Structures Congress 2018

Buildings and Disaster Management

SELECTED PAPERS FROM THE STRUCTURES CONGRESS 2018

April 19–21, 2018 Fort Worth, Texas

SPONSORED BY
The Structural Engineering Institute (SEI) of the American Society of Civil Engineers

EDITED BY
James Gregory Soules, P.E., S.E., P.Eng





Published by the American Society of Civil Engineers

Published by American Society of Civil Engineers 1801 Alexander Bell Drive Reston, Virginia, 20191-4382 www.asce.org/publications | ascelibrary.org

Any statements expressed in these materials are those of the individual authors and do not necessarily represent the views of ASCE, which takes no responsibility for any statement made herein. No reference made in this publication to any specific method, product, process, or service constitutes or implies an endorsement, recommendation, or warranty thereof by ASCE. The materials are for general information only and do not represent a standard of ASCE, nor are they intended as a reference in purchase specifications, contracts, regulations, statutes, or any other legal document. ASCE makes no representation or warranty of any kind, whether express or implied, concerning the accuracy, completeness, suitability, or utility of any information, apparatus, product, or process discussed in this publication, and assumes no liability therefor. The information contained in these materials should not be used without first securing competent advice with respect to its suitability for any general or specific application. Anyone utilizing such information assumes all liability arising from such use, including but not limited to infringement of any patent or patents.

ASCE and American Society of Civil Engineers—Registered in U.S. Patent and Trademark Office.

Photocopies and permissions. Permission to photocopy or reproduce material from ASCE publications can be requested by sending an e-mail to permissions@asce.org or by locating a title in ASCE's Civil Engineering Database (http://cedb.asce.org) or ASCE Library (http://ascelibrary.org) and using the "Permissions" link.

Errata: Errata, if any, can be found at https://doi.org/10.1061/9780784481325

Copyright © 2018 by the American Society of Civil Engineers. All Rights Reserved. ISBN 978-0-7844-8132-5 (PDF) Manufactured in the United States of America.

Preface

The Structures Congress has a robust technical program focusing on topics important to Structural Engineers.

The papers in the proceeding are on the following topics

- Advances in Structural Engineering Research
- Analysis, Design & Performance
- Avoiding Disproportionate Collapse
- Bridge Analysis, Design and Repair
- Bridge Management, Inspection and Sustainability
- Building Structures- Case Studies & Concepts
- Buildings Special Topics in Structures
- Business and Professional Practice
- Codes and Standards Learn from the Experts
- Design for Lateral Loads/Systems
- Extreme Bridge Loads
- Forensic Investigation
- Long Span Bridges & Vibrations
- Materials- Design & Construction
- Natural Disasters Moving Toward Improved Resilience
- Nonbuilding Structures and Nonstructural Components
- Special Topics in Structures
- Transformation in SE Education

Acknowledgments

Preparation for the Structures Congress required significant time and effort from the members of the National Technical Program Committee, the Local Planning Committee and staff. Much of the success of the conference reflects the dedication and hard work by these volunteers.

The National Technical Program Committee, the Local Planning Committee and staff would like to acknowledge the critical support of the sponsors, exhibitors, presenters, and moderators who contributed to the success of the conference through their participation.

Thank you for spending your valuable time attending the Structures Congress. It is our hope that you and your colleagues will benefit greatly from the information provided, learn things you can implement and make professional connections that last for years.

Sincerely,

J. G. (Greg) Soules, P.E., S.E., P.Eng, SECB, F.SEI, F.ASCE CB&I, LLC Chair, National Technical Program Committee

Contents

for Large Earthquakes1
Amir S. J. Gilani and H. Kit Miyamoto
Approximations in Alternate Load Path Capacity of Welded Unreinforced Flange-Bolted Web Connections11
Farshad Hashemi Rezvani and Hamid R. Ronagh
Seismic Evaluation of Dual Steel Frames with Brace Buckling Consideration21 H. Ataei and K. Kalbasi Anaraki
Comparative Cost of Structures Using Moderately or Highly Ductile Steel Moment Frames30 Ruth M. Powell and Johnn P. Judd
Investigation of Vehicle Shock Absorbers for Low-Cost Seismic Protection of Structures41
Christopher M. Zaverdas and Michael D. Symans
Experimental Study of Cyclic Flange Local Buckling49 Tung-Yu Wu, Sherif El-Tawil, and Jason P. McCormick
What Is Your Structural Model Not Telling You? Finding Hidden Modelling Errors and Inaccuracies in Your Analysis Results
Simplified Design Methods for HSS Helicoidal Steel Beams
On the Analytical and Numerical Investigation of 3D Steel Framed Gravity Systems Exposed to Interior Gravity Column Loss
Use of Performance-Based Methods to Evaluate Structural Response to Hurricane Loading90
William R. Earl
Seismic Performance of Reinforced Concrete Frame Buildings Equipped with Friction Dampers94
Ali Naghshineh, Amina Kassem, Anne-Gaelle Pilorge, Oscar Romero Galindo, and Ashutosh Bagchi
Efficient Design of Spanning Trusses Guided by Design Diagrams102 Arek Mazurek

Structural Optimization for Efficient Bridge Designs: The Prototype for the LAX Pedestrian Bridges112 Mark Sarkisian, Eric Long, Alessandro Beghini, Rupa Garai, John Gordon, and Abel Diaz
Considerations for Optimizing Design with Respect to Snow—A Case Study of U.S. Bank Stadium121 Jan Dale, Derek Kelly, and John Aniol
Experimental Study on Long-Span Composite Floor Beams Subject to Fire: Baseline Data at Ambient Temperature129 Lisa Choe, Selvarajah Ramesh, Matthew Hoehler, and John Gross
A Unified Mechanical Model for Fire Design of Simple Steel Connections
Design and Construction of Long-Span Composite Beam Specimens for Large Structural-Fire Tests151 Selvarajah Ramesh, Lisa Choe, Matthew Hoehler, William Grosshandler, and John Gross
The Tallest Modular Tower Design Using a Performance Based Approach163 Hessam Kazemzadeh, Randy Miller, David Tse, and Wenjin Situ
Performance-Based Design for Wind-Excited Tall Buildings Equipped with High Performance Control Systems179 Laura Micheli, Alice Alipour, and Simon Laflamme
Application of Statistical Learning Models for Efficient Seismic Risk Assessment of Large Property Portfolios192 Keivan Rokneddin and Alireza Shahjouei
Structural Peer Review Practice in New York City201 Dan Eschenasy
An Overview of the Changes to AISC 341—Seismic Provisions for Structural Steel Buildings
Seismic Collapse Response of a Four Story Steel Special Moment Frame with Deep Columns213 Tung-Yu Wu, Sherif El-Tawil, and Jason P. McCormick
Design Optimization of Shear Wall High-Rise Building Structures222

Experimental Studies on Channel-Stiffened Steel Plate Shear Walls2 Qiuhong Zhao and Jing Qiu	133
In-Plane Flexibility of Reinforced Concrete Floor Diaphragms with Openings2 R. Khajehdehi, N. Panahshahi, and R. Ghaffari	243
Direct Design Method and Design Diagram for Reinforced Concrete Columns and Shear Walls2 Mustafa Mahamid and Majid Houshiar	251
Reducing Construction Defects and Design Errors in Timber Buildings2 William J. Kirkham	262
Non-Destructive In-Place Concrete Compressive Strength Estimation Using Post-Installed Concrete Pullout Test—Methodology and Field Experience2 Zhengqi Li, Wesley Bullock, Jigar Desai, and Timothy Clepper	:71
Nonlinear Finite Element Analysis of Reinforced Concrete Shear Walls with Staggered Openings under Seismic Loads2 Ehsan Montazeri, Nader Panahshahi, and Brad Cross	81
Rigidity of Metal Plate Connected Truss Joints	92
Reinforcement of Masonry Vaults for Seismic Loading	302
Peeling Prevention in Strengthened RC Beams Using End Cover Replacement	17
Evaluation of Transverse Reinforcement Requirements for High-Strength Concrete Columns3	326
Rami Eid, Konstantin Kovler, Israel David, Waseem Khoury, and Shay Miller	
Comparison of Structural Details and Energy Demands for Residential Structures with Advanced and Traditional Wood Framing	33
Vulnerability Assessment of Port Structures Subjected to Storm Surge and Waves	345
Flood Damage Resistant Materials: Reducing Damages Related to Flood Events	159

Innovative Technologies to Combat Expansive Soils	368
Robert Chase Gooding, Jim Fontaine, and Justin Zuckerbrow	
Inelastic Displacement Ratios of SSI Systems under Repeated Earthquakes	379
Ertugrul Demirol, Argyrios Fragkos, Sinthujan Arulanantham, and Ashraf Ayoub	
Comparative Assessment of Soil-Structure Interaction Regulations of	
ASCE 7-16 and ASCE 7-10	388
Farid Khosravikia, Mojtaba Mahsuli, and Mohammad Ali Ghannad	
Foundation Retrofit of Three Structures Utilizing Micropiles	400
John H. Edens and Billy L. Fisher	