Structural Innovation and Monitoring Technologies Resource Centre

SIMTReC

Professional Development Course
Durability of Concrete Infrastructure

Course Description:

This course focuses on the durability of concrete as a material. It addresses the design of concrete infrastructure from a durability perspective. Durability-based design of concrete is approached as a process of assessing potential forms and severity of attack on concrete infrastructure, and providing the necessary measures to mitigate these forms of attack. The course starts with an introduction to cement and concrete materials science. Key issues that will be discussed in this course include mass transport mechanisms in concrete and deterioration of concrete due to freezing-thawing cycles, corrosion of embedded steel reinforcement, sulfate attack, and alkali-aggregate reactions. Each durability topic is discussed in terms of exposure conditions, mechanisms of attack, influential factors, Canadian and American code requirements and protection methods, where applicable.

Course Objectives:

To provide essential knowledge needed to identify the causes of concrete deterioration, detect damage manifestations, and apply mitigation practices related to concrete infrastructure in the design stage for new and restoration projects.

Credit:

10 Professional Development Hours (PDH)

Who Should Attend this Course:

Civil engineers, designers, consulting engineers, architects, contractors, owners, facility managers, construction inspectors, inspection agency officials, asset managers responsible for the maintenance or rehabilitation of both public and private concrete structures, and other parties interested to learn key deterioration mechanisms of concrete infrastructure.

After attending this course, you will be able to:

- Understand key deterioration mechanisms of concrete infrastructure
- Recognize different forms (physical and chemical) of attack on concrete infrastructure
- Analyze degradation of concrete due to durability issues
- Employ durability requirements in Canadian and American building codes and be able to apply concepts of durability-based design to infrastructure projects

Course Date and Location:

September 12 & 13, 2017

Day 1 (4 hours) - **September 12th**, 1:00 pm to 5:00 pm
Day 2 (4 hours) - **September 13th**, 8:30 am to 12:30 pm (Lunch included:12:30 pm to 1:30 pm)
SmartPark Event Centre - Located at 100-One Research Road SmartPark, University of Manitoba's Fort Garry campus—Free Parking

Day 2 (2 hour) - Laboratory Component **September 13th**, 2:30 pm to 4:30 pm
McQuade Structures Laboratory - University of Manitoba—Agricultural & Civil Engineering Building, 96 Dafoe Road

Registration:

Fee: $1200 plus 5% GST ($60) = $1260
Register online at: http://simtrec.ca/event-registration/

Instructor Bio:

M. T. Bassuoni is an Associate Professor in the Department of Civil Engineering at the University of Manitoba, and a registered professional engineer in Manitoba. He received his PhD from the University of Western Ontario, Canada. Dr. Bassuoni has a vast experience in construction engineering, working in large-scale projects empowered by US Army Corps of Engineers. He has more than 17 years of experience in the design and behavior of cementitious materials, durability of concrete infrastructure under chemical and physical damage mechanisms and prediction of concrete performance by artificial intelligence modeling, with numerous technical publications in these areas. He has transferred this knowledge to various technical and public organizations, for example by participating in developing guidelines for the durability of concrete, a manual for the repair of concrete pavements and novel solutions for cold weather masonry construction. Dr. Bassuoni is an active member of the American Concrete Institute (ACI) Committee 201 (Durability of Concrete) and currently the Task Group Chair of Physical Salt Attack on Concrete in this committee. He is also a member of ACI Committees 236 (Materials Science of Concrete), 237 (Self-Consolidating Concrete) and 241 (Nanotechnology of Concrete). He is a member of ASTM Committees C01 (Cement) and C09 (Concrete and Concrete Aggregates) and an associate member in CSA A23.1/A23.2 (Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete).

For more information or questions contact:
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Program Outline

Day 1 (4 hours) September 12th, 1:00 pm to 5:00 pm

Cement and concrete:

- Overview on cement and types of cement
- Fresh and hardened properties of concrete

Mass transport of fluids in concrete:

- Permeability, diffusion, absorption
- Testing- CSA/ASTM
- Effect of mixture design parameters on transport properties

Freezing and thawing damage:

- Mechanisms of failure
- Effect of mixture design parameters on freeze-thaw damage
- Tests, standards and codes
- Preventive and mitigation measures

Corrosion of steel reinforcement:

- Effect of chloride ions and types of corrosion
- Effect of mixture design parameters on corrosion of reinforcement
- Standards and codes
- Preventive and mitigation measures

Day 2 (4 hours) September 13th, 8:30 am to 12:30 pm
(Lunch included: 12:30 pm to 1:30 pm)

Sulfate attack:

- Mechanisms and types of external and internal sulfate attack
- Case studies
- Effect of mixture design parameters on sulfate attack
- Tests, standards and codes
- Special types of sulfate attack
- Preventive and mitigation measures

Physical salt attack:

- Mechanisms
- Case studies
- Effect of mixture design parameters on physical salt attack
- Tests, standards and codes
- Preventive and mitigation measures

Alkali-aggregate reactions:

- Alkali-silica and alkali-carbonate reactions
- Case studies
- Effect of mixture design parameters on alkali-aggregate reactions
- Tests, standards and codes
- Preventive and mitigation measures

Day 2 (2 hour) Laboratory Component September 13th, 2:30 pm to 4:30 pm

Lab tour in IKO Construction Materials Testing Facility and Q/A:

- Rapid chloride penetrability test
- Non-destructive testing (ultrasonic pulse velocity, resonant frequency)
- Forensic evaluation of deteriorated concrete by Scanning Electron Microscopy and X-Ray Diffraction