# Structural Engineers Association of California Convention 2015 (SEAOC 2015)

Bellevue, Washington, USA 9 - 12 September 2015

ISBN: 978-1-5108-2290-0

### Printed from e-media with permission by:

Curran Associates, Inc. 57 Morehouse Lane Red Hook, NY 12571



Some format issues inherent in the e-media version may also appear in this print version.

Copyright© (2015) by Structural Engineers Association of California All rights reserved.

Printed by Curran Associates, Inc. (2016)

For permission requests, please contact Structural Engineers Association of California at the address below.

Structural Engineers Association of California 921 11th St, Ste. 1100 Sacramento, California 95814 USA

Phone: (916) 447-1198 Fax: (916) 444-1501

info@seaoc.org

### Additional copies of this publication are available from:

Curran Associates, Inc. 57 Morehouse Lane Red Hook, NY 12571 USA

Phone: 845-758-0400 Fax: 845-758-2633

Email: curran@proceedings.com Web: www.proceedings.com



# **Structural Engineers Association of California**

### 2015 SEAOC Convention Technical Presentations

### **Preface**

The following are unedited papers presented by the authors at the 2015 SEAOC Convention. These papers reflect the opinions, positions, and commentary of the authors and do not represent a consensus viewpoint of the Structural Engineers Association of California. The material presented in this publication should not be used or relied upon for any specific application without competent examination and verification of its accuracy, suitability, and applicability by qualified professionals. This document is not intended, nor should it establish or define a "standard of care" or a "standard of practice". Users of information from this publication assume all liability from such use.

### **Table of Contents**

Advancement in Wind Design - Wind Committee Status Report  James S. Lai, S.E., F. SEAOC Chair, SEAOC Wind Committee La Canada Flintridge, CA  Joe Maffei, S.E., PhD, LEED PA, Principal Maffei Structural Engineering San Francisco, CA	Pg. 14
Advancements in Force Transfer Around Openings for Wood Framed Shear Walls Karyn Beebe, P.E., LEED AP BD+C APA San Diego, CA Tom Skaggs, P.E., Ph.D. APA Tacoma, WA	Pg. 19
Assessment of First Generation Performance-Based Seismic Design Methods for New Buildings John Harris, Research Structural Engineer Matthew Speicher, Research Structural Engineer Siamak Sattar, Research Structural Engineer Anne Hulsey, Structural Engineering Intern Steven McCabe, Research Structural Engineer National Institute of Standards and Technology Gaithersburg, MD	Pg. 32
ATC 58-II: Further Development of Next-Generation Performance-based Design Criteria Ronald O. Hamburger, SE Simpson Gumpertz & Heger Inc. San Francisco, CA	Pg. 45
California Structural Engineer Licensure: Past to the Future; SEs Lead or Follow James P. Mwangi, Ph.D., S.E., Professor California Polytechnic State University San Luis Obispo, CA Kevin J. Dong., S.E., Professor California Polytechnic State University San Luis Obispo, CA	Pg. 54
A Case Study in Integrating Sustainability and Structure 2015 SEAOC Convention Keith T. Bauer, S.E., Associate Principal Buehler & Buehler Structural Engineers, Inc. Sacramento, CA	Pg. 64
The Berkeley Art Museum and Pacific Film Archive: Saving a Local Landmark with an Innovative Underpinning Solution Timothy A. Nelson, S.E., Project Engineer Degenkolb Engineers San Francisco, CA	Pg. 70
Case Studies to Demonstrate Effects of Seismic Upgrades to URM Buildings as Dictated by the Proposed Seattle URM Policy Dihong Shao, Principal Coffman Engineers Seattle, WA Steve Moddemeyer, Principal CollinsWoerman Seattle, WA Thomas M. Corcoran, Principal Integrus Architecture Seattle WA	Pg. 78

# 2015 SEAOC CONVENTION PROCEEDINGS



Controlling Wind in Tall and Flexible Structure with Viscous Damping Devices Mark Sarkisian PE, SE, Partner Peter Lee PE, SE, Associate Director Rupa Garai PE, SE, Associate Alvin Tsui PE, SE, Structural Engineer Skidmore, Owings & Merrill LLP, San Francisco, CA Michael Constantinou, PhD, SUNY Distinguished Professor University at Buffalo, Buffalo, NY	Pg. 87
Coupling of Central Core and Perimeter Megabraces in 5th & Columbia Tower, Seattle Bryce Tanner, SE, Associate John Worley, SE, Principal Arup San Francisco, CA	Pg. 106
Development of Design Guidance and Example Applications for ASCE/SEI 41-13, Seismic Evaluation and Retrofit of Existing Buildings, the ATC-124 Project Bret Lizundia, Executive Principal, Rutherford + Chekene, San Francisco, CA Brian McDonald, Principal Engineer, Exponent, Menlo Park, CA Michael Braund, Associate Principal, Degenkolb Engineers, San Diego, CA Veronica Cedillos, Associate Director of Projects, ATC, Redwood City, CA Jim Collins, Executive Vice President, PCS Structural Solutions, Tacoma, WA William Holmes, Senior Consultant, Rutherford + Chekene, San Francisco, CA Ayse Hortacsu, Director of Projects, ATC, Redwood City, CA Ron LaPlante, Consulting Engineer, San Diego, CA Michael Mahoney, Senior Geophysicist, FEMA, Washington, DC Mark Moore, Executive Principal, ZFA Structural Engineers, San Francisco, CA	Pg. 116
Differences in Embodied Carbon Assessments of Structural Systems  Megan Stringer, PE, LEED AP BD+C Chair, SEAONC SDC Holmes Culley San Francisco, CA  Matthew Comber, SE, LEED AP BD+C Vice Chair, SEAONC SDC Project Frog San Francisco, CA	Pg. 131
Evaluating and Upgrading the Seismic Performance of Older Tall Buildings Stephen Mahin, Professor Juin Wei Lai, Post-Doctoral Scholar Shanshan Wang, Graduate Student Researcher Matthew Schoettler, Research Engineer University of California Berkeley, CA	Pg. 142
Evaluation of ASCE 41-13 Nonlinear Dynamic Procedure Based on Recorded Response from Existing RC Buildings Ahmed Mantawy, PhD, PE Arup Los Angeles, CA Arif Ozkan, PE, SE Arup Los Angeles, CA	Pg. 160
The Failure of the Tacoma Narrows Bridge in 1940 Charles Seim, Principal Consulting Bridge Engineer El Cerrito, CA	Pg. 169
Frequently Misunderstood Wind Provisions Emily Guglielmo, SE, Associate Martin/Martin, Inc. Larkspur, CA	Pg. 177
Fundamentals of Tuned Mass Dampers (TMDs) for Seismic Response Reduction Julio C. Miranda, P.E., S.E. Principal Technologist CH2M HILL San Jose, CA	Pg. 179
Global Practices in Earthquake Structural Engineering H Kit Miyamoto, Ph.D, S.E., Miyamoto International, Inc., Los Angeles, CA Amir SJ Gilani, Ph.D, S.E., Miyamoto International, Inc., West Sacramento, CA	Pg. 195



Mass Timber High-Rise Design Research: Museum Tower in Los Angeles Reimagined in Mass Timber  Matthew Timmers, SE; Ben Rogowski, PE John A. Martin & Associates, Inc. Los Angeles, CA Andrew Tsay Jacobs, LEED AP, EIT Perkins+Will Los Angeles, CA Bevan Jones, PE; James O'Neill, Ph.D. Holmes Fire San Francisco, CA	Pg. 214
Napa Church Earthquake Damage Repair & Retrofit  Jeff Weber, SE, SECB, General Manager Coffman Engineers, Oakland, CA  Muneer Merchant, Vice President Pullman SST, Inc., Benicia, CA  Brian Marc-Aurele, PE, Engineer Coffman Engineers, Oakland, CA  Brian Walkenhauer, SE, Structural Engineer Coffman Engineers, Oakland, CA	Pg. 234
A New, Low-Cost Approach to Increasing Seismic Resistance of Wood-Frame Structures Michael D. Symans, Assoc. Prof., Dept. of Civil and Env. Engineering Rensselaer Polytechnic Institute, Troy, NY Steve M. Yang, Graduate Student, Dept. of Civil and Env. Engineering Rensselaer Polytechnic Institute Troy, NY Jesse Karns, Director of Engineering Research MiTek, Ventura, CA David Lee, West Coast Technical Director Taylor Devices, North Tonawanda, NY	Pg. 241
One Big Room: Facebook's New Campus Susan LaFore, SE, Senior Engineer René Vignos, SE, Principal Steve Marusich, SE, Senior Associate Forell/Elsesser Engineers, Inc. San Francisco, CA	Pg. 249
Parametric Study on Effects of Mega-thrust Mw9-class Subduction Earthquakes and Aftershocks in Victoria, British Columbia, Canada Solomon Tesfamariam, Associate Professor The University of British Columbia Kelowna, BC, Canada Katsuichiro Goda, Senior Lecturer University of Bristol Bristol, UK	Pg. 258
Performance Based Design of 111 Main Mark Sarkisian PE, SE, Partner Peter Lee PE, SE, Associate Director Alvin Tsui PE, SE, Structural Engineer Lachezar Handzhiyski, PE, Design Engineer Skidmore, Owings & Merrill LLP San Francisco, CA	Pg. 271
Performance Based Design of Wilshire Grand Tower Leonard M. Joseph, Principal C. Kerem Gulec, Associate Thornton Tomasetti, Los Angeles Peter Maranian, Principal Brandow and Johnston	Pg. 290
Performance-Based Seismic Retrofit of a Tall Precast Concrete Shear Wall Building Using FRP Materials Rami Elhassan, Ph.D., SE, Principal Yangbo Chen, Ph.D., SE, Senior Structural Engineer David Pomerleau, SE, Project Manager IDS Group, Inc. Irvine, CA	Pg. 312
Proposed Changes to Steel Column Evaluation Criteria for Existing Buildings Daniel Bech, Principal Bill Tremayne, Principal Jonas Houston, Project Engineer HolmesCulley San Francisco, CA	Pg. 325



Rational Evaluation of Structural Response to Thermal Loads Mark Sarkisian SE, LEED, Partner Neville Mathias SE, LEED, Assoc. Director Joanna Zhang SE, LEED, Associate Jason Kirkpatrick PE, LEED Skidmore, Owings & Merrill LLP San Francisco, CA	Pg. 337
Recommendations for Confinement in Boundary Elements of Special Concrete Walls Dawn Lehman, Professor University of Washington Travis Welt, PhD Candidate James LaFave, Professor University of Illinois	Pg. 355
Seismic Behavior of Reinforced Concrete Coupling Beams with Innovative Simplistic Detailing Shih-Ho Chao, Ph.D., P.E., Associate Professor Young-Jae Choi, Graduate Student Poorya Hajyalikhani, Graduate Student Chatchai Jiansinlapadamrong, Graduate Student The University of Texas at Arlington, Arlington, Texas	Pg. 369
Seismic Evaluation and Upgrade of a Non-Ductile Concrete Shear Wall Hospital Patient Tower Located in a Low Seismic Hazard Area Brian Walkenhauer, S.E. Engineer Coffman Engineers Oakland, CA Dihong Shao, S.E. Principal Coffman Engineers Seattle, WA	Pg. 384
Shake table and Quasi-Static Testing of Suspended Ceilings with Alternate Perimeter Installations Amir SJ Gilani, Manager Earthquake Engineering Miyamoto International, Inc. West Sacramento, CA Shakhzod M Takhirov, Technical Laboratory Manager, Department of CEE, University of California Berkeley Berkeley, CA Yelena Straight, Product Seismic Engineer, USG Interiors LLC Libertyville, IL	Pg. 392
Shake Table Testing of Precast Concrete Wall with End Columns (PreWEC) Sri Sritharan, Wilson Engineering Professor Iowa State University Ames, Iowa Maryam Nazari, Graduate Research Assistant Iowa State University Ames, Iowa Sriram Aaleti, Assistant Professor University of Alabama Tuscaloosa, AL	Pg. 403
The Shocking Secrets of Rocking Shear Walls Benjamin Mohr, Senior Staff II Stephen Harris, Principal Simpson Gumpertz & Heger Inc. San Francisco, CA	Pg. 415
Special Inspections for Wood Construction David P. Tyree, P.E., C.B.O. Colorado Springs, CO James B. Smith, P.E. Dane, WI Michelle Kam-Biron P.E, S.E., SECB Newbury Park, CA American Wood Council	Pg. 420
Steel Castings in Structural Design – Case Studies Carlos de Oliveira, President and CEO Cast Connex Corporation Toronto, Canada	Pg. 427
T-H Dynamic and Nonlinear Static Analysis for the Ferrocement Canopy of the NewAthens Opera House Gregory G. Penelis, Dr, MSc, DIC, Penelis Consulting Engineers SA Greece, EU	Pg. 440

# 2015 SEAOC CONVENTION PROCEEDINGS



Tsunami Resilient Designs of Buildings for California Gary Chock, S.E., D.CE, F.SEI, F.ASCE, M. SEAONC ASCE 7 Tsunami Loads and Effects Subcommittee Chair Martin & Chock, Inc. Honolulu, HI Guangren Yu, Ph.D., S.E. Martin & Chock, Inc. Honolulu, HI Ian N. Robertson, Ph.D, P.E., M. ASCE University of Hawaii at Manoa Honolulu, HI Rick Wilson, Senior Engineering Geologist California Geological Survey Science Coordinator for the State of California Tsunami Preparedness and Hazard Mitigation Program	Pg. 450
Wind Loads on Utility Scale Solar PV Power Plants Joseph H. Cain, P.E., Principal Civil Engineer SunEdison Belmont, CA David Banks, PhD, P.Eng., Principal Cermak Peterka Petersen (CPP Wind) Fort Collins, CO	Pg. 466
Wood Shear Walls Hardware Analysis for a Proper Connection Alfred D. Commins, President Commins Manufacturing Inc., Friday Harbor, WA	Pg. 474
U.S. Resiliency Council (USRC) Rating Building Performance in Earthquakes and Other Natural Hazards Ronald L. Mayes, Founder and Acting ED, USRC Staff Consultant, Simpson Gumpertz & Heger, San Francisco, CA Evan Reis, Founder, USRC Senior Managing Engineer, HCE, San Francisco, CA	Pg. 488
Use of Bamboo as Out of Plane Reinforcement in CMU Walls Daniel Berger and Caleb Dunne, Miyamoto International, Inc., West Sacramento, CA	Pg. 496