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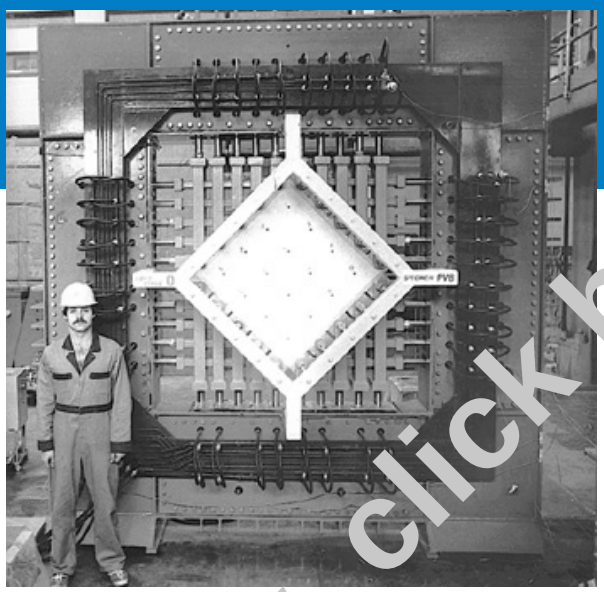

Modeling and Performance Assessment of Concrete Structures

SP-365

Editors:
Anca-Cristina Ferche and Vahid Sadeghian

American Concrete Institute
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Modeling and Performance Assessment of Concrete Structures

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Modeling and Performance Assessment of Concrete Structures

This Symposium Volume reports on the latest advancements related to the various facets of modeling and performance assessment of concrete structures. The volume contains 10 papers that were presented at the ACI Convention held in Toronto on April 1st, 2025. The symposium was dedicated to celebrate Prof. Frank J. Vecchio's extraordinary research contributions and accomplishments in the development of behavioral models and analytical tools for the assessment of concrete structures.

The papers cover different aspects related to modeling and performance assessment of concrete structures including developments of the Modified Compression Field Theory, finite element modeling of punching shear in slabs, behavior and modeling of steel fiber reinforced concrete members subjected to torsion, modeling of concrete structures subjected to impact loading, behavior and modeling of slender walls, modeling of concrete frame elements, behavior and modeling of GFRP reinforced members, crack based assessment of concrete structures, and advancements in modeling deterioration mechanisms and repaired concrete structures.

Sincere acknowledgements are extended to all authors, speakers and reviewers as well as to ACI staff for making this symposium a success.

Anca-Cristina Ferche, Editor
Vahid Sadeghian, Editor

TABLE OF CONTENTS

FINITE ELEMENT ANALYSIS AND DESIGN OF SHEAR BEHAVIOUR OF RC SLABS SUPPORTED ON WALLS

Graeme J. Milligan, Maria Anna Polak and Cory Zurell

Synopsis: Due to the low lateral stiffness of slabs supported on columns alone reinforced concrete flat plates are typically combined with other structural elements, such as shearwalls. In these structures, the slab-column connections are designed to carry gravity loads only, and the shearwalls, which also carry gravity loads, are required to resist the lateral forces. Therefore, the slab-wall connections (SWCs) are essential for the adequate performance of both the gravity and lateral force resisting systems. However, the majority of punching shear research and design provisions have been focused on slab-column connections, even though punching failures around slab-wall connections have been observed experimentally. Empirical testing of slab-wall connections is difficult due to the required specimen size. This paper investigates the punching shear behaviour of interior slab-wall connections subjected to concentric vertical loading, and combined concentric vertical loading and uniaxial unbalanced moment using a plasticity-based nonlinear finite element model (FEM) in Abaqus. The FEM, developed to study the impact of column aspect ratio on punching shear, was calibrated considering seven isolated slab-column specimens. The analysis of isolated slab-wall connections demonstrates that punching failures can occur before one-way shear failures, although the connection capacity is much higher than the expected loads in most structures. Punching shear design methods for interior slab-wall connections subjected to gravity load only, developed from finite element analysis results, are developed and presented in the paper.

Keywords: finite element analysis, punching shear, Reinforced Concrete Slabs, Slab-Wall Connections, Unbalanced Moment, Design Methods