COURSE OVERVIEW SE0100
Durability of Reinforced Concrete Structures

Course Title
Durability of Reinforced Concrete Structures

Course Date/Venue
Session 1: February 23-27, 2024/Al Khobar Meeting Room, Hilton Garden Inn, Al Khobar, KSA
Session 2: August 03-07, 2024/Boardroom 1, Elite Byblos Hotel Al Barsha, Sheikh Zayed Road, Dubai, UAE

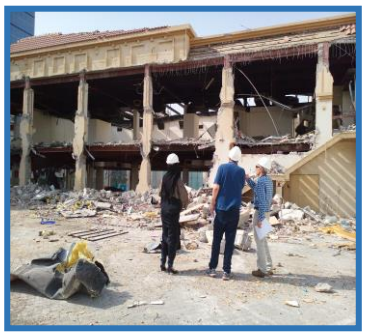
Course Reference
SE0100

Course Duration/Credits
Five days/3.0 CEUs/30 PDHs

Course Description

This practical and highly-interactive course includes practical sessions where participants will visit reinforced concrete structures. Practical sessions will be performed in order to apply the theory learnt in the class.

The Middle East construction boom will collapse without better concrete quality and corrosion protection. The service life of reinforced concrete structures is significantly lower in the Middle East than in other parts of the world due to the harsh weather conditions. There is a tendency to use a 'trial and error' approach to materials and processes which have not been standardised or fully tested as these processes are applied without supervision, which results in poor service life. Therefore, a more professional approach is needed, with special attention to the entire service life, starting from the design phase.



Collapses, premature demolitions, unforeseen extensive maintenance work all over the world created great concern about the durability and safety on the reinforced concrete structures. Engineers need therefore newer and more suitable solutions to prolong the service life of new structures, both using supplementary preventative techniques and adopting efficient maintenance and repair techniques.

The development of cost-effective strategies for maintenance of reinforced concrete structures necessitates the acquisition of reliable information on the extent and rate of damages. If the corrosion risk of the reinforcement is detected sufficiently early, damage can be avoided or reduced significantly, residual life of the structure predicted and relatively simple maintenance measures or repair systems can be used.

The course will provide updated information on diagnosis of the reinforced concrete structures at different levels, starting with a simple or low-level form of periodic visual inspections, until the use of sensors for the new and existing structures. The course therefore covers the principles of a wide range of the latest techniques and illustrates practical applications related to the use of equipments for corrosion and mechanical testing and monitoring in concrete structures on site. These modern techniques can provide rapid and sensitive measurements and detection of damages in concrete structures.

Course Objectives

Upon the successful completion of this course, each participant will be able to:-

- Apply systematic techniques, tools and procedures on reinforced concrete structures and improve the durability of such structures
- Identify the various types of damage that can affect concrete and reinforced concrete structures as well as their effects in the assessment and rehabilitation of the structures
- Determine the causes of concrete and reinforced concrete structure damage and identify the additional preventative measures being applied in concrete structures
- Implement the systematic methodology of damage assessment including the identification of service and exposure conditions of concrete structures
- Carryout assessments of corrosion affected structures and explain the assessment of the reinforced concrete structures conditions
- Explain and employ the rehabilitation of concrete structures including methods to prevent defects in concrete, rehabilitation methods against corrosion damage and determine the required properties of repair materials and systems in concrete structure
- Describe the principles and apply the methods for the rehabilitation of damaged concrete due to reinforcement corrosion
- Implement the risk-based maintenance strategy with the required repair time, required time to start of corrosion and deterioration as well as cost analysis for different protection methods

Exclusive Smart Training Kit - H-STK

*Participants of this course will receive the exclusive "Haward Smart Training Kit" (**H-STK®**). The **H-STK®** consists of a comprehensive set of technical content which includes **electronic version** of the course materials conveniently saved in a **Tablet PC**.*

Who Should Attend

This course provides an overview of the durability of reinforced concrete structures for design engineers, inspection engineers, maintenance engineers, civil engineers, integrity engineers, construction engineers, material engineers, inspectors and other technical staff.

Course Certificate(s)

Internationally recognized certificates will be issued to all participants of the course who completed a minimum of 80% of the total tuition hours.

Certificate Accreditations

Certificates are accredited by the following international accreditation organizations:-

- The International Accreditors for Continuing Education and Training (IACET - USA)

  Haward Technology is an Authorized Training Provider by the International Accreditors for Continuing Education and Training (IACET), 2201 Cooperative Way, Suite 600, Herndon, VA 20171, USA. In obtaining this authority, Haward Technology has demonstrated that it complies with the **ANSI/IACET 2018-1 Standard** which is widely recognized as the standard of good practice internationally. As a result of our Authorized Provider membership status, Haward Technology is authorized to offer IACET CEUs for its programs that qualify under the **ANSI/IACET 2018-1 Standard**.

  Haward Technology's courses meet the professional certification and continuing education requirements for participants seeking **Continuing Education Units** (CEUs) in accordance with the rules & regulations of the International Accreditors for Continuing Education & Training (IACET). IACET is an international authority that evaluates programs according to strict, research-based criteria and guidelines. The CEU is an internationally accepted uniform unit of measurement in qualified courses of continuing education.

  Haward Technology Middle East will award **3.0 CEUs** (Continuing Education Units) or **30 PDHs** (Professional Development Hours) for participants who completed the total tuition hours of this program. One CEU is equivalent to ten Professional Development Hours (PDHs) or ten contact hours of the participation in and completion of Haward Technology programs. A permanent record of a participant's involvement and awarding of CEU will be maintained by Haward Technology. Haward Technology will provide a copy of the participant's CEU and PDH Transcript of Records upon request.

- British Accreditation Council (BAC)

  Haward Technology is accredited by the **British Accreditation Council** for **Independent Further and Higher Education** as an **International Centre**. BAC is the British accrediting body responsible for setting standards within independent further and higher education sector in the UK and overseas. As a BAC-accredited international centre, Haward Technology meets all of the international higher education criteria and standards set by BAC.

Course Fee

US$ 5,500 per Delegate + **VAT**. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

Course Instructor(s)

This course will be conducted by the following instructor(s). However, we have the right to change the course instructor(s) prior to the course date and inform participants accordingly:

Mr. Bilal Nabahani is a **Senior Civil Engineer** with almost **25 years** of practical experience in **construction** of **major civil engineering projects** including building, roads, bridges, airports, theatres, stadium, ports, etc. and other **energy** sectors. His expertise widely covers in the areas of **Civil** Engineering, **Project Relocation** & Development, **Site Inspection & Quality Control**, **Site** Supervision & Management, **Construction** Management, **Structural & Electrical Site Inspection & Quality Control**, **Construction** Management, **Earth Measurements**, **Earthwork** & **Structural Maintenance**, System Safety Program Plan (**SSPP**) Inspection, **Concrete** Structure Inspection & Repair, **Concrete** Inspection & Maintenance, **Concrete Maintenance & Reliability Analysis**, **Civil Engineering** Design, Design and Behaviour of **Steel Structures**, **Advanced Steel Design & Stability of Structures Concrete Structural Design**, **Dynamic Analysis of Rotating Equipment** Foundations & **Structural Steel Piperacks**, **Concrete** Technology, **Construction** Planning, **Construction & Concrete Works** Maintenance, **Seismic Design** for Buildings, Advanced **Building Construction Technology**, Advanced **Seismic & Wind Design of Reinforced Concrete**, **Road** Pavement Design, **Road** Maintenance, **Drainage** System Operations & Maintenance, **Land Surveying**, **AutoCAD Civil 3D**, **GIS & Mapping**, **Structural Analysis & Design** (**STAAD PRO**), **Construction** Planning, Methods & Management, **Sloping**, **Benching**, **Embankments**, **Construction** Planning, **Construction Quality** Management, **Project Risk** Assessment, **Project Quality** Plans, **Excavation**, **Backfill & Compaction**, **Excavation & Reinstatement**, **Excavation Safety** for Construction, **Groundworks Supervision**, Electrical **Project Utility Underground**, **Construction Quality** Remote Sensing, Construction Materials, Construction Surveying and **Detailed Engineering** Drawings, Codes & Standards.

Throughout Mr. Bilal's professional career, he has handled key positions as the **Site Manager**, **Project Manager**, **Project Supervisor**, **Resident Engineer**, **Consultant** and **Trainer/Instructor** for various international companies such as the Saudi Consulting, Tibah University, CKG Construction & Engineering, Almanarah Consulting, Tibah Consulting, Royal Scientific Association, MWH&CC Engineering & Consulting, Jordan Valley Authority, Graybeh Contracting, Alpha Consultant and Al Rakhaies Contracting, just to name a few.

Mr. Bilal has a **Bachelor's** degree in **Civil Engineering** from the **East University** of **North Cyprus**, **Turkey**. Further, he is a **Certified Trainer/Instructor** and has delivered various trainings, seminars, conferences, workshops and courses globally.

Accommodation

Accommodation is not included in the course fees. However, any accommodation required can be arranged at the time of booking.

Training Methodology

All our Courses are including **Hands-on Practical Sessions** using equipment, State-of-the-Art Simulators, Drawings, Case Studies, Videos and Exercises. The courses include the following training methodologies as a percentage of the total tuition hours:-

30% Lectures
20% Practical Workshops & Work Presentations
30% Hands-on Practical Exercises & Case Studies
20% Simulators (Hardware & Software) & Videos

In an unlikely event, the course instructor may modify the above training methodology before or during the course for technical reasons.

Course Program

The following program is planned for this course. However, the course instructor(s) may modify this program before or during the course for technical reasons with no prior notice to participants. Nevertheless, the course objectives will always be met:

Day 1

0730 – 0800	*Registration & Coffee*
0800 – 0815	*Welcome & Introduction*
0815 – 0830	***PRE-TEST***
0830 – 0930	***Causes of Concrete & Reinforced Concrete Structures Damage*** *Mechanical Causes • Physical Causes*
0930 – 0945	*Break*
0945 – 1100	***Causes of Concrete & Reinforced Concrete Structures Damage (cont'd)*** *Structural Causes • Chemical Causes • Reinforcement Corrosion*
1100 – 1215	***Additional Preventative Measures*** *Design for Durability*
1215 – 1230	*Break*
1230 – 1420	***Additional Preventative Measures (cont'd)*** *Surface Applied Barriers • Altering the Electrochemical Behaviour*
1420 – 1430	***Recap***
1430	*Lunch & End of Day One*

Day 2

0730 – 0930	***Damage Assessment*** *Visual Inspection • Determination of the Areas to be Investigated • Physical Tests*
0930 – 0945	*Break*
0945 – 1100	***Damage Assessment (cont'd)*** *Chemical Tests • Electrochemical Tests*
1100 – 1215	***Damage Assessment (cont'd)*** *Monitoring Movements*
1215 – 1230	*Break*
1230 – 1420	***Assessment of Corrosion Affected Structures***
1420 – 1430	***Recap***
1430	*Lunch & End of Day Two*

Day 3

0730 – 0930	***Damage Assessment–Practical Cases***
0930 – 0945	*Break*
0945 – 1100	***Assessment of the Reinforced Concrete Structures Conditions*** *In Situ Tests*
1100 – 1230	***Assessment of the Reinforced Concrete Structures Conditions (cont'd)*** *Discussion of the Results of the Tests*
1230 – 1245	*Break*
1245 – 1420	***Principles of Rehabilitation***
1420 – 1430	***Recap***
1430	*Lunch & End of Day Three*

Day 4

0730 – 0930	***Principles & Methods for Rehabilitation of Damaged Concrete*** *Protection Against Aggressive Substances • Moisture Control of Concrete • Replacement of Damaged Concrete*
0930 – 0945	*Break*
0945 – 1100	***Principles & Methods for Rehabilitation of Damaged Concrete (cont'd)*** *Strengthening of Building Components • Improvement of the Physical Resistance of Concrete • Improvement of the Chemical Resistance of Concrete*
1100 – 1215	***Principles & Methods for Rehabilitation of Concrete Damage Due to Reinforcement Corrosion*** *Restauring Reinforcement Passivity • Control of Cathodic Areas of Reinforcement*
1215 – 1230	*Break*
1230 – 1420	***Principles & Methods for Rehabilitation of Concrete Damage Due to Reinforcement Corrosion (cont'd)*** *Cathodic Protection of Reinforcement • Control of Anodic Areas of Reinforcement*
1420 – 1430	***Recap***
1430	*Lunch & End of Day Four*

Day 5

0730 – 0930	***Rehabilitation of Reinforced Concrete Structures*** *Practical Case*
0930 – 0945	*Break*
0945 – 1100	***Case Study Submitted by the Participants***
1100 – 1215	***Risk-Based Maintenance Strategy (cont'd)*** *Present Value Method • Repair Time • Capacity Loss in Reinforced Concrete Sections • Required Time to Start of Corrosion*
1215 – 1230	*Break*
1230 – 1345	***Risk-Based Maintenance Strategy (cont'd)*** *Time Required to Start of Deterioration • Cost Analysis for Different Protection Methods*
1345 – 1400	***Course Conclusion***
1400 – 1415	***POST-TEST***
1415 – 1430	*Presentation of Course Certificates*
1430	*Lunch & End of Course*

Practical Sessions/Site Visit

Site visit will be organized during the course for delegates to practice the theory learnt: -

Course Coordinator

Mari Nakintu, Tel: +971 2 30 91 714, Email: mari1@haward.org