

# CRACKING AND COLLAPSE OF REINFORCED CONCRETE STRUCTURES

## MNE008

### COURSE DESCRIPTION

This 5 days training course will present the methods of inspection and evaluation of buildings and will diagnose the reason of concrete deterioration or the corrosion of the steel bars to develop preventive maintenance program. The causes of structure deterioration will be discussed in deeply and concentrate on the reason of corrosion and new protection methods to the steel bars. The repair of the reinforced concrete structures recently developed by using new materials will be discussed theoretically and practically, its advantages and disadvantages and how to use the suitable method.

The preventive maintenance strategy with its target and plan in scope of economic point of view will be illustrated in this course, as well as the background of the new software used in the area maintenance management system. Risk based inspection technique will be presented in scope of likelihood of building failure, consequences of failure and the building risk matrix.

This training course will feature:

- Assessment and evaluation technique for concrete and steel structures
- The importance of inspection and testing activity
- Applying the inspection and testing in many construction areas
- Focusing on practical and theoretical ways of inspection
- How to integrate new inspection technique into the work domain

### COURSE OBJECTIVES

By the end of this training course, participants will be familiar with:

- Testing and inspection techniques of engineering materials
- Workmanship in building construction
- NDE for the steel and welding
- The capability to inspect the finishing work activity
- Testing and inspection for road construction
- The ways and skills for the inspector

### WHO SHOULD ATTEND

- Architects
- Engineers
- Practicing Building Construction Inspectors

- Project Engineers
- Technicians and Technologists involved with building maintenance
- Contractors and Building Owners

## **COURSE DURATION**

5 Working Days

## **COURSE OUTLINES**

### **1. Day One: Building Assessment**

**Competency Description:** As an engineer, you need to know the factors affect the concrete durability and the way of inspection.

**Key behaviors:**

- Understand the change in design and code with times
- Understand the codes design principal
- Understand RC reliability
- Inspection technique

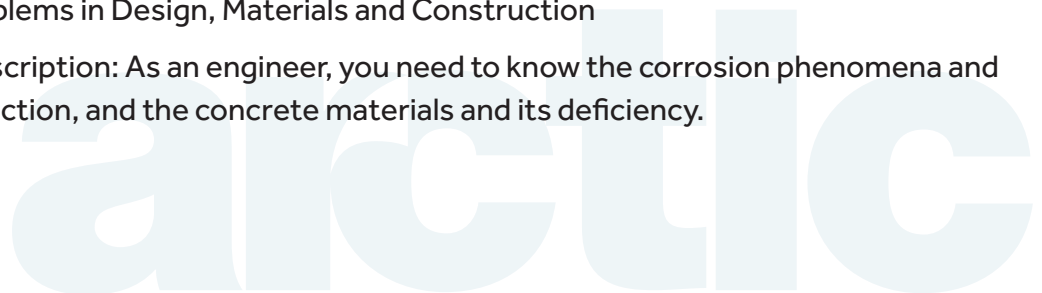
**Topics to be covered:**

- Introduction to mature structure
- Codes and standard deficiency
- Inspection and evaluate the buildings
- Methods of Inspection
- Visual inspection criteria
- Inspect the building using a new techniques
- Using ultrasonic and infrared for inspection.
- Evaluate the building risk
- Diagnoses the reason of deterioration
- Workshop: Define the cracks types
- Workshop: cracks in miscellaneous foundations

### **2. Day Two: Problems in Design, Materials and Construction**

**Competency Description:** As an engineer, you need to know the corrosion phenomena and the ways of protection, and the concrete materials and its deficiency.

**Key behaviors:**



- Understand the corrosion phenomena
- Understand the design, materials and construction pitfalls affect structure integrity
- Understand the concrete construction ways

**Topics to be covered:**

- Concrete materials problems
- Construction ways affect concrete durability
- Design error affect structure integrity
- Corrosion and protection of steel structure in concrete
- Protection of reinforcing bars
- Define the method of repair
- Videos presenting a repair methods
- From inspection and analysis predict the structure life time

### 3. Day Three: Properties of Protective Coating

**Competency Description:** As an engineer you need to know the ways of steel structure QC on site.

**Key behaviors:**

- Understand the repair methods
- Understand the materials used in repair
- Understand the protective coating characteristics.

**Topics to be covered:**

- Precaution during repair
- Selecting the materials repair
- Step by step repair procedure
- Methods of protection
- Cathodic protection
- Comparison between different type of protection.
  - Evaluate the current protective coating
  - Types of protective coating
  - Properties of each type
  - Precautions in using the coating

### 4. Day Four: Methods of Repairing the Cracked Structure Corrosion

**Competency Description:** As an engineer, you need to know the ways of soil investigation and architectural work inspection.

**Key behaviors:**

- Understand the methods of repair
- Understand the polymers and its behavior
- Understand the differences between different cracks
- Understand the use hot rolled steel section for repair

**Topics to be covered:**

- Types of cracks in R. C. structures
- Comparison between different cracks
- Reasons for each type
- Methods of repair and prevent for each type.
- Materials using to repair corroded structure
- Methods of repair
- Using polymer bonding materials
- Types of polymer
- Properties of these materials
- Ways of using steel sections in repair

**5. Day Five: Maintenance Strategy**

**Competency Description:** As an engineer, you need to know the ways of repair using CFRP.

**Key behaviors:**

- Understand the design for CFRP for repair and strengthening
- Understand the application of CFRP
- Understand the RBI technique

**Topics to be covered:**

- CFRP design
- CFRP applications
- Likelihood of building failure
- Define consequences of failure
- Provide risk matrix
- Risk based inspection (RBI)
- Maintenance plan and strategy
- Maintenance plan based economic cost
- Preparing priority lists
- Software for maintenance strategy
- Case study