	28355	23175	278.65	232.31	16595791	288974918	1073818	295258125	295258125	0.58	6.00	0.00	6.58	1.133	0	6.44	5.81	1.108
122	t Gilbert and Nejadi (2004)	B3-a	4401042	3110	<	8484	<	34600	4.078	715169271	712276	28355	23175	278.65	232.31	16595791	288974918	1073818	295258125	295258125	1.32	13.72	0.35	15.39	1.157	380	15.05	13.30	1.132
123	0 Gilbert and Nejadi (2004)	B3-b	4401042	3110	<	8484	<	20800	2.452	715169271	712276	28355	23175	278.65	232.31	16595791	288974918	1073818	317896342	317896342	0.54	3.13	0.00	3.30	1.676	0	3.48	1.97	1.766
124	t Gilbert and Nejadi (2004)	B3-b	4401042	3110	<	8484	<	20800	2.452	715169271	712276	28355	23175	278.65	232.31	16595791	288974918	1073818	317896342	317896342	1.22	7.16	0.35	7.86	0.994	380	8.30	7.90	1.051
125	0 Gilbert and Nejadi (2004)	S1-a	1601667	2373	<	3087	<	6810	2.206	124129167	101929	14343	12402	139.5	124.01	993514	23000169	192212	32420025	32420025	4.01	7.49	0.00	10.35	1.449	0	10.09	7.14	1.413
126	t Gilbert and Nejadi (2004)	S1-a	1601667	2373	<	3087	<	6810	2.206	124129167	101929	14343	12402	139.5	124.01	993514	23000169	192212	32420025	32420025	9.71	18.15	0.65	25.66	1.022	380	25.11	25.10	1.000
127	0 Gilbert and Nejadi (2004)	S1-b	1601667	2373	<	3087	<	5280	1.710	124129167	101929	14343	12402	139.5	124.01	993514	23000169	192212	43210984	43210984	3.01	3.68	0.00	6.02	2.212	0	5.84	2.72	2.147
128	t Gilbert and Nejadi (2004)	S1-b	1601667	2373	<	3087	<	5280	1.710	124129167	101929	14343	12402	139.5	124.01	993514	23000169	192212	43210984	43210984	7.28	8.92	0.65	15.17	0.763	380	14.80	19.90	0.744
129	0 Gilbert and Nejadi (2004)	S2-a	1601667	2373	<	3087	<	9870	3.197	124129167	152893	17644	14732	136.59	118.17	1665131	31941782	271312	34762307	34762307	3.74	11.80	0.00	15.54	1.317	0	14.64	11.80	1.241
130	t Gilbert and Nejadi (2004)	S2-a	1601667	2373	<	3087	<	9870	3.197	124129167	152893	17644	14732	136.59	118.17	1665131	31941782	271312	34762307	34762307	9.05	28.60	0.75	38.41	1.182	380	36.24	32.50	1.115
131	0 Gilbert and Nejadi (2004)	S2-b	1601667	2373	<	3087	<	6810	2.206	124129167	152893	17644	14732	136.59	118.17	1665131	31941782	271312	40528754	40528754	3.20	5.99	0.00	8.28	1.868	0	8.24	4.43	1.860
132	t Gilbert and Nejadi (2004)	S2-b	1601667	2373	<	3087	<	6810	2.206	124129167	152893	17644	14732	136.59	118.17	1665131	31941782	271312	40528754	40528754	7.77	14.52	0.75	20.73	0.947	380	20.73	21.90	0.947
133	0 Gilbert and Nejadi (2004)	S3-a	1601667	2373	<	3087	<	11350	3.677	124129167	203857	20466	16583	134.27	113.54	2375048	39938925	343772	41632811	41632811	3.12	11.80	0.00	14.92	1.394	0	14.39	10.70	1.345
134	t Gilbert and Nejadi (2004)	S3-a	1601667	2373	<	3087	<	11350	3.677	124129167	203857	20466	16583	134.27	113.54	2375048	39938925	343772	41632811	41632811	7.56	28.60	0.82	36.98	1.241	380	35.71	29.80	1.198
135	0 Gilbert and Nejadi (2004)	S3-b	1601667	2373	<	3087	<	8340	2.702	124129167	203857	20466	16583	134.27	113.54	2375048	39938925	343772	44208390	44208390	2.94	7.39	0.00	9.29	1.843	0	9.65	5.04	1.915
136	t Gilbert and Nejadi (2004)	S3-b	1601667	2373	<	3087	<	8340	2.702	124129167	203857	20466	16583	134.27	113.54	2375048	39938925	343772	44208390	44208390	7.12	17.90	0.82	23.26	1.016	380	24.22	22.90	1.058
137	0 Tošić (2017)	NAC7	1066667	1024	<	2035	<	7669	3.769	106666667	128965	9037	7182	177.56	155.13	1205822	25917152	161122	27425901	27425901	1.72	11.50	0.00	13.23	1.442	0	12.69	9.17	1.384
138	t Tošić (2017)	NAC7	1066667	1024	<	2035	<	7669	3.769	106666667	128965	9037	7182	177.56	155.13	1205822	25917152	161122	27425901	27425901	4.25	28.36	0.41	33.02	1.744	450	31.69	18.94	1.673
139	0 Tošić (2017)	NAC28	1066667	1024	<	2433	<	6877	2.827	106666667	107775	8231	6682	179.12	158.27	970995	22354235	139412	26087776	26087776	1.51	8.90	0.00	9.37	1.156	0	9.68	8.11	1.194
140	t Tošić (2017)	NAC28	1066667	1024	<	2433	<	6877	2.827	106666667	107775	8231	6682	179.12	158.27	970995	22354235	139412	26087776	26087776	3.40	19.98	0.41	21.41	1.297	450	22.13	16.51	1.340

Assessment and Correction of ACI model:

Simplified Procedure

Simplified method - ACI+

m	I_{eff}/I_{II}	$I_{eff,max}/I_{II}$	$a_s{*}E{*}I_{II}/(M_{cr}{*}L^2)$
4	1.1024	1.1024	0.2362

Numerical Integration - ACI+

m	ρ	M_{max}/M_{cr}	I_c/I_{II}
4	0.75	2.5	5

$a{*}E{*}I_{II}/(M_{cr}{*}L^2)$
0.2145

ξ	M/M_{cr}	defl. coeff./L	I_{eff}/I_{II}	$I_{eff,max}/I_{II}$	only effective $E{*}I_{II}{*}(1/r_{eff})/M_{cr}$	Uncracked $E{*}I_{II}{*}(1/r_c)/M_{cr}$	corresponding $E{*}I_{II}{*}(1/r)/M_{cr}$	defl. mult.
0.00	0.000	0.00	#DIV/0!	#DIV/0!	#DIV/0!	0.0000	0.0000	0.000
0.02	0.196	0.01	2711.414	3.7500	0.052	0.0392	0.0392	0.000
0.04	0.384	0.02	184.965	3.7500	0.102	0.0768	0.0768	0.002
0.06	0.564	0.03	40.532	3.7500	0.150	0.1128	0.1128	0.003
0.08	0.736	0.04	14.632	3.7500	0.196	0.1472	0.1472	0.006
0.10	0.900	0.05	7.097	3.7500	0.240	0.1800	0.1800	0.009
0.12	1.056	0.06	4.217	3.7500	0.282	0.2112	0.2816	0.017
0.14	1.204	0.07	2.904	2.9035	0.415	0.2408	0.4147	0.029
0.16	1.344	0.08	2.226	2.2259	0.604	0.2688	0.6038	0.048
0.18	1.476	0.09	1.843	1.8428	0.801	0.2952	0.8010	0.072
0.20	1.600	0.10	1.610	1.6104	0.994	0.3200	0.9936	0.099
0.22	1.716	0.11	1.461	1.4613	1.174	0.3432	1.1743	0.129
0.24	1.824	0.12	1.361	1.3614	1.340	0.3648	1.3398	0.161
0.26	1.924	0.13	1.292	1.2919	1.489	0.3848	1.4893	0.194
0.28	2.016	0.14	1.242	1.2422	1.623	0.4032	1.6230	0.227
0.30	2.100	0.15	1.206	1.2057	1.742	0.4200	1.7418	0.261
0.32	2.176	0.16	1.178	1.1784	1.847	0.4352	1.8466	0.295
0.34	2.244	0.17	1.158	1.1577	1.938	0.4488	1.9382	0.330
0.36	2.304	0.18	1.142	1.1419	2.018	0.4608	2.0176	0.363
0.38	2.356	0.19	1.130	1.1298	2.085	0.4712	2.0853	0.396
0.40	2.400	0.20	1.121	1.1206	2.142	0.4800	2.1418	0.428
0.42	2.436	0.21	1.114	1.1136	2.188	0.4872	2.1875	0.459
0.44	2.464	0.22	1.109	1.1085	2.223	0.4928	2.2228	0.489
0.46	2.484	0.23	1.105	1.1051	2.248	0.4968	2.2478	0.517
0.48	2.496	0.24	1.103	1.1031	2.263	0.4992	2.2628	0.543
0.50	2.500	0.25	1.102	1.1024	2.268	0.5000	2.2678	0.567
0.52	2.496	0.24	1.103	1.1031	2.263	0.4992	2.2628	0.543
0.54	2.484	0.23	1.105	1.1051	2.248	0.4968	2.2478	0.517
0.56	2.464	0.22	1.109	1.1085	2.223	0.4928	2.2228	0.489
0.58	2.436	0.21	1.114	1.1136	2.188	0.4872	2.1875	0.459
0.60	2.400	0.20	1.121	1.1206	2.142	0.4800	2.1418	0.428
0.62	2.356	0.19	1.130	1.1298	2.085	0.4712	2.0853	0.396
0.64	2.304	0.18	1.142	1.1419	2.018	0.4608	2.0176	0.363
0.66	2.244	0.17	1.158	1.1577	1.938	0.4488	1.9382	0.330
0.68	2.176	0.16	1.178	1.1784	1.847	0.4352	1.8466	0.295
0.70	2.100	0.15	1.206	1.2057	1.742	0.4200	1.7418	0.261
0.72	2.016	0.14	1.242	1.2422	1.623	0.4032	1.6230	0.227
0.74	1.924	0.13	1.292	1.2919	1.489	0.3848	1.4893	0.194
0.76	1.824	0.12	1.361	1.3614	1.340	0.3648	1.3398	0.161
0.78	1.716	0.11	1.461	1.4613	1.174	0.3432	1.1743	0.129
0.80	1.600	0.10	1.610	1.6104	0.994	0.3200	0.9936	0.099
0.82	1.476	0.09	1.843	1.8428	0.801	0.2952	0.8010	0.072
0.84	1.344	0.08	2.226	2.2259	0.604	0.2688	0.6038	0.048
0.86	1.204	0.07	2.904	2.9035	0.415	0.2408	0.4147	0.029
0.88	1.056	0.06	4.217	3.7500	0.282	0.2112	0.2816	0.017
0.90	0.900	0.05	7.097	3.7500	0.240	0.1800	0.1800	0.009
0.92	0.736	0.04	14.632	3.7500	0.196	0.1472	0.1472	0.006
0.94	0.564	0.03	40.532	3.7500	0.150	0.1128	0.1128	0.003
0.96	0.384	0.02	184.965	3.7500	0.102	0.0768	0.0768	0.002
0.98	0.196	0.01	2711.414	3.7500	0.052	0.0392	0.0392	0.000
1.00	0.000	0.00	#DIV/0!	#DIV/0!	#DIV/0!	0.0000	0.0000	0.000
								10.725

M_{max}/M_{cr}	I_c/I_{II}	m =	4	ρ =	0.5							$a_{simp}/a_{num.int}$							
	1.1	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5	10.0
1.1	1.253	1.253	1.253	1.253	1.253	1.253	1.253	1.253	1.253	1.253	1.253	1.253	1.253	1.253	1.253	1.253	1.253	1.253	1.253
1.2	1.139	1.139	1.139	1.139	1.139	1.139	1.139	1.139	1.139	1.139	1.139	1.139	1.139	1.139	1.139	1.139	1.139	1.139	1.139
1.3	1.088	1.088	1.088	1.088	1.088	1.088	1.088	1.098	1.123	1.142	1.156	1.168	1.178	1.187	1.194	1.201	1.207	1.213	1.218
1.4	1.068	1.068	1.068	1.068	1.068	1.113	1.146	1.171	1.190	1.205	1.218	1.229	1.239	1.247	1.254	1.261	1.267	1.272	1.277
1.5	1.052	1.052	1.052	1.052	1.101	1.141	1.169	1.190	1.207	1.222	1.235	1.245	1.255	1.263	1.271	1.277	1.283	1.289	1.294
2.0	1.019	1.019	1.019	1.066	1.094	1.114	1.131	1.145	1.158	1.169	1.180	1.189	1.198	1.206	1.213	1.220	1.227	1.233	1.239
2.5	1.007	1.007	1.007	1.042	1.058	1.070	1.081	1.090	1.099	1.107	1.114	1.121	1.128	1.134	1.140	1.145	1.151	1.156	1.161
3.0	1.004	1.004	1.004	1.027	1.037	1.044	1.051	1.058	1.063	1.069	1.074	1.079	1.084	1.088	1.092	1.096	1.100	1.104	1.108
3.5	1.002	1.002	1.002	1.017	1.024	1.029	1.034	1.038	1.042	1.046	1.050	1.053	1.056	1.059	1.062	1.065	1.068	1.071	1.074
4.0	1.002	1.002	1.002	1.013	1.017	1.020	1.024	1.027	1.029	1.032	1.035	1.037	1.039	1.042	1.044	1.046	1.048	1.050	1.052
4.5	1.000	1.000	1.000	1.008	1.012	1.014	1.017	1.019	1.021	1.023	1.025	1.027	1.028	1.030	1.032	1.033	1.035	1.036	1.038
5.0	1.000	1.000	1.000	1.006	1.009	1.010	1.012	1.014	1.015	1.017	1.018	1.020	1.021	1.022	1.024	1.025	1.026	1.027	1.028
5.5	1.000	1.000	1.000	1.005	1.007	1.008	1.009	1.011	1.012	1.013	1.014	1.015	1.016	1.017	1.018	1.019	1.020	1.021	1.022
6.0	1.000	1.000	1.000	1.004	1.005	1.006	1.007	1.008	1.009	1.010	1.011	1.012	1.012	1.013	1.014	1.015	1.015	1.016	1.017
6.5	1.000	1.000	1.000	1.003	1.004	1.005	1.006	1.006	1.007	1.008	1.009	1.009	1.010	1.010	1.011	1.012	1.012	1.013	1.013
7.0	1.000	1.000	1.000	1.002	1.003	1.004	1.004	1.005	1.006	1.006	1.007	1.007	1.008	1.008	1.009	1.009	1.010	1.010	1.011
7.5	1.000	1.000	1.000	1.002	1.002	1.003	1.003	1.004	1.004	1.005	1.005	1.006	1.006	1.007	1.007	1.007	1.008	1.008	1.009
8.0	1.000	1.000	1.000	1.001	1.002	1.002	1.003	1.003	1.004	1.004	1.004	1.005	1.005	1.005	1.006	1.006	1.006	1.007	1.007
8.5	1.000	1.000	1.000	1.001	1.002	1.002	1.002	1.003	1.003	1.003	1.004	1.004	1.004	1.005	1.005	1.005	1.005	1.006	1.006
9.0	1.000	1.000	1.000	1.001	1.001	1.002	1.002	1.002	1.003	1.003	1.003	1.003	1.004	1.004	1.004	1.004	1.004	1.005	1.005
9.5	1.000	1.000	1.000	1.001	1.001	1.001	1.002	1.002	1.002	1.002	1.003	1.003	1.003	1.003	1.003	1.004	1.004	1.004	1.004
10.0	1.000	1.000	1.000	1.001	1.001	1.001	1.001	1.002	1.002	1.002	1.002	1.002	1.002	1.003	1.003	1.003	1.003	1.003	1.004

M_{max}/M_{cr}	I_c/I_{II}	m =	4	ρ =	0.75							$a_{simp}/a_{num.int}$							
	1.1	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5	10.0
1.1	1.112	1.112	1.112	1.112	1.112	1.112	1.112	1.112	1.117	1.125	1.131	1.136	1.140	1.143	1.146	1.149	1.152	1.154	1.156
1.2	1.065	1.065	1.075	1.125	1.155	1.176	1.193	1.205	1.215	1.224	1.231	1.237	1.243	1.247	1.251	1.255	1.258	1.261	1.264
1.3	1.042	1.042	1.104	1.149	1.179	1.202	1.220	1.235	1.247	1.258	1.266	1.274	1.281	1.286	1.291	1.296	1.300	1.304	1.307
1.4	1.033	1.033	1.112	1.154	1.184	1.207	1.226	1.242	1.255	1.266	1.276	1.284	1.292	1.299	1.305	1.310	1.315	1.319	1.323
1.5	1.025	1.041	1.107	1.146	1.175	1.198	1.218	1.234	1.247	1.259	1.270	1.279	1.287	1.294	1.301	1.306	1.312	1.317	1.321
2.0	1.009	1.032	1.065	1.089	1.108	1.125	1.139	1.153	1.164	1.175	1.185	1.194	1.202	1.210	1.217	1.224	1.231	1.237	1.242
2.5	1.004	1.018	1.037	1.051	1.063	1.074	1.084	1.093	1.101	1.109	1.116	1.123	1.130	1.136	1.141	1.147	1.152	1.157	1.162
3.0	1.002	1.011	1.023	1.032	1.039	1.047	1.053	1.059	1.065	1.070	1.075	1.080	1.084	1.089	1.093	1.097	1.101	1.105	1.108
3.5	1.001	1.007	1.014	1.020	1.026	1.030	1.035	1.039	1.043	1.047	1.050	1.053	1.057	1.060	1.063	1.066	1.069	1.072	1.074
4.0	1.001	1.005	1.010	1.014	1.018	1.021	1.024	1.027	1.030	1.032	1.035	1.037	1.040	1.042	1.044	1.046	1.048	1.050	1.052
4.5	1.000	1.003	1.007	1.010	1.012	1.015	1.017	1.019	1.021	1.023	1.025	1.027	1.029	1.030	1.032	1.033	1.035	1.037	1.038
5.0	1.000	1.002	1.005	1.007	1.009	1.011	1.013	1.014	1.016	1.017	1.019	1.020	1.021	1.022	1.024	1.025	1.026	1.027	1.028
5.5	1.000	1.002	1.004	1.005	1.007	1.008	1.009	1.011	1.012	1.013	1.014	1.015	1.016	1.017	1.018	1.019	1.020	1.021	1.022
6.0	1.000	1.001	1.003	1.004	1.005	1.006	1.007	1.008	1.009	1.010	1.011	1.012	1.012	1.013	1.014	1.015	1.015	1.016	1.017
6.5	1.000	1.001	1.002	1.003	1.004	1.005	1.006	1.006	1.007	1.008	1.009	1.009	1.010	1.010	1.011	1.012	1.012	1.013	1.013
7.0	1.000	1.001	1.002	1.002	1.003	1.004	1.004	1.005	1.006	1.006	1.007	1.007	1.008	1.008	1.009	1.009	1.010	1.010	1.011
7.5	1.000	1.000	1.001	1.002	1.003	1.003	1.004	1.004	1.005	1.005	1.005	1.006	1.006	1.007	1.007	1.008	1.008	1.008	1.009
8.0	1.000	1.000	1.001	1.002	1.002	1.002	1.003	1.003	1.004	1.004	1.004	1.005	1.005	1.006	1.006	1.006	1.006	1.007	1.007
8.5	1.000	1.000	1.001	1.001	1.002	1.002	1.002	1.003	1.003	1.003	1.004	1.004	1.004	1.005	1.005	1.005	1.005	1.006	1.006
9.0	1.000	1.000	1.001	1.001	1.001	1.002	1.002	1.002	1.003	1.003	1.003	1.003	1.004	1.004	1.004	1.004	1.004	1.005	1.005
9.5	1.000	1.000	1.000	1.001	1.001	1.001	1.002	1.002	1.002	1.002	1.003	1.003	1.003	1.003	1.003	1.004	1.004	1.004	1.004
10.0	1.000	1.000	1.000	1.001	1.001	1.001	1.001	1.002	1.002	1.002	1.002	1.002	1.002	1.003	1.003	1.003	1.003	1.003	1.004

M_{max}/M_{cr}	I_c/I_{II}	m =	4	ρ =	1							$a_{simp}/a_{num.int}$							
	1.1	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5	10.0
1.1	1.016	1.064	1.100	1.123	1.139	1.151	1.160	1.167	1.173	1.178	1.182	1.185	1.188	1.191	1.193	1.195	1.197	1.199	1.200
1.2	1.020	1.082	1.131	1.164	1.188	1.206	1.220	1.232	1.241	1.249	1.256	1.261	1.266	1.271	1.274	1.278	1.281	1.284	1.286
1.3	1.020	1.083	1.136	1.173	1.200	1.221	1.238	1.252	1.263	1.273	1.281	1.289	1.295	1.301	1.306	1.310	1.314	1.318	1.321
1.4	1.019	1.078	1.129	1.166	1.194	1.217	1.235	1.250	1.263	1.273	1.283	1.291	1.298	1.305	1.311	1.316	1.321	1.325	1.329
1.5	1.017	1.071	1.119	1.154	1.182	1.204	1.222	1.238	1.251	1.263	1.273	1.282	1.290	1.297	1.304	1.310	1.315	1.320	1.325
2.0	1.009	1.039	1.067	1.090	1.109	1.126	1.140	1.153	1.165	1.175	1.185	1.194	1.203	1.210	1.218	1.224	1.231	1.237	1.242
2.5	1.005	1.022	1.038	1.052	1.064	1.075	1.085	1.093	1.102	1.109	1.117	1.123	1.130	1.136	1.142	1.147	1.153	1.158	1.162
3.0	1.003	1.013	1.023	1.032	1.040	1.047	1.053	1.059	1.065	1.070	1.075	1.080	1.084	1.089	1.093	1.097	1.101	1.105	1.109
3.5	1.002	1.008	1.015	1.021	1.026	1.031	1.035	1.039	1.043	1.047	1.050	1.054	1.057	1.060	1.063	1.066	1.069	1.072	1.074
4.0	1.001	1.006	1.010	1.014	1.018	1.021	1.024	1.027	1.030	1.032	1.035	1.037	1.040	1.042	1.044	1.046	1.048	1.050	1.052
4.5	1.001	1.004	1.007	1.010	1.013	1.015	1.017	1.019	1.021	1.023	1.025	1.027	1.029	1.030	1.032	1.034	1.035	1.037	1.038
5.0	1.000	1.003	1.005	1.007	1.009	1.011	1.013	1.014	1.016	1.017	1.019	1.020	1.021	1.022	1.024	1.025	1.026	1.027	1.028
5.5	1.000	1.002	1.004	1.005	1.007	1.008	1.009	1.011	1.012	1.013	1.014	1.015	1.016	1.017	1.018	1.019	1.020	1.021	1.022
6.0	1.000	1.001	1.003	1.004	1.005	1.006	1.007	1.008	1.009	1.010	1.011	1.012	1.012	1.013	1.014	1.015	1.015	1.016	1.017
6.5	1.000	1.001	1.002	1.003	1.004	1.005	1.006	1.006	1.007	1.008	1.009	1.009	1.010	1.010	1.011	1.012	1.012	1.013	1.013
7.0	1.000	1.001	1.002	1.003	1.003	1.004	1.005	1.005	1.006	1.006	1.007	1.007	1.008	1.008	1.009	1.009	1.010	1.010	1.011
7.5	1.000	1.001	1.001	1.002	1.003	1.003	1.004	1.004	1.005	1.005	1.005	1.006	1.006	1.007	1.007	1.008	1.008	1.008	1.009
8.0	1.000	1.000	1.001	1.002	1.002	1.002	1.003	1.003	1.004	1.004	1.004	1.005	1.005	1.006	1.006	1.006	1.006	1.007	1.007
8.5	1.000	1.000	1.001	1.001	1.002	1.002	1.002	1.003	1.003	1.003	1.004	1.004	1.004	1.005	1.005	1.005	1.005	1.006	1.006
9.0	1.000	1.000	1.001	1.001	1.001	1.002	1.002	1.002	1.003	1.003	1.003	1.003	1.004	1.004	1.004	1.004	1.004	1.005	1.005
9.5	1.000	1.000	1.000	1.001	1.001	1.001	1.002	1.002	1.002	1.002	1.003	1.003	1.003	1.003	1.003	1.004	1.004	1.004	1.004
10.0	1.000	1.000	1.000	1.001	1.001	1.001	1.001	1.002	1.002	1.002	1.002	1.002	1.002	1.003	1.003	1.003	1.003	1.003	1.004

M_{max}/M_{cr}	I_c/I_{II}	m =	**4**	ρ =	**0.5**							$a'_{simp}/a_{num.int}$							
	1.1	**1.5**	**2.0**	**2.5**	**3.0**	**3.5**	**4.0**	**4.5**	**5.0**	**5.5**	**6.0**	**6.5**	**7.0**	**7.5**	**8.0**	**8.5**	**9.0**	**9.5**	**10.0**
1.1	1.128	1.128	1.128	1.128	1.128	1.128	1.128	1.128	1.128	1.128	1.128	1.128	1.128	1.128	1.128	1.128	1.128	1.128	1.128
1.2	1.025	1.025	1.025	1.025	1.025	1.025	1.025	1.025	1.025	1.025	1.025	1.025	1.025	1.025	1.025	1.025	1.025	1.025	1.025
1.3	0.979	0.979	0.979	0.979	0.979	0.979	0.979	0.989	1.011	1.027	1.040	1.051	1.060	1.068	1.075	1.081	1.086	1.091	1.096
1.4	0.962	0.962	0.962	0.962	0.962	1.001	1.032	1.054	1.071	1.085	1.097	1.106	1.115	1.122	1.129	1.135	1.140	1.145	1.149
1.5	0.947	0.947	0.947	0.947	0.991	1.027	1.052	1.071	1.087	1.100	1.111	1.121	1.129	1.137	1.143	1.150	1.155	1.160	1.165
2.0	0.917	0.917	0.917	0.959	0.985	1.003	1.018	1.031	1.042	1.052	1.062	1.070	1.078	1.085	1.092	1.098	1.104	1.109	1.115
2.5	0.907	0.907	0.907	0.938	0.952	0.963	0.973	0.981	0.989	0.996	1.003	1.009	1.015	1.021	1.026	1.031	1.036	1.040	1.045
3.0	1.004	1.004	1.004	1.027	1.037	1.044	1.051	1.058	1.063	1.069	1.074	1.079	1.084	1.088	1.092	1.096	1.100	1.104	1.108
3.5	1.002	1.002	1.002	1.017	1.024	1.029	1.034	1.038	1.042	1.046	1.050	1.053	1.056	1.059	1.062	1.065	1.068	1.071	1.074
4.0	1.002	1.002	1.002	1.013	1.017	1.020	1.024	1.027	1.029	1.032	1.035	1.037	1.039	1.042	1.044	1.046	1.048	1.050	1.052
4.5	1.000	1.000	1.000	1.008	1.012	1.014	1.017	1.019	1.021	1.023	1.025	1.027	1.028	1.030	1.032	1.033	1.035	1.036	1.038
5.0	1.000	1.000	1.000	1.006	1.009	1.010	1.012	1.014	1.015	1.017	1.018	1.020	1.021	1.022	1.024	1.025	1.026	1.027	1.028
5.5	1.000	1.000	1.000	1.005	1.007	1.008	1.009	1.011	1.012	1.013	1.014	1.015	1.016	1.017	1.018	1.019	1.020	1.021	1.022
6.0	1.000	1.000	1.000	1.004	1.005	1.006	1.007	1.008	1.009	1.010	1.011	1.012	1.012	1.013	1.014	1.015	1.015	1.016	1.017
6.5	1.000	1.000	1.000	1.003	1.004	1.005	1.006	1.006	1.007	1.008	1.009	1.009	1.010	1.010	1.011	1.012	1.012	1.013	1.013
7.0	1.000	1.000	1.000	1.002	1.003	1.004	1.004	1.005	1.006	1.006	1.007	1.007	1.008	1.008	1.009	1.009	1.010	1.010	1.011
7.5	1.000	1.000	1.000	1.002	1.002	1.003	1.003	1.004	1.004	1.005	1.005	1.006	1.006	1.007	1.007	1.007	1.008	1.008	1.009
8.0	1.000	1.000	1.000	1.001	1.002	1.002	1.003	1.003	1.004	1.004	1.004	1.005	1.005	1.005	1.006	1.006	1.006	1.007	1.007
8.5	1.000	1.000	1.000	1.001	1.002	1.002	1.002	1.003	1.003	1.003	1.004	1.004	1.004	1.005	1.005	1.005	1.005	1.006	1.006
9.0	1.000	1.000	1.000	1.001	1.001	1.002	1.002	1.002	1.003	1.003	1.003	1.003	1.004	1.004	1.004	1.004	1.004	1.005	1.005
9.5	1.000	1.000	1.000	1.001	1.001	1.001	1.002	1.002	1.002	1.002	1.003	1.003	1.003	1.003	1.003	1.004	1.004	1.004	1.004
10.0	1.000	1.000	1.000	1.001	1.001	1.001	1.001	1.002	1.002	1.002	1.002	1.002	1.002	1.003	1.003	1.003	1.003	1.003	1.004

M_{max}/M_{cr}	I_c/I_{II}	m =	**4**	ρ =	**0.75**							$a'_{simp}/a_{num.int}$							
	1.1	**1.5**	**2.0**	**2.5**	**3.0**	**3.5**	**4.0**	**4.5**	**5.0**	**5.5**	**6.0**	**6.5**	**7.0**	**7.5**	**8.0**	**8.5**	**9.0**	**9.5**	**10.0**
1.1	1.001	1.001	1.001	1.001	1.001	1.001	1.001	1.001	1.005	1.012	1.018	1.022	1.026	1.029	1.032	1.034	1.036	1.038	1.040
1.2	0.958	0.958	0.968	1.012	1.039	1.058	1.073	1.085	1.094	1.101	1.108	1.113	1.118	1.123	1.126	1.130	1.133	1.135	1.138
1.3	0.938	0.938	0.994	1.034	1.061	1.082	1.098	1.111	1.122	1.132	1.140	1.147	1.152	1.158	1.162	1.166	1.170	1.173	1.176
1.4	0.930	0.930	1.001	1.038	1.066	1.087	1.104	1.118	1.129	1.140	1.148	1.156	1.163	1.169	1.174	1.179	1.183	1.187	1.191
1.5	0.923	0.937	0.997	1.032	1.058	1.079	1.096	1.110	1.123	1.133	1.143	1.151	1.158	1.165	1.170	1.176	1.181	1.185	1.189
2.0	0.908	0.929	0.959	0.980	0.997	1.012	1.025	1.037	1.048	1.058	1.066	1.075	1.082	1.089	1.096	1.102	1.108	1.113	1.118
2.5	0.903	0.917	0.933	0.946	0.957	0.967	0.976	0.984	0.991	0.998	1.005	1.011	1.017	1.022	1.027	1.032	1.037	1.042	1.046
3.0	1.002	1.011	1.023	1.032	1.039	1.047	1.053	1.059	1.065	1.070	1.075	1.080	1.084	1.089	1.093	1.097	1.101	1.105	1.108
3.5	1.001	1.007	1.014	1.020	1.026	1.030	1.035	1.039	1.043	1.047	1.050	1.053	1.057	1.060	1.063	1.066	1.069	1.072	1.074
4.0	1.001	1.005	1.010	1.014	1.018	1.021	1.024	1.027	1.030	1.032	1.035	1.037	1.040	1.042	1.044	1.046	1.048	1.050	1.052
4.5	1.000	1.003	1.007	1.010	1.012	1.015	1.017	1.019	1.021	1.023	1.025	1.027	1.029	1.030	1.032	1.033	1.035	1.037	1.038
5.0	1.000	1.002	1.005	1.007	1.009	1.011	1.013	1.014	1.016	1.017	1.019	1.020	1.021	1.022	1.024	1.025	1.026	1.027	1.028
5.5	1.000	1.002	1.004	1.005	1.007	1.008	1.009	1.011	1.012	1.013	1.014	1.015	1.016	1.017	1.018	1.019	1.020	1.021	1.022
6.0	1.000	1.001	1.003	1.004	1.005	1.006	1.007	1.008	1.009	1.010	1.011	1.012	1.012	1.013	1.014	1.015	1.015	1.016	1.017
6.5	1.000	1.001	1.002	1.003	1.004	1.005	1.006	1.006	1.007	1.008	1.009	1.009	1.010	1.010	1.011	1.012	1.012	1.013	1.013
7.0	1.000	1.001	1.002	1.002	1.003	1.004	1.004	1.005	1.006	1.006	1.007	1.007	1.008	1.008	1.009	1.009	1.010	1.010	1.011
7.5	1.000	1.000	1.001	1.002	1.003	1.003	1.004	1.004	1.005	1.005	1.005	1.006	1.006	1.007	1.007	1.008	1.008	1.008	1.009
8.0	1.000	1.000	1.001	1.002	1.002	1.002	1.003	1.003	1.004	1.004	1.004	1.005	1.005	1.006	1.006	1.006	1.006	1.007	1.007
8.5	1.000	1.000	1.001	1.001	1.002	1.002	1.002	1.003	1.003	1.003	1.004	1.004	1.004	1.005	1.005	1.005	1.005	1.006	1.006
9.0	1.000	1.000	1.001	1.001	1.001	1.002	1.002	1.002	1.003	1.003	1.003	1.003	1.004	1.004	1.004	1.004	1.004	1.005	1.005
9.5	1.000	1.000	1.000	1.001	1.001	1.001	1.002	1.002	1.002	1.002	1.003	1.003	1.003	1.003	1.003	1.004	1.004	1.004	1.004
10.0	1.000	1.000	1.000	1.001	1.001	1.001	1.001	1.002	1.002	1.002	1.002	1.002	1.002	1.003	1.003	1.003	1.003	1.003	1.004

M_{max}/M_{cr}	I_c/I_{II}	m =	**4**	ρ =	**1**							$a'_{simp}/a_{num.int}$							
	1.1	**1.5**	**2.0**	**2.5**	**3.0**	**3.5**	**4.0**	**4.5**	**5.0**	**5.5**	**6.0**	**6.5**	**7.0**	**7.5**	**8.0**	**8.5**	**9.0**	**9.5**	**10.0**
1.1	0.915	0.957	0.990	1.010	1.025	1.036	1.044	1.050	1.056	1.060	1.064	1.067	1.070	1.072	1.074	1.076	1.077	1.079	1.080
1.2	0.918	0.973	1.018	1.048	1.069	1.086	1.098	1.109	1.117	1.124	1.130	1.135	1.140	1.144	1.147	1.150	1.153	1.155	1.158
1.3	0.918	0.975	1.022	1.056	1.080	1.099	1.114	1.127	1.137	1.146	1.153	1.160	1.165	1.171	1.175	1.179	1.183	1.186	1.189
1.4	0.917	0.970	1.016	1.050	1.075	1.095	1.111	1.125	1.136	1.146	1.155	1.162	1.169	1.175	1.180	1.185	1.189	1.193	1.196
1.5	0.915	0.964	1.007	1.039	1.064	1.084	1.100	1.114	1.126	1.137	1.146	1.154	1.161	1.168	1.173	1.179	1.184	1.188	1.192
2.0	0.908	0.935	0.960	0.981	0.998	1.013	1.026	1.038	1.048	1.058	1.067	1.075	1.082	1.089	1.096	1.102	1.108	1.113	1.118
2.5	0.904	0.920	0.935	0.947	0.958	0.967	0.976	0.984	0.992	0.998	1.005	1.011	1.017	1.022	1.028	1.033	1.037	1.042	1.046
3.0	1.003	1.013	1.023	1.032	1.040	1.047	1.053	1.059	1.065	1.070	1.075	1.080	1.084	1.089	1.093	1.097	1.101	1.105	1.109
3.5	1.002	1.008	1.015	1.021	1.026	1.031	1.035	1.039	1.043	1.047	1.050	1.054	1.057	1.060	1.063	1.066	1.069	1.072	1.074
4.0	1.001	1.006	1.010	1.014	1.018	1.021	1.024	1.027	1.030	1.032	1.035	1.037	1.040	1.042	1.044	1.046	1.048	1.050	1.052
4.5	1.001	1.004	1.007	1.010	1.013	1.015	1.017	1.019	1.021	1.023	1.025	1.027	1.029	1.030	1.032	1.034	1.035	1.037	1.038
5.0	1.000	1.003	1.005	1.007	1.009	1.011	1.013	1.014	1.016	1.017	1.019	1.020	1.021	1.022	1.024	1.025	1.026	1.027	1.028
5.5	1.000	1.002	1.004	1.005	1.007	1.008	1.009	1.011	1.012	1.013	1.014	1.015	1.016	1.017	1.018	1.019	1.020	1.021	1.022
6.0	1.000	1.001	1.003	1.004	1.005	1.006	1.007	1.008	1.009	1.010	1.011	1.012	1.012	1.013	1.014	1.015	1.015	1.016	1.017
6.5	1.000	1.001	1.002	1.003	1.004	1.005	1.006	1.006	1.007	1.008	1.009	1.009	1.010	1.010	1.011	1.012	1.012	1.013	1.013
7.0	1.000	1.001	1.002	1.003	1.003	1.004	1.005	1.005	1.006	1.006	1.007	1.007	1.008	1.008	1.009	1.009	1.010	1.010	1.011
7.5	1.000	1.001	1.001	1.002	1.003	1.003	1.004	1.004	1.005	1.005	1.005	1.006	1.006	1.007	1.007	1.008	1.008	1.008	1.009
8.0	1.000	1.000	1.001	1.002	1.002	1.002	1.003	1.003	1.004	1.004	1.004	1.005	1.005	1.006	1.006	1.006	1.006	1.007	1.007
8.5	1.000	1.000	1.001	1.001	1.002	1.002	1.002	1.003	1.003	1.003	1.004	1.004	1.004	1.005	1.005	1.005	1.005	1.006	1.006
9.0	1.000	1.000	1.001	1.001	1.001	1.002	1.002	1.002	1.003	1.003	1.003	1.003	1.004	1.004	1.004	1.004	1.004	1.005	1.005
9.5	1.000	1.000	1.000	1.001	1.001	1.001	1.002	1.002	1.002	1.002	1.003	1.003	1.003	1.003	1.003	1.004	1.004	1.004	1.004
10.0	1.000	1.000	1.000	1.001	1.001	1.001	1.001	1.002	1.002	1.002	1.002	1.002	1.002	1.003	1.003	1.003	1.003	1.003	1.004

Appendix E

Applicability of Model Code 2010

Applicability of Model Code 2010

Testing of Individual Deflection Curves – RAC and HVFAC beams

	Study information		Cross-section		Reinforcement								Mechanical properties											Loading						Deflection		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
	Author	Specimen	b (mm)	h (mm)	A_{s1} (mm^2)	d (mm)	ρ_1 (%)	A_{s2} (mm^2)	d' (mm)	d_2 (mm)	ρ_2 (%)	type	t_0 (days)	$f_{cm}(t_0)$ (MPa)	f_{cm} (MPa)	$f_{ct,sp}$ (t_0) (MPa)	$f_{ctm}(t_0)$ (MPa)	$E_{cm}(t_0)$ (MPa)	E_{cm} (MPa)	E_s (MPa)	φ (–)	ε_{cs} (‰)	$E_{c,eff}$ (MPa)	L (mm)	L/d	M_{L1} (Nm)	K_{L1}	M_{L2} (Nm)	K_{L2}	a (t) (mm)	t (days)	t-t_0 (days)
508	Tošić (2017)	RAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	24.20	28.10	2.00	2.00	26200	30800	200000	0.000	0.155	26200	3200	18.9	1024	0.104	6923	0.107	10.89	7.003	0.003
509	Tošić (2017)	RAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	24.20	28.10	2.00	2.00	26200	30800	200000	0.246	0.155	21663	3200	18.9	1024	0.104	6923	0.107	11.62	7.042	0.042
510	Tošić (2017)	RAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	24.20	28.10	2.00	2.00	26200	30800	200000	0.420	0.155	19298	3200	18.9	1024	0.104	6923	0.107	12.10	7.25	0.25
511	Tošić (2017)	RAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	24.20	28.10	2.00	2.00	26200	30800	200000	0.618	0.155	17170	3200	18.9	1024	0.104	6923	0.107	12.78	8	1
512	Tošić (2017)	RAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	24.20	28.10	2.00	2.00	26200	30800	200000	0.747	0.162	16018	3200	18.9	1024	0.104	6923	0.107	13.27	9	2
513	Tošić (2017)	RAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	24.20	28.10	2.00	2.00	26200	30800	200000	0.843	0.198	15258	3200	18.9	1024	0.104	6923	0.107	13.57	10	3
514	Tošić (2017)	RAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	24.20	28.10	2.00	2.00	26200	30800	200000	0.866	0.207	15089	3200	18.9	1024	0.104	6923	0.107	13.80	11	4
515	Tošić (2017)	RAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	24.20	28.10	2.00	2.00	26200	30800	200000	0.988	0.172	14235	3200	18.9	1024	0.104	6923	0.107	14.08	12	5
516	Tošić (2017)	RAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	24.20	28.10	2.00	2.00	26200	30800	200000	1.027	0.220	13984	3200	18.9	1024	0.104	6923	0.107	14.28	13	6
517	Tošić (2017)	RAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	24.20	28.10	2.00	2.00	26200	30800	200000	1.000	0.245	14157	3200	18.9	1024	0.104	6923	0.107	14.43	14	7
518	Tošić (2017)	RAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	24.20	28.10	2.00	2.00	26200	30800	200000	1.287	0.320	12507	3200	18.9	1024	0.104	6923	0.107	15.55	21	14
519	Tošić (2017)	RAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	24.20	28.10	2.00	2.00	26200	30800	200000	1.308	0.383	12404	3200	18.9	1024	0.104	6923	0.107	16.30	28	21
520	Tošić (2017)	RAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	24.20	28.10	2.00	2.00	26200	30800	200000	1.477	0.410	11610	3200	18.9	1024	0.104	6923	0.107	16.90	35	28
521	Tošić (2017)	RAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	24.20	28.10	2.00	2.00	26200	30800	200000	1.711	0.520	10671	3200	18.9	1024	0.104	6923	0.107	18.39	63	56
522	Tošić (2017)	RAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	24.20	28.10	2.00	2.00	26200	30800	200000	1.846	0.583	10193	3200	18.9	1024	0.104	6923	0.107	19.12	97	90
523	Tošić (2017)	RAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	24.20	28.10	2.00	2.00	26200	30800	200000	1.923	0.597	9941	3200	18.9	1024	0.104	6923	0.107	19.35	127	120
524	Tošić (2017)	RAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	24.20	28.10	2.00	2.00	26200	30800	200000	2.001	0.630	9696	3200	18.9	1024	0.104	6923	0.107	20.02	157	150
525	Tošić (2017)	RAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	24.20	28.10	2.00	2.00	26200	30800	200000	2.053	0.660	9541	3200	18.9	1024	0.104	6923	0.107	20.39	187	180
526	Tošić (2017)	RAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	24.20	28.10	2.00	2.00	26200	30800	200000	2.143	0.670	9281	3200	18.9	1024	0.104	6923	0.107	20.56	217	210
527	Tošić (2017)	RAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	24.20	28.10	2.00	2.00	26200	30800	200000	2.172	0.650	9201	3200	18.9	1024	0.104	6923	0.107	20.67	247	240
528	Tošić (2017)	RAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	24.20	28.10	2.00	2.00	26200	30800	200000	2.211	0.677	9095	3200	18.9	1024	0.104	6923	0.107	21.09	277	270
529	Tošić (2017)	RAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	24.20	28.10	2.00	2.00	26200	30800	200000	2.210	0.750	9098	3200	18.9	1024	0.104	6923	0.107	21.57	307	300
530	Tošić (2017)	RAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	24.20	28.10	2.00	2.00	26200	30800	200000	2.263	0.765	8956	3200	18.9	1024	0.104	6923	0.107	21.98	337	330
531	Tošić (2017)	RAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	24.20	28.10	2.00	2.00	26200	30800	200000	2.326	0.772	8797	3200	18.9	1024	0.104	6923	0.107	22.25	372	365
532	Tošić (2017)	RAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	24.20	28.10	2.00	2.00	26200	30800	200000	2.354	0.772	8727	3200	18.9	1024	0.104	6923	0.107	22.40	407	400
533	Tošić (2017)	RAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	24.20	28.10	2.00	2.00	26200	30800	200000	2.395	0.782	8627	3200	18.9	1024	0.104	6923	0.107	22.47	457	450
534	Tošić (2017)	RAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	28.10	28.10	2.50	2.50	30800	30800	200000	0.000	0.383	30800	3200	18.9	1024	0.104	5414	0.107	6.23	28.003	0.003
535	Tošić (2017)	RAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	28.10	28.10	2.50	2.50	30800	30800	200000	0.136	0.383	27112	3200	18.9	1024	0.104	5414	0.107	6.76	28.042	0.042
536	Tošić (2017)	RAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	28.10	28.10	2.50	2.50	30800	30800	200000	0.331	0.383	23141	3200	18.9	1024	0.104	5414	0.107	7.16	28.25	0.25
537	Tošić (2017)	RAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	28.10	28.10	2.50	2.50	30800	30800	200000	0.456	0.385	21156	3200	18.9	1024	0.104	5414	0.107	7.70	29	1
538	Tošić (2017)	RAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	28.10	28.10	2.50	2.50	30800	30800	200000	0.637	0.387	18818	3200	18.9	1024	0.104	5414	0.107	8.05	30	2
539	Tošić (2017)	RAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	28.10	28.10	2.50	2.50	30800	30800	200000	0.621	0.402	18997	3200	18.9	1024	0.104	5414	0.107	8.23	31	3
540	Tošić (2017)	RAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	28.10	28.10	2.50	2.50	30800	30800	200000	0.722	0.395	17883	3200	18.9	1024	0.104	5414	0.107	8.43	32	4
541	Tošić (2017)	RAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	28.10	28.10	2.50	2.50	30800	30800	200000	0.812	0.385	16997	3200	18.9	1024	0.104	5414	0.107	8.57	33	5
542	Tošić (2017)	RAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	28.10	28.10	2.50	2.50	30800	30800	200000	0.823	0.393	16893	3200	18.9	1024	0.104	5414	0.107	8.68	34	6
543	Tošić (2017)	RAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	28.10	28.10	2.50	2.50	30800	30800	200000	0.877	0.410	16413	3200	18.9	1024	0.104	5414	0.107	8.76	35	7
544	Tošić (2017)	RAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	28.10	28.10	2.50	2.50	30800	30800	200000	1.073	0.443	14858	3200	18.9	1024	0.104	5414	0.107	9.49	42	14
545	Tošić (2017)	RAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	28.10	28.10	2.50	2.50	30800	30800	200000	1.199	0.498	14005	3200	18.9	1024	0.104	5414	0.107	10.00	49	21
546	Tošić (2017)	RAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	28.10	28.10	2.50	2.50	30800	30800	200000	1.295	0.507	13423	3200	18.9	1024	0.104	5414	0.107	10.36	56	28
547	Tošić (2017)	RAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	28.10	28.10	2.50	2.50	30800	30800	200000	1.544	0.587	12106	3200	18.9	1024	0.104	5414	0.107	11.33	84	56
548	Tošić (2017)	RAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	28.10	28.10	2.50	2.50	30800	30800	200000	1.676	0.610	11510	3200	18.9	1024	0.104	5414	0.107	11.65	118	90
549	Tošić (2017)	RAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	28.10	28.10	2.50	2.50	30800	30800	200000	1.886	0.627	10671	3200	18.9	1024	0.104	5414	0.107	12.21	148	120
550	Tošić (2017)	RAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	28.10	28.10	2.50	2.50	30800	30800	200000	2.010	0.637	10233	3200	18.9	1024	0.104	5414	0.107	12.69	178	150
551	Tošić (2017)	RAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	28.10	28.10	2.50	2.50	30800	30800	200000	2.077	0.673	10009	3200	18.9	1024	0.104	5414	0.107	12.91	208	180
552	Tošić (2017)	RAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	28.10	28.10	2.50	2.50	30800	30800	200000	2.163	0.667	9739	3200	18.9	1024	0.104	5414	0.107	13.05	238	210
553	Tošić (2017)	RAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	28.10	28.10	2.50	2.50	30800	30800	200000	2.175	0.702	9700	3200	18.9	1024	0.104	5414	0.107	13.29	268	240
554	Tošić (2017)	RAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	28.10	28.10	2.50	2.50	30800	30800	200000	2.265	0.688	9433	3200	18.9	1024	0.104	5414	0.107	13.71	298	270
555	Tošić (2017)	RAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	28.10	28.10	2.50	2.50	30800	30800	200000	2.297	0.732	9341	3200	18.9	1024	0.104	5414	0.107	14.16	328	300
556	Tošić (2017)	RAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	28.10	28.10	2.50	2.50	30800	30800	200000	2.405	0.775	9045	3200	18.9	1024	0.104	5414	0.107	14.56	358	330
557	Tošić (2017)	RAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	28.10	28.10	2.50	2.50	30800	30800	200000	2.515	0.767	8763	3200	18.9	1024	0.104	5414	0.107	14.59	393	365
558	Tošić (2017)	RAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	28.10	28.10	2.50	2.50	30800	30800	200000	2.468	0.785	8880	3200	18.9	1024	0.104	5414	0.107	14.75	428	400
559	Tošić (2017)	RAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	28.10	28.10	2.50	2.50	30800	30800	200000	2.480	0.782	8851	3200	18.9	1024	0.104	5414	0.107	14.69	478	450

	Study information		Cross-section		Reinforcement								Mechanical properties											Loading						Deflection		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
	Author	Specimen	b (mm)	h (mm)	A_{s1} (mm^2)	d (mm)	ρ_1 (%)	A_{s2} (mm^2)	d' (mm)	d_2 (mm)	ρ_2 (%)	type	t_0 (days)	$f_{cm}(t_0)$ (MPa)	f_{cm} (MPa)	$f_{ct,sp}(t_0)$ (MPa)	$f_{ctm}(t_0)$ (MPa)	$E_{cm}(t_0)$ (MPa)	E_{cm} (MPa)	E_s (MPa)	φ (–)	ε_{cs} (‰)	$E_{c,eff}$ (MPa)	L (mm)	L/d	M_{L1} (Nm)	K_{L1}	M_{L2} (Nm)	K_{L2}	a (t) (mm)	t (days)	t-t_0 (days)
560	Tošić (2017)	HVFAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	16.40	22.60	1.20	1.20	25200	28700	200000	0.000	0.122	25200	3200	18.9	1024	0.104	4569	0.107	6.13	7.003	0.003
561	Tošić (2017)	HVFAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	16.40	22.60	1.20	1.20	25200	28700	200000	0.130	0.122	22618	3200	18.9	1024	0.104	4569	0.107	6.56	7.042	0.042
562	Tošić (2017)	HVFAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	16.40	22.60	1.20	1.20	25200	28700	200000	0.345	0.122	19337	3200	18.9	1024	0.104	4569	0.107	6.90	7.25	0.25
563	Tošić (2017)	HVFAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	16.40	22.60	1.20	1.20	25200	28700	200000	0.395	0.125	18710	3200	18.9	1024	0.104	4569	0.107	7.41	8	1
564	Tošić (2017)	HVFAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	16.40	22.60	1.20	1.20	25200	28700	200000	0.527	0.132	17231	3200	18.9	1024	0.104	4569	0.107	7.74	9	2
565	Tošić (2017)	HVFAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	16.40	22.60	1.20	1.20	25200	28700	200000	0.604	0.158	16466	3200	18.9	1024	0.104	4569	0.107	8.05	10	3
566	Tošić (2017)	HVFAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	16.40	22.60	1.20	1.20	25200	28700	200000	0.625	0.182	16267	3200	18.9	1024	0.104	4569	0.107	8.26	11	4
567	Tošić (2017)	HVFAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	16.40	22.60	1.20	1.20	25200	28700	200000	0.709	0.192	15534	3200	18.9	1024	0.104	4569	0.107	8.45	12	5
568	Tošić (2017)	HVFAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	16.40	22.60	1.20	1.20	25200	28700	200000	0.709	0.225	15531	3200	18.9	1024	0.104	4569	0.107	8.61	13	6
569	Tošić (2017)	HVFAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	16.40	22.60	1.20	1.20	25200	28700	200000	0.723	0.235	15416	3200	18.9	1024	0.104	4569	0.107	8.75	14	7
570	Tošić (2017)	HVFAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	16.40	22.60	1.20	1.20	25200	28700	200000	0.859	0.272	14364	3200	18.9	1024	0.104	4569	0.107	9.40	21	14
571	Tošić (2017)	HVFAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	16.40	22.60	1.20	1.20	25200	28700	200000	0.892	0.330	14131	3200	18.9	1024	0.104	4569	0.107	9.75	28	21
572	Tošić (2017)	HVFAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	16.40	22.60	1.20	1.20	25200	28700	200000	0.941	0.332	13796	3200	18.9	1024	0.104	4569	0.107	10.04	35	28
573	Tošić (2017)	HVFAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	16.40	22.60	1.20	1.20	25200	28700	200000	1.084	0.427	12911	3200	18.9	1024	0.104	4569	0.107	10.65	63	56
574	Tošić (2017)	HVFAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	16.40	22.60	1.20	1.20	25200	28700	200000	1.210	0.410	12219	3200	18.9	1024	0.104	4569	0.107	10.79	97	90
575	Tošić (2017)	HVFAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	16.40	22.60	1.20	1.20	25200	28700	200000	1.171	0.438	12427	3200	18.9	1024	0.104	4569	0.107	10.81	127	120
576	Tošić (2017)	HVFAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	16.40	22.60	1.20	1.20	25200	28700	200000	1.278	0.478	11873	3200	18.9	1024	0.104	4569	0.107	11.18	157	150
577	Tošić (2017)	HVFAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	16.40	22.60	1.20	1.20	25200	28700	200000	1.303	0.492	11755	3200	18.9	1024	0.104	4569	0.107	11.33	187	180
578	Tošić (2017)	HVFAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	16.40	22.60	1.20	1.20	25200	28700	200000	1.321	0.508	11669	3200	18.9	1024	0.104	4569	0.107	11.48	217	210
579	Tošić (2017)	HVFAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	16.40	22.60	1.20	1.20	25200	28700	200000	1.368	0.492	11449	3200	18.9	1024	0.104	4569	0.107	11.52	247	240
580	Tošić (2017)	HVFAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	16.40	22.60	1.20	1.20	25200	28700	200000	1.394	0.502	11330	3200	18.9	1024	0.104	4569	0.107	11.70	277	270
581	Tošić (2017)	HVFAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	16.40	22.60	1.20	1.20	25200	28700	200000	1.464	0.530	11026	3200	18.9	1024	0.104	4569	0.107	12.07	307	300
582	Tošić (2017)	HVFAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	16.40	22.60	1.20	1.20	25200	28700	200000	1.484	0.563	10943	3200	18.9	1024	0.104	4569	0.107	12.32	337	330
583	Tošić (2017)	HVFAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	16.40	22.60	1.20	1.20	25200	28700	200000	1.534	0.587	10738	3200	18.9	1024	0.104	4569	0.107	12.42	372	365
584	Tošić (2017)	HVFAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	16.40	22.60	1.20	1.20	25200	28700	200000	1.584	0.597	10540	3200	18.9	1024	0.104	4569	0.107	12.43	407	400
585	Tošić (2017)	HVFAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	16.40	22.60	1.20	1.20	25200	28700	200000	1.634	0.595	10349	3200	18.9	1024	0.104	4569	0.107	12.45	457	450
586	Tošić (2017)	HVFAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	22.60	22.60	2.10	2.10	28700	28700	200000	0.000	0.330	28700	3200	18.9	1024	0.104	4430	0.107	4.04	28.003	0.003
587	Tošić (2017)	HVFAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	22.60	22.60	2.10	2.10	28700	28700	200000	0.076	0.330	26673	3200	18.9	1024	0.104	4430	0.107	4.30	28.042	0.042
588	Tošić (2017)	HVFAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	22.60	22.60	2.10	2.10	28700	28700	200000	0.169	0.330	24553	3200	18.9	1024	0.104	4430	0.107	4.48	28.25	0.25
589	Tošić (2017)	HVFAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	22.60	22.60	2.10	2.10	28700	28700	200000	0.285	0.315	22326	3200	18.9	1024	0.104	4430	0.107	4.65	29	1
590	Tošić (2017)	HVFAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	22.60	22.60	2.10	2.10	28700	28700	200000	0.297	0.333	22123	3200	18.9	1024	0.104	4430	0.107	4.75	30	2
591	Tošić (2017)	HVFAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	22.60	22.60	2.10	2.10	28700	28700	200000	0.395	0.327	20569	3200	18.9	1024	0.104	4430	0.107	4.89	31	3
592	Tošić (2017)	HVFAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	22.60	22.60	2.10	2.10	28700	28700	200000	0.409	0.335	20372	3200	18.9	1024	0.104	4430	0.107	4.99	32	4
593	Tošić (2017)	HVFAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	22.60	22.60	2.10	2.10	28700	28700	200000	0.417	0.338	20251	3200	18.9	1024	0.104	4430	0.107	5.05	33	5
594	Tošić (2017)	HVFAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	22.60	22.60	2.10	2.10	28700	28700	200000	0.417	0.335	20251	3200	18.9	1024	0.104	4430	0.107	5.17	34	6
595	Tošić (2017)	HVFAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	22.60	22.60	2.10	2.10	28700	28700	200000	0.466	0.332	19574	3200	18.9	1024	0.104	4430	0.107	5.22	35	7
596	Tošić (2017)	HVFAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	22.60	22.60	2.10	2.10	28700	28700	200000	0.593	0.337	18017	3200	18.9	1024	0.104	4430	0.107	5.58	42	14
597	Tošić (2017)	HVFAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	22.60	22.60	2.10	2.10	28700	28700	200000	0.698	0.388	16906	3200	18.9	1024	0.104	4430	0.107	5.80	49	21
598	Tošić (2017)	HVFAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	22.60	22.60	2.10	2.10	28700	28700	200000	0.694	0.410	16940	3200	18.9	1024	0.104	4430	0.107	6.01	56	28
599	Tošić (2017)	HVFAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	22.60	22.60	2.10	2.10	28700	28700	200000	0.834	0.430	15645	3200	18.9	1024	0.104	4430	0.107	6.48	84	56
600	Tošić (2017)	HVFAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	22.60	22.60	2.10	2.10	28700	28700	200000	1.024	0.438	14182	3200	18.9	1024	0.104	4430	0.107	6.61	118	90
601	Tošić (2017)	HVFAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	22.60	22.60	2.10	2.10	28700	28700	200000	1.063	0.470	13915	3200	18.9	1024	0.104	4430	0.107	7.01	148	120
602	Tošić (2017)	HVFAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	22.60	22.60	2.10	2.10	28700	28700	200000	1.069	0.507	13870	3200	18.9	1024	0.104	4430	0.107	7.19	178	150
603	Tošić (2017)	HVFAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	22.60	22.60	2.10	2.10	28700	28700	200000	1.235	0.495	12842	3200	18.9	1024	0.104	4430	0.107	7.33	208	180
604	Tošić (2017)	HVFAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	22.60	22.60	2.10	2.10	28700	28700	200000	1.242	0.485	12804	3200	18.9	1024	0.104	4430	0.107	7.41	238	210
605	Tošić (2017)	HVFAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	22.60	22.60	2.10	2.10	28700	28700	200000	1.351	0.493	12206	3200	18.9	1024	0.104	4430	0.107	7.68	268	240
606	Tošić (2017)	HVFAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	22.60	22.60	2.10	2.10	28700	28700	200000	1.257	0.572	12717	3200	18.9	1024	0.104	4430	0.107	7.99	298	270
607	Tošić (2017)	HVFAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	22.60	22.60	2.10	2.10	28700	28700	200000	1.387	0.568	12024	3200	18.9	1024	0.104	4430	0.107	8.26	328	300
608	Tošić (2017)	HVFAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	22.60	22.60	2.10	2.10	28700	28700	200000	1.505	0.552	11457	3200	18.9	1024	0.104	4430	0.107	8.50	358	330
609	Tošić (2017)	HVFAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	22.60	22.60	2.10	2.10	28700	28700	200000	1.394	0.608	11990	3200	18.9	1024	0.104	4430	0.107	8.60	393	365
610	Tošić (2017)	HVFAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	22.60	22.60	2.10	2.10	28700	28700	200000	1.581	0.593	11119	3200	18.9	1024	0.104	4430	0.107	8.75	428	400
611	Tošić (2017)	HVFAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	22.60	22.60	2.10	2.10	28700	28700	200000	1.554	0.597	11237	3200	18.9	1024	0.104	4430	0.107	8.72	478	450

	Study information		Cross-section		Reinforcement								Mechanical properties												Loading						Deflection		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21		22	23	24	25	26	27	28	29	30	31	32
	Author	Specimen	b (mm)	h (mm)	A_{s1} (mm^2)	d (mm)	ρ_1 (%)	A_{s2} (mm^2)	d' (mm)	d_2 (mm)	ρ_2 (%)	type	t_0 (days)	$f_{cm}(t_0)$ (MPa)	f_{cm} (MPa)	$f_{ct,sp}(t_0)$ (MPa)	$f_{ctm}(t_0)$ (MPa)	$E_{cm}(t_0)$ (MPa)	E_{cm} (MPa)	E_s (MPa)	φ (–)	$\Delta\varepsilon_{cs}$ (‰)	ε_{cs} (‰)	$E_{c,eff}$ (MPa)	L (mm)	L/d	M_{L1} (Nm)	K_{L1}	M_{L2} (Nm)	K_{L2}	a (t) (mm)	t (days)	$t-t_0$ (days)
612	Seara-Paz (2015)	H50-50	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	53.07	51.81	3.44	3.44	31770	31550	200000	0.000	0.000	0.135	31770	3400	13.7	2168	0.104	21940	0.101	7.87	42.1	0.1
613	Seara-Paz (2015)	H50-50	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	53.07	51.81	3.44	3.44	31770	31550	200000	0.282	0.000	0.135	24745	3400	13.7	2168	0.104	21940	0.101	7.95	44	2
614	Seara-Paz (2015)	H50-50	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	53.07	51.81	3.44	3.44	31770	31550	200000	0.292	0.000	0.135	24543	3400	13.7	2168	0.104	21940	0.101	8.00	45	3
615	Seara-Paz (2015)	H50-50	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	53.07	51.81	3.44	3.44	31770	31550	200000	0.392	0.000	0.135	22771	3400	13.7	2168	0.104	21940	0.101	8.20	50	8
616	Seara-Paz (2015)	H50-50	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	53.07	51.81	3.44	3.44	31770	31550	200000	0.417	0.000	0.135	22377	3400	13.7	2168	0.104	21940	0.101	8.26	51	9
617	Seara-Paz (2015)	H50-50	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	53.07	51.81	3.44	3.44	31770	31550	200000	0.385	0.048	0.183	22895	3400	13.7	2168	0.104	21940	0.101	9.22	59	17
618	Seara-Paz (2015)	H50-50	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	53.07	51.81	3.44	3.44	31770	31550	200000	0.382	0.062	0.197	22942	3400	13.7	2168	0.104	21940	0.101	9.30	64	22
619	Seara-Paz (2015)	H50-50	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	53.07	51.81	3.44	3.44	31770	31550	200000	0.402	0.062	0.197	22614	3400	13.7	2168	0.104	21940	0.101	9.47	70	28
620	Seara-Paz (2015)	H50-50	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	53.07	51.81	3.44	3.44	31770	31550	200000	0.395	0.067	0.202	22737	3400	13.7	2168	0.104	21940	0.101	9.47	77	35
621	Seara-Paz (2015)	H50-50	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	53.07	51.81	3.44	3.44	31770	31550	200000	0.337	0.083	0.218	23729	3400	13.7	2168	0.104	21940	0.101	9.64	81	39
622	Seara-Paz (2015)	H50-50	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	53.07	51.81	3.44	3.44	31770	31550	200000	0.360	0.088	0.223	23315	3400	13.7	2168	0.104	21940	0.101	9.99	87	45
623	Seara-Paz (2015)	H50-50	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	53.07	51.81	3.44	3.44	31770	31550	200000	0.425	0.097	0.232	22255	3400	13.7	2168	0.104	21940	0.101	9.94	98	56
624	Seara-Paz (2015)	H50-50	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	53.07	51.81	3.44	3.44	31770	31550	200000	0.461	0.103	0.238	21695	3400	13.7	2168	0.104	21940	0.101	10.10	106	64
625	Seara-Paz (2015)	H50-50	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	53.07	51.81	3.44	3.44	31770	31550	200000	0.432	0.131	0.266	22140	3400	13.7	2168	0.104	21940	0.101	10.27	114	72
626	Seara-Paz (2015)	H50-50	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	53.07	51.81	3.44	3.44	31770	31550	200000	0.400	0.135	0.270	22648	3400	13.7	2168	0.104	21940	0.101	10.45	122	80
627	Seara-Paz (2015)	H50-50	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	53.07	51.81	3.44	3.44	31770	31550	200000	0.469	0.142	0.277	21578	3400	13.7	2168	0.104	21940	0.101	10.55	128	86
628	Seara-Paz (2015)	H50-50	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	53.07	51.81	3.44	3.44	31770	31550	200000	0.557	0.150	0.285	20352	3400	13.7	2168	0.104	21940	0.101	10.55	135	93
629	Seara-Paz (2015)	H50-50	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	53.07	51.81	3.44	3.44	31770	31550	200000	0.518	0.162	0.297	20875	3400	13.7	2168	0.104	21940	0.101	10.75	142	100
630	Seara-Paz (2015)	H50-50	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	53.07	51.81	3.44	3.44	31770	31550	200000	0.646	0.162	0.297	19244	3400	13.7	2168	0.104	21940	0.101	10.79	150	108
631	Seara-Paz (2015)	H50-50	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	53.07	51.81	3.44	3.44	31770	31550	200000	0.633	0.175	0.310	19405	3400	13.7	2168	0.104	21940	0.101	10.98	163	121
632	Seara-Paz (2015)	H50-50	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	53.07	51.81	3.44	3.44	31770	31550	200000	0.678	0.185	0.320	18875	3400	13.7	2168	0.104	21940	0.101	11.12	172	130
633	Seara-Paz (2015)	H50-50	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	53.07	51.81	3.44	3.44	31770	31550	200000	0.806	0.188	0.323	17532	3400	13.7	2168	0.104	21940	0.101	11.32	191	149
634	Seara-Paz (2015)	H50-50	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	53.07	51.81	3.44	3.44	31770	31550	200000	0.922	0.192	0.327	16473	3400	13.7	2168	0.104	21940	0.101	11.95	234	192
635	Seara-Paz (2015)	H50-50	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	53.07	51.81	3.44	3.44	31770	31550	200000	1.116	0.215	0.350	14962	3400	13.7	2168	0.104	21940	0.101	12.08	262	220
636	Seara-Paz (2015)	H50-50	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	53.07	51.81	3.44	3.44	31770	31550	200000	1.127	0.214	0.349	14878	3400	13.7	2168	0.104	21940	0.101	12.17	263	221
637	Seara-Paz (2015)	H50-50	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	53.07	51.81	3.44	3.44	31770	31550	200000	0.986	0.243	0.378	15944	3400	13.7	2168	0.104	21940	0.101	12.13	288	246
638	Seara-Paz (2015)	H50-50	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	53.07	51.81	3.44	3.44	31770	31550	200000	1.085	0.265	0.400	15181	3400	13.7	2168	0.104	21940	0.101	12.35	310	268
639	Seara-Paz (2015)	H50-50	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	53.07	51.81	3.44	3.44	31770	31550	200000	0.994	0.290	0.425	15874	3400	13.7	2168	0.104	21940	0.101	12.49	346	304
640	Seara-Paz (2015)	H50-50	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	53.07	51.81	3.44	3.44	31770	31550	200000	1.029	0.293	0.428	15604	3400	13.7	2168	0.104	21940	0.101	12.66	393	351
641	Seara-Paz (2015)	H50-50	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	53.07	51.81	3.44	3.44	31770	31550	200000	1.026	0.291	0.426	15625	3400	13.7	2168	0.104	21940	0.101	12.97	427	385
642	Seara-Paz (2015)	H50-50	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	53.07	51.81	3.44	3.44	31770	31550	200000	1.121	0.284	0.419	14926	3400	13.7	2168	0.104	21940	0.101	13.26	462	420
643	Seara-Paz (2015)	H50-50	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	53.07	51.81	3.44	3.44	31770	31550	200000	1.108	0.289	0.424	15017	3400	13.7	2168	0.104	21940	0.101	13.22	485	443
644	Seara-Paz (2015)	H50-50	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	53.07	51.81	3.44	3.44	31770	31550	200000	1.095	0.274	0.409	15108	3400	13.7	2168	0.104	21940	0.101	13.29	519	477
645	Seara-Paz (2015)	H50-50	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	53.07	51.81	3.44	3.44	31770	31550	200000	1.069	0.288	0.423	15299	3400	13.7	2168	0.104	21940	0.101	13.44	585	543
646	Seara-Paz (2015)	H50-50	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	53.07	51.81	3.44	3.44	31770	31550	200000	1.085	0.291	0.426	15182	3400	13.7	2168	0.104	21940	0.101	13.38	616	574
647	Seara-Paz (2015)	H50-50	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	53.07	51.81	3.44	3.44	31770	31550	200000	1.138	0.282	0.417	14804	3400	13.7	2168	0.104	21940	0.101	13.40	639	597
648	Seara-Paz (2015)	H50-50	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	53.07	51.81	3.44	3.44	31770	31550	200000	1.123	0.283	0.418	14911	3400	13.7	2168	0.104	21940	0.101	13.32	668	626
649	Seara-Paz (2015)	H50-50	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	53.07	51.81	3.44	3.44	31770	31550	200000	1.168	0.283	0.418	14596	3400	13.7	2168	0.104	21940	0.101	13.49	703	661
650	Seara-Paz (2015)	H50-50	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	53.07	51.81	3.44	3.44	31770	31550	200000	1.145	0.284	0.419	14756	3400	13.7	2168	0.104	21940	0.101	13.49	736	694
651	Seara-Paz (2015)	H50-50	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	53.07	51.81	3.44	3.44	31770	31550	200000	1.184	0.286	0.421	14494	3400	13.7	2168	0.104	21940	0.101	13.70	763	721
652	Seara-Paz (2015)	H50-50	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	53.07	51.81	3.44	3.44	31770	31550	200000	1.162	0.284	0.419	14638	3400	13.7	2168	0.104	21940	0.101	13.89	793	751
653	Seara-Paz (2015)	H50-50	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	53.07	51.81	3.44	3.44	31770	31550	200000	1.110	0.284	0.419	15000	3400	13.7	2168	0.104	21940	0.101	13.95	855	813
654	Seara-Paz (2015)	H50-50	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	53.07	51.81	3.44	3.44	31770	31550	200000	1.143	0.288	0.423	14767	3400	13.7	2168	0.104	21940	0.101	14.13	890	848
655	Seara-Paz (2015)	H50-50	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	53.07	51.81	3.44	3.44	31770	31550	200000	1.143	0.318	0.453	14772	3400	13.7	2168	0.104	21940	0.101	14.03	921	879
656	Seara-Paz (2015)	H50-50	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	53.07	51.81	3.44	3.44	31770	31550	200000	1.161	0.306	0.441	14645	3400	13.7	2168	0.104	21940	0.101	14.03	949	907
657	Seara-Paz (2015)	H50-50	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	53.07	51.81	3.44	3.44	31770	31550	200000	1.082	0.346	0.481	15205	3400	13.7	2168	0.104	21940	0.101	14.06	1017	975
658	Seara-Paz (2015)	H50-50	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	53.07	51.81	3.44	3.44	31770	31550	200000	1.167	0.322	0.457	14604	3400	13.7	2168	0.104	21940	0.101	14.08	1042	1000
659	Seara-Paz (2015)	H50-100	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	45.27	42.85	3.23	3.23	26850	25860	200000	0.000	0.000	0.210	26850	3400	13.7	2168	0.104	23530	0.101	6.8	42.1	0.1
660	Seara-Paz (2015)	H50-100	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	45.27	42.85	3.23	3.23	26850	25860	200000	0.714	0.000	0.210	15424	3400	13.7	2168	0.104	23530	0.101	8.03	47	5
661	Seara-Paz (2015)	H50-100	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	45.27	42.85	3.23	3.23	26850	25860	200000	0.749	0.000	0.210	15100	3400	13.7	2168	0.104	23530	0.101	8.14	48	6
662	Seara-Paz (2015)	H50-100	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	45.27	42.85	3.23	3.23	26850	25860	200000	0.817	0.015	0.225	14529	3400	13.7	2168	0.104	23530	0.101	9.34	56	14
663	Seara-Paz (2015)	H50-100	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	45.27	42.85	3.23	3.23	26850	25860	200000	0.850	0.021	0.231	14263	3400	13.7	2168	0.104	23530	0.101	9.08	57	15
664	Seara-Paz (2015)	H50-100	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	45.27	42.85	3.23	3.23	26850	25860	200000	0.904	0.022	0.232	13850	3400	13.7	2168	0.104	23530	0.101	9.50	61	19
665	Seara-Paz (2015)	H50-100	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	45.27	42.85	3.23	3.23	26850	25860	200000	0.954	0.035	0.245	13487	3400	13.7	2168	0.104	23530	0.101	9.82	67	25
666	Seara-Paz (2015)	H50-100	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	45.27	42.85	3.23	3.23	26850	25860	200000	0.890	0.041	0.251	13955	3400	13.7	2168	0.104	23530	0.101	9.82	74	32
667	Seara-Paz (2015)	H50-100	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	45.27	42.85	3.23	3.23	26850	25860	200000	0.947	0.047	0.257	13537	3400	13.7	2168	0.104	23530	0.101	10.06	78	36
668	Seara-Paz (2015)	H50-100	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	45.27	42.85	3.23	3.23	26850	25860	200000	0.940	0.051	0.261	13591	3400	13.7	2168	0.104	23530	0.101	10.33	82	40
669	Seara-Paz (2015)	H50-100	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	45.27	42.85	3.23	3.23	26850	25860	200000	0.983	0.056	0.266	13285	3400	13.7	2168	0.104	23530	0.101	10.33	84	42
670	Seara-Paz (2015)	H50-100	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	45.27	42.85	3.23	3.23	26850	25860	200000	0.993	0.067	0.277	13219	3400	13.7	2168	0.104	23530	0.101	10.55	95	53
671	Seara-Paz (2015)	H50-100	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	45.27	42.85	3.23	3.23	26850	25860	200000	0.986	0.093	0.303	13264	3400	13.7	2168	0.104	23530	0.101	10.77	103	61
672	Seara-Paz (2015)	H50-100	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	45.27	42.85	3.23	3.23	26850	25860	200000	1.018	0.125	0.335	13054	3400	13.7	2168	0.104	23530	0.101	11.03	111	69
673	Seara-Paz (2015)	H50-100	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	45.27	42.85	3.23	3.23	26850	25860	200000	0.964	0.131	0.341	13420	3400	13.7	2168	0.104	23530	0.101	11.30	119	77
674	Seara-Paz (2015)	H50-100	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	45.27	42.85	3.23	3.23	26850	25860	200000	0.982	0.140	0.350	13293	3400	13.7	2168	0.104	23530	0.101	11.45	125	83
675	Seara-Paz (2015)	H50-100	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	45.27	42.85	3.23	3.23	26850	25860	200000	0.990	0.158	0.368	13242	3400	13.7	2168	0.104	23530	0.101	11.62	132	90
676	Seara-Paz (2015)	H50-100	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	45.27	42.85	3.23	3.23	26850	25860	200000	1.031	0.158	0.368	12968	3400	13.7	2168	0.104	23530	0.101	11.73	139	97
677	Seara-Paz (2015)	H50-100	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	45.27	42.85	3.23	3.23	26850	25860	200000	1.078	0.158	0.368	12668	3400	13.7	2168	0.104	23530	0.101	11.89	147	105
678	Seara-Paz (2015)	H50-100	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	45.27	42.85	3.23	3.23	26850	25860	200000	1.116	0.179	0.389	12441	3400	13.7	2168	0.104	23530	0.101	12.05	160	118
679	Seara-Paz (2015)	H50-100	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	45.27	42.85	3.23	3.23	26850	25860	200000	1.148	0.190	0.400	12250	3400	13.7	2168	0.104	23530	0.101	12.48	169	127
680	Seara-Paz (2015)	H50-100	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	45.27	42.85	3.23	3.23	26850	25860	200000	1.241	0.200	0.410	11731	3400	13.7	2168	0.104	23530	0.101	12.58	188	146
681	Seara-Paz (2015)	H50-100	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	45.27	42.85	3.23	3.23	26850	25860	200000	1.411	0.216	0.426	10893	3400	13.7	2168	0.104	23530	0.101	12.93	231	189
682	Seara-Paz (2015)	H50-100	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	45.27	42.85	3.23	3.23	26850	25860	200000	1.332	0.258	0.468	11268	3400	13.7	2168	0.104	23530	0.101	12.99	259	217
683	Seara-Paz (2015)	H50-100	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	45.27	42.85	3.23	3.23	26850	25860	200000	1.394	0.232	0.442	10969	3400	13.7	2168	0.104	23530	0.101	13.18	285	243
684	Seara-Paz (2015)	H50-100	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	45.27	42.85	3.23	3.23	26850	25860	200000	1.388	0.266	0.476	10998	3400	13.7	2168	0.104	23530	0.101	13.34	307	265
685	Seara-Paz (2015)	H50-100	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	45.27	42.85	3.23	3.23	26850	25860	200000	1.334	0.295	0.505	11259	3400	13.7	2168	0.104	23530	0.101	13.38	343	301
686	Seara-Paz (2015)	H50-100	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	45.27	42.85	3.23	3.23	26850	25860	200000	1.256	0.305	0.515	11653	3400	13.7	2168	0.104	23530	0.101	13.43	390	348
687	Seara-Paz (2015)	H50-100	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	45.27	42.85	3.23	3.23	26850	25860	200000	1.271	0.305	0.515	11576	3400	13.7	2168	0.104	23530	0.101	13.58	424	382
688	Seara-Paz (2015)	H50-100	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	45.27	42.85	3.23	3.23	26850	25860	200000	1.310	0.284	0.494	11375	3400	13.7	2168	0.104	23530	0.101	13.88	459	417
689	Seara-Paz (2015)	H50-100	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	45.27	42.85	3.23	3.23	26850	25860	200000	1.272	0.299	0.509	11568	3400	13.7	2168	0.104	23530	0.101	13.86	482	440
690	Seara-Paz (2015)	H50-100	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	45.27	42.85	3.23	3.23	26850	25860	200000	1.287	0.319	0.529	11494	3400	13.7	2168	0.104	23530	0.101	13.97	516	474
691	Seara-Paz (2015)	H50-100	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	45.27	42.85	3.23	3.23	26850	25860	200000	1.316	0.308	0.518	11347	3400	13.7	2168	0.104	23530	0.101	14.15	582	540
692	Seara-Paz (2015)	H50-100	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	45.27	42.85	3.23	3.23	26850	25860	200000	1.315	0.312	0.522	11349	3400	13.7	2168	0.104	23530	0.101	14.13	613	571
693	Seara-Paz (2015)	H50-100	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	45.27	42.85	3.23	3.23	26850	25860	200000	1.317	0.314	0.524	11339	3400	13.7	2168	0.104	23530	0.101	14.17	636	594
694	Seara-Paz (2015)	H50-100	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	45.27	42.85	3.23	3.23	26850	25860	200000	1.309	0.312	0.522	11380	3400	13.7	2168	0.104	23530	0.101	14.07	665	623
695	Seara-Paz (2015)	H50-100	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	45.27	42.85	3.23	3.23	26850	25860	200000	1.328	0.307	0.517	11285	3400	13.7	2168	0.104	23530	0.101	14.21	700	658
696	Seara-Paz (2015)	H50-100	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	45.27	42.85	3.23	3.23	26850	25860	200000	1.332	0.307	0.517	11267	3400	13.7	2168	0.104	23530	0.101	14.57	733	691
697	Seara-Paz (2015)	H50-100	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	45.27	42.85	3.23	3.23	26850	25860	200000	1.364	0.302	0.512	11112	3400	13.7	2168	0.104	23530	0.101	14.48	760	718
698	Seara-Paz (2015)	H50-100	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	45.27	42.85	3.23	3.23	26850	25860	200000	1.346	0.297	0.507	11198	3400	13.7	2168	0.104	23530	0.101	14.70	790	748
699	Seara-Paz (2015)	H50-100	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	45.27	42.85	3.23	3.23	26850	25860	200000	1.336	0.300	0.510	11246	3400	13.7	2168	0.104	23530	0.101	14.93	852	810
700	Seara-Paz (2015)	H50-100	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	45.27	42.85	3.23	3.23	26850	25860	200000	1.365	0.301	0.511	11106	3400	13.7	2168	0.104	23530	0.101	15.11	887	845
701	Seara-Paz (2015)	H50-100	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	45.27	42.85	3.23	3.23	26850	25860	200000	1.375	0.323	0.533	11061	3400	13.7	2168	0.104	23530	0.101	15.04	918	876
702	Seara-Paz (2015)	H50-100	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	45.27	42.85	3.23	3.23	26850	25860	200000	1.418	0.306	0.516	10862	3400	13.7	2168	0.104	23530	0.101	15.01	946	904
703	Seara-Paz (2015)	H50-100	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	45.27	42.85	3.23	3.23	26850	25860	200000	1.358	0.344	0.554	11141	3400	13.7	2168	0.104	23530	0.101	15.11	1014	972
704	Seara-Paz (2015)	H50-100	200	300	402	249	0.81	100.5	253	47	0.20	deformed	42	45.27	42.85	3.23	3.23	26850	25860	200000	1.390	0.335	0.545	10991	3400	13.7	2168	0.104	23530	0.101	15.20	1042	1000

	Study information			Cross-section				Reinforcement										Mechanical properties									Loading				Deflection	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21		22	23	24	25	26	27	28	29	30	31	32
	Author	Specimen	b (mm)	h (mm)	A_{s1} (mm^2)	d (mm)	ρ_1 (%)	A_{s2} (mm^2)	d' (mm)	d_2 (mm)	ρ_2 (%)	type	t_0 (days)	$f_{cm}(t_0)$ (MPa)	f_{cm} (MPa)	$f_{ct,sp}(t_0)$ (MPa)	$f_{ctm}(t_0)$ (MPa)	$E_{cm}(t_0)$ (MPa)	E_{cm} (MPa)	E_s (MPa)	φ (–)	$\Delta\varepsilon_{cs}$ (‰)	ε_{cs} (‰)	$E_{c,eff}$ (MPa)	L (mm)	L/d	M_{L1} (Nm)	K_{L1}	M_{L2} (Nm)	K_{L2}	a (t) (mm)	t (days)	t-t_0 (days)
705	Seara-Paz (2015)	H65-50	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	41.55	42.23	3.34	3.39	29300	27410	200000	0.000	0.000	0.162	29300	3400	14.5	2168	0.104	17130	0.101	4.96	42.1	0.1
706	Seara-Paz (2015)	H65-50	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	41.55	42.23	3.34	3.39	29300	27410	200000	0.639	0.027	0.189	17407	3400	14.5	2168	0.104	17130	0.101	5.99	51	9
707	Seara-Paz (2015)	H65-50	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	41.55	42.23	3.34	3.39	29300	27410	200000	0.713	0.034	0.196	16625	3400	14.5	2168	0.104	17130	0.101	5.99	57	15
708	Seara-Paz (2015)	H65-50	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	41.55	42.23	3.34	3.39	29300	27410	200000	0.761	0.038	0.200	16156	3400	14.5	2168	0.104	17130	0.101	6.13	63	21
709	Seara-Paz (2015)	H65-50	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	41.55	42.23	3.34	3.39	29300	27410	200000	0.648	0.082	0.244	17312	3400	14.5	2168	0.104	17130	0.101	6.28	70	28
710	Seara-Paz (2015)	H65-50	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	41.55	42.23	3.34	3.39	29300	27410	200000	0.401	0.115	0.277	20508	3400	14.5	2168	0.104	17130	0.101	6.28	76	34
711	Seara-Paz (2015)	H65-50	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	41.55	42.23	3.34	3.39	29300	27410	200000	0.546	0.114	0.276	18497	3400	14.5	2168	0.104	17130	0.101	6.42	82	40
712	Seara-Paz (2015)	H65-50	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	41.55	42.23	3.34	3.39	29300	27410	200000	0.489	0.134	0.296	19237	3400	14.5	2168	0.104	17130	0.101	6.81	91	49
713	Seara-Paz (2015)	H65-50	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	41.55	42.23	3.34	3.39	29300	27410	200000	0.546	0.150	0.312	18497	3400	14.5	2168	0.104	17130	0.101	6.97	99	57
714	Seara-Paz (2015)	H65-50	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	41.55	42.23	3.34	3.39	29300	27410	200000	0.643	0.141	0.303	17361	3400	14.5	2168	0.104	17130	0.101	7.03	105	63
715	Seara-Paz (2015)	H65-50	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	41.55	42.23	3.34	3.39	29300	27410	200000	0.718	0.148	0.310	16573	3400	14.5	2168	0.104	17130	0.101	7.21	113	71
716	Seara-Paz (2015)	H65-50	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	41.55	42.23	3.34	3.39	29300	27410	200000	0.750	0.162	0.324	16264	3400	14.5	2168	0.104	17130	0.101	7.23	119	77
717	Seara-Paz (2015)	H65-50	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	41.55	42.23	3.34	3.39	29300	27410	200000	0.798	0.158	0.320	15813	3400	14.5	2168	0.104	17130	0.101	7.30	126	84
718	Seara-Paz (2015)	H65-50	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	41.55	42.23	3.34	3.39	29300	27410	200000	0.895	0.168	0.330	14970	3400	14.5	2168	0.104	17130	0.101	7.39	134	92
719	Seara-Paz (2015)	H65-50	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	41.55	42.23	3.34	3.39	29300	27410	200000	0.951	0.168	0.330	14529	3400	14.5	2168	0.104	17130	0.101	7.41	139	97
720	Seara-Paz (2015)	H65-50	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	41.55	42.23	3.34	3.39	29300	27410	200000	0.868	0.197	0.359	15195	3400	14.5	2168	0.104	17130	0.101	7.61	155	113
721	Seara-Paz (2015)	H65-50	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	41.55	42.23	3.34	3.39	29300	27410	200000	0.857	0.201	0.363	15291	3400	14.5	2168	0.104	17130	0.101	7.72	163	121
722	Seara-Paz (2015)	H65-50	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	41.55	42.23	3.34	3.39	29300	27410	200000	0.999	0.193	0.355	14170	3400	14.5	2168	0.104	17130	0.101	7.74	184	142
723	Seara-Paz (2015)	H65-50	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	41.55	42.23	3.34	3.39	29300	27410	200000	1.191	0.193	0.355	12892	3400	14.5	2168	0.104	17130	0.101	7.86	225	183
724	Seara-Paz (2015)	H65-50	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	41.55	42.23	3.34	3.39	29300	27410	200000	1.297	0.198	0.360	12279	3400	14.5	2168	0.104	17130	0.101	8.10	254	212
725	Seara-Paz (2015)	H65-50	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	41.55	42.23	3.34	3.39	29300	27410	200000	1.290	0.211	0.373	12314	3400	14.5	2168	0.104	17130	0.101	8.10	278	236
726	Seara-Paz (2015)	H65-50	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	41.55	42.23	3.34	3.39	29300	27410	200000	1.187	0.258	0.420	12915	3400	14.5	2168	0.104	17130	0.101	7.92	302	260
727	Seara-Paz (2015)	H65-50	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	41.55	42.23	3.34	3.39	29300	27410	200000	1.202	0.268	0.430	12825	3400	14.5	2168	0.104	17130	0.101	8.36	336	294
728	Seara-Paz (2015)	H65-50	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	41.55	42.23	3.34	3.39	29300	27410	200000	1.173	0.300	0.462	13001	3400	14.5	2168	0.104	17130	0.101	8.36	385	343
729	Seara-Paz (2015)	H65-50	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	41.55	42.23	3.34	3.39	29300	27410	200000	1.109	0.326	0.488	13405	3400	14.5	2168	0.104	17130	0.101	8.58	418	376
730	Seara-Paz (2015)	H65-50	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	41.55	42.23	3.34	3.39	29300	27410	200000	1.217	0.317	0.479	12733	3400	14.5	2168	0.104	17130	0.101	8.62	453	411
731	Seara-Paz (2015)	H65-50	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	41.55	42.23	3.34	3.39	29300	27410	200000	1.241	0.321	0.483	12596	3400	14.5	2168	0.104	17130	0.101	8.65	476	434
732	Seara-Paz (2015)	H65-50	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	41.55	42.23	3.34	3.39	29300	27410	200000	1.390	0.310	0.472	11788	3400	14.5	2168	0.104	17130	0.101	8.69	510	468
733	Seara-Paz (2015)	H65-50	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	41.55	42.23	3.34	3.39	29300	27410	200000	1.347	0.324	0.486	12007	3400	14.5	2168	0.104	17130	0.101	8.70	576	534
734	Seara-Paz (2015)	H65-50	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	41.55	42.23	3.34	3.39	29300	27410	200000	1.350	0.318	0.480	11990	3400	14.5	2168	0.104	17130	0.101	8.71	609	567
735	Seara-Paz (2015)	H65-50	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	41.55	42.23	3.34	3.39	29300	27410	200000	1.343	0.325	0.487	12029	3400	14.5	2168	0.104	17130	0.101	8.71	630	588
736	Seara-Paz (2015)	H65-50	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	41.55	42.23	3.34	3.39	29300	27410	200000	1.400	0.311	0.473	11734	3400	14.5	2168	0.104	17130	0.101	8.72	659	617
737	Seara-Paz (2015)	H65-50	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	41.55	42.23	3.34	3.39	29300	27410	200000	1.425	0.312	0.474	11613	3400	14.5	2168	0.104	17130	0.101	8.73	694	652
738	Seara-Paz (2015)	H65-50	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	41.55	42.23	3.34	3.39	29300	27410	200000	1.431	0.307	0.469	11580	3400	14.5	2168	0.104	17130	0.101	8.89	726	684
739	Seara-Paz (2015)	H65-50	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	41.55	42.23	3.34	3.39	29300	27410	200000	1.493	0.302	0.464	11286	3400	14.5	2168	0.104	17130	0.101	8.99	754	712
740	Seara-Paz (2015)	H65-50	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	41.55	42.23	3.34	3.39	29300	27410	200000	1.414	0.306	0.468	11664	3400	14.5	2168	0.104	17130	0.101	9.13	784	742
741	Seara-Paz (2015)	H65-50	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	41.55	42.23	3.34	3.39	29300	27410	200000	1.393	0.313	0.475	11769	3400	14.5	2168	0.104	17130	0.101	9.26	846	804
742	Seara-Paz (2015)	H65-50	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	41.55	42.23	3.34	3.39	29300	27410	200000	1.443	0.316	0.478	11525	3400	14.5	2168	0.104	17130	0.101	9.33	880	838
743	Seara-Paz (2015)	H65-50	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	41.55	42.23	3.34	3.39	29300	27410	200000	1.526	0.311	0.473	11136	3400	14.5	2168	0.104	17130	0.101	9.43	915	873
744	Seara-Paz (2015)	H65-50	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	41.55	42.23	3.34	3.39	29300	27410	200000	1.533	0.323	0.485	11105	3400	14.5	2168	0.104	17130	0.101	9.48	940	898
745	Seara-Paz (2015)	H65-50	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	41.55	42.23	3.34	3.39	29300	27410	200000	1.504	0.332	0.494	11234	3400	14.5	2168	0.104	17130	0.101	9.53	1008	966
746	Seara-Paz (2015)	H65-50	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	41.55	42.23	3.34	3.39	29300	27410	200000	1.516	0.348	0.510	11182	3400	14.5	2168	0.104	17130	0.101	9.63	1042	1000
747	Seara-Paz (2015)	H65-100	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	32.34	32.36	2.24	2.27	23980	24050	200000	0.000	0.000	0.250	23980	3400	14.5	2168	0.104	18100	0.101	4.59	42.1	0.1
748	Seara-Paz (2015)	H65-100	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	32.34	32.36	2.24	2.27	23980	24050	200000	0.645	0.022	0.272	14597	3400	14.5	2168	0.104	18100	0.101	6.69	50	8
749	Seara-Paz (2015)	H65-100	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	32.34	32.36	2.24	2.27	23980	24050	200000	0.687	0.040	0.290	14234	3400	14.5	2168	0.104	18100	0.101	6.93	56	14
750	Seara-Paz (2015)	H65-100	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	32.34	32.36	2.24	2.27	23980	24050	200000	0.701	0.067	0.317	14112	3400	14.5	2168	0.104	18100	0.101	7.15	63	21
751	Seara-Paz (2015)	H65-100	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	32.34	32.36	2.24	2.27	23980	24050	200000	0.690	0.080	0.330	14205	3400	14.5	2168	0.104	18100	0.101	7.53	75	33
752	Seara-Paz (2015)	H65-100	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	32.34	32.36	2.24	2.27	23980	24050	200000	0.550	0.104	0.354	15490	3400	14.5	2168	0.104	18100	0.101	7.79	84	42
753	Seara-Paz (2015)	H65-100	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	32.34	32.36	2.24	2.27	23980	24050	200000	0.770	0.109	0.359	13568	3400	14.5	2168	0.104	18100	0.101	8.01	92	50
754	Seara-Paz (2015)	H65-100	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	32.34	32.36	2.24	2.27	23980	24050	200000	0.678	0.118	0.368	14304	3400	14.5	2168	0.104	18100	0.101	8.10	98	56
755	Seara-Paz (2015)	H65-100	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	32.34	32.36	2.24	2.27	23980	24050	200000	0.785	0.114	0.364	13448	3400	14.5	2168	0.104	18100	0.101	8.33	106	64
756	Seara-Paz (2015)	H65-100	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	32.34	32.36	2.24	2.27	23980	24050	200000	1.013	0.114	0.364	11932	3400	14.5	2168	0.104	18100	0.101	8.47	112	70
757	Seara-Paz (2015)	H65-100	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	32.34	32.36	2.24	2.27	23980	24050	200000	1.066	0.115	0.365	11622	3400	14.5	2168	0.104	18100	0.101	8.64	119	77
758	Seara-Paz (2015)	H65-100	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	32.34	32.36	2.24	2.27	23980	24050	200000	1.198	0.120	0.370	10926	3400	14.5	2168	0.104	18100	0.101	8.70	127	85
759	Seara-Paz (2015)	H65-100	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	32.34	32.36	2.24	2.27	23980	24050	200000	1.128	0.130	0.380	11288	3400	14.5	2168	0.104	18100	0.101	8.76	132	90
760	Seara-Paz (2015)	H65-100	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	32.34	32.36	2.24	2.27	23980	24050	200000	1.050	0.149	0.399	11716	3400	14.5	2168	0.104	18100	0.101	8.99	148	106
761	Seara-Paz (2015)	H65-100	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	32.34	32.36	2.24	2.27	23980	24050	200000	1.058	0.184	0.434	11667	3400	14.5	2168	0.104	18100	0.101	9.33	156	114
762	Seara-Paz (2015)	H65-100	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	32.34	32.36	2.24	2.27	23980	24050	200000	1.383	0.158	0.408	10080	3400	14.5	2168	0.104	18100	0.101	9.13	175	133
763	Seara-Paz (2015)	H65-100	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	32.34	32.36	2.24	2.27	23980	24050	200000	1.465	0.194	0.444	9745	3400	14.5	2168	0.104	18100	0.101	9.54	218	176
764	Seara-Paz (2015)	H65-100	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	32.34	32.36	2.24	2.27	23980	24050	200000	1.446	0.268	0.518	9822	3400	14.5	2168	0.104	18100	0.101	9.54	247	205
765	Seara-Paz (2015)	H65-100	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	32.34	32.36	2.24	2.27	23980	24050	200000	1.515	0.245	0.495	9550	3400	14.5	2168	0.104	18100	0.101	9.85	271	229
766	Seara-Paz (2015)	H65-100	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	32.34	32.36	2.24	2.27	23980	24050	200000	1.451	0.289	0.539	9801	3400	14.5	2168	0.104	18100	0.101	9.43	295	253
767	Seara-Paz (2015)	H65-100	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	32.34	32.36	2.24	2.27	23980	24050	200000	1.399	0.310	0.560	10013	3400	14.5	2168	0.104	18100	0.101	9.43	329	287
768	Seara-Paz (2015)	H65-100	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	32.34	32.36	2.24	2.27	23980	24050	200000	1.329	0.368	0.618	10311	3400	14.5	2168	0.104	18100	0.101	9.85	378	336
769	Seara-Paz (2015)	H65-100	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	32.34	32.36	2.24	2.27	23980	24050	200000	1.445	0.364	0.614	9823	3400	14.5	2168	0.104	18100	0.101	10.13	411	369
770	Seara-Paz (2015)	H65-100	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	32.34	32.36	2.24	2.27	23980	24050	200000	1.486	0.371	0.621	9665	3400	14.5	2168	0.104	18100	0.101	10.38	446	404
771	Seara-Paz (2015)	H65-100	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	32.34	32.36	2.24	2.27	23980	24050	200000	1.535	0.373	0.623	9476	3400	14.5	2168	0.104	18100	0.101	10.37	469	427
772	Seara-Paz (2015)	H65-100	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	32.34	32.36	2.24	2.27	23980	24050	200000	1.556	0.346	0.596	9399	3400	14.5	2168	0.104	18100	0.101	10.44	503	461
773	Seara-Paz (2015)	H65-100	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	32.34	32.36	2.24	2.27	23980	24050	200000	1.678	0.333	0.583	8972	3400	14.5	2168	0.104	18100	0.101	10.58	569	527
774	Seara-Paz (2015)	H65-100	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	32.34	32.36	2.24	2.27	23980	24050	200000	1.662	0.331	0.581	9024	3400	14.5	2168	0.104	18100	0.101	10.49	602	560
775	Seara-Paz (2015)	H65-100	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	32.34	32.36	2.24	2.27	23980	24050	200000	1.672	0.359	0.609	8989	3400	14.5	2168	0.104	18100	0.101	10.78	623	581
776	Seara-Paz (2015)	H65-100	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	32.34	32.36	2.24	2.27	23980	24050	200000	1.719	0.333	0.583	8837	3400	14.5	2168	0.104	18100	0.101	10.78	652	610
777	Seara-Paz (2015)	H65-100	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	32.34	32.36	2.24	2.27	23980	24050	200000	1.730	0.348	0.598	8801	3400	14.5	2168	0.104	18100	0.101	10.66	692	650
778	Seara-Paz (2015)	H65-100	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	32.34	32.36	2.24	2.27	23980	24050	200000	1.732	0.349	0.599	8792	3400	14.5	2168	0.104	18100	0.101	10.90	719	677
779	Seara-Paz (2015)	H65-100	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	32.34	32.36	2.24	2.27	23980	24050	200000	1.760	0.349	0.599	8703	3400	14.5	2168	0.104	18100	0.101	10.95	747	705
780	Seara-Paz (2015)	H65-100	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	32.34	32.36	2.24	2.27	23980	24050	200000	1.658	0.363	0.613	9039	3400	14.5	2168	0.104	18100	0.101	10.93	776	734
781	Seara-Paz (2015)	H65-100	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	32.34	32.36	2.24	2.27	23980	24050	200000	1.662	0.383	0.633	9025	3400	14.5	2168	0.104	18100	0.101	11.15	839	797
782	Seara-Paz (2015)	H65-100	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	32.34	32.36	2.24	2.27	23980	24050	200000	1.685	0.398	0.648	8949	3400	14.5	2168	0.104	18100	0.101	11.34	873	831
783	Seara-Paz (2015)	H65-100	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	32.34	32.36	2.24	2.27	23980	24050	200000	1.706	0.403	0.653	8878	3400	14.5	2168	0.104	18100	0.101	11.34	908	866
784	Seara-Paz (2015)	H65-100	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	32.34	32.36	2.24	2.27	23980	24050	200000	1.717	0.402	0.652	8844	3400	14.5	2168	0.104	18100	0.101	11.34	933	891
785	Seara-Paz (2015)	H65-100	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	32.34	32.36	2.24	2.27	23980	24050	200000	1.770	0.404	0.654	8674	3400	14.5	2168	0.104	18100	0.101	11.34	1001	959
786	Seara-Paz (2015)	H65-100	200	300	402	234	0.86	100.5	268	32	0.22	deformed	42	32.34	32.36	2.24	2.27	23980	24050	200000	1.754	0.415	0.665	8724	3400	14.5	2168	0.104	18100	0.101	11.34	1042	1000

	Study information		Cracking moment							State I				State II							Deflection			
	1	2	3	4		5		6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
	Author	Specimen	W_I^* (t_0) (mm^3)	M_{SW} (Nm)		M_{cr} (Nm)		M_{max} (Nm)	M_{max}/M_{cr}	A_I^* (mm^2)	$z_{I,1}^*$ (mm)	I_I^* (mm^4)	S_I^* (mm^3)	A_{II}^* (mm^2)	A_{IIc} (mm^2)	$z_{IIc,1}$ (mm)	$z_{II,1}^*$ (mm)	I_{IIc} (mm^4)	I_{II}^* (mm^4)	S_{II}^* (mm^3)	t-t_0 (days)	$a_{num.int.}$ (mm)	a_{exp} (mm)	$a_{num.int.}/a_{exp}$ (%)
508	Tošić (2017)	RAC7	1162732	1024	<	2325	<	7947	3.418	33633	98.46	114482587	49263	8458	6825	178.67	157.36	1034825	23341931	145436	0.003	12.19	10.89	111.9
509	Tošić (2017)	RAC7	1150300	1024	<	2301	<	7947	3.454	33975	98.16	116102530	59000	9338	7363	176.99	154	1299397	27266669	169297	0.042	12.75	11.62	109.7
510	Tošić (2017)	RAC7	1150300	1024	<	2301	<	7947	3.454	34217	97.95	117242895	65758	9921	7704	175.93	151.88	1488251	29926811	185323	0.25	13.13	12.10	108.5
511	Tošić (2017)	RAC7	1150300	1024	<	2301	<	7947	3.454	34493	97.71	118541054	73348	10551	8058	174.82	149.65	1703129	32859835	202839	1	13.56	12.78	106.1
512	Tošić (2017)	RAC7	1150300	1024	<	2301	<	7947	3.454	34673	97.56	119384307	78235	10947	8274	174.14	148.29	1844009	34716460	213830	2	13.89	13.27	104.7
513	Tošić (2017)	RAC7	1150300	1024	<	2301	<	7947	3.454	34806	97.44	120005682	81782	11232	8426	173.67	147.34	1947113	36065591	221779	3	14.33	13.57	105.6
514	Tošić (2017)	RAC7	1150300	1024	<	2301	<	7947	3.454	34836	97.42	120145872	82599	11297	8461	173.56	147.13	1971585	36366917	223552	4	14.47	13.80	104.8
515	Tošić (2017)	RAC7	1150300	1024	<	2301	<	7947	3.454	35007	97.28	120946129	87165	11654	8647	172.98	145.97	2104913	38072127	233561	5	14.47	14.08	102.8
516	Tošić (2017)	RAC7	1150300	1024	<	2301	<	7947	3.454	35060	97.23	121195920	88563	11764	8704	172.8	145.62	2146653	38597346	236646	6	14.88	14.28	104.2
517	Tošić (2017)	RAC7	1150300	1024	<	2301	<	7947	3.454	35024	97.26	121026077	87601	11690	8666	172.92	145.85	2118766	38240507	234528	7	15.02	14.43	104.1
518	Tošić (2017)	RAC7	1150300	1024	<	2301	<	7947	3.454	35422	96.94	122880949	98037	12489	9067	171.67	143.34	2426049	42082754	256812	14	16.11	15.55	103.6
519	Tošić (2017)	RAC7	1150300	1024	<	2301	<	7947	3.454	35450	96.91	123010313	98731	12544	9094	171.58	143.17	2447820	42342797	258313	21	16.66	16.30	102.2
520	Tošić (2017)	RAC7	1150300	1024	<	2301	<	7947	3.454	35687	96.72	124113436	104829	13002	9315	170.89	141.8	2631277	44560940	271049	28	17.17	16.90	101.6
521	Tošić (2017)	RAC7	1150300	1024	<	2301	<	7947	3.454	36010	96.47	125609985	113013	13606	9596	170.01	140.03	2876848	47501557	287704	56	18.43	18.39	100.2
522	Tošić (2017)	RAC7	1150300	1024	<	2301	<	7947	3.454	36199	96.32	126480014	117690	13952	9753	169.52	139.05	3020211	49179065	297100	90	19.16	19.12	100.2
523	Tošić (2017)	RAC7	1150300	1024	<	2301	<	7947	3.454	36306	96.24	126973661	120345	14146	9840	169.25	138.52	3101309	50121333	302389	120	19.41	19.35	100.3
524	Tošić (2017)	RAC7	1150300	1024	<	2301	<	7947	3.454	36415	96.16	127476675	123042	14339	9924	168.99	137.98	3181244	51074900	307670	150	19.77	20.02	98.8
525	Tošić (2017)	RAC7	1150300	1024	<	2301	<	7947	3.454	36485	96.10	127801882	124741	14465	9980	168.81	137.64	3236167	51684379	311067	180	20.07	20.39	98.4
526	Tošić (2017)	RAC7	1150300	1024	<	2301	<	7947	3.454	36612	96.00	128382789	127792	14687	10075	168.52	137.04	3329104	52773983	317056	210	20.27	20.56	98.6
527	Tošić (2017)	RAC7	1150300	1024	<	2301	<	7947	3.454	36652	95.98	128569718	128825	14757	10105	168.42	136.86	3358676	53117163	319014	240	20.19	20.67	97.7
528	Tošić (2017)	RAC7	1150300	1024	<	2301	<	7947	3.454	36706	95.93	128815571	130071	14851	10145	168.3	136.61	3399283	53576440	321506	270	20.43	21.09	96.9
529	Tošić (2017)	RAC7	1150300	1024	<	2301	<	7947	3.454	36704	95.94	128805739	130059	14847	10143	168.3	136.61	3396566	53553529	321359	300	20.94	21.57	97.1
530	Tošić (2017)	RAC7	1150300	1024	<	2301	<	7947	3.454	36779	95.88	129149740	131843	14978	10199	168.13	136.27	3453933	54192345	324852	330	21.11	21.98	96.1
531	Tošić (2017)	RAC7	1150300	1024	<	2301	<	7947	3.454	36866	95.82	129552419	133972	15128	10262	167.93	135.88	3517501	54928698	328919	365	21.25	22.25	95.5
532	Tošić (2017)	RAC7	1150300	1024	<	2301	<	7947	3.454	36905	95.79	129729104	134886	15194	10289	167.85	135.71	3545380	55254685	330688	400	21.28	22.40	95.0
533	Tošić (2017)	RAC7	1150300	1024	<	2301	<	7947	3.454	36961	95.74	129984208	136168	15290	10329	167.72	135.46	3587475	55717027	333200	450	21.41	22.47	95.3
534	Tošić (2017)	RAC28	1148404	1024	<	2871	<	6438	2.242	33389	98.68	113324518	42208	7779	6390	180.03	160.08	849161	20413561	127484	0.003	8.07	6.23	129.5
535	Tošić (2017)	RAC28	1150300	1024	<	2876	<	6438	2.239	33579	98.51	114228903	47727	8312	6733	178.96	157.94	993566	22710600	141586	0.042	8.33	6.76	123.2
536	Tošić (2017)	RAC28	1150300	1024	<	2876	<	6438	2.239	33849	98.27	115505903	55432	9020	7171	177.59	155.18	1200382	25842804	160657	0.25	8.73	7.16	122.0
537	Tošić (2017)	RAC28	1150300	1024	<	2876	<	6438	2.239	34022	98.12	116324787	60326	9453	7431	176.78	153.58	1335516	27791746	172483	1	9.05	7.70	117.6
538	Tošić (2017)	RAC28	1150300	1024	<	2876	<	6438	2.239	34275	97.89	117514924	67335	10054	7779	175.69	151.39	1532563	30547756	189038	2	9.43	8.05	117.2
539	Tošić (2017)	RAC28	1150300	1024	<	2876	<	6438	2.239	34253	97.92	117414193	66769	10005	7752	175.77	151.57	1516638	30316034	187665	3	9.55	8.23	116.0
540	Tošić (2017)	RAC28	1150300	1024	<	2876	<	6438	2.239	34393	97.79	118068529	70580	10327	7934	175.21	150.43	1625471	31803166	196522	4	9.73	8.43	115.4
541	Tošić (2017)	RAC28	1150300	1024	<	2876	<	6438	2.239	34519	97.69	118661618	74053	10609	8090	174.72	149.45	1723787	33128045	204425	5	9.85	8.57	114.9
542	Tošić (2017)	RAC28	1150300	1024	<	2876	<	6438	2.239	34534	97.67	118731931	74443	10643	8109	174.66	149.33	1735914	33283654	205337	6	9.95	8.68	114.6
543	Tošić (2017)	RAC28	1150300	1024	<	2876	<	6438	2.239	34609	97.61	119083329	76487	10808	8199	174.38	148.77	1793851	34059100	209946	7	10.16	8.76	115.9
544	Tošić (2017)	RAC28	1150300	1024	<	2876	<	6438	2.239	34880	97.38	120356077	83793	11389	8509	173.41	146.83	2005807	36817790	226231	14	10.82	9.49	114.0
545	Tošić (2017)	RAC28	1150300	1024	<	2876	<	6438	2.239	35056	97.24	121175942	88470	11755	8699	172.82	145.64	2142654	38557120	236376	21	11.44	10.00	114.4
546	Tošić (2017)	RAC28	1150300	1024	<	2876	<	6438	2.239	35189	97.13	121794861	91960	12026	8837	172.39	144.78	2246182	39850935	243897	28	11.73	10.36	113.2
547	Tošić (2017)	RAC28	1150300	1024	<	2876	<	6438	2.239	35535	96.85	123408133	100969	12710	9175	171.33	142.67	2513914	43149149	262955	56	12.78	11.33	112.8
548	Tošić (2017)	RAC28	1150300	1024	<	2876	<	6438	2.239	35719	96.70	124262309	105667	13064	9345	170.8	141.62	2656563	44858719	272739	90	13.24	11.65	113.6
549	Tošić (2017)	RAC28	1150300	1024	<	2876	<	6438	2.239	36010	96.47	125609985	113013	13606	9596	170.01	140.03	2876848	47501557	287704	120	13.68	12.21	112.0
550	Tošić (2017)	RAC28	1150300	1024	<	2876	<	6438	2.239	36182	96.33	126400985	117252	13922	9740	169.56	139.14	3007669	49026804	296265	150	13.94	12.69	109.8
551	Tošić (2017)	RAC28	1150300	1024	<	2876	<	6438	2.239	36276	96.26	126835490	119593	14092	9816	169.33	138.67	3078355	49861195	300926	180	14.27	12.91	110.5
552	Tošić (2017)	RAC28	1150300	1024	<	2876	<	6438	2.239	36396	96.17	127387944	122549	14306	9910	169.03	138.07	3168260	50905614	306723	210	14.35	13.05	110.0
553	Tošić (2017)	RAC28	1150300	1024	<	2876	<	6438	2.239	36413	96.16	127466816	122983	14337	9924	168.99	137.99	3181244	51056307	307565	240	14.60	13.29	109.8
554	Tošić (2017)	RAC28	1150300	1024	<	2876	<	6438	2.239	36537	96.06	128038264	125988	14555	10018	168.69	137.39	3273132	52126315	313494	270	14.63	13.71	106.7
555	Tošić (2017)	RAC28	1150300	1024	<	2876	<	6438	2.239	36582	96.03	128245007	127099	14635	10053	168.58	137.18	3307707	52512145	315637	300	14.95	14.16	105.6
556	Tošić (2017)	RAC28	1150300	1024	<	2876	<	6438	2.239	36732	95.91	128933538	130686	14896	10164	168.24	136.49	3418344	53793976	322692	330	15.34	14.56	105.4
557	Tošić (2017)	RAC28	1150300	1024	<	2876	<	6438	2.239	36883	95.80	129630952	134346	15155	10272	167.9	135.81	3528635	55074053	329734	365	15.42	14.59	105.7
558	Tošić (2017)	RAC28	1150300	1024	<	2876	<	6438	2.239	36819	95.85	129336386	132821	15046	10227	168.04	136.09	3481476	54532889	326749	400	15.48	14.75	105.0
559	Tošić (2017)	RAC28	1150300	1024	<	2876	<	6438	2.239	36836	95.84	129414954	133244	15076	10240	168	136.02	3495302	54678010	327571	450	15.48	14.69	105.4

	Study information						Cracking moment						State I						State II					Deflection		
	1	2	3	4		5		6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
	Author	Specimen	W_I^* (t_0) (mm^3)	M_{SW} (Nm)		M_{cr} (Nm)		M_{max} (Nm)	M_{max}/M_{cr}	A_I^* (mm^2)	$z_{I,1}^*$ (mm)	I_I^* (mm^4)	S_I^* (mm^3)	A_{II}^* (mm^2)	A_{IIc} (mm^2)	$z_{IIc,1}$ (mm)	$z_{II,1}^*$ (mm)	I_{IIc} (mm^4)	I_{II}^* (mm^4)	S_{II}^* (mm^3)	t-t_0 (days)	$a_{num.int.}$ (mm)	a_{exp} (mm)	$a_{num.int.}/a_{exp}$ (%)
560	Tošić (2017)	HVFAC7	1166636	1024	<	1400	<	5593	3.995	33699	98.40	114796941	51162	8632	6933	178.33	156.67	1084808	24117575	150172	0.003	8.93	6.13	145.7
561	Tošić (2017)	HVFAC7	1150300	1024	<	1380	<	5593	4.053	33892	98.23	115708244	56640	9131	7239	177.38	154.77	1234650	26328995	163600	0.042	9.17	6.56	139.8
562	Tošić (2017)	HVFAC7	1150300	1024	<	1380	<	5593	4.053	34213	97.95	117222737	65631	9909	7696	175.95	151.9	1483555	29878589	185009	0.25	9.52	6.90	137.9
563	Tošić (2017)	HVFAC7	1150300	1024	<	1380	<	5593	4.053	34288	97.88	117575351	67693	10084	7796	175.64	151.28	1542172	30686216	189854	1	9.64	7.41	130.1
564	Tošić (2017)	HVFAC7	1150300	1024	<	1380	<	5593	4.053	34485	97.71	118500860	73096	10532	8047	174.85	149.7	1696280	32768691	202267	2	9.90	7.74	127.9
565	Tošić (2017)	HVFAC7	1150300	1024	<	1380	<	5593	4.053	34600	97.62	119043184	76262	10788	8188	174.41	148.83	1786761	33969112	209413	3	10.20	8.05	126.8
566	Tošić (2017)	HVFAC7	1150300	1024	<	1380	<	5593	4.053	34630	97.59	119183678	77061	10853	8223	174.3	148.61	1809873	34277516	211247	4	10.42	8.26	126.1
567	Tošić (2017)	HVFAC7	1150300	1024	<	1380	<	5593	4.053	34754	97.49	119765252	80423	11123	8369	173.85	147.71	1908011	35547371	218738	5	10.61	8.45	125.6
568	Tošić (2017)	HVFAC7	1150300	1024	<	1380	<	5593	4.053	34756	97.49	119775273	80485	11128	8372	173.84	147.7	1909861	35568588	218880	6	10.85	8.61	126.0
569	Tošić (2017)	HVFAC7	1150300	1024	<	1380	<	5593	4.053	34776	97.47	119865446	80992	11169	8393	173.77	147.55	1924704	35762096	219993	7	10.95	8.75	125.2
570	Tošić (2017)	HVFAC7	1150300	1024	<	1380	<	5593	4.053	34979	97.30	120816184	86418	11597	8618	173.07	146.15	2083268	37796473	231936	14	11.45	9.40	121.8
571	Tošić (2017)	HVFAC7	1150300	1024	<	1380	<	5593	4.053	35028	97.26	121046062	87725	11697	8669	172.91	145.83	2120750	38282130	234800	21	11.95	9.75	122.5
572	Tošić (2017)	HVFAC7	1150300	1024	<	1380	<	5593	4.053	35103	97.20	121395654	89709	11850	8747	172.66	145.33	2178822	39013756	239056	28	12.06	10.04	120.1
573	Tošić (2017)	HVFAC7	1150300	1024	<	1380	<	5593	4.053	35315	97.02	122383059	95237	12279	8964	171.99	143.99	2344496	41064223	250936	56	12.99	10.65	122.0
574	Tošić (2017)	HVFAC7	1150300	1024	<	1380	<	5593	4.053	35503	96.87	123258989	100122	12648	9145	171.42	142.86	2489543	42846416	261233	90	13.08	10.79	121.2
575	Tošić (2017)	HVFAC7	1150300	1024	<	1380	<	5593	4.053	35443	96.92	122980463	98581	12531	9088	171.6	143.22	2443455	42283312	258004	120	13.27	10.81	122.7
576	Tošić (2017)	HVFAC7	1150300	1024	<	1380	<	5593	4.053	35606	96.79	123736080	102769	12846	9240	171.13	142.26	2567638	43809748	266729	150	13.69	11.18	122.4
577	Tošić (2017)	HVFAC7	1150300	1024	<	1380	<	5593	4.053	35640	96.76	123895003	103636	12912	9272	171.02	142.06	2594785	44122753	268534	180	13.83	11.33	122.0
578	Tošić (2017)	HVFAC7	1150300	1024	<	1380	<	5593	4.053	35668	96.74	124024089	104354	12964	9296	170.95	141.9	2615270	44383356	270000	210	13.97	11.48	121.7
579	Tošić (2017)	HVFAC7	1150300	1024	<	1380	<	5593	4.053	35739	96.68	124351611	106139	13100	9361	170.75	141.5	2670423	45036081	273702	240	13.91	11.52	120.7
580	Tošić (2017)	HVFAC7	1150300	1024	<	1380	<	5593	4.053	35777	96.65	124530164	107120	13173	9396	170.64	141.29	2700619	45389300	275729	270	14.02	11.70	119.8
581	Tošić (2017)	HVFAC7	1150300	1024	<	1380	<	5593	4.053	35882	96.57	125015888	109783	13370	9488	170.35	140.72	2780667	46343912	281171	300	14.30	12.07	118.4
582	Tošić (2017)	HVFAC7	1150300	1024	<	1380	<	5593	4.053	35912	96.55	125154576	110552	13425	9513	170.27	140.55	2802118	46613824	282676	330	14.55	12.32	118.1
583	Tošić (2017)	HVFAC7	1150300	1024	<	1380	<	5593	4.053	35987	96.49	125501122	112429	13565	9578	170.07	140.15	2859858	47291355	286494	365	14.78	12.42	119.0
584	Tošić (2017)	HVFAC7	1150300	1024	<	1380	<	5593	4.053	36062	96.43	125847420	114298	13702	9640	169.88	139.76	2915932	47965289	290292	400	14.90	12.43	119.9
585	Tošić (2017)	HVFAC7	1150300	1024	<	1380	<	5593	4.053	36134	96.37	126183588	116097	13833	9699	169.69	139.39	2970250	48610848	293963	450	14.95	12.45	120.1
586	Tošić (2017)	HVFAC28	1154402	1024	<	2424	<	5454	2.250	33492	98.59	113812523	45195	8071	6579	179.44	158.89	926884	21661521	135138	0.003	6.95	4.04	172.0
587	Tošić (2017)	HVFAC28	1150300	1024	<	2416	<	5454	2.257	33605	98.49	114350692	48471	8381	6776	178.82	157.65	1012843	23013188	143423	0.042	7.11	4.30	165.4
588	Tošić (2017)	HVFAC28	1150300	1024	<	2416	<	5454	2.257	33744	98.36	115009756	52446	8750	7006	178.11	156.22	1119441	24641407	153359	0.25	7.31	4.48	163.1
589	Tošić (2017)	HVFAC28	1150300	1024	<	2416	<	5454	2.257	33917	98.21	115829602	57370	9193	7276	177.26	154.54	1254122	26617898	165380	1	7.57	4.65	162.8
590	Tošić (2017)	HVFAC28	1150300	1024	<	2416	<	5454	2.257	33935	98.19	115910488	57844	9236	7301	177.19	154.37	1266748	26812930	166527	2	7.68	4.75	161.6
591	Tošić (2017)	HVFAC28	1150300	1024	<	2416	<	5454	2.257	34080	98.06	116597398	61925	9594	7514	176.52	153.06	1381225	28430958	176329	3	7.86	4.89	160.7
592	Tošić (2017)	HVFAC28	1150300	1024	<	2416	<	5454	2.257	34101	98.05	116698321	62541	9645	7544	176.42	152.87	1397692	28663978	177744	4	7.95	4.99	159.3
593	Tošić (2017)	HVFAC28	1150300	1024	<	2416	<	5454	2.257	34114	98.04	116758863	62902	9674	7560	176.37	152.75	1406729	28804995	178576	5	8.01	5.05	158.7
594	Tošić (2017)	HVFAC28	1150300	1024	<	2416	<	5454	2.257	34114	98.04	116758863	62902	9674	7560	176.37	152.75	1406729	28804995	178576	6	8.03	5.17	155.3
595	Tošić (2017)	HVFAC28	1150300	1024	<	2416	<	5454	2.257	34187	97.97	117101774	64913	9847	7660	176.06	152.12	1463318	29599783	183344	7	8.11	5.22	155.4
596	Tošić (2017)	HVFAC28	1150300	1024	<	2416	<	5454	2.257	34375	97.81	117988048	70122	10284	7909	175.28	150.57	1610558	31619103	195449	14	8.47	5.58	151.9
597	Tošić (2017)	HVFAC28	1150300	1024	<	2416	<	5454	2.257	34532	97.67	118721888	74380	10639	8107	174.67	149.35	1734178	33262485	205214	21	9.02	5.80	155.6
598	Tošić (2017)	HVFAC28	1150300	1024	<	2416	<	5454	2.257	34527	97.68	118701798	74279	10628	8101	174.68	149.39	1730710	33214749	204968	28	9.23	6.01	153.5
599	Tošić (2017)	HVFAC28	1150300	1024	<	2416	<	5454	2.257	34735	97.50	119675057	79888	11082	8347	173.91	147.84	1893253	35348345	217564	56	9.74	6.48	150.3
600	Tošić (2017)	HVFAC28	1150300	1024	<	2416	<	5454	2.257	35017	97.27	120996098	87445	11675	8658	172.94	145.9	2112822	38174848	234181	90	10.15	6.61	153.6
601	Tošić (2017)	HVFAC28	1150300	1024	<	2416	<	5454	2.257	35075	97.22	121265836	88966	11795	8720	172.75	145.52	2158679	38744339	237497	120	10.45	7.01	149.1
602	Tošić (2017)	HVFAC28	1150300	1024	<	2416	<	5454	2.257	35086	97.21	121315771	89245	11817	8731	172.71	145.44	2166721	38846260	238077	150	10.73	7.19	149.2
603	Tošić (2017)	HVFAC28	1150300	1024	<	2416	<	5454	2.257	35332	97.01	122462757	95695	12312	8980	171.94	143.89	2357249	41227950	251899	180	10.88	7.33	148.5
604	Tošić (2017)	HVFAC28	1150300	1024	<	2416	<	5454	2.257	35343	97.00	122512562	95969	12334	8991	171.9	143.82	2365777	41327047	252474	210	10.84	7.41	146.3
605	Tošić (2017)	HVFAC28	1150300	1024	<	2416	<	5454	2.257	35507	96.87	123278878	100244	12655	9148	171.41	142.84	2491752	42886030	261482	240	11.04	7.68	143.7
606	Tošić (2017)	HVFAC28	1150300	1024	<	2416	<	5454	2.257	35366	96.98	122622113	96578	12378	9012	171.84	143.68	2382894	41554595	253780	270	11.42	7.99	143.0
607	Tošić (2017)	HVFAC28	1150300	1024	<	2416	<	5454	2.257	35559	96.83	123517474	101570	12755	9196	171.26	142.53	2531738	43367510	264208	300	11.56	8.26	140.0
608	Tošić (2017)	HVFAC28	1150300	1024	<	2416	<	5454	2.257	35736	96.69	124341690	106116	13095	9359	170.75	141.52	2668109	45012387	273621	330	11.60	8.50	136.5
609	Tošić (2017)	HVFAC28	1150300	1024	<	2416	<	5454	2.257	35570	96.82	123567166	101839	12777	9207	171.23	142.47	2540681	43469580	264788	365	11.83	8.60	137.6
610	Tošić (2017)	HVFAC28	1150300	1024	<	2416	<	5454	2.257	35850	96.59	124867250	108952	13309	9459	170.44	140.89	2754598	46051174	279501	400	11.95	8.75	136.6
611	Tošić (2017)	HVFAC28	1150300	1024	<	2416	<	5454	2.257	35809	96.63	124678907	107954	13232	9423	170.55	141.11	2724001	45679822	277387	450	11.95	8.72	137.0

	Study information		Cracking moment							State I				State II							Deflection			
	1	2	3	4		5		6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
	Author	Specimen	W_I^* (t_0) (mm^3)	M_{SW} (Nm)		M_{cr} (Nm)		M_{max} (Nm)	M_{max}/M_{cr}	A_I^* (mm^2)	$z_{I,1}^*$ (mm)	I_I^* (mm^4)	S_I^* (mm^3)	A_{II}^* (mm^2)	A_{IIc} (mm^2)	$z_{IIc,1}$ (mm)	$z_{II,1}^*$ (mm)	I_{IIc} (mm^4)	I_{II}^* (mm^4)	S_{II}^* (mm^3)	t-t_0 (days)	$a_{num.int.}$ (mm)	a_{exp} (mm)	$a_{num.int.}/a_{exp}$ (%)
612	Seara-Paz (2015)	H50-50	3270735	2168	<	11251	<	24108	2.143	63166	147.06	480994264	176206	16557	13391	266.52	233.03	5002870	104191951	448365	0.1	6.56	7.87	83.4
613	Seara-Paz (2015)	H50-50	3270735	2168	<	11251	<	24108	2.143	64060	146.29	489566456	222864	18846	14786	263.04	226.06	6734066	127086695	546747	2	7.22	7.95	90.8
614	Seara-Paz (2015)	H50-50	3270735	2168	<	11251	<	24108	2.143	64095	146.26	489902006	224672	18930	14835	262.91	225.81	6802339	127945852	550459	3	7.28	8.00	91.0
615	Seara-Paz (2015)	H50-50	3270735	2168	<	11251	<	24108	2.143	64412	145.99	492916751	240848	19686	15274	261.82	223.63	7423148	135645889	583392	8	7.60	8.20	92.7
616	Seara-Paz (2015)	H50-50	3270735	2168	<	11251	<	24108	2.143	64492	145.92	493680918	244923	19875	15383	261.54	223.09	7584038	137562724	591598	9	7.66	8.26	92.8
617	Seara-Paz (2015)	H50-50	3270735	2168	<	11251	<	24108	2.143	64392	146.00	492725615	239795	19641	15249	261.88	223.76	7386902	135160121	581305	17	7.96	9.22	86.4
618	Seara-Paz (2015)	H50-50	3270735	2168	<	11251	<	24108	2.143	64382	146.01	492630033	239290	19616	15234	261.92	223.83	7365211	134921341	580282	22	8.09	9.30	87.0
619	Seara-Paz (2015)	H50-50	3270735	2168	<	11251	<	24108	2.143	64442	145.96	493203383	242361	19756	15314	261.72	223.43	7481388	136368820	586490	28	8.19	9.47	86.5
620	Seara-Paz (2015)	H50-50	3270735	2168	<	11251	<	24108	2.143	64422	145.98	493012304	241353	19711	15289	261.78	223.56	7444952	135884113	584412	35	8.26	9.47	87.2
621	Seara-Paz (2015)	H50-50	3270735	2168	<	11251	<	24108	2.143	64236	146.14	491243046	231883	19271	15035	262.41	224.82	7080047	131386365	565177	39	8.27	9.64	85.8
622	Seara-Paz (2015)	H50-50	3270735	2168	<	11251	<	24108	2.143	64311	146.07	491960699	235707	19450	15139	262.15	224.31	7228822	133215798	573035	45	8.37	9.99	83.8
623	Seara-Paz (2015)	H50-50	3270735	2168	<	11251	<	24108	2.143	64517	145.90	493919598	246202	19930	15413	261.47	222.93	7628317	138167655	594183	56	8.57	9.94	86.2
624	Seara-Paz (2015)	H50-50	3270735	2168	<	11251	<	24108	2.143	64633	145.80	495016778	252038	20200	15567	261.08	222.16	7859840	140904436	605818	64	8.70	10.10	86.1
625	Seara-Paz (2015)	H50-50	3270735	2168	<	11251	<	24108	2.143	64538	145.88	494110500	247207	19981	15443	261.39	222.78	7672768	138640078	596147	72	8.81	10.27	85.8
626	Seara-Paz (2015)	H50-50	3270735	2168	<	11251	<	24108	2.143	64437	145.97	493155618	242131	19746	15309	261.73	223.46	7474091	136245503	585960	80	8.81	10.45	84.2
627	Seara-Paz (2015)	H50-50	3270735	2168	<	11251	<	24108	2.143	64658	145.78	495255134	253312	20255	15597	261.01	222.01	7905185	141503447	608404	86	8.96	10.55	85.0
628	Seara-Paz (2015)	H50-50	3270735	2168	<	11251	<	24108	2.143	64940	145.54	497920787	267429	20891	15951	260.12	220.22	8455078	148068170	636316	93	9.15	10.55	86.7
629	Seara-Paz (2015)	H50-50	3270735	2168	<	11251	<	24108	2.143	64814	145.65	496731652	261157	20611	15797	260.51	221.01	8211951	145156119	623936	100	9.17	10.75	85.3
630	Seara-Paz (2015)	H50-50	3270735	2168	<	11251	<	24108	2.143	65221	145.31	500579290	281463	21511	16290	259.28	218.53	9005098	154523118	663743	108	9.38	10.79	86.9
631	Seara-Paz (2015)	H50-50	3270735	2168	<	11251	<	24108	2.143	65181	145.34	500199938	279451	21426	16245	259.39	218.77	8930971	153606701	659875	121	9.44	10.98	85.9
632	Seara-Paz (2015)	H50-50	3270735	2168	<	11251	<	24108	2.143	65327	145.22	501574404	286672	21741	16414	258.96	217.9	9213155	156896691	673802	130	9.57	11.12	86.0
633	Seara-Paz (2015)	H50-50	3270735	2168	<	11251	<	24108	2.143	65734	144.89	505403494	306686	22611	16877	257.81	215.61	10015243	165960136	712161	149	9.79	11.32	86.5
634	Seara-Paz (2015)	H50-50	3270735	2168	<	11251	<	24108	2.143	66100	144.59	508842039	324478	23371	17271	256.82	213.65	10732084	173916265	745768	192	10.01	11.95	83.7
635	Seara-Paz (2015)	H50-50	3270735	2168	<	11251	<	24108	2.143	66718	144.10	514609793	354061	24606	17888	255.28	210.54	11924928	186956542	800433	220	10.40	12.08	86.0
636	Seara-Paz (2015)	H50-50	3270735	2168	<	11251	<	24108	2.143	66754	144.07	514937074	355712	24677	17923	255.19	210.36	11994781	187680421	803408	221	10.41	12.17	85.6
637	Seara-Paz (2015)	H50-50	3270735	2168	<	11251	<	24108	2.143	66301	144.43	510721276	334161	23776	17475	256.31	212.61	11117238	178206894	763787	246	10.37	12.13	85.5
638	Seara-Paz (2015)	H50-50	3270735	2168	<	11251	<	24108	2.143	66618	144.18	513674135	349294	24412	17794	255.52	211.03	11736696	184874834	791702	268	10.62	12.35	86.0
639	Seara-Paz (2015)	H50-50	3270735	2168	<	11251	<	24108	2.143	66332	144.41	511002866	335633	23837	17505	256.24	212.45	11174363	178853525	766428	304	10.62	12.49	85.0
640	Seara-Paz (2015)	H50-50	3270735	2168	<	11251	<	24108	2.143	66442	144.32	512034700	340913	24061	17619	255.95	211.89	11395156	181181109	776203	351	10.69	12.66	84.4
641	Seara-Paz (2015)	H50-50	3270735	2168	<	11251	<	24108	2.143	66432	144.33	511940941	340446	24041	17609	255.98	211.95	11375842	180977352	775378	385	10.68	12.97	82.4
642	Seara-Paz (2015)	H50-50	3270735	2168	<	11251	<	24108	2.143	66734	144.09	514750069	354788	24637	17903	255.24	210.46	11954832	187264664	801691	420	10.78	13.26	81.3
643	Seara-Paz (2015)	H50-50	3270735	2168	<	11251	<	24108	2.143	66693	144.12	514375957	352871	24561	17868	255.33	210.66	11885134	186435702	798243	443	10.79	13.22	81.6
644	Seara-Paz (2015)	H50-50	3270735	2168	<	11251	<	24108	2.143	66653	144.15	514001711	350951	24481	17828	255.43	210.85	11805812	185600897	794713	477	10.70	13.29	80.5
645	Seara-Paz (2015)	H50-50	3270735	2168	<	11251	<	24108	2.143	66568	144.22	513205990	346905	24312	17744	255.64	211.27	11638426	183818689	787267	543	10.73	13.44	79.8
646	Seara-Paz (2015)	H50-50	3270735	2168	<	11251	<	24108	2.143	66618	144.18	513674135	349294	24412	17794	255.52	211.03	11736696	184874834	791702	574	10.77	13.38	80.5
647	Seara-Paz (2015)	H50-50	3270735	2168	<	11251	<	24108	2.143	66789	144.04	515264253	357361	24747	17958	255.11	210.2	12064906	188418978	806506	597	10.80	13.40	80.6
648	Seara-Paz (2015)	H50-50	3270735	2168	<	11251	<	24108	2.143	66739	144.08	514796824	354985	24647	17908	255.23	210.43	11964811	187372659	802087	626	10.78	13.32	81.0
649	Seara-Paz (2015)	H50-50	3270735	2168	<	11251	<	24108	2.143	66884	143.97	516151791	361905	24932	18048	254.88	209.74	12246482	190375716	814682	661	10.85	13.49	80.4
650	Seara-Paz (2015)	H50-50	3270735	2168	<	11251	<	24108	2.143	66809	144.03	515451166	358351	24787	17978	255.06	210.1	12105100	188833490	808213	694	10.82	13.49	80.2
651	Seara-Paz (2015)	H50-50	3270735	2168	<	11251	<	24108	2.143	66935	143.93	516618614	364269	25032	18097	254.76	209.5	12348140	191411814	818964	721	10.88	13.70	79.4
652	Seara-Paz (2015)	H50-50	3270735	2168	<	11251	<	24108	2.143	66864	143.98	515965004	360917	24897	18033	254.92	209.84	12216094	189966963	812990	751	10.84	13.89	78.1
653	Seara-Paz (2015)	H50-50	3270735	2168	<	11251	<	24108	2.143	66698	144.12	514422730	353136	24571	17873	255.32	210.64	11895074	186543914	798708	813	10.77	13.95	77.2
654	Seara-Paz (2015)	H50-50	3270735	2168	<	11251	<	24108	2.143	66804	144.03	515404440	358087	24777	17973	255.07	210.12	12095044	188725867	807753	848	10.84	14.13	76.7
655	Seara-Paz (2015)	H50-50	3270735	2168	<	11251	<	24108	2.143	66804	144.03	515404440	358087	24777	17973	255.07	210.12	12095044	188725867	807753	879	10.98	14.03	78.3
656	Seara-Paz (2015)	H50-50	3270735	2168	<	11251	<	24108	2.143	66864	143.98	515965004	360917	24897	18033	254.92	209.84	12216094	189966963	812990	907	10.95	14.03	78.0
657	Seara-Paz (2015)	H50-50	3270735	2168	<	11251	<	24108	2.143	66608	144.19	513580524	348830	24392	17784	255.54	211.07	11716998	184657510	790764	975	11.04	14.06	78.5
658	Seara-Paz (2015)	H50-50	3270735	2168	<	11251	<	24108	2.143	66884	143.97	516151791	361905	24932	18048	254.88	209.74	12246482	190375716	814682	1000	11.04	14.08	78.4
659	Seara-Paz (2015)	H50-100	3319741	2168	<	10723	<	25698	2.397	63744	146.56	486541245	206498	18066	14322	264.19	228.38	6120874	119171142	512802	0.1	7.74	6.80	113.9
660	Seara-Paz (2015)	H50-100	3319741	2168	<	10723	<	25698	2.397	66517	144.26	512737634	344511	24211	17694	255.77	211.53	11540707	182775303	782938	5	9.41	8.03	117.2
661	Seara-Paz (2015)	H50-100	3319741	2168	<	10723	<	25698	2.397	66653	144.15	514001711	350951	24481	17828	255.43	210.85	11805812	185600897	794713	6	9.50	8.14	116.7
662	Seara-Paz (2015)	H50-100	3319741	2168	<	10723	<	25698	2.397	66919	143.94	516478589	363547	25001	18082	254.79	209.57	12317584	191090849	817668	14	9.84	9.34	105.3
663	Seara-Paz (2015)	H50-100	3319741	2168	<	10723	<	25698	2.397	67045	143.84	517644892	369442	25247	18202	254.5	208.99	12563451	193672084	828427	15	9.94	9.08	109.5
664	Seara-Paz (2015)	H50-100	3319741	2168	<	10723	<	25698	2.397	67256	143.68	519601370	379349	25652	18396	254.01	208.01	12969925	197935991	846134	19	10.09	9.50	106.3
665	Seara-Paz (2015)	H50-100	3319741	2168	<	10723	<	25698	2.397	67452	143.53	521414858	388477	26022	18570	253.57	207.13	13342092	201852302	862429	25	10.30	9.82	104.9
666	Seara-Paz (2015)	H50-100	3319741	2168	<	10723	<	25698	2.397	67201	143.72	519089310	376747	25547	18346	254.13	208.26	12864878	196813836	841488	32	10.28	9.82	104.7
667	Seara-Paz (2015)	H50-100	3319741	2168	<	10723	<	25698	2.397	67422	143.55	521136061	387053	25968	18546	253.64	207.27	13288495	201266455	859978	36	10.44	10.06	103.8
668	Seara-Paz (2015)	H50-100	3319741	2168	<	10723	<	25698	2.397	67397	143.57	520903675	385891	25918	18521	253.7	207.38	13235042	200760700	857881	40	10.46	10.33	101.3
669	Seara-Paz (2015)	H50-100	3319741	2168	<	10723	<	25698	2.397	67568	143.44	522482898	393821	26243	18675	253.31	206.62	13568774	204151377	871945	42	10.57	10.33	102.3
670	Seara-Paz (2015)	H50-100	3319741	2168	<	10723	<	25698	2.397	67603	143.41	522807740	395423	26308	18705	253.24	206.47	13634008	204855851	874857	53	10.70	10.55	101.4
671	Seara-Paz (2015)	H50-100	3319741	2168	<	10723	<	25698	2.397	67578	143.43	522575719	394268	26258	18680	253.3	206.57	13579631	204354679	872724	61	10.84	10.77	100.7
672	Seara-Paz (2015)	H50-100	3319741	2168	<	10723	<	25698	2.397	67698	143.34	523688959	399850	26488	18790	253.03	206.06	13819973	206742442	882687	69	11.08	11.03	100.5
673	Seara-Paz (2015)	H50-100	3319741	2168	<	10723	<	25698	2.397	67487	143.50	521740026	390086	26087	18600	253.5	206.98	13406599	202560811	865376	77	11.05	11.30	97.8
674	Seara-Paz (2015)	H50-100	3319741	2168	<	10723	<	25698	2.397	67563	143.44	522436483	393559	26233	18670	253.32	206.64	13557921	204047533	871517	83	11.14	11.45	97.2
675	Seara-Paz (2015)	H50-100	3319741	2168	<	10723	<	25698	2.397	67588	143.42	522668534	394715	26278	18690	253.28	206.53	13601365	204562212	873578	90	11.26	11.62	96.9
676	Seara-Paz (2015)	H50-100	3319741	2168	<	10723	<	25698	2.397	67749	143.30	524152465	402150	26578	18829	252.93	205.83	13908069	207727261	886667	97	11.34	11.73	96.7
677	Seara-Paz (2015)	H50-100	3319741	2168	<	10723	<	25698	2.397	67934	143.16	525865700	410688	26923	18989	252.53	205.05	14264193	211357622	901753	105	11.43	11.89	96.2
678	Seara-Paz (2015)	H50-100	3319741	2168	<	10723	<	25698	2.397	68080	143.05	527206598	417342	27193	19113	252.22	204.44	14546607	214182066	913386	118	11.62	12.05	96.4
679	Seara-Paz (2015)	H50-100	3319741	2168	<	10723	<	25698	2.397	68206	142.95	528361207	423010	27419	19213	251.97	203.91	14775203	216599005	923237	127	11.74	12.48	94.0
680	Seara-Paz (2015)	H50-100	3319741	2168	<	10723	<	25698	2.397	68568	142.68	531679639	439348	28075	19507	251.23	202.45	15463490	223471939	951435	146	11.96	12.58	95.0
681	Seara-Paz (2015)	H50-100	3319741	2168	<	10723	<	25698	2.397	69226	142.19	537691700	468583	29236	20010	249.98	199.94	16690778	235718127	1001379	189	12.33	12.93	95.4
682	Seara-Paz (2015)	H50-100	3319741	2168	<	10723	<	25698	2.397	68919	142.42	534896266	455067	28700	19781	250.55	201.09	16124064	230062540	978366	217	12.44	12.99	95.7
683	Seara-Paz (2015)	H50-100	3319741	2168	<	10723	<	25698	2.397	69161	142.24	537096542	465724	29121	19960	250.1	200.17	16566468	234510907	996396	243	12.41	13.18	94.1
684	Seara-Paz (2015)	H50-100	3319741	2168	<	10723	<	25698	2.397	69140	142.25	536913353	464793	29085	19945	250.14	200.26	16529296	234146809	995032	265	12.58	13.34	94.3
685	Seara-Paz (2015)	H50-100	3319741	2168	<	10723	<	25698	2.397	68924	142.41	534942149	455234	28710	19786	250.54	201.08	16136245	230160642	978828	301	12.65	13.38	94.6
686	Seara-Paz (2015)	H50-100	3319741	2168	<	10723	<	25698	2.397	68623	142.64	532185734	441837	28174	19551	251.12	202.24	15570325	224515134	955762	348	12.59	13.43	93.7
687	Seara-Paz (2015)	H50-100	3319741	2168	<	10723	<	25698	2.397	68683	142.59	532737570	444493	28279	19596	251.01	202	15677651	225652368	960362	382	12.61	13.58	92.8
688	Seara-Paz (2015)	H50-100	3319741	2168	<	10723	<	25698	2.397	68834	142.48	534115949	451238	28550	19716	250.71	201.42	15966264	228469714	971911	417	12.57	13.88	90.5
689	Seara-Paz (2015)	H50-100	3319741	2168	<	10723	<	25698	2.397	68688	142.59	532783544	444750	28289	19601	251	201.99	15689607	225751391	960831	440	12.59	13.86	90.8
690	Seara-Paz (2015)	H50-100	3319741	2168	<	10723	<	25698	2.397	68744	142.55	533289130	447230	28390	19646	250.88	201.76	15797480	226771978	964933	474	12.71	13.97	91.0
691	Seara-Paz (2015)	H50-100	3319741	2168	<	10723	<	25698	2.397	68859	142.46	534345511	452344	28595	19736	250.66	201.32	16014707	228937384	973790	540	12.70	14.15	89.8
692	Seara-Paz (2015)	H50-100	3319741	2168	<	10723	<	25698	2.397	68854	142.46	534299604	452088	28585	19731	250.67	201.34	16002587	228839036	973414	571	12.72	14.13	90.1
693	Seara-Paz (2015)	H50-100	3319741	2168	<	10723	<	25698	2.397	68864	142.46	534391418	452601	28600	19736	250.66	201.3	16014707	229030893	974165	594	12.74	14.17	89.9
694	Seara-Paz (2015)	H50-100	3319741	2168	<	10723	<	25698	2.397	68829	142.48	534070031	450981	28540	19711	250.72	201.43	15954168	228371268	971447	623	12.72	14.07	90.4
695	Seara-Paz (2015)	H50-100	3319741	2168	<	10723	<	25698	2.397	68904	142.43	534758603	454386	28670	19766	250.59	201.15	16087557	229787679	977247	658	12.72	14.21	89.5
696	Seara-Paz (2015)	H50-100	3319741	2168	<	10723	<	25698	2.397	68919	142.42	534896266	455067	28700	19781	250.55	201.09	16124064	230062540	978366	691	12.73	14.57	87.3
697	Seara-Paz (2015)	H50-100	3319741	2168	<	10723	<	25698	2.397	69045	142.32	536042788	460571	28920	19875	250.31	200.61	16356560	232379272	987804	718	12.75	14.48	88.1
698	Seara-Paz (2015)	H50-100	3319741	2168	<	10723	<	25698	2.397	68975	142.37	535400883	457438	28795	19820	250.45	200.88	16221687	231084342	982545	748	12.70	14.70	86.4
699	Seara-Paz (2015)	H50-100	3319741	2168	<	10723	<	25698	2.397	68934	142.41	535033912	455746	28725	19791	250.52	201.03	16148433	230332351	979484	810	12.70	14.93	85.1
700	Seara-Paz (2015)	H50-100	3319741	2168	<	10723	<	25698	2.397	69050	142.32	536088624	460827	28930	19880	250.3	200.59	16368858	232476891	988172	845	12.75	15.11	84.3
701	Seara-Paz (2015)	H50-100	3319741	2168	<	10723	<	25698	2.397	69085	142.29	536409425	462346	28990	19905	250.24	200.46	16430442	233130124	990832	876	12.88	15.04	85.6
702	Seara-Paz (2015)	H50-100	3319741	2168	<	10723	<	25698	2.397	69251	142.17	537920522	469675	29281	20030	249.93	199.84	16740676	236177684	1003181	904	12.85	15.01	85.6
703	Seara-Paz (2015)	H50-100	3319741	2168	<	10723	<	25698	2.397	69020	142.34	535813578	459472	28875	19855	250.36	200.7	16307429	231915517	985872	972	12.96	15.11	85.8
704	Seara-Paz (2015)	H50-100	3319741	2168	<	10723	<	25698	2.397	69146	142.25	536959152	465049	29096	19950	250.13	200.23	16541680	234244074	995305	1000	12.96	15.20	85.2

	Study information			Cracking moment						State I				State II							Deflection			
	1	2	3	4		5		6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
	Author	Specimen	W_I^* (t_0) (mm^3)	M_{SW} (Nm)		M_{cr} (Nm)		M_{max} (Nm)	M_{max}/M_{cr}	A_I^* (mm^2)	$z_{I,1}^*$ (mm)	I_I^* (mm^4)	S_I^* (mm^3)	A_{II}^* (mm^2)	A_{IIc} (mm^2)	$z_{IIc,1}$ (mm)	$z_{II,1}^*$ (mm)	I_{IIc} (mm^4)	I_{II}^* (mm^4)	S_{II}^* (mm^3)	t-t_0 (days)	$a_{num.int.}$ (mm)	a_{exp} (mm)	$a_{num.int.}/a_{exp}$ (%)
705	Seara-Paz (2015)	H65-50	3241520	2168	<	10989	<	19298	1.756	63432	147.64	478578017	141539	16658	13226	266.94	233.86	4819620	97457102	437452	0.1	5.26	4.96	106.0
706	Seara-Paz (2015)	H65-50	3241520	2168	<	10989	<	19298	1.756	65774	146.17	497706735	229621	21920	16146	259.64	219.27	8769071	146332535	651680	9	6.88	5.99	114.8
707	Seara-Paz (2015)	H65-50	3241520	2168	<	10989	<	19298	1.756	66045	146.01	499905758	239445	22462	16417	258.96	217.9	9218814	151516624	674026	15	7.16	5.99	119.4
708	Seara-Paz (2015)	H65-50	3241520	2168	<	10989	<	19298	1.756	66221	145.90	501329180	245728	22812	16591	258.52	217.04	9513603	154826214	688286	21	7.35	6.13	119.9
709	Seara-Paz (2015)	H65-50	3241520	2168	<	10989	<	19298	1.756	65804	146.15	497951246	230704	21978	16174	259.56	219.11	8814903	146900035	654155	28	7.47	6.28	118.8
710	Seara-Paz (2015)	H65-50	3241520	2168	<	10989	<	19298	1.756	64899	146.71	490596677	197494	20086	15187	262.03	224.07	7296934	129004941	576509	34	7.30	6.28	116.2
711	Seara-Paz (2015)	H65-50	3241520	2168	<	10989	<	19298	1.756	65432	146.38	494932551	217172	21218	15786	260.54	221.08	8194932	139678206	622945	40	7.58	6.42	118.0
712	Seara-Paz (2015)	H65-50	3241520	2168	<	10989	<	19298	1.756	65226	146.51	493257131	209615	20782	15556	261.11	222.21	7842949	135591999	605223	49	7.64	6.81	112.2
713	Seara-Paz (2015)	H65-50	3241520	2168	<	10989	<	19298	1.756	65432	146.38	494932551	217172	21218	15786	260.54	221.08	8194932	139678206	622945	57	7.86	6.97	112.6
714	Seara-Paz (2015)	H65-50	3241520	2168	<	10989	<	19298	1.756	65789	146.16	497828996	230163	21949	16160	259.6	219.19	8791967	146616429	652919	63	7.99	7.03	113.7
715	Seara-Paz (2015)	H65-50	3241520	2168	<	10989	<	19298	1.756	66065	146.00	500068509	240181	22506	16441	258.9	217.8	9258290	151896515	675660	71	8.17	7.21	113.3
716	Seara-Paz (2015)	H65-50	3241520	2168	<	10989	<	19298	1.756	66181	145.93	501003955	244325	22734	16553	258.62	217.23	9449341	154078646	685013	77	8.31	7.23	114.9
717	Seara-Paz (2015)	H65-50	3241520	2168	<	10989	<	19298	1.756	66357	145.82	502426251	250578	23079	16722	258.2	216.39	9740817	157373440	699165	84	8.38	7.30	114.8
718	Seara-Paz (2015)	H65-50	3241520	2168	<	10989	<	19298	1.756	66713	145.61	505307041	263232	23767	17054	257.37	214.73	10333119	163953915	727263	92	8.59	7.39	116.2
719	Seara-Paz (2015)	H65-50	3241520	2168	<	10989	<	19298	1.756	66919	145.49	506967917	270480	24160	17241	256.9	213.8	10677146	167692542	743146	97	8.68	7.41	117.2
720	Seara-Paz (2015)	H65-50	3241520	2168	<	10989	<	19298	1.756	66613	145.67	504496148	259689	23578	16965	257.59	215.18	10172328	162109988	719351	113	8.74	7.61	114.8
721	Seara-Paz (2015)	H65-50	3241520	2168	<	10989	<	19298	1.756	66573	145.69	504171662	258241	23501	16928	257.68	215.37	10105129	161366614	716227	121	8.76	7.72	113.5
722	Seara-Paz (2015)	H65-50	3241520	2168	<	10989	<	19298	1.756	67090	145.39	508343758	276450	24481	17391	256.52	213.04	10957802	170756764	756107	142	8.95	7.74	115.7
723	Seara-Paz (2015)	H65-50	3241520	2168	<	10989	<	19298	1.756	67794	144.99	513995154	300762	25775	17981	255.05	210.1	12110676	183135923	808214	183	9.25	7.86	117.7
724	Seara-Paz (2015)	H65-50	3241520	2168	<	10989	<	19298	1.756	68186	144.77	517134316	314086	26475	18289	254.28	208.55	12745591	189848751	836172	212	9.43	8.10	116.5
725	Seara-Paz (2015)	H65-50	3241520	2168	<	10989	<	19298	1.756	68161	144.78	516933287	313204	26432	18271	254.32	208.65	12706494	189412415	834421	236	9.49	8.10	117.3
726	Seara-Paz (2015)	H65-50	3241520	2168	<	10989	<	19298	1.756	67784	144.99	513914575	300374	25755	17971	255.07	210.14	12091773	182955409	807484	260	9.58	7.92	120.9
727	Seara-Paz (2015)	H65-50	3241520	2168	<	10989	<	19298	1.756	67834	144.96	514317429	302078	25847	18013	254.97	209.94	12176993	183831548	811130	294	9.66	8.36	115.5
728	Seara-Paz (2015)	H65-50	3241520	2168	<	10989	<	19298	1.756	67728	145.03	513471309	298550	25652	17924	255.19	210.37	11997552	182002828	803527	343	9.78	8.36	116.9
729	Seara-Paz (2015)	H65-50	3241520	2168	<	10989	<	19298	1.756	67497	145.16	511616184	290595	25234	17737	255.66	211.32	11625562	177976134	786617	376	9.82	8.58	114.4
730	Seara-Paz (2015)	H65-50	3241520	2168	<	10989	<	19298	1.756	67894	144.93	514800706	304166	25954	18060	254.85	209.7	12272150	184865686	815479	411	9.92	8.62	115.1
731	Seara-Paz (2015)	H65-50	3241520	2168	<	10989	<	19298	1.756	67980	144.88	515485077	307059	26106	18126	254.69	209.36	12406201	186339153	821590	434	9.97	8.65	115.2
732	Seara-Paz (2015)	H65-50	3241520	2168	<	10989	<	19298	1.756	68527	144.58	519865605	325577	27074	18547	253.63	207.26	13291333	195590426	860076	468	10.12	8.69	116.5
733	Seara-Paz (2015)	H65-50	3241520	2168	<	10989	<	19298	1.756	68372	144.66	518621077	320299	26802	18430	253.93	207.85	13041377	192992389	849304	534	10.13	8.70	116.4
734	Seara-Paz (2015)	H65-50	3241520	2168	<	10989	<	19298	1.756	68382	144.66	518701402	320684	26821	18439	253.9	207.8	13061257	193149410	849904	567	10.11	8.71	116.1
735	Seara-Paz (2015)	H65-50	3241520	2168	<	10989	<	19298	1.756	68357	144.67	518500584	319806	26777	18420	253.95	207.9	13021517	192731610	848192	588	10.13	8.71	116.3
736	Seara-Paz (2015)	H65-50	3241520	2168	<	10989	<	19298	1.756	68563	144.55	520146484	326663	27138	18575	253.56	207.12	13351794	196177592	862425	617	10.14	8.72	116.3
737	Seara-Paz (2015)	H65-50	3241520	2168	<	10989	<	19298	1.756	68653	144.50	520868502	329681	27293	18640	253.4	206.8	13493582	197688237	868766	652	10.18	8.73	116.5
738	Seara-Paz (2015)	H65-50	3241520	2168	<	10989	<	19298	1.756	68678	144.49	521069000	330552	27337	18659	253.35	206.7	13534276	198100314	870421	684	10.16	8.89	114.3
739	Seara-Paz (2015)	H65-50	3241520	2168	<	10989	<	19298	1.756	68904	144.37	522872299	338096	27727	18823	252.94	205.88	13893847	201832413	885800	712	10.22	8.99	113.6
740	Seara-Paz (2015)	H65-50	3241520	2168	<	10989	<	19298	1.756	68618	144.52	520587758	328513	27230	18612	253.47	206.92	13432693	197103425	866269	742	10.14	9.13	111.0
741	Seara-Paz (2015)	H65-50	3241520	2168	<	10989	<	19298	1.756	68537	144.57	519945860	325875	27093	18556	253.61	207.23	13311466	195763312	860834	804	10.14	9.26	109.5
742	Seara-Paz (2015)	H65-50	3241520	2168	<	10989	<	19298	1.756	68718	144.47	521389744	331909	27405	18687	253.28	206.56	13595471	198766770	873232	838	10.22	9.33	109.6
743	Seara-Paz (2015)	H65-50	3241520	2168	<	10989	<	19298	1.756	69025	144.30	523833180	342044	27932	18907	252.73	205.45	14081224	203808639	893916	873	10.30	9.43	109.3
744	Seara-Paz (2015)	H65-50	3241520	2168	<	10989	<	19298	1.756	69050	144.29	524033289	342905	27976	18926	252.69	205.37	14123091	204231758	895681	898	10.36	9.48	109.4
745	Seara-Paz (2015)	H65-50	3241520	2168	<	10989	<	19298	1.756	68945	144.34	523192660	339354	27796	18851	252.87	205.73	13956120	202492300	888457	966	10.37	9.53	108.9
746	Seara-Paz (2015)	H65-50	3241520	2168	<	10989	<	19298	1.756	68990	144.32	523552985	340890	27874	18884	252.79	205.57	14029007	203237025	891511	1000	10.46	9.63	108.6
747	Seara-Paz (2015)	H65-100	3294645	2168	<	7479	<	20268	2.710	64191	147.15	484807069	170777	18498	14307	264.23	228.47	6100742	114204976	511577	0.1	7.47	4.59	162.8
748	Seara-Paz (2015)	H65-100	3294645	2168	<	7479	<	20268	2.710	66884	145.51	506684490	269243	24092	17208	256.98	213.95	10616398	167053329	740401	8	8.99	6.69	134.4
749	Seara-Paz (2015)	H65-100	3294645	2168	<	7479	<	20268	2.710	67060	145.41	508101058	275415	24423	17363	256.59	213.17	10904809	170216470	753810	14	9.23	6.93	133.1
750	Seara-Paz (2015)	H65-100	3294645	2168	<	7479	<	20268	2.710	67120	145.38	508586417	277554	24539	17419	256.45	212.91	11010966	171296214	758396	21	9.47	7.15	132.4
751	Seara-Paz (2015)	H65-100	3294645	2168	<	7479	<	20268	2.710	67075	145.40	508222413	275933	24452	17377	256.56	213.11	10931284	170494272	754995	33	9.60	7.53	127.4
752	Seara-Paz (2015)	H65-100	3294645	2168	<	7479	<	20268	2.710	66487	145.75	503481876	255274	23335	16848	257.88	215.77	9963314	159791614	709513	42	9.55	7.79	122.5
753	Seara-Paz (2015)	H65-100	3294645	2168	<	7479	<	20268	2.710	67407	145.21	510889620	287460	25069	17662	255.84	211.69	11478946	176374992	779867	50	9.96	8.01	124.2
754	Seara-Paz (2015)	H65-100	3294645	2168	<	7479	<	20268	2.710	67025	145.43	507817857	274184	24360	17335	256.66	213.33	10851987	169585080	751178	56	9.88	8.10	122.0
755	Seara-Paz (2015)	H65-100	3294645	2168	<	7479	<	20268	2.710	67472	145.17	511414397	289696	25186	17714	255.72	211.42	11579611	177538415	784728	64	10.05	8.33	120.6
756	Seara-Paz (2015)	H65-100	3294645	2168	<	7479	<	20268	2.710	68422	144.63	519022651	321969	26889	18467	253.83	207.65	13121019	193824790	852717	70	10.41	8.47	123.0
757	Seara-Paz (2015)	H65-100	3294645	2168	<	7479	<	20268	2.710	68648	144.51	520828398	329576	27284	18636	253.41	206.81	13483421	197603297	868348	77	10.51	8.64	121.7
758	Seara-Paz (2015)	H65-100	3294645	2168	<	7479	<	20268	2.710	69201	144.20	525233383	347789	28235	19034	252.42	204.84	14365437	206683727	905724	85	10.74	8.70	123.5
759	Seara-Paz (2015)	H65-100	3294645	2168	<	7479	<	20268	2.710	68904	144.37	522872299	338096	27727	18823	252.94	205.88	13893847	201832413	885800	90	10.71	8.76	122.2
760	Seara-Paz (2015)	H65-100	3294645	2168	<	7479	<	20268	2.710	68578	144.55	520266843	327238	27162	18584	253.54	207.07	13371988	196433970	863515	106	10.72	8.99	119.2
761	Seara-Paz (2015)	H65-100	3294645	2168	<	7479	<	20268	2.710	68613	144.53	520547647	328408	27225	18612	253.47	206.94	13432693	197019831	865936	114	10.93	9.33	117.1
762	Seara-Paz (2015)	H65-100	3294645	2168	<	7479	<	20268	2.710	69970	143.79	531339397	372763	29518	19548	251.13	202.24	15562872	218948881	955486	133	11.27	9.13	123.4
763	Seara-Paz (2015)	H65-100	3294645	2168	<	7479	<	20268	2.710	70311	143.61	534045554	383683	30079	19768	250.58	201.16	16094150	224282903	977099	176	11.60	9.54	121.6
764	Seara-Paz (2015)	H65-100	3294645	2168	<	7479	<	20268	2.710	70231	143.65	533409226	381101	29948	19717	250.71	201.41	15968742	223037889	972038	205	11.98	9.54	125.6
765	Seara-Paz (2015)	H65-100	3294645	2168	<	7479	<	20268	2.710	70522	143.50	535714703	390379	30421	19899	250.25	200.5	16416331	227537645	990153	229	11.96	9.85	121.4
766	Seara-Paz (2015)	H65-100	3294645	2168	<	7479	<	20268	2.710	70256	143.64	533608107	381934	29992	19736	250.66	201.33	16014269	223422982	973604	253	12.11	9.43	128.4
767	Seara-Paz (2015)	H65-100	3294645	2168	<	7479	<	20268	2.710	70035	143.75	531857109	374804	29625	19590	251.02	202.03	15663687	219964855	959640	287	12.16	9.43	129.0
768	Seara-Paz (2015)	H65-100	3294645	2168	<	7479	<	20268	2.710	69749	143.91	529585874	365666	29152	19403	251.49	202.97	15218933	215453955	941413	336	12.38	9.85	125.7
769	Seara-Paz (2015)	H65-100	3294645	2168	<	7479	<	20268	2.710	70231	143.65	533409226	381101	29948	19717	250.71	201.41	15968742	223037889	972038	369	12.52	10.13	123.6
770	Seara-Paz (2015)	H65-100	3294645	2168	<	7479	<	20268	2.710	70397	143.56	534721371	386342	30217	19820	250.45	200.88	16220213	225604150	982283	404	12.62	10.38	121.6
771	Seara-Paz (2015)	H65-100	3294645	2168	<	7479	<	20268	2.710	70608	143.45	536389813	393018	30559	19951	250.12	200.23	16544069	228848276	995328	427	12.69	10.37	122.5
772	Seara-Paz (2015)	H65-100	3294645	2168	<	7479	<	20268	2.710	70693	143.41	537064644	395755	30700	20007	249.98	199.97	16684173	230156389	1000563	461	12.58	10.44	120.5
773	Seara-Paz (2015)	H65-100	3294645	2168	<	7479	<	20268	2.710	71201	143.14	541068125	411515	31508	20307	249.23	198.45	17444771	237840084	1031027	527	12.67	10.58	119.7
774	Seara-Paz (2015)	H65-100	3294645	2168	<	7479	<	20268	2.710	71135	143.18	540553379	409560	31404	20269	249.33	198.65	17348458	236870590	1027241	560	12.64	10.49	120.5
775	Seara-Paz (2015)	H65-100	3294645	2168	<	7479	<	20268	2.710	71181	143.15	540909758	410888	31478	20297	249.26	198.51	17420659	237550368	1029847	581	12.80	10.78	118.7
776	Seara-Paz (2015)	H65-100	3294645	2168	<	7479	<	20268	2.710	71372	143.05	542413625	416768	31777	20405	248.99	197.96	17699288	240406640	1041181	610	12.72	10.78	118.1
777	Seara-Paz (2015)	H65-100	3294645	2168	<	7479	<	20268	2.710	71422	143.03	542809150	418381	31860	20438	248.91	197.82	17784674	241159914	1044183	650	12.82	10.66	120.3
778	Seara-Paz (2015)	H65-100	3294645	2168	<	7479	<	20268	2.710	71432	143.02	542888244	418635	31874	20442	248.89	197.78	17796894	241290375	1044645	677	12.83	10.90	117.7
779	Seara-Paz (2015)	H65-100	3294645	2168	<	7479	<	20268	2.710	71547	142.96	543797550	422175	32055	20508	248.73	197.46	17968567	243015877	1051511	705	12.86	10.95	117.5
780	Seara-Paz (2015)	H65-100	3294645	2168	<	7479	<	20268	2.710	71120	143.18	540434567	409006	31380	20260	249.35	198.69	17324435	236637765	1026295	734	12.81	10.93	117.2
781	Seara-Paz (2015)	H65-100	3294645	2168	<	7479	<	20268	2.710	71135	143.18	540553379	409560	31404	20269	249.33	198.65	17348458	236870590	1027241	797	12.92	11.15	115.9
782	Seara-Paz (2015)	H65-100	3294645	2168	<	7479	<	20268	2.710	71231	143.13	541305647	412510	31556	20325	249.19	198.37	17493061	238304359	1032904	831	13.03	11.34	114.9
783	Seara-Paz (2015)	H65-100	3294645	2168	<	7479	<	20268	2.710	71321	143.08	542018004	415266	31698	20377	249.06	198.11	17626318	239656420	1038279	866	13.08	11.34	115.4
784	Seara-Paz (2015)	H65-100	3294645	2168	<	7479	<	20268	2.710	71362	143.06	542334508	416514	31762	20400	249	197.99	17687112	240252373	1040602	891	13.10	11.34	115.5
785	Seara-Paz (2015)	H65-100	3294645	2168	<	7479	<	20268	2.710	71588	142.94	544113712	423413	32119	20531	248.67	197.34	18030145	243607015	1053781	959	13.17	11.34	116.1
786	Seara-Paz (2015)	H65-100	3294645	2168	<	7479	<	20268	2.710	71522	142.98	543599917	421487	32016	20494	248.77	197.53	17931687	242653753	1050029	1000	13.21	11.34	116.5

Applicability of Model Code 2010

Database – NAC, RAC and HVFAC beams

		Study information		Green concrete		Cross-section		Reinforcement								Mechanical properties												Loading						Deflection		
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
		Author	Specimen	RAC (%)	FA/cm	b (mm)	h (mm)	A_{s1} (mm^2)	d (mm)	ρ_1 (%)	A_{s2} (mm^2)	d' (mm)	d_2 (mm)	ρ_2 (%)	type	RH (%)	T (°C)	t_{test} (days)	$f_{cm}(t_{test})$ (MPa)	f_{cm} (MPa)	f_{cm} (t_0) (MPa)	$f_{ctm}(t_0)$ (MPa)	$E_{cm}(t_0)$ (MPa)	E_s (MPa)	φ (–)	ε_{cs} (‰)	$E_{c,eff}$ (MPa)	L (mm)	L/d	M_{L1} (Nm)	K_{L1}	M_{L2} (Nm)	K_{L2}	a (t-t_0) (mm)	t_0 (days)	t-t_0 (days)
1	0	Tošić (2017)	NAC7	0	0	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	28	30.50	30.50	24.97	1.98	28212	200000	0.000	0.000	28212	3200	18.9	1024	0.104	6645	0.107	9.17	7	0
2	t	Tošić (2017)	NAC7	0	0	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	28	30.50	30.50	24.97	1.98	28212	200000	2.744	0.705	7535	3200	18.9	1024	0.104	6645	0.107	18.94	7	450
3	0	Tošić (2017)	NAC28	0	0	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	28	30.50	30.50	30.50	2.39	31180	200000	0.000	0.000	31180	3200	18.9	1024	0.104	5853	0.107	8.11	28	0
4	t	Tošić (2017)	NAC28	0	0	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	28	30.50	30.50	30.50	2.39	31180	200000	2.105	0.705	10042	3200	18.9	1024	0.104	5853	0.107	16.51	28	450
5	0	Tošić (2017)	RAC7	100	0	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	28	28.10	28.10	23.01	1.83	27454	200000	0.000	0.000	27454	3200	18.9	1024	0.104	6923	0.107	10.89	7	0
6	t	Tošić (2017)	RAC7	100	0	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	28	28.10	28.10	23.01	1.83	27454	200000	2.982	0.720	6895	3200	18.9	1024	0.104	6923	0.107	22.47	7	450
7	0	Tošić (2017)	RAC28	100	0	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	28	28.10	28.10	28.10	2.22	30339	200000	0.000	0.000	30339	3200	18.9	1024	0.104	5414	0.107	6.23	28	0
8	t	Tošić (2017)	RAC28	100	0	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	28	28.10	28.10	28.10	2.22	30339	200000	2.287	0.720	9230	3200	18.9	1024	0.104	5414	0.107	14.69	28	450
9	0	Tošić (2017)	HVFAC7	0	0.5	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	28	22.60	22.60	18.50	1.44	25527	200000	0.000	0.000	25527	3200	18.9	1024	0.104	4569	0.107	6.13	7	0
10	t	Tošić (2017)	HVFAC7	0	0.5	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	28	22.60	22.60	18.50	1.44	25527	200000	3.723	0.755	5405	3200	18.9	1024	0.104	4569	0.107	12.45	7	450
11	0	Tošić (2017)	HVFAC28	0	0.5	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	28	22.60	22.60	22.60	1.79	28215	200000	0.000	0.000	28215	3200	18.9	1024	0.104	4430	0.107	4.04	28	0
12	t	Tošić (2017)	HVFAC28	0	0.5	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	28	22.60	22.60	22.60	1.79	28215	200000	2.853	0.755	7323	3200	18.9	1024	0.104	4430	0.107	8.72	28	450
13	0	Knaack and Kurama (2015)	UT-0-28	0	0	150	230	397	200	1.32	0	0	0	0.00	deformed	44.3	23	28	32.60	32.60	32.60	2.54	31879	200000	0.000	0.000	31879	3700	18.5	1476	0.104	3013	0.091	0.86	28	0
14	t	Knaack and Kurama (2015)	UT-0-28	0	0	150	230	397	200	1.32	0	0	0	0.00	deformed	44.3	23	28	32.60	32.60	32.60	2.54	31879	200000	1.544	0.404	12531	3700	18.5	1476	0.104	3013	0.091	5.00	28	119
15	0	Knaack and Kurama (2015)	UT-0-7	0	0	150	230	397	200	1.32	0	0	0	0.00	deformed	44.3	23	28	50.30	50.30	39.17	2.97	32508	200000	0.000	0.000	32508	3700	18.5	1476	0.104	3021	0.091	0.74	7	0
16	t	Knaack and Kurama (2015)	UT-0-7	0	0	150	230	397	200	1.32	0	0	0	0.00	deformed	44.3	23	28	50.30	50.30	39.17	2.97	32508	200000	1.557	0.377	12711	3700	18.5	1476	0.104	3021	0.091	4.62	7	119
17	0	Knaack and Kurama (2015)	UC-0-28	0	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	49.30	49.30	49.30	3.58	36592	200000	0.000	0.000	36592	3700	18.5	1476	0.104	3013	0.091	0.66	28	0
18	t	Knaack and Kurama (2015)	UC-0-28	0	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	49.30	49.30	49.30	3.58	36592	200000	1.038	0.378	17952	3700	18.5	1476	0.104	3013	0.091	3.51	28	119
19	0	Knaack and Kurama (2015)	UC-0-7	0	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	42.00	42.00	32.71	2.55	30613	200000	0.000	0.000	30613	3700	18.5	1476	0.104	3021	0.091	0.94	7	0
20	t	Knaack and Kurama (2015)	UC-0-7	0	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	42.00	42.00	32.71	2.55	30613	200000	1.851	0.388	10739	3700	18.5	1476	0.104	3021	0.091	5.11	7	119
21	0	Knaack and Kurama (2015)	CC-0-28	0	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	40.20	40.20	40.20	3.04	34186	200000	0.000	0.000	34186	3700	18.5	1476	0.104	7918	0.091	3.15	28	0
22	t	Knaack and Kurama (2015)	CC-0-28	0	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	40.20	40.20	40.20	3.04	34186	200000	1.261	0.390	15120	3700	18.5	1476	0.104	7918	0.091	10.19	28	119
23	0	Knaack and Kurama (2015)	CC-0-7	0	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	46.50	46.50	36.21	2.78	31667	200000	0.000	0.000	31667	3700	18.5	1476	0.104	7893	0.091	3.40	7	0
24	t	Knaack and Kurama (2015)	CC-0-7	0	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	46.50	46.50	36.21	2.78	31667	200000	1.679	0.381	11821	3700	18.5	1476	0.104	7893	0.091	10.69	7	119
25	0	Knaack and Kurama (2015)	UT-50-28	50	0	150	230	397	200	1.32	0	0	0	0.00	deformed	44.3	23	28	43.60	43.60	43.60	3.25	35124	200000	0.000	0.000	35124	3700	18.5	1476	0.104	3013	0.091	0.91	28	0
26	t	Knaack and Kurama (2015)	UT-50-28	50	0	150	230	397	200	1.32	0	0	0	0.00	deformed	44.3	23	28	43.60	43.60	43.60	3.25	35124	200000	1.167	0.385	16211	3700	18.5	1476	0.104	3013	0.091	5.38	28	119
27	0	Knaack and Kurama (2015)	UT-50-7	50	0	150	230	397	200	1.32	0	0	0	0.00	deformed	44.3	23	28	40.20	40.20	31.31	2.45	30170	200000	0.000	0.000	30170	3700	18.5	1476	0.104	3013	0.091	0.94	7	0
28	t	Knaack and Kurama (2015)	UT-50-7	50	0	150	230	397	200	1.32	0	0	0	0.00	deformed	44.3	23	28	40.20	40.20	31.31	2.45	30170	200000	1.931	0.390	10294	3700	18.5	1476	0.104	3013	0.091	6.96	7	119
29	0	Knaack and Kurama (2015)	UC-50-28	50	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	49.60	49.60	49.60	3.60	36666	200000	0.000	0.000	36666	3700	18.5	1476	0.104	3021	0.091	0.86	28	0
30	t	Knaack and Kurama (2015)	UC-50-28	50	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	49.60	49.60	49.60	3.60	36666	200000	1.032	0.378	18040	3700	18.5	1476	0.104	3021	0.091	4.70	28	119
31	0	Knaack and Kurama (2015)	UC-50-7	50	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	43.60	43.60	33.96	2.63	30999	200000	0.000	0.000	30999	3700	18.5	1476	0.104	3013	0.091	0.84	7	0
32	t	Knaack and Kurama (2015)	UC-50-7	50	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	43.60	43.60	33.96	2.63	30999	200000	1.785	0.385	11129	3700	18.5	1476	0.104	3013	0.091	5.99	7	119
33	0	Knaack and Kurama (2015)	CC-50-28	50	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	37.70	37.70	37.70	2.88	33462	200000	0.000	0.000	33462	3700	18.5	1476	0.104	7893	0.091	4.93	28	0
34	0	Knaack and Kurama (2015)	CC-50-7	50	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	40.00	40.00	31.15	2.44	30118	200000	0.000	0.000	30118	3700	18.5	1476	0.104	7893	0.091	4.14	7	0
35	t	Knaack and Kurama (2015)	CC-50-7	50	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	40.00	40.00	31.15	2.44	30118	200000	1.940	0.391	10243	3700	18.5	1476	0.104	7893	0.091	12.90	7	119
36	0	Knaack and Kurama (2015)	UT-100-28	100	0	150	230	397	200	1.32	0	0	0	0.00	deformed	44.3	23	28	41.40	41.40	41.40	3.11	34523	200000	0.000	0.000	34523	3700	18.5	1476	0.104	3013	0.091	1.24	28	0
37	t	Knaack and Kurama (2015)	UT-100-28	100	0	150	230	397	200	1.32	0	0	0	0.00	deformed	44.3	23	28	41.40	41.40	41.40	3.11	34523	200000	1.226	0.388	15508	3700	18.5	1476	0.104	3013	0.091	7.39	28	119
38	0	Knaack and Kurama (2015)	UT-100-7	100	0	150	230	397	200	1.32	0	0	0	0.00	deformed	44.3	23	28	35.70	35.70	27.80	2.20	28997	200000	0.000	0.000	28997	3700	18.5	1476	0.104	3021	0.091	1.12	7	0
39	0	Knaack and Kurama (2015)	UC-100-28	100	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	48.20	48.20	48.20	3.52	36318	200000	0.000	0.000	36318	3700	18.5	1476	0.104	3021	0.091	0.97	28	0
40	t	Knaack and Kurama (2015)	UC-100-28	100	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	48.20	48.20	48.20	3.52	36318	200000	1.060	0.379	17626	3700	18.5	1476	0.104	3021	0.091	5.94	28	119
41	0	Knaack and Kurama (2015)	UC-100-7	100	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	40.60	40.60	31.62	2.47	30269	200000	0.000	0.000	30269	3700	18.5	1476	0.104	3021	0.091	1.27	7	0
42	t	Knaack and Kurama (2015)	UC-100-7	100	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	40.60	40.60	31.62	2.47	30269	200000	1.913	0.390	10392	3700	18.5	1476	0.104	3021	0.091	7.62	7	119
43	0	Knaack and Kurama (2015)	CC-100-28	100	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	43.80	43.80	43.80	3.26	35177	200000	0.000	0.000	35177	3700	18.5	1476	0.104	7918	0.091	5.11	28	0
44	t	Knaack and Kurama (2015)	CC-100-28	100	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	43.80	43.80	43.80	3.26	35177	200000	1.162	0.385	16274	3700	18.5	1476	0.104	7918	0.091	12.27	28	119
45	0	Knaack and Kurama (2015)	CC-100-7	100	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	38.50	38.50	29.98	2.35	29736	200000	0.000	0.000	29736	3700	18.5	1476	0.104	7918	0.091	4.60	7	0
46	t	Knaack and Kurama (2015)	CC-100-7	100	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	38.50	38.50	29.98	2.35	29736	200000	2.014	0.393	9866	3700	18.5	1476	0.104	7918	0.091	14.68	7	119
47	0	Seara-Paz (2015)	H50-0	0	0	200	300	402	249	0.81	100.6	253	47	0.20	deformed	75	15	28	60.7	60.70	62.97	4.34	39946	200000	0.000	0.000	39946	3400	13.7	2168	0.104	31550	0.101	11.73	42	0
48	t	Seara-Paz (2015)	H50-0	0	0	200	300	402	249	0.81	100.6	253	47	0.20	deformed	75	15	28	60.7	60.70	62.97	4.34	39946	200000	0.867	0.405	21397	3400	13.7	2168	0.104	31550	0.101	18.39	42	1000
49	0	Seara-Paz (2015)	H50-50	50	0	200	300	402	249	0.81	100.6	253	47	0.20	deformed	75	15	28	51.8	51.80	53.74	3.84	37891	200000	0.000	0.000	37891	3400	13.7	2168	0.104	21940	0.101	7.87	42	0
50	t	Seara-Paz (2015)	H50-50	50	0	200	300	402	249	0.81	100.6	253	47	0.20	deformed	75	15	28	51.8	51.80	53.74	3.84	37891	200000	0.994	0.418	19002	3400	13.7	2168	0.104	21940	0.101	14.08	42	1000
51	0	Seara-Paz (2015)	H50-100	100	0	200	300	402	249	0.81	100.6	253	47	0.20	deformed	75	15	28	42.9	42.90	44.50	3.30	35580	200000	0.000	0.000	35580	3400	13.7	2168	0.104	23530	0.101	6.80	42	0
52	t	Seara-Paz (2015)	H50-100	100	0	200	300	402	249	0.81	100.6	253	47	0.20	deformed	75	15	28	42.9	42.90	44.50	3.30	35580	200000	1.171	0.435	16385	3400	13.7	2168	0.104	23530	0.101	15.20	42	1000
53	0	Seara-Paz (2015)	H65-0	0	0	200	300	402	234	0.86	100.6	268	32	0.22	deformed	75	15	28	46.9	46.90	48.65	3.55	36654	200000	0.000	0.000	36654	3400	14.5	2168	0.104	22710	0.101	6.71	42	0
54	t	Seara-Paz (2015)	H65-0	0	0	200	300	402	234	0.86	100.6	268	32	0.22	deformed	75	15	28	46.9	46.90	48.65	3.55	36654	200000	1.083	0.427	17596	3400	14.5	2168	0.104	22710	0.101	11.58	42	1000
55	0	Seara-Paz (2015)	H65-50	50	0	200	300	402	234	0.86	100.6	268	32	0.22	deformed	75	15	28	42.2	42.20	43.78	3.26	35388	200000	0.000	0.000	35388	3400	14.5	2168	0.104	17130	0.101	4.96	42	0
56	t	Seara-Paz (2015)	H65-50	50	0	200	300	402	234	0.86	100.6	268	32	0.22	deformed	75	15	28	42.2	42.20	43.78	3.26	35388	200000	1.188	0.437	16171	3400	14.5	2168	0.104	17130	0.101	9.63	42	1000
57	0	Seara-Paz (2015)	H-65-100	100	0	200	300	402	234	0.86	100.6	268	32	0.22	deformed	75	15	28	32.4	32.40	33.61	2.61	32403	200000	0.000	0.000	32403	3400	14.5	2168	0.104	18100	0.101	4.59	42	0
58	t	Seara-Paz (2015)	H-65-100	100	0	200	300	402	234	0.86	100.6	268	32	0.22	deformed	75	15	28	32.4	32.40	33.61	2.61	32403	200000	1.503	0.461	12948	3400	14.5	2168	0.104	18100	0.101	11.34	42	1000

Applicability of Model Code 2010

Database – NAC, RAC and HVFAC beams – Calculated Deflections

		Study information		Green concrete		Cracking moment						State I				State II								Deflection									
		1	2	3	4	5	6		7		8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
		Author	Specimen	RAC (%)	FA/cm	W_I^* (t_0) (mm^3)	M_{SW} (Nm)		M_{cr} (Nm)		M_{max} (Nm)	M_{max}/M_{cr}	A_I^* (mm^2)	$z_{I,1}^*$ (mm)	I_I^* (mm^4)	S_I^* (mm^3)	A_{II}^* (mm^2)	A_{IIc} (mm^2)	$z_{IIc,1}$ (mm)	$z_{II,1}^*$ (mm)	I_{IIc} (mm^4)	I_{II}^* (mm^4)	S_{II}^* (mm^3)	I_I^*/I_{II}^*	$t-t_0$ (days)	β	α	ζ_s	γ	$a_{simp.}$ (mm)	$a_{simp.}/a_{exp}$	$a_{num.int.}$ (mm)	a_{exp} (mm)	$a_{num.int.}/a_{exp}$
1	0	Tošić (2017)	NAC7	0	0	1155873	1024	<	2289	<	7669	3.350	33517	98.57	113934435	45943	8142	6625	179.3	158.62	946449	21971049	137055	5.186	0	1.000	1.655	0.865	1.000	12.04	1.313	11.51	9.17	1.255
2	t	Tošić (2017)	NAC7	0	0	1155873	1024	<	2289	<	7669	3.350	37680	95.22	133269788	152952	16485	10805	166.23	132.48	4106533	61569046	364573	2.165	450	0.502	1.655	0.932	1.000	22.43	1.184	21.90	18.94	1.156
3	0	Tošić (2017)	NAC28	0	0	1147347	1024	<	2742	<	6877	2.508	33372	98.70	113243127	41715	7729	6357	180.13	160.27	836290	20202862	126173	5.605	0	1.000	1.655	0.782	1.000	9.77	1.205	9.11	8.11	1.123
4	t	Tošić (2017)	NAC28	0	0	1147347	1024	<	2742	<	6877	2.508	36263	96.27	126776262	119277	14068	9805	169.36	138.73	3068190	49745900	300278	2.548	450	0.502	1.655	0.890	1.000	18.96	1.149	18.20	16.51	1.102
5	0	Tošić (2017)	RAC7	100	0	1158301	1024	<	2120	<	7947	3.749	33558	98.53	114127386	47112	8253	6695	179.08	158.16	976901	22456637	140011	5.082	0	1.000	1.655	0.888	1.000	12.80	1.176	12.33	10.89	1.132
6	t	Tošić (2017)	RAC7	100	0	1158301	1024	<	2120	<	7947	3.749	38208	94.85	135672319	164890	17330	11122	165.25	130.52	4477906	65712062	386334	2.065	450	0.502	1.655	0.944	1.000	23.77	1.058	23.30	22.47	1.037
7	0	Tošić (2017)	RAC28	100	0	1149668	1024	<	2552	<	6438	2.523	33410	98.66	113426233	42830	7840	6430	179.91	159.84	865435	20676848	129110	5.486	0	1.000	1.655	0.784	1.000	9.22	1.480	8.59	6.23	1.379
8	t	Tošić (2017)	RAC28	100	0	1149668	1024	<	2552	<	6438	2.523	36637	95.99	128500857	128457	14731	10094	168.46	136.93	3347903	52993061	318311	2.425	450	0.502	1.655	0.891	1.000	18.48	1.258	17.74	14.69	1.208
9	0	Tošić (2017)	HVFAC7	0	0.5	1165265	1024	<	1678	<	5593	3.333	33676	98.42	114685423	50487	8571	6895	178.45	156.91	1067135	23843479	148494	4.81	0	1.000	1.655	0.864	1.000	8.93	1.457	8.55	6.13	1.394
10	t	Tošić (2017)	HVFAC7	0	0.5	1165265	1024	<	1678	<	5593	3.333	39918	93.71	143375493	201278	19913	11995	162.52	125.05	5617893	78294775	449428	1.831	450	0.502	1.655	0.931	1.000	19.22	1.544	18.77	12.45	1.508
11	0	Tošić (2017)	HVFAC28	0	0.5	1155873	1024	<	2069	<	5454	2.636	33517	98.57	113934435	45943	8142	6625	179.3	158.62	946449	21971049	137055	5.186	0	1.000	1.655	0.799	1.000	8.03	1.989	7.53	4.04	1.863
12	t	Tošić (2017)	HVFAC28	0	0.5	1155873	1024	<	2069	<	5454	2.636	37844	95.10	134019888	156688	16749	10905	165.92	131.86	4221663	62874449	371526	2.132	450	0.502	1.655	0.899	1.000	17.47	2.003	16.83	8.72	1.930
13	0	Knaack and Kurama (2015)	UT-0-28	0	0	1545220	1476	<	3925	<	4489	1.144	36989	109.28	168861637	197343	12470	9981	196.73	163.45	3682633	59066915	332182	2.859	0	1.000	1.799	0.215	0.893	1.36	1.582	1.27	0.86	1.471
14	t	Knaack and Kurama (2015)	UT-0-28	0	0	1545220	1476	<	3925	<	4489	1.144	40836	101.81	190762994	454997	20499	14163	182.79	135.56	10522090	112717948	668841	1.692	119	0.544	1.799	0.573	0.893	5.78	1.157	5.55	5.00	1.110
15	0	Knaack and Kurama (2015)	UT-0-7	0	0	1541066	1476	<	4577	>	4497	0.983	36942	109.38	168561819	193810	12348	9906	196.98	163.96	3600238	58215254	327070	2.895	0	1.000	1.799	0.000	0.845	1.07	1.446	1.07	0.74	1.449
16	t	Knaack and Kurama (2015)	UT-0-7	0	0	1541066	1476	<	4577	>	4497	0.983	40745	101.97	190291064	449439	20339	14094	183.02	136.04	10369052	111695858	662200	1.704	119	0.544	1.799	0.439	0.845	4.82	1.044	4.85	4.62	1.050
17	0	Knaack and Kurama (2015)	UC-0-28	0	0	1547114	1476	<	5539	>	4489	0.810	37448	111.83	173013814	109216	12080	9132	199.56	169.11	2820551	54052647	278096	3.201	0	1.000	1.799	0.000	0.793	0.92	1.394	0.93	0.66	1.403
18	t	Knaack and Kurama (2015)	UC-0-28	0	0	1547114	1476	<	5539	>	4489	0.810	40504	109.04	194030309	205673	17764	11760	190.8	151.59	6023629	93194906	461163	2.082	119	0.544	1.799	0.206	0.793	2.59	0.737	2.68	3.51	0.763
19	0	Knaack and Kurama (2015)	UC-0-7	0	0	1590494	1476	<	4056	<	4497	1.109	38020	111.28	176990206	128445	13276	9756	197.48	164.95	3439154	62113784	317345	2.849	0	1.000	1.799	0.169	0.883	1.25	1.334	1.21	0.94	1.287
20	t	Knaack and Kurama (2015)	UC-0-7	0	0	1590494	1476	<	4056	<	4497	1.109	44536	105.94	220941567	312661	23833	13797	184.01	138.02	9727253	135320005	634621	1.633	119	0.544	1.799	0.548	0.883	4.82	0.944	4.63	5.11	0.905
21	0	Knaack and Kurama (2015)	CC-0-28	0	0	1562680	1476	<	4751	<	9394	1.977	37653	111.63	174442008	116173	12519	9366	198.78	167.55	3042977	56993247	292497	3.061	0	1.000	1.799	0.707	1.000	4.93	1.564	4.23	3.15	1.342
22	t	Knaack and Kurama (2015)	CC-0-28	0	0	1562680	1476	<	4751	<	9394	1.977	41631	108.11	201633512	237628	19566	12435	188.55	147.09	7121535	105765226	515593	1.906	119	0.544	1.799	0.841	1.000	9.78	0.959	8.89	10.19	0.873
23	0	Knaack and Kurama (2015)	CC-0-7	0	0	1581868	1476	<	4398	<	9369	2.130	37906	111.39	176204280	124689	13045	9639	197.87	165.74	3316898	60550896	309831	2.91	0	1.000	1.799	0.743	1.000	5.18	1.524	4.53	3.40	1.333
24	t	Knaack and Kurama (2015)	CC-0-7	0	0	1581868	1476	<	4398	<	9369	2.130	43620	106.59	214895201	290043	22536	13416	185.28	140.56	8943456	126370899	599845	1.701	119	0.544	1.799	0.861	1.000	10.32	0.965	9.58	10.69	0.896
25	0	Knaack and Kurama (2015)	UT-50-28	50	0	1524916	1476	<	4956	>	4489	0.906	36759	109.78	167405317	180217	11859	9600	198	166	3276800	54888369	307214	3.05	0	1.000	1.799	0.000	0.822	1.00	1.099	1.00	0.91	1.096
26	t	Knaack and Kurama (2015)	UT-50-28	50	0	1524916	1476	<	4956	>	4489	0.906	39399	104.43	183081500	364631	17829	12930	186.9	143.79	8006299	95469140	557455	1.918	119	0.544	1.799	0.350	0.822	3.95	0.734	3.97	5.38	0.739
27	0	Knaack and Kurama (2015)	UT-50-7	50	0	1557685	1476	<	3816	<	4489	1.176	37132	108.98	169756476	207884	12838	10206	195.98	161.95	3937340	61583453	347307	2.757	0	1.000	1.799	0.253	0.903	1.49	1.584	1.37	0.94	1.455
28	t	Knaack and Kurama (2015)	UT-50-7	50	0	1557685	1476	<	3816	<	4489	1.176	42214	99.47	197635230	535871	22852	15138	179.54	129.06	12848184	127117034	764120	1.555	119	0.544	1.799	0.594	0.903	6.27	0.901	6.11	6.96	0.878
29	0	Knaack and Kurama (2015)	UC-50-28	50	0	1546303	1476	<	5567	>	4497	0.808	37438	111.84	172938561	108846	12058	9120	199.6	169.19	2809446	53896204	277315	3.209	0	1.000	1.799	0.000	0.792	0.92	1.070	0.93	0.86	1.077
30	t	Knaack and Kurama (2015)	UC-50-28	50	0	1546303	1476	<	5567	>	4497	0.808	40478	109.06	193847538	204869	17723	11745	190.85	151.7	6000609	92884573	459750	2.087	119	0.544	1.799	0.202	0.792	2.57	0.546	2.66	4.70	0.567
31	0	Knaack and Kurama (2015)	UC-50-7	50	0	1587234	1476	<	4174	<	4489	1.075	37977	111.32	176690912	127010	13188	9711	197.63	165.24	3391783	61520278	314466	2.872	0	1.000	1.799	0.123	0.873	1.15	1.366	1.15	0.84	1.372
32	t	Knaack and Kurama (2015)	UC-50-7	50	0	1587234	1476	<	4174	<	4489	1.075	44186	106.18	218634168	304071	23342	13656	184.48	138.96	9432064	131933664	621572	1.657	119	0.544	1.799	0.523	0.873	4.62	0.771	4.46	5.99	0.744
33	0	Knaack and Kurama (2015)	CC-50-28	50	0	1568034	1476	<	4516	<	9369	2.075	37723	111.56	174929904	118529	12667	9444	198.52	167.04	3119638	57985802	297353	3.017	0	1.000	1.799	0.731	1.000	5.04	1.023	4.38	4.93	0.888
34	0	Knaack and Kurama (2015)	CC-50-7	50	0	1595051	1476	<	3892	<	9369	2.407	38079	111.22	177401523	130394	13395	9816	197.28	164.55	3502998	62926144	321259	2.819	0	1.000	1.799	0.794	1.000	5.46	1.319	4.91	4.14	1.185
35	t	Knaack and Kurama (2015)	CC-50-7	50	0	1595051	1476	<	3892	<	9369	2.407	45027	105.60	224162968	324362	24516	13989	183.37	136.74	10139026	139992129	652163	1.601	119	0.544	1.799	0.888	1.000	10.85	0.841	10.24	12.90	0.794
36	0	Knaack and Kurama (2015)	UT-100-28	100	0	1528468	1476	<	4754	>	4489	0.944	36799	109.69	167657706	183178	11965	9666	197.78	165.54	3344850	55620203	311556	3.014	0	1.000	1.799	0.000	0.833	1.01	0.815	1.01	1.24	0.817
37	t	Knaack and Kurama (2015)	UT-100-28	100	0	1528468	1476	<	4754	>	4489	0.944	39621	104.01	184306232	379027	18261	13140	186.2	142.4	8402767	98312344	575634	1.875	119	0.544	1.799	0.397	0.833	4.27	0.578	4.25	7.39	0.574
38	0	Knaack and Kurama (2015)	UT-100-7	100	0	1567109	1476	<	3448	<	4497	1.304	37239	108.75	170423096	215720	13107	10368	195.44	160.87	4127824	63434337	358492	2.687	0	1.000	1.799	0.380	0.941	1.84	1.639	1.59	1.12	1.423
39	0	Knaack and Kurama (2015)	UC-100-28	100	0	1548737	1476	<	5452	>	4497	0.825	37470	111.81	173164294	109955	12129	9159	199.47	168.94	2845643	54365020	279625	3.185	0	1.000	1.799	0.000	0.797	0.93	0.959	0.93	0.97	0.963
40	t	Knaack and Kurama (2015)	UC-100-28	100	0	1548737	1476	<	5452	>	4497	0.825	40618	108.94	194797491	208938	17953	11835	190.55	151.1	6139613	94493069	466858	2.062	119	0.544	1.799	0.231	0.797	2.71	0.457	2.77	5.94	0.467
41	0	Knaack and Kurama (2015)	UC-100-7	100	0	1593756	1476	<	3937	<	4497	1.142	38063	111.24	177289371	129876	13364	9801	197.33	164.66	3486964	62705015	320200	2.827	0	1.000	1.799	0.213	0.893	1.35	1.065	1.27	1.27	0.997
42	t	Knaack and Kurama (2015)	UC-100-7	100	0	1593756	1476	<	3937	<	4497	1.142	44876	105.70	223172864	320749	24305	13929	183.57	137.13	10009124	138562820	646859	1.611	119	0.544	1.799	0.572	0.893	5.00	0.656	4.78	7.62	0.627
43	0	Knaack and Kurama (2015)	CC-100-28	100	0	1556042	1476	<	5073	<	9394	1.852	37567	111.72	173841035	113271	12337	9270	199.1	168.19	2950363	55762360	286460	3.118	0	1.000	1.799	0.670	1.000	4.73	0.926	3.99	5.11	0.781
44	t	Knaack and Kurama (2015)	CC-100-28	100	0	1556042	1476	<	5073	<	9394	1.852	41124	108.52	198222607	223460	18771	12147	189.51	149.03	6638093	100204612	491811	1.978	119	0.544	1.799	0.821	1.000	9.47	0.772	8.50	12.27	0.693
45	0	Knaack and Kurama (2015)	CC-100-7	100	0	1598650	1476	<	3757	<	9394	2.500	38127	111.18	177737874	132016	13491	9864	197.12	164.23	3554638	63587653	324453	2.795	0	1.000	1.799	0.808	1.000	5.55	1.206	5.02	4.60	1.091
46	t	Knaack and Kurama (2015)	CC-100-7	100	0	1598650	1476	<	3757	<	9394	2.500	45426	105.33	226775073	333702	25062	14136	182.88	135.75	10462027	143735628	666057	1.578	119	0.544	1.799	0.895	1.000	11.01	0.750	10.44	14.68	0.711
47	0	Seara-Paz (2015)	H50-0	0	0	3215514	2168	<	13955	<	33718	2.416	62518	147.64	474738526	141533	14709	12191	269.52	239.03	3774688	86412536	371655	5.494	0	1.000	1.712	0.779	1.000	9.37	0.798	8.47	11.73	0.722
48	t	Seara-Paz (2015)	H50-0	0	0	3215514	2168	<	13955	<	33718	2.416	64699	145.75	495647139	255256	20346	15647	260.88	221.75	7981147	142444736	612404	3.48	1000	0.500	1.712	0.890	1.000	14.20	0.772	13.41	18.39	0.729
49	0	Seara-Paz (2015)	H50-50	50	0	3227039	2168	<	12392	<	24108	1.945	62654	147.52	476052819	148842	15114	12460	268.85	237.69	4030034	90230435	388129	5.276	0	1.000	1.712	0.680	1.000	6.11	0.776	5.33	7.87	0.678
50	t	Seara-Paz (2015)	H50-50	50	0	3227039	2168	<	12392	<	24108	1.945	65292	145.25	501255035	284824	21666	16374	259.06	218.12	9146232	156104739	670480	3.211	1000	0.500	1.712	0.840	1.000	10.71	0.760	9.88	14.08	0.702
51	0	Seara-Paz (2015)	H50-100	100	0	3241536	2168	<	10697	<	25698	2.402	62825	147.37	477705225	158003	15609	12784	268.04	236.07	4352356	94961702	408546	5.031	0	1.000	1.712	0.777	1.000	7.31	1.075	6.63	6.80	0.975
52	t	Seara-Paz (2015)	H50-100	100	0	3241536	2168	<	10697	<	25698	2.402	66137	144.57	509185513	326093	23443	17306	256.74	213.46	10797202	174683624	748854	2.915	1000	0.500	1.712	0.889	1.000	12.18	0.801	11.52	15.20	0.758
53	0	Seara-Paz (2015)	H65-0	0	0	3193380	2168	<	11336	<	24878	2.195	62744	148.09	472907657	114317	14832	12088	269.78	239.56	3680184	81281540	365329	5.818	0	1.000	1.723	0.742	1.000	7.68	1.145	6.84	6.71	1.019
54	t	Seara-Paz (2015)	H65-0	0	0	3193380	2168	<	11336	<	24878	2.195	65715	146.21	497234448	227313	21795	16080	259.8	219.58	8662750	145165428	646590	3.425	1000	0.500	1.723	0.871	1.000	12.79	1.104	11.95	11.58	1.032
55	0	Seara-Paz (2015)	H65-50	50	0	3200007	2168	<	10432	<	19298	1.850	62840	148.03	473696976	118125	15097	12257	269.36	238.71	3836214	83588366	375628	5.667	0	1.000	1.723	0.654	1.000	5.46	1.101	4.70	4.96	0.947
56	t	Seara-Paz (2015)	H65-50	50	0	3200007	2168	<	10432	<	19298	1.850	66217	145.91	501306969	245440	22803	16586	258.54	217.07	9505555	154745965	687853	3.24	1000	0.500	1.723	0.827	1.000	10.32	1.072	9.45	9.63	0.981
57	0	Seara-Paz (2015)	H-65-100	100	0	3218278	2168	<	8400	<	20268	2.413	63101	147.86	475854659	128469	15803	12702	268.25	236.5	4268997	89793402	403346	5.299	0	1.000	1.723	0.781	1.000	6.71	1.462	6.08	4.59	1.325
58	t	Seara-Paz (2015)	H-65-100	100	0	3218278	2168	<	8400	<	20268	2.413	67765	145.01	513776774	299564	25722	17957	255.11	210.23	12063455	182620843	806008	2.813	1000	0.500	1.723	0.890	1.000	11.99	1.057	11.33	11.34	0.999

Applicability of Model Code 2010

Database – NAC, RAC and HVFAC beams – RAC Corrections

		Study information		Green concrete		Cross-section					Reinforcement										Mechanical properties								Loading					Deflection	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
		Author	Specimen	RAC (%)	FA/cm	b (mm)	h (mm)	A_{s1} (mm^2)	d (mm)	ρ_1 (%)	A_{s2} (mm^2)	d' (mm)	d_2 (mm)	ρ_2 (%)	type	RH (%)	T (°C)	t_{test} (days)	$f_{cm}(t_{test})$ (MPa)	f_{cm} (MPa)	f_{cm} (t_0) (MPa)	$f_{ctm}(t_0)$ (MPa)	$E_{cm}(t_0)$ (MPa)	E_s (MPa)	φ (–)	ε_{cs} (‰)	$E_{c,eff}$ (MPa)	L (mm)	L/d	M_{L1} (Nm)	K_{L1}	M_{L2} (Nm)	K_{L2}	a (t-t_0) (mm)	t_0 (days)	t-t_0 (days)
1	0	Tošić (2017)	NAC7	0	0	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	28	30.50	30.50	24.97	1.98	28212	200000	0.000	0.000	28212	3200	18.9	1024	0.104	6645	0.107	9.17	7	0
2	t	Tošić (2017)	NAC7	0	0	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	28	30.50	30.50	24.97	1.98	28212	200000	2.744	0.705	7535	3200	18.9	1024	0.104	6645	0.107	18.94	7	450
3	0	Tošić (2017)	NAC28	0	0	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	28	30.50	30.50	30.50	2.39	31180	200000	0.000	0.000	31180	3200	18.9	1024	0.104	5853	0.107	8.11	28	0
4	t	Tošić (2017)	NAC28	0	0	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	28	30.50	30.50	30.50	2.39	31180	200000	2.105	0.705	10042	3200	18.9	1024	0.104	5853	0.107	16.51	28	450
5	0	Tošić (2017)	RAC7	100	0	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	28	28.10	28.10	23.01	1.83	22513	200000	0.000	0.000	22513	3200	18.9	1024	0.104	6923	0.107	10.89	7	0
6	t	Tošić (2017)	RAC7	100	0	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	28	28.10	28.10	23.01	1.83	22513	200000	4.481	1.063	4107	3200	18.9	1024	0.104	6923	0.107	22.47	7	450
7	0	Tošić (2017)	RAC28	100	0	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	28	28.10	28.10	28.10	2.22	24878	200000	0.000	0.000	24878	3200	18.9	1024	0.104	5414	0.107	6.23	28	0
8	t	Tošić (2017)	RAC28	100	0	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	28	28.10	28.10	28.10	2.22	24878	200000	3.706	1.063	5286	3200	18.9	1024	0.104	5414	0.107	14.69	28	450
9	0	Tošić (2017)	HVFAC7	0	0.5	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	28	22.60	22.60	18.50	1.44	25527	200000	0.000	0.000	25527	3200	18.9	1024	0.104	4569	0.107	6.13	7	0
10	t	Tošić (2017)	HVFAC7	0	0.5	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	28	22.60	22.60	18.50	1.44	25527	200000	3.723	0.755	5405	3200	18.9	1024	0.104	4569	0.107	12.45	7	450
11	0	Tošić (2017)	HVFAC28	0	0.5	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	28	22.60	22.60	22.60	1.79	28215	200000	0.000	0.000	28215	3200	18.9	1024	0.104	4430	0.107	4.04	28	0
12	t	Tošić (2017)	HVFAC28	0	0.5	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	28	22.60	22.60	22.60	1.79	28215	200000	2.853	0.755	7323	3200	18.9	1024	0.104	4430	0.107	8.72	28	450
13	0	Knaack and Kurama (2015)	UT-0-28	0	0	150	230	397	200	1.32	0	0	0	0.00	deformed	44.3	23	28	32.60	32.60	32.60	2.54	31879	200000	0.000	0.000	31879	3700	18.5	1476	0.104	3013	0.091	0.86	28	0
14	t	Knaack and Kurama (2015)	UT-0-28	0	0	150	230	397	200	1.32	0	0	0	0.00	deformed	44.3	23	28	32.60	32.60	32.60	2.54	31879	200000	1.544	0.404	12531	3700	18.5	1476	0.104	3013	0.091	5.00	28	119
15	0	Knaack and Kurama (2015)	UT-0-7	0	0	150	230	397	200	1.32	0	0	0	0.00	deformed	44.3	23	28	50.30	50.30	39.17	2.97	32508	200000	0.000	0.000	32508	3700	18.5	1476	0.104	3021	0.091	0.74	7	0
16	t	Knaack and Kurama (2015)	UT-0-7	0	0	150	230	397	200	1.32	0	0	0	0.00	deformed	44.3	23	28	50.30	50.30	39.17	2.97	32508	200000	1.557	0.377	12711	3700	18.5	1476	0.104	3021	0.091	4.62	7	119
17	0	Knaack and Kurama (2015)	UC-0-28	0	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	49.30	49.30	49.30	3.58	36592	200000	0.000	0.000	36592	3700	18.5	1476	0.104	3013	0.091	0.66	28	0
18	t	Knaack and Kurama (2015)	UC-0-28	0	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	49.30	49.30	49.30	3.58	36592	200000	1.038	0.378	17952	3700	18.5	1476	0.104	3013	0.091	3.51	28	119
19	0	Knaack and Kurama (2015)	UC-0-7	0	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	42.00	42.00	32.71	2.55	30613	200000	0.000	0.000	30613	3700	18.5	1476	0.104	3021	0.091	0.94	7	0
20	t	Knaack and Kurama (2015)	UC-0-7	0	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	42.00	42.00	32.71	2.55	30613	200000	1.851	0.388	10739	3700	18.5	1476	0.104	3021	0.091	5.11	7	119
21	0	Knaack and Kurama (2015)	CC-0-28	0	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	40.20	40.20	40.20	3.04	34186	200000	0.000	0.000	34186	3700	18.5	1476	0.104	7918	0.091	3.15	28	0
22	t	Knaack and Kurama (2015)	CC-0-28	0	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	40.20	40.20	40.20	3.04	34186	200000	1.261	0.390	15120	3700	18.5	1476	0.104	7918	0.091	10.19	28	119
23	0	Knaack and Kurama (2015)	CC-0-7	0	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	46.50	46.50	36.21	2.78	31667	200000	0.000	0.000	31667	3700	18.5	1476	0.104	7893	0.091	3.40	7	0
24	t	Knaack and Kurama (2015)	CC-0-7	0	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	46.50	46.50	36.21	2.78	31667	200000	1.679	0.381	11821	3700	18.5	1476	0.104	7893	0.091	10.69	7	119
25	0	Knaack and Kurama (2015)	UT-50-28	50	0	150	230	397	200	1.32	0	0	0	0.00	deformed	44.3	23	28	43.60	43.60	43.60	3.25	31260	200000	0.000	0.000	31260	3700	18.5	1476	0.104	3013	0.091	0.91	28	0
26	t	Knaack and Kurama (2015)	UT-50-28	50	0	150	230	397	200	1.32	0	0	0	0.00	deformed	44.3	23	28	43.60	43.60	43.60	3.25	31260	200000	1.932	0.527	10662	3700	18.5	1476	0.104	3013	0.091	5.38	28	119
27	0	Knaack and Kurama (2015)	UT-50-7	50	0	150	230	397	200	1.32	0	0	0	0.00	deformed	44.3	23	28	40.20	40.20	31.31	2.45	26851	200000	0.000	0.000	26851	3700	18.5	1476	0.104	3013	0.091	0.94	7	0
28	t	Knaack and Kurama (2015)	UT-50-7	50	0	150	230	397	200	1.32	0	0	0	0.00	deformed	44.3	23	28	40.20	40.20	31.31	2.45	26851	200000	2.586	0.541	7487	3700	18.5	1476	0.104	3013	0.091	6.96	7	119
29	0	Knaack and Kurama (2015)	UC-50-28	50	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	49.60	49.60	49.60	3.60	33000	200000	0.000	0.000	33000	3700	18.5	1476	0.104	3021	0.091	0.86	28	0
30	t	Knaack and Kurama (2015)	UC-50-28	50	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	49.60	49.60	49.60	3.60	33000	200000	1.686	0.499	12286	3700	18.5	1476	0.104	3021	0.091	4.70	28	119
31	0	Knaack and Kurama (2015)	UC-50-7	50	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	43.60	43.60	33.96	2.63	27589	200000	0.000	0.000	27589	3700	18.5	1476	0.104	3013	0.091	0.84	7	0
32	t	Knaack and Kurama (2015)	UC-50-7	50	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	43.60	43.60	33.96	2.63	27589	200000	2.345	0.527	8247	3700	18.5	1476	0.104	3013	0.091	5.99	7	119
33	0	Knaack and Kurama (2015)	CC-50-28	50	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	37.70	37.70	37.70	2.88	29781	200000	0.000	0.000	29781	3700	18.5	1476	0.104	7893	0.091	4.93	28	0
34	0	Knaack and Kurama (2015)	CC-50-7	50	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	40.00	40.00	31.15	2.44	26805	200000	0.000	0.000	26805	3700	18.5	1476	0.104	7893	0.091	4.14	7	0
35	t	Knaack and Kurama (2015)	CC-50-7	50	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	40.00	40.00	31.15	2.44	26805	200000	2.600	0.542	7446	3700	18.5	1476	0.104	7893	0.091	12.90	7	119
36	0	Knaack and Kurama (2015)	UT-100-28	100	0	150	230	397	200	1.32	0	0	0	0.00	deformed	44.3	23	28	41.40	41.40	41.40	3.11	28999	200000	0.000	0.000	28999	3700	18.5	1476	0.104	3013	0.091	1.24	28	0
37	t	Knaack and Kurama (2015)	UT-100-28	100	0	150	230	397	200	1.32	0	0	0	0.00	deformed	44.3	23	28	41.40	41.40	41.40	3.11	28999	200000	2.200	0.590	9063	3700	18.5	1476	0.104	3013	0.091	7.39	28	119
38	0	Knaack and Kurama (2015)	UT-100-7	100	0	150	230	397	200	1.32	0	0	0	0.00	deformed	44.3	23	28	35.70	35.70	27.80	2.20	24067	200000	0.000	0.000	24067	3700	18.5	1476	0.104	3021	0.091	1.12	7	0
39	0	Knaack and Kurama (2015)	UC-100-28	100	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	48.20	48.20	48.20	3.52	30870	200000	0.000	0.000	30870	3700	18.5	1476	0.104	3021	0.091	0.97	28	0
40	t	Knaack and Kurama (2015)	UC-100-28	100	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	48.20	48.20	48.20	3.52	30870	200000	1.863	0.553	10783	3700	18.5	1476	0.104	3021	0.091	5.94	28	119
41	0	Knaack and Kurama (2015)	UC-100-7	100	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	40.60	40.60	31.62	2.47	25426	200000	0.000	0.000	25426	3700	18.5	1476	0.104	3021	0.091	1.27	7	0
42	t	Knaack and Kurama (2015)	UC-100-7	100	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	40.60	40.60	31.62	2.47	25426	200000	2.744	0.593	6792	3700	18.5	1476	0.104	3021	0.091	7.62	7	119
43	0	Knaack and Kurama (2015)	CC-100-28	100	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	43.80	43.80	43.80	3.26	29901	200000	0.000	0.000	29901	3700	18.5	1476	0.104	7918	0.091	5.11	28	0
44	t	Knaack and Kurama (2015)	CC-100-28	100	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	43.80	43.80	43.80	3.26	29901	200000	2.081	0.574	9704	3700	18.5	1476	0.104	7918	0.091	12.27	28	119
45	0	Knaack and Kurama (2015)	CC-100-7	100	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	38.50	38.50	29.98	2.35	24978	200000	0.000	0.000	24978	3700	18.5	1476	0.104	7918	0.091	4.60	7	0
46	t	Knaack and Kurama (2015)	CC-100-7	100	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	38.50	38.50	29.98	2.35	24978	200000	2.916	0.596	6379	3700	18.5	1476	0.104	7918	0.091	14.68	7	119
47	0	Seara-Paz (2015)	H50-0	0	0	200	300	402	249	0.81	100.6	253	47	0.20	deformed	75	15	28	60.7	60.70	62.97	4.34	39946	200000	0.000	0.000	39946	3400	13.7	2168	0.104	31550	0.101	11.73	42	0
48	t	Seara-Paz (2015)	H50-0	0	0	200	300	402	249	0.81	100.6	253	47	0.20	deformed	75	15	28	60.7	60.70	62.97	4.34	39946	200000	0.867	0.405	21397	3400	13.7	2168	0.104	31550	0.101	18.39	42	1000
49	0	Seara-Paz (2015)	H50-50	50	0	200	300	402	249	0.81	100.6	253	47	0.20	deformed	75	15	28	51.8	51.80	53.74	3.84	34102	200000	0.000	0.000	34102	3400	13.7	2168	0.104	21940	0.101	7.87	42	0
50	t	Seara-Paz (2015)	H50-50	50	0	200	300	402	249	0.81	100.6	253	47	0.20	deformed	75	15	28	51.8	51.80	53.74	3.84	34102	200000	1.473	0.418	13788	3400	13.7	2168	0.104	21940	0.101	14.08	42	1000
51	0	Seara-Paz (2015)	H50-100	100	0	200	300	402	249	0.81	100.6	253	47	0.20	deformed	75	15	28	42.9	42.90	44.50	3.30	29887	200000	0.000	0.000	29887	3400	13.7	2168	0.104	23530	0.101	6.80	42	0
52	t	Seara-Paz (2015)	H50-100	100	0	200	300	402	249	0.81	100.6	253	47	0.20	deformed	75	15	28	42.9	42.90	44.50	3.30	29887	200000	1.896	0.457	10319	3400	13.7	2168	0.104	23530	0.101	15.20	42	1000
53	0	Seara-Paz (2015)	H65-0	0	0	200	300	402	234	0.86	100.6	268	32	0.22	deformed	75	15	28	46.9	46.90	48.65	3.55	36654	200000	0.000	0.000	36654	3400	14.5	2168	0.104	22710	0.101	6.71	42	0
54	t	Seara-Paz (2015)	H65-0	0	0	200	300	402	234	0.86	100.6	268	32	0.22	deformed	75	15	28	46.9	46.90	48.65	3.55	36654	200000	1.083	0.427	17596	3400	14.5	2168	0.104	22710	0.101	11.58	42	1000
55	0	Seara-Paz (2015)	H65-50	50	0	200	300	402	234	0.86	100.6	268	32	0.22	deformed	75	15	28	42.2	42.20	43.78	3.26	31495	200000	0.000	0.000	31495	3400	14.5	2168	0.104	17130	0.101	4.96	42	0
56	t	Seara-Paz (2015)	H65-50	50	0	200	300	402	234	0.86	100.6	268	32	0.22	deformed	75	15	28	42.2	42.20	43.78	3.26	31495	200000	1.792	0.437	11281	3400	14.5	2168	0.104	17130	0.101	9.63	42	1000
57	0	Seara-Paz (2015)	H-65-100	100	0	200	300	402	234	0.86	100.6	268	32	0.22	deformed	75	15	28	32.4	32.40	33.61	2.61	26894	200000	0.000	0.000	26894	3400	14.5	2168	0.104	18100	0.101	4.59	42	0
58	t	Seara-Paz (2015)	H-65-100	100	0	200	300	402	234	0.86	100.6	268	32	0.22	deformed	75	15	28	32.4	32.40	33.61	2.61	26894	200000	2.438	0.504	7822	3400	14.5	2168	0.104	18100	0.101	11.34	42	1000

Applicability of Model Code 2010

Database – NAC, RAC and HVFAC beams – Calculated Deflections with RAC Corrections

		Study information		Green concrete		Cross-section		Reinforcement								Mechanical properties												Loading						Deflection		
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
		Author	Specimen	RAC (%)	FA/cm	b (mm)	h (mm)	A_{s1} (mm^2)	d (mm)	ρ_1 (%)	A_{s2} (mm^2)	d' (mm)	d_2 (mm)	ρ_2 (%)	type	RH (%)	T (ºC)	t_{test} (days)	$f_{cm}(t_{test})$ (MPa)	f_{cm} (MPa)	f_{cm} (t_0) (MPa)	$f_{ctm}(t_0)$ (MPa)	$E_{cm}(t_0)$ (MPa)	E_s (MPa)	φ (–)	ε_{cs} (‰)	$E_{c,eff}$ (MPa)	L (mm)	L/d	M_{L1} (Nm)	K_{L1}	M_{L2} (Nm)	K_{L2}	a (t-t_0) (mm)	t_0 (days)	t-t_0 (days)
1	0	Tošić (2017)	NAC7	0	0	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	28	30.50	30.50	24.97	1.98	28212	200000	0.000	0.000	28212	3200	18.9	1024	0.104	6645	0.107	9.17	7	0
2	t	Tošić (2017)	NAC7	0	0	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	28	30.50	30.50	24.97	1.98	28212	200000	2.744	0.705	7535	3200	18.9	1024	0.104	6645	0.107	18.94	7	450
3	0	Tošić (2017)	NAC28	0	0	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	28	30.50	30.50	30.50	2.39	31180	200000	0.000	0.000	31180	3200	18.9	1024	0.104	5853	0.107	8.11	28	0
4	t	Tošić (2017)	NAC28	0	0	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	28	30.50	30.50	30.50	2.39	31180	200000	2.105	0.705	10042	3200	18.9	1024	0.104	5853	0.107	16.51	28	450
5	0	Tošić (2017)	RAC7	100	0	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	28	28.10	28.10	23.01	1.83	22513	200000	0.000	0.000	22513	3200	18.9	1024	0.104	6923	0.107	10.89	7	0
6	t	Tošić (2017)	RAC7	100	0	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	28	28.10	28.10	23.01	1.83	22513	200000	4.481	1.063	4107	3200	18.9	1024	0.104	6923	0.107	22.47	7	450
7	0	Tošić (2017)	RAC28	100	0	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	28	28.10	28.10	28.10	2.22	24878	200000	0.000	0.000	24878	3200	18.9	1024	0.104	5414	0.107	6.23	28	0
8	t	Tošić (2017)	RAC28	100	0	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	28	28.10	28.10	28.10	2.22	24878	200000	3.706	1.063	5286	3200	18.9	1024	0.104	5414	0.107	14.69	28	450
9	0	Tošić (2017)	HVFAC7	0	0.5	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	28	22.60	22.60	18.50	1.44	25527	200000	0.000	0.000	25527	3200	18.9	1024	0.104	4569	0.107	6.13	7	0
10	t	Tošić (2017)	HVFAC7	0	0.5	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	28	22.60	22.60	18.50	1.44	25527	200000	3.723	0.755	5405	3200	18.9	1024	0.104	4569	0.107	12.45	7	450
11	0	Tošić (2017)	HVFAC28	0	0.5	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	28	22.60	22.60	22.60	1.79	28215	200000	0.000	0.000	28215	3200	18.9	1024	0.104	4430	0.107	4.04	28	0
12	t	Tošić (2017)	HVFAC28	0	0.5	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	28	22.60	22.60	22.60	1.79	28215	200000	2.853	0.755	7323	3200	18.9	1024	0.104	4430	0.107	8.72	28	450
13	0	Knaack and Kurama (2015)	UT-0-28	0	0	150	230	397	200	1.32	0	0	0	0.00	deformed	44.3	23	28	32.60	32.60	32.60	2.54	31879	200000	0.000	0.000	31879	3700	18.5	1476	0.104	3013	0.091	0.86	28	0
14	t	Knaack and Kurama (2015)	UT-0-28	0	0	150	230	397	200	1.32	0	0	0	0.00	deformed	44.3	23	28	32.60	32.60	32.60	2.54	31879	200000	1.544	0.404	12531	3700	18.5	1476	0.104	3013	0.091	5.00	28	119
15	0	Knaack and Kurama (2015)	UT-0-7	0	0	150	230	397	200	1.32	0	0	0	0.00	deformed	44.3	23	28	50.30	50.30	39.17	2.97	32508	200000	0.000	0.000	32508	3700	18.5	1476	0.104	3021	0.091	0.74	7	0
16	t	Knaack and Kurama (2015)	UT-0-7	0	0	150	230	397	200	1.32	0	0	0	0.00	deformed	44.3	23	28	50.30	50.30	39.17	2.97	32508	200000	1.557	0.377	12711	3700	18.5	1476	0.104	3021	0.091	4.62	7	119
17	0	Knaack and Kurama (2015)	UC-0-28	0	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	49.30	49.30	49.30	3.58	36592	200000	0.000	0.000	36592	3700	18.5	1476	0.104	3013	0.091	0.66	28	0
18	t	Knaack and Kurama (2015)	UC-0-28	0	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	49.30	49.30	49.30	3.58	36592	200000	1.038	0.378	17952	3700	18.5	1476	0.104	3013	0.091	3.51	28	119
19	0	Knaack and Kurama (2015)	UC-0-7	0	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	42.00	42.00	32.71	2.55	30613	200000	0.000	0.000	30613	3700	18.5	1476	0.104	3021	0.091	0.94	7	0
20	t	Knaack and Kurama (2015)	UC-0-7	0	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	42.00	42.00	32.71	2.55	30613	200000	1.851	0.388	10739	3700	18.5	1476	0.104	3021	0.091	5.11	7	119
21	0	Knaack and Kurama (2015)	CC-0-28	0	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	40.20	40.20	40.20	3.04	34186	200000	0.000	0.000	34186	3700	18.5	1476	0.104	7918	0.091	3.15	28	0
22	t	Knaack and Kurama (2015)	CC-0-28	0	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	40.20	40.20	40.20	3.04	34186	200000	1.261	0.390	15120	3700	18.5	1476	0.104	7918	0.091	10.19	28	119
23	0	Knaack and Kurama (2015)	CC-0-7	0	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	46.50	46.50	36.21	2.78	31667	200000	0.000	0.000	31667	3700	18.5	1476	0.104	7893	0.091	3.40	7	0
24	t	Knaack and Kurama (2015)	CC-0-7	0	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	46.50	46.50	36.21	2.78	31667	200000	1.679	0.381	11821	3700	18.5	1476	0.104	7893	0.091	10.69	7	119
25	0	Knaack and Kurama (2015)	UT-50-28	50	0	150	230	397	200	1.32	0	0	0	0.00	deformed	44.3	23	28	43.60	43.60	43.60	3.25	31260	200000	0.000	0.000	31260	3700	18.5	1476	0.104	3013	0.091	0.91	28	0
26	t	Knaack and Kurama (2015)	UT-50-28	50	0	150	230	397	200	1.32	0	0	0	0.00	deformed	44.3	23	28	43.60	43.60	43.60	3.25	31260	200000	1.932	0.527	10662	3700	18.5	1476	0.104	3013	0.091	5.38	28	119
27	0	Knaack and Kurama (2015)	UT-50-7	50	0	150	230	397	200	1.32	0	0	0	0.00	deformed	44.3	23	28	40.20	40.20	31.31	2.45	26851	200000	0.000	0.000	26851	3700	18.5	1476	0.104	3013	0.091	0.94	7	0
28	t	Knaack and Kurama (2015)	UT-50-7	50	0	150	230	397	200	1.32	0	0	0	0.00	deformed	44.3	23	28	40.20	40.20	31.31	2.45	26851	200000	2.586	0.541	7487	3700	18.5	1476	0.104	3013	0.091	6.96	7	119
29	0	Knaack and Kurama (2015)	UC-50-28	50	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	49.60	49.60	49.60	3.60	33000	200000	0.000	0.000	33000	3700	18.5	1476	0.104	3021	0.091	0.86	28	0
30	t	Knaack and Kurama (2015)	UC-50-28	50	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	49.60	49.60	49.60	3.60	33000	200000	1.686	0.499	12286	3700	18.5	1476	0.104	3021	0.091	4.70	28	119
31	0	Knaack and Kurama (2015)	UC-50-7	50	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	43.60	43.60	33.96	2.63	27589	200000	0.000	0.000	27589	3700	18.5	1476	0.104	3013	0.091	0.84	7	0
32	t	Knaack and Kurama (2015)	UC-50-7	50	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	43.60	43.60	33.96	2.63	27589	200000	2.345	0.527	8247	3700	18.5	1476	0.104	3013	0.091	5.99	7	119
33	0	Knaack and Kurama (2015)	CC-50-28	50	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	37.70	37.70	37.70	2.88	29781	200000	0.000	0.000	29781	3700	18.5	1476	0.104	7893	0.091	4.93	28	0
34	0	Knaack and Kurama (2015)	CC-50-7	50	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	40.00	40.00	31.15	2.44	26805	200000	0.000	0.000	26805	3700	18.5	1476	0.104	7893	0.091	4.14	7	0
35	t	Knaack and Kurama (2015)	CC-50-7	50	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	40.00	40.00	31.15	2.44	26805	200000	2.600	0.542	7446	3700	18.5	1476	0.104	7893	0.091	12.90	7	119
36	0	Knaack and Kurama (2015)	UT-100-28	100	0	150	230	397	200	1.32	0	0	0	0.00	deformed	44.3	23	28	41.40	41.40	41.40	3.11	28999	200000	0.000	0.000	28999	3700	18.5	1476	0.104	3013	0.091	1.24	28	0
37	t	Knaack and Kurama (2015)	UT-100-28	100	0	150	230	397	200	1.32	0	0	0	0.00	deformed	44.3	23	28	41.40	41.40	41.40	3.11	28999	200000	2.200	0.590	9063	3700	18.5	1476	0.104	3013	0.091	7.39	28	119
38	0	Knaack and Kurama (2015)	UT-100-7	100	0	150	230	397	200	1.32	0	0	0	0.00	deformed	44.3	23	28	35.70	35.70	27.80	2.20	24067	200000	0.000	0.000	24067	3700	18.5	1476	0.104	3021	0.091	1.12	7	0
39	0	Knaack and Kurama (2015)	UC-100-28	100	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	48.20	48.20	48.20	3.52	30870	200000	0.000	0.000	30870	3700	18.5	1476	0.104	3021	0.091	0.97	28	0
40	t	Knaack and Kurama (2015)	UC-100-28	100	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	48.20	48.20	48.20	3.52	30870	200000	1.863	0.553	10783	3700	18.5	1476	0.104	3021	0.091	5.94	28	119
41	0	Knaack and Kurama (2015)	UC-100-7	100	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	40.60	40.60	31.62	2.47	25426	200000	0.000	0.000	25426	3700	18.5	1476	0.104	3021	0.091	1.27	7	0
42	t	Knaack and Kurama (2015)	UC-100-7	100	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	40.60	40.60	31.62	2.47	25426	200000	2.744	0.593	6792	3700	18.5	1476	0.104	3021	0.091	7.62	7	119
43	0	Knaack and Kurama (2015)	CC-100-28	100	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	43.80	43.80	43.80	3.26	29901	200000	0.000	0.000	29901	3700	18.5	1476	0.104	7918	0.091	5.11	28	0
44	t	Knaack and Kurama (2015)	CC-100-28	100	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	43.80	43.80	43.80	3.26	29901	200000	2.081	0.574	9704	3700	18.5	1476	0.104	7918	0.091	12.27	28	119
45	0	Knaack and Kurama (2015)	CC-100-7	100	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	38.50	38.50	29.98	2.35	24978	200000	0.000	0.000	24978	3700	18.5	1476	0.104	7918	0.091	4.60	7	0
46	t	Knaack and Kurama (2015)	CC-100-7	100	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	38.50	38.50	29.98	2.35	24978	200000	2.916	0.596	6379	3700	18.5	1476	0.104	7918	0.091	14.68	7	119
47	0	Seara-Paz (2015)	H50-0	0	0	200	300	402	249	0.81	100.6	253	47	0.20	deformed	75	15	28	60.7	60.70	62.97	4.34	39946	200000	0.000	0.000	39946	3400	13.7	2168	0.104	31550	0.101	11.73	42	0
48	t	Seara-Paz (2015)	H50-0	0	0	200	300	402	249	0.81	100.6	253	47	0.20	deformed	75	15	28	60.7	60.70	62.97	4.34	39946	200000	0.867	0.405	21397	3400	13.7	2168	0.104	31550	0.101	18.39	42	1000
49	0	Seara-Paz (2015)	H50-50	50	0	200	300	402	249	0.81	100.6	253	47	0.20	deformed	75	15	28	51.8	51.80	53.74	3.84	34102	200000	0.000	0.000	34102	3400	13.7	2168	0.104	21940	0.101	7.87	42	0
50	t	Seara-Paz (2015)	H50-50	50	0	200	300	402	249	0.81	100.6	253	47	0.20	deformed	75	15	28	51.8	51.80	53.74	3.84	34102	200000	1.473	0.418	13788	3400	13.7	2168	0.104	21940	0.101	14.08	42	1000
51	0	Seara-Paz (2015)	H50-100	100	0	200	300	402	249	0.81	100.6	253	47	0.20	deformed	75	15	28	42.9	42.90	44.50	3.30	29887	200000	0.000	0.000	29887	3400	13.7	2168	0.104	23530	0.101	6.80	42	0
52	t	Seara-Paz (2015)	H50-100	100	0	200	300	402	249	0.81	100.6	253	47	0.20	deformed	75	15	28	42.9	42.90	44.50	3.30	29887	200000	1.896	0.457	10319	3400	13.7	2168	0.104	23530	0.101	15.20	42	1000
53	0	Seara-Paz (2015)	H65-0	0	0	200	300	402	234	0.86	100.6	268	32	0.22	deformed	75	15	28	46.9	46.90	48.65	3.55	36654	200000	0.000	0.000	36654	3400	14.5	2168	0.104	22710	0.101	6.71	42	0
54	t	Seara-Paz (2015)	H65-0	0	0	200	300	402	234	0.86	100.6	268	32	0.22	deformed	75	15	28	46.9	46.90	48.65	3.55	36654	200000	1.083	0.427	17596	3400	14.5	2168	0.104	22710	0.101	11.58	42	1000
55	0	Seara-Paz (2015)	H65-50	50	0	200	300	402	234	0.86	100.6	268	32	0.22	deformed	75	15	28	42.2	42.20	43.78	3.26	31495	200000	0.000	0.000	31495	3400	14.5	2168	0.104	17130	0.101	4.96	42	0
56	t	Seara-Paz (2015)	H65-50	50	0	200	300	402	234	0.86	100.6	268	32	0.22	deformed	75	15	28	42.2	42.20	43.78	3.26	31495	200000	1.792	0.437	11281	3400	14.5	2168	0.104	17130	0.101	9.63	42	1000
57	0	Seara-Paz (2015)	H-65-100	100	0	200	300	402	234	0.86	100.6	268	32	0.22	deformed	75	15	28	32.4	32.40	33.61	2.61	26894	200000	0.000	0.000	26894	3400	14.5	2168	0.104	18100	0.101	4.59	42	0
58	t	Seara-Paz (2015)	H-65-100	100	0	200	300	402	234	0.86	100.6	268	32	0.22	deformed	75	15	28	32.4	32.40	33.61	2.61	26894	200000	2.438	0.504	7822	3400	14.5	2168	0.104	18100	0.101	11.34	42	1000

Appendix F

Applicability of ACI 318 and ACI 435R

Applicability of ACI 318 and ACI 435R

Testing of Individual Deflection Curves – RAC and HVFAC beams

	Study information		Cross-section					Reinforcement									Mechanical properties								Loading					Deflection	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
	Author	Specimen	b (mm)	h (mm)	A_{s1} (mm^2)	d (mm)	ρ_1 (%)	A_{s2} (mm^2)	d' (mm)	d_2 (mm)	ρ_2 (%)	type	t_0 (days)	$f_{cm}(t_0)$ (MPa)	f_{cm} (MPa)	$f_r(t_0)$ (MPa)	$f_{r,red}(t_0)$ (MPa)	$E_{cm}(t_0)$ (MPa)	E_{cm} (MPa)	E_s (MPa)	φ (–)	ε_{cs} (‰)	L (mm)	L/d	M_{L1} (Nm)	K_{L1}	M_{L2} (Nm)	K_{L2}	a (t) (mm)	t (days)	t-t_0 (days)
508	Tošić (2017)	RAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	24.20	28.10	5.40	3.60	26200	30800	200000	0.000	0.155	3200	18.9	1024	0.104	6923	0.107	10.89	7.003	0.003
509	Tošić (2017)	RAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	24.20	28.10	5.40	3.60	26200	30800	200000	0.246	0.155	3200	18.9	1024	0.104	6923	0.107	11.62	7.042	0.042
510	Tošić (2017)	RAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	24.20	28.10	5.40	3.60	26200	30800	200000	0.420	0.155	3200	18.9	1024	0.104	6923	0.107	12.10	7.25	0.25
511	Tošić (2017)	RAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	24.20	28.10	5.40	3.60	26200	30800	200000	0.618	0.155	3200	18.9	1024	0.104	6923	0.107	12.78	8	1
512	Tošić (2017)	RAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	24.20	28.10	5.40	3.60	26200	30800	200000	0.747	0.162	3200	18.9	1024	0.104	6923	0.107	13.27	9	2
513	Tošić (2017)	RAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	24.20	28.10	5.40	3.60	26200	30800	200000	0.843	0.198	3200	18.9	1024	0.104	6923	0.107	13.57	10	3
514	Tošić (2017)	RAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	24.20	28.10	5.40	3.60	26200	30800	200000	0.866	0.207	3200	18.9	1024	0.104	6923	0.107	13.80	11	4
515	Tošić (2017)	RAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	24.20	28.10	5.40	3.60	26200	30800	200000	0.988	0.172	3200	18.9	1024	0.104	6923	0.107	14.08	12	5
516	Tošić (2017)	RAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	24.20	28.10	5.40	3.60	26200	30800	200000	1.027	0.220	3200	18.9	1024	0.104	6923	0.107	14.28	13	6
517	Tošić (2017)	RAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	24.20	28.10	5.40	3.60	26200	30800	200000	1.000	0.245	3200	18.9	1024	0.104	6923	0.107	14.43	14	7
518	Tošić (2017)	RAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	24.20	28.10	5.40	3.60	26200	30800	200000	1.287	0.320	3200	18.9	1024	0.104	6923	0.107	15.55	21	14
519	Tošić (2017)	RAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	24.20	28.10	5.40	3.60	26200	30800	200000	1.308	0.383	3200	18.9	1024	0.104	6923	0.107	16.30	28	21
520	Tošić (2017)	RAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	24.20	28.10	5.40	3.60	26200	30800	200000	1.477	0.410	3200	18.9	1024	0.104	6923	0.107	16.90	35	28
521	Tošić (2017)	RAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	24.20	28.10	5.40	3.60	26200	30800	200000	1.711	0.520	3200	18.9	1024	0.104	6923	0.107	18.39	63	56
522	Tošić (2017)	RAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	24.20	28.10	5.40	3.60	26200	30800	200000	1.846	0.583	3200	18.9	1024	0.104	6923	0.107	19.12	97	90
523	Tošić (2017)	RAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	24.20	28.10	5.40	3.60	26200	30800	200000	1.923	0.597	3200	18.9	1024	0.104	6923	0.107	19.35	127	120
524	Tošić (2017)	RAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	24.20	28.10	5.40	3.60	26200	30800	200000	2.001	0.630	3200	18.9	1024	0.104	6923	0.107	20.02	157	150
525	Tošić (2017)	RAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	24.20	28.10	5.40	3.60	26200	30800	200000	2.053	0.660	3200	18.9	1024	0.104	6923	0.107	20.39	187	180
526	Tošić (2017)	RAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	24.20	28.10	5.40	3.60	26200	30800	200000	2.143	0.670	3200	18.9	1024	0.104	6923	0.107	20.56	217	210
527	Tošić (2017)	RAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	24.20	28.10	5.40	3.60	26200	30800	200000	2.172	0.650	3200	18.9	1024	0.104	6923	0.107	20.67	247	240
528	Tošić (2017)	RAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	24.20	28.10	5.40	3.60	26200	30800	200000	2.211	0.677	3200	18.9	1024	0.104	6923	0.107	21.09	277	270
529	Tošić (2017)	RAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	24.20	28.10	5.40	3.60	26200	30800	200000	2.210	0.750	3200	18.9	1024	0.104	6923	0.107	21.57	307	300
530	Tošić (2017)	RAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	24.20	28.10	5.40	3.60	26200	30800	200000	2.263	0.765	3200	18.9	1024	0.104	6923	0.107	21.98	337	330
531	Tošić (2017)	RAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	24.20	28.10	5.40	3.60	26200	30800	200000	2.326	0.772	3200	18.9	1024	0.104	6923	0.107	22.25	372	365
532	Tošić (2017)	RAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	24.20	28.10	5.40	3.60	26200	30800	200000	2.354	0.772	3200	18.9	1024	0.104	6923	0.107	22.40	407	400
533	Tošić (2017)	RAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	24.20	28.10	5.40	3.60	26200	30800	200000	2.395	0.782	3200	18.9	1024	0.104	6923	0.107	22.47	457	450
534	Tošić (2017)	RAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	28.10	28.10	6.40	4.27	30800	30800	200000	0.000	0.383	3200	18.9	1024	0.104	5414	0.107	6.23	28.003	0.003
535	Tošić (2017)	RAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	28.10	28.10	6.40	4.27	30800	30800	200000	0.136	0.383	3200	18.9	1024	0.104	5414	0.107	6.76	28.042	0.042
536	Tošić (2017)	RAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	28.10	28.10	6.40	4.27	30800	30800	200000	0.331	0.383	3200	18.9	1024	0.104	5414	0.107	7.16	28.25	0.25
537	Tošić (2017)	RAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	28.10	28.10	6.40	4.27	30800	30800	200000	0.456	0.385	3200	18.9	1024	0.104	5414	0.107	7.70	29	1
538	Tošić (2017)	RAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	28.10	28.10	6.40	4.27	30800	30800	200000	0.637	0.387	3200	18.9	1024	0.104	5414	0.107	8.05	30	2
539	Tošić (2017)	RAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	28.10	28.10	6.40	4.27	30800	30800	200000	0.621	0.402	3200	18.9	1024	0.104	5414	0.107	8.23	31	3
540	Tošić (2017)	RAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	28.10	28.10	6.40	4.27	30800	30800	200000	0.722	0.395	3200	18.9	1024	0.104	5414	0.107	8.43	32	4
541	Tošić (2017)	RAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	28.10	28.10	6.40	4.27	30800	30800	200000	0.812	0.385	3200	18.9	1024	0.104	5414	0.107	8.57	33	5
542	Tošić (2017)	RAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	28.10	28.10	6.40	4.27	30800	30800	200000	0.823	0.393	3200	18.9	1024	0.104	5414	0.107	8.68	34	6
543	Tošić (2017)	RAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	28.10	28.10	6.40	4.27	30800	30800	200000	0.877	0.410	3200	18.9	1024	0.104	5414	0.107	8.76	35	7
544	Tošić (2017)	RAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	28.10	28.10	6.40	4.27	30800	30800	200000	1.073	0.443	3200	18.9	1024	0.104	5414	0.107	9.49	42	14
545	Tošić (2017)	RAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	28.10	28.10	6.40	4.27	30800	30800	200000	1.199	0.498	3200	18.9	1024	0.104	5414	0.107	10.00	49	21
546	Tošić (2017)	RAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	28.10	28.10	6.40	4.27	30800	30800	200000	1.295	0.507	3200	18.9	1024	0.104	5414	0.107	10.36	56	28
547	Tošić (2017)	RAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	28.10	28.10	6.40	4.27	30800	30800	200000	1.544	0.587	3200	18.9	1024	0.104	5414	0.107	11.33	84	56
548	Tošić (2017)	RAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	28.10	28.10	6.40	4.27	30800	30800	200000	1.676	0.610	3200	18.9	1024	0.104	5414	0.107	11.65	118	90
549	Tošić (2017)	RAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	28.10	28.10	6.40	4.27	30800	30800	200000	1.886	0.627	3200	18.9	1024	0.104	5414	0.107	12.21	148	120
550	Tošić (2017)	RAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	28.10	28.10	6.40	4.27	30800	30800	200000	2.010	0.637	3200	18.9	1024	0.104	5414	0.107	12.69	178	150
551	Tošić (2017)	RAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	28.10	28.10	6.40	4.27	30800	30800	200000	2.077	0.673	3200	18.9	1024	0.104	5414	0.107	12.91	208	180
552	Tošić (2017)	RAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	28.10	28.10	6.40	4.27	30800	30800	200000	2.163	0.667	3200	18.9	1024	0.104	5414	0.107	13.05	238	210
553	Tošić (2017)	RAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	28.10	28.10	6.40	4.27	30800	30800	200000	2.175	0.702	3200	18.9	1024	0.104	5414	0.107	13.29	268	240
554	Tošić (2017)	RAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	28.10	28.10	6.40	4.27	30800	30800	200000	2.265	0.688	3200	18.9	1024	0.104	5414	0.107	13.71	298	270
555	Tošić (2017)	RAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	28.10	28.10	6.40	4.27	30800	30800	200000	2.297	0.732	3200	18.9	1024	0.104	5414	0.107	14.16	328	300
556	Tošić (2017)	RAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	28.10	28.10	6.40	4.27	30800	30800	200000	2.405	0.775	3200	18.9	1024	0.104	5414	0.107	14.56	358	330
557	Tošić (2017)	RAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	28.10	28.10	6.40	4.27	30800	30800	200000	2.515	0.767	3200	18.9	1024	0.104	5414	0.107	14.59	393	365
558	Tošić (2017)	RAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	28.10	28.10	6.40	4.27	30800	30800	200000	2.468	0.785	3200	18.9	1024	0.104	5414	0.107	14.75	428	400
559	Tošić (2017)	RAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	28.10	28.10	6.40	4.27	30800	30800	200000	2.480	0.782	3200	18.9	1024	0.104	5414	0.107	14.69	478	450

	Study information		Cross-section		Reinforcement								Mechanical properties									Loading						Deflection		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
	Author	Specimen	b (mm)	h (mm)	A_{s1} (mm^2)	d (mm)	ρ_1 (%)	A_{s2} (mm^2)	d' (mm)	d_2 (mm)	ρ_2 (%)	type	t_0 (days)	$f_{cm}(t_0)$ (MPa)	f_{cm} (MPa)	$f_r(t_0)$ (MPa)	$f_{r,red}(t_0)$ (MPa)	$E_{cm}(t_0)$ (MPa)	E_{cm} (MPa)	E_s (MPa)	φ (–)	ε_{cs} (‰)	L (mm)	L/d	M_{L1} (Nm)	K_{L1}	M_{L2} (Nm)	K_{L2}	a (t) (mm)	t (days)	t-t_0 (days)
560	Tošić (2017)	HVFAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	16.40	22.60	4.30	2.87	25200	28700	200000	0.000	0.122	3200	18.9	1024	0.104	4569	0.107	6.13	7.003	0.003
561	Tošić (2017)	HVFAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	16.40	22.60	4.30	2.87	25200	28700	200000	0.130	0.122	3200	18.9	1024	0.104	4569	0.107	6.56	7.042	0.042
562	Tošić (2017)	HVFAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	16.40	22.60	4.30	2.87	25200	28700	200000	0.345	0.122	3200	18.9	1024	0.104	4569	0.107	6.90	7.25	0.25
563	Tošić (2017)	HVFAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	16.40	22.60	4.30	2.87	25200	28700	200000	0.395	0.125	3200	18.9	1024	0.104	4569	0.107	7.41	8	1
564	Tošić (2017)	HVFAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	16.40	22.60	4.30	2.87	25200	28700	200000	0.527	0.132	3200	18.9	1024	0.104	4569	0.107	7.74	9	2
565	Tošić (2017)	HVFAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	16.40	22.60	4.30	2.87	25200	28700	200000	0.604	0.158	3200	18.9	1024	0.104	4569	0.107	8.05	10	3
566	Tošić (2017)	HVFAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	16.40	22.60	4.30	2.87	25200	28700	200000	0.625	0.182	3200	18.9	1024	0.104	4569	0.107	8.26	11	4
567	Tošić (2017)	HVFAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	16.40	22.60	4.30	2.87	25200	28700	200000	0.709	0.192	3200	18.9	1024	0.104	4569	0.107	8.45	12	5
568	Tošić (2017)	HVFAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	16.40	22.60	4.30	2.87	25200	28700	200000	0.709	0.225	3200	18.9	1024	0.104	4569	0.107	8.61	13	6
569	Tošić (2017)	HVFAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	16.40	22.60	4.30	2.87	25200	28700	200000	0.723	0.235	3200	18.9	1024	0.104	4569	0.107	8.75	14	7
570	Tošić (2017)	HVFAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	16.40	22.60	4.30	2.87	25200	28700	200000	0.859	0.272	3200	18.9	1024	0.104	4569	0.107	9.40	21	14
571	Tošić (2017)	HVFAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	16.40	22.60	4.30	2.87	25200	28700	200000	0.892	0.330	3200	18.9	1024	0.104	4569	0.107	9.75	28	21
572	Tošić (2017)	HVFAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	16.40	22.60	4.30	2.87	25200	28700	200000	0.941	0.332	3200	18.9	1024	0.104	4569	0.107	10.04	35	28
573	Tošić (2017)	HVFAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	16.40	22.60	4.30	2.87	25200	28700	200000	1.084	0.427	3200	18.9	1024	0.104	4569	0.107	10.65	63	56
574	Tošić (2017)	HVFAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	16.40	22.60	4.30	2.87	25200	28700	200000	1.210	0.410	3200	18.9	1024	0.104	4569	0.107	10.79	97	90
575	Tošić (2017)	HVFAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	16.40	22.60	4.30	2.87	25200	28700	200000	1.171	0.438	3200	18.9	1024	0.104	4569	0.107	10.81	127	120
576	Tošić (2017)	HVFAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	16.40	22.60	4.30	2.87	25200	28700	200000	1.278	0.478	3200	18.9	1024	0.104	4569	0.107	11.18	157	150
577	Tošić (2017)	HVFAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	16.40	22.60	4.30	2.87	25200	28700	200000	1.303	0.492	3200	18.9	1024	0.104	4569	0.107	11.33	187	180
578	Tošić (2017)	HVFAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	16.40	22.60	4.30	2.87	25200	28700	200000	1.321	0.508	3200	18.9	1024	0.104	4569	0.107	11.48	217	210
579	Tošić (2017)	HVFAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	16.40	22.60	4.30	2.87	25200	28700	200000	1.368	0.492	3200	18.9	1024	0.104	4569	0.107	11.52	247	240
580	Tošić (2017)	HVFAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	16.40	22.60	4.30	2.87	25200	28700	200000	1.394	0.502	3200	18.9	1024	0.104	4569	0.107	11.70	277	270
581	Tošić (2017)	HVFAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	16.40	22.60	4.30	2.87	25200	28700	200000	1.464	0.530	3200	18.9	1024	0.104	4569	0.107	12.07	307	300
582	Tošić (2017)	HVFAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	16.40	22.60	4.30	2.87	25200	28700	200000	1.484	0.563	3200	18.9	1024	0.104	4569	0.107	12.32	337	330
583	Tošić (2017)	HVFAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	16.40	22.60	4.30	2.87	25200	28700	200000	1.534	0.587	3200	18.9	1024	0.104	4569	0.107	12.42	372	365
584	Tošić (2017)	HVFAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	16.40	22.60	4.30	2.87	25200	28700	200000	1.584	0.597	3200	18.9	1024	0.104	4569	0.107	12.43	407	400
585	Tošić (2017)	HVFAC7	160	200	157	169	0.58	57	171	29	0.21	deformed	7	16.40	22.60	4.30	2.87	25200	28700	200000	1.634	0.595	3200	18.9	1024	0.104	4569	0.107	12.45	457	450
586	Tošić (2017)	HVFAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	22.60	22.60	5.20	3.47	28700	28700	200000	0.000	0.330	3200	18.9	1024	0.104	4430	0.107	4.04	28.003	0.003
587	Tošić (2017)	HVFAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	22.60	22.60	5.20	3.47	28700	28700	200000	0.076	0.330	3200	18.9	1024	0.104	4430	0.107	4.30	28.042	0.042
588	Tošić (2017)	HVFAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	22.60	22.60	5.20	3.47	28700	28700	200000	0.169	0.330	3200	18.9	1024	0.104	4430	0.107	4.48	28.25	0.25
589	Tošić (2017)	HVFAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	22.60	22.60	5.20	3.47	28700	28700	200000	0.285	0.315	3200	18.9	1024	0.104	4430	0.107	4.65	29	1
590	Tošić (2017)	HVFAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	22.60	22.60	5.20	3.47	28700	28700	200000	0.297	0.333	3200	18.9	1024	0.104	4430	0.107	4.75	30	2
591	Tošić (2017)	HVFAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	22.60	22.60	5.20	3.47	28700	28700	200000	0.395	0.327	3200	18.9	1024	0.104	4430	0.107	4.89	31	3
592	Tošić (2017)	HVFAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	22.60	22.60	5.20	3.47	28700	28700	200000	0.409	0.335	3200	18.9	1024	0.104	4430	0.107	4.99	32	4
593	Tošić (2017)	HVFAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	22.60	22.60	5.20	3.47	28700	28700	200000	0.417	0.338	3200	18.9	1024	0.104	4430	0.107	5.05	33	5
594	Tošić (2017)	HVFAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	22.60	22.60	5.20	3.47	28700	28700	200000	0.417	0.335	3200	18.9	1024	0.104	4430	0.107	5.17	34	6
595	Tošić (2017)	HVFAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	22.60	22.60	5.20	3.47	28700	28700	200000	0.466	0.332	3200	18.9	1024	0.104	4430	0.107	5.22	35	7
596	Tošić (2017)	HVFAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	22.60	22.60	5.20	3.47	28700	28700	200000	0.593	0.337	3200	18.9	1024	0.104	4430	0.107	5.58	42	14
597	Tošić (2017)	HVFAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	22.60	22.60	5.20	3.47	28700	28700	200000	0.698	0.388	3200	18.9	1024	0.104	4430	0.107	5.80	49	21
598	Tošić (2017)	HVFAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	22.60	22.60	5.20	3.47	28700	28700	200000	0.694	0.410	3200	18.9	1024	0.104	4430	0.107	6.01	56	28
599	Tošić (2017)	HVFAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	22.60	22.60	5.20	3.47	28700	28700	200000	0.834	0.430	3200	18.9	1024	0.104	4430	0.107	6.48	84	56
600	Tošić (2017)	HVFAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	22.60	22.60	5.20	3.47	28700	28700	200000	1.024	0.438	3200	18.9	1024	0.104	4430	0.107	6.61	118	90
601	Tošić (2017)	HVFAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	22.60	22.60	5.20	3.47	28700	28700	200000	1.063	0.470	3200	18.9	1024	0.104	4430	0.107	7.01	148	120
602	Tošić (2017)	HVFAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	22.60	22.60	5.20	3.47	28700	28700	200000	1.069	0.507	3200	18.9	1024	0.104	4430	0.107	7.19	178	150
603	Tošić (2017)	HVFAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	22.60	22.60	5.20	3.47	28700	28700	200000	1.235	0.495	3200	18.9	1024	0.104	4430	0.107	7.33	208	180
604	Tošić (2017)	HVFAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	22.60	22.60	5.20	3.47	28700	28700	200000	1.242	0.485	3200	18.9	1024	0.104	4430	0.107	7.41	238	210
605	Tošić (2017)	HVFAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	22.60	22.60	5.20	3.47	28700	28700	200000	1.351	0.493	3200	18.9	1024	0.104	4430	0.107	7.68	268	240
606	Tošić (2017)	HVFAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	22.60	22.60	5.20	3.47	28700	28700	200000	1.257	0.572	3200	18.9	1024	0.104	4430	0.107	7.99	298	270
607	Tošić (2017)	HVFAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	22.60	22.60	5.20	3.47	28700	28700	200000	1.387	0.568	3200	18.9	1024	0.104	4430	0.107	8.26	328	300
608	Tošić (2017)	HVFAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	22.60	22.60	5.20	3.47	28700	28700	200000	1.505	0.552	3200	18.9	1024	0.104	4430	0.107	8.50	358	330
609	Tošić (2017)	HVFAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	22.60	22.60	5.20	3.47	28700	28700	200000	1.394	0.608	3200	18.9	1024	0.104	4430	0.107	8.60	393	365
610	Tošić (2017)	HVFAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	22.60	22.60	5.20	3.47	28700	28700	200000	1.581	0.593	3200	18.9	1024	0.104	4430	0.107	8.75	428	400
611	Tošić (2017)	HVFAC28	160	200	157	169	0.58	57	171	29	0.21	deformed	28	22.60	22.60	5.20	3.47	28700	28700	200000	1.554	0.597	3200	18.9	1024	0.104	4430	0.107	8.72	478	450

	Study information		Cracking moment							Uncracked cross-section		Fully cracked cross-section							Deflection			
	1	2	3	4		5		6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	Author	Specimen	W_c (mm^3)	M_{SW} (Nm)		M_{cr} (Nm)		M_{max} (Nm)	M_{cr}/M_{max} (%)	I_c (mm^4)	S_c (mm^3)	A_{II}^* (mm^2)	A_{IIc} (mm^2)	$z_{IIc,1}$ (mm)	$z_{II,1}^*$ (mm)	I_{IIc} (mm^4)	I_{II}^* (mm^4)	S_{II}^* (mm^3)	t-t_0 (days)	$a_{num.int.}$ (mm)	a_{exp} (mm)	$a_{num.int.}/a_{exp}$ (%)
508	Tošić (2017)	RAC7	1066667	1024	<	3842	<	7947	48.3	106666667	113588	8458	6825	178.67	157.36	1034825	23341931	145436	0.003	9.19	10.89	84.4
509	Tošić (2017)	RAC7	1066667	1024	<	3842	<	7947	48.3	106666667	113588	8458	6825	178.67	157.36	1034825	23341931	145436	0.042	10.93	11.62	94.1
510	Tošić (2017)	RAC7	1066667	1024	<	3842	<	7947	48.3	106666667	113588	8458	6825	178.67	157.36	1034825	23341931	145436	0.25	12.16	12.10	100.5
511	Tošić (2017)	RAC7	1066667	1024	<	3842	<	7947	48.3	106666667	113588	8458	6825	178.67	157.36	1034825	23341931	145436	1	13.56	12.78	106.1
512	Tošić (2017)	RAC7	1066667	1024	<	3842	<	7947	48.3	106666667	113588	8458	6825	178.67	157.36	1034825	23341931	145436	2	14.48	13.27	109.1
513	Tošić (2017)	RAC7	1066667	1024	<	3842	<	7947	48.3	106666667	113588	8458	6825	178.67	157.36	1034825	23341931	145436	3	15.17	13.57	111.8
514	Tošić (2017)	RAC7	1066667	1024	<	3842	<	7947	48.3	106666667	113588	8458	6825	178.67	157.36	1034825	23341931	145436	4	15.34	13.80	111.2
515	Tošić (2017)	RAC7	1066667	1024	<	3842	<	7947	48.3	106666667	113588	8458	6825	178.67	157.36	1034825	23341931	145436	5	16.18	14.08	114.9
516	Tošić (2017)	RAC7	1066667	1024	<	3842	<	7947	48.3	106666667	113588	8458	6825	178.67	157.36	1034825	23341931	145436	6	16.48	14.28	115.4
517	Tošić (2017)	RAC7	1066667	1024	<	3842	<	7947	48.3	106666667	113588	8458	6825	178.67	157.36	1034825	23341931	145436	7	16.31	14.43	113.0
518	Tošić (2017)	RAC7	1066667	1024	<	3842	<	7947	48.3	106666667	113588	8458	6825	178.67	157.36	1034825	23341931	145436	14	18.38	15.55	118.2
519	Tošić (2017)	RAC7	1066667	1024	<	3842	<	7947	48.3	106666667	113588	8458	6825	178.67	157.36	1034825	23341931	145436	21	18.56	16.30	113.9
520	Tošić (2017)	RAC7	1066667	1024	<	3842	<	7947	48.3	106666667	113588	8458	6825	178.67	157.36	1034825	23341931	145436	28	19.77	16.90	117.0
521	Tošić (2017)	RAC7	1066667	1024	<	3842	<	7947	48.3	106666667	113588	8458	6825	178.67	157.36	1034825	23341931	145436	56	21.48	18.39	116.8
522	Tošić (2017)	RAC7	1066667	1024	<	3842	<	7947	48.3	106666667	113588	8458	6825	178.67	157.36	1034825	23341931	145436	90	22.47	19.12	117.5
523	Tošić (2017)	RAC7	1066667	1024	<	3842	<	7947	48.3	106666667	113588	8458	6825	178.67	157.36	1034825	23341931	145436	120	23.02	19.35	119.0
524	Tošić (2017)	RAC7	1066667	1024	<	3842	<	7947	48.3	106666667	113588	8458	6825	178.67	157.36	1034825	23341931	145436	150	23.59	20.02	117.8
525	Tošić (2017)	RAC7	1066667	1024	<	3842	<	7947	48.3	106666667	113588	8458	6825	178.67	157.36	1034825	23341931	145436	180	23.98	20.39	117.6
526	Tošić (2017)	RAC7	1066667	1024	<	3842	<	7947	48.3	106666667	113588	8458	6825	178.67	157.36	1034825	23341931	145436	210	24.62	20.56	119.7
527	Tošić (2017)	RAC7	1066667	1024	<	3842	<	7947	48.3	106666667	113588	8458	6825	178.67	157.36	1034825	23341931	145436	240	24.81	20.67	120.0
528	Tošić (2017)	RAC7	1066667	1024	<	3842	<	7947	48.3	106666667	113588	8458	6825	178.67	157.36	1034825	23341931	145436	270	25.10	21.09	119.0
529	Tošić (2017)	RAC7	1066667	1024	<	3842	<	7947	48.3	106666667	113588	8458	6825	178.67	157.36	1034825	23341931	145436	300	25.13	21.57	116.5
530	Tošić (2017)	RAC7	1066667	1024	<	3842	<	7947	48.3	106666667	113588	8458	6825	178.67	157.36	1034825	23341931	145436	330	25.52	21.98	116.1
531	Tošić (2017)	RAC7	1066667	1024	<	3842	<	7947	48.3	106666667	113588	8458	6825	178.67	157.36	1034825	23341931	145436	365	25.97	22.25	116.7
532	Tošić (2017)	RAC7	1066667	1024	<	3842	<	7947	48.3	106666667	113588	8458	6825	178.67	157.36	1034825	23341931	145436	400	26.17	22.40	116.8
533	Tošić (2017)	RAC7	1066667	1024	<	3842	<	7947	48.3	106666667	113588	8458	6825	178.67	157.36	1034825	23341931	145436	450	26.46	22.47	117.8
534	Tošić (2017)	RAC28	1066667	1024	<	4553	<	6438	70.7	106666667	96623	7779	6390	180.03	160.08	849161	20413561	127484	0.003	4.19	6.23	67.3
535	Tošić (2017)	RAC28	1066667	1024	<	4553	<	6438	70.7	106666667	96623	7779	6390	180.03	160.08	849161	20413561	127484	0.042	4.63	6.76	68.5
536	Tošić (2017)	RAC28	1066667	1024	<	4553	<	6438	70.7	106666667	96623	7779	6390	180.03	160.08	849161	20413561	127484	0.25	5.26	7.16	73.5
537	Tošić (2017)	RAC28	1066667	1024	<	4553	<	6438	70.7	106666667	96623	7779	6390	180.03	160.08	849161	20413561	127484	1	5.66	7.70	73.5
538	Tošić (2017)	RAC28	1066667	1024	<	4553	<	6438	70.7	106666667	96623	7779	6390	180.03	160.08	849161	20413561	127484	2	6.25	8.05	77.6
539	Tošić (2017)	RAC28	1066667	1024	<	4553	<	6438	70.7	106666667	96623	7779	6390	180.03	160.08	849161	20413561	127484	3	6.21	8.23	75.5
540	Tošić (2017)	RAC28	1066667	1024	<	4553	<	6438	70.7	106666667	96623	7779	6390	180.03	160.08	849161	20413561	127484	4	6.53	8.43	77.5
541	Tošić (2017)	RAC28	1066667	1024	<	4553	<	6438	70.7	106666667	96623	7779	6390	180.03	160.08	849161	20413561	127484	5	6.81	8.57	79.5
542	Tošić (2017)	RAC28	1066667	1024	<	4553	<	6438	70.7	106666667	96623	7779	6390	180.03	160.08	849161	20413561	127484	6	6.85	8.68	78.9
543	Tošić (2017)	RAC28	1066667	1024	<	4553	<	6438	70.7	106666667	96623	7779	6390	180.03	160.08	849161	20413561	127484	7	7.04	8.76	80.4
544	Tošić (2017)	RAC28	1066667	1024	<	4553	<	6438	70.7	106666667	96623	7779	6390	180.03	160.08	849161	20413561	127484	14	7.69	9.49	81.0
545	Tošić (2017)	RAC28	1066667	1024	<	4553	<	6438	70.7	106666667	96623	7779	6390	180.03	160.08	849161	20413561	127484	21	8.12	10.00	81.2
546	Tošić (2017)	RAC28	1066667	1024	<	4553	<	6438	70.7	106666667	96623	7779	6390	180.03	160.08	849161	20413561	127484	28	8.44	10.36	81.5
547	Tošić (2017)	RAC28	1066667	1024	<	4553	<	6438	70.7	106666667	96623	7779	6390	180.03	160.08	849161	20413561	127484	56	9.29	11.33	82.0
548	Tošić (2017)	RAC28	1066667	1024	<	4553	<	6438	70.7	106666667	96623	7779	6390	180.03	160.08	849161	20413561	127484	90	9.72	11.65	83.4
549	Tošić (2017)	RAC28	1066667	1024	<	4553	<	6438	70.7	106666667	96623	7779	6390	180.03	160.08	849161	20413561	127484	120	10.41	12.21	85.3
550	Tošić (2017)	RAC28	1066667	1024	<	4553	<	6438	70.7	106666667	96623	7779	6390	180.03	160.08	849161	20413561	127484	150	10.81	12.69	85.2
551	Tošić (2017)	RAC28	1066667	1024	<	4553	<	6438	70.7	106666667	96623	7779	6390	180.03	160.08	849161	20413561	127484	180	11.05	12.91	85.6
552	Tošić (2017)	RAC28	1066667	1024	<	4553	<	6438	70.7	106666667	96623	7779	6390	180.03	160.08	849161	20413561	127484	210	11.32	13.05	86.7
553	Tošić (2017)	RAC28	1066667	1024	<	4553	<	6438	70.7	106666667	96623	7779	6390	180.03	160.08	849161	20413561	127484	240	11.38	13.29	85.6
554	Tošić (2017)	RAC28	1066667	1024	<	4553	<	6438	70.7	106666667	96623	7779	6390	180.03	160.08	849161	20413561	127484	270	11.67	13.71	85.1
555	Tošić (2017)	RAC28	1066667	1024	<	4553	<	6438	70.7	106666667	96623	7779	6390	180.03	160.08	849161	20413561	127484	300	11.79	14.16	83.3
556	Tošić (2017)	RAC28	1066667	1024	<	4553	<	6438	70.7	106666667	96623	7779	6390	180.03	160.08	849161	20413561	127484	330	12.17	14.56	83.6
557	Tošić (2017)	RAC28	1066667	1024	<	4553	<	6438	70.7	106666667	96623	7779	6390	180.03	160.08	849161	20413561	127484	365	12.51	14.59	85.7
558	Tošić (2017)	RAC28	1066667	1024	<	4553	<	6438	70.7	106666667	96623	7779	6390	180.03	160.08	849161	20413561	127484	400	12.38	14.75	83.9
559	Tošić (2017)	RAC28	1066667	1024	<	4553	<	6438	70.7	106666667	96623	7779	6390	180.03	160.08	849161	20413561	127484	450	12.41	14.69	84.5

	Study information		Cracking moment							Uncracked cross-section		Fully cracked cross-section							Deflection			
	1	2	3	4		5		6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	Author	Specimen	W_c (mm^3)	M_{SW} (Nm)		M_{cr} (Nm)		M_{max} (Nm)	M_{cr}/M_{max} (%)	I_c (mm^4)	S_c (mm^3)	A_{II}^* (mm^2)	A_{IIc} (mm^2)	$z_{IIc,1}$ (mm)	$z_{II,1}^*$ (mm)	I_{IIc} (mm^4)	I_{II}^* (mm^4)	S_{II}^* (mm^3)	$t\text{-}t_0$ (days)	$a_{num.int.}$ (mm)	a_{exp} (mm)	$a_{num.int.}/a_{exp}$ (%)
560	Tošić (2017)	HVFAC7	1066667	1024	<	3059	<	5593	54.7	106666667	118095	8632	6933	178.33	156.67	1084808	24117575	150172	0.003	5.83	6.13	95.1
561	Tošić (2017)	HVFAC7	1066667	1024	<	3059	<	5593	54.7	106666667	118095	8632	6933	178.33	156.67	1084808	24117575	150172	0.042	6.42	6.56	97.9
562	Tošić (2017)	HVFAC7	1066667	1024	<	3059	<	5593	54.7	106666667	118095	8632	6933	178.33	156.67	1084808	24117575	150172	0.25	7.38	6.90	107.0
563	Tošić (2017)	HVFAC7	1066667	1024	<	3059	<	5593	54.7	106666667	118095	8632	6933	178.33	156.67	1084808	24117575	150172	1	7.61	7.41	102.7
564	Tošić (2017)	HVFAC7	1066667	1024	<	3059	<	5593	54.7	106666667	118095	8632	6933	178.33	156.67	1084808	24117575	150172	2	8.20	7.74	105.9
565	Tošić (2017)	HVFAC7	1066667	1024	<	3059	<	5593	54.7	106666667	118095	8632	6933	178.33	156.67	1084808	24117575	150172	3	8.56	8.05	106.3
566	Tošić (2017)	HVFAC7	1066667	1024	<	3059	<	5593	54.7	106666667	118095	8632	6933	178.33	156.67	1084808	24117575	150172	4	8.67	8.26	105.0
567	Tošić (2017)	HVFAC7	1066667	1024	<	3059	<	5593	54.7	106666667	118095	8632	6933	178.33	156.67	1084808	24117575	150172	5	9.05	8.45	107.1
568	Tošić (2017)	HVFAC7	1066667	1024	<	3059	<	5593	54.7	106666667	118095	8632	6933	178.33	156.67	1084808	24117575	150172	6	9.07	8.61	105.3
569	Tošić (2017)	HVFAC7	1066667	1024	<	3059	<	5593	54.7	106666667	118095	8632	6933	178.33	156.67	1084808	24117575	150172	7	9.14	8.75	104.5
570	Tošić (2017)	HVFAC7	1066667	1024	<	3059	<	5593	54.7	106666667	118095	8632	6933	178.33	156.67	1084808	24117575	150172	14	9.77	9.40	103.9
571	Tošić (2017)	HVFAC7	1066667	1024	<	3059	<	5593	54.7	106666667	118095	8632	6933	178.33	156.67	1084808	24117575	150172	21	9.95	9.75	102.1
572	Tošić (2017)	HVFAC7	1066667	1024	<	3059	<	5593	54.7	106666667	118095	8632	6933	178.33	156.67	1084808	24117575	150172	28	10.17	10.04	101.3
573	Tošić (2017)	HVFAC7	1066667	1024	<	3059	<	5593	54.7	106666667	118095	8632	6933	178.33	156.67	1084808	24117575	150172	56	10.86	10.65	102.0
574	Tošić (2017)	HVFAC7	1066667	1024	<	3059	<	5593	54.7	106666667	118095	8632	6933	178.33	156.67	1084808	24117575	150172	90	11.42	10.79	105.8
575	Tošić (2017)	HVFAC7	1066667	1024	<	3059	<	5593	54.7	106666667	118095	8632	6933	178.33	156.67	1084808	24117575	150172	120	11.26	10.81	104.2
576	Tošić (2017)	HVFAC7	1066667	1024	<	3059	<	5593	54.7	106666667	118095	8632	6933	178.33	156.67	1084808	24117575	150172	150	11.77	11.18	105.3
577	Tošić (2017)	HVFAC7	1066667	1024	<	3059	<	5593	54.7	106666667	118095	8632	6933	178.33	156.67	1084808	24117575	150172	180	11.88	11.33	104.9
578	Tošić (2017)	HVFAC7	1066667	1024	<	3059	<	5593	54.7	106666667	118095	8632	6933	178.33	156.67	1084808	24117575	150172	210	11.97	11.48	104.3
579	Tošić (2017)	HVFAC7	1066667	1024	<	3059	<	5593	54.7	106666667	118095	8632	6933	178.33	156.67	1084808	24117575	150172	240	12.17	11.52	105.6
580	Tošić (2017)	HVFAC7	1066667	1024	<	3059	<	5593	54.7	106666667	118095	8632	6933	178.33	156.67	1084808	24117575	150172	270	12.30	11.70	105.1
581	Tošić (2017)	HVFAC7	1066667	1024	<	3059	<	5593	54.7	106666667	118095	8632	6933	178.33	156.67	1084808	24117575	150172	300	12.63	12.07	104.6
582	Tošić (2017)	HVFAC7	1066667	1024	<	3059	<	5593	54.7	106666667	118095	8632	6933	178.33	156.67	1084808	24117575	150172	330	12.73	12.32	103.3
583	Tošić (2017)	HVFAC7	1066667	1024	<	3059	<	5593	54.7	106666667	118095	8632	6933	178.33	156.67	1084808	24117575	150172	365	12.97	12.42	104.4
584	Tošić (2017)	HVFAC7	1066667	1024	<	3059	<	5593	54.7	106666667	118095	8632	6933	178.33	156.67	1084808	24117575	150172	400	13.20	12.43	106.2
585	Tošić (2017)	HVFAC7	1066667	1024	<	3059	<	5593	54.7	106666667	118095	8632	6933	178.33	156.67	1084808	24117575	150172	450	13.43	12.45	107.9
586	Tošić (2017)	HVFAC28	1066667	1024	<	3700	<	5454	67.8	106666667	103693	8071	6579	179.44	158.89	926884	21661521	135138	0.003	3.98	4.04	98.5
587	Tošić (2017)	HVFAC28	1066667	1024	<	3700	<	5454	67.8	106666667	103693	8071	6579	179.44	158.89	926884	21661521	135138	0.042	4.21	4.30	97.9
588	Tošić (2017)	HVFAC28	1066667	1024	<	3700	<	5454	67.8	106666667	103693	8071	6579	179.44	158.89	926884	21661521	135138	0.25	4.50	4.48	100.4
589	Tošić (2017)	HVFAC28	1066667	1024	<	3700	<	5454	67.8	106666667	103693	8071	6579	179.44	158.89	926884	21661521	135138	1	4.85	4.65	104.3
590	Tošić (2017)	HVFAC28	1066667	1024	<	3700	<	5454	67.8	106666667	103693	8071	6579	179.44	158.89	926884	21661521	135138	2	4.89	4.75	102.9
591	Tošić (2017)	HVFAC28	1066667	1024	<	3700	<	5454	67.8	106666667	103693	8071	6579	179.44	158.89	926884	21661521	135138	3	5.19	4.89	106.1
592	Tošić (2017)	HVFAC28	1066667	1024	<	3700	<	5454	67.8	106666667	103693	8071	6579	179.44	158.89	926884	21661521	135138	4	5.23	4.99	104.8
593	Tošić (2017)	HVFAC28	1066667	1024	<	3700	<	5454	67.8	106666667	103693	8071	6579	179.44	158.89	926884	21661521	135138	5	5.26	5.05	104.2
594	Tošić (2017)	HVFAC28	1066667	1024	<	3700	<	5454	67.8	106666667	103693	8071	6579	179.44	158.89	926884	21661521	135138	6	5.26	5.17	101.7
595	Tošić (2017)	HVFAC28	1066667	1024	<	3700	<	5454	67.8	106666667	103693	8071	6579	179.44	158.89	926884	21661521	135138	7	5.41	5.22	103.6
596	Tošić (2017)	HVFAC28	1066667	1024	<	3700	<	5454	67.8	106666667	103693	8071	6579	179.44	158.89	926884	21661521	135138	14	5.80	5.58	103.9
597	Tošić (2017)	HVFAC28	1066667	1024	<	3700	<	5454	67.8	106666667	103693	8071	6579	179.44	158.89	926884	21661521	135138	21	6.15	5.80	106.0
598	Tošić (2017)	HVFAC28	1066667	1024	<	3700	<	5454	67.8	106666667	103693	8071	6579	179.44	158.89	926884	21661521	135138	28	6.15	6.01	102.3
599	Tošić (2017)	HVFAC28	1066667	1024	<	3700	<	5454	67.8	106666667	103693	8071	6579	179.44	158.89	926884	21661521	135138	56	6.59	6.48	101.7
600	Tošić (2017)	HVFAC28	1066667	1024	<	3700	<	5454	67.8	106666667	103693	8071	6579	179.44	158.89	926884	21661521	135138	90	7.17	6.61	108.5
601	Tošić (2017)	HVFAC28	1066667	1024	<	3700	<	5454	67.8	106666667	103693	8071	6579	179.44	158.89	926884	21661521	135138	120	7.31	7.01	104.3
602	Tošić (2017)	HVFAC28	1066667	1024	<	3700	<	5454	67.8	106666667	103693	8071	6579	179.44	158.89	926884	21661521	135138	150	7.35	7.19	102.2
603	Tošić (2017)	HVFAC28	1066667	1024	<	3700	<	5454	67.8	106666667	103693	8071	6579	179.44	158.89	926884	21661521	135138	180	7.85	7.33	107.1
604	Tošić (2017)	HVFAC28	1066667	1024	<	3700	<	5454	67.8	106666667	103693	8071	6579	179.44	158.89	926884	21661521	135138	210	7.86	7.41	106.1
605	Tošić (2017)	HVFAC28	1066667	1024	<	3700	<	5454	67.8	106666667	103693	8071	6579	179.44	158.89	926884	21661521	135138	240	8.20	7.68	106.8
606	Tošić (2017)	HVFAC28	1066667	1024	<	3700	<	5454	67.8	106666667	103693	8071	6579	179.44	158.89	926884	21661521	135138	270	7.96	7.99	99.6
607	Tošić (2017)	HVFAC28	1066667	1024	<	3700	<	5454	67.8	106666667	103693	8071	6579	179.44	158.89	926884	21661521	135138	300	8.35	8.26	101.1
608	Tošić (2017)	HVFAC28	1066667	1024	<	3700	<	5454	67.8	106666667	103693	8071	6579	179.44	158.89	926884	21661521	135138	330	8.71	8.50	102.5
609	Tošić (2017)	HVFAC28	1066667	1024	<	3700	<	5454	67.8	106666667	103693	8071	6579	179.44	158.89	926884	21661521	135138	365	8.40	8.60	97.7
610	Tošić (2017)	HVFAC28	1066667	1024	<	3700	<	5454	67.8	106666667	103693	8071	6579	179.44	158.89	926884	21661521	135138	400	8.96	8.75	102.4
611	Tošić (2017)	HVFAC28	1066667	1024	<	3700	<	5454	67.8	106666667	103693	8071	6579	179.44	158.89	926884	21661521	135138	450	8.88	8.72	101.8

Applicability of ACI 318 and ACI 435R

Database – NAC, RAC and HVFAC beams

		Study information		Green concrete		Cross-section		Reinforcement								Mechanical properties												Loading						Deflection		
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
		Author	Specimen	RAC (%)	FA/cm	b (mm)	h (mm)	A_{s1} (mm^2)	d (mm)	ρ_1 (%)	A_{s2} (mm^2)	d' (mm)	d_2 (mm)	ρ_2 (%)	type	RH (%)	T (ºC)	t_{test} (days)	$f_{cm}(t_{test})$ (MPa)	f_{cm} (MPa)	$f_{cm}(t_0)$ (MPa)	f_r (t_0) (MPa)	$f_{r,red}$ (t_0) (MPa)	$E_{cm}(t_0)$ (MPa)	E_s (MPa)	φ (–)	ε_{cs} (‰)	L (mm)	L/d	M_{L1} (Nm)	K_{L1}	M_{L2} (Nm)	K_{L2}	a $(t-t_0)$ (mm)	t_0 (days)	t-t_0 (days)
1	0	Tošić (2017)	NAC7	0	0	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	14	28	30.50	21.46	2.87	1.91	23162	200000	0.000	0.000	3200	18.9	1024	0.104	6645	0.107	9.17	7	0
2	t	Tošić (2017)	NAC7	0	0	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	14	28	30.50	21.46	2.87	1.91	23162	200000	1.906	0.743	3200	18.9	1024	0.104	6645	0.107	18.94	7	450
3	0	Tošić (2017)	NAC28	0	0	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	14	28	30.50	30.72	3.44	2.29	27713	200000	0.000	0.000	3200	18.9	1024	0.104	5853	0.107	8.11	28	0
4	t	Tošić (2017)	NAC28	0	0	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	14	28	30.50	30.72	3.44	2.29	27713	200000	1.618	0.743	3200	18.9	1024	0.104	5853	0.107	16.51	28	450
5	0	Tošić (2017)	RAC7	100	0	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	14	28	28.10	19.77	2.76	1.84	22232	200000	0.000	0.000	3200	18.9	1024	0.104	6923	0.107	10.89	7	0
6	t	Tošić (2017)	RAC7	100	0	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	14	28	28.10	19.77	2.76	1.84	22232	200000	1.906	0.743	3200	18.9	1024	0.104	6923	0.107	22.47	7	450
7	0	Tošić (2017)	RAC28	100	0	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	14	28	28.10	28.30	3.30	2.20	26599	200000	0.000	0.000	3200	18.9	1024	0.104	5414	0.107	6.23	28	0
8	t	Tošić (2017)	RAC28	100	0	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	14	28	28.10	28.30	3.30	2.20	26599	200000	1.618	0.743	3200	18.9	1024	0.104	5414	0.107	14.69	28	450
9	0	Tošić (2017)	HVFAC7	0	0.5	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	14	28	22.60	15.90	2.47	1.65	19937	200000	0.000	0.000	3200	18.9	1024	0.104	4569	0.107	6.13	7	0
10	t	Tošić (2017)	HVFAC7	0	0.5	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	14	28	22.60	15.90	2.47	1.65	19937	200000	1.906	0.743	3200	18.9	1024	0.104	4569	0.107	12.45	7	450
11	0	Tošić (2017)	HVFAC28	0	0.5	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	14	28	22.60	22.76	2.96	1.97	23854	200000	0.000	0.000	3200	18.9	1024	0.104	4430	0.107	4.04	28	0
12	t	Tošić (2017)	HVFAC28	0	0.5	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	14	28	22.60	22.76	2.96	1.97	23854	200000	1.618	0.743	3200	18.9	1024	0.104	4430	0.107	8.72	28	450
13	0	Knaack and Kurama (2015)	UT-0-28	0	0	150	230	397	200	1.32	0	0	0	0.00	deformed	44.3	23	14	28	32.60	32.83	3.55	2.37	28649	200000	0.000	0.000	3700	18.5	1476	0.104	3013	0.091	0.86	28	0
14	t	Knaack and Kurama (2015)	UT-0-28	0	0	150	230	397	200	1.32	0	0	0	0.00	deformed	44.3	23	14	28	32.60	32.83	3.55	2.37	28649	200000	1.298	0.573	3700	18.5	1476	0.104	3013	0.091	5.00	28	119
15	0	Knaack and Kurama (2015)	UT-0-7	0	0	150	230	397	200	1.32	0	0	0	0.00	deformed	44.3	23	14	28	50.30	35.39	3.69	2.46	29745	200000	0.000	0.000	3700	18.5	1476	0.104	3021	0.091	0.74	7	0
16	t	Knaack and Kurama (2015)	UT-0-7	0	0	150	230	397	200	1.32	0	0	0	0.00	deformed	44.3	23	14	28	50.30	35.39	3.69	2.46	29745	200000	1.529	0.573	3700	18.5	1476	0.104	3021	0.091	4.62	7	119
17	0	Knaack and Kurama (2015)	UC-0-28	0	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	14	28	49.30	49.65	4.37	2.91	35231	200000	0.000	0.000	3700	18.5	1476	0.104	3013	0.091	0.66	28	0
18	t	Knaack and Kurama (2015)	UC-0-28	0	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	14	28	49.30	49.65	4.37	2.91	35231	200000	1.298	0.573	3700	18.5	1476	0.104	3013	0.091	3.51	28	119
19	0	Knaack and Kurama (2015)	UC-0-7	0	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	28	42.00	29.55	3.37	2.25	27180	200000	0.000	0.000	3700	18.5	1476	0.104	3021	0.091	0.94	7	0
20	t	Knaack and Kurama (2015)	UC-0-7	0	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	28	42.00	29.55	3.37	2.25	27180	200000	1.529	0.573	3700	18.5	1476	0.104	3021	0.091	5.11	7	119
21	0	Knaack and Kurama (2015)	CC-0-28	0	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	28	40.20	40.49	3.95	2.63	31816	200000	0.000	0.000	3700	18.5	1476	0.104	7918	0.091	3.15	28	0
22	t	Knaack and Kurama (2015)	CC-0-28	0	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	28	40.20	40.49	3.95	2.63	31816	200000	1.298	0.573	3700	18.5	1476	0.104	7918	0.091	10.19	28	119
23	0	Knaack and Kurama (2015)	CC-0-7	0	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	32	28	46.50	32.71	3.55	2.37	28596	200000	0.000	0.000	3700	18.5	1476	0.104	7893	0.091	3.40	7	0
24	t	Knaack and Kurama (2015)	CC-0-7	0	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	32	28	46.50	32.71	3.55	2.37	28596	200000	1.529	0.573	3700	18.5	1476	0.104	7893	0.091	10.69	7	119
25	0	Knaack and Kurama (2015)	UT-50-28	50	0	150	230	397	200	1.32	0	0	0	0.00	deformed	44.3	23	35	28	43.60	43.91	4.11	2.74	33132	200000	0.000	0.000	3700	18.5	1476	0.104	3013	0.091	0.91	28	0
26	t	Knaack and Kurama (2015)	UT-50-28	50	0	150	230	397	200	1.32	0	0	0	0.00	deformed	44.3	23	35	28	43.60	43.91	4.11	2.74	33132	200000	1.298	0.573	3700	18.5	1476	0.104	3013	0.091	5.38	28	119
27	0	Knaack and Kurama (2015)	UT-50-7	50	0	150	230	397	200	1.32	0	0	0	0.00	deformed	44.3	23	35	28	40.20	28.28	3.30	2.20	26589	200000	0.000	0.000	3700	18.5	1476	0.104	3013	0.091	0.94	7	0
28	t	Knaack and Kurama (2015)	UT-50-7	50	0	150	230	397	200	1.32	0	0	0	0.00	deformed	44.3	23	35	28	40.20	28.28	3.30	2.20	26589	200000	1.529	0.573	3700	18.5	1476	0.104	3013	0.091	6.96	7	119
29	0	Knaack and Kurama (2015)	UC-50-28	50	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	35	28	49.60	49.96	4.38	2.92	35341	200000	0.000	0.000	3700	18.5	1476	0.104	3021	0.091	0.86	28	0
30	t	Knaack and Kurama (2015)	UC-50-28	50	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	35	28	49.60	49.96	4.38	2.92	35341	200000	1.298	0.573	3700	18.5	1476	0.104	3021	0.091	4.70	28	119
31	0	Knaack and Kurama (2015)	UC-50-7	50	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	28	43.60	30.67	3.43	2.29	27690	200000	0.000	0.000	3700	18.5	1476	0.104	3013	0.091	0.84	7	0
32	t	Knaack and Kurama (2015)	UC-50-7	50	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	28	43.60	30.67	3.43	2.29	27690	200000	1.529	0.573	3700	18.5	1476	0.104	3013	0.091	5.99	7	119
33	0	Knaack and Kurama (2015)	CC-50-28	50	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	28	37.70	37.97	3.82	2.55	30810	200000	0.000	0.000	3700	18.5	1476	0.104	7893	0.091	4.93	28	0
34	t	Knaack and Kurama (2015)	CC-50-7	50	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	28	40.00	28.14	3.29	2.19	26524	200000	0.000	0.000	3700	18.5	1476	0.104	7893	0.091	4.14	7	0
35	0	Knaack and Kurama (2015)	CC-50-7	50	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	28	40.00	28.14	3.29	2.19	26524	200000	1.529	0.573	3700	18.5	1476	0.104	7893	0.091	12.90	7	119
36	0	Knaack and Kurama (2015)	UT-100-28	100	0	150	230	397	200	1.32	0	0	0	0.00	deformed	44.3	23	28	28	41.40	41.70	4.00	2.67	32288	200000	0.000	0.000	3700	18.5	1476	0.104	3013	0.091	1.24	28	0
37	t	Knaack and Kurama (2015)	UT-100-28	100	0	150	230	397	200	1.32	0	0	0	0.00	deformed	44.3	23	28	28	41.40	41.70	4.00	2.67	32288	200000	1.298	0.573	3700	18.5	1476	0.104	3013	0.091	7.39	28	119
38	t	Knaack and Kurama (2015)	UT-100-7	100	0	150	230	397	200	1.32	0	0	0	0.00	deformed	44.3	23	28	28	35.70	25.12	3.11	2.07	25060	200000	0.000	0.000	3700	18.5	1476	0.104	3021	0.091	1.12	7	0
39	0	Knaack and Kurama (2015)	UC-100-28	100	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	28	48.20	48.55	4.32	2.88	34839	200000	0.000	0.000	3700	18.5	1476	0.104	3021	0.091	0.97	28	0
40	t	Knaack and Kurama (2015)	UC-100-28	100	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	28	48.20	48.55	4.32	2.88	34839	200000	1.298	0.573	3700	18.5	1476	0.104	3021	0.091	5.94	28	119
41	0	Knaack and Kurama (2015)	UC-100-7	100	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	28	40.60	28.56	3.31	2.21	26721	200000	0.000	0.000	3700	18.5	1476	0.104	3021	0.091	1.27	7	0
42	t	Knaack and Kurama (2015)	UC-100-7	100	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	28	40.60	28.56	3.31	2.21	26721	200000	1.529	0.573	3700	18.5	1476	0.104	3021	0.091	7.62	7	119
43	0	Knaack and Kurama (2015)	CC-100-28	100	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	28	43.80	44.12	4.12	2.75	33211	200000	0.000	0.000	3700	18.5	1476	0.104	7918	0.091	5.11	28	0
44	t	Knaack and Kurama (2015)	CC-100-28	100	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	28	43.80	44.12	4.12	2.75	33211	200000	1.298	0.573	3700	18.5	1476	0.104	7918	0.091	12.27	28	119
45	0	Knaack and Kurama (2015)	CC-100-7	100	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	28	38.50	27.09	3.23	2.15	26024	200000	0.000	0.000	3700	18.5	1476	0.104	7918	0.091	4.60	7	0
46	t	Knaack and Kurama (2015)	CC-100-7	100	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	28	38.50	27.09	3.23	2.15	26024	200000	1.529	0.573	3700	18.5	1476	0.104	7918	0.091	14.68	7	119
47	0	Seara-Paz (2015)	H50-0	0	0	200	300	402	249	0.81	100.6	253	47	0.20	deformed	75	15	15	28	60.7	64.22	4.97	3.31	40069	200000	0.000	0.000	3400	13.7	2168	0.104	31550	0.101	11.73	42	0
48	t	Seara-Paz (2015)	H50-0	0	0	200	300	402	249	0.81	100.6	253	47	0.20	deformed	75	15	15	28	60.7	64.22	4.97	3.31	40069	200000	1.199	0.478	3400	13.7	2168	0.104	31550	0.101	18.39	42	1000
49	0	Seara-Paz (2015)	H50-50	50	0	200	300	402	249	0.81	100.6	253	47	0.20	deformed	75	15	15	28	51.8	54.80	4.59	3.06	37014	200000	0.000	0.000	3400	13.7	2168	0.104	21940	0.101	7.87	42	0
50	t	Seara-Paz (2015)	H50-50	50	0	200	300	402	249	0.81	100.6	253	47	0.20	deformed	75	15	15	28	51.8	54.80	4.59	3.06	37014	200000	1.199	0.478	3400	13.7	2168	0.104	21940	0.101	14.08	42	1000
51	0	Seara-Paz (2015)	H50-100	100	0	200	300	402	249	0.81	100.6	253	47	0.20	deformed	75	15	15	28	42.9	45.39	4.18	2.79	33686	200000	0.000	0.000	3400	13.7	2168	0.104	23530	0.101	6.80	42	0
52	t	Seara-Paz (2015)	H50-100	100	0	200	300	402	249	0.81	100.6	253	47	0.20	deformed	75	15	15	28	42.9	45.39	4.18	2.79	33686	200000	1.199	0.478	3400	13.7	2168	0.104	23530	0.101	15.20	42	1000
53	0	Seara-Paz (2015)	H65-0	0	0	200	300	402	234	0.86	100.6	268	32	0.22	deformed	75	15	15	28	46.9	49.62	4.37	2.91	35221	200000	0.000	0.000	3400	14.5	2168	0.104	22710	0.101	6.71	42	0
54	t	Seara-Paz (2015)	H65-0	0	0	200	300	402	234	0.86	100.6	268	32	0.22	deformed	75	15	15	28	46.9	49.62	4.37	2.91	35221	200000	1.199	0.478	3400	14.5	2168	0.104	22710	0.101	11.58	42	1000
55	0	Seara-Paz (2015)	H65-50	50	0	200	300	402	234	0.86	100.6	268	32	0.22	deformed	75	15	15	28	42.2	44.64	4.14	2.76	33407	200000	0.000	0.000	3400	14.5	2168	0.104	17130	0.101	4.96	42	0
56	t	Seara-Paz (2015)	H65-50	50	0	200	300	402	234	0.86	100.6	268	32	0.22	deformed	75	15	15	28	42.2	44.64	4.14	2.76	33407	200000	1.199	0.478	3400	14.5	2168	0.104	17130	0.101	9.63	42	1000
57	0	Seara-Paz (2015)	H-65-100	100	0	200	300	402	234	0.86	100.6	268	32	0.22	deformed	75	15	28	28	32.4	34.28	3.63	2.42	29275	200000	0.000	0.000	3400	14.5	2168	0.104	18100	0.101	4.59	42	0
58	t	Seara-Paz (2015)	H-65-100	100	0	200	300	402	234	0.86	100.6	268	32	0.22	deformed	75	15	28	28	32.4	34.28	3.63	2.42	29275	200000	1.199	0.478	3400	14.5	2168	0.104	18100	0.101	11.34	42	1000

Applicability of ACI 318 and ACI 435R

Database – NAC, RAC and HVFAC beams – Calculated Deflections

		Study information		Green concrete		Cracking moment							Uncracked cross-section		Fully cracked cross-section							Effective moment of inertia		Simplified method			Deflection					
		1	2	3	4	5	6		7		8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
		Author	Specimen	RAC (%)	FA/cm	W_c (mm^3)	M_{SW} (Nm)		M_{cr} (Nm)		M_{max} (Nm)	M_{max}/M_{cr}	I_c (mm^4)	S_c (mm^3)	A_{II}^* (mm^2)	A_{IIc} (mm^2)	$z_{IIc,1}$ (mm)	$z_{II,1}^*$ (mm)	I_{IIc} (mm^4)	I_{II}^* (mm^4)	S_{II}^* (mm^3)	I_{eff}	$I_{eff,max}$	$a_{eff,L1}$ (mm)	$a_{eff,L2}$ (mm)	$a_{eff,cs}$ (mm)	a_{simp} (mm)	a_{simp}/ a_{exp} (%)	t-t$_0$ (days)	$a_{num.int.}$ (mm)	a_{exp} (mm)	$a_{num.int.}/a_{exp}$ (%)
1	0	Tošić (2017)	NAC7	0	0	1066667	1024	<	2042	<	7669	3.756	106666667	128486	9015	7168	177.6	155.2	1199024	25818794	160508	27345023	27345023	1.72	11.50	0.00	13.22	1.441	0	12.67	9.17	1.382
2	t	Tošić (2017)	NAC7	0	0	1066667	1024	<	2042	<	7669	3.756	106666667	128486	9015	7168	177.6	155.2	1199024	25818794	160508	27345023	27345023	4.25	28.34	0.41	33.00	1.742	450	31.65	18.94	1.671
3	0	Tošić (2017)	NAC28	0	0	1066667	1024	<	2447	<	6877	2.810	106666667	107386	8218	6673	179.15	158.31	967463	22304088	139089	26104710	26104710	1.51	8.86	0.00	9.33	1.151	0	9.63	8.11	1.187
4	t	Tošić (2017)	NAC28	0	0	1066667	1024	<	2447	<	6877	2.810	106666667	107386	8218	6673	179.15	158.31	967463	22304088	139089	26104710	26104710	3.38	19.89	0.41	21.32	1.291	450	22.03	16.51	1.334
5	0	Tošić (2017)	RAC7	100	0	1066667	1024	<	1964	<	7947	4.046	106666667	133861	9216	7290	177.22	154.46	1261126	26715288	165964	27922103	27922103	1.76	12.22	0.00	13.98	1.283	0	13.48	10.89	1.238
6	t	Tošić (2017)	RAC7	100	0	1066667	1024	<	1964	<	7947	4.046	106666667	133861	9216	7290	177.22	154.46	1261126	26715288	165964	27922103	27922103	4.33	30.13	0.41	34.87	1.552	450	33.66	22.47	1.498
7	0	Tošić (2017)	RAC28	100	0	1066667	1024	<	2348	<	6438	2.742	106666667	111884	8393	6784	178.8	157.62	1016485	23065231	143757	27120831	27120831	1.51	8.22	0.00	8.76	1.406	0	9.03	6.23	1.449
8	t	Tošić (2017)	RAC28	100	0	1066667	1024	<	2348	<	6438	2.742	106666667	111884	8393	6784	178.8	157.62	1016485	23065231	143757	27120831	27120831	3.39	18.45	0.41	20.03	1.364	450	20.69	14.69	1.408
9	0	Tošić (2017)	HVFAC7	0	0.5	1066667	1024	<	1757	<	5593	3.183	106666667	149270	9752	7606	176.23	152.48	1432544	29157505	180708	31560395	31560395	1.73	7.96	0.00	9.69	1.581	0	9.22	6.13	1.504
10	t	Tošić (2017)	HVFAC7	0	0.5	1066667	1024	<	1757	<	5593	3.183	106666667	149270	9752	7606	176.23	152.48	1432544	29157505	180708	31560395	31560395	4.27	19.62	0.41	24.30	1.952	450	23.14	12.45	1.859
11	0	Tošić (2017)	HVFAC28	0	0.5	1066667	1024	<	2106	<	5454	2.590	106666667	124759	8877	7084	177.86	155.73	1157451	25206601	156808	29896618	29896618	1.53	6.81	0.00	7.50	1.857	0	7.73	4.04	1.913
12	t	Tošić (2017)	HVFAC28	0	0.5	1066667	1024	<	2106	<	5454	2.590	106666667	124759	8877	7084	177.86	155.73	1157451	25206601	156808	29896618	29896618	3.43	15.27	0.41	17.20	1.973	450	17.76	8.72	2.037
14	t	Knaack and Kurama (2015)	UT-0-28	0	0	1322500	1476	<	3131	<	4489	1.434	152087500	235575	13187	10416	195.28	160.55	4185421	63976932	361762	93873985	93873985	1.64	2.94	0.71	4.76	0.951	119	5.33	5.00	1.066
16	t	Knaack and Kurama (2015)	UT-0-7	0	0	1322500	1476	<	3255	<	4497	1.382	152087500	226895	12928	10260	195.8	161.58	4000169	62203820	351034	96288966	96288966	1.69	3.02	0.71	4.87	1.055	119	5.45	4.62	1.180
18	t	Knaack and Kurama (2015)	UC-0-28	0	0	1322500	1476	<	3855	<	4489	1.164	152087500	260083	12326	9264	199.12	168.23	2944638	55685084	286079	116738821	116738821	0.97	1.73	0.49	2.86	0.816	119	3.24	3.51	0.923
20	t	Knaack and Kurama (2015)	UC-0-7	0	0	1322500	1476	<	2973	<	4497	1.513	152087500	337123	14158	10191	196.03	162.06	3920005	68142240	346217	92397852	92397852	1.72	3.07	0.49	4.75	0.93	119	5.36	5.11	1.049
21	0	Knaack and Kurama (2015)	CC-0-28	0	0	1322500	1476	<	3484	<	9394	2.696	152087500	288000	13014	9624	197.92	165.85	3301437	60326312	308733	65007346	65007346	1.02	4.77	0.00	5.21	1.653	0	6.30	3.15	2.000
22	t	Knaack and Kurama (2015)	CC-0-28	0	0	1322500	1476	<	3484	<	9394	2.696	152087500	288000	13014	9624	197.92	165.85	3301437	60326312	308733	65007346	65007346	1.92	9.02	0.49	10.29	1.01	119	12.42	10.19	1.219
23	0	Knaack and Kurama (2015)	CC-0-7	0	0	1322500	1476	<	3131	<	9369	2.992	152087500	320429	13770	10002	196.66	163.31	3705926	65483144	333521	68715426	68715426	1.07	5.00	0.00	5.47	1.608	0	6.70	3.40	1.971
24	t	Knaack and Kurama (2015)	CC-0-7	0	0	1322500	1476	<	3131	<	9369	2.992	152087500	320429	13770	10002	196.66	163.31	3705926	65483144	333521	68715426	68715426	2.19	10.26	0.49	11.65	1.09	119	14.22	10.69	1.330
26	t	Knaack and Kurama (2015)	UT-50-28	50	0	1322500	1476	<	3625	<	4489	1.238	152087500	203700	12232	9834	197.22	164.44	3522304	57428772	322371	107275411	107275411	1.24	2.22	0.71	3.75	0.698	119	4.20	5.38	0.781
28	t	Knaack and Kurama (2015)	UT-50-7	50	0	1322500	1476	<	2911	<	4489	1.542	152087500	253827	13710	10725	194.25	158.49	4569073	67572622	383599	90619440	90619440	2.01	3.58	0.71	5.66	0.814	119	6.38	6.96	0.917
30	t	Knaack and Kurama (2015)	UC-50-28	50	0	1322500	1476	<	3864	<	4497	1.164	152087500	259274	12303	9252	199.16	168.32	2933210	55530406	285346	116783337	116783337	0.96	1.73	0.49	2.86	0.608	119	3.23	4.70	0.687
32	t	Knaack and Kurama (2015)	UC-50-7	50	0	1322500	1476	<	3026	<	4489	1.483	152087500	330914	14011	10119	196.27	162.52	3837506	67141260	341421	93160950	93160950	1.67	2.98	0.49	4.63	0.773	119	5.21	5.99	0.870
33	0	Knaack and Kurama (2015)	CC-50-28	50	0	1322500	1476	<	3370	<	9369	2.780	152087500	297403	13233	9735	197.55	165.1	3416993	61817317	315926	66018333	66018333	1.03	4.83	0.00	5.28	1.071	0	6.42	4.93	1.302
34	t	Knaack and Kurama (2015)	CC-50-7	50	0	1322500	1476	<	2902	<	9369	3.228	152087500	345461	14342	10278	195.74	161.47	4021259	69420230	352286	71876896	71876896	1.10	5.16	0.00	6.26	1.512	0	6.95	4.14	1.679
35	0	Knaack and Kurama (2015)	CC-50-7	50	0	1322500	1476	<	2902	<	9369	3.228	152087500	345461	14342	10278	195.74	161.47	4021259	69420230	352286	71876896	71876896	2.26	10.58	0.49	13.33	1.033	119	14.74	12.90	1.143
37	t	Knaack and Kurama (2015)	UT-100-28	100	0	1322500	1476	<	3528	<	4489	1.272	152087500	209025	12387	9930	196.9	163.8	3626469	58499869	328804	103931190	103931190	1.32	2.35	0.71	3.94	0.533	119	4.40	7.39	0.595
38	t	Knaack and Kurama (2015)	UT-100-7	100	0	1322500	1476	<	2743	<	4497	1.639	152087500	269314	14145	10977	193.41	156.81	4898772	70547986	401742	89052466	89052466	0.94	1.69	0.00	2.37	2.112	0	2.69	1.12	2.402
40	t	Knaack and Kurama (2015)	UC-100-28	100	0	1322500	1476	<	3811	<	4497	1.180	152087500	263010	12394	9300	199	167.99	2979100	56148128	288358	114539013	114539013	1.00	1.78	0.49	2.94	0.495	119	3.32	5.94	0.559
42	t	Knaack and Kurama (2015)	UC-100-7	100	0	1322500	1476	<	2920	<	4497	1.540	152087500	342914	14283	10251	195.83	161.66	3989651	68995342	350249	91743170	91743170	1.76	3.15	0.49	4.86	0.637	119	5.48	7.62	0.719
43	0	Knaack and Kurama (2015)	CC-100-28	100	0	1322500	1476	<	3634	<	9394	2.585	152087500	275903	12713	9468	198.44	166.88	3143482	58289869	298823	63719808	63719808	0.99	4.66	0.00	5.09	0.996	0	6.13	5.11	1.200
44	t	Knaack and Kurama (2015)	CC-100-28	100	0	1322500	1476	<	3634	<	9394	2.585	152087500	275903	12713	9468	198.44	166.88	3143482	58289869	298823	63719808	63719808	1.88	8.82	0.49	10.07	0.821	119	12.08	12.27	0.985
45	0	Knaack and Kurama (2015)	CC-100-7	100	0	1322500	1476	<	2849	<	9394	3.297	152087500	352098	14498	10353	195.49	160.98	4109934	70477678	357264	72754180	72754180	1.11	5.21	0.00	6.32	1.374	0	7.03	4.60	1.528
46	t	Knaack and Kurama (2015)	CC-100-7	100	0	1322500	1476	<	2849	<	9394	3.297	152087500	352098	14498	10353	195.49	160.98	4109934	70477678	357264	72754180	72754180	2.28	10.69	0.49	13.45	0.916	119	14.90	14.68	1.015
47	0	Seara-Paz (2015)	H50-0	0	0	3000000	2168	<	9945	<	33718	3.390	450000000	250367	14679	12171	269.57	239.13	3756215	86127801	370422	95464166	95464166	0.68	9.63	0.00	10.31	0.879	0	10.24	11.73	0.873
48	t	Seara-Paz (2015)	H50-0	0	0	3000000	2168	<	9945	<	33718	3.390	450000000	250367	14679	12171	269.57	239.13	3756215	86127801	370422	95464166	95464166	1.31	18.54	0.25	20.11	1.094	1000	19.97	18.39	1.086
49	0	Seara-Paz (2015)	H50-50	50	0	3000000	2168	<	9185	<	24108	2.625	450000000	271032	15289	12575	268.56	237.12	4142199	91907178	395403	111711024	111711024	0.63	6.20	0.00	6.14	0.781	0	6.61	7.87	0.840
50	t	Seara-Paz (2015)	H50-50	50	0	3000000	2168	<	9185	<	24108	2.625	450000000	271032	15289	12575	268.56	237.12	4142199	91907178	395403	111711024	111711024	1.21	11.93	0.25	12.06	0.856	1000	12.98	14.08	0.922
51	0	Seara-Paz (2015)	H50-100	100	0	3000000	2168	<	8364	<	25698	3.072	450000000	297808	16058	13073	267.32	234.63	4654089	99345279	427509	111435209	111435209	0.69	7.32	0.00	8.01	1.178	0	7.92	6.80	1.165
52	t	Seara-Paz (2015)	H50-100	100	0	3000000	2168	<	8364	<	25698	3.072	450000000	297808	16058	13073	267.32	234.63	4654089	99345279	427509	111435209	111435209	1.34	14.09	0.25	15.68	1.032	1000	15.50	15.20	1.020
53	0	Seara-Paz (2015)	H65-0	0	0	3000000	2168	<	8744	<	24878	2.845	450000000	259157	15140	12285	269.29	238.58	3862640	83950515	377251	99844173	99844173	0.74	7.54	0.00	7.45	1.111	0	8.05	6.71	1.200
54	t	Seara-Paz (2015)	H65-0	0	0	3000000	2168	<	8744	<	24878	2.845	450000000	259157	15140	12285	269.29	238.58	3862640	83950515	377251	99844173	99844173	1.42	14.48	0.26	14.55	1.256	1000	15.72	11.58	1.358
55	0	Seara-Paz (2015)	H65-50	50	0	3000000	2168	<	8284	<	19298	2.330	450000000	273229	15563	12552	268.62	237.24	4119767	87659466	393807	116321056	116321056	0.67	5.15	0.00	5.24	1.056	0	5.53	4.96	1.115
56	t	Seara-Paz (2015)	H65-50	50	0	3000000	2168	<	8284	<	19298	2.330	450000000	273229	15563	12552	268.62	237.24	4119767	87659466	393807	116321056	116321056	1.29	9.88	0.26	10.29	1.068	1000	10.89	9.63	1.131
57	0	Seara-Paz (2015)	H-65-100	100	0	3000000	2168	<	7264	<	20268	2.790	450000000	311794	16659	13226	266.94	233.86	4819620	97457898	437429	113687423	113687423	0.78	6.35	0.00	6.42	1.399	0	6.96	4.59	1.516
58	t	Seara-Paz (2015)	H-65-100	100	0	3000000	2168	<	7264	<	20268	2.790	450000000	311794	16659	13226	266.94	233.86	4819620	97457898	437429	113687423	113687423	1.50	12.19	0.26	12.56	1.108	1000	13.63	11.34	1.202

Applicability of ACI 318 and ACI 435R

Database – NAC, RAC and HVFAC beams – RAC Corrections

		Study information		Green concrete		Cross-section		Reinforcement								Mechanical properties												Loading						Deflection		
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
		Author	Specimen	RAC (%)	FA/cm	b (mm)	h (mm)	A_{s1} (mm^2)	d (mm)	ρ_1 (%)	A_{s2} (mm^2)	d' (mm)	d_2 (mm)	ρ_2 (%)	type	RH (%)	T (ºC)	t_{test} (days)	$f_{cm}(t_{test})$ (MPa)	f_{cm} (MPa)	$f_{cm}(t_0)$ (MPa)	f_r (t_0) (MPa)	$f_{r,red}$ (t_0) (MPa)	$E_{cm}(t_0)$ (MPa)	E_s (MPa)	φ (–)	ε_{cs} (‰)	L (mm)	L/d	M_{L1} (Nm)	K_{L1}	M_{L2} (Nm)	K_{L2}	a (t-t_0) (mm)	t_0 (days)	t-t_0 (days)
1	0	Tošić (2017)	NAC7	0	0	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	14	28	30.50	21.46	2.87	1.91	23162	200000	0.000	0.000	3200	18.9	1024	0.104	6645	0.107	9.17	7	0
2	t	Tošić (2017)	NAC7	0	0	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	14	28	30.50	21.46	2.87	1.91	23162	200000	1.906	0.743	3200	18.9	1024	0.104	6645	0.107	18.94	7	450
3	0	Tošić (2017)	NAC28	0	0	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	14	28	30.50	30.72	3.44	2.29	27713	200000	0.000	0.000	3200	18.9	1024	0.104	5853	0.107	8.11	28	0
4	t	Tošić (2017)	NAC28	0	0	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	14	28	30.50	30.72	3.44	2.29	27713	200000	1.618	0.743	3200	18.9	1024	0.104	5853	0.107	16.51	28	450
5	0	Tošić (2017)	RAC7	100	0	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	14	28	28.10	19.77	2.76	1.84	20867	200000	0.000	0.000	3200	18.9	1024	0.104	6923	0.107	10.89	7	0
6	t	Tošić (2017)	RAC7	100	0	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	14	28	28.10	19.77	2.76	1.84	20867	200000	4.481	1.063	3200	18.9	1024	0.104	6923	0.107	22.47	7	450
7	0	Tošić (2017)	RAC28	100	0	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	14	28	28.10	28.30	3.30	2.20	24967	200000	0.000	0.000	3200	18.9	1024	0.104	5414	0.107	6.23	28	0
8	t	Tošić (2017)	RAC28	100	0	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	14	28	28.10	28.30	3.30	2.20	24967	200000	3.706	1.063	3200	18.9	1024	0.104	5414	0.107	14.69	28	450
9	0	Tošić (2017)	HVFAC7	0	0.5	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	14	28	22.60	15.90	2.47	1.65	19937	200000	0.000	0.000	3200	18.9	1024	0.104	4569	0.107	6.13	7	0
10	t	Tošić (2017)	HVFAC7	0	0.5	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	14	28	22.60	15.90	2.47	1.65	19937	200000	1.906	0.743	3200	18.9	1024	0.104	4569	0.107	12.45	7	450
11	0	Tošić (2017)	HVFAC28	0	0.5	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	14	28	22.60	22.76	2.96	1.97	23854	200000	0.000	0.000	3200	18.9	1024	0.104	4430	0.107	4.04	28	0
12	t	Tošić (2017)	HVFAC28	0	0.5	160	200	157	169	0.58	57	171	29	0.21	deformed	48.7	21.3	14	28	22.60	22.76	2.96	1.97	23854	200000	1.618	0.743	3200	18.9	1024	0.104	4430	0.107	8.72	28	450
13	0	Knaack and Kurama (2015)	UT-0-28	0	0	150	230	397	200	1.32	0	0	0	0.00	deformed	44.3	23	14	28	32.60	32.83	3.55	2.37	28649	200000	0.000	0.000	3700	18.5	1476	0.104	3013	0.091	0.86	28	0
14	t	Knaack and Kurama (2015)	UT-0-28	0	0	150	230	397	200	1.32	0	0	0	0.00	deformed	44.3	23	14	28	32.60	32.83	3.55	2.37	28649	200000	1.298	0.573	3700	18.5	1476	0.104	3013	0.091	5.00	28	119
15	0	Knaack and Kurama (2015)	UT-0-7	0	0	150	230	397	200	1.32	0	0	0	0.00	deformed	44.3	23	14	28	50.30	35.39	3.69	2.46	29745	200000	0.000	0.000	3700	18.5	1476	0.104	3021	0.091	0.74	7	0
16	t	Knaack and Kurama (2015)	UT-0-7	0	0	150	230	397	200	1.32	0	0	0	0.00	deformed	44.3	23	14	28	50.30	35.39	3.69	2.46	29745	200000	1.529	0.573	3700	18.5	1476	0.104	3021	0.091	4.62	7	119
17	0	Knaack and Kurama (2015)	UC-0-28	0	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	14	28	49.30	49.65	4.37	2.91	35231	200000	0.000	0.000	3700	18.5	1476	0.104	3013	0.091	0.66	28	0
18	t	Knaack and Kurama (2015)	UC-0-28	0	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	14	28	49.30	49.65	4.37	2.91	35231	200000	1.298	0.573	3700	18.5	1476	0.104	3013	0.091	3.51	28	119
19	0	Knaack and Kurama (2015)	UC-0-7	0	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	28	42.00	29.55	3.37	2.25	27180	200000	0.000	0.000	3700	18.5	1476	0.104	3021	0.091	0.94	7	0
20	t	Knaack and Kurama (2015)	UC-0-7	0	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	28	42.00	29.55	3.37	2.25	27180	200000	1.529	0.573	3700	18.5	1476	0.104	3021	0.091	5.11	7	119
21	0	Knaack and Kurama (2015)	CC-0-28	0	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	28	40.20	40.49	3.95	2.63	31816	200000	0.000	0.000	3700	18.5	1476	0.104	7918	0.091	3.15	28	0
22	t	Knaack and Kurama (2015)	CC-0-28	0	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	28	40.20	40.49	3.95	2.63	31816	200000	1.298	0.573	3700	18.5	1476	0.104	7918	0.091	10.19	28	119
23	0	Knaack and Kurama (2015)	CC-0-7	0	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	32	28	46.50	32.71	3.55	2.37	28596	200000	0.000	0.000	3700	18.5	1476	0.104	7893	0.091	3.40	7	0
24	t	Knaack and Kurama (2015)	CC-0-7	0	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	32	28	46.50	32.71	3.55	2.37	28596	200000	1.529	0.573	3700	18.5	1476	0.104	7893	0.091	10.69	7	119
25	0	Knaack and Kurama (2015)	UT-50-28	50	0	150	230	397	200	1.32	0	0	0	0.00	deformed	44.3	23	35	28	43.60	43.91	4.11	2.74	31371	200000	0.000	0.000	3700	18.5	1476	0.104	3013	0.091	0.91	28	0
26	t	Knaack and Kurama (2015)	UT-50-28	50	0	150	230	397	200	1.32	0	0	0	0.00	deformed	44.3	23	35	28	43.60	43.91	4.11	2.74	31371	200000	1.932	0.573	3700	18.5	1476	0.104	3013	0.091	5.38	28	119
27	0	Knaack and Kurama (2015)	UT-50-7	50	0	150	230	397	200	1.32	0	0	0	0.00	deformed	44.3	23	35	28	40.20	28.28	3.30	2.20	25519	200000	0.000	0.000	3700	18.5	1476	0.104	3013	0.091	0.94	7	0
28	t	Knaack and Kurama (2015)	UT-50-7	50	0	150	230	397	200	1.32	0	0	0	0.00	deformed	44.3	23	35	28	40.20	28.28	3.30	2.20	25519	200000	2.586	0.573	3700	18.5	1476	0.104	3013	0.091	6.96	7	119
29	0	Knaack and Kurama (2015)	UC-50-28	50	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	35	28	49.60	49.96	4.38	2.92	33119	200000	0.000	0.000	3700	18.5	1476	0.104	3021	0.091	0.86	28	0
30	t	Knaack and Kurama (2015)	UC-50-28	50	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	35	28	49.60	49.96	4.38	2.92	33119	200000	1.686	0.573	3700	18.5	1476	0.104	3021	0.091	4.70	28	119
31	0	Knaack and Kurama (2015)	UC-50-7	50	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	28	43.60	30.67	3.43	2.29	26219	200000	0.000	0.000	3700	18.5	1476	0.104	3013	0.091	0.84	7	0
32	t	Knaack and Kurama (2015)	UC-50-7	50	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	28	43.60	30.67	3.43	2.29	26219	200000	2.345	0.573	3700	18.5	1476	0.104	3013	0.091	5.99	7	119
33	0	Knaack and Kurama (2015)	CC-50-28	50	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	28	37.70	37.97	3.82	2.55	29888	200000	0.000	0.000	3700	18.5	1476	0.104	7893	0.091	4.93	28	0
34	t	Knaack and Kurama (2015)	CC-50-7	50	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	28	40.00	28.14	3.29	2.19	25477	200000	0.000	0.000	3700	18.5	1476	0.104	7893	0.091	4.14	7	0
35	0	Knaack and Kurama (2015)	CC-50-7	50	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	28	40.00	28.14	3.29	2.19	25477	200000	2.600	0.573	3700	18.5	1476	0.104	7893	0.091	12.90	7	119
36	0	Knaack and Kurama (2015)	UT-100-28	100	0	150	230	397	200	1.32	0	0	0	0.00	deformed	44.3	23	28	28	41.40	41.70	4.00	2.67	29104	200000	0.000	0.000	3700	18.5	1476	0.104	3013	0.091	1.24	28	0
37	t	Knaack and Kurama (2015)	UT-100-28	100	0	150	230	397	200	1.32	0	0	0	0.00	deformed	44.3	23	28	28	41.40	41.70	4.00	2.67	29104	200000	2.200	0.590	3700	18.5	1476	0.104	3013	0.091	7.39	28	119
38	t	Knaack and Kurama (2015)	UT-100-7	100	0	150	230	397	200	1.32	0	0	0	0.00	deformed	44.3	23	28	28	35.70	25.12	3.11	2.07	22878	200000	0.000	0.000	3700	18.5	1476	0.104	3021	0.091	1.12	7	0
39	0	Knaack and Kurama (2015)	UC-100-28	100	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	28	48.20	48.55	4.32	2.88	30983	200000	0.000	0.000	3700	18.5	1476	0.104	3021	0.091	0.97	28	0
40	t	Knaack and Kurama (2015)	UC-100-28	100	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	28	48.20	48.55	4.32	2.88	30983	200000	1.863	0.573	3700	18.5	1476	0.104	3021	0.091	5.94	28	119
41	0	Knaack and Kurama (2015)	UC-100-7	100	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	28	40.60	28.56	3.31	2.21	24164	200000	0.000	0.000	3700	18.5	1476	0.104	3021	0.091	1.27	7	0
42	t	Knaack and Kurama (2015)	UC-100-7	100	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	28	40.60	28.56	3.31	2.21	24164	200000	2.744	0.593	3700	18.5	1476	0.104	3021	0.091	7.62	7	119
43	0	Knaack and Kurama (2015)	CC-100-28	100	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	28	43.80	44.12	4.12	2.75	30010	200000	0.000	0.000	3700	18.5	1476	0.104	7918	0.091	5.11	28	0
44	t	Knaack and Kurama (2015)	CC-100-28	100	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	28	43.80	44.12	4.12	2.75	30010	200000	2.081	0.574	3700	18.5	1476	0.104	7918	0.091	12.27	28	119
45	0	Knaack and Kurama (2015)	CC-100-7	100	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	28	38.50	27.09	3.23	2.15	23743	200000	0.000	0.000	3700	18.5	1476	0.104	7918	0.091	4.60	7	0
46	t	Knaack and Kurama (2015)	CC-100-7	100	0	150	230	397	200	1.32	142	200	30	0.47	deformed	44.3	23	28	28	38.50	27.09	3.23	2.15	23743	200000	2.916	0.596	3700	18.5	1476	0.104	7918	0.091	14.68	7	119
47	0	Seara-Paz (2015)	H50-0	0	0	200	300	402	249	0.81	100.6	253	47	0.20	deformed	75	15	15	28	60.7	64.22	4.97	3.31	40069	200000	0.000	0.000	3400	13.7	2168	0.104	31550	0.101	11.73	42	0
48	t	Seara-Paz (2015)	H50-0	0	0	200	300	402	249	0.81	100.6	253	47	0.20	deformed	75	15	15	28	60.7	64.22	4.97	3.31	40069	200000	1.199	0.478	3400	13.7	2168	0.104	31550	0.101	18.39	42	1000
49	0	Seara-Paz (2015)	H50-50	50	0	200	300	402	249	0.81	100.6	253	47	0.20	deformed	75	15	15	28	51.8	54.80	4.59	3.06	34437	200000	0.000	0.000	3400	13.7	2168	0.104	21940	0.101	7.87	42	0
50	t	Seara-Paz (2015)	H50-50	50	0	200	300	402	249	0.81	100.6	253	47	0.20	deformed	75	15	15	28	51.8	54.80	4.59	3.06	34437	200000	1.473	0.478	3400	13.7	2168	0.104	21940	0.101	14.08	42	1000
51	0	Seara-Paz (2015)	H50-100	100	0	200	300	402	249	0.81	100.6	253	47	0.20	deformed	75	15	15	28	42.9	45.39	4.18	2.79	30185	200000	0.000	0.000	3400	13.7	2168	0.104	23530	0.101	6.80	42	0
52	t	Seara-Paz (2015)	H50-100	100	0	200	300	402	249	0.81	100.6	253	47	0.20	deformed	75	15	15	28	42.9	45.39	4.18	2.79	30185	200000	1.896	0.478	3400	13.7	2168	0.104	23530	0.101	15.20	42	1000
53	0	Seara-Paz (2015)	H65-0	0	0	200	300	402	234	0.86	100.6	268	32	0.22	deformed	75	15	15	28	46.9	49.62	4.37	2.91	35221	200000	0.000	0.000	3400	14.5	2168	0.104	22710	0.101	6.71	42	0
54	t	Seara-Paz (2015)	H65-0	0	0	200	300	402	234	0.86	100.6	268	32	0.22	deformed	75	15	15	28	46.9	49.62	4.37	2.91	35221	200000	1.199	0.478	3400	14.5	2168	0.104	22710	0.101	11.58	42	1000
55	0	Seara-Paz (2015)	H65-50	50	0	200	300	402	234	0.86	100.6	268	32	0.22	deformed	75	15	15	28	42.2	44.64	4.14	2.76	31803	200000	0.000	0.000	3400	14.5	2168	0.104	17130	0.101	4.96	42	0
56	t	Seara-Paz (2015)	H65-50	50	0	200	300	402	234	0.86	100.6	268	32	0.22	deformed	75	15	15	28	42.2	44.64	4.14	2.76	31803	200000	1.792	0.478	3400	14.5	2168	0.104	17130	0.101	9.63	42	1000
57	0	Seara-Paz (2015)	H-65-100	100	0	200	300	402	234	0.86	100.6	268	32	0.22	deformed	75	15	28	28	32.4	34.28	3.63	2.42	27161	200000	0.000	0.000	3400	14.5	2168	0.104	18100	0.101	4.59	42	0
58	t	Seara-Paz (2015)	H-65-100	100	0	200	300	402	234	0.86	100.6	268	32	0.22	deformed	75	15	28	28	32.4	34.28	3.63	2.42	27161	200000	2.438	0.504	3400	14.5	2168	0.104	18100	0.101	11.34	42	1000

Applicability of ACI 318 and ACI 435R

Database – NAC, RAC and HVFAC beams – Calculated Deflections with RAC Corrections

		Study information		Green concrete		Cracking moment							Uncracked cross-section		Fully cracked cross-section						Effective moment of inertia			Simplified method			Deflection					
		1	2	3	4	5	6		7		8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
		Author	Specimen	RAC (%)	FA/cm	W_c (mm^3)	M_{SW} (Nm)		M_{cr} (Nm)		M_{max} (Nm)	M_{max}/M_{cr}	I_c (mm^4)	S_c (mm^3)	A_{II}^* (mm^2)	A_{IIc} (mm^2)	$z_{IIc,1}$ (mm)	$z_{II,1}^*$ (mm)	I_{IIc} (mm^4)	I_{II}^* (mm^4)	S_{II}^* (mm^3)	I_{eff}	$I_{eff,max}$	$a_{eff,L1}$ (mm)	$a_{eff,L2}$ (mm)	$a_{eff,cs}$ (mm)	a_{simp} (mm)	a_{simp}/a_{exp} (%)	t-t_0 (days)	$a_{num.int.}$ (mm)	a_{exp} (mm)	$a_{num.int.}/a_{exp}$ (%)
1	0	Tošić (2017)	NAC7	0	0	1066667	1024	<	2042	<	7669	3.756	106666667	128486	9015	7168	177.6	155.2	1199024	25818794	160508	27345023	27345023	1.72	11.50	0.00	13.22	1.441	0	12.67	9.17	1.382
2	t	Tošić (2017)	NAC7	0	0	1066667	1024	<	2042	<	7669	3.756	106666667	128486	9015	7168	177.6	155.2	1199024	25818794	160508	27345023	27345023	4.25	28.34	0.41	33.00	1.742	450	31.65	18.94	1.671
3	0	Tošić (2017)	NAC28	0	0	1066667	1024	<	2447	<	6877	2.810	106666667	107386	8218	6673	179.15	158.31	967463	22304088	139089	26104710	26104710	1.51	8.86	0.00	9.33	1.151	0	9.63	8.11	1.187
4	t	Tošić (2017)	NAC28	0	0	1066667	1024	<	2447	<	6877	2.810	106666667	107386	8218	6673	179.15	158.31	967463	22304088	139089	26104710	26104710	3.38	19.89	0.41	21.32	1.291	450	22.03	16.51	1.334
5	0	Tošić (2017)	RAC7	100	0	1066667	1024	<	1964	<	7947	4.046	106666667	142615	9521	7471	176.65	153.32	1357505	28098596	174322	29284531	29284531	1.78	12.41	0.00	14.20	1.304	0	13.72	10.89	1.260
6	t	Tošić (2017)	RAC7	100	0	1066667	1024	<	1964	<	7947	4.046	106666667	142615	9521	7471	176.65	153.32	1357505	28098596	174322	29284531	29284531	7.93	55.18	0.59	63.70	2.835	450	61.58	22.47	2.741
7	0	Tošić (2017)	RAC28	100	0	1066667	1024	<	2348	<	6438	2.742	106666667	119200	8671	6957	178.26	156.52	1096272	24293427	151239	28289446	28289446	1.54	8.40	0.00	8.95	1.436	0	9.25	6.23	1.485
8	t	Tošić (2017)	RAC28	100	0	1066667	1024	<	2348	<	6438	2.742	106666667	119200	8671	6957	178.26	156.52	1096272	24293427	151239	28289446	28289446	5.94	32.33	0.59	34.98	2.381	450	36.22	14.69	2.466
9	0	Tošić (2017)	HVFAC7	0	0.5	1066667	1024	<	1757	<	5593	3.183	106666667	149270	9752	7606	176.23	152.48	1432544	29157505	180708	31560395	31560395	1.73	7.96	0.00	9.69	1.581	0	9.22	6.13	1.504
10	t	Tošić (2017)	HVFAC7	0	0.5	1066667	1024	<	1757	<	5593	3.183	106666667	149270	9752	7606	176.23	152.48	1432544	29157505	180708	31560395	31560395	4.27	19.62	0.41	24.30	1.952	450	23.14	12.45	1.859
11	0	Tošić (2017)	HVFAC28	0	0.5	1066667	1024	<	2106	<	5454	2.590	106666667	124759	8877	7084	177.86	155.73	1157451	25206601	156808	29896618	29896618	1.53	6.81	0.00	7.50	1.857	0	7.73	4.04	1.913
12	t	Tošić (2017)	HVFAC28	0	0.5	1066667	1024	<	2106	<	5454	2.590	106666667	124759	8877	7084	177.86	155.73	1157451	25206601	156808	29896618	29896618	3.43	15.27	0.41	17.20	1.973	450	17.76	8.72	2.037
14	t	Knaack and Kurama (2015)	UT-0-28	0	0	1322500	1476	<	3131	<	4489	1.434	152087500	235575	13187	10416	195.28	160.55	4185421	63976932	361762	93873985	93873985	1.64	2.94	0.71	4.76	0.951	119	5.33	5.00	1.066
16	t	Knaack and Kurama (2015)	UT-0-7	0	0	1322500	1476	<	3255	<	4497	1.382	152087500	226895	12928	10260	195.8	161.58	4000169	62203820	351034	96288966	96288966	1.69	3.02	0.71	4.87	1.055	119	5.45	4.62	1.180
18	t	Knaack and Kurama (2015)	UC-0-28	0	0	1322500	1476	<	3855	<	4489	1.164	152087500	260083	12326	9264	199.12	168.23	2944638	55685084	286079	116738821	116738821	0.97	1.73	0.49	2.86	0.816	119	3.24	3.51	0.923
20	t	Knaack and Kurama (2015)	UC-0-7	0	0	1322500	1476	<	2973	<	4497	1.513	152087500	337123	14158	10191	196.03	162.06	3920005	68142240	346217	92397852	92397852	1.72	3.07	0.49	4.75	0.93	119	5.36	5.11	1.049
21	0	Knaack and Kurama (2015)	CC-0-28	0	0	1322500	1476	<	3484	<	9394	2.696	152087500	288000	13014	9624	197.92	165.85	3301437	60326312	308733	65007346	65007346	1.02	4.77	0.00	5.21	1.653	0	6.30	3.15	2.000
22	t	Knaack and Kurama (2015)	CC-0-28	0	0	1322500	1476	<	3484	<	9394	2.696	152087500	288000	13014	9624	197.92	165.85	3301437	60326312	308733	65007346	65007346	1.92	9.02	0.49	10.29	1.01	119	12.42	10.19	1.219
23	0	Knaack and Kurama (2015)	CC-0-7	0	0	1322500	1476	<	3131	<	9369	2.992	152087500	320429	13770	10002	196.66	163.31	3705926	65483144	333521	68715426	68715426	1.07	5.00	0.00	5.47	1.608	0	6.70	3.40	1.971
24	t	Knaack and Kurama (2015)	CC-0-7	0	0	1322500	1476	<	3131	<	9369	2.992	152087500	320429	13770	10002	196.66	163.31	3705926	65483144	333521	68715426	68715426	2.19	10.26	0.49	11.65	1.09	119	14.22	10.69	1.330
26	t	Knaack and Kurama (2015)	UT-50-28	50	0	1322500	1476	<	3625	<	4489	1.238	152087500	215137	12583	10050	196.5	162.98	3759538	59841908	336820	108417806	108417806	1.63	2.92	0.71	4.73	0.879	119	5.31	5.38	0.987
28	t	Knaack and Kurama (2015)	UT-50-7	50	0	1322500	1476	<	2911	<	4489	1.542	152087500	264470	14014	10902	193.66	157.32	4799044	69650668	396281	92130812	92130812	2.86	5.11	0.71	7.80	1.121	119	8.82	6.96	1.267
30	t	Knaack and Kurama (2015)	UC-50-28	50	0	1322500	1476	<	3864	<	4497	1.164	152087500	276668	12736	9480	198.4	166.8	3155450	58441670	299555	117847783	117847783	1.16	2.08	0.49	3.36	0.715	119	3.81	4.70	0.811
32	t	Knaack and Kurama (2015)	UC-50-7	50	0	1322500	1476	<	3026	<	4489	1.483	152087500	349486	14436	10323	195.59	161.17	4074310	70055512	355258	95182544	95182544	2.20	3.93	0.49	5.95	0.994	119	6.72	5.99	1.122
33	0	Knaack and Kurama (2015)	CC-50-28	50	0	1322500	1476	<	3370	<	9369	2.780	152087500	306578	13449	9843	197.19	164.37	3531984	63293996	323030	67426290	67426290	1.04	4.88	0.00	5.33	1.081	0	6.48	4.93	1.314
34	t	Knaack and Kurama (2015)	CC-50-7	50	0	1322500	1476	<	2902	<	9369	3.228	152087500	359656	14659	10428	195.24	160.47	4199903	71598241	362539	73990182	73990182	1.11	5.22	0.00	6.33	1.529	0	7.04	4.14	1.700
35	0	Knaack and Kurama (2015)	CC-50-7	50	0	1322500	1476	<	2902	<	9369	3.228	152087500	359656	14659	10428	195.24	160.47	4199903	71598241	362539	73990182	73990182	3.11	14.54	0.49	18.13	1.406	119	20.10	12.90	1.558
37	t	Knaack and Kurama (2015)	UT-100-28	100	0	1322500	1476	<	3528	<	4489	1.272	152087500	231890	13077	10350	195.5	160.99	4106363	63230187	357261	106365216	106365216	1.95	3.48	0.73	5.54	0.75	119	6.23	7.39	0.843
38	t	Knaack and Kurama (2015)	UT-100-7	100	0	1322500	1476	<	2743	<	4497	1.639	152087500	294998	14840	11370	192.1	154.2	5443994	75299553	430947	92725718	92725718	0.99	1.77	0.00	2.49	2.222	0	2.85	1.12	2.545
40	t	Knaack and Kurama (2015)	UC-100-28	100	0	1322500	1476	<	3811	<	4497	1.180	152087500	295748	13199	9717	197.61	165.21	3398074	61594591	314849	116670634	116670634	1.33	2.37	0.49	3.77	0.635	119	4.28	5.94	0.721
42	t	Knaack and Kurama (2015)	UC-100-7	100	0	1322500	1476	<	2920	<	4497	1.540	152087500	379196	15089	10626	194.58	159.15	4443710	74573301	376507	95794072	95794072	2.62	4.69	0.51	7.04	0.923	119	8.00	7.62	1.050
43	0	Knaack and Kurama (2015)	CC-100-28	100	0	1322500	1476	<	3634	<	9394	2.585	152087500	305331	13418	9828	197.24	164.48	3515861	63073390	321976	68226412	68226412	1.03	4.82	0.00	5.26	1.029	0	6.36	5.11	1.245
44	t	Knaack and Kurama (2015)	CC-100-28	100	0	1322500	1476	<	3634	<	9394	2.585	152087500	305331	13418	9828	197.24	164.48	3515861	63073390	321976	68226412	68226412	2.49	11.71	0.49	13.22	1.078	119	15.95	12.27	1.300
45	0	Knaack and Kurama (2015)	CC-100-7	100	0	1322500	1476	<	2849	<	9394	3.297	152087500	385917	15227	10689	194.37	158.73	4523217	75530842	380967	77666387	77666387	1.14	5.35	0.00	6.49	1.411	0	7.24	4.60	1.574
46	t	Knaack and Kurama (2015)	CC-100-7	100	0	1322500	1476	<	2849	<	9394	3.297	152087500	385917	15227	10689	194.37	158.73	4523217	75530842	380967	77666387	77666387	3.42	16.07	0.51	20.00	1.362	119	22.24	14.68	1.515
47	0	Seara-Paz (2015)	H50-0	0	0	3000000	2168	<	9945	<	33718	3.390	450000000	250367	14679	12171	269.57	239.13	3756215	86127801	370422	95464166	95464166	0.68	9.63	0.00	10.31	0.879	0	10.24	11.73	0.873
48	t	Seara-Paz (2015)	H50-0	0	0	3000000	2168	<	9945	<	33718	3.390	450000000	250367	14679	12171	269.57	239.13	3756215	86127801	370422	95464166	95464166	1.31	18.54	0.25	20.11	1.094	1000	19.97	18.39	1.086
49	0	Seara-Paz (2015)	H50-50	50	0	3000000	2168	<	9185	<	24108	2.625	450000000	291316	15878	12958	267.61	235.21	4532822	97575943	419847	117066286	117066286	0.65	6.35	0.00	6.30	0.801	0	6.80	7.87	0.864
50	t	Seara-Paz (2015)	H50-50	50	0	3000000	2168	<	9185	<	24108	2.625	450000000	291316	15878	12958	267.61	235.21	4532822	97575943	419847	117066286	117066286	1.38	13.58	0.25	13.70	0.973	1000	14.79	14.08	1.050
51	0	Seara-Paz (2015)	H50-100	100	0	3000000	2168	<	8364	<	25698	3.072	450000000	332354	17002	13670	265.82	231.65	5321987	108566172	467239	120338183	120338183	0.72	7.56	0.00	8.28	1.218	0	8.22	6.80	1.209
52	t	Seara-Paz (2015)	H50-100	100	0	3000000	2168	<	8364	<	25698	3.072	450000000	332354	17002	13670	265.82	231.65	5321987	108566172	467239	120338183	120338183	1.77	18.64	0.25	20.66	1.359	1000	20.50	15.20	1.349
53	0	Seara-Paz (2015)	H65-0	0	0	3000000	2168	<	8744	<	24878	2.845	450000000	259157	15140	12285	269.29	238.58	3862640	83950515	377251	99844173	99844173	0.74	7.54	0.00	7.45	1.111	0	8.05	6.71	1.200
54	t	Seara-Paz (2015)	H65-0	0	0	3000000	2168	<	8744	<	24878	2.845	450000000	259157	15140	12285	269.29	238.58	3862640	83950515	377251	99844173	99844173	1.42	14.48	0.26	14.55	1.256	1000	15.72	11.58	1.358
55	0	Seara-Paz (2015)	H65-50	50	0	3000000	2168	<	8284	<	19298	2.330	450000000	287007	15961	12800	268	236	4368862	91199985	409610	119581516	119581516	0.69	5.26	0.00	5.35	1.079	0	5.67	4.96	1.143
56	t	Seara-Paz (2015)	H65-50	50	0	3000000	2168	<	8284	<	19298	2.330	450000000	287007	15961	12800	268	236	4368862	91199985	409610	119581516	119581516	1.63	12.49	0.26	12.94	1.344	1000	13.72	9.63	1.425
57	0	Seara-Paz (2015)	H-65-100	100	0	3000000	2168	<	7264	<	20268	2.790	450000000	336062	17322	13623	265.94	231.88	5267723	103450184	464049	119403850	119403850	0.80	6.52	0.00	6.59	1.435	0	7.17	4.59	1.562
58	t	Seara-Paz (2015)	H-65-100	100	0	3000000	2168	<	7264	<	20268	2.790	450000000	336062	17322	13623	265.94	231.88	5267723	103450184	464049	119403850	119403850	2.31	18.71	0.27	19.16	1.69	1000	20.85	11.34	1.839

Bibliography

ACI 209.2R-08 (2008). *Guide for Modeling and Calculating Shrinkage and Creep in Hardened Concrete*. American Concrete Institute, Farmington Hills, MI.

ACI 209R-92 (1992). *Prediction of Creep, Shrinkage, and Temperature Effects in Concrete Structures*. American Concrete Institute, Farmington Hills, MI.

ACI 318-11 (2011). *Building code requirements for structural concrete (ACI 318-11) and commentary*. American Concrete Institute, Farmington Hills, MI.

ACI 435R-95 (2003). *Control of deflection in concrete Structures*. American Concrete Institute, Farmington Hills, MI.

ACI Committe 232 (1986). *Use of fly ash in concrete Reported by ACI Comittee 232*, volume 96. American Concrete Institute, Detroit.

Aćić, M. (2012). The history and development of reinforced concrete in Europe and the world with an overview of the conditions in the Kingdom of Serbia. In Aćić, M. and Marinković, S., editors, *One hundred years of teaching reinforced concrete at the University of Belgrade's Faculty of Civil Engineering*, pages 13–37. Faculty of Civil Engineering, University of Belgrade - Institute of Materials and Structures, Belgrade.

Acker, P., Bažant, Z., Chem, J., Huet, C., and Wittmann, F. (1998). Measurement of time-dependent strains of concrete. *Materials and Structures*, 31(October 1998):507–512.

Acker, P. and Ulm, F. J. (2001). Creep and shrinkage of concrete: Physical origins and practical measurements. *Nuclear Engineering and Design*, 203:143–158.

Ajdukiewicz, A. and Kliszczewicz, A. (2002). Influence of recycled aggregates on mechanical properties of HS/HPC. *Cement and Concrete Composites*, 24:269–279.

Ajdukiewicz, A. and Kliszczewicz, A. (2011). Long-term behaviour of reinforced-concrete beams and columns made of recycled aggregate. In *fib Symposium: Concrete engineering for excellence and efficiency, June 8-10*, pages 479–482.

Ajdukiewicz, A. B. and Kliszczewicz, A. T. (2007). Comparative tests of beams and columns made of recycled aggregate concrete and natural aggregate concrete. *Journal of Advanced Concrete Technology*, 5(2):259–273.

Al-Manaseer, A. and Prado, A. (2015). Statistical Comparisons of Creep and Shrinkage Prediction Models Using RILEM and NU-ITI Databases. *ACI Materials Journal*, 112(1):125–135.

Arangjelovski, T., Markovski, G., and Mark, P. (2012). Influence of repeated variable load on long-term behavior of concrete elements. *Journal of Civil Engineering and Architecture*, 8(3):302–314.

Arezoumandi, M., Ortega, C. a., and Volz, J. S. (2015). Flexural Behavior of High-Volume Fly Ash Concrete Beams. *Transportation Research Record: Journal of the Transportation Research Board*, 2508:22–30.

Arezoumandi, M., Volz, J. S., Ortega, C. A., and Myers, J. J. (2013). Effect of total cementitious content on shear strength of high-volume fly ash concrete beams. *Materials and Design*, 46:301–309.

ASTM C188-15 (2015). *Standard Test Method for Density of Hydraulic Cement*. ASTM International, West Conshohocken, PA.

ASTM-C618-12a (2012). *Standard specification for coal fly ash and raw or calcined natural pozzolan for use in concrete*. ASTM International, West Conshohocken, PA.

Atiş, C. D. (2003). High-Volume Fly Ash Concrete with High Strength and Low Drying Shrinkage. *Journal of Materials in Civil Engineering*, 15(April):153–156.

Bakoss, S., Gilbert, R., Faulkes, K., and Pulmano, V. (1983). Long-term tests on reinforced concrete beams. Technical report, University of New South Wales, Kensington.

Bažant, Z. and Baweja, S. (1995a). Creep and shrinkage prediction model for analysis and design of concrete structures - model B3. *Materials and Structures*, 28:357–365.

Bažant, Z. and Baweja, S. (1995b). Justification and refinements of Model B3 for concrete creep and shrinkage 1. Statistics and sensitivity. *Materials and Structures*, 28:415–430.

Bažant, Z. and Baweja, S. (1995c). Justification and refinements of model B3 for concrete creep and shrinkage 2. Updating and theoretical basis. *Materials and Structures*, 28:488–495.

Bažant, Z., Hauggaard, A. B., Baweja, S., and Ulm, F.-j. (1997). Microprestress-solidification theory for concrete creep. I: Aging and drying effects. *Journal of Engineering Mechanics*, 123(11):1188–1194.

Bažant, Z., Hubler, M., and Wendner, R. (2015). RILEM draft recommendation: TC-242-MDC multi-decade creep and shrinkage of concrete: material model and structural analysis. *Materials and Structures*, 48:753–770.

Bažant, Z. and Li, G. (2008). Comprehensive database on concrete creep and shrinkage. Technical report, Infrastructure Technology Institute of Northwestern University, Evanston, IL.

Bažant, Z. and Li, G. (2013). NU-ITI database on concrete creep and shrinkage.

Bažant, Z. and Panula, L. (1978). Practical prediction of time-dependent deformations of concrete. Part I: Shrinkage. Part II: Basic creep. Part III: Drying creep. Part IV: Temperature effect on basic creep. *Materials and Structures*, 11:307–434.

Beeby, A. and Narayanan, S. (2005). *Designer's guide to Eurocode 2: Design of concrete structures*. Thomas Telford, London.

Belin, P., Habert, G., Thiery, M., and Roussel, N. (2014). Cement paste content and water absorption of recycled concrete coarse aggregates. *Materials and Structures*, 47(9):1451–1465.

Branson, D. and Metz, G. (1963). Instantaneous and time-dependent deflections of simple and continuous reinforced concrete beams - Alabama Highway Research Report. Technical report, U.S. Department of Commerce, Bureau of Public Roads.

C512/512M-10, A. (2010). *Standard Test Method for Creep of Concrete in Compression*. ASTM International, West Conshohocken, PA.

CEB (1985). *CEB Design Manual on Cracking and Deformations*. Comite Euro-International Du Beton, Lausanne.

CEB-FIP (1978). *Model Code 1978*. Comite Euro-International Du Beton, Paris.

CEB-FIP (1991). *Model Code 1990*. Comite Euro-International Du Beton, Paris.

Chen, J., Kuder, K. G., Lehman, D. E., Roeder, C. W., and Lowes, L. N. (2017). Creep modeling of concretes with high volumes of supplementary cementitious materials and its application to concrete-filled tubes. *Materials and Structures*, 50(1):89.

Choi, W.-C. and Yun, H.-D. (2013). Long-term deflection and flexural behavior of reinforced concrete beams with recycled aggregate. *Materials & Design*, 51:742–750.

Clarke, G., Sholz, H., and Alexander, M. (1988). New method to predict the creep deflection of cracked reinforced concrete flexural members. In *Proc. ACI 85*, pages 95–101.

Coelho, A. and De Brito, J. (2013a). Economic viability analysis of a construction and demolition waste recycling plant in Portugal - Part I: Location, materials, technology and economic analysis. *Journal of Cleaner Production*, 39:338–352.

Coelho, A. and De Brito, J. (2013b). Economic viability analysis of a construction and demolition waste recycling plant in Portugal - Part II: Economic sensitivity analysis. *Journal of Cleaner Production*, 39:329–337.

Corinaldesi, V. (2010). Mechanical and elastic behaviour of concretes made of recycled-concrete coarse aggregates. *Construction and Building Materials*, 24(9):1616–1620.

Corley, W. G. and Sozen, M. A. (1966). Time-Dependent Deflections of Reinforced Concrete Beams. *Journa of the American Concrete Institute*, 63:373–386.

Cottingham, W., Fluck, P. G., and Washa, G. (1961). Creep of Prestressed Concrete Beams. *Proc. ACI*, 57(2):929–936.

Criel, P., Caspeele, R., Matthys, S., and Taerwe, L. (2014). Creep experiments and analysis of T-shaped beams subjected to loading and unloading at young age. In *Life-Cycle of Structural Systems: Design, Assessment, Maintenance and Management (IALCCE-2014)*, pages 2186–2192. CRC Press.

Dajung, D. (1984). Experimental research on reinforced and prestressed concrete beams under long-term loading. In *RILEM Symposium on long-term observation of concrete structures*, pages 58–67.

Dragaš, J., Tošić, N., Ignjatović, I., and Marinković, S. (2016). Mechanical and time-dependent properties of high-volume fly ash concrete for structural use. *Magazine of Concrete Research*, 68(12):632–645.

Du Plessis, C. (2002). *Agenda 21 for: Sustainable construction in developing countries - a discussion document.* CSIR Building and Construction Technology, Pretoria.

Duan, A., Li, Z.-y., Zhang, W.-c., and Jin, W.-l. (2016). Flexural behaviour of reinforced concrete beams under freeze–thaw cycles and sustained load. *Structure and Infrastructure Engineering*, 2016:1–9.

Duran, X., Lenihan, H., and O'Regan, B. (2006). A model for assessing the economic viability of construction and demolition waste recycling—the case of Ireland. *Resources, Conservation and Recycling*, 46(3):302–320.

EN 1097-2 (2010). *Tests for mechanical and physical properties of aggregates - Part 2: Methods for the determination of resistance to fragmentation.* CEN, Brussels.

EN 1097-6 (2000). *Tests for mechanical and physical properties of aggregates - Part 6: Determination of particle density and water absorption.* CEN, Brussels.

EN 12350-2 (2010). *Testing fresh concrete - Part 2: Slump-test.* CEN, Brussels.

EN 12620 (2010). *Aggregates for concrete.* CEN, Brussels.

EN 14630 (2006). *Products and systems for the protection and repair of concrete structures - Test methods - Determination of carbonation depth in hardened concrete by the phenolphthalein method.* CEN, Brussels.

EN 197-1 (2000). *Cement - Part 1: Composition, specifications and conformity criteria for common cements.* CEN, Bru.

EN 1992-1-1 (2004). *Eurocode 2: Design of concrete structures - Part 1-1: General rules and rules for buildings.* CEN, Brussels.

EN 206-1 (2000). *Concrete - Part 1: Specification performance, production and conformity*. CEN, Brussels.

EN 450-1 (2012). *Fly ash for concrete - Part 1: Definition, specifications and conformity criteria*. CEN, Brussels.

EN 933-1 (1997). *Tests for geometrical properties of aggregates - Part 1: Determination of particle size distribution - Sieving method*. CEN, Brussels.

Espion, B. (1988). *Long-Term Sustained Loading Test on Reinforced Concrete Beams*. Université Libre de Bruxelles Service Génie Civile, Brussels.

Espion, B. and Halleux, P. (1990). Long-Term Deflections of Reinforced Concrete Beams: Reconsideration of Their Validity. *ACI Structural Journal*, 87(2):232–236.

Evangelista, L. and de Brito, J. (2007). Mechanical behaviour of concrete made with fine recycled concrete aggregates. *Cement and Concrete Composites*, 29(5):397–401.

Faber, O. (1928). Plastic Yield, Shrinkage, and Other Problems of Concrete, and their Effect on Design. *Minutes of the Proceedings of the Institution of Civil Engineers*, 225(1928):27–73.

Fan, Y., Xiao, J., and Tam, V. W. (2014). Effect of old attached mortar on the creep of recycled aggregate concrete. *Structural Concrete*, 15(2):169–178.

Fathifazl, G., Abbas, A., Razaqpur, A. G., Isgor, O. B., Fournier, B., and Foo, S. (2009). New Mixture Proportioning Method for Concrete Made with Coarse Recycled Concrete Aggregate. *Journal of Materials in Civil Engineering*, 21(10):601–611.

Fathifazl, G. and Razaqpur, G. (2013). Creep rheological models for recycled aggregate concrete. *ACI Materials Journal*, 2(110):115–125.

Ferreira, L., de Brito, J., and Barra, M. (2011). Influence of the pre-saturation of recycled coarse concrete aggregates on concrete properties. *Magazine of Concrete Research*, 63(8):617–627.

FIB (2013). *fib Model Code for Concrete Structures 2010*. International Federation for Structural Concrete (fib), Lausanne.

FIB Bulletin 52 (2010). *Structural Concrete - Textbook on Behaviour, Design and Performance*, volume 2. International Federation for Structural Concrete (fib), Lausanne.

FIB Task Group 4.4 (2008). Practitioner's guide to finite element modelling of reinforced concrete structures. Technical report, International Federation for Structural Concrete (fib), Lausanne.

Fisher, C. and Werge, M. (2011). EU as a Recycling Society.

Gao, Z., Liang, R. Y., and Patnaik, A. K. (2016). Effects of sustained loading and pre-existing cracks on corrosion behavior of reinforced concrete slabs. *Construction and Building Materials*, 124:776–785.

Gardner, N. J. (2004). Comparison of Prediction Provisions for Drying Shrinkage and Creep of Normal Strength Concretes. *Canadian Journal of Civil Engineering*, 31(5):767–775.

Gardner, N. J. and Lockman, M. J. (2001). Design provisions for drying shrinkage and creep of normal-strength concrete. *ACI Materials Journal*, 98(2):159–167.

Ghali, A., Favre, R., and Eldbadry, M. (2002). *Concrete Structures. Stresses and Deformation*. Taylor & Francis, New York.

Gilbert, R. and Nejadi, S. (2004). An experimental study of flexural cracking in reinforced concrete members under sustained loads. Technical report, University of New South Wales, Kensington.

Gilbert, R. and Ranzi, G. (2011). *Time-dependent behaviour of conrete structures*. Spon Press, New York.

Glanville, W. and Thomas, F. (1939). *Studies in Reinforced Concrete: Further Investigations on the Creep Or Flow of Concrete Under Load. IV*. HM Stationary Office, London.

Goméz-Soberón, J. M. (2002). Creep of concrete with substitution of normal aggregate by recycled concrete aggregate. *ACI Special Publication SP209-25*, pages 461–474.

Gómez-Soberón, J. M. (2002). Shrinkage of concrete with replacement of aggregate with recycled concrete aggregate. *ACI Special Publications*, 209:475–496.

Gribniak, V., Kaklauskas, G., and Bacinskas, D. (2008). Shrinkage in reinforced concrete structures: A computational aspect. *Journal of Civil Engineering and Management*, 14(1):49–60.

Habert, G., Marinković, S., Brumaud, C., Ignjatović, I., Dragaš, J., and Tošić, N. (2017). Physical and Mechanical Properties of Recycled Concrete Aggregate Exposed to Natural and Accelerated Carbonation. In De Schutter, G., De Belie, N., Janssens, A., and Van Den Bossche, N., editors, *Proceedings of the Fourteenth International Conference on Durability of Building Materials and Components (XIV DBMC 2017)*, pages 1–7, Ghent. RILEM.

Hajnal-Konyi, K. (1963). Tests on beams with sustained loading. *Magazine of Concrete Research*, 15(43):3–14.

Hatt, W. (1907). Notes on the effect of time element in loading reinforced concrete beams. In *Proceedings of the ASTM*, pages 421–433.

Hubler, M. H., Wendner, R., and Bažant, Z. (2015a). Comprehensive Database for Concrete Creep and Shrinkage: Analysis and Recommendations for Testing and Recording. *ACI Materials Journal*, 112(4).

Hubler, M. H., Wendner, R., and Bažant, Z. (2015b). Statistical justification of Model B4 for drying and autogenous shrinkage of concrete and comparisons to other models. *Materials and Structures*, 48:797–814.

Hwang, K., Noguchi, T., and Tomosawa, F. (2004). Prediction model of compressive strength development of fly-ash concrete. *Cement and Concrete Research*, 34(12):2269–2276.

Ignjatović, I. (2009). *Recycled Aggregate Concrete and its Application in Reinforced Concrete Structural Elements*. Magister dissertation, University of Belgrade.

Ignjatović, I. (2013). *Ultimate strength of reinforced recycled concrete beams*. Doctoral dissertation, University of Belgrade.

Ignjatović, I., Marinković, S., Mišković, Z., and Savić, A. (2013). Flexural behavior of reinforced recycled aggregate concrete beams under short-term loading. *Materials and Structures*, 469(6):1045–1059.

ISO 4012 (1978). *Concrete – Determination of compressive strength of test specimens.* International Organization for Standardization, Geneva.

ISO 4013 (1978). *Concrete – Determination of flexural strength of test specimens.* International Organization for Standardization, Geneva.

ISO 4108 (1980). *Concrete – Determination of tensile splitting strength of test specimens.* International Organization for Standardization, Geneva.

ISO 6784 (1982). *Concrete – Determination of static modulus of elasticity in compression.* International Organization for Standardization, Geneva.

Ivković, M. and Pakvor, A. (1989). *Handbook on Concrete and Reinforced Concrete According to PBAB 87.* Faculty of Civil Engineering, University of Belgrade - Institute of Materials and Structures, Belgrade.

Jaccoud, J.-P. and Favre, R. (1982). Fleche des structures en béton armé: Verification experimentale d'une methode de calcul. Technical report, Ecole Polytechnique Federale de Lausanne, Lausanne.

Jirásek, M. and Bažant, Z. (2001). *Inelastic analysis of strutures.* John Wiley & Sons, Inc., New York.

Kang, T. H.-K., Kim, W., Kwak, Y.-K., and Hong, S.-G. (2014). Flexural Testing of Reinforced Concrete Beams with Recycled Concrete Aggregates (with Appendix). *Structural Journal*, 111(3):607–616.

Knaack, A. M. and Kurama, Y. C. (2015). Sustained Service Load Behavior of Concrete Beams with Recycled Concrete Aggregates. *ACI Structural Journal*, 112(5):565–578.

Langer, W. H., Drew, L. J., and Sachs, J. J. (2004). Aggregate and the Environment. Technical report, American Geological Institute, Alexandria, VA.

Łapko, A. and Grygo, R. (2010). Long term deformations of recycled aggregate concrete (RAC) beams made of recycled concrete. In *Modern Building Materials, Structures and Techniques*, pages 709–712, Vilnius. Vilnius Gediminas Technical University.

Le Chatelier, H. (1887). *Experimental researches on the constitution of hydraulic mortars.* McGraw Publishing Company, New York.

Leite, M. B. (2001). *Evaluation of the mechanical properties of concrete made with aggregates recycled from construction and demolition waste*. Phd, Federal University of Rio Grande do Sul.

L'Hermite, R. (1960). Volume changes of concrete. In *Proceedings of the Fourth International Symposium on the Chemistry of Cement*, pages 659–694, Washington DC.

Li, X. (2009). Recycling and reuse of waste concrete in China. Part I. Material behaviour of recycled aggregate concrete. *Resources, Conservation and Recycling*, 53(3):107–112.

Liu, X.-j., Yu, Z.-w., and Jiang, L.-z. (2008). Long term behavior of self-compacting reinforced concrete beams. *J. Cent. South Univ. Technol.*, 15:423–428.

Luo, X. G., Zhong, X. G., and Dai, G. L. (2006). Experimental study on the deformations for shrinkage and creep of beams in non-glued prestressed high performance fly ash concrete bridges. *Gongcheng Lixue/Engineering Mechanics*, 23(7):136–141.

Lutz, L., Sharma, N., and Gergely, P. (1967). Increase in crack-width in reinforced concrete members under sustained loading. In *Proc. ACI 64(9)*, pages 538–546.

Lye, C. Q., Dhir, R. K., and Ghataora, G. S. (2016a). Elastic Modulus of Concrete Cast with Recycled Aggregates. *Structures and Buildings*, 169(SB5):314–339.

Lye, C. Q., Dhir, R. K., Ghataora, G. S., and Li, H. (2016b). Creep strain of recycled aggregate concrete. *Construction and Building Materials*, 102:244–259.

Lye, C.-q., Ghataora, G. S., and Dhir, R. K. (2016c). Shrinkage of recycled aggregate concrete. In *Structures and Buildings, Proceedings of the Institution of Civil Engineers*, pages 1–25. ICE.

Marinković, S., Habert, G., Ignjatović, I., Dragaš, J., Tošić, N., and Bruamud, C. (2016). Life Cycle Analysis of Recycled Aggregate Concrete With Fly Ash as Partial Cement Replacement. In *Sustainable Built Environment (SBE) Regional Conference*, pages 1–7, Zurich.

Marinković, S., Radonjanin, V., Malešev, M., and Ignjatović, I. (2010). Comparative environmental assessment of natural and recycled aggregate concrete. *Waste Management*, 30:2255–2264.

Maruyama, I., Oka, Y., and Sato, R. (2005). Time-dependent Behavior of Reinforced Recycled Concrete Beams. In *CONCREEP 7*.

Mensi, R. and Acker, P. (1988). Séchage du béton: analyse et modélisation. *Materials and Structures*, 21(121):3–12.

Mola, F. and Pellegrini, L. (2012). The New model for creep of concrete in FIP Model Code 2010. In *37th Conference on OUR WORLD IN CONCRETE AND STRUCTURES*, Singapore.

Müller, H., Mechtcherine, V., Curbach, M., Speck, K., Dehn, F., Häußler-Combe, U., Wlaraven, J., Reinhardt, H., Lohaus, L., Oneschkow, N., Gehlen, C., and Beddoe, R. (2013). *Code-type models for concrete behaviour*. DCC Document Competence Center Siegmar Kästl e.K., Lausanne.

Neville, A. (1995). *Properties of concrete*. Pearson Education Ltd, Harlow.

Nixon, P. (1978). Recycled concrete as an aggregate for concrete - a review. *Materials and Structures*, 11:371–378.

Nunes, K., Mahler, C., Valle, R., and Neves, C. (2007). Evaluation of investments in recycling centres for construction and demolition wastes in Brazilian municipalities. *Waste Management*, 27(11):1531–1540.

Pacheco, J., Brito, J. D., and Soares, D. (2015). Destructive Horizontal Load Tests of Full-scale Recycled Aggregate Concrete Structures. *ACI Structural Journal*, 112(6):815–826.

Pauw, A. and Meyers, B. (1964). Effect of creep and shrinkage on the behaviour of reinforced concrete members. *ACI Special Publications*, SP-9:130–159.

P.C.A. (1950). Unpublished P.C.A. results.

Pecić, N. (2012). *Improved method for deflection control of reinforced concrete structures*. Phd, Faculty of Civil Engineering, Belgrade University.

Pecić, N., Mašović, S., and Stošić, S. (2017). Verification of deflection according to Eurocode 2. *Structural Concrete*, (May):1–11.

Pickett, G. (1942). The effect of change in moisture-content on the creep of concrete under a sustained load. *Journal of the American Concrete Institute*, 13(4):333–355.

Poon, C. S., Shui, Z. H., and Lam, L. (2004). Effect of microstructure of ITZ on compressive strength of concrete prepared with recycled aggregates. *Construction and Building Materials*, 18(6):461–468.

Powers, T. C. (1968). The thermodynamics of volume change and creep. *Materials and Structures*, 1(6):487–507.

Rahal, K. (2007). Mechanical properties of concrete with recycled concrete aggregates. *Building and Environment*, 42(1):407–415.

Ramezanianpour, A. A. and Malhotra, V. M. (1995). Effect of curing on the compressive strength, resistance to chloride-ion penetration and porosity of concretes incorporating slag, fly ash or silica fume. *Cement and Concrete Composites*, 17(2):125–133.

Rashad, A. M. (2015). A brief on high-volume Class F fly ash as cement replacement - A guide for Civil Engineer. *International Journal of Sustainable Built Environment*, 4(2):278–306.

Reybrouck, N., Criel, P., Caspeele, R., and Taerwe, L. (2015). Modelling of Long-Term Loading Tests on Reinforced Concrete Beams. In *CONCREEP 10*, pages 745–753.

RILEM TC 121-DRG (1994). RILEM recommendation: specifications for concrete with recycled aggregates. *Materials and Structures*, 27:557–559.

Santana Rangel, C., Amario, M., Pepe, M., Yao, Y., Mobasher, B., and Toledo Filho, R. D. (2017). Tension stiffening approach for interface characterization in recycled aggregate concrete. *Cement and Concrete Composites*, 82:176–189.

Sato, R., Maruyama, I., Sogabe, T., and Sogo, M. (2007). Flexural Behavior of Reinforced Recycled Concrete Beams. *Journal of Advanced Concrete Technology*, 5(1):43–61.

Sattler, K. (1956). Betrachtungen über die Durchbiegung von Stahlbetonträgern. *Die Bautechnik*, 33(11):378–383.

Scanlon, A. and Bischoff, P. H. (2008). Shrinkage restraint and loading history effects on deflections of flexural members. *ACI Structural Journal*, 105(4):498–506.

Scrivener, K., Vanderley, J., and Gartner, E. (2016). Eco-efficient cements: Potential, economically viable solutions for a low-CO2, cement based materials industry. Technical report, United Nations Environmental Programme, Paris.

Seara-Paz, S. (2015). *Efect of long-term deformations in structural flexural performance and bond behaviour analysis of recycled concrete*. Phd, Universidade de Coruna.

Seara-Paz, S., González-Fonteboa, B., Martínez-Abella, F., and González-Taboada, I. (2016). Time-dependent behaviour of structural concrete made with recycled coarse aggregates. Creep and shrinkage. *Construction and Building Materials*, 122:95–109.

Silva, R. (2015). *Use of recycled aggregates from construction and demolition waste in the production of structural concrete*. Doctoral dissertation, Universidade de Lisboa.

Silva, R., De Brito, J., and Dhir, R. K. (2014). Properties and composition of recycled aggregates from construction and demolition waste suitable for concrete production. *Construction and Building Materials*, 65:201–217.

Silva, R., de Brito, J., and Dhir, R. K. (2015). Establishing a relationship between the modulus of elasticity and compressive strength of recycled aggregate concrete. *Journal of Cleaner Production*.

Silva, R., De Brito, J., Evangelista, L., and Dhir, R. K. (2016). Design of reinforced recycled aggregate concrete elements in conformity with Eurocode 2. *Construction and Building Materials*, 105:144–156.

Soman, M. and Sobha, K. (2014). Strength and Behaviour of High Volume Fly Ash Concrete. *International Journal of Innovative Research in Science, Engineering and Technology*, 3(5):12416–12424.

SRPS B.B2.009 (1986). *Raw materials for production of aggregates for concrete - Technical requirements*. ISS, Belgrade.

SRPS B.B8.033 (1994). *Mineral aggregate - Determination of crushability by compression in cylinder*. ISS, Belgrade.

SRPS B.B8.048 (1984). *Mineral aggregate-particle shape determination with calliper*. ISS, Belgrade.

SRPS B.B8.049 (1984). *Mineral aggregate - Determination of volumetric coefficient*. ISS, Belgrade.

SRPS U.M1.027:1983 (1983). *Concrete - Determination of deformation*. ISS, Belgrade.

SRPS U.M1.029:1983 (1983). *Concrete - Determination of deformation*. ISS, Belgrade.

SRPS U.M1.057 (1984). *Concrete - Grading of aggregate for concrete*. ISS, Belgrade.

Tam, V. W. Y., Butera, A., and Le, K. N. (2016). Carbon-conditioned recycled aggregate in concrete production. *Journal of Cleaner Production*, 133:672–680.

Tam, V. W. Y., Gao, X. F., Tam, C. M., and Chan, C. H. (2008). New approach in measuring water absorption of recycled aggregates. *Construction and Building Materials*, 22(3):364–369.

Tazawa, E.-i. (1999). *Autogenous shrinkage of concrete*. E & FN Spon, London.

Thiery, M., Dangla, P., Belin, P., Habert, G., and Roussel, N. (2013). Carbonation kinetics of a bed of recycled concrete aggregates: A laboratory study on model materials. *Cement and Concrete Research*, 46:50–65.

Thomas, M. (2007). Optimizing the Use of Fly Ash in Concrete. *Portland Cement Association*, page 24.

Tošić, N., Marinković, S., and Ignjatović, I. (2016). A database on flexural and shear strength of reinforced recycled aggregate concrete beams and comparison to Eurocode 2 predictions. 127:932–944.

UNEP (1992). *1992 Rio Declaration on Environment and Development*. United Nations Environment Programme, Paris.

USGS (2015). Minerals Yearbook.

Van Nieuwenburg, D. (1984). Invloed van de werkingsduur van permanente lasten op het gedrag van elementen in gewapend beton. Technical report, Syntheseverslag Ghent, Laboratorium Magnel voor Gewapend Beton.

Vandamme, M. and Ulm, F.-J. (2009). Nanogranular origin of concrete creep. *Proceedings of the National Academy of Sciences of the United States of America*, 106(26):10552–10557.

Washa, G. and Fluck, P. (1952). Effect of compressive reinforcement on the plastic flow of reinforced concrete beams. *Proc. ACI*, Proc. ACI(49):89–108.

Washa, G. and Fluck, P. G. (1956). Plastic flow of reinforced concrete continuous beams. *Proc. ACI*, 52:549–561.

WBCSD (2009). The Cement Sustainability Initiative.

Wendner, R., Hubler, M., and Bažant, Z. (2013). The B4 model for multi-decade creep and shrinkage prediction. In Ulm, F., Jennings, H., and Pellenq, R., editors, *CONCREEP 9*, pages 429–436. American Society of Civil Engineers.

Wendner, R., Hubler, M. H., and Bažant, Z. (2015a). Optimization method, choice of form and uncertainty quantification of Model B4 using laboratory and multi-decade bridge databases. *Materials and Structures*, 48:771–796.

Wendner, R., Hubler, M. H., and Bažant, Z. (2015b). Statistical justification of model B4 for multi-decade concrete creep using laboratory and bridge databases and comparisons to other models. *Materials and Structures*, 48:815–833.

Wesche, K. (2004). Fly ash in concrete: properties and performance. Technical report, RILEM, London.

Wittmann, F., Bažant, Z., Alou, F., and Kim, J.-K. (1987). No Title. *Cement, concrete and aggregates*, 9(2):129–153.

World Bank (2016). World Bank Indicators.

Xiao, J., Li, J., and Zhang, C. (2005). Mechanical properties of recycled aggregate concrete under uniaxial loading. *Cement and Concrete Research*, 35:1187–1194.

Xiao, J., Sun, Y., and Falkner, H. (2006). Seismic performance of frame structures with recycled aggregate concrete. *Engineering Structures*, 28(1):1–8.

Xiao, J., Wang, C., Li, J., and Tawana, M. (2012). Shake-table model tests on recycled aggregate concrete frame structure. *ACI Structural Journal*, 109(6):777–786.

Yoo, S., Ryu, G., and Choo, J. (2015). Evaluation of the effects of high-volume fly ash on the flexural behavior of reinforced concrete beams. *Construction and Building Materials*, 93:1132–1144.

Zhang, Q., Le Roy, R., Vandamme, M., and Zuber, B. (2014). Long-term creep properties of cementitious materials: Comparing microindentation testing with macroscopic uniaxial compressive testing. *Cement and Concrete Research*, 58:89–98.

Zilch, K. and Zehetmaier, G. (2009). *Bemessung im konstruktiven Betonbau: nach DIN 1045-1 (Fassung 2008) und EN 1992-1-1 (Eurocode 2)*. Springer-Verlag.

Curriculum Vitae

Nikola Tošić was born in Belgrade on May 9, 1987 where he finished elementary and high school. He enrolled Bachelor studies in structural engineering at the University of Belgrade's Faculty of Civil Engineering in 2006 and obtained his Bachelor degree in 2010 with an average grade 9.4 and a grade 10 on his final project. He enrolled a Master programme in structural engineering at the University of Belgrade's Faculty of Civil Engineering in 2010 and obtained his Master degree in 2011 with an average grade 9.86 and a grade 10 on his final project titled 'Analysis of structural systems for covering football stadium tribunes with a proposed solution for FC Partizan stadium'. Nikola began his PhD studies at the University of Belgrade's Faculty of Civil Engineering in 2012. He passed all the exams envisioned by the programme with an average grade of 9.87.

After getting his Master degree in 2011, Nikola worked for two months on a student placement position in Mace Ltd. on the Shard London Bridge project. In 2012 he worked in Čelikinvest, Belgrade, as an engineer on several design and construction projects in Serbia.

From January 2013, he has been working as a teaching assistant at the University of Belgrade's Faculty of Civil Engineering on courses on reinforced and prestressed concrete structures.

Beside teaching, Nikola has participated in several research projects dealing with the search for sustainable alternatives to traditional concrete. He is the co-author of 25 journal articles and conference proceedings, five of which are in journals listed in JCR.

Nikola is an active member of the academic and research community participating in several faculty commissions and task groups. He is also a member of the board of the *fib* International Young Members Group, acting as a representative for research and universities.

Nikola is also a freelance professional proofreader and copy editor. He speaks Serbian, English, Italian, German, French and Chinese.

Образац 5.

Изјава о ауторству

Име и презиме аутора Никола Тошић

Број индекса 901/12

Изјављујем

да је докторска дисертација под насловом

“ПОНАШАЊЕ АРМИРАНОБЕТОНСКИХ ГРЕДНИХ ЕЛЕМЕНАТА ОД БЕТОНА СА РЕЦИКЛИРАНИМ И ОТПАДНИМ МАТЕРИЈАЛИМА ПОД ДУГОТРАЈНИМ ОПТЕРЕЋЕЊЕМ”

- резултат сопственог истраживачког рада;
- да дисертација у целини ни у деловима није била предложена за стицање друге дипломе према студијским програмима других високошколских установа;
- да су резултати коректно наведени и
- да нисам кршио/ла ауторска права и користио/ла интелектуалну својину других лица.

Потпис аутора

У Београду, 1.9.2017. године

Образац 6.

Изјава о истоветности штампане и електронске верзије докторског рада

Име и презиме аутора Никола Тошић

Број индекса 901/12

Студијски програм Докторске студије – Грађевинарство

Наслов рада “ПОНАШАЊЕ АРМИРАНОБЕТОНСКИХ ГРЕДНИХ ЕЛЕМЕНАТА ОД БЕТОНА СА РЕЦИКЛИРАНИМ И ОТПАДНИМ МАТЕРИЈАЛИМА ПОД ДУГОТРАЈНИМ ОПТЕРЕЋЕЊЕМ”

Ментор проф. др Снежана Маринковић, дипл. инж. грађ.

Изјављујем да је штампана верзија мог докторског рада истоветна електронској верзији коју сам предао/ла ради похрањена у **Дигиталном репозиторијуму Универзитета у Београду.**

Дозвољавам да се објаве моји лични подаци везани за добијање академског назива доктора наука, као што су име и презиме, година и место рођења и датум одбране рада.

Ови лични подаци могу се објавити на мрежним страницама дигиталне библиотеке, у електронском каталогу и у публикацијама Универзитета у Београду.

Потпис аутора

У Београду, 1.9.2017.

Образац 7.

Изјава о коришћењу

Овлашћујем Универзитетску библиотеку „Светозар Марковић“ да у Дигитални репозиторијум Универзитета у Београду унесе моју докторску дисертацију под насловом:

“ПОНАШАЊЕ АРМИРАНОБЕТОНСКИХ ГРЕДНИХ ЕЛЕМЕНАТА ОД БЕТОНА СА РЕЦИКЛИРАНИМ И ОТПАДНИМ МАТЕРИЈАЛИМА ПОД ДУГОТРАЈНИМ ОПТЕРЕЋЕЊЕМ”

која је моје ауторско дело.

Дисертацију са свим прилозима предао/ла сам у електронском формату погодном за трајно архивирање.

Моју докторску дисертацију похрањену у Дигиталном репозиторијуму Универзитета у Београду и доступну у отвореном приступу могу да користе сви који поштују одредбе садржане у одабраном типу лиценце Креативне заједнице (Creative Commons) за коју сам се одлучио/ла.

1. Ауторство (CC BY)

2. Ауторство – некомерцијално (CC BY-NC)

3. Ауторство – некомерцијално – без прерада (CC BY-NC-ND)

[✓ 4.] Ауторство – некомерцијално – делити под истим условима (CC BY-NC-SA)

5. Ауторство – без прерада (CC BY-ND)

6. Ауторство – делити под истим условима (CC BY-SA)

(Молимо да заокружите само једну од шест понуђених лиценци.
Кратак опис лиценци је саставни део ове изјаве).

Потпис аутора

У Београду, 1.9.2017. године

1. **Ауторство**. Дозвољавате умножавање, дистрибуцију и јавно саопштавање дела, и прераде, ако се наведе име аутора на начин одређен од стране аутора или даваоца лиценце, чак и у комерцијалне сврхе. Ово је најслободнија од свих лиценци.

2. **Ауторство – некомерцијално**. Дозвољавате умножавање, дистрибуцију и јавно саопштавање дела, и прераде, ако се наведе име аутора на начин одређен од стране аутора или даваоца лиценце. Ова лиценца не дозвољава комерцијалну употребу дела.

3. **Ауторство – некомерцијално – без прерада**. Дозвољавате умножавање, дистрибуцију и јавно саопштавање дела, без промена, преобликовања или употребе дела у свом делу, ако се наведе име аутора на начин одређен од стране аутора или даваоца лиценце. Ова лиценца не дозвољава комерцијалну употребу дела. У односу на све остале лиценце, овом лиценцом се ограничава највећи обим права коришћења дела.

4. **Ауторство – некомерцијално – делити под истим условима**. Дозвољавате умножавање, дистрибуцију и јавно саопштавање дела, и прераде, ако се наведе име аутора на начин одређен од стране аутора или даваоца лиценце и ако се прерада дистрибуира под истом или сличном лиценцом. Ова лиценца не дозвољава комерцијалну употребу дела и прерада.

5. **Ауторство – без прерада**. Дозвољавате умножавање, дистрибуцију и јавно саопштавање дела, без промена, преобликовања или употребе дела у свом делу, ако се наведе име аутора на начин одређен од стране аутора или даваоца лиценце. Ова лиценца дозвољава комерцијалну употребу дела.

6. **Ауторство – делити под истим условима**. Дозвољавате умножавање, дистрибуцију и јавно саопштавање дела, и прераде, ако се наведе име аутора на начин одређен од стране аутора или даваоца лиценце и ако се прерада дистрибуира под истом или сличном лиценцом. Ова лиценца дозвољава комерцијалну употребу дела и прерада. Слична је софтверским лиценцама, односно лиценцама отвореног кода.