Repair and Rehabilitation of Concrete Structures

14 - 18 September 2020
The purpose of the course is to provide participants with a fundamental and practical understanding on condition assessment of concrete structures and concrete repair and service life extension 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 course 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.
Course Topics

1. **(Introduction to:) Concrete deterioration processes and damage to concrete structures**
   - Reinforcement corrosion
   - Chemical and physical attack
   - Structural damage
   - Fire damage
   - Cracking
   - Construction defects
   - Case studies

2. **(Introduction to:) Condition assessment of concrete structures**
   - Planning and strategies for condition assessments
   - On-site diagnostic testing and visual assessment methods
   - Non-destructive testing methods and interpretation of results
   - Laboratory-based testing of samples
   - Prediction of residual service life
   - Case studies

3. **(Main focus:) Repair and rehabilitation of concrete structures**
   - Philosophies and strategies for concrete repair and rehabilitation
   - Repair methods, materials and systems
   - Repair principles for reinforcement corrosion damaged structures
   - Concrete surface protection and coatings
   - Bonded concrete overlays and patch repair
   - Principles, methods and materials for concrete crack repair
   - Repair guidelines according to the Eurocode
   - Service life extension methods
   - The repair contractor’s perspective
   - The material supplier’s perspective
   - The discipline of forensic engineering: philosophy and added value
   - Case studies

**Delivery Modes**

The course will be presented through formal lectures, laboratory demonstrations and hands-on exercises, as well as site visits. Lectures will be presented by international leaders in the respective field, supported by repair material suppliers, practicing engineers and repair contractors.

**Please note:** Due to limitations as a result of COVID 19, it may be necessary to present this course online via Zoom and Vula:

Please refer to the website [www.cpd.uct.ac.za](http://www.cpd.uct.ac.za) for further information or contact the course administrators at ebe-cpd@uct.ac.za for information on whether the course will be presented online.
Course Presenters

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

Prof. Pilate Moyo (PrEng) is Professor of Structural Engineering and Director of the Concrete Materials and Structural Integrity Research Unit (CoMSIRU) in the Department of Civil Engineering at the University of Cape Town. His research and consultancy is on structural health monitoring, condition assessment, structural dynamics, vibration testing, and structural strengthening strategies for civil structures. His research is focused on developing structural assessment technologies integrating finite element modelling, full scale field testing, and advanced data analysis algorithms. He has published widely in these areas. View profile

Emeritus Prof. Mark Alexander is a Senior Research Scholar in the University of Cape Town. He is a Fellow of RILEM and he co-authored “Aggregates in Concrete” (2005), “Alkali-Aggregate Reaction and Structural Damage to Concrete” (2011), and “Durability of concrete – design and construction” (2017) (CRC Press) and was Editor of “Marine concrete structures. Design, durability and performance” (Woodhead Publishers (2016)). He is involved in CoMSIRU at UCT, which focuses on infrastructure performance and renewal research.

Prof. Rob Polder has been a materials scientist at TNO, The Netherlands, from 1984 until 2017 and a part-time professor at Delft University of Technology from 2009 until 2017. After retirement he is a private consultant. From a background in chemistry he has worked on durability of concrete and corrosion of reinforcement, combining research and consultancy. He has been active in national and international research committees and projects including RILEM and EU projects and holds the chair of the Dutch Knowledge Centre for Cathodic Protection of concrete structures. He has authored over 200 publications. His main focus is corrosion of steel reinforcement in concrete, including chloride penetration modelling, critical chloride threshold, methods for corrosion detection; prevention by mineral additions, electrochemical methods and surface treatments, monitoring, repair and protection methods, including cathodic protection of steel in concrete.
## Course Overview

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<tr>
<th>Name</th>
<th>Repair and Rehabilitation of Concrete Structures (CIV5139)</th>
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<tbody>
<tr>
<td>Duration</td>
<td>20 – 24 April 2020</td>
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<tr>
<td>Venue</td>
<td>Due to limitations as a result of COVID 19, it may be necessary to present this course online via Zoom and Vula</td>
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<tr>
<td>CPD</td>
<td>5 CPD points; ECSA Validation UCTCIMMRRCS20</td>
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<tr>
<td>Participants</td>
<td>Suitable for consulting engineers, students and academics</td>
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| Fees       | Standard delegate: R13500.00  
              | Full-time student: R6750.00                                  |
Registration and Cancellation

- **Register online**
- Registration covers attendance of all sessions of the course and course material.
- 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](http://www.cpd.uct.ac.za/cpd/applications)

Certificates and CPD Points

A certificate of attendance will be awarded to CPD participants for each course. Participants need to attend 80% of the lectures to qualify for an attendance certificate.

According to guidelines set out by the Engineering Council of South Africa, attendance of this course will earn participants 5 points towards Category 1 (Developmental Activities). The ECSA validation number for this course is UCTCMMRCS20

Please note: If you are interested in attending this course for credit purposes, you will need to register for the Master’s Programme or as an occasional student. If you attend the course as a CPD participant, credit cannot be claimed in retrospect.

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](http://www.cpd.uct.ac.za)
- **E-mail:** ebe-cpd@uct.ac.za

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