

# **9th International Conference on Short and Medium Span Bridges (SMSB 2014)**

Calgary, Canada  
15 - 18 July 2014

Volume 1 of 4

ISBN: 978-1-5108-6536-5

**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© (2014) by Canadian Society for Civil Engineering  
All rights reserved.

Printed by Curran Associates, Inc. (2018)

For permission requests, please contact Canadian Society for Civil Engineering  
at the address below.

Canadian Society for Civil Engineering  
521-300 rue St-Sacrement  
Montréal, QC  
H2Y 1x4

Phone: (514) 933-2634  
Fax: (514) 933-3504

info@csce.ca

**Additional copies of this publication are available from:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571 USA  
Phone: 845-758-0400  
Fax: 845-758-2633  
Email: curran@proceedings.com  
Web: www.proceedings.com

# TABLE OF CONTENTS

## VOLUME 1

### KEYNOTE PAPERS

<b>Creative Construction Methods</b> .....	1
<i>Peter G. Buckland</i>	
<b>Inclined Stirrups and Inclined Stud Shear Reinforcement in Zones of High Shear</b> .....	13
<i>Walter H. Dilger</i>	
<b>Power of Prestressing</b> .....	27
<i>Jiri Strasky</i>	
<b>Examples of Strength and Serviceability Failures</b> .....	42
<i>Amin Ghali, Ramez B. Gayed, Jadwiga Kroman</i>	

### ACCELERATED BRIDGE CONSTRUCTION

<b>Puente Mercosur – Truss Girder bridge Across the Orinoco: Design, Analysis and Construction</b> .....	59
<i>Karl Humpf, Michael Müller, Volkhard Angelmaier, Celso Silingardi</i>	
<b>Longitudinal Joint with Headed Bar Details for Accelerated Bridge Construction</b> .....	69
<i>Lungui Li, Zhongguo Ma</i>	
<b>Design of a Bifurcated Steel Bridge with Complex Geometry on an Aggressive Schedule</b> .....	80
<i>Robert Mateega</i>	
<b>Design and Use of Steel Diaphragms for Highway Bridges</b> .....	90
<i>Yohchia Frank Chen</i>	
<b>An Eight Year Review of Field-Cast UHPC Connections for Precast Concrete Bridge Elements and ABC</b> .....	100
<i>Vic Perry</i>	
<b>Fiberglass Composite Bridges for Rapid Construction</b> .....	109
<i>Crawford Dewar, Joshua Dewar, Benjamin Dewar, Cory Zurell</i>	
<b>Two Films that Educate the Average Citizen about Successful ABC Techniques for Short and Medium Span Bridges</b> .....	119
<i>Alfred R. Mangus, Craig A. Copelan, Greg Kaderabek</i>	
<b>Steel Girder Erection Engineering for Calgary Southeast Stoney Trail Project</b> .....	129
<i>Yulin Gao, Lihua Zou, Jaime Enri, Alfredo Palomo, Laura Granda</i>	
<b>Three Nations Bridge Crossing: Incremental Launching with Constrained Launching Beds</b> .....	139
<i>Anthony Wing, Glenn Hewus</i>	
<b>Engineering to Manufacturing Process for the Union Pearson Express</b> .....	149
<i>Theresa Erskine, Greg Sebastiano</i>	
<b>Bridge Superstructure Replacements – Highway 7/8, Ontario</b> .....	156
<i>Theresa Erskine, Greg Sebastiano</i>	
<b>Prefabricated Superstructure Placement – A Designer’s Perspective</b> .....	163
<i>Steve Haines, Eddie He</i>	
<b>G37 Interchange — Stage 1 Detour, Innovation and Integrated Project Delivery</b> .....	169
<i>Calvin McClary, Andrew Boucher</i>	
<b>Rapid Orthotropic Deck Replacement for Alberta Three-Span Bridge</b> .....	179
<i>Matthew Spratlin, Alan Saunders, Ron Pierce, Francois Jutras, Eric Levesque</i>	
<b>Slab-on-Girder Bridges in Slovakia</b> .....	190
<i>Jaroslav Halvonik, Ludovit Fillo, Viktor Borzovic</i>	
<b>Footbridge Segments Made of Ultra High Performance Concrete (UHPC)</b> .....	198
<i>Jan Vitek, Robert Coufal, Robert Brož</i>	
<b>Accelerated Bridge Construction Techniques in the New Fraser Heights Bridge</b> .....	208
<i>Don Kennedy, David Harvey</i>	
<b>Achieving High Productivity in Bridge Construction – The Organic Prestressing Impact</b> .....	218
<i>Pedro Pacheco, Hugo Coelho, André Resende</i>	

### ADVANCED MATERIALS IN BRIDGES

<b>Upgrade of Single Span Non-Composite Steel Girder Bridges</b> .....	230
<i>Abheetha Peiris, Issam Harik</i>	
<b>A Comparative Study on High Performance Steel Bridges</b> .....	240
<i>Yohchia Frank Chen, Hiep Bui</i>	
<b>Oregon’s ASTM A1010 Bridges</b> .....	246
<i>Hormoz Seradj, Fred Fletcher</i>	
<b>Hodder Avenue Underpass - A Modular Construction Approach and a Unique UHPC Pier Cap Design</b> .....	256
<i>Yang Eileen Li, Liang Guo, Biljana Rajlic, Philip Murray, Raymond Krisciunas, Vic Perry</i>	
<b>Bridges Built with Advanced Materials</b> .....	266
<i>Juan A. Sobrino, Javier Jordan, Dritan Topuzi</i>	

<b>Bridge Pier Seismic Strengthening Using UHPFRC Cover .....</b>	<b>276</b>
<i>Bruno Massicote, Marc-Andre Dagenais, Jean-Francois Garneau</i>	
<b>Design of Bridge Deck Slabs Using Glass Fiber-Reinforced Polymer (GFRP) Bars of Different Grades.....</b>	<b>285</b>
<i>Ehab Ahmed, Brahim Benmokrane</i>	
<b>New UHPC Decks for Existing Motorway Bridges .....</b>	<b>295</b>
<i>Philipp Hadl, Hoang Kim, Regina della Pietra, Nguyen Viet Tue</i>	

### **ADVANCEMENT IN MATERIALS**

<b>Development of Aluminum Diaphragms for Concrete Bridges .....</b>	<b>303</b>
<i>Matthew Snyder, Yohchia Frank Chen</i>	
<b>Dawyck Recycled Plastic Bridge.....</b>	<b>314</b>
<i>Robert Lark, Barry Mawson</i>	
<b>Development of Plastic Hinge Length Expression for Shape Memory Alloy Reinforced Concrete Bridge Pier.....</b>	<b>324</b>
<i>AHM Muntasir Billah, Shahria Alam</i>	
<b>FEM Simulation of Carbon Fiber Reinforced Elastomers Manufactured Through a Cold-Vulcanization Process .....</b>	<b>334</b>
<i>Farshad Hedayati Dezfuli, Shahria Alam</i>	
<b>Application of High Strength PS Strands for Post-tensioned Prestressed Concrete Girders.....</b>	<b>342</b>
<i>Youn-Hwan Jeong, Ho Park, Ho-Kyung Kim, Jae-Yeol Cho</i>	
<b>Flexural Anchorage Performance and Strengthening Using Titanium for Reinforced Concrete Bridge Girders .....</b>	<b>351</b>
<i>Christopher Higgins, Deanna Amneus, Laura Barker</i>	
<b>Aluminum Bridge Decking Advancements and Applications .....</b>	<b>361</b>
<i>Greg Osberg, Michel Vachon</i>	

### **ANALYTICAL INVESTIGATIONS**

<b>Bridge Evaluation under Heavy Live Loads – Simplified Method vs. 3D FEA .....</b>	<b>371</b>
<i>Dane Parent</i>	
<b>Bridge Weigh-in-Motion Techniques to Evaluate Saskatchewan’s Rural Bridge Inventory .....</b>	<b>378</b>
<i>Amir Bozorgmehr, Bruce Sparling, Lisa Feldman</i>	
<b>Bridge Performance Prediction Using Adaptive-Network-Based Fuzzy Inference System (ANFIS).....</b>	<b>389</b>
<i>Maryam Taghboostani, Lynne Cowe Falls</i>	
<b>Analytical Investigation of Distortion-Induced Fatigue Cracking in a Seismically-Retrofitted Steel Bridge.....</b>	<b>399</b>
<i>Will Lindquist, Ahmed Ibrahim, Ying Tung, Riyadh Hindi</i>	
<b>Comparison of Moment and Shear Distribution Factors for Shear Connected Concrete Girders.....</b>	<b>409</b>
<i>Theresa Holden, Bob Ramsay</i>	
<b>Understanding Cables / A Problem of Large Scale Displacement Solved by Finite Difference Method.....</b>	<b>419</b>
<i>Guy Mailhot</i>	
<b>Analysis and Design of a Highly Skewed and Curved Steel I-Girder Bridge.....</b>	<b>432</b>
<i>Wayne Dang, Jianmin Zhang, Jim Zhao</i>	

### **ARCH BRIDGES**

<b>In-Plane Ultimate Load-Carrying Capacity of Dumbbell-Shaped CFST Arch Bridge .....</b>	<b>440</b>
<i>Ye Sheng, Baochun Chen, Chungqiao Wu, Amir Fam</i>	
<b>Construction of St. Patrick’s Pedestrian Bridge in Calgary, Canada .....</b>	<b>451</b>
<i>Jean-François Blassel, Christian Rieser, Thomas Cooper, Michael McDonagh, Brent Whitcomb</i>	
<b>Burgoyne Bridge: An Innovative Design of A Unique Medium Span Steel Arch Bridge on Tall Piers .....</b>	<b>462</b>
<i>Sameh Salib, Brent Archibald, Vic Anderson, Jason Marr, Mike DiPaola</i>	
<b>Strandherd Armstrong Bridge Design .....</b>	<b>472</b>
<i>Jack Ajrab, W. Victor Anderson, Sylvain Montminy, Hugh Hawk, Marcel Delph</i>	
<b>Chicago’s New Tied Arch Bridge .....</b>	<b>483</b>
<i>Robert Hong, Soliman Khudeira</i>	

### **ASSET MANAGEMENT**

<b>New Bridge for the St. Lawrence / Where We’re at and Where We’re Heading .....</b>	<b>492</b>
<i>Guy Mailhot, Marc Brazeau, Vincent Jarry</i>	
<b>Managing MDTA’s Bridge Inventory .....</b>	<b>503</b>
<i>Benoit Kroely, Jennifer Laning, Dan Williams, Will Pines</i>	
<b>Managing a Diverse Asset Base.....</b>	<b>510</b>
<i>David Woolford, Darrel Gagnon</i>	
<b>A Framework for Statistical Regression of Bridge Deterioration Rates for Improved BMS Classification.....</b>	<b>518</b>
<i>Raka Goyal, Joshua Ramsey, Matthew Whelan, Tara Cavalline, Brett Tempest</i>	

## **BRIDGE AESTHETICS**

<b>Tamina Canyon Crossing, Bad Ragaz, Switzerland</b> .....	528
<i>Volkhard Angelmaier, Wolfgang Eilzer</i>	
<b>“From Here Until Now” – Public Art within the Rehabilitated Osborne Street Bridge</b> .....	538
<i>Vaibhav Banthia, Eduardo Aquino, Darren Burney, Kimberly Yathon</i>	
<b>Nipigon River Cable-Stayed Bridge</b> .....	549
<i>Bob Stofko, Ray Krisciunas, Xiaosong Nie, Dick Dykstra</i>	
<b>Calgary West Light Rail Transit Extension Project: Elevated Guideway Design and Construction Challenges</b> .....	560
<i>Caroline Ngan, Michael Hatch, Henry Leung, Scott Leitch, Jan Kocaba, Monty Knaus</i>	
<b>The Design of St. Patrick’s Bridge in Calgary</b> .....	570
<i>Jean-François Blassel, Michael McDonagh, Daniel Garcia</i>	
<b>Elbow River Traverse: Spanning the Ages</b> .....	580
<i>Geoff Kallweit</i>	
<b>Robert Maillart: The Evolution of Reinforced Concrete Bridge Forms</b> .....	588
<i>Edvard Bruun</i>	
<b>The Yeni Gezi Footbridge in the Heart of a Metropolis under Transformation</b> .....	597
<i>Alessandro Stocco, Enzo Siviero</i>	
<b>Comprehensive Approach to Aesthetic Treatments of the Structures in The Rt. Hon. Herb Gray Parkway</b> .....	604
<i>Eha Naylor, Kiran Chhibra</i>	

## **VOLUME 2**

<b>The Social Meaning of Small and Medium Span Bridges</b> .....	612
<i>Enzo Siviero, Michele Culatti, Luca Guido, Viviana Martini, Alessandro Stocco, Andrea Totaro</i>	

## **BRIDGE BARRIERS**

<b>Development of Bridge Barriers for Industrial Applications</b> .....	623
<i>John Deenihan, Julien Henley</i>	
<b>Experimental Investigation of Steel-Reinforced PL-3 Bridge Barriers Subjected to Transverse Static Loading</b> .....	633
<i>Hamidreza Khederzadeh, Khaled Sennah</i>	
<b>AASHTO-LRFD Yield-Line Analysis for Flexural Resistance of Bridge Barrier Wall: Re-visited</b> .....	642
<i>Hamidreza Khederzadeh, Khaled Sennah</i>	
<b>Parametric Study on Bridge Barrier-Deck Anchorage Forces Using the Finite Element Method</b> .....	652
<i>Hossein Azimi, Khaled Sennah</i>	
<b>Experimental Study on the Pullout Capacity of Post-Installed GFRP Bars for Bridge Barrier Replacement</b> .....	661
<i>Hossein Azimi, Alireza Abolghasem, Khaled Sennah</i>	
<b>Experimental Investigation on Transverse Strength of PL-3 Barriers Reinforced with Sand-Coated GFRP Bars</b> .....	671
<i>Hamidreza Khederzadeh, Khaled Sennah</i>	

## **BRIDGE BEARINGS**

<b>Multirotational Bearings for Short Span Transit Structures</b> .....	681
<i>Ronald Watson</i>	
<b>Base Isolation Retrofit of the Granville Street Bridge</b> .....	691
<i>Shane Cook, Don Kennedy, Nik Cuperlovic</i>	
<b>Self-Heating of High Damping Rubber Bearings and its Effects on Bridge Seismic Performance</b> .....	700
<i>Yoshiaki Okui, Dung Anh Nguyen, Takashi Imai, Shinya Okada</i>	
<b>Seismic Isolation of Curved Highway Viaducts Using Lead Rubber Bearings – Case Studies</b> .....	707
<i>Carlos Mendez, Gianni Moor, Colm O’Suilleabhain</i>	
<b>Resisting Upward Forces in Bridge Design – the Role of Uplift Bearings</b> .....	716
<i>Thomas Spuler, Gianni Moor, Niculin Meng</i>	

## **BURIED STRUCTURES AND SOIL INTERACTION**

<b>Critical CN/CP Diamond Operability during Circle Drive South Design Build Project in Saskatoon, SK</b> .....	726
<i>Christophe Deniaud, Jack Ju</i>	
<b>Underpinning of Existing Foundations of a Major River Crossing Using Micropiles in Ontario, Canada</b> .....	735
<i>Edward Li, Sergiy Morozevych, Chak Lo</i>	
<b>Retaining Walls: Creating Space to Accommodate New Transportation Infrastructure in a Built Urban Setting</b> .....	745
<i>Michael Hatch, Qingsong Liu</i>	
<b>Innovative Solutions to a Highly Skewed Railway Overhead Built on Compressible Clay</b> .....	756
<i>Bruce Hamersley, William Wu, Daniel Lawson</i>	
<b>Design of Bridges on Existing Coal Mines</b> .....	765
<i>David MacLaggan, Manoj Medhekar, Eric Tromposch</i>	

<b>Design and Construction of Railway and Roadway Live Load Relief Spans Over Failing Existing Culverts .....</b>	<b>775</b>
<i>Christophe Deniaud, Barry Palynchuk</i>	
<b>Vertical Load Capacity of Steel Sheet Piles for Bridge abutments - Preliminary Assessment for Sand Conditions .....</b>	<b>783</b>
<i>Corey Rice, Miguel Pando, Matthew Whelan, Vincent Ogunro</i>	
<b>Precast Arch Application to Extend Tunnel under Heavy Rail Loading.....</b>	<b>793</b>
<i>Thomas Brunet, Bill Brockbank</i>	
<b>Franklin Avenue Underpass on Highway 63, Fort McMurray, Alberta.....</b>	<b>802</b>
<i>Erum Mohsin, Manoj Medhekar</i>	
<b>Construction and Monitoring of Soil-Steel Bridge with Deeper Corrugated Plates.....</b>	<b>812</b>
<i>Joel Vallee, John Newhook, Wayne Ford</i>	

## **CONNECTORS FOR COMPOSITE CONSTRUCTION**

<b>Design of Shear Connections for Composite Action Between Precast Concrete Decks and Steel Girders .....</b>	<b>822</b>
<i>Changsu Shim, Seok-Goo Youn, Doobyong Bae, Dong-Wook Kim</i>	
<b>Development of Durable Headed Studs Welded with Improved Ferrules for Steel-Concrete Composite Decks .....</b>	<b>833</b>
<i>Hiroshi Higashiyama, Kenji Yoshida, Koji Inamoto, Shigeyuki Matsui, Hiroshi Kaido</i>	
<b>Improvement of Fatigue Durability of Headed Studs in Steel-Concrete Composite Decks under Rotating Shear Force.....</b>	<b>841</b>
<i>Kenji Yoshida, Hiroshi Higashiyama, Koji Inamoto, Shigeyuki Matsui, Hiroshi Kaido</i>	
<b>Static Push Tests of Through-Bolt Shear Connectors for Accelerated Composite Bridge Construction.....</b>	<b>850</b>
<i>David (Yu-Ta) Chen, Jeffrey West, Scott Walbridge</i>	
<b>Pull-Out Response of Innovative Composite Connection in Bridge Girders.....</b>	<b>859</b>
<i>Sadegh Kazemi, Roger Cheng</i>	

## **DAMAGE DUE TO FLOODING**

<b>Impact of the 2013 Alberta Floods on the Construction of St. Patrick's Pedestrian Bridge in Calgary, Canada.....</b>	<b>868</b>
<i>Jean-François Blassel, Christian Rieser, Tom Cooper, Brent Whitcomb, Bill Campbell, Kimberly Haddow</i>	
<b>Underwater Imaging for the Inspection of Bridges during Floods.....</b>	<b>878</b>
<i>Terence Browne, Matt Donahue</i>	
<b>A Review of Alberta Transportation's Hydrotechnical Standards in Response to the 2013 Flood Event.....</b>	<b>887</b>
<i>Caroline Watt, Des Williamson</i>	
<b>A Review of Bridge Damage Due to Flooding in Southern Alberta.....</b>	<b>895</b>
<i>Mohamed Sorour, Glen Mikesh, Ahmed Abdel Fattah</i>	
<b>The Great Alberta Flood of 2013: Reconstruction of BF 71429 Over the Elbow River at Highway 66.....</b>	<b>903</b>
<i>James Hanley, Mario Prezelj</i>	

## **DESIGN FOR FIRE AND WIND**

<b>Fire Protection of NU Girders on the Herb Gray Parkway .....</b>	<b>913</b>
<i>Jamie McIntyre, Amir Golpaygan, Nancy McGee, Chelene Wong</i>	
<b>The Assessment and Reinforcement of Fire Damage on a Prestressed Concrete Continuous Girder Bridge.....</b>	<b>924</b>
<i>Hua Liu, Zong-yu Gao, Qi-wei Liu, Jun-lei Zhang</i>	
<b>Wind Engineering for the Fort Edmonton Footbridge .....</b>	<b>935</b>
<i>Peter King</i>	
<b>Wind Tunnel Study of the Bow River Pedestrian Bridge .....</b>	<b>945</b>
<i>Lingzhe Kong, Peter King, Unyong Jeong</i>	

## **DURABILITY**

<b>Effect of Moisture and Chloride Diffusion on the FRP-Reinforced Concrete.....</b>	<b>954</b>
<i>Muhammad Shafqat Ali, M. Saeed Mirza, Larry Lessard</i>	
<b>Assessment of Life-Cycle Structural Integrity of Concrete Bridges Subjected to Aggressive Environments .....</b>	<b>964</b>
<i>Juan Manuel Macía, M. Saeed Mirza</i>	
<b>Ultra-Weatherable Fluoropolymer Topcoats for Bridges .....</b>	<b>974</b>
<i>J. Winn Darden</i>	
<b>Long-Term Performance of Electrochemical Chloride Extraction and Cathodic Protection of Bridge Substructures: Manitoba Highway 75/100 Interchange .....</b>	<b>982</b>
<i>Ruth Eden, Drew Monnier, David Whitmore, Felix Sandron</i>	
<b>Study on Evaluation of Shear Performance for Waterproofing Layer with Thin Surfacing.....</b>	<b>990</b>
<i>Yasumoto Aoki, Izumi Tanikura, Koji Miura, Shigeyuki Matsui</i>	

## **DYNAMICS AND FATIGUE**

<b>Dynamic Impact Factor of Simply Supported Bridge at Resonant Vibration Excited by High Speed Train .....</b>	<b>1000</b>
<i>Yinghong Cao, Eddie He</i>	

<b>Dynamic Load Allowance Factors for Bridges Carrying Light Rail Vehicles</b> .....	1011
<i>Magdy Samaan</i>	
<b>Web Gap Fatigue Retrofit in the Lawrence Avenue East Bridge</b> .....	1018
<i>Frank Ou</i>	
<b>A Simplified Method to Identify Human Walking Force Based on the Body Response Spectrum Obtained by FFT Analysis</b> .....	1028
<i>M. Yoneda</i>	
<b>Assessment of Corrosion Damage in Slab-on-Girder Bridge Superstructures and Columns Based on Dynamic and Static Deformations Under Moving Trucks</b> .....	1036
<i>Amina Mohammed, Husham Almansour</i>	
<b>Dynamic Amplification Factors of an Extradosed Bridge during the Accidental Breakage of a Cable</b> .....	1045
<i>Jose Benjumea, Gustavo Chio</i>	
<b>Fatigue Behaviour of Precast Concrete Truss Girders Reinforced with Double-Headed Bars: Experimental Assessment</b> .....	1053
<i>Mohammad Moravvej Hamedani, Mamdouh El-Badry, Mohammad Hadi Aghahassani</i>	

### **EXPERIMENTAL STUDIES**

<b>A Comparison of Bore Sounding, Global Stiffness and Through Compression Wave Technology Testing</b> .....	1063
<i>Daniel Tingley</i>	
<b>Experimental Testing of 55-Year-Old Pretensioned Bridge Girders</b> .....	1073
<i>Brandon Ross, H.R. (Trey) Hamilton, Gary Consolazio</i>	
<b>Tests on Concrete Beams with Exposed Flexural Reinforcing Simulating Bridge Soffit Spalling</b> .....	1083
<i>Alireza Masnavi, Marianna Polak, Scott Walbridge</i>	
<b>Experimental Study for a Time Series Based Method for Damage Detection Using Output Data Only</b> .....	1092
<i>Q. Mei, Mustafa Gul</i>	
<b>Behaviour of Partially Prestressed High Strength Concrete Girders (Deflection Viewpoint)</b> .....	1099
<i>Tarek El-Hashimy, Shady Salem, Khalid Hilal, Amr Abdelrahman, Ahmed Essawy</i>	
<b>Behaviour of Partially Prestressed High Strength Concrete Girders (Cracking Viewpoint)</b> .....	1109
<i>Shady Salem, Tarek El-Hashimy, Khalid Hilal, Tarek Hassan, Ahmed Essawy</i>	
<b>Shear in Concrete Beams Reinforced with High-Performance ASTM A1035 Steel</b> .....	1119
<i>Admasu Desalegne, Adam Lubell</i>	
<b>Large-Scale Fatigue Testing of Concrete Hollow Box Girder Deck Slabs under Axle Loads</b> .....	1128
<i>Gregor Borkowski, Karel Thoma, Patrick Roos</i>	

### **FRP AND FIBRE REINFORCEMENT IN BRIDGES**

<b>Use of CFRP for Confinement of ASR Expansion in Concrete Bridges</b> .....	1140
<i>Mark Williams, Domingo Moran</i>	
<b>Flexural Characteristics of Reinforced Concrete Beams with FRP Composite Shell</b> .....	1148
<i>Muhammad Shafiqat Ali, M. Saeed Mirza, Larry Lessard</i>	
<b>Behaviour of Full Scale GFRP and Steel Reinforced Bridge Decks Designed by Traditional and Empirical Methodologies</b> .....	1158
<i>Joseph Yost, David Dinehart, Shawn Gross, Philip Reilly, David Reichmann</i>	
<b>Numerical Modeling of Concrete T-Girders Strengthened in Flexure with NSM Composite System</b> .....	1166
<i>Elsayed Sherif</i>	
<b>GFRP Bars as Compressive Reinforcement in Exposed Structures</b> .....	1174
<i>Edvard P.G. Bruun, Shamim Sheikh</i>	
<b>Experimental Ultimate Strength and Fatigue Behavior of Cast-in-Place Concrete Bridge Deck Slabs Reinforced with Ribbed--Surface GFRP Bars</b> .....	1183
<i>Imad Eldin Khalafalla, Khaled Sennah</i>	
<b>Durability of Bridge Decks with FRP Stay-in-Place Structural Forms under Freeze-Thaw Cycles</b> .....	1191
<i>Raouf Boles, Amir Fam</i>	
<b>GFRP-Reinforced Circular Columns under Simulated Seismic Loads</b> .....	1197
<i>Arjang Tavassoli, Shamim Sheikh</i>	
<b>Three-Dimensional Finite Element Modeling of Concrete Slabs Reinforced with Partially-Bonded Composite Strips</b> .....	1207
<i>Tamer El-Maaddawy, El-Sayed Sherif</i>	

### **VOLUME 3**

<b>Effect of Fiber Orientation on Fatigue Strength of Ultra high Strength Fiber Reinforced Concrete</b> .....	1214
<i>Aya Shimura, Katsuya Kono, Takahisa Okamoto</i>	
<b>Laboratory Tests of a Temporary Rescue Bridge Using FRP Composite Materials</b> .....	1224
<i>Hsiao-Hui Hung, Yu-Chi Sung, Shih-Hsun Yin, Kuo-Chun Chang, Fang-Yao Yeh, Wei-Ting Chen, Chung-Wei Lin</i>	
<b>Development of Transverse Joints for Full-Depth Precast Normal-Strength Concrete Deck Panels Incorporating Ribbed-Surface GFRP Bars and UHPFRC</b> .....	1235
<i>Mahmoud Sayed-Ahmed, Khaled Sennah, David Lai</i>	

<b>Analysis and Preliminary Design of All-FRP Composite Bridge Decks</b> .....	1246
<i>Husham Almansour, Moe M.S. Cheung, Zhao Peng, Lingzhi Xie</i>	
<b>Recent Developments of GFRP Bent Bars and Applicable Testing Methods</b> .....	1258
<i>Andre Weber, Dritan Topuzi</i>	

## **HISTORIC BRIDGES**

<b>Aesthetic and Historical Value: Reconstructing the Canadian Niagara Power Forebay Bridge</b> .....	1267
<i>Brian Ellis, Duane VanGeest, Arih Struger-Kalkman, Bill Snow</i>	
<b>Rehabilitation of the Historic Minto Bridge West</b> .....	1277
<i>Patrick Mergel, Sylvain Montminy</i>	
<b>Design Build Reconstruction of the Murray Morgan Lift Bridge</b> .....	1287
<i>David DeLuca, Frank Marzella</i>	
<b>Historic Meadowlily Footbridge – A Life Changing Renewal</b> .....	1297
<i>John Pucchio, Trevor Scott, Gavan McDonald, Stephanie Dalo, Jane Fullick, Karl Grabowski</i>	
<b>Assessment of an Old RC Hinged Strut Frame Bridge</b> .....	1307
<i>Ana Ivankovic, Marin Franetovic, Ante Radak</i>	
<b>Retrofitting of the Historic Alexandra Bridge</b> .....	1316
<i>Michel Vachon, Frank Pfendt, Janette McCann</i>	
<b>Heritage Rehabilitation of the Burrard Street Bridge</b> .....	1326
<i>Shane Cook, Mingyu Li</i>	
<b>Kinsol Trestle Restoration, Cowichan Valley, BC</b> .....	1336
<i>Robin Zirnhelt, T. Reid Costley</i>	
<b>Rehabilitation of a Heritage Movable Bridge using Accelerated Bridge Construction</b> .....	1346
<i>Christopher Suffern, Doug Dixon, Lawrence Yu</i>	
<b>Risk Assessment, Inspection, Evaluation and Short-Term Repairs of Historic Blackfriars Bridge in Ontario</b> .....	1355
<i>Chris Haines</i>	

## **INNOVATIONS IN INCREMENTAL CONSTRUCTION**

<b>Bridges with Progressively Erected Decks</b> .....	1365
<i>Jiri Strasky, Milos Zich, Petr Novotny</i>	
<b>Incremental Launch of the Sombrio Bridge</b> .....	1375
<i>Morgan Trowland, Prabhjeet Singh</i>	
<b>Fairway Road Grand River Bridge – Design and Construction of a Post-Tensioned Cast-in-Place Segmental Concrete Girder Bridge</b> .....	1384
<i>Scott Leitch, Matthew Bowser, Bob Stofko, Xiaosong Nie</i>	
<b>Urban Area Elevated Freeway Program</b> .....	1395
<i>James C. Tai, Ching-Te Liu, Chien-Hung Chen, Kuan-Fu Lin, Tien-Jen Hsiao</i>	
<b>Construction Staging for the Replacement and Widening of the Steinhauer Bridge Superstructure</b> .....	1405
<i>Peter Little</i>	
<b>Incrementally Launched Viaducts on Mount Edgecombe Interchange, South Africa</b> .....	1415
<i>William Martin</i>	

## **INNOVATIONS IN PRECAST CONSTRUCTION**

<b>Performance Evaluation of Hybrid FRP-Concrete Bridge Truss Girders of Different Spans and Connection Reinforcement</b> .....	1424
<i>Mamdouh El-Badry, Mohammad Moravvej, Mohammad Aghahassani</i>	
<b>Precast Solutions for Design-Build of the Indian River Inlet Bridge</b> .....	1436
<i>Hohsing Lee</i>	
<b>Evaluation of Design Code Requirements on End Zone Reinforcement in Precast Prestressed Bridge Girders</b> .....	1446
<i>Bo Hu, Dongzhou Huang, Zichao Wu</i>	
<b>Precast Prestressed Girders for Medium Span Bridges</b> .....	1453
<i>Magdy Samaan</i>	
<b>Design and Construction of Precast Deck Panels for Calgary Southeast Stoney Trail Project</b> .....	1459
<i>Yulin Gao, Jaime Martin, Laura Granda, Lihua Zou, Alfredo Palomo</i>	

## **INNOVATIVE DESIGN AND CONSTRUCTION – CASE STUDIES**

<b>Design and Construction of a Double Deck Viaduct with Eccentric Single Pier - Take National Freeway No. 1 Widening Works from Wuku to Yangmei as an Example</b> .....	1469
<i>Kuang-Hui Chen, Hung-Wen Wang, Gin-Ren Lai, Jenn-Chuan Lai, Yew-Tsang Lin</i>	
<b>Challenges Encountered in the Design-Build of the Highway 11 CNR Overpass Replacement, Orillia, Ontario</b> .....	1481
<i>Don Gardonio, Philip Loh, Glen Powney, Storer Boone, Henry Huotari</i>	
<b>Replacement of the Fountain Street Bridge Superstructure</b> .....	1490
<i>Jonathan Werner, John Stephenson, Norman Walker</i>	



<b>Design and Construction of a 160-metre-Long Timber Bridge in Mistissini, Quebec</b> .....	1499
<i>Denis Lefebvre, Grégoire Richard</i>	
<b>Straddle-Bent Supports in Four Recent Alberta Projects</b> .....	1509
<i>Kelvin Fields, Myles Lewis, Sean Xiao</i>	
<b>Glacier Skywalk</b> .....	1520
<i>Simon Brown</i>	
<b>Superstructure Replacement of the Grant MacEwan Bridge</b> .....	1530
<i>Manoj Medhekar, Homayoon Niknia</i>	
<b>Okotoks 32 Street Crossing</b> .....	1541
<i>Calvin T. McClary</i>	
<b>Tradeston Bridge – Integrating Safety in Design</b> .....	1550
<i>Peter Lyttle</i>	
<b>Innovative Design and Construction for New Expressway Bridges in Japan</b> .....	1560
<i>Hideaki Sakai, Mikio Nishioka</i>	
<b>A Gateway for Innovation in New Brunswick</b> .....	1568
<i>Brian Byrne, Roumiana Douchanova</i>	
<b>Construction of the Strandherd Armstrong Bridge</b> .....	1578
<i>Robbie Fraser, Sarah K. Foster Hardy</i>	
<b>Creating a Gateway to the Cape Breton Highlands Through Innovative Design and Construction Methods</b> .....	1588
<i>Robbie Fraser, Paul Burke, Ghislain Doucet</i>	
<b>Complex Interchange Structures for Section 1 of the NJ Turnpike Interchange 6 to 9 Widening</b> .....	1598
<i>David Rue, Thomas Fisher, Lyly Lau, Kwang S. Ro</i>	
<b>Assessment of a Partially Constructed Bridge with Vertically Misaligned Post-Tensioning Ducts</b> .....	1609
<i>Kurt Weber, Kris Karvinen, Filip Brogowski</i>	
<b>Design and Construction of the IH25 / Santa Fe Boulevard Interchange Bridges in Denver Colorado</b> .....	1616
<i>Gregg Athur Reese</i>	
<b>Channel Bridges – An Overview and Case Study of the DCR Access Road Bridge in Randolph Massachusetts</b> .....	1626
<i>Zachary McGain, Thomas Cyran, Benjamin Soule</i>	
<b>Design and Construction of the Letellier Bridge</b> .....	1633
<i>Graeme Loepky, Sital Rihal, Jon Friesen, Dami Adedapo, Rob Kenyon, Drew Monnier, Ruth Eden</i>	

## **INNOVATIVE DESIGN AND CONSTRUCTION - STEEL**

<b>Development of a Shallow Press-Brake Formed Tub Gider for Short-Span Steel Bridges</b> .....	1644
<i>Karl Barth, Gregory Michaelson, Lindsay Kelly, Jason Mash, Michael Barker, Daniel Snyder</i>	
<b>Lateral Torsional Buckling Resistance of Horizontally Curved Steel I-girders</b> .....	1654
<i>Nolan Rettie, Gilbert Grondin</i>	
<b>Design and Construction of a Horizontally-Curved Box-Girder Bridge over Laurentian Interchange in Montreal</b> .....	1664
<i>Tomasz Pietraszek, Munzer Hassan</i>	
<b>Composite Girder Grillage</b> .....	1673
<i>Thomas Hehne</i>	
<b>Competitiveness of Steel Girder Bridges in Today’s Design and Construction Environment</b> .....	1683
<i>Konstantinos Kris Merngias</i>	
<b>Sombrio No.1 Bridge Design Considerations and Challenges</b> .....	1693
<i>Saqib Khan, Henry Leung</i>	
<b>Limit State Design of Columns Reinforced with Welded Steel Plates</b> .....	1702
<i>Anjan Bhowmick, Gilbert Grondin</i>	

## **INSPECTION, EVALUATION AND REHABILITATION**

<b>Strengthening of Shear Critical RC Beams with Various FRP Systems</b> .....	1713
<i>Daniel Baggio, Khaled Soudki</i>	
<b>Abutment and Pier Stabilization - Fort Vermilion Bridge</b> .....	1725
<i>Malika Ali, Ken McWhinnie</i>	
<b>Deterioration of Expansion Joints of Short and Medium Span Bridges and Their Renovation</b> .....	1735
<i>Atsushi Toyoda, Makoto Kawakami, Tomio Yasuoka, Kyu-Seok Yeon</i>	
<b>Rehabilitation of the Reinforced Concrete Arch Jolicoeur Bridge</b> .....	1745
<i>Jimmy Fortier, Nikolay Velev</i>	
<b>In-Service Performance and Behavior Characterization of the Hybrid Composite Bridge System – A Case Study</b> .....	1755
<i>John M. Civitillo, Devin Harris, Amir Gheitasi, Mark Saliba, Bernard L. Kassner</i>	
<b>Bridge Lifting at Columns</b> .....	1765
<i>Stephen Brown, Jason Jelinek</i>	
<b>Rehabilitation of the Maple Avenue Bridge</b> .....	1775
<i>Kris Karvinen, Hamid Y. Omran</i>	
<b>Estimating Effective Prestress in Concrete Members</b> .....	1782
<i>Hiroshi Watase, Kyoji Niitani, Takahiro Nishida, Nobuaki Otsuki</i>	
<b>Evaluation of Performance Limit States for Reinforced Concrete Wall Pier in Out-of-Plane Direction</b> .....	1791
<i>Kader Siddiquee, Shahria Alam</i>	

<b>Performance Evaluation of a Steel Box Girder Bridge Using Load Distribution Factor from Operational Monitoring Data</b> .....	1801
<i>Hyun-Moo Koh, Hyun-Joong Kim, Wonsuk Park, Chul-Young Kim</i>	
<b>Inspection, Evaluation and Rehabilitation of the Macdonald-Cartier Bridge</b> .....	1809
<i>Michel Vachon, William Bohme, Saqib Khan</i>	

## VOLUME 4

<b>The Seismic Assessment and Structural Upgrading of the Gaglardi Way R18 Bridge in Burnaby, British Columbia</b> .....	1819
<i>Malcolm Sutton, Ryan Taylor, Christian Hilbig</i>	
<b>Refined Structural Evaluation of Existing Bridges by Field Instrumentation, Diagnostic Load Testing and FEA</b> .....	1830
<i>Satrajit Das</i>	
<b>Lynn River Lift Bridge Rehabilitation</b> .....	1840
<i>Janan Boparai, Stephen Mikucki</i>	
<b>50 Year Old Welded Steel Plate Girders – Assessment and Repairs</b> .....	1850
<i>Katrin Habel, Matthias Andermatt, Bob Ramsay, John Alexander</i>	
<b>Repairs to Damaged 100 Year Old Steel Through Truss Bridge</b> .....	1861
<i>Geoff Sarazin</i>	
<b>Hagwilget Suspension Bridge Refurbishment, Hazelton, BC</b> .....	1867
<i>Jeff Mellor</i>	
<b>Rehabilitation of Bridge Piers Utilizing UHPC</b> .....	1878
<i>Gaston Doiron, Vic Perry</i>	
<b>Bell’s Bridge Refurbishment</b> .....	1885
<i>Peter James Lyttle</i>	
<b>Athabasca River Bridge on Hwy 40 Near Entrance, Alberta: Assessment, Repair, and Widening</b> .....	1895
<i>Shahab Afhami, Dale Serink</i>	
<b>Deck Assessment of the Peace River Bridge</b> .....	1905
<i>Scott Alexander</i>	
<b>An Alternative Evaluation and Repair Approach for Impact-Damaged Steel Box Girder Bridges</b> .....	1915
<i>David Pow, Brad Schmidt, Jason Ropchan, Brad Craig, Martin Haalstra</i>	
<b>Rehabilitation Works for Pinawa Bridge over Winnipeg River</b> .....	1925
<i>Vaibhav Banthia, Beth Phillips, Troy Hengen</i>	
<b>Construction and Maintenance of Bridges – the Contribution of Automated Monitoring Systems</b> .....	1935
<i>Gianni Moor, Kleidi Islami, Niculin Meng</i>	

## INTEGRAL ABUTMENTS

<b>FEM Based Study on Benefits of Adaptation of Conventional Single Span Bridges to Frame Bridges</b> .....	1945
<i>Regina Della Pietra, Stefan Oberwalder, Nguyen Viet Tue</i>	
<b>Integral Bridges and the Modeling of Soil-Structure Interaction</b> .....	1953
<i>Stephen Rhodes, Terry Cakebread</i>	
<b>Low Cycle Fatigue Performance of Integral Bridge Steel H-Piles Subjected to Earthquakes</b> .....	1964
<i>Murat Dicleli, Memduh Karalar</i>	
<b>Extending Applicability of Integral Abutment in Highly Skewed Bridges</b> .....	1970
<i>Bo Hu, Zichao Wu</i>	
<b>Seismic Adjustment of Existing Bridges: the Change of the Static Scheme as a Possible Solution for Short and Medium Span Bridges</b> .....	1980
<i>Andrea Totaro, Enzo Siviero</i>	

## LESSONS LEARNED

<b>Corrosion Failure of Grouted Post-Tension Tendons in Bridge Structures Leads to Development of Innovative Cable Impregnation Technique</b> .....	1991
<i>David Whitmore, Haixue Liao, Garth Fallis</i>	
<b>Lateral Movement of a Widened Post-tensioned Concrete Bridge</b> .....	2002
<i>David Hubbell, Stephen Brown</i>	
<b>Investigation, Major Repair, Monitoring, and Subsequent Risk Mitigation of the Diefenbaker Bridge Fracture</b> .....	2013
<i>Reed Ellis, Manoj Medhekar, David MacLaggan</i>	
<b>Lessons Learned from Scour-Induced Bridge Failure Investigation</b> .....	2023
<i>Helsin Wang, Chung-Hsin Wang</i>	
<b>Customized Solutions for Bridge Coating/Corrosion Projects - Lessons Learned</b> .....	2032
<i>Mohit Soni, Siva Venugopalan</i>	

## MITIGATION OF DECK CRACKING

<b>Field Performance of Low-Shrinkage High-Performance Concrete Deck at Canal Bridge in Cornwall, Ontario</b> .....	2042
<i>Daniel Cusson, Jim Margeson, Glenn Hewus</i>	

<b>Case Studies of Internal Curing to Improve the Service Life of Short and Medium Span Bridges and Approach Pavements</b> .....	2052
<i>Ronald Vaughan, Bruce Jones, Randall Butcher, Patrick Piazza, John Roberts</i>	
<b>Crack Mitigation in Concrete Bridge Decks: Testing and Finite Element Modeling</b> .....	2063
<i>Ahmed Ibrahim, Will Lindquist, Ying Tung, Riyadh Hindi</i>	
<b>Design Considerations for Composite Girder Bridges Reinforced with GFRP Reinforcement in the Deck Slab</b> .....	2073
<i>Konstantinos Kris Mermgias, David Lai</i>	

## **PEDESTRIAN BRIDGES**

<b>Saline Creek Drive Pedestrian Bridge – Design and Construction of a Signature Pedestrian Bridge in Fort McMurry, Alberta</b> .....	2084
<i>Michael Paulsen, Bradford Appleton</i>	
<b>Rotated-Ellipse Arch Pedestrian Bridge for the Calgary West Light Rail Transit Extension Project</b> .....	2094
<i>Edmund Ho, Monty Knaus</i>	
<b>Town of Souris Swinging Bridge</b> .....	2104
<i>Kevin Amy, Gerd Birkle</i>	
<b>Sirinevler District: A New Footbridge Connection in Istanbul</b> .....	2113
<i>Alessandro Stocco, Enzo Siviero</i>	
<b>Network Arch Design for Pedestrian Bridges</b> .....	2121
<i>Schaun Valdovinos, Chelene Wong</i>	

## **PORT MANN-HIGHWAY 1**

<b>Port Mann / Highway 1 Improvement Project: Description and Overview</b> .....	2131
<i>Marek Buksowicz, Jianping Jiang</i>	
<b>Port Mann / Highway 1 Improvement Project: Performance Based Seismic Design</b> .....	2141
<i>Casey Leggett, Marc Gérin</i>	
<b>Port Mann / Highway 1 Improvement Project: Design and Construction of Curved Steel Bridges</b> .....	2151
<i>Maged Ibrahim, Jacek Doniec</i>	
<b>Port Mann / Highway 1 Improvement Project Staged Bridge Design and Construction</b> .....	2161
<i>Ian Walters, Jamie McIntyre, Casey Leggett</i>	
<b>Port Mann / Highway 1 Project: Rehabilitation, Retrofit and Upgrade of Existing Structures</b> .....	2171
<i>Keith Holmes, Jamie McIntyre, Marc Gérin</i>	
<b>Port Mann / Highway 1 Improvement Project: Lightweight EPS Embankments</b> .....	2181
<i>John Campbell, Stuart Culpan, Marc Gérin</i>	

## **RAIL BRIDGES**

<b>Osborne Station Bridge on Winnipeg Southwest Transitway</b> .....	2191
<i>Mike Lau, Sital Rihal, Robert Taylor, Brad Neirinck</i>	
<b>Challenge in Design and Construction for Railway Bridge Replacement in a Roadway Widening Project – Montréal, Quebec</b> .....	2200
<i>Adel R. Zaki, Mohammed Naimi</i>	
<b>Design and Construction of LRT Viaduct Esenler</b> .....	2210
<i>Cenan Ozkaya, Gulden Cetin, Fikret Tulumtas</i>	
<b>Design of Two Multi-Track Skewed Concrete Bridges for the Georgetown South Project in Toronto</b> .....	2219
<i>David O'Sullivan</i>	

## **RESEARCH AND DEVELOPMENT**

<b>Probabilistic Quantification of Military Vehicle Loading</b> .....	2227
<i>Andrew MacDonald, F. Michael Bartlett, Rusmir Tanovic, Gordon Wight</i>	
<b>Practical Application of Transverse Load Redistribution in Reinforced Concrete Solid Slab Bridges</b> .....	2238
<i>Eva Lantsoght, Cor van der Veen, Ane de Boer</i>	
<b>The Multi Scale Studies for FRP Composite Decks in Bridge System</b> .....	2249
<i>Wang Chao, Moe M.S. Cheung</i>	
<b>Accuracy of CHBDC Simplified Methods of Analysis</b> .....	2257
<i>Hendrik Westerink, F. Michael Bartlett</i>	
<b>Evaluation of the Structural Performance of Thick Concrete Slabs Affected by Alkali-Silica Reaction (ASR)</b> .....	2268
<i>François Pissot, Anthony Allard, Josée Bastien, Benoit Fournier, Benoit Bissonnette, Denis Mitchell</i>	
<b>Optimal Infrastructure Investment as a Real Option: A Monte Carlo Approach</b> .....	2279
<i>Charli Tandja, Gabriel Power, Josée Bastien, Alexandre Gagné</i>	
<b>The Effects of Increasing Overload Axle Widths on Bridge Girder Distribution Factors</b> .....	2288
<i>Ruby C.Y. Kwan, Scott Loptson, Kent LaRose</i>	

<b>Analysis of Live Load Effects on Bridges Modeled as Plates Considering Multiple Presence from WIM Data .....</b>	<b>2298</b>
<i>Adrián García-Soto, Felicitas Calderón-Vega, Roberto Gómez, José Alberto Escobar</i>	

## **SEISMIC**

<b>Seismic Analysis of an Isolated and Non-Isolated Curved Bridge Including Temperature Effects.....</b>	<b>2308</b>
<i>Mohammed Naimi, Philippe Brisebois</i>	
<b>New Hysteretic Damper Featuring Displacement-Dependent Hardening for Seismic Protection of Bridges .....</b>	<b>2318</b>
<i>Murat Dicleli, Ali Salem Milani</i>	
<b>Seismic Isolation of Bridges in Cold Climates .....</b>	<b>2325</b>
<i>Francois Paradis, Yannick Maltais, Jean-François Martel, Paul Dandois</i>	
<b>Seismic Performance Degradation of a Steel Pile Supported Highway Bridge Bent due to Corrosion .....</b>	<b>2334</b>
<i>Rafiqul Haque, Siriwut Sasibut, Kader Siddiquee, Shahria Alam</i>	

## **STANDARDS AND GUIDELINES**

<b>Development of Economical Short-Span Steel Bridge Standards.....</b>	<b>2344</b>
<i>Karl E. Barth, Gregory K. Michaelson, Michael G. Barker, Daniel R. Snyder</i>	
<b>Developing a Quality Management Program for Bridge Inspection Consultants .....</b>	<b>2355</b>
<i>Jennifer Laning</i>	
<b>Highway Bridge Widening: Critical Issues for Peer Review .....</b>	<b>2359</b>
<i>Mark Williams</i>	
<b>Alberta Transportation Bridge Load Evaluation Manual.....</b>	<b>2365</b>
<i>Bob Ramsay, John Alexander, Clayton Matwychuk</i>	
<b>Navigating the FHWA “Primer for the Inspection and Strength Evaluation of Suspension Bridge Cables” .....</b>	<b>2374</b>
<i>Brian J. Leshko, Brandon W. Chavel</i>	

## **STRUCTURAL HEALTH MONITORING**

<b>Damage Assessment of a Laboratory Bridge Model Using Time Series Analysis.....</b>	<b>2384</b>
<i>Branislav Kostic, Mustafa Gul</i>	
<b>Scour and Structural Health Monitoring of the Frontera Bridge .....</b>	<b>2394</b>
<i>Stephen Schorn, Benoit Kroely, Bernard Basile, Cesar Rivera</i>	
<b>Structural Identification of a Tied Arch Bridge Span: Effect of Boundary Conditions on Model Correlation .....</b>	<b>2401</b>
<i>Neal Salas Zamudio, Timothy Kernicky, Matthew Whelan</i>	
<b>Structural Health Monitoring of a Steel Girder Bridge Rehabilitated with Precast Deck Panels in Morris, Manitoba.....</b>	<b>2411</b>
<i>Hugues Vogel, Reed Ellis, Ruth Eden, Evan Fer</i>	
<b>Optical Remote Sensing Systems for Structural Deflection Measurement and Crack Characterization .....</b>	<b>2420</b>
<i>Ayman Habib, Derek Lichti, Mamdouh El-Badry, Ivan Detchev</i>	
<b>Author Index</b>	