

AEI 2015

Birth and Life of the Integrated Building

Proceedings of the AEI Conference 2015

March 24–27, 2015 | Milwaukee, Wisconsin

Edited by Christopher H. Raebel, Ph.D., P.E., S.E.



ARCHITECTURAL
ENGINEERING
INSTITUTE

This is a preview. [Click here to purchase the full publication.](#)

AEI 2015

Birth and Life of the Integrated Building

PROCEEDINGS OF THE AEI CONFERENCE 2015

March 24–27, 2015
Milwaukee, Wisconsin

HOSTED BY
Milwaukee School of Engineering

SPONSORED BY
The Architectural Engineering Institute (AEI)
of the American Society of Civil Engineers

EDITED BY
Christopher H. Raebel, Ph.D., P.E., S.E.



Published by the American Society of Civil Engineers

This is a preview. [Click here to purchase the full publication.](#)

Published by American Society of Civil Engineers
1801 Alexander Bell Drive
Reston, Virginia, 20191-4382
www.asce.org/bookstore | 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 <http://dx.doi.org/10.1061/9780784479070>.

Copyright © 2015 by the American Society of Civil Engineers.
All Rights Reserved.
ISBN 978-0-7844-7907-0 (PDF)
Manufactured in the United States of America.

Contents

Track 1

BIM Advances

Advancing in Building Information Modeling (BIM) Contracting: Trends in the AEC/FM Industry1
Hamid Abdirad

Information Exchange Standardization for BIM Application to Multi-Story Modular Residential Buildings13
Issa J. Ramaji and Ali M. Memari

LEED Embedded Building Information Modeling System25
C. Zhang and J. Chen

MESH: Integrating BIM, Engineering, and Fabrication into the Architectural Design Studio.....37
Gil Snyder

Energy

Comparison of Energy Efficiency Strategies for Mosques in the United Arab Emirates.....43
A. Mokhtar

Development of Multi-Linear Regression Model to Predict Energy Consumption in the Early Stages of Building Design.....54
Shideh Shams Amiri, Mohammad Mottahedi, and Somayeh Asadi

Response of Meso-Scale Energy Harvesters Coupled with Dynamic Floor Systems.....66
C. H. Raebel and J. A. Schultz

Simulating the Impact of Feedback on Energy Consumption and Emission Production in Commercial Buildings Using Agent-Based Approach78
Mohammad Saeed Bastani and Somayeh Asadi

Innovative Structural Design

A Study on Effect of Water Tanks Modeled As Tuned Mass Dampers on Dynamic Properties of Structures	91
D. Rupesh Kumar, M. Gopal Naik, and Fahimeh Hoseinzadeh	
Comparative Efficiency between Structural Systems for Tall Buildings of Various Forms.....	111
Kyoung Sun Moon	
Innovative Double Skin Façade (DSF) with High Performance Green Hybrid Fiber-Reinforced Concrete (HP-G-HyFRC) for Resilient and Sustainable Buildings	120
Rotana Hay and Claudia P. Ostertag	
Integrated Damping Systems for Tall Buildings.....	134
Kyoung Sun Moon	
Nothing Temporary Here: Gain Efficiency by Integrating Excavation Support as Permanent Foundation	141
S. Y. Fantaye, S. O. H. Johnson, and R. D. Verastegui	

Project Delivery

Accelerators to Occupancy: Expediting the Design and Construction Process for Large Scale Projects	151
Anwar A. Hakim	
Integration of Building Information Modeling (BIM) and Laser Scanning in Construction Industry	163
Sepehr Alizadehsalehi, Ozan Koseoglu, and Murude Celikag	
Relational Contracting in the Construction Industry: Mapping Practice to Theory	175
Yongjian Ke, Thayaparan Gajendran, and Peter R. Davis	

Robustness and Resiliency in Building Design

Progressive Collapse Mitigation: Geometrically Nonlinear Catenary Behavior.....	185
L. T. Deputy and B. A. Story	
Resilient Structural Systems—Using Mechanisms to Optimize Performance .	197
M. Sarkisian, P. Lee, N. Mathias, J. Gordon, and R. Garai	

Wood, Timber, Light Gage Steel, and Composites

Flexural Capacity of Built-Up Stud Using Nail Plates as Shear Connectors211

R. A. DeVries

The Effect of Rigid Board Insulation on Screw Connections in Cold-Formed Steel219

Anthony Leonardelli, Douglas Stahl, and Cristopher D. Moen

Track 2

Building Façades

Building Envelopes: A Comparison of Impacts on Environment230

Rahman Azari and Rogelio Palomera-Arias

Parametric Studies of Point-Supported Laminated Glass for Simplified Design.....237

J. A. Schultz and M. Kuba

Concrete, Formwork, and Reinforcing

Acoustic Emission Performances of Stressed-GFRP Bars Embedded in Concrete under Accelerated Aging Conditions248

Yeonho Park, Guillermo Ramirez, Ali Abolmaali, and Young Hoon Kim

Fabric Forms for Architectural Concrete: A State-of-the-Art Report.....259

Robert P. Schmitz

Load Distribution between Bond and End-Bearing for Hooked and Headed Bars in Concrete269

R. A. DeVries

Daylighting and Solar Energy

Analysis of a Fixed Passive Louver Shading Device.....279

S. W. Baur and C. J. Brennan

Passive Heating and Lighting—A Case Study Using S&T 2009 Solar House ..289

S. W. Baur and V. Cheng

The Balance between Daylighting and Thermal Performance Based on Exploiting the Kaleidocycle Typology in Hot Arid Climate of Aswan, Egypt ..300

A. Wagdy, Y. Elghazi, S. Abdalwahab, and A. Hassan

Using High Dynamic Range Photogrammetry for Luminance Mapping of the Sky and the Sun	316
Hongyi Cai	

*Multi-Disciplinary Assessment and Design Considerations for Buildings
Subjected to Abnormal Demands*

Designing Resilient Structures Subjected to Abnormal Loads	331
M. Sarkisian, P. Lee, J. Gordon, and R. Garai	

Development of the Resilience Management Tool: A Pilot Program at the Port Authority of New York and New Jersey	342
M. Valletta, A. W. Hapij, M. M. Ettouney, and N. N. Abboud	

Multidisciplinary Design and Assessment of Building Systems within a Multi-Hazards Framework.....	357
A. W. Hapij and M. M. Ettouney	

Smart Buildings

Cold Weather Condensation Problems: Utilizing Computer Thermal Simulations and Data Collection Monitoring to Evaluate Repair Approaches	373
Kevin A. Kalata, Michael J. Huhtala, and Elizabeth R. Hausheer	

Preparing for Climate Change with Computation and Resiliency	385
A. Gowda, A. Puras Ustarroz, and M. Shaxted	

Sustainable and Resilient Building Envelopes

Integrators to Healthy and Lower Carbon Cities in the 21st Century	400
L. Leung, S. D. Ray, and J. Lee	

Design of Compressed Stabilized Earthen Wall Systems for High-Wind Resistant Residential Unit Construction	409
Ece Erdogmus, Benjamin Wagner, Linsey Rohe, Eric Garcia, Avery Schwer, Fabio Matta, and Esther Obonyo	

State-of-the-Art Review: Analysis and Rehabilitation of Existing Masonry Walls against Progressive Collapse	421
A. Kousgaard and E. Erdogmus	

Technology in Construction

Construction Project Cost and Duration Optimization Using Artificial Neural Network.....	433
M. Gopal Naik and D. Rupesh Kumar	
Overview of Building Information Modeling Applications in Construction Projects	445
A. M. Aboushady and M. M. G. Elbarkouky	
State-of-the-Art Review of Virtual Reality Environment Applications in Construction Safety	457
Sneha Bhoir and Behzad Esmaeili	

Track 3

AE Education

Comprehensive and Creative Conclusions: Enhancing Structural Design Educational Opportunities in Labs for Architecture Students	469
Robert Whitehead	
Energy Efficiency and Sustainability Attributes of the Solar Decathlon Projects	483
Ehsan Kamel and Ali M. Memari	
Evaluation of High School Pre-Engineering Curricula on Freshman Architectural Engineering Student Performance	495
Blake Wentz and Christopher Raebel	
Simulation of the 2013 Solar House for Missouri S&T	501
S. W. Baur	

Fire Safety

Effects of Green Roofs on Fire Safety	514
B. L. Hoskins and J. Homer	
Reliability-Based Decision Making to ITM Frequency for Fire Protection and Detection Systems	524
Thomas M. Korman, Lonny Simonian, and Laura Radle	

Multi-Disciplinary Innovations in Tall Building Design

Advanced Sustainability Concepts for Tall Buildings.....	534
Brian D. Griffith	
Creative Energy Systems in High-Rise Buildings.....	545
L. Leung and S. Ray	
Developing a Basis for Design—Embodied Carbon in Structures.....	555
M. Sarkisian, D. Shook, and J. Zhang	
Material Optimization for Tall Buildings.....	567
Alessandro Beghini, David Shook, and Arkadiusz Mazurek	
New Concepts for Exterior Wall Systems for Tall Buildings	581
Christopher P. Johnson and Christoph Timm	

Self-Sustaining Building Design

Mapping the Integrated Early Design Process of the Largest Net-Zero Energy Office Building.....	594
R. Tiwari and J. R. Jones	
The Future of LCAs and EPDs: Incorporating Service-Life in the Environmental Impact Assessments of Green Building Materials	606
W. V. Srubar III	
Two Building Path to Sustainability with Integrated Design	616
Sean Timmons	

Soil-Structure Interaction

Effectiveness of Using Shelves with Cantilever Retaining Walls	627
Hany Farouk	
Validation of Using Modulus of Subgrade Reaction to Consider the Soil Structure Interaction.....	638
Hany Farouk and Mohammed Farouk	

Track 4

AE Education

A Curriculum Approach to Deploying BIM in Architectural Engineering651
Ryan L. Solnosky and M. Kevin Parfitt

**Advancing Student Engagement of Buildings through Virtual Facility
Dissection663**
Ryan Solnosky and Robert Leicht

**Conversant Immersion: Toward Long-Term Collaboration in the
Architectural Engineering Capstone Studio674**
Jeanne Homer

Integration of LEED Concepts into the AEC Curriculum686
Gulbin Ozcan-Deniz

Energy Efficient and Advanced Building Enclosures

Coordination of Advanced Enclosures696
Jonathan D. Hill and Christopher W. Norton

Detailing Glazed Systems to Accommodate Structural Movement709
Xiu T. Li and Jonathan D. Hill

Integrated Project Delivery

Survey of Stair Construction Codes in New York City.....724
Anthony M. Dolhon and Ibrahim Erdem

Work and Teamwork: Notes on Collaborative Practice in the 20th Century ..735
Anthony Denzer

Moisture Control in Building Envelopes

**Extending the Service Life of Historic Terra Cotta Roofing with
Fluid-Applied Waterproofing Membranes752**
Christina T. Parker and Niklas W. Vigener

Sustainable Building Envelopes

Sustainable Recladding: Bringing New Life to Aging Buildings.....763
J. D. Kerr and N. W. Vigener