ADAA INTERNATIONAL SYMPOSIUM

8th - 9th October 2024

UNSW, Roundhouse

"EXPLORING COAL COMBUSTION PRODUCT HARVESTING OPPORTUNITIES IN AUSTRALIA DURING THIS ONCE IN A LIFE-TIME ENERGY TRANSITION"

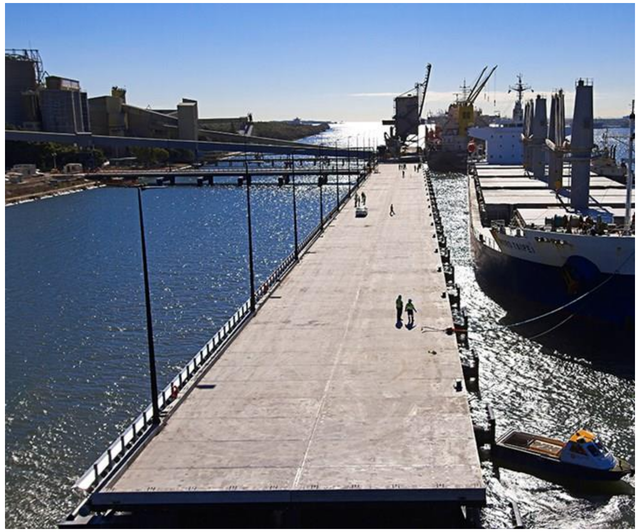
Low Carbon Cements and Alternative Binder Concrete

40,000 m^3 of geopolymer concrete; Nov 2014.

A 252 m long by 16 m-wide wharf structure on the Brisbane River; July 2018

Wagners Qld

Wellcamp Airport



Pinkenba Wharf Brisbane

330 m^3 of geopolymer concrete - 33 floor beams that form the 3 suspended floors in the Global Change Institute (GCI) building at the University of QLD.

High Density Breakwater Armour Unit Project – with CRC-LCL and NSW Ports

THE UNIVERSITY OF
NEW SOUTH WALES

STUDIES FROM
SCHOOL OF CIVIL AND ENVIRONMENTAL ENGINEERING

Performance of High-density Geopolymer Concrete at Port Kembla's Northern Breakwater Armour Units: Update June 2021

BY

Aziz Hasan Mahmood and Stephen J Foster

UNICIV REPORT No. R-469 AUGUST 2022
THE UNIVERSITY OF NEW SOUTH WALES
SYDNEY 2052 AUSTRALIA
http://www.civeng.unsw.edu.au

ISBN: 978-0-7334-4045-8
DOI: 10.26190/03ma-4p24

Fig. 1. Site location – Port Kembla Northern breakwater (courtesy: Google maps).

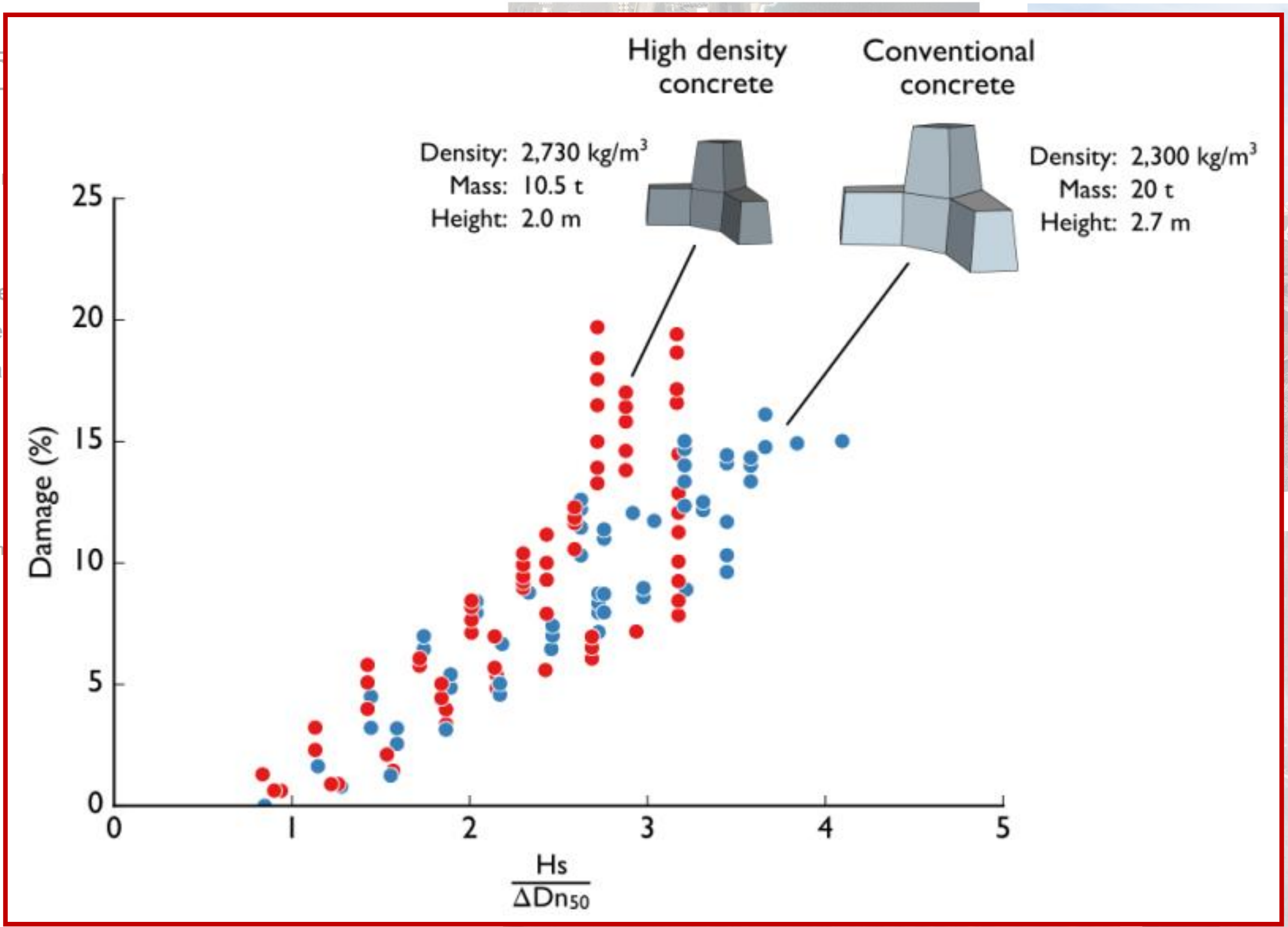
High Density Breakwater Armour Unit Project – with CRC-LCL and NSW Ports

THE UNIVER
NEW SOUTH

STUDIES FROM
SCHOOL OF CIVIL AND ENVIRONI

Performance of High-de
Port Kembla's Northe
Upda

Aziz Hasan Mahn



SA TS 199:2023

Technical Specification

Design of geopolymer and alkali-activated binder concrete structures

SA TS 199:2023

SA TS 199:2023

This Australian Technical Specification was prepared by BD-002, Concrete Structures. It was approved on behalf of the Council of Standards Australia on DD Month 2023.

This Technical Specification Not yet published

The following are represented on Committee BD-002:

Australian Building Codes Board
Australian Industry Group
Austroads
Bureau of Steel Manufacturers of Australia
Cement Concrete & Aggregates Australia — Cement
Cement Concrete & Aggregates Australia — Concrete
Concrete Institute of Australia
Concrete NZ
Consult Australia
Engineers Australia
Master Builders Australia
National Precast Concrete Association Australia
Steel Reinforcement Institute of Australia
The University of Melbourne
The University of Sydney
University of New South Wales
University of Technology Sydney

This Technical Specification was issued in draft form for comment as DR SA TS 199:2023.

Keeping Standards up-to-date

Ensure you have the latest versions of our publications and keep up-to-date about Amendments, Rulings, Withdrawals, and new projects by visiting:
www.standards.org.au

ISBN to be allocated on publication of the final document

Technical Specification

DR SA TS 199:2023, Design of geopolymer and alkali activated binder concrete structures

Performance-based – provides a roadmap on how to quickly introduce new/novel materials into practice!

STANDARDS Australia

Section 1: Scope and General

Section 2: Specification and supply of geopolymer and alkali-activated binder concrete

Section 3: Design procedures, actions and loads.

Section 4: Design properties of materials

Section 5: Design for durability

Section 6: Design for fire resistance

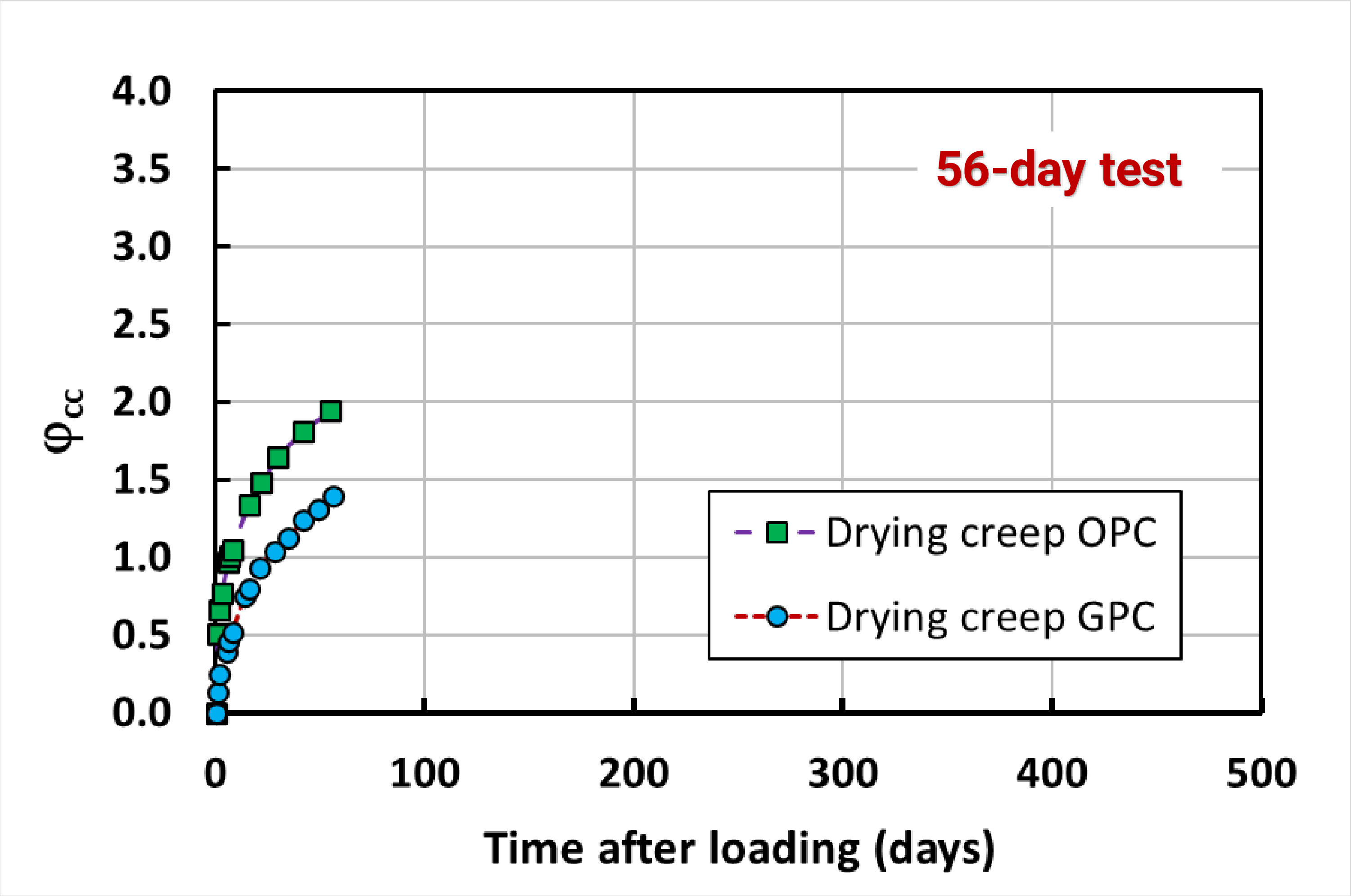
Section 7: Design for strength

Section 8: Field testing of geopolymer and alkali activated binder concrete binder systems.

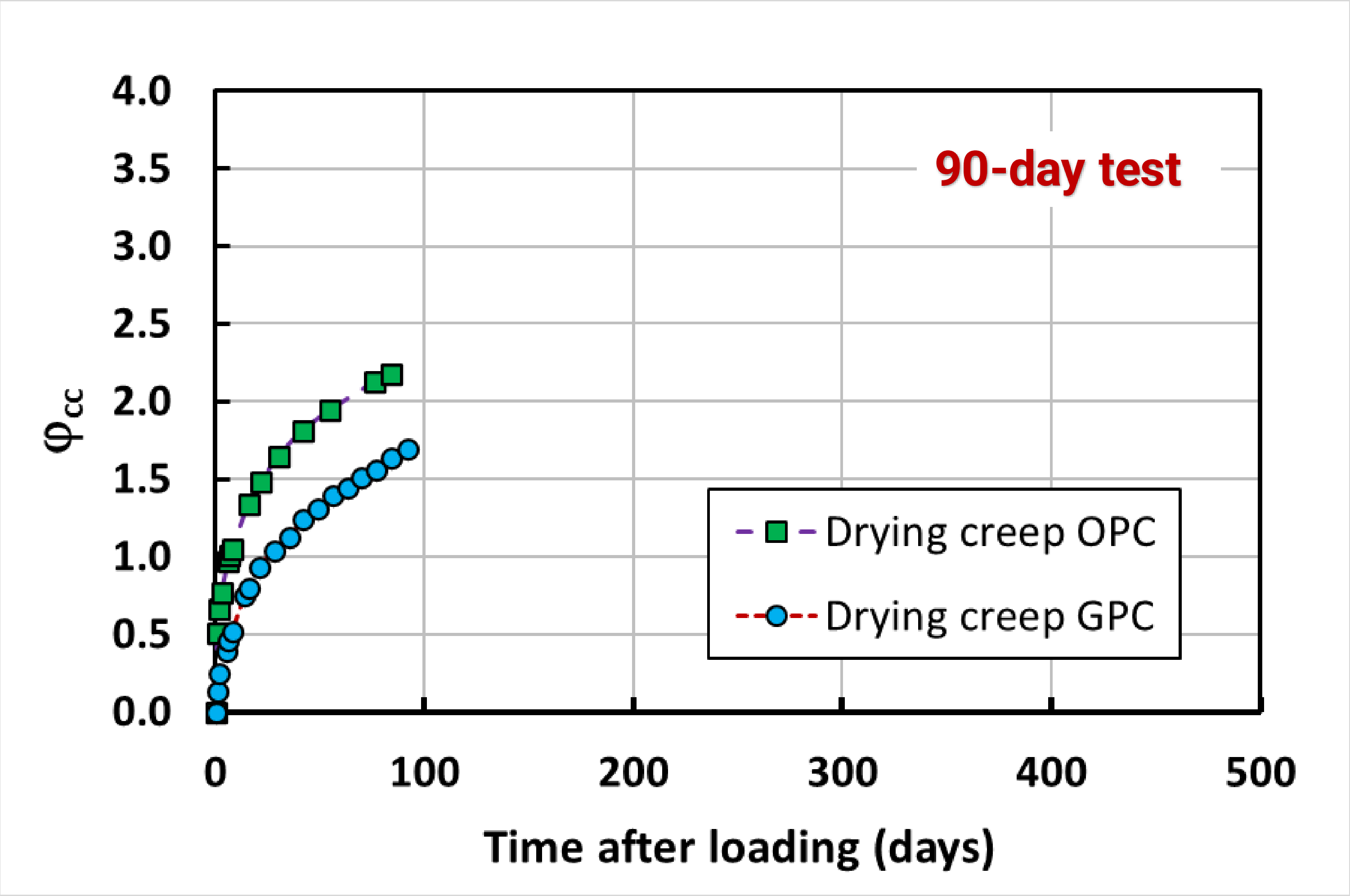
App. A: Procedure for determination of risk of efflorescence

UNSW SYDNEY

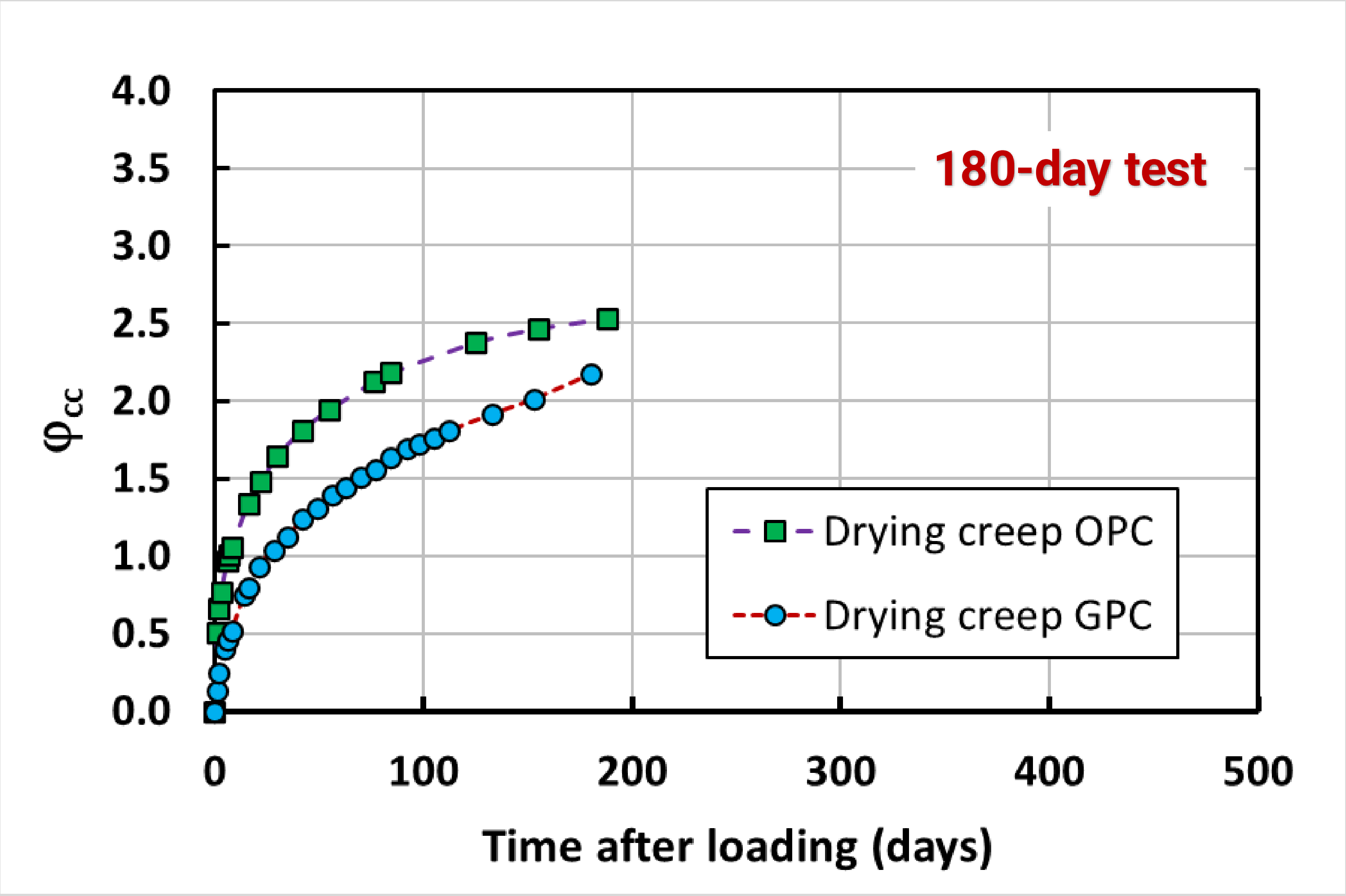
Which performs better for creep OPC or GPC?



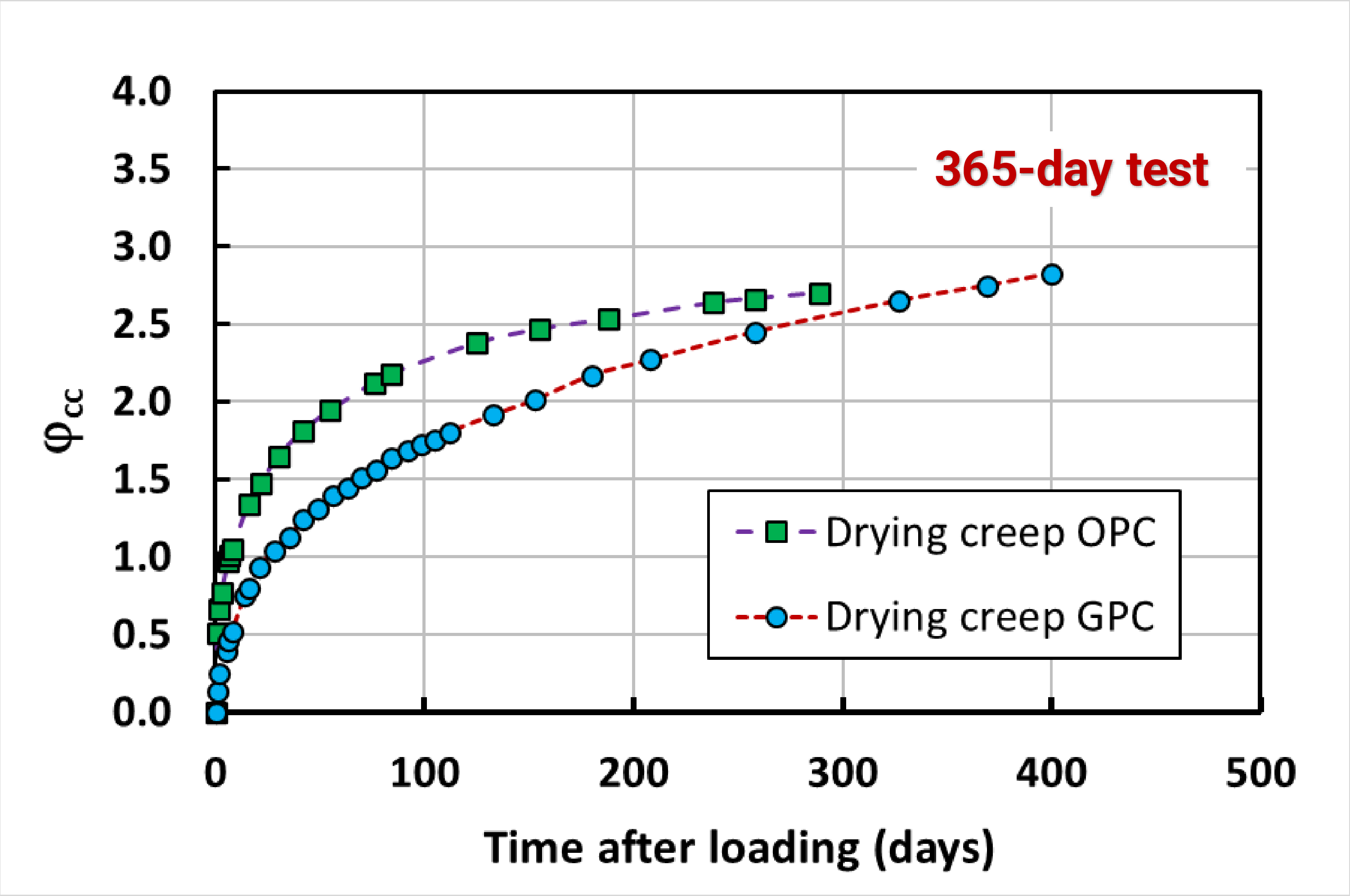
Which performs better for creep OPC or GPC?



Which performs better for creep OPC or GPC?



Which performs better for creep OPC or GPC?



UNSW SYDNEY

Consideration of Creep

4.1.8 Creep

4.1.8.1 General

(b) by tests in accordance with AS 1012.16 and tested for a minimum of 90 days after application of the loading at a relative humidity consistent with determination of c_4 in Clause 4.1.8.3.

(b) by tests in accordance with AS 1012.16 and tested for a minimum of 90 days after application of the loading at a relative humidity consistent with determination of c_4 in Clause 4.1.8.3.

From the results of the creep testing undertaken in accordance with AS 1012.16, the test creep strain at time (t) after loading may be calculated from the following:

For $1 \le t \le t_c$ days:

$$\varphi_{cc.b}(t) = at^b \qquad 4.1.8.2(a)$$

For $t > t_c$ days:

$$\varphi_{cc.b}(t) = at_c^b + abt_c^b\left[\ln(t) - \ln(t_c)\right] \qquad 4.1.8.2(b)$$

where

t = time in days after loading.

t_c = time at transition.

a and b = coefficients.

$\varphi_{cc.b}$ is determined from the total creep strain (ε_{cc}) determined from testing by subtracting the initial elastic strain due to the applied load and the shrinkage strain that occurs after the application of the load.

Shrinkage control specimens should be cured under the same environment as the creep test.

The transition time (t_c), shown in Figure 4.1, is the time at which the creep coefficient becomes approximately linear with log (t). This transition time shall be determined from testing. The transition time need not be taken as greater than t_c = 180 days.

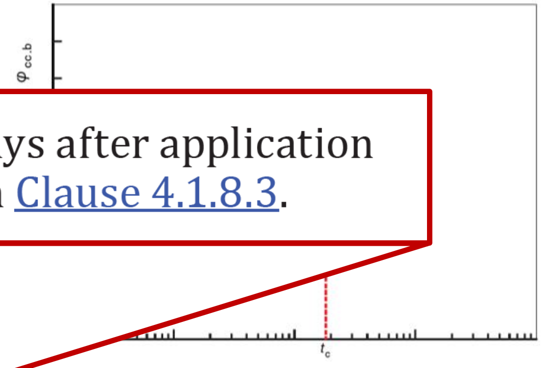


Figure 4.1 — Relationship between creep coefficient and log(time) locations

The coefficients a and b in Equation 4.1.8.2(a) are obtained from test data and determined from the following:

$$a = \frac{\varphi_{cc.b}(t_2)}{t_2^{\,b}} \qquad 4.1.8.2(c)$$

$$b = \frac{\log\left(\frac{\varphi_{cc.b}(t_2)}{\varphi_{cc.b}(t_1)}\right)}{\log(t_2/t_1)} \qquad 4.1.8.2(d)$$

where t_1 = 14 days after loading and t_2 is not less than 56 days after loading.

It is recommended that t_2 be taken at 90 days after loading.

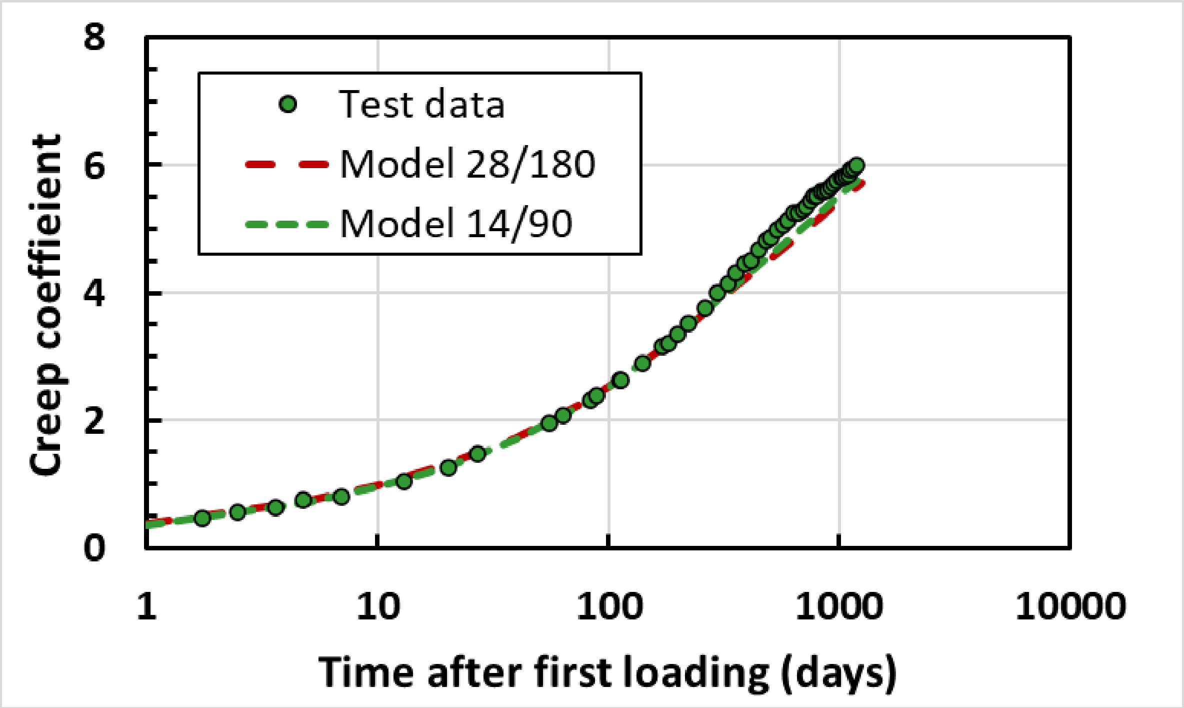
For building structures, the basic creep strain shall be determined at a time equal to 50 years (t = 18,000 days).

For background, see:

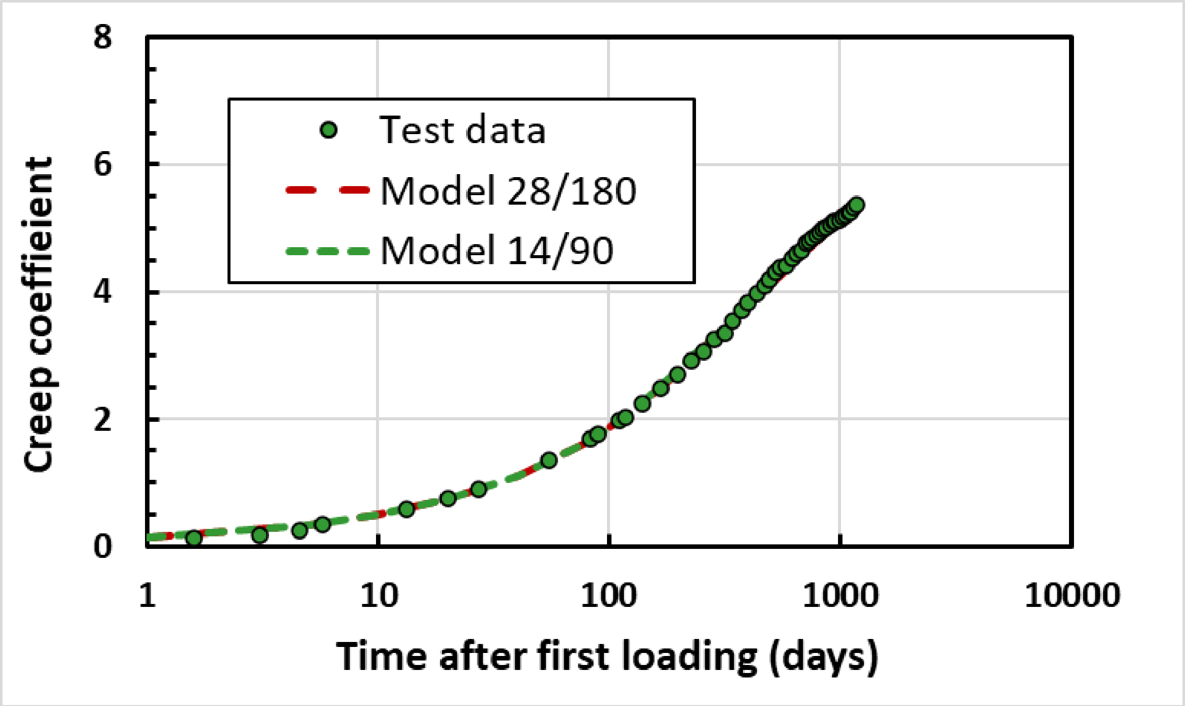
GAO, H., AL-DAMAD, I., HAMED, E., HAJIMOHAMMADI, A., AND FOSTER, S., "Creep of Geopolymer and Alkali Activated Binder Concrete: Comparison with OPC Concrete and Design Codes", Concrete 2023, 31st Biennial National Conference of the Concrete Institute of Australia, Sydney, 10 – 13 September, 2023, 8 pp.

UNSW SYDNEY

Comparison of Model for AAB Concretes: Un (2017)

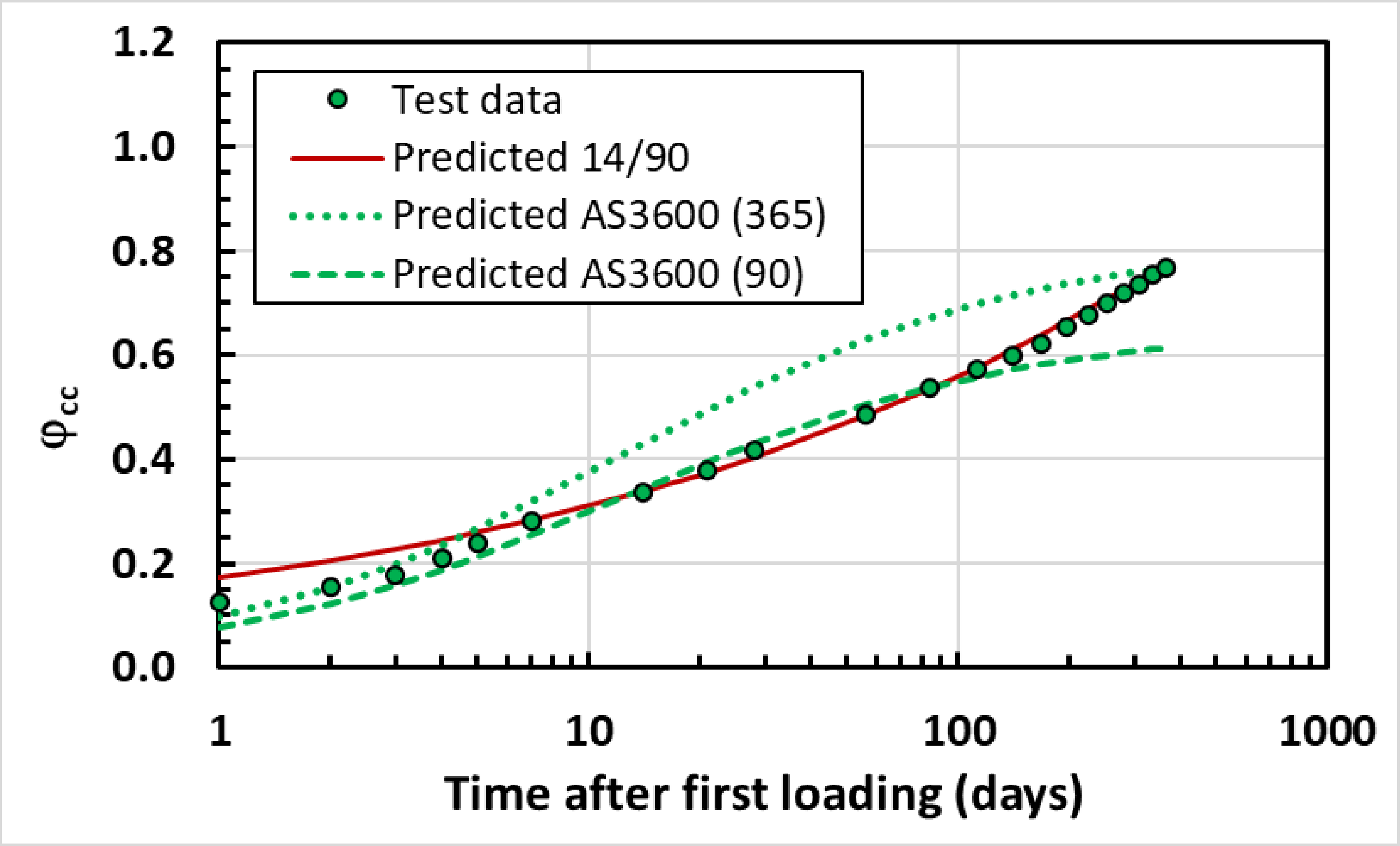


First loading at 14 days



First loading at 28 days

Comparison of Model for AAB Concretes: Boral Aspire



fib 2018 7 - 11 October Melbourne, Australia BETTER | SMARTER | STRONGER

DEVELOPMENT OF A HIGH MODULUS, VERY HIGH STRENGTH, HIGH PERFORMANCE, SUPER-WORKABLE LOW CARBON CONCRETE

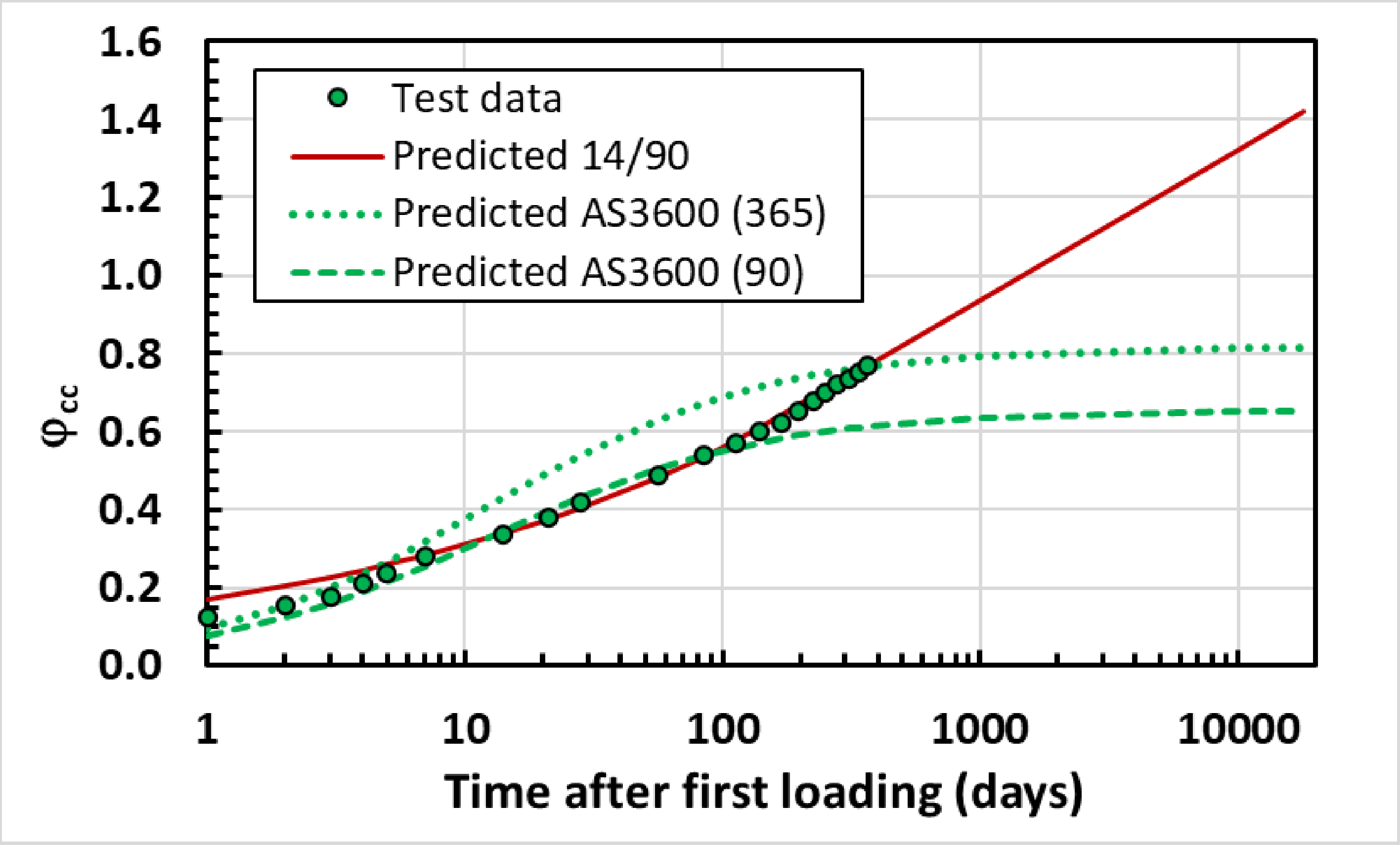
Howard Titus[1] Mario Tabone[1] John Biondo[1] and Stephen Foster[2]

[1] Boral Concrete Australia
[2] School of Civil and Environmental Engineering, UNSW Sydney, Australia

Abstract:

This study reports on the development of a High Mod-E, high performance, super-workable low carbon concrete known as Aspire®. With 40% cement replacement, strengths exceeding 120 MPa and elastic moduli of greater than 50 GPa are achieved. The combination of high-strength with high-stiffness allows for significant reductions in the thickness of vertical elements in tall and slender buildings, while maintaining the lateral stiffness required for wind induced vibrations; thus, increasing valuable floor space, reducing concrete, reinforcement, formwork and labour costs. Laboratory and field trials demonstrate that the material has low shrinkage and is pumpable to heights exceeding 250 metres. This paper reports on the outcomes of laboratory and field trials, including pumping to Level 78 on the Victoria One building, Melbourne; an industry first for Australia.

Comparison of Model for AAB Concretes: Boral Aspire



7 - 11 October
fib 2018
Melbourne, Australia
BETTER | SMARTER | STRONGER

DEVELOPMENT OF A HIGH MODULUS, VERY HIGH STRENGTH, HIGH PERFORMANCE, SUPER-WORKABLE LOW CARBON CONCRETE

Howard Titus[1] Mario Tabone[1] John Biondo[1] and Stephen Foster[2]

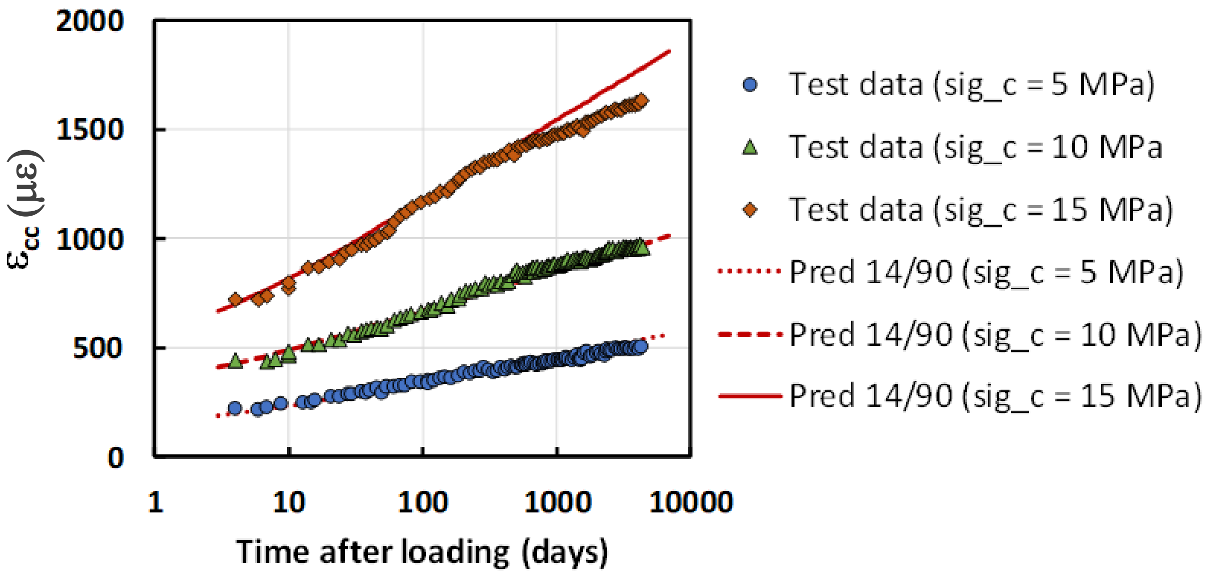
[1] Boral Concrete Australia
[2] School of Civil and Environmental Engineering, UNSW Sydney, Australia

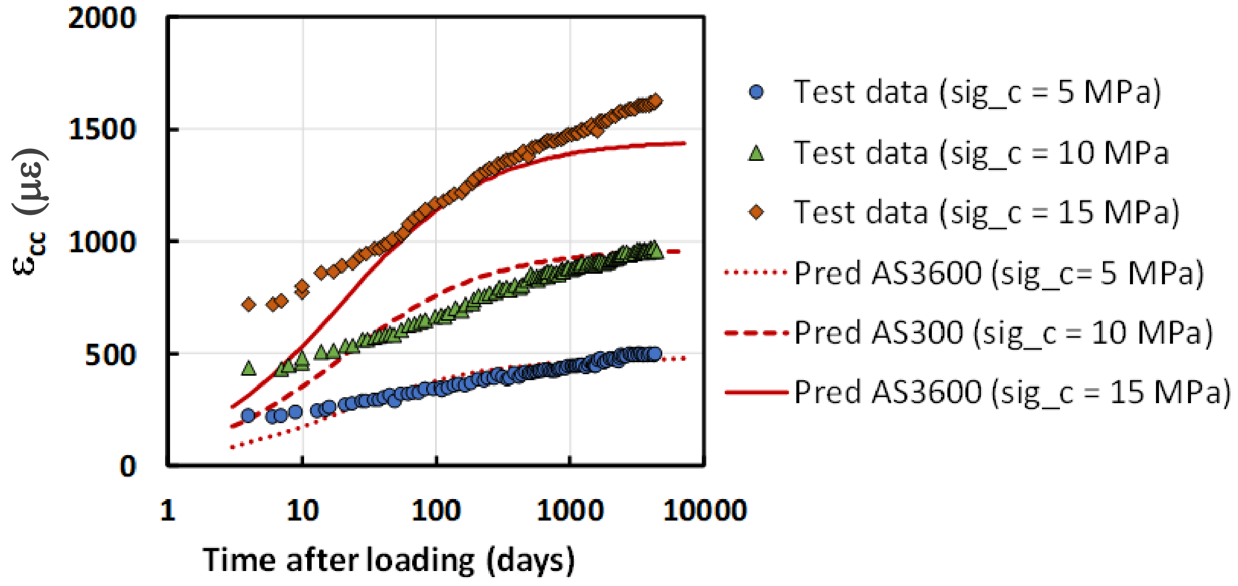
Abstract:

This study reports on the development of a High Mod-E, high performance, super-workable low carbon concrete known as Aspire®. With 40% cement replacement, strengths exceeding 120 MPa and elastic moduli of greater than 50 GPa are achieved. The combination of high-strength with high-stiffness allows for significant reductions in the thickness of vertical elements in tall and slender buildings, while maintaining the lateral stiffness required for wind induced vibrations; thus, increasing valuable floor space, reducing concrete, reinforcement, formwork and labour costs. Laboratory and field trials demonstrate that the material has low shrinkage and is pumpable to heights exceeding 250 metres. This paper reports on the outcomes of laboratory and field trials, including pumping to Level 78 on the Victoria One building, Melbourne; an industry first for Australia.

UNSW SYDNEY

Comparison of Model for OPC Concretes: Taerwe data





Comparison of SA TS 199 (left) and AS 3600 (right) models for OPCC mix of [10]

Final comments

Regulation – sensible, looking after the public good but not to be so burdensome such as to inhibit innovation.

Standardisation – speedy implementation, performance based, founded in science.

Innovation – solutions that push boundaries, embrace calculated risks, and not afraid of failure.