

# **Computing in Civil Engineering 2015**

**Proceedings of the 2015 International Workshop on Computing  
in Civil Engineering**

**Austin, Texas, USA  
21-23 June 2015**

**Editors:**

**William J. O'Brien  
Simone Ponticelli**

**ISBN: 978-1-5108-0735-8**

**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 the American Society of Civil Engineers  
All rights reserved.

Printed by Curran Associates, Inc. (2015)

For permission requests, please contact the American Society of Civil Engineers  
at the address below.

American Society of Civil Engineers  
1801 Alexander Bell Drive  
Reston, VA 20191

Phone: (800) 548-2723  
Fax: (703) 295-6333

[www.asce.org](http://www.asce.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: 845-758-2634  
Email: [curran@proceedings.com](mailto:curran@proceedings.com)  
Web: [www.proceedings.com](http://www.proceedings.com)

# Contents

## *Data, Sensing, and Analysis*

<b>4D Full-Scale Finite Element Analysis in Bridge Engineering</b> .....	1
Yi-Xin Li and Jian-Guo Nie	
<b>Agent Based Model for Resource Constrained Scheduling of Construction Projects</b> .....	8
A. B. Senouci, K. Abdel Warith, and N. N. Eldin	
<b>Comparison between Nominal and Actual Hourly Production of Crawler-Type Dozer: A Case Study</b> .....	17
Hamed Nabizadeh Rafsanjani	
<b>Automatic Satellite-Based Vessel Detection Method for Offshore Pipeline Safety</b> .....	25
M. Poshtiban, L. Song, and N. Eldin	
<b>Skeleton-Based Registration of 3D Laser Scans for Automated Quality Assurance of Industrial Facilities</b> .....	33
M. Nahangi, L. Chaudhary, J. Yeung, C. T. Haas, and S. Walbridge	
<b>Mobile Proximity Sensing Technologies for Personnel and Equipment Safety in Work Zones</b> .....	41
J. Park, E. Marks, Y. K. Cho, and W. Suryanto	
<b>Feature Extraction and Classification of Household Refrigerator Operation Cycles: A Study of Undisturbed Refrigerator Scenario</b> .....	49
Zeyu Wang and Ravi S. Srinivasan	
<b>Automated Tolerance Analysis of Curvilinear Components Using 3D Point Clouds for Adaptive Construction Quality Control</b> .....	57
Vamsi Sai Kalasapudi and Pingbo Tang	
<b>A Spatial Analysis of Occupant Energy Efficiency by Discrete Signal Processing on Graphs</b> .....	66
Rishee K. Jain, Rimas Gulbinas, José M. F. Moura, and John E. Taylor	
<b>Pavement Surface Permanent Deformation Detection and Assessment Based on Digital Aerial Triangulation</b> .....	74
Su Zhang, Susan M. Bogus, and Christopher D. Lippitt	

<b>A Case Study of Construction Equipment Recognition from Time-Lapse Site Videos under Low Ambient Illuminations .....</b>	<b>82</b>
Xiaoning Ren, Zhenhua Zhu, Chantale Germain, Bryan Dean, and Zhi Chen	
<b>A BIM-Enabled Platform for Power Consumption Data Collection and Analysis.....</b>	<b>90</b>
C. T. Chiang, T. W. Ho, and C. C. Chou	
<b>Wavelet Transform on Multi-GPU for Real-Time Pavement Distress Detection .....</b>	<b>99</b>
K. Georgieva, C. Koch, and M. König	
<b>Real-Time Location Data for Automated Learning Curve Analysis of Linear Repetitive Construction Activities.....</b>	<b>107</b>
H. Ergun and N. Pradhananga	
<b>An Empirical Comparison of Internal and External Load Profile Codebook Coverage of Building Occupant Energy-Use Behavior .....</b>	<b>115</b>
Ardalan Khosrowpour, Rimas Gulbinas, and John E. Taylor	
<b>Challenges in Data Management When Monitoring Confined Spaces Using BIM and Wireless Sensor Technology .....</b>	<b>123</b>
Z. Riaz, M. Arslan, and F. Peña-Mora	
<b>GIS-Based Decision Support System for Smart Project Location .....</b>	<b>131</b>
A. Komeily and R. Srinivasan	
<b>Thermal Comfort and Occupant Satisfaction of a Mosque in a Hot and Humid Climate.....</b>	<b>139</b>
Gulben Calis, Berna Alt, and Merve Kuru	
<b>Threshold-Based Approach to Detect Near-Miss Falls of Iron Workers Using Inertial Measurement Units .....</b>	<b>148</b>
K. Yang, H. Jebelli, C. R. Ahn, and M. C. Vuran	
<b>A Framework for Model-Driven Acquisition and Analytics of Visual Data Using UAVs for Automated Construction Progress Monitoring .....</b>	<b>156</b>
Jacob J. Lin, Kevin K. Han, and Mani Golparvar-Fard	
<b>Semantic Annotation for Context-Aware Information Retrieval for Supporting the Environmental Review of Transportation Projects.....</b>	<b>165</b>
Xuan Lv and Nora M. El-Gohary	
<b>Automated Extraction of Information from Building Information Models into a Semantic Logic-Based Representation.....</b>	<b>173</b>
J. Zhang and N. M. El-Gohary	

<b>Electrical Contractors' Safety Risk Management: An Attribute-Based Analysis</b> .....	181
Pouya Gholizadeh and Behzad Esmaeili	
<b>Ontology-Based Information Extraction from Environmental Regulations for Supporting Environmental Compliance Checking</b> .....	190
Peng Zhou and Nora El-Gohary	
<b>Laser Scanning Intensity Analysis for Automated Building Wind Damage Detection</b> .....	199
A. G. Kashani, M. J. Olsen, and A. J. Graettinger	
<b>Recognition and 3D Localization of Traffic Signs via Image-Based Point Cloud Models</b> .....	206
Vahid Balali and Mani Golparvar-Fard	
<b>Automated Cycle Time Measurement and Analysis of Excavator's Loading Operation Using Smart Phone-Embedded IMU Sensors</b> .....	215
N. Mathur, S. S. Aria, T. Adams, C. R. Ahn, and S. Lee	
<b>Deviation Analysis of the Design Intent and Implemented Controls of HVAC Systems Using Sensor Data: A Case Study</b> .....	223
R. Sunnam, S. Ergan, and B. Akinci	
<b>Implications of Micro-Management in Construction Projects: An Agent Based Modeling Approach</b> .....	232
Jing Du and Mohamed El-Gafy	
<b>A Data Quality-Driven Framework for Asset Condition Assessment Using LiDAR and Image Data</b> .....	240
Pedram Oskouie, Burcin Becerik-Gerber, and Lucio Soibelman	
<b>Efficient Management of Big Datasets Using HDF and SQLite: A Comparative Study Based on Building Simulation Data</b> .....	249
Wael M. Elhaddad and Bulent N. Alemdar	
<b>Trip Characteristics Study through Social Media Data</b> .....	257
Chuan-Heng Lin and Albert Y. Chen	
<b>A Non-Invasive Sensing System for Decoding Occupancy Behaviors Affecting Building Energy Performance</b> .....	263
Triana S. Carmenate, Diana Leante, Sebastian A. Zanlongo, Leonardo Bobadilla, and Ali Mostafavi	

**Visual Complexity Analysis of Sparse Imageries for Automatic Laser Scan Planning in Dynamic Environments .....271**  
Cheng Zhang and Pingbo Tang

**Automated Post-Production Quality Control for Prefabricated Pipe-Spools...280**  
Mahdi Safa, Arash Shahi, Mohammad Nahangi, Carl Haas, and Majeed Safa

**Characterizing Travel Time Distributions in Earthmoving Operations Using GPS Data .....288**  
Sanghyung Ahn, Jiwon Kim, Phillip S. Dunston, Amr Kandil, and Julio C. Martinez

*Education*

**A Qualitative Study on the Impact of Digital Technologies on Building Engineering Design Offices .....296**  
Graham Hayne, Bimal Kumar, and Billy Hare

**Learning about Performance of Building Systems and Facility Operations through a Capstone Project Course .....305**  
Miguel Mora, Semiha Ergan, Hanzhi Chen, Hengfang Deng, An-Lei Huang, Jared Maurer, and Nan Wang

**Integrated Target Value Approach Engaging Project Teams in an Iterative Process of Exploration and Decision Making to Provide Clients with the Highest Value .....313**  
Renate Fruchter, Flavia Grey, Norayr Badasyan, Sarah Russell-Smith, and Fernando Castillo

**Enhancing Spatial and Temporal Cognitive Ability in Construction Education through the Effect of Artificial Visualizations.....322**  
Ivan Mutis

*Visualization, Information Modeling, and Simulation*

**A Real-Time Building HVAC Model Implemented as a Plug-In for SketchUp.....330**  
Zaker A. Syed and Thomas H. Bradley

**Visualization of Indoor Thermal Conditions Using Augmented Reality for Improving Thermal Environment.....339**  
Nobuyoshi Yabuki, Masahiro Hosokawa, Tomohiro Fukuda, and Takashi Michikawa

<b>A Conceptual Framework for Modeling Critical Infrastructure Interdependency: Using a Multilayer Directed Network Model and Targeted Attack-Based Resilience Analysis .....</b>	<b>347</b>
Chen Zhao, Nan Li, and Dongping Fang	
<b>An Integrated Framework for the Assessment of the Impacts of Uncertainty in Construction Projects Using Dynamic Network Simulation .....</b>	<b>355</b>
Jin Zhu and Ali Mostafavi	
<b>Information Representation Schema for Tower Crane Planning in Building Construction Projects .....</b>	<b>363</b>
Yuanshen Ji and Fernanda Leite	
<b>An eeBIM-Based Platform Integrating Carbon Cost Evaluation for Sustainable Building Design .....</b>	<b>371</b>
Qiuchen Lu and Sanghoon Lee	
<b>Optimizing Disaster Recovery Strategies Using Agent-Based Simulation .....</b>	<b>379</b>
Mohamed S. Eid and Islam H. El-Adaway	
<b>An Analytical Approach to Evaluating Effectiveness of Lift Configuration ....</b>	<b>387</b>
Seokyon Hwang	
<b>A Case Study of BIM-Based Model Adaptation for Healthcare Facility Management—Information Needs Analysis .....</b>	<b>395</b>
Zhulin Wang, Tanyel Bulbul, and Jason Lucas	
<b>Estimating Fuel Consumption from Highway-Rehabilitation Program Implementation on Transportation Networks .....</b>	<b>403</b>
Charinee Limsawasd, Wallied Orabi, and Sitthapon Pumpichet	
<b>GPU-Powered High-Performance Computing for the Analysis of Large-Scale Structures Based on OpenSees .....</b>	<b>411</b>
Yuan Tian, Linlin Xie, Zhen Xu, and Xinzheng Lu	
<b>Automated Underground Utility Mapping and Compliance Checking Using NLP-Aided Spatial Reasoning .....</b>	<b>419</b>
Shuai Li and Hubo Cai	
<b>Information Extraction for Freight-Related Natural Language Queries .....</b>	<b>427</b>
Dan P. K. Seedah and Fernanda Leite	
<b>BIM-Based Planning of Temporary Structures for Construction Safety .....</b>	<b>436</b>
Kyunki Kim and Yong Cho	

<b>Applying a Reference Collection to Develop a Domain Ontology for Supporting Information Retrieval .....</b>	<b>445</b>
Nai-Wen Chi, Yu-Huei Jin, and Shang-Hsien Hsieh	
<b>BIM-Driven Islamic Construction: Part 1—Digital Classification.....</b>	<b>453</b>
A. M. Almaimani and N. O. Nawari	
<b>BIM-Driven Islamic Construction: Part 2—Digital Libraries .....</b>	<b>460</b>
A. M. Almaimani and and N. O. Nawari	
<b>Integration of BIM and GIS: Highway Cut and Fill Earthwork Balancing .....</b>	<b>468</b>
Hyunjoo Kim, Zhenhua Chen, Chung-Suk Cho, Hyounseok Moon, Kibum Ju, and Wonsik Choi	
<b>Towards Understanding End-User Lighting Preferences in Office Spaces by Using Immersive Virtual Environments.....</b>	<b>475</b>
Arsalan Heydarian, Evangelos Pantazis, Joao P. Carneiro, David Gerber, and Burcin Becerik-Gerber	
<b>Temporal and Spatial Information Integration for Construction Safety Planning .....</b>	<b>483</b>
Sooyoung Choe and Fernanda Leite	
<b>Modeling Construction Processes: A Structured Graphical Approach Compared to Construction Simulation.....</b>	<b>491</b>
I. Flood	
<b>A Hybrid Control Mechanism for Stabilizing a Crane Load under Environmental Wind on a Construction Site.....</b>	<b>499</b>
Bin Ren, A. Y. T. Leung, Jiayu Chen, and Xiaowei Luo	
<b>Regional Seismic Damage Simulation of Buildings: A Case Study of the Tsinghua Campus in China .....</b>	<b>507</b>
Xiang Zeng, Zhen Xu, and Xinzheng Lu	
<b>Construction Operation Simulation Reflecting Workers’ Muscle Fatigue.....</b>	<b>515</b>
J. Seo, M. Moon, and S. Lee	
<b>Construction Productivity Impacts of Forecasted Global Warming Trends Utilizing an Integrated Information Modeling Approach .....</b>	<b>523</b>
Yongwei Shan, Paul M. Goodrum, and M. Phil Lewis	
<b>Towards Automated Constructability Checking: A Case Study of Aligning Design Information with Formwork Decisions .....</b>	<b>531</b>
Li Jiang, Robert M. Leicht, and John I. Messner	



<b>A Hierarchical Computer Vision Approach to Infrastructure Inspection.....</b>	<b>540</b>
Ali Khaloo and David Lattanzi	
<b>Advancing in Object-Based Landscape Information Modeling: Challenges and Future Needs.....</b>	<b>548</b>
Hamid Abdirad and Ken-Yu Lin	
<b>BIM and QR Code for Operation and Maintenance.....</b>	<b>556</b>
Pavan Meadati and Javier Irizarry	
<b>Measuring End-User Satisfaction in the Design of Building Projects Using Eye-Tracking Technology .....</b>	<b>564</b>
Atefeh Mohammadpour, Ebrahim Karan, Somayeh Asadi, and Ling Rothrock	
<b>Automated Rule-Based Checking for the Validation of Accessibility and Visibility of a Building Information Model.....</b>	<b>572</b>
Y. C. Lee, C. M. Eastman, and J. K. Lee	
<b>Using Building Energy Simulation and Geospatial Analysis to Determine Building and Transportation Related Energy Use .....</b>	<b>580</b>
Ebrahim Karan, Somayeh Asadi, Atefeh Mohammadpour, Mehrzad V. Yousefi, and David Riley	
<b>A Simulation Framework for Network Level Cost Analysis in Infrastructure Systems.....</b>	<b>588</b>
M. Batouli, O. A. Swei, J. Zhu, J. Gregory, R. Kirchain, and A. Mostafavi	
<b>BIM-Assisted Structure-from-Motion for Analyzing and Visualizing Construction Progress Deviations through Daily Site Images and BIM.....</b>	<b>596</b>
Kevin K. Han and Mani Golparvar-Fard	
<b>Using BIM for Last Planner System: Case Studies in Brazil .....</b>	<b>604</b>
M. C. Garrido, R. Mendes Jr., S. Scheer, and T. F. Campestrini	
<b>Collecting Fire Evacuation Performance Data Using BIM-Based Immersive Serious Games for Performance-Based Fire Safety Design.....</b>	<b>612</b>
Jun Zhang and Raja R. A. Issa	
<b>Automatic Construction Schedule Generation Method through BIM Model Creation .....</b>	<b>620</b>
Jaehyun Park and Hubo Cai	
<b>Data-Driven Analysis Framework for Activity Cycle Diagram-Based Simulation Modeling of Construction Operations.....</b>	<b>628</b>
Sanghyung Ahn, Phillip S. Dunston, Amr Kandil, and Julio C. Martinez	

<b>Process Mining Technique for Automated Simulation Model Generation Using Activity Log Data .....</b>	<b>636</b>
Sanghyung Ahn, Phillip S. Dunston, Amr Kandil, and Julio C. Martinez	
<b>Towards the Integration of Inspection Data with Bridge Information Models to Support Visual Condition Assessment.....</b>	<b>644</b>
V. Kasireddy and B. Akinci	
<b>Methodology for Crew-Job Allocation Optimization in Project and Workforce Scheduling.....</b>	<b>652</b>
Ming-Fung Francis Siu, Ming Lu, and Simaan AbouRizk	
<b>Error Assessment of Machine Vision Techniques for Object Detection and Evaluation.....</b>	<b>660</b>
S. German Paal and I. F. C. Smith	
<b>An Integrated BIM-GIS Framework for Utility Information Management and Analyses.....</b>	<b>667</b>
Jack C. P. Cheng and Yichuan Deng	
<b>The Benefits of BIM Integration with Facilities Management: A Preliminary Case Study .....</b>	<b>675</b>
S. Terreno, C. J. Anumba, E. Gannon, and C. Dubler	
<b>A Computational Procedure for Generating Specimens of BIM and Point Cloud Data for Building Change Detection.....</b>	<b>684</b>
Ling Ma, Rafael Sacks, Reem Zeibak-Shini, and Sagi Filin	
<b>Understanding the Science of Virtual Design and Construction: What It Takes to Go beyond Building Information Modeling .....</b>	<b>692</b>
David K. H. Chua and Justin K. W. Yeoh	
<b>Crane Load Positioning and Sway Monitoring Using an Inertial Measurement Unit.....</b>	<b>700</b>
Yihai Fang and Yong K. Cho	
<b>Sustainable Construction Enhanced through Building Information Modeling .....</b>	<b>708</b>
L. Alvarez-Anton, J. Díaz, and D. Castro-Fresno	