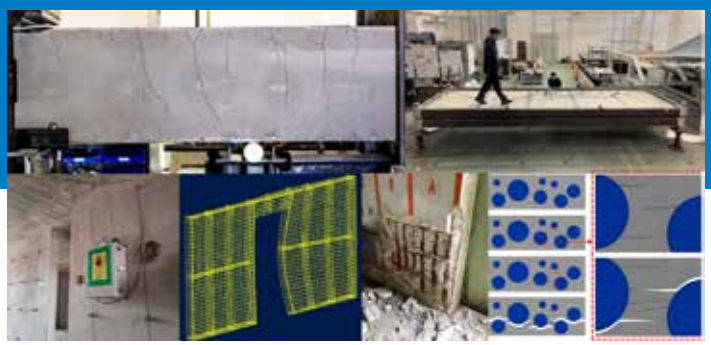
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Serviceability and Performance Evaluation of Concrete Bridges and Structures: Analysis, Design, and Construction

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

TABLE OF CONTENTS

SP-364-1:
Simplified Method for Serviceability Design of Cracked Prestressed Concrete Members Belonging to Class C Section.....1-19
Authors: Deuckhang Lee, Hyo-Eun Joo, Sun-Jin Han, Jae Hyun Kim, and Kang Su Kim

SP-364-2:
Vibration Performance of Inter-Module Composite Floors for Modular Buildings 20-39
Authors: Youjin Chae, Min-Jun Jeon, Chang-Kil Ju, Seung-Il Kim, and Tae-Sung Eom

SP-364-3:
Development of Structural Integrity Assessment Technologies for a Concrete Containment Structure under Ultimate Pressure Condition 40-51
Authors: Minkyu Kim, Tae-Hyun Kwon, Gyeonghee An, and Habeun Choi

SP-364-4:
Stress Measurement of Reinforcing Bars Embedded in Concrete by Hole-Drilling Method.....52-61
Authors: Mohammad T. Nikoukalam, Shahabeddin Torabian, and Said Bolourchi

SP-364-5:
Serviceability of Concrete Structures for Explosives Operating Locations and Live-Fire Training Facilities 62-79
Authors: Michael Pickett, Daniel Richey, Chris Moore, Joshua Umphrey, and Gordon Borne

SP-364-6:
Serviceability of Concrete Structures for Explosives Storage.....80-99
Authors: Josh Umphrey, Chris Moore, Daniel Richey, Gordon Borne, and Michael Pickett

SP-364-7:
Influence of Earthquake Duration on Response of Steel Jacket Retrofitted Reinforced Concrete Bridge Columns.....100-120
Author: Christopher J. Motter

SP-364-8:
Serviceability Wind Design of Reinforced Concrete Tall Buildings..... 121-137
Authors: Thomas Kang and Hamidreza Alinejad

SP-364-9:
Blast Load Prediction for Deflagration of Low Explosives in Confined Concrete Structures.....138-146
Author: Ming Liu

SP-364-10:
Prediction and Measurement of Slab Construction Load of Wall-Type Residential Building.....147-165
Authors: Hyeon-Jong Hwang, Jong-Min Lee, Han-Se Moon, and Hong-Gun Park

SP-364-11:
Tension Stiffening in RC Beams Retrofitted with NSM CFRP Strips.....166-176
Authors: Wajdi Ammar and Yail J. Kim

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