

## CoMSIRU CPD Courses 2018

### CPD courses offered by the Concrete Materials and Structural Integrity Research Unit

The Concrete Materials and Structural Integrity Research Unit (CoMSIRU) has pursued an active research programme aimed at creating a better understanding of the use and application of cement-based materials in the South African environment for more than 20 years. This includes basic concrete materials studies, and the development of technologies and procedures for the design and assessment of concrete structures. Over the last decade, there has been a marked focus on research into infrastructure performance, largely in response to industry needs.

The unit also provides consultancy and postgraduate teaching in the areas of concrete material technology, concrete durability, structural health monitoring and repair and rehabilitation.

#### CPD COURSES:

#### Course List

Course name	Duration	2018 dates	Course fee
Research methodology and technical writing	2 days	26-27 March	R7300
Concrete Technology	2 days	17-18 April	R7300
Repair and Rehabilitation of Concrete Structures	5 days	4-8 June	R11600
Structural Design	3 days	18-20 July	R8500
Bridge & Tunnel Management	5 days	27-31 August	R11600
Structural health monitoring & Non-destructive testing of concrete structures	3 days	26-28 September	R8500
Condition Assessment of Steel Structures	2 days	22-23 October	R7300

## Research Methodology and Technical Writing: 26 – 27 March 2018

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A 2-day certificated course, ECSA approved for 2 CPD points, ECSA CPD course code: UCTRMTW2018

Presented in Johannesburg. Venue to be confirmed.

### Course description

Most engineers involved in the management and operation of railway infrastructure conduct engineering investigations, 1) to identify the causes of failure of systems or their components, 2) to develop appropriate solutions to engineering problems and 3) to develop new products/processes to improve productivity. Such investigation require a systematic approach starting with the definition of the problem to reporting of the outcome of the investigation. This course aims to equip professionals in the Railway Industry with the transferable skills of technical investigation, technical writing and presentation.

### Course content

- Research/investigation process
- Paper writing
  - Selection of information and structure of a conference paper
  - Referencing, annotations and graphics
- Presentation skills
  - Powerpoint
  - Oral/Poster Presentation

### Course objectives

At the end of this course, participants should be able to:

- Develop a systematic plan for engineering investigation
- Identify and select appropriate information
- Write a technical paper
- Create effective visuals for presentation of technical findings

### Course presenters

Prof Pilate Moyo

Prof Jane English

### Course cost

Standard delegate: R7300

Full time student: R3650

## Concrete Technology: 17 – 18 April 2018

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A 2-day certificated course, ECSA approved for 2 CPD points, ECSA CPD course code: UCTCT2018

Presented in Johannesburg. Venue to be confirmed.

### Course Description

Engineers are required to make reasonable assumptions and provide economical solutions for the design of reinforced concrete structures. An important part of this process is the choice of appropriate concrete material properties and the relevant specification of mix constituents, mix proportions and construction methods.

Modern design methods usually involve the use of software packages in which predefined values for relevant concrete properties, such as strength and deformation characteristics, are made. Accepting such predefined assumptions without accounting for specific project requirements, and site conditions may result in conservative and uneconomic design of reinforced concrete structures. In addition,

innovative and modern types of concrete are often not considered in the design process as many structural engineers have limited knowledge of fundamental concrete materials technology.

The workshop will refresh the engineer's and technician's knowledge and understanding of concrete properties to enable him/her to rationally specify economic design solutions for reinforced concrete structures. Based on fundamental aspects of concrete materials technology, the workshop will discuss design procedures and constituent material choices for general and specific requirements. Important properties such as strength and strength development, elastic deformations, shrinkage and creep, and durability will be discussed. The presentations cover fundamental materials aspects, design methods, test procedures and prediction models for concrete properties.

The underlying aims of the workshop are to highlight the importance of materials in the design and performance of concrete structures and to facilitate a good understanding of modern concrete technology in order to promote economic and sustainable design of reinforced concrete structures.

#### Course content

- Critical review of common design assumptions and code provisions (SABS and EN)
- Critical review of concrete material properties suggested in common structural design software
- Cement types and hydration process (principles, property development, hydration heat), highlighting how to influence hydration and property development through the choice of constituent materials and mix parameters
- Modern admixtures for concrete: types, applications, and limitations
- Compressive strength of concrete (design assumptions, strength classes, influencing factors, prediction models)
- Tensile and flexural strength (common values, relationship between compressive and tensile strength, significance in design, test methods)
- Concrete behaviour under load (deformation principles, failure and fracture)
- Elastic properties (importance and relevance, design assumptions and prediction models, test methods, material influences)
- Shrinkage and creep (importance in design, structural effects, design assumptions and prediction models, test methods and their limitations, material influences)
- Special requirements for concrete (early age properties, workability, strength development, heat of hydration)
- Concrete durability (overview on deterioration mechanisms, design for durability, material choice, prediction models and test methods)
- Overview on special concretes (self-compacting concrete, high strength concrete)

#### Course outcome

- At the end of the course the participants should;
- Understand the constituents of concrete
- Specify a concrete mix design
- Specify relevant tests for structural concrete
- Understand the importance of durability of concrete structures

#### Course presenter

Prof Hans Beushausen

#### Course cost

Standard delegate: R7300

Full time student: R3650

## Repair and Rehabilitation of Concrete Structures: 4 – 8 June 2018

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A 5-day certificated course, ECSA approved for 5 CPD points, ECSA CPD course code: UCTRCS2018

Presented in Johannesburg. Venue to be confirmed.

### Course description

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 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 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 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

- **Concrete deterioration processes**
  - Chemical and physical attack
  - Fire damage
  - Cracking
  - Construction defects
- **Reinforcement corrosion**
  - Principles, mechanisms and influences
  - Carbonation and chloride ingress
  - Corrosion prevention in new structures
- **Condition assessment of concrete structures**
  - Planning and strategies for condition assessments
  - On-site diagnostic testing
  - Visual assessment methods
  - Non-destructive testing methods and interpretation of results
  - Laboratory-based testing of samples
  - Prediction of residual service life
  - Case studies

- **Repair 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
- **Strengthening of concrete structures**
  - Principles and strategies
  - Assessing structural capacity
  - Strengthening using steel plates
  - Strengthening using FRP
- **Site visit to one concrete bridge, culvert or tunnel (within 100 km from course venue).**

#### Course outcomes

- At the end of this course, participants should be able to:
- Identify common deterioration mechanisms of concrete structures
- Assess the condition of concrete structures
- Specify repair and strengthening solutions for concrete structures
- Conduct laboratory tests on specimens collected from existing structures

#### Course presenter

Prof Hans Beushausen

Prof Pilate Moyo

#### Course cost

Standard delegate: R11600

Full time student: R5800

## Structural Design: 18 – 20 July 2018

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A 3-day certificated course, ECSA approved for 3 CPD points, ECSA CPD course code: UCTSD2018

Presented in Johannesburg. Venue to be confirmed.

### Course description

This course focuses on the structural design principles of reinforced concrete and structural steel. These principles are critical in both design of new structures as well as the assessment of existing structures. At the design stage, codes of practice provide guidance on selection of loading and materials, however at the assessment stage both the material and the loading maybe available, and a good understanding of structural behaviour is critical.

### Course content

- Limit state design philosophy
- Elastic behaviour of reinforced concrete sections
- Serviceability and ultimate limit state design of reinforced concrete elements
- Design of retaining walls
- Design principles for structural steelwork: ties, struts, beams, trusses, frames and connections.

### Course outcomes

- At the end of this course participants should;
- understand the philosophy of limit-state [service limit state and ultimate limit state]
- perform a basic structural design of reinforced concrete elements including railway sleepers, and
- perform basic structural design steel elements,
- interpret requirements of structural design codes
- understand the implications of structural design to structural performance assessment during operation

### Course presenter

Prof Pilate Moyo

Dr Alvin Masarira

### Course cost

Standard delegate: R8500

Full time student: R4250

## Bridge & Tunnel Management: 27 – 31 August 2018

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A 5-day certificated course, ECSA approved for 5 CPD points, ECSA CPD course code: UCTBTM2018

Presented in Johannesburg. Venue to be confirmed.

### Course description

Bridges and tunnels constitute significant and critical discrete components of a transportation system and they are among the most expensive investment asset of any country's civil infrastructure. They also have a long service life compared with most commercial products and are rarely replaceable once they are erected. Therefore effective bridge and tunnel asset management practices are required to obtain the best value from limited resources. The course will provide participants meaningful guidance to quantify their bridge & tunnel infrastructure deficit and prioritize bridge & tunnel investment. The course will give a broad overview of bridge & tunnel management systems and maintenance strategies. Attention will be paid to the DER method of bridge inspection. This approach is used by a number of national, provincial and municipal authorities in South Africa.

### Course content

- Background: bridge failures
- Overview of Structures Management Systems
- Bridge asset management
- Visual assessment of structures
- Overview of typical defects on structures
- The DER Rating System
- BMS implementation in SA: Case Studies
- Implementing a BMS
- Applying bridge asset management
- Preventative maintenance of structures
- Asset valuation: replacement and current asset value
- Site visit to two concrete bridges (within 100 km from course venue).

### Course outcomes

At the end of this course the participants should be able to:

- Select relevant bridge and tunnel management systems for their environment
- Create bridge and tunnel inventories
- Prioritise maintenance programs based on management systems
- Conduct bridge and tunnel inspection

### Course presenter

Dr Paul Nordengen  
Mr Stephen Humphries  
Prof Pilate Moyo  
Prof Jose Matos  
Mr Nkululeko Mbedle

### Course cost

Standard delegate: R11600

Full time student: R5800

## Structural Health Monitoring & Non-destructive Testing of Concrete Structures: 26 – 28 September 2018

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A 3-day certificated course, ECSA approved for 3 CPD points, ECSA CPD course code: UCTSHM2018

Presented in Johannesburg. Venue to be confirmed.

### Course description

This course covers structural health monitoring and non-destructive techniques for civil infrastructure. These techniques are increasingly used for structural performance assessment of structures both during construction and operational phases. During the construction phase, these techniques are used for quality control and verification of design assumptions and in the post construction phase they are used to track the behaviour of a structure and thus provide necessary information for operation, management and maintenance activities.

The course covers: philosophy of structural performance assessment, performance indicators, strategies for structural performance assessment, introduction to theoretical modal analysis, experimental modal analysis, instrumentation, data acquisition, data quality assurance, modal parameter estimation and validation, introduction to model updating and non-destructive testing (NDT) methods.

### Course content

- **Structural health monitoring**
  - Modal analysis
  - Model updating and correlation
  - Data acquisition, instrumentation, sensing technologies, data analysis
- **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

### Course outcomes

At the end of this course participants should be able to:

- Specify field measurement systems for structural assessment
- Select appropriate non-destructive tests for assessment of concrete structures
- Conduct field non-destructive tests

### Course presenter

Prof Pilate Moyo

### Course cost

Standard delegate: R8500

Full time student: R4250

## Condition Assessment of Steel Structures: 22 – 23 October 2018

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A 2-day certificated course, ECSA approved for 2 CPD points, ECSA CPD course code: UCTCASS2018

Presented in Johannesburg. Venue to be confirmed.

### Course description

The structural infrastructure in railway operations is exposed to excessive and even extreme loading conditions due to the nature and environment of these operations. The structures often support operational equipment and loads that are often dynamic in nature and could vary in magnitude and intensity depending on the operational conditions and requirements. As a result these structures experience high levels of deterioration and other effects which often lead to compromising their integrity, load bearing behaviour and structural efficiency. Safe and reliable structures are a fundamental aspect of any operation and every structural failure has potential for injuries, fatalities and operational shut-downs, and the risk of structural failures is closely associated with the condition of the structures. This workshop will consider the structural material (which is mainly steel), will present a systematic method for regular condition assessment (inspections) on structures so as to determine the levels of structural deterioration at any given time in the life of the operation. The assessment considers the current condition of the structures with reference to their original condition, identify deterioration mechanisms, assess and rate the risk of failure and make appropriate recommendations and prioritise any such interventions. This ensures early identification of structural maintenance requirements, thereby facilitating preventive maintenance, to ensure safety and prevent asset value destruction.

### Course content

- Basics of structural steel
- Structural behaviour of steel
- Deterioration of steel
- Fire damage
- Dynamics/vibrations problems
- Fatigue
- Risks Assessment and Rating
- Condition Assessment and Monitoring
- Remedial Action and Repairs
- Site visit to a steel bridge/culvert (within 40 km from the course venue).

### Course outcomes

At the end of this course the participants should be able to:  
Identify elements to inspect in steel structures.  
Identify and quantify structural defects in steel structures.  
Specify of remedial actions.

### Course presenter

Dr Alvin Masarira  
Prof Pilate Moyo

### Course cost

Standard delegate: R7300

Full time student: R3650

## COURSE INFORMATION

### *Who should attend?*

Consulting Engineers, academics and students.

### *Format*

Each module comprises formal lectures, class assignments and seminars/tutorials. The length of each course is listed with the course details.

Courses are presented in Johannesburg at the Transnet School of Rail, unless otherwise specified

### *Cost*

The fee for each course is indicated with the course details. This fee includes lecture notes and refreshments.

Payment details are on the application form.

### *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 points towards Category 1 (Developmental Activities). The ECSA course code information is listed with the course details.

CPD participants can also request a formal university transcript, which will show this course as part of a Professional Development Career.

### *Venue*

Venue details will be sent to course participants in the week before the course.

### *Application and cancellation*

Application forms are available on the website <http://www.cpd.uct.ac.za/cpd/applications>

In order to ensure a place on the course applicants must complete and return a signed application form to the course administrators: Heidi Tait or Sandra Jemaar.

Confirmation of acceptance will be sent on receipt of an application form.

Applications close one week before the start of each course.

**Payment is due one week before the start of each course.**

**Cancellations must be received one week before the start of a course, or the full course fee will be charged**

### *Administrators*

Heidi Tait or Sandra Jemaar:

CPD Programme, EBE Faculty Office, New Engineering Building, University of Cape Town

Phone: 021 650 5793

Email: [ebe-cpd@uct.ac.za](mailto:ebe-cpd@uct.ac.za)