Course Name:
Repair and Rehabilitation of Structures

Course Number:
20893

Credit:
3

Course Content (outline):

1. Introduction
   1.1. What is Infrastructure?
   1.2. Infrastructures and the Economy
2. Deterioration of Structures
   2.1. Causes of Deterioration in Steel and Concrete Structures
   2.2. Mechanism of Corrosion of Steel in Concrete
   2.3. Protection Against corrosion in Construction
3. Method of Strengthening Existing Structures (Conventional Techniques)
   3.1. Composite Steel-Concrete Structures
      3.1.1. Influence of Construction Method (shored vs. unshored)
      3.1.2. Design Guidelines (AASHTO)
      3.1.3. Design Examples
   3.2. External Post-Tensioning in Composite Steel-Concrete
      3.2.1. Method of Application of Prestressing Steel Structures (Preflex, Hybrid, and End Anchoring High Strength Steel Wires or bars)
      3.2.2. Calculation of bar force using strain energy approach
      3.2.3. Design and Retrofit of the Section
4. Method of Strengthening Existing Structures (Modern Techniques)
   4.1. Development and Evolution of Fiber Composites in Civil Engineering
   4.2. The Available Codes and Design Guidelines
   4.3. Test Methods and Mechanical Properties of Fiber Composites
   4.4. Design and Retrofit of Beams and Columns Using Fiber Composites
   4.5. Design and Retrofit of Masonry Walls Using Fiber Composites
5. Durability and Long-term Performance of Fiber Composites
   5.1. Degradation Mechanisms in Fiber Composites
   5.2. Diffusion Process and Remaining Life Prediction
6. Case Studies
   6.1. Steel and Concrete Pipes
   6.2. Interface Behavior of FRP and Backfill Soil

References:

- ACI 222R-01: “Corrosion of Metals in Concrete.”

- Transportation Research Board (TRB) Report 12-28(4), ERI. “Methods of Strengthening Existing Highway Bridges.”
- National Cooperative Highway Research Program (NCHRP) Report 514: ”Bonded Repair and Retrofit of Concrete Structures Using FRP Composites.”
- ACI 440.02: “Guidelines for Design of Concrete Structures Externally Bonded with Epoxy Bonded FRP Composites.”
- ACI 440.3R-04: “Guide Test Methods for Fiber-Reinforced Polymers (FRPs) for Reinforcing or Strengthening Concrete Structures.”
- ACI 503.5R-92: “Guide for the Selection of Polymer Adhesives with Concrete.”
- ACI 440.1R-03: “Guide for the Design and Construction of Concrete Reinforced with FRP Bars.”