COURSE OVERVIEW SE0496
Advanced Concrete Technology for Durable & Sustainable Civil Infrastructure

Course Title
Advanced Concrete Technology for Durable & Sustainable Civil Infrastructure

Course Date/Venue
Please see page 3

Course Reference
SE0496

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

3.0 CEUs (30 PDHs) AWARD

H-STK© INCLUDED

Course Description

This practical and highly-interactive course includes various practical sessions and exercises. Theory learnt will be applied using our state-of-the-art simulators.

This course is designed to provide participants with a detailed and up-to-date overview of Advanced Concrete Technology for Durable & Sustainable Civil Infrastructure. It covers the advanced concrete technology, cement chemistry and mineral additives; the aggregates and their role in durability including water, admixtures and their effects; the sustainable concrete design concepts, standards and specifications; the durability design principles and corrosion of reinforcement in concrete; the permeability and porosity control, freeze-thaw and sulfate attack resistance; the alkali-silica and other aggregate reactions, concrete microstructure and durability link; the performance-based concrete mix design; and the high-performance and ultra-high-performance concrete (HPC/UHPC).

Further, the course will also discuss the self-consolidating concrete (SCC), fiber reinforced concrete (FRC) and testing methods for fresh concrete and hardened concrete; the mechanisms of concrete deterioration and condition assessment and diagnosis; the concrete repair materials and methods, surface protection and coatings; the strengthening and rehabilitation techniques, innovative concrete technologies and concrete for extreme environments; and the field practices and quality assurance.

During this interactive course, participants will learn the role of concrete in sustainable development goals (SDGs), embodied energy and carbon analysis, green procurement for concrete materials and infrastructure sustainability rating systems; the codes, guidelines and international best practices covering ACI 201, ACI 546, EN 1504, BS 8500, FIB, RILEM and ISO documents and durability design frameworks; and the compliance, auditing and documentation.

Course Objectives

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

- Apply and gain an advanced knowledge on concrete technology for durable and sustainable civil infrastructure
- Discuss advanced concrete technology, cement chemistry and mineral additives
- Identify aggregates and their role in durability as well as water, admixtures and their effects, sustainable concrete design concepts and standards and specifications
- Explain durability design principles, corrosion of reinforcement in concrete, permeability and porosity control and freeze-thaw and sulfate attack resistance
- Identify alkali-silica and other aggregate reactions, concrete microstructure and durability link
- Discuss performance-based concrete mix design and high-performance and ultra-high-performance concrete (HPC/UHPC)
- Recognize self-consolidating concrete (SCC), fiber reinforced concrete (FRC) and testing methods for fresh concrete and hardened concrete
- Describe mechanisms of concrete deterioration and carryout condition assessment and diagnosis, concrete repair materials and methods and surface protection and coatings
- Apply strengthening and rehabilitation techniques, innovative concrete technologies, concrete for extreme environments, field practices and quality assurance
- Identify the role of concrete in sustainable development goals (SDGs), embodied energy and carbon analysis, green procurement for concrete materials and infrastructure sustainability rating systems
- Discuss codes, guidelines and international best practices covering ACI 201, ACI 546, EN 1504, BS 8500, FIB, RILEM, and ISO documents, durability design frameworks and compliance, auditing and documentation

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 a basic overview of all significant aspects and considerations of advanced concrete technology for durable and sustainable civil infrastructure for civil engineers, structural engineers, materials engineers, construction engineers and project managers, quality control / quality assurance (QC/QA) engineers and technicians, concrete technologists, contractors and site supervisors, asset managers and facility engineers and those who involved in the design, specification, testing, construction and maintenance of concrete infrastructure.

Course Date/Venue

Session(s)	Date	Venue
1	August 03-07, 2025	Al Buraimi Meeting Room, Sheraton Oman Hotel, Muscat, Oman
2	November 02-06, 2025	Tamra Meeting Room, Al Bandar Rotana Creek, Dubai, UAE
3	February 01-05, 2026	Al Buraimi Meeting Room, Sheraton Oman Hotel, Muscat, Oman
4	April 19-23, 2026	Tamra Meeting Room, Al Bandar Rotana Creek, Dubai, UAE

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

Haward's certificates are accredited by the following international accreditation organizations: -

- British Accreditation Council (BAC)

  Haward Technology is accredited by the **British Accreditation Council** for **Independent Further and Higher Education** as an **International Centre**. Haward's certificates are internationally recognized and accredited by the British Accreditation Council (BAC). 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.

- 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.

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:

Professor Engin Aktas, PostDoc, PhD, MSc, BSc, is a **Senior Civil & Structural Engineer** with over **25 years** of extensive experience and academic experience as a **University Professor**. His wide expertise includes **Structural Engineering & Design**, **Wind & Seismic** Requirements, Pipe Support Frames & Modular Construction, **3D System Modeling**, **2D CAD Drafting**, **Reinforced Concrete & Structural Steel Models**, **Engineering Drawings**, **Structural Reliability**, **Earthquake Engineering**, **Design of Concrete & Steel Structures**, **Structural Reliability Design**, **Structural Damage Assessment & Safety Evaluation**, **Structural Health Monitoring**, **Concrete Mixing & Testing**, Advanced **Concrete Technology**, **Concrete Structural Material**, **Mixing** & **Handling Concrete**, **Concrete & Steel Structural Analysis & Design**, **Design of Reinforced Concrete Structures**, **Concrete Structures** in Process Plants, **Concrete Inspection** & **Repair**, **Structural Analysis** Calculation, **Matrix Structural Analysis**, **Structural Engineering**, **Structural Dynamics**, Advanced Techniques in **Structural Engineering**, **Structural Optimization**, **Engineering Design**, **Road Design** Skills, **GPS** & **Building Seismic Designs**, **Pavement Design**, Composite Structures, Oil & Gas Installations and Related Structures, **Damage Assessment** & **Rehabilitation**, **Structured Reliability Analysis**, **Building Preventive Maintenance**, **Cement Properties**, Admixtures, Backfiling & Asphalting, Asphalt Paving Installation, **Road Maintenance** & Safety, **Road Construction**, Engineering Projects Surveying, **Land Surveying**, **Surface Drainage**, **Materials Engineering**, Construction & Management of **Heavy Civil Engineering**, **Civil Engineering System Analysis**, Buildings/Housing, Infrastructures & Utilities, **Civil Works**, **Sloping**, **Benching**, **Embankments** & **Bundwalls**. He is currently the **Associate Professor** of Izmir Institute of Technology wherein he is responsible for designing and developing the overall curriculum as well as managing research and other collaboration partnerships with other educational institutions or other external bodies.

During his career life, Professor Aktas performed the design, construction and installation of numerous buildings and industrial structures. Previously, he was the **Structural Design Engineer** with an international company handling multi-million design projects. He is renowned for his enthusiasm and tremendous instructing skills. Moreover, he had been a **Post-Doctoral Fellow** of **NRL/ASEE** and the recipient of the **Naval Research Laboratory/American Society for Engineering Education Fellowship** for his dedication and contributions to his field and was engaged with the **US Naval Research** for a project on "**Damage Detection on Composite Wing of Unmanned Air Vehicle using FBG sensors**". Further, he held various significant positions and dedications as the **International Relation Office Director**, **Civil Engineering Department Chairman**, **Design Engineer**, **Research Engineer**, **Visiting Professor**, **Senior Technical Consultant**, **Senior Trainer/Lecturer**, **Research Assistant**, **Teaching Assistant**, **Analyst** and **Lab Assistant** for various universities and institutions like the Izmir Institute of Technology, Kazakh-British Technical University (KBTU), US Naval Research Laboratory, University of Pittsburgh, Modul Construction Co., Atak Engineering & Construction and Evtam Engineering, Inc.

Professor Aktas has **PhD** and **Master** degrees in **Civil & Environmental Engineering** from the **University of Pittsburgh**, **USA** and a **Bachelor** degree in **Civil Engineering** from the **Middle East Technical University**, **Turkey**, respectively. Further, he is a **Certified Instructor/Trainer**, **a Certified Internal Verifier/ Assessor/Trainer by the Institute of Leadership and Management** (**ILM**) and had served as a **Post-Doctoral Fellow** in **US Naval Research Laboratory** (**ASEE/NRL Fellow**) in **Washington DC**, **USA**. Moreover, he is well-respected member of the Union of Chambers of Engineers and Architects, the Earthquake Engineering Association, and the International Association for Bridge Maintenance and Safety (**IABMAS**). He has further delivered numerous technical courses, trainings, workshops, seminars and conferences worldwide.

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	***Introduction to Advanced Concrete Technology*** *Evolution of Concrete and Modern Applications • Differences Between Conventional and Advanced Concrete • Scope in Infrastructure Durability and Sustainability • Challenges in Current Concrete Practices*
0930 – 0945	*Break*
0945 – 1030	***Cement Chemistry & Mineral Additives*** *Composition and Hydration of Portland Cement • Pozzolanic and Hydraulic Reactions • Supplementary Cementitious Materials (SCMs): Fly Ash, GGBS, Silica Fume • Benefits and Selection Criteria for SCMs*
1030 – 1100	***Aggregates & Their Role in Durability*** *Properties of Fine and Coarse Aggregates • Alkali-Aggregate Reactions and Mitigation • Recycled and Lightweight Aggregates • Aggregate Grading and Moisture Correction*
1100– 1230	***Water, Admixtures & Their Effects*** *Water Quality and Water-Cement Ratio Implications • Types of Chemical Admixtures (Plasticizers, Retarders, Accelerators) • Impact of Admixtures on Setting, Workability and Strength • Compatibility Issues with Cement and SCMs*
1230 – 1245	*Break*
1245 – 1315	***Sustainable Concrete Design Concepts*** *Life-Cycle Assessment in Concrete • Carbon Footprint Reduction Strategies • Use of Alternative Binders (e.g., Geopolymer Cement) • Principles of Green Construction*
1315– 1330	***Standards & Specifications*** *ASTM, ACI, EN and ISO References • Durability Exposure Classes (e.g., BS EN 206) • Sustainability Assessment Tools (e.g., LEED, BREEAM) • Concrete Performance-Based Specifications*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day One*

Day 2

0730 – 0830	***Durability Design Principles*** *Service Life Prediction Models • Exposure Classification and Environmental Conditions • Durability Index Parameters • Role of Mix Design in Durability*
0830– 0930	***Corrosion of Reinforcement in Concrete*** *Mechanisms of Corrosion and Depassivation • Chloride Ingress and Carbonation Effects • Corrosion Monitoring Techniques • Cathodic Protection and Corrosion Inhibitors*
0930 – 0945	*Break*

0945 – 1130	***Permeability & Porosity Control*** *Factors Affecting Permeability • Water Absorption, Diffusion and Sorptivity • Testing Methods (RCPT, ISAT, Permeability Tests) • Techniques to Reduce Permeability*
1130 – 1230	***Freeze-Thaw & Sulfate Attack Resistance*** *Damage Mechanisms from Freezing and Thawing • Use of Air-Entraining Admixtures • Sulfate Classifications and Resistant Mix Design • Protective Measures for Harsh Environments*
1230 – 1245	*Break*
1245 – 1315	***Alkali-Silica & Other Aggregate Reactions*** *Identification of Reactive Aggregates • Effects of ASR on Structural Integrity • Testing Protocols and Expansion Limits • Control Strategies (e.g., Lithium-Based Admixtures)*
1315– 1330	***Concrete Microstructure & Durability Link*** *Microstructural Features of Hardened Concrete • Role of CSH, CH and Capillary Pores • Imaging Techniques (SEM, XRD, CT Scan) • Interpretation of Microstructure for Durability*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day Two*

Day 3

0730 – 0830	***Performance-Based Concrete Mix Design*** *Comparison of Prescriptive versus Performance-Based Approach • Mix Optimization Techniques • Use of Computer-Aided Mix Design Tools • Case Examples of Durable Mix Designs*
0830– 0930	***High-Performance & Ultra-High Performance Concrete (HPC/UHPC)*** *Material Composition and Properties • Strength and Durability Benefits • Placement and Curing Requirements • Applications in Bridges and Offshore Structures*
0930 – 0945	*Break*
0945 – 1130	***Self-Consolidating Concrete (SCC)*** *Rheological Requirements and Mix Proportions • Flowability and Passing Ability Tests (Slump Flow, V-Funnel) • Quality Control During Batching and Pouring • Surface Finish and Defect Minimization*
1130 – 1230	***Fiber Reinforced Concrete (FRC)*** *Types of Fibers (Steel, Glass, Synthetic, Natural) • Effect on Ductility, Crack Control and Fatigue • Dosage, Mixing and Distribution Considerations • Design Codes and Case Studies*
1230 – 1245	*Break*
1245 – 1315	***Testing Methods for Fresh Concrete*** *Workability and Consistency Tests • Setting Time and Air Content • Temperature and Slump Loss Monitoring • Quality Control Procedures on Site*

1315– 1330	***Testing Methods for Hardened Concrete*** *Compressive, Flexural and Tensile Strength • Modulus of Elasticity and Shrinkage Tests • Nondestructive Testing (Rebound Hammer, UPV) • Core Sampling and Load Testing*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day Three*

Day 4

0730 – 0830	***Mechanisms of Concrete Deterioration*** *Cracking Due to Thermal, Shrinkage and Structural Causes • Chemical Deterioration (Chloride, Sulfate, Acid Attack) • Biological Growth and Weathering Effects • Signs of Early-Stage Deterioration*
0830– 0930	***Condition Assessment & Diagnosis*** *Visual Inspections and Defect Mapping • NDT Tools: GPR, Infrared Thermography, Half-Cell Potential • Structural Health Monitoring Systems • Data Interpretation and Diagnosis Formulation*
0930 – 0945	*Break*
0945 – 1130	***Concrete Repair Materials & Methods*** *Cementitious, Epoxy and Polymer-Based Mortars • Surface Treatment and Crack Injection Techniques • Selection Criteria for Repair Materials • Repair Compatibility and Shrinkage Considerations*
1130 – 1230	***Surface Protection & Coatings*** *Waterproofing Membranes and Sealers • Silane/Siloxane Coatings for Chloride Protection • Anti-Carbonation Coatings • Application Methods and Curing Requirements*
1230 – 1245	*Break*
1245 – 1315	***Strengthening & Rehabilitation Techniques*** *FRP Wrapping and Anchoring • Steel Plate Bonding • Shotcreting and Jacketing Methods • Design Considerations for Retrofitting*
1315– 1330	***Case Studies in Durable Repairs*** *Bridge Deck Rehabilitation • Coastal Structure Corrosion Mitigation • Underground Tank Lining • Repair Failures and Lessons Learned*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day Four*

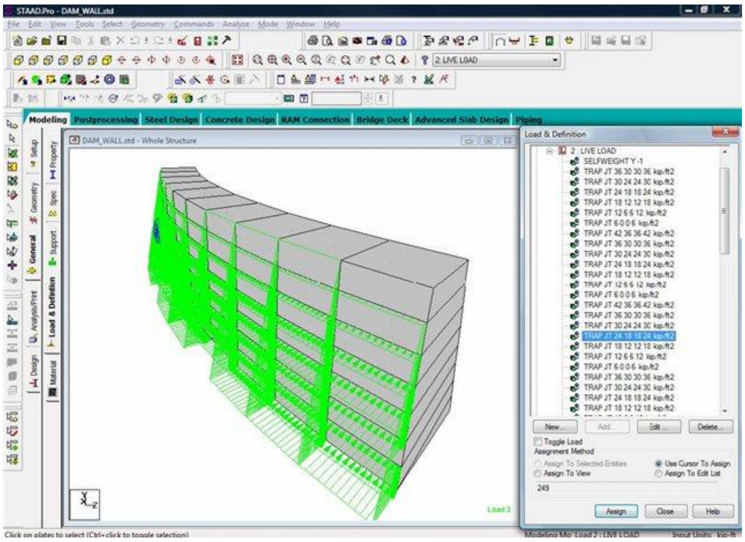
Day 5

0730 – 0830	***Innovative Concrete Technologies*** *3D Printed Concrete Structures • Self-Healing Concrete • Nano-Concrete and Smart Materials • Carbon-Capturing Concrete*
0830– 0930	***Concrete for Extreme Environments*** *Marine and Offshore Concrete • High-Temperature and Fire-Resistant Concrete • Radiation Shielding Concrete • Concrete for Seismic Zones*
0930 – 0945	*Break*

0945 – 1100	***Field Practices & Quality Assurance*** *Transport, Placement, Compaction Best Practices • Curing Methods and Their Impact on Durability • On-Site Concrete Quality Checklists • Troubleshooting Common Field Issues*
1100 – 1230	***Sustainable Infrastructure Development*** *Role of Concrete in Sustainable Development Goals (SDGs) • Embodied Energy and Carbon Analysis • Green Procurement for Concrete Materials • Infrastructure Sustainability Rating Systems*
1230 – 1245	*Break*
1245 – 1345	***Codes, Guidelines & International Best Practices*** *ACI 201, ACI 546, EN 1504, BS 8500 • FIB, RILEM and ISO Documents • Durability Design Frameworks • Compliance, Auditing and Documentation*
1345 – 1400	***Course Conclusion*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Course Topics that were Covered During the Course*
1400 – 1415	***POST-TEST***
1415 – 1430	*Presentation of Course Certificates*
1430	*Lunch & End of Course*

Simulators (Hands-on Practical Sessions)

Practical sessions will be organized during the course for delegates to practice the theory learnt. Delegates will be provided with an opportunity to carryout various exercises using one of our state-of-the-art simulator “STAAD-PRO”.



STAAD-PRO SOFTWARE

Course Coordinator

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