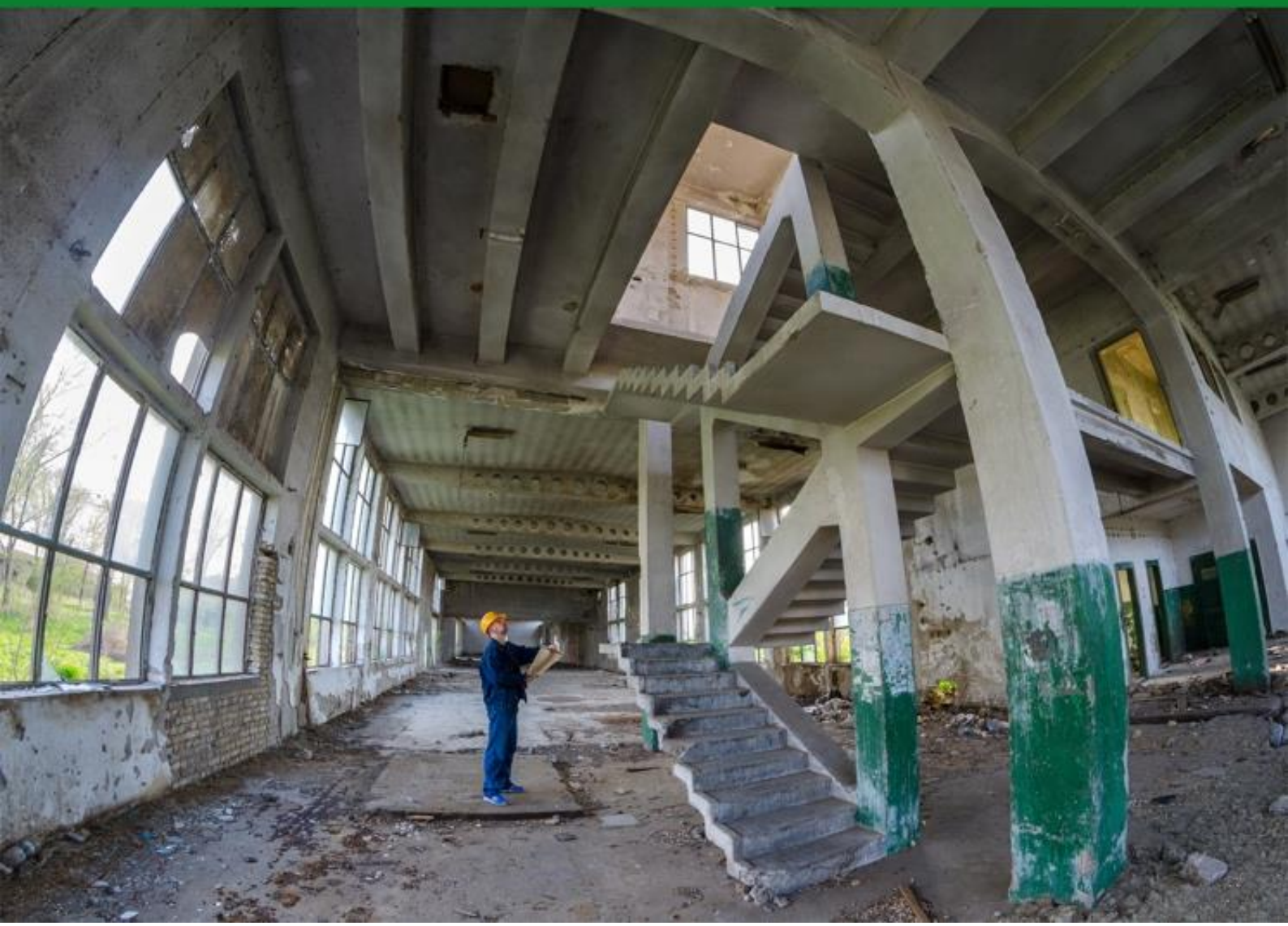
FACULTY OF
ENGINEERING &
THE BUILT ENVIRONMENT

CPD



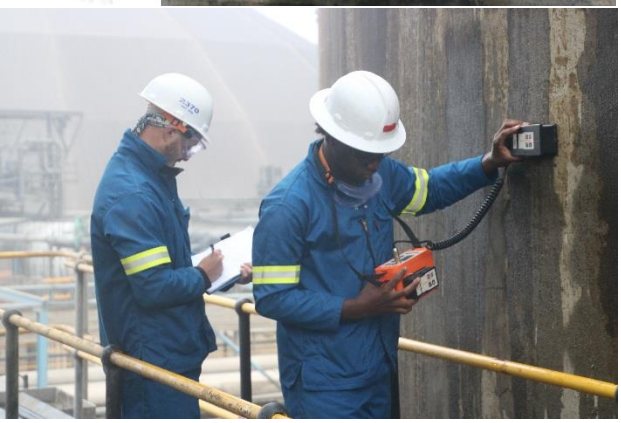
RILEM PhD Course

Repair and Rehabilitation of Concrete Structures

26 – 30 September 2022

UNIVERSITY OF CAPE TOWN
IYUNIVESITHI YASEKAPA • UNIVERSITEIT VAN KAAPSTAD

Introduction



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 economical 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.

In cooperation with the International Conference on Concrete Repair, Rehabilitation and Retrofitting, ICCRRR 2022.

ICCRRR2022
03–05 OCT 2022 · CAPE TOWN, SOUTH AFRICA

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 material supplier's perspective
    - The discipline of forensic engineering: phylosophy 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, and practicing engineers.

Presenters

Prof. Hans Beushausen is a researcher, lecturer, and consultant in the fields of structural engineering, construction material technology, structural condition assessment, and concrete repair technology in the Department of Civil Engineering at the University of Cape Town and Director of the Concrete Materials and Structural Integrity Research Unit (CoMSIRU). He is a Fellow of RILEM and Chairman of the RILEM Development Advisory Committee, as well as Head of the *fib* National Member Group South Africa.

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. Pilate Moyo (PrEng) is Professor of Structural Engineering and Co-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.

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.

Professor Vernon Collis is a consulting engineer and architect specializing in integrated and adaptive sustainable systems design and construction in the building and civil engineering industries. His design methodology allows room for reflection by client and team and space for transdisciplinary design to happen, unlike conventional practice which is based on substitutional rather than transformative sustainable design. Collis has designed and built 500+ projects in the mining, commercial, educational, infrastructural and housing sectors. He is an adjunct associate professor at the University of Cape Town and is presently researching sustainable construction materials with the university's Concrete Materials and Structural Integrity Research Unit.

Dr. Radhakrishna G. Pillai is an Associate Professor in the Dept. of Civil Eng. at IIT Madras, India. He earned MSc and PhD in Civil Eng. at Texas A&M University (TAMU), USA and got passionate to combat corrosion of steel in reinforced and prestressed concrete structures. In September 2010, he joined IIT Madras and has been teaching in the areas of construction materials, concrete technology, and repair of concrete structures and engaged in the development and activities of the Construction Materials Research Laboratory (CMRL). He is running various projects focusing on steel corrosion and its impact on the durability and service life of concrete structures. In particular, he focuses on developing corrosion test methods, database, and tools for practicing engineers to promote service life-based design of concrete structures. Recently, he has been extending his research to cathodic protection and extension of the residual service life of concrete structures.