

ASCE/CIB Construction Research Congress 2007

(CRC 2007)

**Grand Bahama Island, Bahamas
6-8 May 2007**

Volume 1 of 2

ISBN: 978-1-61567-440-4

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© (2007) by Academic Event Planners LLC
All rights reserved.

Printed by Curran Associates, Inc. (2009)

For permission requests, please contact Academic Event Planners LLC
at the address below.

Academic Event Planners LLC
814 Trail Ridge Drive
Louisville, CO 80027

Phone: (303) 359-2402
Melissa@acedemiceventplanner.com

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

VOLUME 1

SESSION 1

AUTOMATED/REAL-TIME SYSTEMS FOR PROJECT CONTROL

Metric For Automated Detection And Identification Of 3D CAD Elements In 3D Scanned Data	1
<i>Frederic Bosche, Carl Haas</i>	
Semi-Automated Visualization Of Construction Progress Monitoring	9
<i>Mani Golparvar Fard, Feniosky Peña-Mora</i>	
Wireless Sensor Technologies For Automated Tracking And Monitoring Of Construction Materials Utilizing Zigbee Networks	18
<i>Won-Suk Jang, Miroslaw J. Skibniewski</i>	
Developing Mobile RFID-Based Facility Management Information System	26
<i>Liang-Hao Hsiao, Yu-Cheng Lin, Jyh-Dong Lin</i>	

OPERATIONS, PRODUCTIVITY & WORKFORCE ISSUES

Assessing The Current State Of Practice In Adopting Trenchless Construction Methods In China	35
<i>Samuel Ariaratnam, Derek Choi</i>	
Meeting The Workforce Challenges Of The Nuclear Energy Industry	43
<i>Stefanie Brandenburg, Lansford Bell</i>	
Front End Planning For Renovation Projects	52
<i>G. Edward Gibson, Qingbin Cui, Suzanne Howard, Kyle Irons</i>	
Project Management Control Of Expert Judgement In Project Cost Estimating In Australia	60
<i>Guomin (Kevin) Zhang, Chandra Bhuta</i>	

ORGANIZATIONAL LEADERSHIP & MANAGEMENT

Leadership Research - Enhanced Leadership Skills Improves Performance	69
<i>William Badger, Peter Bopp, Avi Wiesel</i>	
Investigating The Changing Role Within PM Teams In AEC Projects	81
<i>Antonios Panas, Francis Edum-Fotwe, Dimitris Antoniadis, John-Paris Pantouvakis</i>	
Analysis Of Construction Project Managers, Leadership Development, And Succession Planning	89
<i>Charles Skipper, Lansford Bell</i>	
Integrated Practice: The Road Ahead	99
<i>Eddy M. Rojas, Susan Locsin</i>	

TECHNOLOGIES TO IMPROVE PROJECT PLANNING, DESIGN, CONSTRUCTION

Virtual Design And Construction: Preventive Innovation Or Construction Management Planning Aid?	107
<i>Timo Hartmann, Martin Fischer</i>	
A New Modeling Methodology For Construction Project Planning	115
<i>Ian Flood, Raja R. A. Issa, Liu Wen</i>	
Hierarchical Modeling Of Design Information Using Dependency Structure Matrix	124
<i>Senthil Kumar, Koshy Varghese</i>	

SUSTAINABLE CONSTRUCTION & FACILITIES

A Study on LCCA Application on Measuring the Cost of Sustainable Design	132
<i>Wai Chong, Sanat Kumar Pokharel, Cassandra Leyden, Yong Bai</i>	
Social Impact Metrics For Sustainable Construction And Infrastructure	140
<i>Chris Hendrickson</i>	

Green Building Construction: Cost/Benefit Analysis Of A Precast Concrete Manufacturing Plant.....	148
<i>Robert Ries, Melissa Bilec, Kim Lascola Needy, Nuri Mehmet Gokhan</i>	

SESSION 2

AUTOMATED/REAL-TIME SYSTEMS FOR PROJECT CONTROL

Technological Framework To Improve On-Site Communication And Construction Productivity.....	156
<i>Kasun Naranja Hewage, Janaka Yasantha Ruwanpura</i>	
Lessons-Learned From RFID Applications In The Korean Construction Industry.....	166
<i>Sangyoon Chin, Suwon Yoon, Cheolho Choi, Soon-Wook Kwon, Yea-Sang Kim, Chul Soo Kim</i>	
A Framework For Georeferencing Based Automated Retrieval Of Contextual Project Information On Construction Sites.....	174
<i>Hiam Khoury, Vineet Kamat</i>	
An Information Structure For Construction Operations Management.....	183
<i>Craig Capano, Saeed Karshenas</i>	

PROCUREMENT & CONTRACTING

Competing Beyond Design-Build.....	192
<i>Stephen Mulva</i>	
Use Of Design-Build On Highway Projects.....	200
<i>John Schaufelberger</i>	
Comparison Between Design-Build And Design-Bid-Build Transportation Projects Using Lane Mile Data.....	207
<i>Pramen Shrestha, Giovanni Migliaccio, James O'Connor, G. Edward Gibson</i>	
Comparison Of Contract General Conditions: U.S. AIA-A201 vs. China GF-1999-0201.....	216
<i>Ka Wah Chui, Yong Bai</i>	

TECHNOLOGIES TO IMPROVE PROJECT PLANNING, DESIGN, CONSTRUCTION

4D CAD Via Linear Planning And 3D CAD.....	225
<i>Ngoc Tran, Alan Russell, Sheryl Staub-French</i>	
Framework To Enable Dynamic State Control Of Discrete-Event Simulation Models To Enhance Model Validation.....	235
<i>Prasant Rekapalli, Julio Martinez</i>	
GSIM: An Application For Geometry-Integrated Simulation For Construction Planning.....	244
<i>Ragip Akbas, Martin Fischer</i>	

SUSTAINABLE CONSTRUCTION & FACILITIES

A Tool For Assessing Environmental Impacts In Construction.....	252
<i>Mohamed Marzouk, Magdy Madany, Azza Abou-Zied, Moheeb El-Said</i>	
Effective Metrics For High Performance Green Building Delivery.....	262
<i>Sinem Korkmaz, David Riley, Michael Horman</i>	
Transforming Sustainable Project Delivery By Establishing Project Design And Management Expectations In The Request For Proposals.....	270
<i>Peter Dahl, Michael Horman</i>	

SESSION 3

EDUCATION

The Engineering Doctorate In Construction: An Innovative Approach To Knowledge Exchange Between Industry And Academia.....	278
<i>Chimay Anumba</i>	

Developing A Construction Engineering Program From The Ground Up	286
<i>G. Edward Gibson, Kenneth Fridley, Philip Johnson</i>	
Path Toward Improvement Of The Professional Engineering Licensure Process For Construction Engineers	295
<i>David Johnston, Michael Qwyn</i>	
Semi And Fully Immersive Technologies And Collaboration Suites For Design And Construction Research And Education	303
<i>Carrie Sturts Dossick, Eddy M. Rojas, Brian Wiersema</i>	

PROCUREMENT & CONTRACTING

Project Performance Due To Type Of Delivery Method For The United States Army Corps Of Engineers	309
<i>Matthew Luzzatto, Angela Guggemos, Mostafa Khattab</i>	
Investigating Delivery, Procurement And Contracting Relationships In Healthcare Facility Construction	319
<i>Russell Manning, John I. Messner</i>	
Implementing Best Value Concepts Into The Low Bid Environment	328
<i>Kenneth Sullivan</i>	
Contractors' Experiences And Perceived Impediments In Public-Private Partnerships	335
<i>Ahmed Abdel Aziz, Ashley Anderson Kangas</i>	

TECHNOLOGIES TO IMPROVE PROJECT PLANNING, DESIGN, CONSTRUCTION

A Schematic Design Cost Management System	344
<i>Saeed Karshenas</i>	
Automated Air Pockets Detection For Architectural Concrete Inspection	353
<i>Supat Suwwanakarn, Zhenhua Zhu, Ioannis Brilakis</i>	
A Management Information System For Subway Tunnel Maintenance	361
<i>Veerasak Likhitruangsilp, Photios Ioannou</i>	

PROJECT RISKS & SAFETY

Factors Impacting Safety In Construction	369
<i>Brenda McCabe, Catherine Loughlin, Susan Tighe, Douglas Hyatt</i>	
Work Practices Of High Reliability Crews: An Exploratory Study	378
<i>Panagiotis Mitropoulos, Gerardo Cupido</i>	
Highway Work Zone Safety Guidelines And Implementation Issues	387
<i>Jonathan Shi, Zongzhi Li, Helen Zhou</i>	

SUSTAINABLE CONSTRUCTION & FACILITIES

The Challenge Of Correlating Air Monitor Data With Construction Site Activity: A Pittsburgh Case Study	395
<i>Aurora Sharrard, Ashley Nikithser, Corinne Scown, H. Scott Matthews, Melissa Bilec</i>	
Optimizing Prefabrication Strategy Selection for Sustainable Projects	404
<i>Yupeng Luo, David Riley, Michael Horman, Gul Kremer</i>	
Building Green: A Case Study at the University of South Carolina	412
<i>Denise Grant, Liv Haselbach</i>	
AHP-Based Selection Model For Best Sustainable Practices for Construction Projects	420
<i>Suhasini Hyderabad, Susan Bogus</i>	

SESSION 1

AUTOMATED/REAL-TIME SYSTEMS FOR PROJECT CONTROL

A Framework For Automated Localization Of On- Site Construction Components.....	428
<i>David Grau, Carlos Caldas</i>	
Real-Time Tracking And Analysis Of Construction Operations.....	436
<i>Yunyi Su, Liang Liu</i>	
Project Progress Measurement Using Cad-Based Vision System.....	444
<i>Lingguang Song</i>	
A Planning Based Approach For Fusing Data From Multiple Sources For Productivity Monitoring.....	452
<i>Anu Pradhan, Burcu Akinci</i>	

PROCUREMENT & CONTRACTING

Expectations For Accuracy In Highway Design-Build Cost Estimates.....	461
<i>Keith Molenaar, Spencer Won, Rick Smith</i>	
Concession Projects In Social Infrastructure: How To Define Whether They Are Working?.....	471
<i>Anneloes Blanken, Geert Dewulf, Mirjam Bult-Spiering</i>	
Total Customer Satisfaction – Introducing A Dynamic Measurement Model For Construction Consultants.....	480
<i>Alex Copping, Vikram Bhujun</i>	
Projects Cash Flow Factors – Contractor Perspective.....	489
<i>Alaa Al Issa, Tarek Zayed</i>	

PROJECT RISKS & SAFETY

Beginning Construction Under Design Uncertainty.....	498
<i>Nicolas Blacud, Susan Bogus, Keith Molenaar, James Diekmann</i>	
The Future Of Designing For Construction Safety.....	506
<i>T. Michael Toole, John Gambatese</i>	
Safety Performance Indicators For Construction Projects.....	513
<i>Sun-Ju An, Hyun-Soo Lee, Moonseo Park, Sang-Hoon Song</i>	
Sustainable Construction Safety And Health Rating System - A Feasibility Study.....	523
<i>Sathyanarayanan Rajendran, John Gambatese</i>	

PROJECT PLANNING & CONTROL

Critical Activities In The Front End Planning Process.....	531
<i>Ryan George, Lansford Bell, W. Edward Back</i>	
Cost Prediction Of Highway Projects Using Regression.....	540
<i>Ahmed Abdel Aziz</i>	
Framework For Evaluating The Effect Of Pre-Construction Planning And Project Management On Performance.....	549
<i>Cindy Menches</i>	
Estimating Minimum Acceptable Claim Amount In Negotiation Process.....	557
<i>Mohamed Marzouk, Mohamed Moamen</i>	

SUSTAINABLE CONSTRUCTION & FACILITIES

Exploring The Relationships Between Transparency, Sustainable Building Delivery, And Process Mapping.....	567
<i>Leidy Klotz, Michael Hornan, David Riley, John Bechtel</i>	
Modeling Framework For Sustainable Underground Infrastructure Construction.....	578
<i>Dae-Hyun Koo, Samuel Ariaratnam</i>	

Building Consensus On The Environmental Impacts Of Construction Using An Input-Output-Based Hybrid Life Cycle Assessment Model	586
<i>Aurora Sharrard, H. Scott Matthews</i>	
Preliminary Study of Green Design and Project Delivery Methods in the Public Sectors	595
<i>Melissa Bilec, Robert Ries</i>	

SESSION 2

PROJECT/PROCESS INTEGRATION & IMPROVEMENT

Comparative Analysis of Infrastructure Assessment Methodologies at the Small Unit Level	604
<i>William O'Brien, Marc Distefano</i>	
Development Of A Productivity Information Management System Using Data Warehousing For Construction Organizations.....	616
<i>Salman Azhar</i>	
Construction Process Data + Visualization Tools = Performance Insights.....	624
<i>Chao-Ying Chiu, Alan D. Russell</i>	
Developing Dynamical Network-Based Experience Management System For Construction Projects.....	633
<i>Yu-Cheng Lin, Shu-Hui Jan</i>	

EDUCATION

Cultivating Leaders For The Construction Industry.....	642
<i>Mike Garvin, Tony Songer</i>	
Demonstrating Construction Productivity Using CPG.....	650
<i>Kris Mattila, Ke Li</i>	
On-Campus Construction As A Teaching And Research Environment	658
<i>Philip W. Johnson, Tim Leopard, Pauline Johnson, G. Edward Gibson Jr., Qingbin Cui</i>	
Creating An Educational Ecosystem For Construction: A Model For Research, Teaching, And Outreach Integration And Synergy.....	665
<i>Annie Pearce, Andrew McCoy</i>	

ORGANIZATIONAL LEADERSHIP & MANAGEMENT

Research Methods For Organizational Research In AEC	674
<i>Constantine Katsanis</i>	
Aligning Innovations To Design And Construction Networks.....	683
<i>John Taylor, Ray Levitt</i>	
Benchmark Of Innovation In The Architecture/Engineering/Construction Industry	693
<i>John Gambatese, Matthew Hallowell, David Sillars</i>	
The Knowledge Management To Learning Organization Connection.....	701
<i>Paul Chinowsky, Patricia Carrillo</i>	

VOLUME 2

PROJECT PLANNING & CONTROL

Using Association Rules As A Predictive Indicator Of Project Cost Overruns.....	709
<i>Trefor Williams</i>	
Assessment Of Different Feasible Construction Project Schedules	717
<i>Jonathan Shi, Bin Wang</i>	
Finance-Based Scheduling: A Potential Enhancement Of Construction Scheduling Techniques.....	725
<i>Ashraf Elazouni</i>	
Optimizing The Graphical Arrangement Of Network Construction Schedules	735
<i>George Anton, Gunnar Lucko, Abdulhamit Duzkale</i>	

LEAN CONSTRUCTION

A Qualitative Evaluation Of Construction Supply Chain Visual Process Modeling Tools	744
<i>Marcelo Azambuja, William O'Brien</i>	
A Two-Level Programming Method For Collaborative Project Scheduling In Supply Chain Environment	753
<i>Haiqiang Wang, Xiaolong Xue, Yaowu Wang, Qiping Shen</i>	
Redesign Production Process In Residential Construction Using Value Stream Mapping	761
<i>Haitao Yu, Tarry Tweed, Mohamed Al-Hussein, Reza Nasser</i>	
Ten-Week Testing Model To Improve Construction Productivity	771
<i>Xin Liu, Janaka Yasantha Ruwanpura</i>	

SESSION 3

MANAGING PROGRAMS & COMPLEX PROJECTS

Construction Programme Management - Current Context	780
<i>Mohamad Syazli Fathi, Chimay Anumba, Patricia Carillo, Zeeshan Aziz</i>	
Construction Challenges In Maglev Transport	788
<i>F. H. Griffis</i>	
Evaluation Of Outsourcing Of Project Delivery By The Oregon Department Of Transportation	797
<i>Matthew Hallowell, David Rogge</i>	
A System-Of-Systems (SoS) Approach To Effective Organizational Decision-Making For Civil Infrastructure Project Selection	806
<i>Reid Vander Schaaf, Dulcy Abraham, Dan Delaurentis</i>	

EDUCATION

The Case Method In Construction Management Education	817
<i>Kirsten Davis</i>	
Construction Principles For The Future: A Revised Approach To Teaching The Basics	825
<i>Annie Pearce, Dawn Maxey</i>	
Games And Simulations In Construction Engineering And Management: The Pedagogical Perspective	834
<i>Eddy M. Rojas, Namhun Lee</i>	

OPERATIONS, PRODUCTIVITY & WORKFORCE ISSUES

Benchmarking The Contribution Of Labor In Production Homebuilding	843
<i>Howard Bashford, Anil Sawhney, Josh Felt, Derek Koh</i>	
Automatic Climbing Form System Productivity Model	852
<i>Elsayed Mohamed, Tarek Zayed</i>	
Temporal And Spatial Comparison Of Construction Productivity And Cost	865
<i>Kenneth Walsh, Anil Sawhney</i>	
An Integrated Project Planning System For Tsunami Mass Housing In India	873
<i>Ashwin Mahalingam, Koshy Varghese, Anil Sawhney, Sivakumar Palaniappan</i>	

ORGANIZATIONAL LEADERSHIP & MANAGEMENT

Integrated Housing Models in Construction: Why Are They Not Used More Often?	882
<i>Mieke Hoezen, Hans Voordijk, Geert Dewulf, Tim Benschop</i>	
Sharing Knowledge Through Peer Mentoring: A Study Of Professional Grade Staff In Government Works Departments	890
<i>Patrick S. W. Fong, Chiffon S. F. Yeung</i>	
Architectural Ontology: Knowledge Management Resource For Building Design	898
<i>Ajla Aksamija, Francois Grobler</i>	

Understanding Differences In Information Needs Of Expert And Novice Estimators From Construction Project Histories	906
<i>Semiha Kiziltas, Burcu Akinci, Cleotilde Gonzalez</i>	

PROJECT RISKS & SAFETY

Evolving Risk Analysis Techniques: Managing Project Development Risk From A Top-Down Perspective.....	914
<i>David Sillars, Michael O'Connor</i>	
Effect Of Energy Prices And Construction Demand On Highway Construction Cost In The Dallas Area.....	925
<i>Raed Jarrah, James O'Connor</i>	
Accounting For Economy-Driven Project Cost Escalation: Case Study From Venezuela	935
<i>Eloy Lares, Francis Edum-Fotwe, Ronald McCaffer</i>	
Critical Risk Elements During The Advance Planning Phase Of Transportation Infrastructure Projects	943
<i>Tiendung Le, Carlos Caldas, G. Edward Gibson, Michael Thole</i>	

PLENARY PAPER

Why is Construction Education So Backward?	951
<i>Thomas Mills, Yvan Beliveau</i>	

SESSION 1

INFRASTRUCTURE MANAGEMENT & DISASTER MITIGATION

Effective Emergency Contracting Strategies For The U.S. Navy	962
<i>John Jeffrey, Cindy Menches</i>	
A Multi-Constituent Model For Deployment Of Homeland Port Security Screening Systems.....	970
<i>Nathan Pakish, David Sillars</i>	
A Disaster-Survivable Building Blackbox System For Supporting Disaster Response And Recovery.....	982
<i>Min-Hsuan Tsai, Liang Liu, Feniosky Peña-Mora, Carlos A. Arboleda</i>	

OPERATIONS, PRODUCTIVITY & WORKFORCE ISSUES

Model Of Construction Site Sediment Discharge Prevention Performance	990
<i>Lauren Ferrell, R. Edward Beighley, Kenneth Walsh</i>	
Application Of Mistake Proofing In Production Homebuilding.....	999
<i>Howard Bashford, Anil Sawhney, Jeffrey Crane</i>	
A Model Of Productivity Loss Using Multiple Regression.....	1008
<i>Engy Serag, Amr Oloufa</i>	
XCOPE: A Computer System For Explaining Construction Performance	1017
<i>Aminah Robinson, Manjula Dissanayake</i>	

ORGANIZATIONAL LEADERSHIP & MANAGEMENT

Influences Of Hemisphericity Between Design And Construction Engineers	1026
<i>Amarjit Singh, Kamal Gautam, A Singh</i>	
Negotiating Design Collaboration In Architecture: A Case Study Of A European Design Tender.....	1035
<i>Leentje Volker, John L. Heintz</i>	
Opportunities And Challenges In China's Construction Industry Towards Globalization: A Review.....	1043
<i>Huanqing Lu, Danny Lee Morton</i>	
Managing Workplace Conflict: Managing Conflicts Within Large Construction Companies In Ghana	1052
<i>Lily Sena Agbodjah, Theophilous Adjei-Kumi, Andy R J Dainty, Kofi Asempe Manteau</i>	

PROJECT RISKS & SAFETY

The Impacts Of Construction Events On The Capital Cost Of The Channel Tunnel Project	1062
<i>Chen-Yu Chang</i>	
How Facility Delivery Delay Will Affect Project Evaluation	1071
<i>Kun-Jung Hsu</i>	
Risk And Control As Sources Of Trust In Alliance	1079
<i>Ellen Lau, Jason Fung</i>	
Contracting To Appropriately Allocate Risk	1089
<i>Justin R. Swanson, Awad S. Hanna</i>	

SESSION 2

AUTOMATED/REAL-TIME SYSTEMS FOR PROJECT CONTROL

Building A Wireless Infrastructure On Construction Sites Enhances Education And Field Applications.....	1099
<i>Huanqing Lu, Eric Connell</i>	
Real Time Construction Project Progress Tracking: A Utility Function Model For Technology Evaluation And Selection	1108
<i>Amine Ghanem, Yassir Abdelrazig</i>	
Ultra Wideband Positioning System And Method For Safety Improvement In Building Construction Sites.....	1117
<i>Daniel Castro-Lacouture, Javier Irizarry, Carlos A. Arboleda</i>	
Rapid Surveillance Of Trenches For Safety	1125
<i>Jochen Teizer</i>	

PROJECT PLANNING & CONTROL

Floats In RSM: Repetitive Scheduling Method	1133
<i>Rita Awwad, Photios Ioannou</i>	
Proactive Coordination To Reduce Structural Steel Delay	1141
<i>Kamlesh Bhagnani, Sanghyun Lee, Feniosky Peña-Mora, Philip Helmes</i>	
AEC Tolerance Management Theory	1149
<i>Colin Milberg</i>	
Space Availability Approach To Planning And Staffing Construction Activities	1157
<i>Hazar Dib, Raja R. A. Issa, Ian Flood</i>	

TECHNOLOGIES TO IMPROVE PROJECT PLANNING, DESIGN, CONSTRUCTION

Factors Influencing The Use Of Interorganisational ICT In Dutch Construction Projects	1165
<i>Arjen Adriaanse, Hans Voordijk, Geert Dewulf</i>	
Design And Development Of An Operational Project Management System For A Public Works Authority	1174
<i>Ihab Saad, Taher Abdel-Moneim</i>	
Improving The Risk Management Process Using IT	1183
<i>Cheryl Nelms, Alan Russell</i>	

ORGANIZATIONAL LEADERSHIP & MANAGEMENT

Technology Strategy In Road Construction: Customer Orientation Or Cost Focus?	1192
<i>Jasper Caerteling, Johannes Halman, André Dorée</i>	
An Implementation Strategy For Integrated Enterprise Systems In Construction	1200
<i>Booyoung Chung, Miroslaw J. Skibniewski</i>	
Market Share, Business Practices, And Union/Non-Union Differences For Wisconsin Electrical Contractors	1211
<i>G. D. Roth, Awad S. Hanna</i>	

Identifying Attributes Of Change Initiators In Construction Project Environments	1218
<i>Stan F. H. M. Van De Mortel, Francis Edum-Fotwe, Emilia Van Egmond, Uwe Matzat</i>	

QUANTITATIVE METHODS & MODELS

Risk Modeling Of Greenfield BOT Project Uncertainties: The General Variance Model	1225
<i>Nicola Chiara, Mike Garvin</i>	
Fuzzy Decision Support Model For Macro-Level Urban Infrastructure Routing	1233
<i>Hesham Osman, Tamer El-Diraby</i>	
Post-Disaster Optimization Of Temporary Housing Efforts	1244
<i>Omar El-Anwar, Khaled El-Rayes</i>	
Developing Project Performance Measurement Framework Of Data Visualization Of Earned Value Management System	1252
<i>Jui-Sheng Chou, Wai Chong</i>	

SESSION 3

PROCUREMENT & CONTRACTING

Legal Implications Of Performance Based Warranties In Highway Construction	1260
<i>Elizabeth Sees, Qingbin Cui, Philip Johnson, Ronald Baldwin</i>	
Technology Transfer In BOT Projects	1268
<i>Antonio Levy</i>	
Contractor Cash Flow And Profitability Analysis Between Best Value And Low Bid	1277
<i>Kenneth Sullivan</i>	
Assessment Of The Performance Of The Contracts And The Contractors	1285
<i>Jonathan Shi, Ray Lemming, Deepak Nathani</i>	

TECHNOLOGIES TO IMPROVE PROJECT PLANNING, DESIGN, CONSTRUCTION

Capturing Expertise In The Form Of User Specified Causal Models	1293
<i>Mingen Li, Alan Russell</i>	
RFID Tracking And Laser Scanning To Increase The Productivity Of Off-Shore Pipe Fitting	1303
<i>Brett D. Vogt, Jochen Teizer</i>	
A Case Study on Using 4D Modeling for Renovation Planning	1312
<i>Peggy Ho, Calvin Kam, Martin Fischer</i>	
Productivity Analysis Of A Multi-Task Autonomous Robot For Concrete Paving	1322
<i>L. Sebastian Bryson, Daniel Castro-Lacouture, Christopher Maynard, Robert L. Williams, Paul Bosscher</i>	

ORGANIZATIONAL LEADERSHIP & MANAGEMENT

Foreign Market Entry Modes In Construction	1330
<i>Suat Gunhan, David Ardit</i>	
Design By Sourcing, How To Create Variety Economically	1340
<i>Erwin Hofman, Johannes Halman, Hans Voordijk</i>	
Modelling Actors And Roles For AEC Community	1351
<i>Tamer El-Diraby, Jinyue Zhang</i>	

QUANTITATIVE METHODS & MODELS

Assigning Membership In Fuzzy Set Analysis For Construction Management Applications	1359
<i>Aminah Robinson, Manjula Dissanayake</i>	
Measuring And Quantifying Lighting Glare During Nighttime Highway Construction Projects	1369
<i>Khaled El-Rayes, Liang Liu, Ibrahim Odeh</i>	
A System Dynamics Model To Evaluate The Impact Of Uncertainty On ADR Investments In AEC Projects	1377
<i>Carol Menassa, Feniosky Peña-Mora</i>	

Mathematical Analysis Of Linear Schedules	1387
<i>Gunnar Lucko</i>	
Construction Productivity Improvement: Accessing Untapped Resources	1396
<i>Jiukun Dai, Paul M. Goodrum, William F. Maloney</i>	
Information Technology Deployment in Construction Industry: Legal Barriers	1405
<i>Y. Nielsen</i>	
Author Index	