

Construction Research Congress 2012

**West Lafayette, Indiana, USA
21-23 May 2012**

Volume 1 of 3

Editors:

**Hubo Cai
Makarand Hastak**

**Amr Kandil
Phillip S. Dunston**

ISBN: 978-1-62276-155-5

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© (2012) by the American Society of Civil Engineers
All rights reserved.

Printed by Curran Associates, Inc. (2012)

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

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
Web: www.proceedings.com

Table of Contents

Contracting and Legal Issues

1 A Delphi Study on the Effects of Culture on the Choice of Dispute Resolution Methods in International Construction Contracts

Ghada M. Gad and Jennifer S. Shane

11 Applying Delay Analysis Techniques to the World Bank Funded Projects

Salwa Fawzy and Islam El-Adaway

21 Comparative Analysis of Design-Bid-Build and Design-Build from the Standpoint of Claims

Pardis Pishdad-Bozorgi and Jesus M. de la Garza

31 Delivering Solar Highway Project: A Case Study

Xinyuan Zhu and Qingbin Cui

41 Impact of Unit Time Value on Contractors' Optimal Bidding Strategies in Price-Time Bi-Parameter Bidding

Saeed Abdollahipour and "David" Hyung Seok Jeong

51 Implementing a New Doctrine for Health Facility Commissioning

Gregory Lasker, Phillip Dunston, Chen Chen, and Mark Kenneday

61 Initiating IPD Concepts on Campus Facilities with a "Collaboration Addendum"

Bryan Franz and Robert M. Leicht

71 Managing the Period Preceding the Calling for a DAB's Decision

Ayman Makarem, M. Asem Abdul-Malak, and Issam Srouf

80 Mapping the Submittal Process in a Design-Bid-Build Project

Ana Catarina V. M. F. Pestana, and Thais da C. L. Alves

90 Modified Isolated Delay Type Technique

Sasan Golanaraghi and Sabah Alkass

Construction Means and Methods

100 A Decision-Support Model Utilizing a Linear Cost Optimization Approach for Heavy Equipment Selection

Ahmad Jrade and Nizar Markiz

110 Automation System Design and Lab Testing to Facilitate Tunnel Boring Machine Guidance in Construction of Large-Diameter Drainage Tunnels

Xuesong Shen, Ming Lu, and Siri Fernando

121 Equipment Technology Innovation for Extreme-Batter Pile Driving Operations

David Grau, John Kirk, and Edward W. Back

129 Evaluation of Data Requirements for Computerized Constructability Analysis of Pavement Rehabilitation Projects

Masoud Gheisari, Laura Florez, Javier Irizarry, and Daniel Castro

139 Integrated Construction Engineering Activities to Satisfy Challenging Project Objectives

Clyde B. Tatum

149 Monitoring the Efficiency of Bridge Construction Using LWSM Model

Seonghoon Kim and Yong Bai

159 Pilot Tube Microtunneling: A Current State of Practice in North America

Jason S. Lueke, Vamseedhar Gottipati, and Jeff Boschert

169 Task Analysis for Improving Training of Construction Equipment Operators

Robert W. Proctor, Phillip S. Dunston, Joey C. Y. So, and Xiangyu Wang

Construction Planning, Control, and Risk Management

179 A Conceptual Model to Develop a Worker Performance Measurement Tool to Improve Construction Productivity

Chandana S. A. Siriwardana and Janaka Y. Ruwanpura

189 A Framework for Construction Strategy Formulation and Visualization

Ngoc Tran, Alan Russell, and Sheryl Staub-French

199 A Risk-Sensitive Markup Decision Model

Rita Awwad and Photios Ioannou

209 A Study on Crew Performance Measurement by Using Heart Rate and Oxygen Consumption

Wen-ta Hsiao, Hsien-tang Wu, and Tao-ming Cheng

217 Accuracy Analysis of Selected Tools for Estimating Contract Time on Highway Construction Projects

Timothy R. B. Taylor, Michael Brockman, Dong Zhai, Paul M. Goodrum, and Roy Sturgill

226 Algorithm for Time-Cost Tradeoff Analysis in Construction Projects by Aggregating Activity-Level Singularity Functions

Shannon B. Terry and Gunnar Lucko

236 An Analytic Review of Earned Value Management Studies in the Construction Industry

Shu Chen and Xueqing Zhang

247 An Optimization Model for Maximizing the Benefits of Fast-Tracking Construction Projects

Youssef Khoueiry, Issam Srour, and Ali Yassine

258 Analysis of Risk-Response Measures for Tunneling Projects

Veerasak Likhitrungsilp and Photios G. Ioannou

268 Analysis of the Work Flow in a Complex Project

Adam Frandson and Thais da C. L. Alves

278 Are Soft Costs Increasing in Transit Projects?

Ye Zhang and Ali Touran

289 Attribute-Based Risk Model for Measuring Safety Risk of Struck-By Accidents

Behzad Esmaeili and Matthew Hallowell

299 Comparison of Design Risk Factors of Multistory Commercial Office Buildings

Vineeth Dharmapalan and John A. Gambatese

310 Continuous Process Planning and Controlling Techniques for Construction Productivity Performance Enhancement

Upul Ranasinghe and Janaka Ruwanpura

321 Creating Automated Crane Work Plans Using Real Time Operational Data and Predictive Analysis

Amir Zavichi and Amir H. Behzadan

331 Critical Risk Factors in Project Delivery Method Selection for Highway Projects

Dai (Daniel) Tran and Keith Molenaar

341 Designer, Contractor, and Owner Views on the Topic of Design for Construction Worker Safety

Nicholas Tymvios, John Gambatese, and David Sillars

356 Development of a Framework for Identifying Information Bottlenecks and Evaluating Different Data Capture Technologies to Support Proactive Productivity Management

Te Gao, Semiha Ergan, Burcu Akinci, James H. Garrett, Jr., and Lucio Soibelman

366 Development of Fuzzy Enabled Shuffled Frog Leaping Algorithm with Activity Splitting Allowed in Construction Project Scheduling

Mehdi Tavakolan and Baabak Ashuri

376 Exploring the Impact of WorkFace Planning on Labour Productivity Variance Mitigation on Industrial Construction Projects: A Mathematical Framework

Jing Peng, Aminah Robinson Fayek, Ashraf Mohamed, and Chris Kennett

386 Finance-Based Scheduling for Multiple Projects with Multimode Activities

Mohammed Saeed El-Abbasy, Tarek Zayed, and Ashraf Elazouni

397 Formalizing the Four-Dimensional (4D) Topology As the Base for 4D Analysis in Construction Planning

Xing Su, Lei Zhang, Abdul Rahman Andoh, and Hubo Cai

407 Hazard Recognition Methods in the Construction Industry

Alex Albert and Matthew R. Hallowell

417 Historical Data Driven and Component Based Prediction Models for Predicting Preliminary Engineering Costs of Roadway Projects

Asregedew Woldesenbet and “David” HyungSeok Jeong

427 Identification of Changes Formation Scenarios in Construction Projects Based on Changes Occurrence Paths Analysis

Mohammad Hadi Charkhakan and Gholamreza Heravi

437 Information Exchange Requirements for Capital Equipment and Facility Infrastructure for Semiconductor Facilities

Allan D. Chasey and Shruthi Pindukuri

447 Interface Management Model for Mega Capital Projects

Samin Shokri, Mahdi Safa, Carl T. Haas, Ralph C. G. Haas, Kelly Maloney, and Sandra MacGillivray

457 Is the Information Available from Historical Time Series Data on Economic, Energy, and Construction Market Variables Useful to Explain Variations in ENR Construction Cost Index?

Baabak Ashuri, Seyed Mohsen Shahandashti, and Jian Lu

465 Maximizing Labor Stability As a Sustainability Performance Indicator in Project Scheduling

Laura Florez, Daniel Castro, and Andrés L. Medaglia

475 Method Using Metric-Based Performance Feedback to Predict Client Satisfaction—A Hospital Case Study

Wendy Li, Leah Jin, Martin Fischer, and John Kunz

485 Modeling Measures of Float Monetization for Quantitative Risk Management of Construction Projects

Richard C. Thompson, Jr., and Gunnar Lucko

495 Pipe Spool Fabrication Sequencing by Automated Planning

Di Hu and Yasser Mohamed

505 Predicting the Preliminary Engineering Duration of Bridge Projects

Min Liu, William Rasdorf, Donna A. Hollar, Joseph E. Hummer, and Shalin C. Parikh

515 Relationships between Methods for Constructability Analysis during Design and Constructability Failures in Projects

Gabriel Raviv, Aviad Shapira, and Rafael Sacks

525 Safety Risk Analysis and Proposing Risk Mitigation Strategies for Operations and Maintenance Activities in Highways: A Qualitative Method

Sayanti Mukhopadhyay, Jennifer S. Shane, and Kelly C. Strong

535 Schedule Assessment and Evaluation

S. Farzad Moosavi and Osama Moselhi

545 Stochastic Method for Forecasting Project Time and Cost

Adel Alshibani and Osama Moselhi

556 Understanding of Target Value Design for Integrated Project Delivery with the Context of Game Theory

Wooyong Jung, Glenn Ballard, Yong-Woo Kim, and Seung Heon Han

Knowledge Management and Information Technology

564 A Framework for an Integrated and Evolutionary Body of Knowledge

Daniel Forgues, Ivanka Iordanova, and François Chiocchio

574 A Framework for Automatic Safety Checking of Building Information Models

Sijie Zhang, Jin-Kook Lee, Manu Venugopal, Jochen Teizer, and Charles M. Eastman

582 A Model for Product-Process Integration in the Building Industry Using Industry Foundation Classes and Design Structure Matrix

Jeevan Jacob and Koshy Varghese

591 A Semantic Approach to Representation, Sharing, and Discovery of Construction Simulation Models

Farzaneh Saba and Yasser Mohamed

602 An Extension of the Technology Acceptance Model for BIM-Based FM

Seul-Ki Lee, Hyo-Kyung An, and Jung-Ho Yu

612 Automated Generation of 4D Building Information Models through Spatial Reasoning

Yibrah W. Weldu and Gerald M. Knapp

622 Automated Regulatory Information Extraction from Building Codes: Leveraging Syntactic and Semantic Information

Jiansong Zhang and Nora El-Gohary

633 Automatic Identification of Unsafe Bending Behavior of Construction Workers Using Real-Time Location Sensing and Physiological Status Monitoring

Giovanni C. Migliaccio, Jochen Teizer, Tao Cheng, and Umberto C. Gatti

643 Cognitive Analysis of Field Managers

Fernando A. Mondragon Solis and William J. O'Brien

650 Comparing Information Technology Adoption between Developing and Developed Countries

Mehdi Nourbakhsh, Rosli Mohamad Zin, Javier Irizarry, Samaneh Zolfagharian, and Masoud Gheisari

658 Conceptual Framework of the Green Building Information Management System

Veerasak Likhitrungsilp, Wanida Putthividhya, and Photios G. Ioannou

668 Concurrent Data Collection Method for Building Energy Analysis Using Project Temporary Database

Ka-ram Kim and Jung-ho Yu

678 Construction Research Data Management

Arash Shahi, Kaitlin Carlson, A. J. Antony Chettupuzha, Carl T. Haas, Jeffrey S. West, and Burcu Akinci

688 Construction to Operations Exchange: Challenges of Implementing COBie and BIM in a Large Owner Organization

Anne Anderson, Andrew Marsters, Carrie Sturts Dossick, and Gina Neff

698 Context-Aware Computing Framework for Improved Bridge Inspection

Manu Akula, Atul Sandur, Vineet R. Kamat, and Atul Prakash

708 Coordination Process and Network Centrality in ISGI Airport's Wayfinding Project

Sevgi Zeynep Doğan, Suat Gunhan, and Bengi Erbasaranoğlu

718 Cost-Effective Mobile Application Strategies in a Competitive and Economically Challenged Industry

Tim Clancy, Jeong-Han Woo, and Pawel Wyszowski

728 Facilities Management Interaction with Healthcare Delivery Process

Atefeh Mohammadpour, Chimay Anumba, Tanyel Bulbul, and John Messner

737 Identifying Energy Auditing Process and Information Exchange Requirements for the Commercial Building Retrofit Sector

Tabitha L. Sprau Coulter, Jason Hinsey, Robert M. Leicht, Michael G. Whelton, and David R. Riley

747 Leveraging Building Information Models to Support Supply Chain Decisions in Construction Projects

Marcelo Azambuja, Thais Alves, Fernanda Leite, and Jie Gong

757 Machine Vision-Based Infrastructure As-Built Documentation Using Edge Points

Habib Fathi and Ioannis Brilakis

767 Providing Query Support to Leverage BIM for Construction

Madhav Nepal, Sheryl Staub-French, and Rachel Pottinger

778 Rethinking the Cost Estimating Process through 5D BIM: A Case Study

Daniel Forgues, Ivanka Iordanova, Fernando Valdivesio, and Sheryl Staub-French

787 Spatio-Temporal Safety Analysis of Construction Site Operations Using GPS Data

Nipesh Pradhananga and Jochen Teizer

797 Value-Sensitive Construction: Value Discovery in Building Projects

Hamid Jahani and Nora El-Gohary

Data Sensing and Analysis

808 A Boundary Condition-Based Algorithm for Locating Construction Site Objects Using RFID and GPS

Abdul Rahman Andoh, Xing Su, and Hubo Cai

818 A Framework of RFID and GPS for Tracking Construction Site Dynamics

Abdul Rahman Andoh, Xing Su, and Hubo Cai

828 A Non-Intrusive Occupancy Monitoring System for Demand Driven HVAC Operations

Zheng Yang, Nan Li, Burcin Becerik-Gerber, and Michael Orosz

838 Activity-Based Data Fusion for Automated Progress Tracking of Construction Projects

Arash Shahi, Jose M. Cardona, Carl T. Haas, Jeffrey S. West, and Gary L. Caldwell

848 Analysis of XBOX Kinect Sensor Data for Use on Construction Sites: Depth Accuracy and Sensor Interference Assessment

Nima Rafibakhsh, Jie Gong, Mohsin K. Siddiqui, Chris Gordon, and H. Felix Lee

858 Application of Microsoft Kinect Sensor for Tracking Construction Workers

I. P. Tharindu Weerasinghe, Janaka Y. Ruwanpura, Jeffrey E. Boyd, and Ayman F. Habib

868 Application Potential of Ultra-Wide Band Radar for Detecting Buried Obstructions in Construction

Junhao Zou, Ming Lu, Rambabu Karumudi, and Xuesong Shen

879 Automated Vision-Based Recognition of Construction Worker Actions for Building Interior Construction Operations Using RGBD Cameras

Víctor Escorcía, María A. Dávila, Mani Golparvar-Fard, and Juan Carlos Niebles

889 Automated Visual Recognition of Construction Equipment Actions Using Spatio-Temporal Features and Multiple Binary Support Vector Machines

Arsalan Heydarian, Mani Golparvar-Fard, and Juan Carlos Niebles

899 Automating and Optimizing Spatial Data Processing Workflows for Civil Infrastructure Inspection

Pingbo Tang and Anu Pradhan

909 Binary and Multi-Class Classification of Fused LIDAR-Imagery Data Using an Ensemble Method

Seyed Hossein Hosseini Nourzad and Anu Pradhan

919 Classification of Bricklaying Activities in Work Sampling Categories Using Accelerometers

Liju Joshua and Koshy Varghese

929 Comparison of Image-Based and Time-of-Flight-Based Technologies for 3D Reconstruction of Infrastructure

Fei Dai, Abbas Rashidi, Ioannis Brilakis, and Patricio Vela

940 Detection of Construction Workers in Video Frames for Automatic Initialization of Vision Trackers

Man-Woo Park, Evangelos Palinginis, and Ioannis Brilakis

950 Effects of Planning and Data Collection Approaches on the Quality of Processed Laser Scanned Data: Lessons Learned

Matineh Eybpoosh, Burcu Akinci, and Mario Bergés

960 Image-Based 3D Mapping of Rebar Location for Automated Assessment of Safe Drilling Areas Prior to Placing Embedments in Concrete Bridge Decks

Mani Golparvar-Fard, Behshad Ghadimi, Kamel S. Saidi, Geraldine S. Cheok, Marek Franaszek, and Robert R. Lipman

971 Productivity Enhancement for Maintenance Equipment Operations Using Telematics Technology

Bugra Aslan and Dae-Hyun (Dan) Koo

981 Proximity Sensing and Warning Technology for Heavy Construction Equipment Operation

Eric Marks and Jochen Teizer

991 Rapid 3D Energy Performance Modeling of Existing Buildings Using Thermal and Digital Imagery

Youngjib Ham and Mani Golparvar-Fard

1001 Real-Time Posture Analysis of Construction Workers for Ergonomics Training

Soumitry J. Ray and Jochen Teizer

1011 RFID+ for Tracking Earthmoving Operations

Ali Montaser and Osama Moselhi

1021 Sensor Modeling of Laser Scanners for Automated Scan Planning on Construction Jobsites

Pingbo Tang and Fahd Saleh Alaswad

1032 Vision-Based Motion Detection for Safety Behavior Analysis in Construction

SangUk Han, SangHyun Lee, and Feniosky Peña-Mora

1042 Vision-Based Recognition of Dirt Loading Cycles in Construction Sites

Ehsan Rezazadeh Azar and Brenda McCabe

Construction Simulation, Visualization, and Product Modeling

1052 A Case Study of 3D Imaging Productivity Needs to Support Infrastructure Construction

Gabriel B. Dadi, Paul M. Goodrum, Kamel S. Saidi, Christopher U. Brown, and Joseph W. Betit

1063 A Hybrid Framework for Modeling Construction Operations Using Discrete Event Simulation and System Dynamics

Hani Alzraiee, Osama Moselhi, and Tarek Zayed

1074 A Special Purpose Simulation Template for Modeling Tire Usage of Mining Truck Fleet

Ronald Ekyalimpa, Simaan M. Abourizk, and Rod Wales

1084 A VR Model of Ergonomics and Productivity Assessment in Panelized Construction Production Line

Ndukeabasi Inyang, SangHyeok Han, Mohamed Al-Hussein, and Marwan El-Rich

1094 Activity Criticality Index Assessment Using Critical Path Segment Technique and Interactive Simulation

Pei Tang and Amlan Mukherjee

1104 Agent-Based Simulation of Labour Emergency Evacuation in High-Rise Building Construction Sites

Hisham Said, Amr Kandil, and Hubo Cai

1114 An Ontological Approach to Building Information Model Exchanges in the Precast/Pre-Stressed Concrete Industry

Manu Venugopal, Charles M. Eastman, and Jochen Teizer

1124 Application of Electimize in Solving the Construction Site Layout Planning Optimization Problem

Mohamed Abdel-Raheem and Ahmed Khalafallah

1135 Assessing Productivity Improvement of Quick Connection Systems in the Steel Construction Industry Using Building Information Modeling (BIM)

Yongwei Shan, Paul Goodrum, Carl Haas, and Carlos Caldas

1145 Augmenting BIM with 3D Imaging Data to Control Drilling for Embeds into Reinforced Concrete Bridge Decks

Manu Akula, Robert R. Lipman, Marek Franaszek, Kamel S. Saidi, Geraldine S. Cheok, and Vineet R. Kamat

1155 Automated 3D Building Envelope Recognition from Point Clouds for Energy Analysis

Chao Wang and Yong Cho

1165 Automated Planning and Design of Formwork for Freeform Shell Structures

Khaled Nassar and Ebrahim A. Aly

1175 BIM + AR: A Framework of Bringing BIM to Construction Site

Xiangyu Wang, Peter E. D. Love, and Peter Rex Davis

1182 Change Management with Building Information Models: A Case Study

Behzad Pilehchian Langroodi and Sheryl Staub-French

1192 Combined Discrete and Continuous Modeling of Construction Activities Using Three Phase Activity Scanning Approach

Vivek Puri and Julio C. Martinez

1202 Construction Processes Planning of TBM Tunneling Projects: A System Dynamics Approach

Mohammad Mahdi Farshchian and Gholamreza Heravi

1212 Creating 3D Web-Based Game Environment Using BIM Models for Virtual On-Site Visiting of Building HVAC Systems

Zhigang Shen, Landu Jiang, Kevin Grosskopf, and Charles Berryman

1222 Data Management for Construction Processes Using Fuzzy Approach

Emad El Wakil and Tarek Zayed

1232 Developing As-Built Building Information Model Using Construction Process History Captured by a Laser Scanner and a Camera

Xuesong Liu, Matineh Eybpoosh, and Burcu Akinci

1242 Development of 4D Public Participation GIS to Improve Communication of City Transformation Processes

Tim Johansson, Timo Hartmann, Rogier Jongeling, and Thomas Olofsson

1252 GIS-Based Buffering for Construction Workspace Management

Xing Su, Lei Zhang, Abdul Rahman Andoh, and Hubo Cai

1262 Hybrid Approach to Visualize Building Energy Information Model in Geospatial Application Programs

Hee Jung Im, Mengmeng Gai, Chao Wang, and Yong Cho

1271 Integrated BIM/Lean Base Production Line Schedule Model for Modular Construction Manufacturing

Mansoorh Moghadam, Aladdin Alwisy, and Mohamed Al-Hussein

1281 Integrated Building Information Model to Identify Possible Crane Instability Caused by Strong Winds

Shafiul Hasan, Hamid Zaman, Sanghyeok Han, Mohamed Al-Hussein, and Yi Su

1291 Integrating Building Information Modeling with Universal Design Requirements for Highly Accessible Homes

Ahmad Jrade and Paola Zurro Valdez

1301 Integrating Structural and Construction Engineering

Clyde B. Tatum and Gregory P. Luth

1311 Modeling Airport Check-In and Security Procedures Using SimFC

Jamal Siadat, Faisal Arain, and Janaka Ruwanpura

1320 Modeling of Continuous Stochastic Construction Operations for Discrete Event Simulation

Vivek Puri and Julio C. Martinez

1330 Monitoring and Visualization of Building Construction Embodied Carbon Footprint Using DnAR-N-Dimensional Augmented Reality Models

Milad Memarzadeh and Mani Golparvar-Fard

1340 Multi-Criteria Design Evaluation and Optimization of School Buildings Using Artificial Intelligent Approaches

Eilnaz A. Tabrizi, Mohamed Al-Hussein, and Ndukeabasi Inyang

1350 Photo-Modeling for Construction Site Space Planning

Satish Gore, Lingguang Song, and Neil Eldin

1360 Remote Monitoring of Dynamic Construction Processes Using Automated Equipment Tracking

Reza Akhavian and Amir H. Behzadan

1370 Rendering Stereoscopic Augmented Reality Scenes with Occlusions Using Depth from Stereo and Texture Mapping

Joseph Louis and Julio Martinez

1381 Sensitivity of Energy Simulation Models to Occupancy Related Parameters in Commercial Buildings

Elie Azar and Carol Menassa

1391 Structural Steel Fabrication Special Purpose Simulation

Amin Alvanchi, Allen Nguyen, and Simaan M. Abourizk

Organizational and Labor Issues

1400 A Framework of Teamwork Attributes Affecting Workers' Safety

Panagiotis Mitropoulos and Babak Memarian

1410 A Quantitative Approach for Measuring Managerial Interfaces in the Development of a Capital Project

Sungmin Yun, Stephen P. Mulva, and William J. O'Brien

1420 A Research Framework for Work Sampling and Its Application in Developing Comparative Direct and Support Activity Proportions for Different Trades

Abraham Assefa Tsehayae and Aminah Robinson Fayek

1430 Corporate Safety Performance Benchmarking in Construction

Jiukun Dai, Stephen Mulva, Arpamart Chanmeka, Sung-Joon Suk, and Sungmin Yun

1440 Effective Methods and Learning Environment for Retaining Cost Estimating Knowledge and Skills

Anwar Alroomi and "David" Hyung Seok Jeong

1450 Exploring Absenteeism Control Policies with Awareness of the Effect of Group Norms on Absence Behavior, Using Agent-Based Modeling

Seungjun Ahn, SangHyun Lee, and Moonseo Park

1460 Impact of Inter-Firm Collaboration Networks in International Construction Projects: A Longitudinal Study

Heedae Park and Seung Heon Han

1471 Implementation of Survey Method in a Construction Team Effectiveness Study

Nurhidayah Azmy, Jennifer S. Shane, and Mack C. Shelley

1481 Institutional Issues Related to Project Governance of Infrastructure PPP Projects in India

Venkata S. K. Delhi and Ashwin Mahalingam

1491 Interpreting Design Practice from the Lens of Heidegger's Modes of Being

Timo Hartmann

1499 Long and High Jumps: Knowledge Sharing Connections That Span Geographic and Disciplinary Boundaries in Interdisciplinary Intra-Firm Networks

John Wanberg and Amy Javernick-Will

1510 The Need for Indices to Assess the Health of the Construction Industry

Nader Naderpajouh, Akhila Boppana, and Makarand Hastak

1520 Relationship between Floor Number and Labor Productivity in Multistory Structural Work: A Case Study

Long D. Nguyen and Hung T. Nguyen

1530 Strategic Management Concepts and Practices in Pakistan: A Construction Industry Perspective

Farrukh Arif, Nida Azhar, and Mehmet Emre Bayraktar

1540 Sustainable Management of Infrastructure Projects: The Role of Workers' Satisfaction through Financial Loss Reduction

Islam El-Adaway

Quantitative Methods

1550 Assessment of Public Opposition to Infrastructure Developments: The Case of Nuclear Power Projects

Vanessa Valentin, Dulcy Abraham, Fred Mannering, and Ali Mostafavi

1560 Hybrid Genetic Algorithm Parameter Effects for Optimization of Construction Resource Allocation Problem

Jin-Lee Kim

1570 Impact of Design Cost on Design Bid Build Project Performance

Pramen P. Shrestha and Nirajan Mani

1580 Optimal Material Logistics Planning in Congested Construction Sites

Hisham Said and Khaled El-Rayes

1590 Stochastic Optimization of Construction Projects Planning with Genetic Algorithm

Mehdi Tavakolan and Baabak Ashuri

1600 Valuation of Minimum Revenue Guarantees for PPP Wastewater Treatment Plants

Mohammed R. Hassan Ali, Hesham Osman, Mohamed Marzouk, and Moheeb Ibrahim

Environmentally Sustainable Design and Construction

1610 A Comparative Study on Environmental Life Cycle Impacts of Curtain Walls

Rahman Azari and Yong-Woo Kim

1620 A Framework for Evaluating Sustainable Rural Development: A Case Study Using a Distributed Water Reclamation Facility

Scott Glick, Angela Acree Guggemos, and Alison R. G. Rosso

1631 A Framework for Managing Construction Demolition Waste: Economic Determinants of Recycling

Issam M. Srour, Sandy Tamraz, Ghassan R. Chehab, and Mutasem El-Fadel

1641 A Real Options Model to Evaluate Investments in Photovoltaic (PV) Systems

Hamed Kashani, Baabak Ashuri, Jian Lu, and Mohsen Shahandashti

1651 An Experimental Approach to Optimizing Natural Ventilation in Public Spaces of Complex Buildings

Nathan Taylor and Carol C. Menassa

1662 Carbon Emissions of On-Site Equipment Use in Post-Tensioned Slab Foundation Construction

Sivakumar Palaniappan, Howard Bashford, Ke Li, John Crittenden, Apostolos Fafitis, Leger Stecker, and Steven Hay

1672 Comparison and Analysis of International Construction Waste Management Policies

Yashuai Li and Xueqing Zhang

1682 Concrete Recycling and Utilization of Recycled Concrete: An Investigation of the Barriers and Drivers within the Phoenix Metropolitan Area

J. D. Thompson and H. H. Bashford

1689 Developing a Carbon Footprint Calculator for Construction Buildings

Nicolas Harmouche, Ali Ammouri, Issam Srour, Ghassan Chehab, and Ramsey Hamade

1700 Developing a Framework for Pre-Design Process Simulation for Green Buildings

Srinivasa Nookala, Hisham Said, Amr Kandil, Hubo Cai, Hassan Al-Derham, Ahmed Senouci, and Mohammed El-Gafy

1710 Developing a Target Value Design Protocol for Commercial Energy Retrofits—Part 1

Hyun Woo Lee, Glenn Ballard, and Iris D. Tommelein

1720 Developing a Target Value Design Protocol for Commercial Energy Retrofits—Part 2

Hyun Woo Lee, Glenn Ballard, and Iris D. Tommelein

1730 Economic and Environmental Assessment of Deconstruction Strategies Using Building Information Modeling

Ali Akbarnezhad, Khim Chye Gary Ong, Lado Riannevo Chandra, and Zhisheng Lin

1740 Effectiveness of Green-Roof on Reducing Energy Consumption through Simulation Program for a Residential Building: Cairo, Egypt

Basil Kamel, Sherine Wahba, Khaled Nassar, and Ahmed Abdelsalam

1750 Environmental Impacts Assessment on Construction Sites

Samaneh Zolfagharian, Mehdi Nourbakhsh, Javier Irizarry,
Aziruddin Ressang, and Masoud Gheisari

**1760 Environmentally Friendly Stabilization of Unpaved
Shoulders**

Richard Harris, Fangyu Guo, and Charles Jahren

**1770 Estimating the Economic, Energy, and Environmental
Impact of Earthwork Activities**

Phil Lewis and Apif Hajji

**1780 Evaluating Energy Savings Potential in United States
Residential Buildings**

Sami Kolahdoozan and Fernanda Leite

**1791 Evaluating Net-Zero Energy Houses from the U.S.
Department of Energy Solar Decathlon 2011**

Jordan Wallpe, William Hutzler, Gregory Lasker, and Clark Cory

**1799 Evaluation Model for Carbon Dioxide Emissions of
Construction Methods**

SeungWon Han, ChangTaek Hyun, and HyunSeok Moon

**1809 Exploratory Study of Sustainability Knowledge
Management in Capital Project Offices**

Xiao Tan, Ken-Yu Lin, Chimay J. Anumba, Hai-Chen Tan, and Hui-
Min Li

**1820 Green and Non-Green School Buildings: An Empirical
Comparison of Construction Cost and Schedule**

Pramen P. Shrestha and Nitisha Pushpala

**1830 Human-Building Interaction for Energy Conservation in
Office Buildings**

Farrokh Jazizadeh, Geoffrey Kavulya, Jun-Young Kwak, Burcin
Becerik-Gerber, Milind Tambe, and Wendy Wood

**1840 Improving Uncertainty Estimate of Embodied-Energy of
Construction Materials Using Analytical Hierarchical Process
in Weighted DQI Method**

Endong Wang and Zhigang Shen

1850 Introducing the Concept of Emissions Liability Insurance in Managing Greenhouse Gas (GHG) Emissions and Promoting Sustainability in Construction Projects

Xinyi Song and Feniosky Peña-Mora

1859 Minimizing Greenhouse Gas Emissions from Construction Activities and Processes

Wallied Orabi, Yimin Zhu, and Gulbin Ozcan-Deniz

1869 Minimum Operational Emissions in Earthmoving

David G. Carmichael, Evan H. Williams, and Alireza S. Kaboli

1879 Monitoring System for Operational Efficiency and Environmental Performance of Construction Operations Using Vibration Signal Analysis

Changbum R. Ahn, SangHyun Lee, and Feniosky Peña-Mora

1889 Multi-Attribute Decision Making in Choosing Suitable Construction Waste Management Methods

Xueqing Zhang and Yashuai Li

1899 Multi-Criteria Decision Making to Improve Performance in Construction Projects with LEED Certification

H. L. Sulochana P. Madanayake and Janaka Y. Ruwanpura

1910 Multi-Objective Criteria for the Optimal Design of Sustainable Water Distribution Networks

Kalyan R. Piratla and Samuel T. Ariaratnam

1920 Nitrogen Oxide Reduction and Nitrate Measurements on TiO₂ Photocatalytic Pervious Concrete Pavement

Marwa Hassan, Somayeh Asadi, John T. Kevern, and Tyson Rupnow

1931 Practicality and Sustainability of Using HVFA for Concrete Sidewalks

Hossein Lavasani and Anne Werner

1941 A Project Based Framework for Assessing and Monitoring Highway Construction Greenhouse Gas Emissions

Amlan Mukherjee and Darrell Cass

1951 Review of Existing Transportation Sustainability Initiatives and Their Applicability to Qatar

Karim A. Abdelwarith, Amr A. Kandil, John E. Haddock, Ahmed B. Senouci, and Hassan R. Al-Derham

1961 Sustainable Energy Performance Indicators of Green Building in Developing Countries

Mahsa Qaemi and Gholamreza Heravi

1971 Sustainable Fuel Cells for Residential Construction: Challenges and Opportunities

Marcel Granier and Daniel Castro-Lacouture

1981 Toward a More Sustainable Rating for the Built Environment: A Comprehensive Construction Assessment Framework

Islam El-Adaway and Jerome Knapp

1991 Using a Thematic Framework to Compare Sustainability Rating Systems Applicable to Transportation Projects

Ross Curz, Jin-Lee Kim, and Hee Sung Cha

2001 Value Creation Chain for Going Green: Evidence from the Construction Industry

Yujie Lu, Qingbin Cui, and Xianglin Jiang

2011 Water Reclamation Strategies in the Built Environment—A Framework and Case Study of a University Campus

Saqib Naveed Cheema and Muhammad Irfan

Construction Education

2021 Assessing the Impact of Physical Prototyping in First-Year Engineering Education

Steven K. Ayer, Robert M. Leicht, and Christie A. Smith

2031 Collaborative Authoring for On-Line Construction Curricula

Georg Reichard and Vera Novak

2042 Developing a Serious Game for Construction Planning and Scheduling Education

Saeed Karshenas and David Haber

2052 Ensuring Scientific Rigor of JCEM Papers through Transparent Reviews of Scholarship

Leonhard E. Bernold

2060 Evaluating Construction Management Programs at the Graduate Level in the U.S.

Sangwook Lee and Afshin Esmaeilzadeh

2071 Expected Outcomes of a Construction Career: Gender Identity and Engineers Without Borders-USA

Jessica Kaminsky, Casey Casias, Amy Javernick-Will, and Cathy Leslie

2081 Exploration of New Frontiers for Educating Engineers through Local and Global Service-Learning Projects

James L. Huff, Ali Mostafavi, Dulcy M. Abraham, and William C. Oakes

2091 Learning Assessment Strategies for an Educational Construction Safety Video Game

Yuan-Ling Liaw, Ken-Yu Lin, Min Li, and Nai-Wen Chi

2101 Measuring the Value of "All Play and No Work": Can the Rigorous Assessment of Simulation Games Drive Innovative Teaching in Construction?

Dragana Nikolic and John I. Messner

2111 Problem-Based Learning and Learning-through-Service for Sustainability Education

Islam El-Adaway and Dennis Truax

2120 Student-Centered Teaching Construction Equipment and Methods to 350 Students

Leonhard E. Bernold

2129 Teaching Social Sustainability in Sustainable Construction and Infrastructure Courses: A Collaborative Approach

Rodolfo Valdes-Vasquez, Annie Pearce, and Caroline Clevenger

2139 Using Tele-Engineering As a Tool to Reverse Engineer the Inka Road

Edward J. Jaselskis, Clifford Schexnayder, Christine Fiori, Timothy C. Becker, Wu-Chueh Andrew Hung, Christine Beckman, Manop Kaewmoracharoen, and Kathleen Short

2149 Working in Inter-Disciplinary, Multi-Cultural Teams: Lessons from the Field

Christine Fiori, Edward J. Jaselskis, Clifford Schexnayder, Jennifer Shane, Timothy C. Becker, Kathleen Short, Edgar Rodriguez Velásquez, Gerardo Chang Recavarren, and Alexei Vranich

Disaster Management and Response

2160 Creating a Community-Based Housing Response Pool

Omar El-Anwar and Lei Chen

2170 GIS for the Geo-Referenced Analysis and Rapid Dissemination of Forensic Evidence Collected in the Aftermath of the Tuscaloosa Tornado

Andrew J. Graettinger, David Grau, John Van de Lindt, and David O. Prevatt

2180 Hazard Management: Integrated Framework for Engineering and Public Policy

Islam El-Adaway, Gerald Emison, and Keith Coble

2190 Measuring Community Resilience and Recovery: A Content Analysis of Indicators

Elizabeth Jordan and Amy Javernick-Will

2200 Modeling Dynamics of Post-Disaster Recovery

Ali Nejat and Ivan Damnjanovic

Infrastructure Management

2211 Adaptive Stormwater Sewer System Management for Climate Change

Yeonsang Hwang, Charles Bradsky, and Joo Hyoung Lee

2221 Agent-Based Modeling and Simulation for Hazard Management

William M. Bulleit and Matthew W. Drewek

2231 Alternative Quality Organizations in Highway Design and Construction

Elizabeth Kraft and Keith Molenaar

2241 Analysis of Heterogeneity in Infrastructure Condition Assessment Models

Yongliang Jin and Amlan Mukherjee

2250 Approval Risks in Transportation Infrastructure Projects in India

Aneetha Vilventhan and Satyanarayana N. Kalidindi

2260 Assessment of Public Perceptions of Innovative Financing for Infrastructure

Ali Mostafavi, Dulcy Abraham, Fred Mannering, Antonio Vives, and Vanessa Valentin

2270 Causes for Sustainable Maintenance and Operation of On-Site Sanitation Systems

Jessica Kaminsky and Amy Javernick-Will

2280 Complex Systems Modeling of Infrastructure Assets, Operators, Users, and Politicians Using System Dynamics

Hesham Osman and Mohammed R. Hassan Ali

2290 Design of Concession and Annual Payments for Availability Payment Public Private Partnership (PPP) Projects

Deepak Sharma and Qingbin Cui

2300 Innovation Policy Assessment for Civil Infrastructure System-of-Systems

Ali Mostafavi, Dulcy Abraham, Daniel Delaurentis, Joseph Sinfield, and Cesar Queiroz

2310 Long Term Concessions on Public-Private Partnership Projects—How to Make This Right?

Mehdi Tavakolan, Baabak Ashuri, Reza Tavakolan, and Mohammad Mahdi Farshchian

2320 Maintaining Subway Infrastructure Using BIM

Mohamed Marzouk and Ahmed Abdel Aty

**2329 Optimization Application for Financial Viability
Evaluation of PPP Toll Road Projects**

Tanaphat Jeerangsuwan, Hisham Said, Amr Kandil, and Satish Ukkusuri

**2339 The Relationship between Delivery Processes and
Transportation Projects' Performance**

Yong-Woo Kim, Omar El-Anwar, and Michael Houston

**2349 Theoretical Framework for Transportation
Infrastructure Asset Management Based on Review of Best
Practices**

Farrukh Arif and Mehmet Emre Bayraktar

Global Construction Issues

**2359 Advanced Construction Technologies for the Nuclear
Construction Industry**

Erik R. Wright, Kyuman Cho, and Makarand Hastak

**2369 Challenges in the Planning Process of Infrastructure
Projects in Germany**

Meltem Sözüer and Konrad Spang

**2379 Characterization of Nano Particles Released during
Asphalt and Concrete Laboratory Activities**

Somayeh Asadi, Marwa M. Hassan, and Heather Dylla

**2389 Construction and Maintenance of Concrete Piles in
Corrosive and Destructive Marine Environments Based on
Study of the Persian Gulf Marine Installations**

Nasser Arafati, AbdolHosseini Fazli, Seyed Mehdi Mousavi, and Fouzieh Rouzmehr

**2400 Cost Normalization for Global Capital Projects
Benchmarking**

Jiukun Dai, Stephen Mulva, Sung-Joon Suk, and Youngcheol Kang

**2410 Empirical Simulation to Compare Opportunistic Bidding
Behavior in China and the U.S.A.**

Muqing Liu, Qinghua Xu, and John E. Taylor

2420 Railroad Construction Opportunities in an Age of Global Warming and Peak Oil

Trefor Williams

Construction Industry Institute Research

2429 A Benchmarking Framework for Public Transportation Projects Delivery

Youngcheol Kang, Jiukun Dai, and Stephen P. Mulva

2439 Assessing CII Best Practices Applicability

Adeniyi Olumide, John Walewski, and Stuart Anderson

2449 Barriers to Applying Probabilistic Risk Analysis in Design and Construction Projects

Christopher Senesi, Amy Javernick-Will, and Keith Molenaar

2459 Common Barriers to Effective Front-End Planning of Capital Projects

G. Edward Gibson, Jr., and Roberta Bosfield

2469 Industry Practices for Estimating, Controlling, and Managing Key Indirect Construction Costs at the Project Level

Timothy C. Becker, Edward J. Jaselskis, Mohamed El-Gafy, and Jing Du

2479 Improving Concrete Trade Labor Productivity through the Use of Innovations

Gabriel B. Dadi, Mahdi Safa, Paul M. Goodrum, Carl T. Haas, Carlos H. Caldas, and David MacNeel

2489 Owner and Contractor Jobsite Organizations

James T. O'Connor and Chong Yao Wang

2499 Quantification of Front End Planning Input Parameters in Capital Projects

Sungmin Yun, Sung-Joon Suk, Jiukun Dai, and Stephen P. Mulva

2510 Safety Incidents and High-Risk Activities of Masonry Construction

Babak Memarian and Panagiotis Mitropoulos

2520 Two-Dimensional Globalizing Index and Globalizing Self-Assessment Tool for Engineering and Construction Companies

Semra Comu, John E. Taylor, and John I. Messner