Course syllabus

Department of Civil Engineering, Indian Institute of Technology Madras

CE5043W - Maintenance, Assessment, Repair and Strengthening of Bridges.

Credit Distribution: C:9 L:3 T:0 P:0 E:0 O:6 TH:0

Course Type: Theory

Description: To provide students with understanding of: (1) Life of existing bridges through durable repairs - with an emphasis on preventive maintenance strategies. (2) Exposure conditions, materials behavior, underlying degradation mechanisms, methodologies to prevent degradation, select and design durable repair systems. (3) Condition of bridges by using various non-destructive, partially destructive tools. (4) Measurable parameters that can ensure that the repairs are durable. (5) Good practices for typical near-surface repair, protection of steel/concrete from corrosion/deterioration, structural strengthening, and (6) Design a durable repair system.

Course Content: Introduction; State of bridge industry in India and abroad, Repair philosophies, preventive and corrective maintenance approaches, Vision for a structured repair industry, Mindset of stakeholders and changes required. Deterioration of steel and concrete systems, Chemical and physical mechanisms, Condition assessment, Assessment of exposure conditions, non-destructive, semi-destructive and load tests in the laboratory and field; LIDAR for estimating deflection and sag; instrumentation; use of drones Surface repair strategies and materials Root-cause analysis, repair strategies for durability, selection of repair materials, compatibility of repair materials with existing substrate, materials for underwater repair, grouting materials, non-metallic reinforcement systems, Surface preparation and protective treatments CPF liners; dehumidification systems. Strengthening of concrete bridges, Techniques for strengthening of conventionally reinforced and prestressed concrete members, Construction joints, Expansion joints Bearings/supports. Strengthening of steel bridges, Techniques for strengthening of steel bridges, Connections, Use of ultra high performance concrete in strengthening steel bridges. Durability-based design of repair, Estimation of residual service life, Durability-based tender specifications, Warranty/contracts worldwide.

Text Books: None

Reference Books

- Concrete Maintenance and Repair, P.H. Emmons, R.S. Means Company, Kingston, MA, USA, 2014.
- Maintenance Repair & Rehabilitation & Minor Works of Buildings, P.C. Varghese, PHI Learning Private Limited, New Delhi, 2010.
- Concrete Repair to EN1504: Diagnosis, Design, Principles and Practice, M. Raupach, T. Buttner, CRC Press., Taylor and Francis Group, Boca Raton, FL, USA, 2010.
- Concrete Structures: Protection, Repair and Rehabilitation, D.R. Woodson, Butterworth-Heinemann, Elsevier, UK, 2010.

Prerequisite: NIL

Prepared in January 2021