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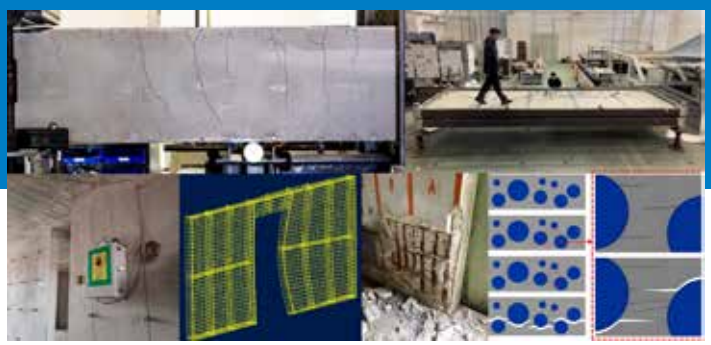

Serviceability and Performance Evaluation of Concrete Bridges and Structures: Analysis, Design, and Construction

SP-364

Editors:
Yail J. Kim and Hyeon-Jong Hwang

American Concrete Institute
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Serviceability and Performance Evaluation of Concrete Bridges and Structures: Analysis, Design, and Construction

Serviceability is considered a critical factor in the management of concrete bridges and structures. Typical components for evaluating the serviceability limit state include cracking, deflection, and vibration. Additionally, to ensure the adequate performance of load-bearing members, proper evaluation methodologies should be adopted. Although numerous research projects have been undertaken to examine the serviceability and performance assessment of concrete bridges and structures, significant endeavors are still required to address unexplored challenges. Of interest are the development of simplified prediction and appraisal approaches; novel techniques for quantifying stress levels; serviceability criteria under unusual distress; and the characterization of structural responses when exposed to blast, wind, and seismic loadings. This Special Publication contains 11 papers selected from technical sessions held in the ACI Fall Convention in November 2024. The Editors wish to thank all contributing authors and anonymous reviewers for their rigorous efforts. The Editors also gratefully acknowledge Ms. Barbara Coleman at ACI for her knowledgeable guidance.

Yail J. Kim, University of Colorado Denver, Editor
Hyeon-Jong Hwang, Konkuk University, Editor

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Simplified Method for Serviceability Design of Cracked Prestressed Concrete Members Belonging to Class C Section

Deuckhang Lee, Hyo-Eun Joo, Sun-Jin Han, Jae-Hyun Kim, and Kang Su Kim

Synopsis: In current ACI 318 code, crack control design criterion for prestressed concrete (PSC) members is stricter than conventional reinforced concrete (RC) members. In particular, it is stipulated that the net tensile stress of prestressing strands should be controlled under 250 MPa (36.3 ksi) in the serviceability design of PSC members belonging to the Class C section that is expected to be cracked under service load conditions. To this end, the nonlinear cracked section analysis is essentially required to estimate the tensile stress of the prestressing strands under the service loads, which requires cumbersome iterative calculations in practice. This study aims to propose a simplified method to estimate the net tensile stress of the prestressing strands (Δf_{ps}) under the service load conditions and also a tabulated checking method whether the net tensile stress (Δf_{ps}) exceeds the stress limit with respect to the magnitude of effective prestress (Δf_{se}). Finally, applicability of 2,400 MPa (348 ksi) Grade strands is also experimentally investigated.

Keywords: design code; effective prestress; prestressed concrete; serviceability; strand; stress limit