

Structures Congress 2018

**Blast, Impact Loading,
and Response; and
Research and Education**



Proceedings of the Structures Congress 2018

- Fort Worth, Texas
- April 19–21, 2018

ASCE

EDITED BY

James Gregory Soules, P.E., S.E., PEng.

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**STRUCTURAL
ENGINEERING
INSTITUTE**

Structures Congress 2018

Blast, Impact Loading, and Response; and Research and Education

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



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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

Modeling Interactions in Community Resilience.....	1
Szu-Yun Lin, Lichao Xu, Wei-Chu Chuang, Sherif El-Tawil, Seymour M. J. Spence, Vineet R. Kamat, Carol C. Menassa, and Jason McCormick	
Analysis and Behavior of Composite Transmission Towers.....	9
Kamel Bilal, Mustafa Mahamid, and Cenk Tort	
Pole Breakaway Devices—Feasibility Study	21
Peter H. Feenstra, Jeremy Isenberg, and Yousef Alostaz	
Deterioration Modeling of Steel Columns under Variable Axial Forces.....	33
Thanh N. Do and Filip C. Filippou	
Ultrasonic Stress Measurement in Steel Buildings	43
Ahmed Al-Zuheriy, Sarah Orton, and Glenn Washer	
Structural Monitoring and Damage Detection Using High-Speed Vibration Imaging.....	56
Abdollah Bagheri, Devin K. Harris, and Osman E. Ozbulut	
Optimal Design in Wind Engineering Using Cyber-Physical Systems and Non-Stochastic Search Algorithms	64
Michael L. Whiteman, Pedro L. Fernández Cabán, Brian M. Phillips, Forrest J. Masters, Jennifer A. Bridge, and Justin R. Davis	
Improving Estimates of Earthquake-Induced Downtime in Individual Buildings Using the REDi Methodology	77
Nicole Paul, Ji Su Lee, Michael Mieler, and Ibrahim Almufti	
Numerical Prediction of the Behavior of Reinforced Concrete Shear Walls under In-Plane Cyclic Loading, with Particular Focus on Assessing Local Cracking Response	87
Gloria Faraone and Tara Hutchinson	
Performance Based Assessment and Retrofit of Nonductile Existing Reinforced Concrete Structures	98
Andrea Miano, Halil Sezen, Fatemeh Jalayer, and Andrea Prota	
Nonlinear Analysis of AFRP Connections of Reinforced Concrete Bridge Decks.....	112
Siafa Anthony Grose, Mehdi Shokouhian, and Monique Head	

Evaluation of ASCE-41 Modeling Parameters and Acceptance Criteria through an RC Building Case Study	130
Adolfo Matamoros, Anil Suwal, and Andres Lepage	
Cyclic Shear Transfer Model for Smeared-Crack RC Membrane Elements	138
Alexander Kagermanov and Paola Ceresa	
Real Time Assessment and Reporting of a Long Span Vertical Lift Bridge State of Balance	150
Charles Young and Nathaniel C. Dubbs	
PEOPLES: A Tool to Measure Community Resilience.....	161
Omar Kammouh and G. P. Cimellaro	
The Impact of Non-Spectral Intensity Measures on the Structural Responses	172
Jalal Kiani, Charles Camp, and Shahram Pezeshk	
Alternate Load-Path Analysis for Mid-Rise Mass-Timber Buildings	181
Hercend Mpidi Bitu and Thomas Tannert	
Field Testing of Masonry Wall Structure Building for Assessment of Progressive Collapse	191
Kai Li and Halil Sezen	
Response of Reinforced and Sandwich Concrete Panels Subjected to Projectile Impact	200
Mohammad Hanifehzadeh, Bora Gencturk, and Kaspar Willam	
Dynamic Response of Roof Truss Systems under Blast Loading	213
Doaa Bondok, Gabriela Clayton, and Hani Salim	
Vulnerability Assessment of Concrete Filled Steel Tube Columns under Multiple Extreme Events: Corrosion and Vehicular Impact	224
D. S. Saini and B. Shafei	
Enhanced Bolted Connection Detailing of H-Beam-to-RHS Column Joints for Disproportionate Collapse Prevention.....	236
Wei Wang, Junjie Wang, Xi Qin, and Yihai Bao	
Post-Punching Mechanism of Slab-Column Joints Subjected Upward and Downward Punching Shear Actions	246
Mengzhu Diao, Yi Li, Xinzheng Lu, Hong Guan, and Fangfang Liu	
Dynamic Behavior of Multi-Bay Flat Slab Subjected to the Missing of an Interior Column Scenario	255
Kai Qian, Yun-Hao Weng, En-En Yu, and Bing Li	

Experimental Study on Robustness of Three-Dimensional Steel Moment-Resisting Frames	263
Honghao Li	
Experimental Tests on Steel Frames with Different Beam-Column Connections Subject to Falling Floor Impact.....	273
Hao Wang, Kang Hai Tan, Bo Yang, and Shao Bo Kang	
Strengthening RC Frames against Disproportionate Collapse by Post-Tensioning Strands.....	283
Kai Qian, Zong-Ze Li, Fei-Xuan Cen, and Bing Li	
Progressive Collapse Resistance of GFRP Strengthened RC Substructures under a Column-Removal Scenario	291
Peng Feng, Han-Lin Qiang, Wei-Hong Qin, and Xin Ou	
Dynamic Debris Loading in Flat Plate and Steel Framed Buildings	299
Aamer Jawdhari, Sarah Orton, Bassam Izzuddin, and David Cormie	
Experimental Study of the Horizontal Progressive Collapse of RC Frames.....	311
Mengzhu Diao, Lanping Qian, Yi Li, Hong Guan, Xinzheng Lu, and Youzhe Yang	
A Review of Analysis Methods for Falling Debris Resulting from Structural Collapse.....	319
Kyle Haas, Michael Bychkowski, and Shalva Marjanishvili	
A New Observation on the Transient Behavior of Reinforced Concrete Beams under Impact Loading.....	332
Wuchao Zhao and Jiang Qian	
Fragility Analysis of Girder Bridges Subjected to Blast Load	343
Jingyu Wang and Wancheng Yuan	
Collapse Resistance of Locally Web Damaged Steel Columns	353
J. Fogarty	
The Blast Load Acting on a Structure in an Internal Explosion Scenario	362
Idan E. Edri, Vladimir R. Feldgun, Yuri S. Karinski, and David Z. Yankelevsky	
Impact Behaviour of Sandwich Panels Made of Flax Fiber-Reinforced Bio-Based Polymer Face Sheets and Foam Cores.....	376
Dillon J. Betts, Pedram Sadeghian, and Amir Fam	
Structural Characterization and Blast Response of Adobe Walls	383
Hesham El-Emam, Hani Salim, Stephen Robert, Gabriela Pigg, and Aaron Saucier	

Performance of Hybrid Nano-Modified Polymer Concrete (NMPC) and Ultra High-Performance Fiber Reinforced (UHPFRC) Walls in Protective Structures.....	392
Olaniyi Arowojolu, Ahmed Ibrahim, and Mahmoud Reda Taha	
Blast Testing of Loaded Cross-Laminated Timber Structures	400
Mark K. Weaver, Charles M. Newberry, Lisa Podesto, and Casey O'Laughlin	
Automated Construction with Concrete: Response of Wall and Beam Sections to Blast Loads	412
Jedediah F. Burroughs, Carol F. Johnson, Ghassan K. Al-Chaar, Marion L. Banko, and Michael P. Case	
A Blast Testing and Numerical Study for Open Web Steel Joists.....	425
Yin Mao, Barry L. Bingham, Michael J. Lowak, and Jay S. Idriss	
Site Adaptation of Explosive Threats for Improved Blast Design Efficiency	436
J. Mikhael Erekson and Kenneth W. Herrle	
A Unique Design Approach for Retrofitting Existing Window Systems for Blast Loads	447
Brian Petruzzi, Amy Allen, and Peggy Van Eepoel	
Design Considerations for Electrical Enclosures Subject to Accidental Vapor Cloud Explosions.....	457
L. Magenes and T. Burse	
Pine Hill Tank Weld Seam Failure Forensic Investigation.....	469
Donnell Duncan	
Simultaneous Collapse of Three Raw Coal Conveyors at the Largest Underground Coal Mining Complex in North America	481
Terence M. Taylor	
Collapse Load Prediction for an Ultra-Large Metal Building Using Finite Element Analysis Method.....	493
Guzhao Li, Paul B. Summers, Carlos A. Ortega, and Zonglei Mu	
An Investigation into the Collapse of a Large Scaffold	502
Ibrahim Erdem, Rahul Ratakonda, and David B. Peraza	
Wooden I-Joists Exposed to Floods, How Do They Perform?	513
John Cleary and Sean Byrne	
Opportunities for BIM to Enhance Structural Engineering Curricula.....	522
Ryan L. Solnosky	

High Fidelity Structural Analysis for Undergrad Structural Engineering Students.....533
Aaron Freidenberg, Jakob C. Bruhl, Christopher H. Conley,
and Charles L. Radow

Student Mastery of Structural Analysis with Design Review553
Aaron T. Hill Jr.

Modeling Interactions in Community Resilience

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ABSTRACT

A new platform, based on distributed computing concepts, is proposed with the potential to model the physical, social, and economic interactions that occur during disasters. The platform uses lightweight communications and marshalling (LCM) libraries for message passing and data marshalling thereby enabling various types of simulators to interact together. Each simulator is discipline specific, represents one part of a disaster scenario, and is viewed as a black box that subscribes to data from other simulators and/or publishes its results for other simulators to use. The new LCM framework is versatile and scalable and, as such, enables the developed system to grow through addition of new simulators provided by other users. The new concepts are demonstrated through an introductory case study that is focused on the simulation of wind-induced progressive damage due to both the structural response of the building as well as the external wind pressures.

INTRODUCTION

A community that is resilient to hazards has an understanding of the risks it faces and, through planning and preparation, is able to recover quickly from extreme events. Community resilience is a topic that has gained national attention in the recent past (Chang and Miles 2003, NER 2011, Coulbourne et al. 2014) and involves many dimensions, including engineering, economic, societal, financial, environmental, political, and others. Each of these dimensions is rooted in a specific discipline or spread across a number of closely related disciplines. Modeling the various aspects of these dimensions and the interactions that occur between them during a disaster scenario is necessary to create a meaningful and high fidelity simulation of the event. However, achieving this goal is difficult because of the challenges of transcending disciplinary boundaries.

In this paper, the word ‘simulator’ is used to describe a model that takes an input (subscribes to the information it needs from other simulators) and then produces an output (publishes its results for other simulators to consume). Each simulator represents the contribution of a discipline or sub-discipline within a disaster scenario simulation. Each simulator can run on its own separate computer or cluster of nodes on a network or it can run with other simulators on a single computer. The key idea in this work is that a disaster scenario can be modeled by allowing a group of stand-alone simulators to interact together within a publish-subscribe setting in order to study the effect of simulator behaviors and interactions on community resilience.