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Strength enhancement of existing concrete infrastructure: Challenges and opportunities

The strength enhancement of existing concrete infrastructure is an application of considerable economic importance. It has been estimated that the cost of replacing structurally deficient transport infrastructure in Europe, a significant amount of which are concrete structures, is about €400 billion. In the United States, thousands of concrete bridges have been rated as structurally deficient and \$20.5 billion would need to be invested annually to eliminate the bridge deficient backlog by 2028. There is thus scope for safe, practical and economic strengthening techniques for existing concrete infrastructure. Extensive research has resulted in approved flexural strengthening methods for concrete structures. In contrast, shear strengthening of concrete members is a particular challenge due to the brittle nature of shear failure and the complex mechanics of the behaviour. The collapse of the de la Concorde Overpass in 2006 in Canada, which killed or injured eleven people, was a tragic reminder of the dire consequences of concrete shear failures. This Keynote Paper will critically review current concrete shear strengthening techniques, with a special focus on a promising method known as the Deep Embedment (DE), or Embedded through-section (ETS), technique. The Keynote Paper will also highlight the experimental, numerical and analytical work on DE/ETS strengthening of concrete members carried out at the University of Birmingham. Topics will include the development of bond models for reinforcement bars embedded into concrete, repair of corrosion-damaged beams, strengthening of large-scale bridge girders, seismic strengthening of beam-column joints, nonlinear finite element modeling and development of design guidance.

Biography

Samir Dirar is an internationally recognized expert in strengthening and repair of concrete structures. After receiving his PhD from the University of Cambridge, United Kingdom, he worked as Postdoctoral Researcher in Zienkiewicz Centre for Computational Engineering at Swansea University. He is currently a Senior Lecturer (Associate Professor) in Structural Engineering at the University of Birmingham with overall responsibility for the Structures Research Lab. He has published over 50 journal and conference publications and has been serving as Grant Reviewer for funding agencies as well as Member of ACI Committee 440-0F-FRP-Repair-Strengthening and ASTM International Committee D30 on Composite Materials.

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