FACULTY OF
ENGINEERING &
THE BUILT ENVIRONMENT

Repair and Rehabilitation of
Concrete Structures
17 – 21 September 2018

UNIVERSITY OF CAPE TOWN
IYUNIVESITHI YASEKAPA • UNIVERSITEIT VAN KAAPSTAD
Introduction

The purpose of the workshop is to provide participants with a fundamental and practical understanding on condition assessment of concrete structures and concrete repair and strengthening methods.

A large number of concrete structures are deteriorating, often prematurely, and need remedial measures to reinstate their safety and/or serviceability. Consequently, the need for repair and protection has grown considerably in recent years. While costs associated with repair of deteriorating concrete structures can be substantial, costs resulting from poorly designed or executed repairs may be even higher. The technical and economic success of repair projects depends on a range of factors, including a proper condition assessment of the structure, design and execution of remedial measures, and design and implementation of maintenance strategies.

For reinforced concrete structures, the main durability problem is corrosion of the reinforcement, resulting from the ingress of chloride ions or carbon dioxide and the subsequent depassivation of the steel. Other causes for concrete deterioration and damage include construction defects, structural loading, chemical attack (ASR, sulphate attack, acid attack) and fire damage. At the beginning of any repair project, a systematic condition assessment of the structure needs to be carried out to identify the cause(s) of deterioration and the extent of damage. The workshop informs about concrete deterioration mechanisms, on-site evaluation techniques, the principles of diagnostic testing (strategies, test methods and interpretation of results), and concrete repair strategies.

Repair methods need to be designed with consideration for the anticipated or desired remaining service life of the structure. A distinction must be made between repairs intended to stop deterioration fully and those merely aimed at slowing down deterioration processes for a limited period of time. During the course relevant repair methods for damaged concrete structures are discussed, focussing on design methods, application principles and limitations. The scope of relevant repair methods includes the application of penetrating corrosion inhibitors and surface coatings, temporary electrochemical techniques, cathodic protection systems, bonded overlays (patch repairs), and crack injection.

The workshop further covers assessment methods for structural damage, as well as methods and systems for structural strengthening, including FRP system design.
Course Content

1. Concrete deterioration processes and damage to concrete structures
   - Chemical and physical attack
   - Fire damage
   - Structural damage
   - Cracking
   - Construction defects
2. Design for concrete durability
   - Mix design, constituent materials, service life modelling
3. Reinforcement corrosion
   - Principles, mechanisms and influences
   - Carbonation and chloride ingress
   - Corrosion prevention in new structures
4. Condition assessment of concrete structures
   - Planning and strategies for condition assessments
   - On-site diagnostic testing
   - Visual assessment methods
   - Assessing structural capacity
   - Non-destructive testing methods and interpretation of results
   - Laboratory-based testing of samples
   - Prediction of residual service life
   - Case studies
5. Repair and rehabilitation of concrete structures
   - Philosophies and strategies
   - Repair methods, materials and systems
   - Repair principles for corrosion damaged structures
   - Concrete surface protection and coatings
   - Bonded concrete overlays and patch repair
   - Repair guidelines according to the Eurocode
   - Service life extension
   - Structural repairs and strengthening
6. Non-destructive testing of concrete structures
   - Assessment of concrete compressive strength
   - Concrete cover and rebar location
   - Crack detection, void detection, honey comb detection
   - Stiffness assessment
   - Pile testing
7. Strengthening of concrete structures
   - Principles and strategies
   - Strengthening using steel plates
   - Strengthening using FRP
Course Presenters

**Prof. Pilate Moyo** performs research and lectures in the fields of structural engineering and structural condition assessment at the University of Cape Town. He is a member of the Concrete Materials & Structural Integrity Research Unit (CoMSIRU) at UCT, which focuses on infrastructure performance and renewal research. Prof Moyo’s specific interests in bridge design are bridge loading and design of footbridges for vibration serviceability. [View profile](#)

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**Prof. Hans Beushausen** is a researcher and lecturer in the fields of structural engineering, construction material technology, structural condition assessment, and concrete repair technology at the University of Cape Town. He is a member of the Concrete Materials & Structural Integrity Research Unit (CoMSIRU) at UCT, which focuses on infrastructure performance and renewal research. His research interests include concrete durability, performance assessment of concrete structures, repair systems for concrete structures, and bonded concrete overlays. [View profile](#)

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**Course Overview**

<table>
<thead>
<tr>
<th>Name</th>
<th>Repair and Rehabilitation of Concrete Structures</th>
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<tbody>
<tr>
<td>Duration</td>
<td>17 – 21 September 2018</td>
</tr>
<tr>
<td>Venue</td>
<td>Transnet School of Rail, Esselen Park, Johannesburg</td>
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<tr>
<td>CPD</td>
<td>5 CPD points; ECSA Validation No: UCTRRC18</td>
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<tr>
<td>Participants</td>
<td>Suitable for consulting engineers, students and academics</td>
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<tr>
<td>Fees</td>
<td>Standard delegate: R11600 Full-time student: R5800</td>
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<td>DAY 1</td>
<td>DAY 2</td>
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<td>Durability, deterioration and condition assessment</td>
<td>Deterioration and condition assessment</td>
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07:30 – 08:00
REGISTRATION AND COFFEE / TEA

08:00 – 10:00
Introduction, desirable properties of concrete, concrete materials and proportions, durable concrete design and construction

08:00 – 10:00
Fire damage: mechanisms, condition assessment, damage rating, repair principles, case studies

08:00 – 10:00
Reinforcement corrosion: principles, mechanisms, service life estimation, prevention of corrosion

08:00 – 10:00
Overview, assessment of compressive strength of concrete (ends 9:30)

08:00 – 10:00
Structural failure and serviceability problems: principles of structural damage assessment and in-situ testing (ends 9:30)

10:00 – 10:30
TEA BREAK

10:30 – 12:00
Designing for durability: materials, concrete mix design, service life modelling, Durability Index approach, surface coatings, durability enhancers

10:30 – 12:00
Bonded concrete overlays, material selection, construction methods, performance criteria

10:30 – 12:00
Reinforcement corrosion: condition assessment and damage rating

10:30 – 12:00
(starts 10:00) Concrete cover and rebar location

10:30 – 12:00
(starts 10:00) Structural strengthening: design principles and methods, system and material selection

12:00 – 13:00
LUNCH BREAK

13:00 – 14:30
Concrete deterioration mechanisms (cracking, chemical attack, physical attack, ASR, structural damage, construction defects), including discussion on basic repair principles, case studies

13:00 – 14:30
Damage assessment and diagnostic testing; planning of condition surveys with a view on possible repair options; principles of non-destructive testing

13:00 – 14:30
Repair principles for structures damaged by reinforcement corrosion

13:00 – 14:30
Ultrasonic testing, impact echo and sonic echo tests

13:00 – 14:30
Strengthening structures for flexural and shear capacity; bonded plate systems; external prestressing

14:30 – 15:00
TEA BREAK

15:00 - 16:30
Concrete deterioration, continued

15:00 - 16:30
Concrete crack repair, principles, materials, systems

15:00 - 16:30
Repair principles for structures damaged by reinforcement corrosion

15:00 - 16:30
SASW, Ground penetrating radar

15:00 - 16:30
FRP systems: design principles, system solutions, application methods

07:30 – 08:00
REGISTRATION AND COFFEE / TEA
Registration

Registration and Cancellation

- You can register for this course in one of the following ways:
  1. register online or
  2. download the registration form and email it to ebe-cpd@uct.ac.za
- Registration covers attendance of all sessions of the workshop, teas and lunches, and a set of notes.
- Registrations close one week before the start of the course. Confirmation of acceptance will be sent on receipt of a registration form.
- Cancellations must be received one week before the start of a course, or the full course fee will be charged.
- For more information on application and registration procedures, please visit our website: www.cpd.uct.ac.za/cpd/applications

Certificates and CPD Points

A certificate of attendance will be awarded to CPD participants. Participants need to attend 80% of the lectures to qualify for an attendance certificate. CPD participants can also request a formal university transcript, which will show this course as part of a Professional Development Career.

Contact details

For more information or details on CPD courses, visit our website or contact us.

Web:  http://www.cpd.uct.ac.za
E-mail:  ebe-cpd@uct.ac.za

<table>
<thead>
<tr>
<th>Physical address</th>
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<tbody>
<tr>
<td>CPD Programme</td>
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</tr>
<tr>
<td>Room 6.10, 6th Floor</td>
<td>EBE Faculty</td>
</tr>
<tr>
<td>New Engineering Building</td>
<td>University of Cape Town</td>
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<td>Upper Campus</td>
<td>Private Bag X3</td>
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<td>University of Cape Town</td>
<td>Rondebosch 7701</td>
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<td>South Africa</td>
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Programme administrators

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