

Canadian Society for Civil Engineering

Annual Conference
of the Canadian Society
for Civil Engineering
2006

“Towards a Sustainable Future”

May 23-26, 2006
Calgary, Alberta, Canada

Volume 1 of 4

Printed from e-media with permission by:

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

ISBN: 978-1-60423-311-7

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

DISCLAIMER

The papers herein are published in the form submitted by the authors. Minor editorial changes have been made where obvious errors and discrepancies were detected, and to standardize visual presentation.

The opinions expressed in the papers are solely those of the authors. Neither the Canadian Society for Civil Engineering nor the Organizing Committee accepts responsibility for the accuracy of the statements made by the authors. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

Published by

The Canadian Society for Civil Engineering
4920 de Maisonneuve O., Suite 201
Montréal, Québec, Canada H3Z 1N1
Tel.: (514) 933-2634, Fax: (514) 933-3504
e-mail: info@csce.ca, web: <http://www.csce.ca>

TABLE OF CONTENTS

Volume 1

GENERAL CONFERENCE

Comparison Study of Member Stiffness Using Theoretical and Finite Element Method	1
<i>N. Rasti</i>	
Physical Modelling of Headworks: A Design Tool for Small Hydro	10
<i>S.V. Thapa</i>	
David Thompson and George Back: Mappers of the Northwest	20
<i>K.R. Johnson</i>	
Design and Winter Construction of Sewage Lagoon Discharge Pipeline in Landslide Area near Fort Smith, NWT	27
<i>K.R. Johnson</i>	
Highway Life Cycle Management: Pricing and Risk Allocation	35
<i>S. Parche</i>	
Effect of Grid Spacing on the Prediction of Oscillatory Boundary Layer Properties Using k-e Model	45
<i>Abdul Razzaq Ghumman, Ahmad Sana, Muhammad Ali Shamim</i>	
Effect of Latin Hypercube Sampling Sample Size on Uncertainty Analysis of a Tier 3 RBCA Model – MOFAT	53
<i>A. Khan, T. Husain, L.M. Lye</i>	
Cement and Concrete Role towards Sustainable Development	62
<i>A. Vizer</i>	
SPATIORAGE: Analyse spatiale et temporelle de la précipitation en milieu urbain	70
<i>L. Jolliet, N. El-Jabi, J.-M. Ribí</i>	
The Changes in Low-Temperature Grades of Asphalts upon Aging	75
<i>S. Ho, J. Chow, L. Zanzotto</i>	
A Mechanism for Asset Management Integration	84
<i>L. Cowe Falls, R. Haas, S. Tighe</i>	
Accelerated Pavement Testing in Canada	93
<i>S. L. Tighe, L. Cowe Falls, G. Dore</i>	
An Econometric Model of Infrastructure Investments and Science Park Development	104
<i>K.-J. Hsu</i>	
Analysis of Long-Term Rainfall to Develop Stormwater Quality Flow Rate Design Criteria	112
<i>B. Lee, F. Tonto, P. Tov</i>	
Application of Geographic Information Systems to Identify Sources of Water Pollution Areas in a Drainage Basin	121
<i>M.H. Woo</i>	
Civil Engineering History and Ethics	125
<i>R. Hamilton</i>	

Comparison of Storm Water Quality Treatment Guidelines and Critical Structural Best Management Performance Factors and Parameters to Consider	128
<i>P. Tov, B. Lee, F. Tonto</i>	
Comportement des barrages en enrochement avec masque amont en béton de ciment fondes sur des alluvions granulaires	134
<i>M. Massiéra, J. Vautour, Y. Coulibaly, Y. Hammamji, A. Szostak-Chrzanowski</i>	
Disinfection of New and Rehabilitated Water Mains – A Review of Various Practices	144
<i>M. Mathrani, R.H. Boon</i>	
Experimental Study on the Improvement of Bank Protection Structures under Wave Action	149
<i>S. Masoom, M. A. Matin</i>	
Engineered Phytotechnologies for Urban Restoration: Re-greening China's Cities	158
<i>B.C. Anderson, Y. Zhong, L. Zhang, X. Ruan, W. Ren</i>	
Use of Ozone for Drinking Water Disinfection in Canada	168
<i>A.R. Bale, M. Mathrani</i>	
Treatment of Sewer Gas Odours with a Biofilter and Carbon Adsorber	171
<i>C. Jeng, B.R. Rogers, W. Pelz, J. Fiala, C. Wards</i>	
Rubble Pile-up and Ride-up Observations	180
<i>M. ElSeify, T.G. Brown</i>	
Links between Pacific Climate Variability and Low-Frequency Hydroclimatic Variability in Southern Alberta	187
<i>A.K. Gobena, T.Y. Gan</i>	
Application of Large Scale At-Grade Sewage Treatment and Disposal in Fort Good Hope NWT	201
<i>K.R. Johnson, A. Agha, M. Mathrani</i>	
Residential Construction and Its Impact on Sustainable Development	208
<i>D. Mah, M. Al-Hussein</i>	
The Relationships between DHV and Holiday Traffic Peaking for Various Types of Roads	217
<i>Z. Liu, S. Datla, S. Sharma</i>	
Pilot Testing of the AmmEL-HC System for Ammonia Removal from Biosolids Centrate	228
<i>I.D. Buchanan, L. Su, L. Seed, G. Shelp</i>	
Removal of Disinfection By-Products by a Point-of-Use Activated Carbon Treatment Unit	237
<i>E. Smith, B. Emam</i>	
More Sustainable Curtain Wall Systems: Using a Solar Dynamic Buffer Zone (SDBZ) to Reduce Energy Costs	247
<i>R. Richman, K.D. Pressnail</i>	
Is Urban Diversity Synonymous with Urban Sustainability? What do people “suggest” for Clerkenwell in London?	257
<i>I. Perdikogianni, A. Penn</i>	
Two-Dimensional Hydrodynamic Modeling of the Saskatchewan River below E.B. Campbell Hydroelectric Dam – A Case Study	268
<i>A. Watanabe, Y.C. Jin, C. Katopodis</i>	
The Assessment of Life Cycle Management in Construction Industry	277
<i>L.-k. Lin, C.-c. Chang, H.-c. Lin</i>	
Effect of Simulating Environmental Factors on Stripping Evaluation of Asphalt Pavements	286
<i>A. Mostafa, A.O. Abd El Halim, S. Easa, A. Eldesouky</i>	

Evaluation of Pavement Deterioration in the Province of Alberta	296
<i>A. Abdelfattah, L. Cowe Falls</i>	
An Early Evaluation of the Initial Canadian Experience with Warm Asphalt Mix	305
<i>A. Johnston, M. Da Silva, H. Soleymani, C.K. Yeung</i>	
Resistance of a Single Spur Dike in an Open Channel	315
<i>H. Azinfar, J.A. Kells</i>	
Direct Measurement of the Impact of Heavy Loads on Thin Membrane Pavements	325
<i>A. Hamad, L. Cowe Falls</i>	
Updating of the CSCE Guidelines on Sustainable Development.....	336
<i>A. Perks, B.C. Burrell, B. Korol, A. Khan, J. Heroux, L. Ford</i>	
A Statistical Study on the Learning Styles and Teaching Approaches in Civil Engineering Education in Xi'an University of Architecture and Technology	346
<i>M. Lu, F. Lin, M.Y. Leung, Y. Song</i>	
Modeling of Advective-Dispersive-Reactive Contaminant Transport in Saturated Zone Using Fuzzy Set Theory	354
<i>D.G.M. Senevirathna, G. Achari, F.King</i>	
Numerical Modeling of Gas, Heat and Moisture Transport in Landfills	363
<i>A. Garg, G. Achari</i>	
Sustainability-Related Courses in Canadian Engineering Programs.....	372
<i>T. E. El-Diraby, B.C. Burrell, H.T. Chan, V. Komarnicki</i>	
Investigating Efficiency of Statewide Continuous Traffic Monitoring Program and A Discussion About AASHTO Minimum Data Requirements.....	382
<i>M. Zhong, S.C. Sharma, S. Datla</i>	
Multi-Criteria Decision Making In Fuzzy Environment.....	392
<i>S. Chowdhury, P. Champagne</i>	
A Multimedia Model for Risk assessment of Landfill Emissions.....	403
<i>R.R. Zhang, Z. Chen</i>	
Three-Dimensional Roller of Spatial Submerged Hydraulic Jump	413
<i>H.K. Zare, R.E. Baddour</i>	
Comparison of Two Finite Element Models of a Human Tibia	423
<i>M.A. Whitty, G. Akhras</i>	
Dingman Pump Station Sanitary Storage Facility: Optimizing Existing and Future Sanitary Services through Large Volume Storage Detention	433
<i>J.A. Dann</i>	
A Generic Database Model for SHM Applications from Experiences in Monitoring of the Confederation Bridge	440
<i>D.N.Tiwari, T.G. Brown</i>	
Comparative Analysis of Guidelines on Sustainable Development	450
<i>A. Khan, L. Ford, B.C. Burrell, J. Heroux, A. Perks, B. Korol</i>	
Submerged Membrane Bioreactor Configurations for Biological Nutrient Removal Process	460
<i>J. Mouthon-Bello, H. Zhou</i>	
Use of Ozone as a Sanitizer to Wash Fresh Agricultural Products	470
<i>Kuangji Wei, Hongde Zhou</i>	
Stochastic Analysis of User Costs.....	479
<i>A. Deshpande, O. Salem, A. El-Assaly</i>	
Riprap Protection against Local Scour.....	491
<i>M.A.F. Sadeque, M.M. Hossain</i>	

Seismic Hazard Analysis (SHA) and Developing the Uniform Hazard Spectra (UHS) for one Site of Islamic Azad University (IAU) in Iran	501
<i>M. Firoozi Nezamabadi, F. Yaghoobi Vayeghan</i>	
Reliability Analysis of Rigid Marine Riser	509
<i>M. Nazir, F. Khan, P. Amyotte</i>	
Diffusion Coefficient of Methane in Compost Amended Landfill Final Cover Soil	518
<i>D. Pokhrel, J.P.A. Hettiaratchi, B. K. Rajbhandari</i>	
Managing Risk with Infrastructure Management Systems	526
<i>K.J. Kostuk, G.A. Sparks</i>	
Advancement of a New Accurate Foundation Concept	534
<i>S.P.G. Moonen</i>	
A Direct Optimization Approach for Identification of Dynamic Characteristics of Vibrating Structures.....	543
<i>L. Li, F. Ghrib</i>	
Environmentally Compatible Design of Structures	552
<i>N.K. Srivastava, A.-M. Laroche</i>	
Biodegradation of High Moisture and Organic Content Solid Waste in Bioreactor Landfills	561
<i>H. Jin, M. Warith</i>	
Biodegradation of Municipal Solid Waste in Aerobic Bioreactor	571
<i>H. Jin, M. Warith</i>	
Sustainable Landfilling in Northern Climates: The Calgary Biocell Project	581
<i>J.P.A Hettiaratchi, M.D.N. Perera, D. Davies, N. Richards, J. Hundal</i>	
Earthquake Response of Concrete Arch Dams in Time Domain	589
<i>A.R.S. Barikani, M. Hashemiravan</i>	
Streamflow Measurements in the Oil Sands Region of Northeastern Alberta	597
<i>M. Ashiq, F. Ade</i>	
Heavy-Metal Removal from Petroleum Oily Sludge Using Lemon-Scented Geraniums	607
<i>A. Badawieh, M. Elektorowicz</i>	
Heavy-Metals Removal from Oil Sludge Using Ion Exchange System.....	614
<i>M. Elektorowicz, Z. Musla</i>	
A Numerical Model to Predict Settlements and Moisture Distribution in Bioreactor Landfills	623
<i>C.H. Hettiarachchi, J.N. Meegoda, J.P.A. Hettiaratchi</i>	
Adaptation of SUPERPAVE Asphalt Concrete Mix Design Procedure to Jordan Climatic and Traffic Conditions.....	632
<i>I. Asj, F. Elayan</i>	
Achieving LEED® Credits With Segmental Concrete Pavement	643
<i>Rob Burak</i>	
Analysis of Ambient Air Quality Trends at Selected West Central Airshed Society Stations: Tomahawk and Carrot Creek.....	652
<i>N. Haque, M. Gamal El-Din, W.B. Kindzierski</i>	

Volume 2

Establishment of Ambient Air Quality Trends Using Historical Monitoring Data from Edmonton and Fort McKay, Alberta.....	661
<i>K. Faisal, M. Gamal El-Din, W.B. Kindzierski</i>	

Removal of Diphenylamine from Water by Enzymatic Treatment with Laccase and Color Removal Using Sodium Lauryl Sulfate and Alum	670
<i>B. Saha, N. Biswas, J.K. Bewtra, K.E. Taylor</i>	
Optimization of the Reaction Conditions for Enzymatic Removal of 2,4-Dimethylphenol from Wastewater	678
<i>J.P. Ghosh, N. Biswas, J.K. Bewtra, K.E. Taylor</i>	
Heavy Metals Concentrations in Lake Erie’s Western Basin Sediments	685
<i>S. Elsayed, N. Biswas, I. Al-Aasm, M. Orlandea</i>	
Implications and Trends of Siloxanes in Landfill and Wastewater Biogases	696
<i>E.A. McBean</i>	
Chlorine Residual Decay in Water Distribution Systems	697
<i>J. Huang, E.A. McBean</i>	
Wavelet, Scaling and Multifractal Analysis of Southwestern Canadian Precipitation Variability and Teleconnectivity	698
<i>A.K. Gobena, T.Y. Gan</i>	
Cellular Concrete: Engineering and Technological Advancement for Construction in Cold Climates	709
<i>B. Dolton, C. Hannah</i>	
Achieving Sustainable Transportation Infrastructure: Role of Intelligent Systems	719
<i>A. Khan, Y. Hu</i>	
Enhancement of the Performance of Bioreactor Landfills Operating under Saline Conditions by Sludge Addition	729
<i>S. Alkaabi, P.J. Van Geel, M.A. Warith</i>	
Making Infrastructure Investment Decisions to Address Canada’s Infrastructure Deficit	738
<i>M. Lemay, M. Carter, D. Danyluk</i>	
Stabilization of Paper Waste in Bioreactor Landfills Using Soybean Peroxidase Enzyme	739
<i>R.K. Sah, M.A. Warith, J.P.A. Hettiaratchi</i>	
General Considerations for Municipal Solid Waste Management as a Strategic Subject for Urban Sustainability	740
<i>A. Gómez-Pedroso, L. Garrido</i>	
Characterization of Chromite Ore Processing Residue	749
<i>W. Kamolpornwijit, J.N. Meegoda</i>	
 1ST SPECIALTY CONFERENCE ON DISASTER MITIGATION	
Fiber Reinforced Polymers for Blast Mitigation of Existing Structures	750
<i>P. Milligan, S. Witt</i>	
Ductal® - An Ultra-High Performance Material for Resistance to Blasts and Impacts	757
<i>B. Cavill, M. Rebentrost, V. Perry</i>	
Behaviour of Steel Anchors under Impulse-type Loading	767
<i>A. Braimah, E. Contestabile, R. Guilbeault</i>	
Vulnerability Assessment of Arizona’s Critical Infrastructure	776
<i>T. White, S. Ariaratnam, K. Knutson</i>	
Emergency Response Planning for a Second Catastrophic Rock Slide at Turtle Mountain, Alberta	787
<i>C.R. Froese, G. Carter, W. Langenberg, F. Moreno</i>	
Reduction in Fire Resistance of Steel Beams Due to Partial Fire Protection Loss	796
<i>Y. Kang, H. A. Khoo, G. V. Hadjisophocleous</i>	

Understanding the Propagation of Fractures and Failures Leading to Dangerous and Destructive Snow Avalanches: Recent Developments	806
<i>D. Gauthier, J.B. Jamieson</i>	
Tornado Hazard Assessment for Overhead Power Transmission Lines in Southern Ontario.....	815
<i>S.S. Banik, H.P. Hong, G.A. Kopp</i>	
Lessons Learned from Application of Progressive Collapse Guidelines o Highrise Building Design.....	824
<i>G. Birkle, B. Schroeder, J. Gilliland</i>	
Developing a Risk Analysis Procedure for Post-Wildfire Mass Movement and Flooding in British Columbia	834
<i>P. Jordan, K. Turner, D. Nicol, D. Boyer</i>	
Integral Avalanche Risk Management – a case study from Davos, Switzerland	844
<i>N. Bischof, M. Bründl, A. Guler, L. Stoffel</i>	
A Research Framework for Assessing Critical Infrastructure Designs to Maximize Protection from an Internal Chemical or Biological Attack	855
<i>V. Nakano, W. Croisant Jr., D. Abraham</i>	
Simulation as a Tool to Assess the Vulnerability of the Operation of a Health Care Facility.....	865
<i>C. Arboleda, D. Abraham, R. Lubitz</i>	
Progressive Collapse for Reinforced Concrete Buildings.....	875
<i>R. El-Hacha, B. Bullock</i>	
Framework for Research into Disaster Response for Critical Infrastructure Reconstruction.....	888
<i>R. Vander Schaaf, D. Abraham</i>	
Tsunami Hydrodynamic Impact Forces on Physical Infrastructures in Thailand and Indonesia	896
<i>I. Nistor, M. Saatcioglu, A. Ghobarah</i>	
A Brief Overview of Landslide-Generated Tsunamis Affecting North America	906
<i>A. Blais-Stevens, M. Geertsema, J.W. Schwab, B.D. Bornhold, D.C. Mosher</i>	
Landslides Impacting Linear Infrastructure in West Central British Columbia.....	917
<i>M. Geertsema, J.W. Schwab, A. Blais-Stevens</i>	
The “Three Little Pigs” Full-Scale Testing Facility.....	927
<i>G.A. Kopp, F.M. Bartlett, J. Galsworthy, D. Henderson, H.P. Hong, D.R. Inculet, E. Savory, L.M. St. Pierre, D. Surry</i>	
Retrofitting of Reinforced Concrete Structures against Blast Loads	935
<i>F. Shalouf</i>	
FRP – A Potential Blast Retrofitting Material	945
<i>R. El-Hacha, C. Yuen</i>	
The Effectiveness of Textile Barriers to Attenuate Blast Wave Ingress into Buildings.....	958
<i>P.J. Heffernan, C.C. Moyle, R.G. Wight, K.D. Scherbatyuk</i>	
Assessing the Vulnerability of Infrastructure to Extreme Weather Events and Related Climate Change Impacts	966
<i>D. Danyluk, J. Nodelman, D. Lapp</i>	
Numerical Analysis of the Response of Blast Loaded GFRP Retrofitted Concrete Slabs.....	967
<i>A.G. Razaqpur, W. Mekky, W. El-Dakhakhni, A. Tolba, E. Contestabile</i>	
Emergency Plans Organization in Mexico.....	976
<i>D. Robledo</i>	

1ST INTERNATIONAL CONSTRUCTION SPECIALTY CONFERENCE

Sustainable Utility Infrastructure via Multi-Utility Tunnels	977
<i>C.D.F. Rogers, D.V.L. Hunt</i>	
Target Costing in Construction	987
<i>G. Ballard</i>	
Management Information System Development for Schedule Delay Analysis	997
<i>J.B. Yang, Y.L. Teng</i>	
Benchmarking for Project Development Sustainability Practices	1005
<i>W.K. Chong, C.T. Haas, S. Kim</i>	
Appropriate Scope Definition for Highway Design-Build Projects	1015
<i>K. Molenaar, J. Shane</i>	
Computer Game for Simplified Project Management Training	1025
<i>T. Hegazy</i>	
Simulation-based Risk Management Using Multilevel/Multi-managed Integrated Networks	1033
<i>M. Moussa, J. Ruwanpura, G. Jergeas</i>	
Technology Adoptability and Adaptability Issues Related to Communication in Alberta Commercial Construction Projects	1042
<i>K.N. Hewage, J.Y. Ruwanpura</i>	
Working Efficiencies and Analysis of Non-Tool Time in Alberta Commercial Construction Projects	1054
<i>K.N. Hewage, J.Y. Ruwanpura</i>	
Project Lessons Learned: Implications for an Empirical Study in the Canadian Energy Sector	1064
<i>K. Jugdev</i>	
Estimating Design Costs for Design-Build Transportation Projects	1073
<i>D. Gransberg, C. Lopez del Puerto, K. Robson</i>	
Rationalization and Optimisation Methodologies to Automate Highway Network Programming and Planning	1083
<i>A. El-Assaly, S. Hasham, D. Davidson, J. Price</i>	
Cost Forecast Model for Sewer Infrastructure Network in Edmonton, Alberta	1092
<i>A. El-Assaly, H. Ng, K. Chua, C. Yong, S. Ariaratnam, J. Ruwanpura</i>	
Relating Key Factors to the Performance of Industrial Construction Mega Projects	1101
<i>A. Robinson Fayek, D. Rowan, S. Revay, D. Mousseau</i>	
Robotic Assessment of Lined Concrete Pipe	1110
<i>S.T. Ariaratnam, R. Webb</i>	
Lawyerization of the Engineering and Construction Industry: The Good, The Bad, and The Ugly	1120
<i>Roger Owers, Samuel T. Ariaratnam, Daniel Armstrong</i>	
Factors Affecting Technology Transfer Performance: Evidence from Thailand	1130
<i>T. Waroonkun, R. Stewart, S. Mohamed</i>	
Concreting Productivity Improvements in Alberta on Commercial Construction Projects	1139
<i>S. Peres da Silva, J.Y. Ruwanpura</i>	
Context Sensitive and Sustainable Solutions for Oregon's OTIA III State Bridge Delivery Program – Community Values Shaping a New Generation of Bridges	1147
<i>M. Wolfe, M. Wittmann, J. Neil, K. Wamstad-Evans</i>	

Contractors and Design Risk in Major Civil Works Design/Build Projects	1157
<i>J. Bröchner, U. Håkansson, L. Hässler</i>	
An AI- Based Cost Estimating System for Underground Utility Projects	1166
<i>T. Shehab, E. Nasr, M. Farooq</i>	
Critical Path Scheduling under Resource-Availability and Activity-Interruption Constraints	1172
<i>H.-C. Lam, M. Lu</i>	
New Optimization Approach for Construction Site Layout	1181
<i>S. Easa, F. Sadeghpour, A. Hossain</i>	
A Procedure to Forecast the Maintenance/Repair Costs of Office Buildings	1191
<i>Y. Liu, S. Alkass, S. Al-Jibouri</i>	
The Effect of Construction Duration Delay on Project Evaluation	1199
<i>K.-J. Hsu, H.J. Chien</i>	
A Survey of the Project Extranet Practices in the UK AEC Industry	1207
<i>L.H.J. Chien, K.-J. Hsu</i>	
Application of Radio Frequencies and Wireless Communications for Construction Site Positioning and Vehicle Tracking	1216
<i>M. Lu, W. Chen, X. Shen, H.-C. Lam</i>	
Investigation of Data Formats for the Integration of 3D Sensed and 3D CAD Data for Improved Equipment Operation Safety	1225
<i>F. Bosche, C.T. Haas</i>	
Research and Application of a 4D Construction Planning System for Construction Management	1234
<i>Y. Zhang, J.P. Zhang, J.L. Li, D.P. Wu, W. Lu, D.Y. Wang</i>	
Sustainable Educational Facilities: The Green School (Case Study)	1242
<i>M. Attalla, E. Kamarah</i>	
The Need for Simulation in Civil Engineering Education	1252
<i>M. Mawdesley, S. Al-Jibouri, D. Scott, S.J. Gribble</i>	
Cost Estimation Factors for the Development of an ANN Model for Waste Water and Sewer Installation Services	1259
<i>D.P. Alex, M. Al-Hussein, A. Bouferguène, S. Fernando</i>	
Establishing Effective Project Teams for Design-Build Project Delivery	1270
<i>K. Crawford</i>	
Utilizing the Analytical Network Process for Evaluating the Sustainability Performance of Construction Projects Over Their Life Cycle	1280
<i>V.W.Y. Tam, S. Mohamed, R.A. Stewart</i>	
Evaluation of Physical Waste Levels with Reference to the Stepwise Incentive System in Construction	1288
<i>V.W.Y. Tam, S. Mohamed, R.A. Stewart</i>	
Sustainable Construction Materials and Procedures for U.S. National Park Service Projects	1298
<i>T. Gilchrist, S. Bogus</i>	
Stabilization of Deep, Vertical Slope, Excavation	1308
<i>F. De la Mora, N. Hassón</i>	
Productivity of Tunnel Construction Using Road-Headers	1319
<i>A. Obeidat, H. Al-Barqawi, T. Zayed, M. Amer</i>	

Volume 3

Slip-Form Productivity Analysis for Concrete Silos	1329
<i>M.R. Sharifi, S. Baciú, T. Zayed</i>	
Simulation and Optimization of Prefabricated Steel-Structure Installation Operations	1339
<i>Z.-Z. Hu, J.-P. Zhang, M. Lu, M. Cao, S.-D. Gao</i>	
Development of Landmark Precast Concrete Foundation System for Residential Construction	1348
<i>H. Yu, M. Al-Hussein, R. Nasser, J.J.R. Cheng</i>	
Bridge Risk Assessment Using Neural Networks	1358
<i>T.M.S. Elhag, Y.M. Wang</i>	
Challenges in Transmission Lines Engineering: Innovative Approaches	1366
<i>I. Shoala, S. Cripps, S. Abdelatif Hassanien</i>	
Solutions for Construction of Two Linked Highrise Towers in a Dense Urban Setting	1372
<i>J. Gilliland, B. Schroeder, F. Carinelli, R. Pedersen</i>	
Reasoning About Construction Performance Using Causal Models	1380
<i>A.D. Russell, M. Li</i>	
Knowledge Management – Its Role in Quality Management	1391
<i>K. Zhang, A. Russell, S. Staub-French</i>	
Features of a Risk Management Tool Applied to a Major Building Project	1402
<i>C.E. Nelms, S. De Zoysa, A.D. Russell</i>	
Incorporating Critical Infrastructure Issues into Risk Management Practices	1412
<i>C.S. Burke, C.F. Duffield</i>	
The Performance of Major Australian Projects: A Comparison of PPP Projects versus More Traditional Procurement Strategies	1422
<i>J.P. Fitzgerald, C.F. Duffield</i>	
Quantifying Weather Impacts on Construction Activities – An Application on HDPE Pipeline Installation	1430
<i>A.A. Shahin, Y. Mohamed, S. AbouRizk</i>	
Decision Support System for Quality Control Examination of Welding in Pipe Fabrication	1440
<i>G. Corona-Suarez, M. Al-Hussein, Y. Mohamed, S. AbouRizk</i>	
Why is the Selection of an Appropriate Project Delivery Methodology So Hard?	1450
<i>S. Sweeney, C.F. Duffield</i>	
Construction Site Photography: Virtual Reality vs. The Focus+Context Problem	1460
<i>L. Waugh</i>	
Exploring the Principles of Interactive Collaborative Workspaces	1468
<i>J. Rankin, M. Issa, A.J. Christian</i>	
Design and Application of an Interior Slab Mix Incorporating High Volumes of Waste Materials	1478
<i>L.M. Moore, M.N. Nazir, R.L. Day</i>	
Case Study of Economic and Environmental Life-Cycle Assessment of Roofing Systems	1488
<i>A.A. Guggemos</i>	
Providing Housing in a Developing Country: Sustainability Issues in the Colombian Case	1498
<i>D. Echeverry</i>	

Laboratory and Case Studies of the Use of High-Volume Fly-Ash Concrete in Insulated Concrete-Form Construction	1507
<i>R.L. Day, M.N. Nazir, L.M. Moore</i>	
Cell-Based Representation and Analysis of Spatial Resources in Construction Simulation	1517
<i>C. Zhang, A. Hammad, T. Zayed, G. Wainer</i>	
Navigation Methods for Engineering Applications in Urban Virtual Environments	1527
<i>E. Mozaffari, A. Hammad</i>	
Comparison of Cluster Analysis and Unsupervised-Learning Neural Networks in Classifying Construction Contractors	1535
<i>A. Elazouni</i>	
Investigation into the Relationship between Just-in-time (JIT) Training and Productivity in Building Construction in Indonesia	1545
<i>S. Alwi, S. Kajewski, K. Hampson</i>	
Evaluation of New Mexico Highway 44's Warranty Provisions from a Real Option Perspective	1552
<i>A. Quick, Q. Cui</i>	
Practical Guidelines for a Successful Design-Build Projects Experience	1562
<i>S. Fahmy, G. Jergeas</i>	
Cultural Risks on International Projects	1570
<i>M. Sennara, F. Hartman</i>	
Application of PIP in the Construction Projects for Beijing Olympic Games	1582
<i>G. Wang, X. Yan, G. Jia</i>	
Towards Building Sustainable Concrete Pavements	1593
<i>A. Mukherjee, H. Muga, T. Van Dam</i>	
A Comparison of the Effects of Time Clauses in Private and Public Contracts on Projects' Construction Duration	1603
<i>A. El-Assaly, M. Farag, O. Salem, S. Fahmy</i>	
Difficulties in Implementing Project Partnering – A Case Analysis of a Public Sector Housing Project	1619
<i>A.P.C. Chan, D.W.M. Chan, L.C.N. Fan, P.T.I. Lam, J.F.Y. Yeung</i>	
P3 Projects and the Changing Roles of Consulting Engineers	1627
<i>E. Drimoussis, G. Webster</i>	
An Example of a Project Management Training Program in a Developing Country	1636
<i>M. Mortaheb, A. Aghajani, J. Ruwanpura</i>	
Problems Created on Delayed Supply of Feedstock for the HDPE Plant of Jam Petrochemical Complex (JPC) in Iran -A Case Study	1645
<i>S. Etemadzadeh, M. Mortaheb, H. Beigi</i>	
Discrepancies in Measuring Project Progress	1655
<i>F. Khoramshahi, M. Sohrabi, M. Mortaheb</i>	
Managerial Challenges Involved in Construction of Mega Petrochemical Projects in Developing Countries	1665
<i>H. Beigi, M. Mortaheb, A. Toorani</i>	
Using Information Technology to Enhance Project Management Process	1674
<i>F. Khoramshahi, R. Dehghan, M. Mortaheb</i>	
Barriers Facing Proper Implementation of EVM	1684
<i>K. Hazini, B. Sharif, M. Mortaheb</i>	
Fly Ash Concrete in Curb and Gutter Construction after 20 Years in Service	1697
<i>Robert L. Day, Bozena Czarniecki</i>	

Managing Risk While Tunnelling Through Benzene Contaminated Ground	1707
<i>A. Kwan, S. Fernando, F. Policicchio, S. AbouRizk</i>	
1ST INTERNATIONAL STRUCTURAL SPECIALTY CONFERENCE	
Wind Tunnel Test for Dynamic Response of a 300 m Guyed Mast	1718
<i>N. Zhu, B.F. Sparling, J.P.C. King</i>	
Behaviour and Strengthening of RC T-Girders under Various Torque to Shear Ratios	1728
<i>A. Deifalla, A. Ghobarah</i>	
Corrosion Durability and Structural Response of RC Beams Containing Supplementary Cementing Materials	1738
<i>S.F.U. Ahmed, M. Maalej, P. Paramasivam, H. Mihashi</i>	
Dynamic Response of Rectangular Orthotropic Plate Supported by Pasternak Foundation Subjected to Dynamic Load	1749
<i>S.W. Alisjahbana, W. Wangsadinata</i>	
Static Equivalent Procedures for Seismic Analysis of Air Cooler Petrochemical Structures	1759
<i>H. Meshmehsha, A. Rashed, S. Guirguis</i>	
Identification of Parameters Affecting Ductility of Reinforced Concrete Beams	1770
<i>A. Elmenshawi, T.G. Brown</i>	
Mechanical Properties of Hybrid PVA Fibre Reinforced Cementitious Composites Under Bending	1780
<i>S.F.U. Ahmed, H. Mihashi, S. Suzuki</i>	
Shear Force Response of Guyed Towers for Different Earthquake Levels	1790
<i>H. Meshmesha, K. Sennah, J. Kennedy</i>	
Thermal Buckling Analysis of Thick Laminated Composite Plates Using Complex Finite Strip Method	1799
<i>F. Saba, M. Azhar</i>	
Effect of Longitudinal Stiffness on Bridge Live Load Distribution Using the CHBDC, AASHTO-LRFD and Finite Element Analysis	1808
<i>Z. Yousif, R. Hindi</i>	
State of the Art in Cellular and Castellated Beam Design	1818
<i>S. Parent, R.M. Hoffman, D.W. Dinehart, J.R. Yost, S.P. Gross</i>	
Punching Shear Strength of Interior Flat-Slab Connections with Openings	1829
<i>A. Sherif, G. Ghanem, A. Abdel-Razek</i>	
Upgrading Shear Deficient RC Beam-Column Joints for Earthquake Loading Using Steel Reinforced Polymer Sheets	1839
<i>R. Izi, M. Elbadry, H. Ibrahim</i>	
Use of DOE Methodology for Investigating Conditions that Influence the Tension in Marine Risers for FPSO Ships	1840
<i>D. Hawkins, L.M. Lye</i>	
Load-Deflection Behavior of Composite Precast Pretensioned Prestressed Beam with Cast-In-Situ Concrete Slab	1850
<i>B.N. Shah, M. Reza Kianoush</i>	
Effect of Anchoring of Stiffening Elements on Flexural Capacity of Strengthened Beams	1859
<i>A. Asran, A. Amer, A. Riad</i>	
Combined Experimental and Numerical Investigation on the Mechanism of Frost Salt Scaling in Cement Mortars	1869
<i>O. Copuroglu, E. Schlangen, A. Fraaij, K. van Breugel</i>	

Influence of the Excitation Source on Modal Parameter Estimation for the Red Deer River Bridge	1876
<i>M. Alwash, B.F. Sparling, L. Wegner</i>	
SOS: An Optimization System for the Sustainable Use of Supplementary Cementing Materials in Concrete	1886
<i>R.L. Day, M. de Spot, M. Thomas, M.N. Nazir</i>	
Predictive Formulas for Natural Frequencies and Their Application to Non-Destructive Testing of Beam Members	1895
<i>D. Bockstael, C. Ward, N. Rattanawangcharoen, C. Gheorghiu</i>	
Analysis of GFRP-Reinforced Concrete Panels under Direct Uniaxial and Biaxial Tension	1903
<i>T.B. Sabrah, H. Marzouk, A. Hussein</i>	
Flexural Behaviour of Fibre Reinforced Polymer (FRP) Poles	1914
<i>R. Masmoudi, S. Metiche</i>	
Thermal Effect on FRP-Reinforced Concrete Slabs	1926
<i>A. Zaidi, R. Masmoudi</i>	
A Review of Current Code Provisions for Beams with Flange Fastener Holes	1936
<i>P. Arasaratnam, K.S. Sivakumaran, M. Tait</i>	
Probabilistic Analysis to Investigate the Various Parameters Influencing the Design Process of RC Infilled Frames against Seismic Loads	1947
<i>M. ElSeify, M. El-Attar, A. Ragab, O. Hodhod</i>	
The Influence of Presence of Openings on the Non-Linear Seismic Response of RC Infilled Frames	1957
<i>M. ElSeify, M. El-Attar, A. Ragab, O. Hodhod</i>	
Advances in Transmission Lines Design: A life Cycle Cost Optimization Approach	1967
<i>S. Abdelatif Hassanien, N. Shrive, I. Shoala</i>	
Experimental Investigation of Bond of Plain Flexural Reinforcement	1976
<i>L.R. Feldman, F.M. Bartlett</i>	
Analytical Modeling and Seismic Instrumentation of Jamuna Multipurpose Bridge	1986
<i>A. Iqbal</i>	

Volume 4

Assessment of Seismic Response of Multi-Span Box Girder Bridges Considering Soil-Structure Interaction	1996
<i>A.M. Halabian, A. Salehi</i>	
Comparison of the Failure Mechanism of Steel-Free Circular Concrete Deck with Rational Mechanics Model	2006
<i>G. Mediwake, A.A. Mufti, N. Rattanawangcharoen</i>	
Deformation Capacity of High-Strength Steel Members	2016
<i>K.S. Sivakumaran, T. Thanga</i>	
Design for Flexural Crack Control – Recent Amendments to the Australian Standard AS3600	2026
<i>R.I. Gilbert</i>	
Development of a Uniaxial Stress-Strain Relationship for Concrete Confined by Steel Tubes	2036
<i>Iraj H.P. Mamaghani</i>	

Residential Houses Cracking Due to Nearby Subsurface Construction Blasting: Critical Review of Current Safe Limits	2046
<i>E.Y. Sayed-Ahmed, K.K. Naji</i>	
The Ductility of Reinforced Concrete Slabs and the Influence of Strain Localization	2056
<i>R. I. Gilbert</i>	
Structural Design of the New Canadian War Museum	2066
<i>C.M. Allen, J. Turner</i>	
Structural Behaviour of Carbon FRP Stirrups Used as Shear Reinforcement for Concrete Beams	2076
<i>A.K. El-Sayed, E. El-Salakawy, B. Benmokrane</i>	
CFRP Strengthening of Prestressed-Precast Hollow Core Slabs to Resist Negative Moments: An Experimental Investigation and a Critical Review of ACI 440.2 R-02 Provisions	2086
<i>A. Hosny, E.Y. Sayed-Ahmed, A.A. Abdelrahman, N.A. Alhlaby</i>	
Durability, Drying Shrinkage and Physical Properties of Mortars Used in Restoration of Historical Buildings in Egypt	2096
<i>H.H. Ibrahim, H.A. Hodhod, M.A.R Youssef</i>	
Non-linear Finite Element Model for Wide Flange Beams under Torsional and Flexural Loads	2106
<i>D.M. Bremault, R.G. Driver, G.Y. Grondin</i>	
Non-linear Finite Element Analysis of Steel Plate Shear Walls	2116
<i>A.K. Bhowmick, G.Y. Grondin, R.G. Driver</i>	
Properties of Exposed Aggregate Concrete	2126
<i>T.I. Al-Anany, M.N. Abou-Zeid, E.H. Fahmy</i>	
Monotonic and Cyclic Behavior of Square Hollow Structural Section for Passive Energy Dissipation	2137
<i>R.W.K. Chan, F. Albermani</i>	
Mechanical Properties of Mortars Used in Restoration of Egyptian Architectural Heritage	2147
<i>H.H. Ibrahim, H.A. Hodhod, M.A.R Youssef</i>	
Effect of Infill Walls on the Performance of Multi-Storey Building During Earthquakes	2155
<i>M. Abdel El Razik, A. Asran, A. Abdel Hafiz</i>	
Environmental, Aesthetics and Development Gaps in Current Concrete Codes of Practice	2165
<i>M.N. Abou-Zeid, E.H. Fahmy</i>	
Prediction of Extreme Ice and Wind Loadings on a Transmission Line in the Province of Manitoba	2175
<i>H. Schultz, N. Rattanawangcharoen, M. Lu</i>	
Design of Two High-rise Towers Linked with Full-Height Glazed Atrium	2184
<i>B. Schroeder, J. Gilliland, G. Birkle</i>	
The Influence of Construction Sequencing on Stresses in Precast Concrete Bridges	2194
<i>G. Birkle, R.M. Herzinger, J. Hanley</i>	
Repairing of R/C Shell with Steel and FRP Sheets	2204
<i>T. Hara</i>	
Ice Monitoring on Confederation Bridge – What has been learnt	2212
<i>T.G. Brown</i>	
Diagnosis of a Subway Concrete Structure Affected by Alkali-Silica Reaction	2222
<i>T.Y. Hao, Y.L. Hui</i>	

Bridge Inspection DSS Using Learning-Based Belief Network	2232
<i>Y. Hu, A. Hammad</i>	
Prediction of Interfacial Stresses at the Bond Critical Junction of FRP and RC Beams	2242
<i>A. Hojat Kashani, M. Z. Kabir</i>	
Shaking Table Test of Full-Scale Single Story Building of 3D-Panel Prefabricated System	2252
<i>M.Z. Kabir, O. Rezaifar, M. Taribakhsh, A. Tehranian</i>	
The Behavior of Steel Beam to Built-Up Column Moment Connections Using Side Plates	2262
<i>A. Deylami, M.R. Shiravand</i>	
Control Tests on a Steel Girder Bridge	2271
<i>A.A. Mufti, B. Bakht, G. Tadros, R. Eden, K. Amy</i>	
Calculation of Equivalent Constant Torsional Rigidity for Beams with Variable Torsional Rigidity	2281
<i>L.G. Jaeger, B. Bakht</i>	
Sensitivity Analysis of Time to Repair Parking Structures	2289
<i>R.E. Loov</i>	
Reconstruction of the Myra Canyon Trestles on the Kettle Valley Railway	2299
<i>K. Witzke, E. de Fleuriot, L. Dunaszegi, A. Esarte, K. Weber, J. Klett, J. Unsworth, B. Lidstone, G. Rutherford</i>	
Punching of Concrete Flat Plates Due to Unbalanced Moment Transfer in CSA A23.3-04	2309
<i>R.B. Gayed, A. Ghali</i>	
Monotonic and Cyclic Behaviour of Corrugated Steel Plate Shear Walls	2318
<i>R. Botros, M. Elbadry</i>	
Finite Element Analysis of Slab-Column Connections	2330
<i>A. Kheyroddin, S.R. Hoseini Vaez</i>	
Nonlinear Finite Element Analysis of RC Shear Walls Retrofitted Using Externally Bonded Steel Plates and FRP Sheets	2340
<i>A. Kheyroddin, H. Naderpour</i>	
Bond and Tension Stiffening in Concrete Tension Members with Plain Reinforcement	2350
<i>P.H. Bischoff, D.A. MacLaggan</i>	
Flexural Strengthening of Steel-Concrete Composite Girders	2360
<i>N. Ragab, R. El-Hacha</i>	
Structural Health Monitoring of the Esplanade Riel Pedestrian Bridge	2370
<i>E. Shehata, R. Haldane-Wilsone, D. Stewart, A.A. Mufti, G. Tadros, B. Bakht, B. Ebenspanger</i>	
Displacement-Based Seismic Design of Shear Walls Submitted to Eastern Canada Seismic Hazard	2377
<i>N. Bouaanani, K. Alexieva</i>	
Seismic analysis of Ice-Dam-Reservoir systems	2389
<i>N. Bouaanani, M.A. Chagnon</i>	
Proposed Method for Determining the Residual Mortar Content of Recycled Concrete Aggregates	2399
<i>A. Abbas, O.B. Isgor, A.G. Razaqpur, B. Fournier, G. Fathifazl, S. Foo</i>	
Appréciation des outils actuels concernant l'évaluation de la vulnérabilité sismique des bâtiments à caractère historique	2407
<i>M.-J. Nollet, K. Lefebvre, A. Karbassi</i>	

Modeling Reinforced Concrete and Post-Tensioned Two-Way Slabs	2417
<i>J.I. Lee, A. Scanlon, Y.H. Lee</i>	
Civionics Specifications for Structural Health Monitoring Using Fibre Optic Sensors	2427
<i>E. Rivera, A.A. Mufti, D.J. Thomson</i>	
Field Performance of Water Mains Buried in Expansive Soil	2436
<i>Y. Hu, H.Q. Vu</i>	
Debonding Failures in FRP-Strengthened Concrete Beams: A Simplified Analysis Based on Response Surface Methodology	2449
<i>U.A. Ebead, K.W. Neale, H. Abdel Baky</i>	
Retrofitting Non-ductile Concrete Frames against Earthquakes through Diagonal Prestressing	2460
<i>F. Shalouf, M. Saatcioglu</i>	
Combining “Steel Free Deck” Technology with Partial Depth Precast Concrete Panels	2472
<i>J.D. Bowen, A. Mufti, K. Dick</i>	
Comparison of Different Retrofit Strategies by Performance Based Design Procedure	2482
<i>F. Aras</i>	
Dissipative Buckling Restrained Braces: Theoretical-Numerical Analysis and Design Criteria	2494
<i>M. Mele, O. Iannone</i>	
Confederation Bridge Vibration Monitoring: Implications for Structural Health Monitoring	2504
<i>N.A. Londoño, D.T. Lau</i>	
The Role of Footbridges in the Functional Adaptation of Bridges and Viaducts	2514
<i>E. Siviero</i>	
Architectural and Structural Design of Complex Shapes: Integrated Processes through Digital Models, E-learning Didactic Experiences at the Faculty of Architecture IUAV in Venice	2520
<i>E. Siviero, M. Petrucci, M. Mantoan, M. Turrin, D. Frigo, L. Gorgi</i>	
Offshore Concrete Crack Analysis	2530
<i>M.A. Hossin, H. Marzouk</i>	
Structural Behaviour of Syncrude’s Aurora II Crusher	2540
<i>V.P. Sharma, C.L. Denkhaus, K. Obaia, J.J.R. Cheng</i>	
Assessment of Canadian Highway Bridge Design Code (CHBDC) for C-shaped Prestressed Concrete Girder Bridge: Clause 5.7 Live Load	2551
<i>Yail J. Kim, Mark F. Green, R. Gordon Wight</i>	
Adaptive Building Reuse and Component Reuse	2560
<i>V. Straka, M. Gorgolewski</i>	
Experimental Investigation on the Fatigue Behaviour of GFRP Reinforced Concrete Bridge Deck Slabs	2570
<i>A. El Ragaby, E. El Salakawy, B. Benmokrane</i>	
Analytical Investigation on New Continuous Reinforced Concrete Pavement (CRCP) Using GFRP Bars	2580
<i>M. Eisa, E. El-Salakawy, B. Benmokrane</i>	
Behaviour of FRP Wrapped HSC Columns under Eccentric Loads	2590
<i>M.N.S. Hadi</i>	
Fibre Reinforcing the Cover of Concrete Columns	2600
<i>M.N.S. Hadi</i>	

Service Life Evaluation of Bridge Decks Constructed with Different Reinforcement Strategies	2610
<i>A. Kumar, M. Boulfiza, N. Banthia</i>	
Effect of Cations and Carbonation on Chlorides binding in Concrete.....	2621
<i>S. Munshi, M. Boulfiza</i>	
The Effects of Synthetic-Fibre and Natural-Fibre on the Mechanical and Physical Properties of FRP Rebars in Concrete.....	2632
<i>A.S.M. Kamal, M. Boulfiza, A.C. Tripathy, S. Panigrahi</i>	
Dynamic Analysis with Damping for Free Standing Structures Using Mechanical Event Simulation	2639
<i>I. Giosan</i>	
Rehabilitation of the Structural Slabs of Laurier-Tache Parking Garage (Gatineau, Quebec) Using Glass FRP Bars.....	2650
<i>B. Benmokrane, E. El-Salakawy, A. El Ragaby, A. Wiseman</i>	

Author Index