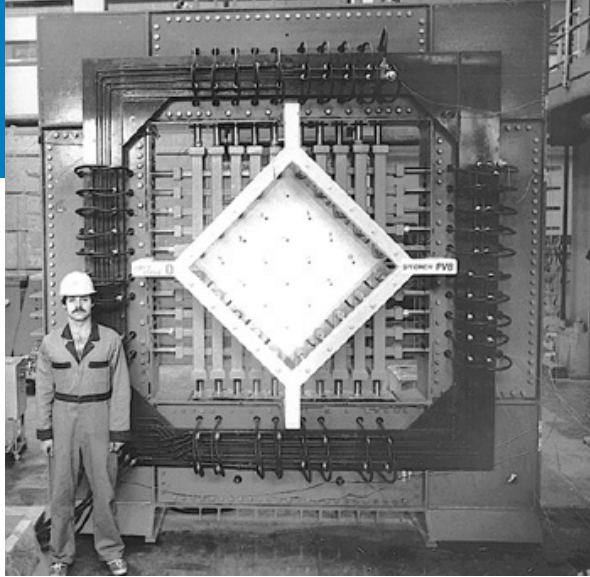


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SYMPOSIUM VOLUME



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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Editors:  
Anca-Cristina Ferche  
and Vahid Sadeghian



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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

### **SP-365-1:**

Finite Element Analysis and Design of Shear Behaviour of RC Slabs Supported on Walls .....1-16  
Authors: Graeme J. Milligan, Maria Anna Polak and Cory Zurell

### **SP-365-2:**

Recent Developments in Torsion Design of SFRC Elements .....17-34  
Authors: Luca Facconi, Ali Amin, Fausto Minelli and Giovanni Plizzari

### **SP-365-3:**

Historical Development of the Simplified Modified Compression Field Theory .....35-49  
Authors: Evan C. Bentz and Michael P. Collins

### **SP-365-4:**

Material Modeling for Concrete Structures Subjected to High Strain Rate Deformation ..... 50-78  
Authors: Neul Oh, Junhwi Ye, Hyukjun Ahn and Jae-Yeol Cho

### **SP-365-5:**

Damage and Failure of RC Flat Slabs Subjected to Impact Loading ..... 79-92  
Authors: David Z. Yankelevsky, Yuri S. Karinski, and Vladimir R. Feldgun

### **SP-365-6:**

Response and Modelling of Slender Wall Subjected to Lateral and Axial Loading .....93-112  
Authors: Austin Martins-Robalino, Alessandro Paglia, and Dan Palermo

### **SP-365-7:**

Nonlinear Modeling of Concrete Frame Elements including Shear Effects ..... 113-134  
Author: Serhan Guner

### **SP-365-8:**

The Effect of Bond on the Behavior of GFRP Reinforced Deep Beams .....135-147  
Authors: Taylor Brodbeck, Giorgio T. Proestos, and Rudolf Seracino

### **SP-365-9:**

Toward Crack-Based Assessment of Existing Reinforced Concrete Structures .....148-164  
Authors: Amirali Bahnamiri and Trevor D. Hrynyk

### **SP-365-10:**

The Evolution of the Modified Compression Field Theory for Modeling Existing  
Concrete Structures: Field Assessment, Deterioration, and Repair .....165-184  
Authors: Anca Ferche and Vahid Sadeghian





**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