WebCorr
CORROSION CONSULTING
SERVICES

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• Consulting • Training • Expert Witness • Failure Analysis • Design Review • Corrosion Test • Modeling • Coatings • Materials • Cathodic Protection

WebCorr Corrosion Consulting Services Presents

An Advanced Course in Concrete Durability

Date: As published on website Venue: As published on website

Course Overview

The corrosion of reinforcing steel in concrete structures such as buildings, car parks, concrete marine structures, road beds, bridge decks and bridge substructures is a world-wide problem and leads to cracking, staining, spalling from the surface and ultimately structural weakness. This 5-day advanced course thoroughly and systematically covers the concrete durability issues: the causes of reinforcement corrosion, common control and prevention methods for both old and new structures, surveying and diagnosing techniques for condition assessment, the conventional and some promising emerging technologies for repair and rehabilitation of concrete structures. Participants will gain essential knowledge and skills in managing corrosion in concrete structures. Engineers, architects and designers will grasp the theories and practices of corrosion control and prevention which would lead to corrosion-proof designs and low cost durability. Participants will also learn the principles and applications of advanced corrosion sensors and monitoring systems for life prediction, repair and rehabilitation, surveying, diagnosis and condition assessment. Facility owners will benefit from increased durability, enhanced safety and reduced maintenance costs.

Who Should Attend

- Engineers, architects and designer who are concerned with the durability and corrosion of reinforced concrete structures;
- Building inspectors and surveyors who are interested in corrosion damages in concrete structures;
- Technicians and maintenance personnel who deal with repair and rehab of reinforced concrete structures;
- Facility owners and users who are concerned with corrosion and method of mitigation

Course Outline

1. Corrosion and concrete durability
1.1 Impact of corrosion on society
1.2 Factors influencing concrete durability

2. Terminology and conventions
2.1 corrosion, pH, potential, reference electrode, potential-pH diagram
2.2 passivation, passive rebar, depassivation, anode, cathode, cathodic protection, galvanizing, carbonation, etc.
3. Why & How does rebar corrode in concrete?
3.1 corrosion of steel in aqueous environment
3.2 the nature of concrete environment
3.3 corrosion of steel in concrete
3.4 actions from aggressive species chloride, carbon dioxide, sulphate, soft water action
3.5 potential difference
3.6 corrosion reactions
3.7 ionic flow
3.8 autocatalytic process
3.9 Type of reinforcement corrosion: general/uniform, pitting, concentration cells, differential aeration cells, galvanic cells, stray current corrosion, microbiologically influenced corrosion (MIC)
4. How to control and prevent concrete corrosion
4.1 concrete quality, porosity, permeability, depth of cover, water/cement ratio, chloride content
4.2 patching practices
4.3 membranes and sealers
4.4 corrosion inhibitors

Course Outline

4.5 epoxy coating
4.6 galvanizing (zinc coating)
4.7 cathodic protection: principles of cathodic protection, standards, criteria of protection, design of cathodic protection systems, installation practices, operation and maintenance, testing and monitoring
5. Surveying and diagnosing
5.1 Introduction: the need for survey and diagnosis
5.2 Non-destructive structural surveys
5.2.1 Visual and physical appraisal
5.2.2 Resistivity mapping: principles and data interpretation
5.2.3 ASTM C876 Half-Cell potential survey/mapping: principles and data interpretation
5.2.4 Electrochemical techniques for corrosion rate measurements: LPR, EIS, principles and data inpterpretation
5.2.5 Determining the remaining rebar diameter
5.2.6 Determining rebar condition: passive or depassivated, polarization measurements
5.3 Depth of carbonation
5.4 Chloride contents
6. Testing and Monitoring
6.1 The Need for Corrosion Testing and Monitoring in Concrete Structures
6.1.1 Assessment of the Extent of Corrosion Damage
6.1.2 Determing the Rate of Corrosion Damage
6.1.3 Early Warning -Monitoring the Rate of Corrosion Damage
6.1.4 Evaluating the Effectiveness of Repair /Rehabilitation
6.2 The Nature of Corrosion Process in Concrete Structures
6.2.1 Physical Changes Due to Corrosion
6.2.2 Chemical Changes Due to Corrosion
6.2.3 Corrosion Rate and Current Density
6.3 Indirect Methods for Corrosion Testing and Monitoring
6.3.1 Depth of carbonation
6.3.2 Depth of chloride penetration
6.3.3 Electrical resistance (ER probe)
6.3.4 Concrete resistivity
6.3.5 Half-cell potential mapping (ASTM standard C876)
6.3.6 pH, Temperature
6.3.7 Moisture
6.4 Direct Methods for Corrosion Testing and Monitoring
6.4.1 Linear polarisation resistance measurement
6.4.2 Potentiodynamic polarization
6.4.3 AC Impedance measurement
6.4.4 Electrochemical noise measurement
6.5 Design of Corrosion Sensors in Concrete Structures
6.5.1 Overview of sensor designs
6.5.2 Interfaces with sensors
6.5.3 Types of sensors
6.5.4 Principles of LPR-based sensors
6.5.5 Principles of ZRA-based sensors
6.5.6 Advantages and limitations
6.5.7 Monitoring system and components
6.5.8 The new generation of sensors for early warning and life prediction
6.5.9 Cost considerations
7. Repair and Rehabilitation
7.1 Corrosion and concrete durability
7.2 Factors influencing corrosion of reinforcement in concrete structures
7.3 Conventional methods of concrete repair/rehabilitation
7.3.1 patch repair and the incipient anode effect
7.3.2 membranes and sealers
7.3.3 corrosion inhibitors
7.3.4 epoxy coating
7.3.5 galvanizing
7.4 Innovative Cathodic Protection Systems for Concrete Repair and Rehabilitation
7.4.1 Principles of cathodic protection
7.4.2 Sacrificial anode CP
7.4.3 Pressure-sensitive Zinc-Hydrogel anode
7.4.4 Snap-on zinc mesh anode CP system
7.4.5 Impressed current CP
7.4.6 Anode design
7.4.7 Electrodes selection
7.4.8 Installation
7.4.9 Life expectancy and calculations
7.4.10 Case study and Applications
7.5 Chloride Extraction For Concrete Repair and Rehabilitation
7.5.1 Principles of chloride extraction
7.5.2 System setup and operating parameters
7.5.3 Assessment of effectiveness& Application
7.6 Electrochemical Realkalisation For Concrete Repair and Rehabilitation
7.6.1 Principles of electrochemical realkalisation
7.6.2 System setup and operating parameters
7.6.3 Assessment of effectiveness & Application
7.7 Conductive Concrete
7.7.1 The nature of conductive concrete
7.7.2 Conductive concrete in cathodic protection
7.7.3 Case studies and Applications
7.8 Stainless Steels and Alloys Reinforcements
7.8.1 The fundamental difference between black rebar and stainless steel rebar
7.8.2 Type of stainless steels and alloys
7.8.3 Mechanical properties of stainless steels and alloys
7.8.4 Corrosion resistance of stainless steels and alloys
7.8.5 Cost comparison
7.8.6 Case studies and Applications
7.9 Ranking of The Emerging Technologies For Corrosion Control In Concrete Structures
7.10 Techniques to monitor the effectiveness of repair/rehab strategies
8. Corrosion Modeling and Prediction Software
8.1 Concrete-Compass
8.2 CP-Compass-Concrete

Course Registration

Please register online at www.corrosionclinic.com
Or use the form below (photocopies of this form may be used for multiple bookings).

Dr/Mr/Ms _____

Organization _____

_____

Contact Person _____

Contact Dept _____

Telephone _____ Fax _____

Email _____

Payment should be made by TT or online banking. Currencies in Australian Dollar, Canadian Dollar, US Dollar, Euro and Sterling Pound can be transferred directly without conversion. Our bank details can be found at the link below:

https://www.corrosionclinic.com/payment.html

Course Fee and Discount

Standard: $4,950 **Discount**: $4,455

The fee includes a hardcopy of course note, certificate, light lunch, coffee breaks each day during the course.

Discount applies to a group of 3 or more persons from the same organization registering at the same time, or early-birds making payment at least 8 weeks before the course commencing date.

Cancellation and Refunds

Cancellation or replacement should be conveyed to WebCorr in writing (email or fax). An administration charge of 50% of the course fee will be levied if the cancellation notice is received from 14 to 7 days before the course commencing date. No refund will be made for cancellation notice received 6 days and less. No refunds will be given for no-shows. Should WebCorr find it necessary to cancel a course, paid registrants will receive full refund. Refund of fees is the full extent of WebCorr's liability in these circumstances.

WebCorr has NACE certified Corrosion Specialist (#5047) providing customized in-house training, online and distance learning corrosion courses, corrosion seminars and workshops on corrosion, materials, metallurgy, paints and metallic coatings. Our corrosion courses are developed and taught by NACE certified Corrosion Specialist with over 30 years of practical experience in the field. Our training success is measured by your learning outcome.