

SEABC Young Members Group 7th ANNUAL PRESENTATION COMPETITION

SO YOU THINK YOU CAN GIVE A SEMINAR?

Join us as five young engineers each give a 15 minutes presentation on a topic of their interest. Don't miss out on this chance to take in what the talented young structural engineers in our community have to offer!



Date: Wednesday February 21, 2018

Refreshments 5:30pm - 6:00pm

Presentations 6:00pm - 8:45pm

Followed by a social gathering at the Lennox Pub

Venue: Room C100, UBC Robson Square, 800 Robson Street, Vancouver, BC

Cost: Free for SEABC members, \$10 for non-members

Contestant Presentations (See following pages for abstracts)

Amir Garekani, Structural EIT, Ausenco Engineering
Seismic Upgrade of a Steel Moment Frame

Brook Robazza, Junior Bridge Engineer, McElhanney Consulting Services Ltd.
Design and Erection of the Veer Kunwar Singh Bridge

Julia Halipchuk, Design Engineer, Read Jones Christoffersen
Is SRG the New NBCC?

Qi Zhang, Designer EIT, WSP, PhD student at UBC Okanagan
Performance - Based Design in Bridge Engineering: A state-of-the-art review

Reza Saiedi, Bridge Engineer, Associated Engineering
A Building Made of Bridges: Jamarat Bridge, Saudi Arabia

Distinguished Guest Speaker (More on Page 4)

Don Bergman

P.Eng., P.E., Vice President Major Projects, COWI Bridge North America

Don Bergman is a Vice President of COWI North America, formerly Buckland & Taylor Ltd. Don completed an Applied Science honors degree at the University of British Columbia before joining Buckland & Taylor Ltd in 1981. In the 37 years since joining the company, he has worked in a wide range of areas in bridge engineering. Much of that work has been associated with long span cable supported bridges. His fields of expertise include analysis and design of cable-stayed bridges, the design, fabrication, and erection of steel and composite bridges, and seismic engineering for bridges. He has worked on the design and construction of bridge projects in Canada, Australia, the U.S.A., Thailand, Britain, and Hong Kong.



Russky Bridge, Vladivostok, Russia, Main Span

Don's presentation to the SEABC Young Members Group will focus on the development of the cable stayed bridge form and in particular the extradosed bridge form which is relatively new. Don will present the St Croix Extradosed Bridge and describe the development of the concept, the design and the construction of the bridge.

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Competition Judges

Levi Stoelting, P.Eng, Principal of Glotman Simpson Consulting Engineers

Charles King, Ph.D, C.Eng, F.I.Struct.E, Senior Steel Specialist, COWI Bridge North America

Ronald Krpan, P. Eng, Instructor, Civil Engineering School of Construction and the Environment, BCIT

Competitor Presentations (1/2)

Seismic Upgrade of a Steel Moment Frame

Amir Garekani, Structural EIT, Ausenco Engineering



One of the more unique projects that I had the opportunity to work on was the seismic upgrade of a four-storey steel moment frame using a buckling restrained bracing (BRB) solution to eliminate the soft-storey mechanism and using performance based approach to assess and upgrade the structure. Through the course of this project, I was heavily involved with the structural modelling and analysis of the building; this included conducting non-linear pushover analysis for each direction of the building to obtain the backbone curve for each storey and verifying the soft-storey in the



first level. With the backbone of the soft-story available, a preliminary BRB property was calculated and the analyses were repeated; after a few iterations and obtaining representative BRB properties from the manufacture, a series of non-linear time-history analyses and non-linear pushover analyses were conducted to verify that the desired performance levels have been achieved.

For the purpose of this presentation, firstly a brief overview of the project definition and the goals set out will be presented. The focus of this presentation is mainly on the seismic upgrade methodology including the codes and guidelines used and the performance criteria set out as well as the combination of non-linear time history and non-linear pushover analyses conducted to evaluate the structural performance with the proposed upgrade solution.

Design and Erection of the Veer Kunwar Singh Bridge

Brook Robazza, Junior Bridge Engineer, McElhanney Consulting Services Ltd.

Many of tomorrow's mega structures will be built in India as the nation's transformative economic growth continues. Today the 117 million people of the northeastern state of Bihar are benefiting from a new link provided by the Veer Kunwar Singh Bridge across the Ganges River. Prior to the bridge completion, this region, a vast and populous river plane with the nation's lowest per capita income, had just six road lanes on three bridges over this 400 km stretch of river. Upon inauguration in 2017, this four lane bridge became the world's longest extradosed bridge, while also representing an evolution of bridge technology and construction processes in the state. The design and erection engineering of this 4.35km long signature bridge was completed by the Canadian engineering company, McElhanney. The bridge comprises a series of central extradosed spans covering the 1920m wide navigational channel, which are flanked by simply supported girder approach spans. For the 16 extradosed units, a stay cable system was used to carry the superstructure self-weight, which permitted the use of a relatively shallow 3.4 m constant depth box girder for the 120m long extradosed spans. This allowed the girder to be composed of precast segments, which could be erected much more rapidly than the typical insitu concrete construction used on previous Ganges bridges. This presentation describes the design and erection of the Veer Kunwar Singh Bridge and how Canadian engineering and innovation has helped improve the region's local economy.



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Competitor Presentations (2/2)



Is SRG the New NBCC?

Julia Halipchuk, Design Engineer, Read Jones Christoffersen

The purpose of this speech is to provide an introduction to the Seismic Retrofit Guidelines that were developed by the Ministry of Education as a method to assess and retrofit schools in the province of British Columbia. The chief purpose of the speech will be to provide a discussion on how the system can be implemented as a code for existing buildings for seismic assessment and retrofit method of low rise buildings. It will discuss the principle elements of the analysis method, its advantages and benefits as well as its limitations. I will also provide a brief comparison to FEMA 273 Guidelines for the Seismic Rehabilitation of Buildings, ASCE 31 Seismic Evaluation of Existing Building, and ASCE

41 The Seismic Rehabilitation of Existing Buildings that are used in the United States. And finally, I will provide a rudimentary sample building to illustrate how building would go from a rapid assessment, to a seismic project identification report to a detailed design retrofit upgrade.

Performance - Based Design in Bridge Engineering: A state-of-the-art review

Qi Zhang, Designer EIT, WSP, PhD student at UBC Okanagan

Performance-based design (PBD) is a philosophy that aims at protecting life safety from major earthquakes and limiting losses from small earthquakes. This presentation reviews the fundamentals and the current practices of PBD for standard highway bridges covering Canadian Highway Bridge Design Code (CHBDC), BC Ministry of Transportation and Infrastructure (MoTI) Supplement to CHBDC, AASHTO and a number of Departments of Transportation in the US. The design criteria vary from one region to another and are based on various damage measurements such as strains, drifts and ductility. Based on case studies, it is found that CHBDC has the most stringent design criteria. BC MoTI Supplement has similar level of design safety to South California DOT and Oregon DOT at the lower hazard level (500-year return period). In addition to code comparison, since most codes do not quantify residual strength of earthquake-damaged columns, this study investigates the impact of seismic damages on column axial capacities. It is concluded that column compressive strength is well sustained if the ductility demand is not greater than two and proper seismic details are used.



Photo source: myofedia.org

A Building Made of Bridges: Jamarat Bridge, Saudi Arabia

Reza Saiedi, Bridge Engineer, Associated Engineering



The Jamarat Bridge in Saudi Arabia is a very exciting and unique \$2B bridge project. The structure consists of a series of 60-80m long segmental box girder bridges stitched together transversely to create large column-free platforms. The segments were erected by the balanced cantilever method.



The presentation is a series of full-screen photos (samples below) highlighting typical features of a segmental box girder bridge: haunched girders, adjustable steel formwork, dense rebar cage, match-casting, shear keys, epoxy glue, temporary pre-stressing bars, and cantilever and continuity pre-stressing tendons. I worked on this project in 2006 as an intern with a British design firm (Benaim) in Malaysia.

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Distinguished Guest Speaker

Recent Development of the Modern Cable Stayed Bridge

Don Bergman, P.Eng., P.E., Vice President Major Projects, COWI Bridge North America

The development of the modern cable stayed bridge form over the past 7 decades has remarkable. Although there were early forms of bridges that resembled cable stayed bridges as far back as the seventeenth century the modern version emerged largely based upon important work done by German engineers who were rebuilding many of the river crossings lost in the Second World War. The primary characteristic which defines the modern cable stayed bridge is the presence of well defined and tuned cables which provide vertical support but also introduce compression into the deck. The bridge has become a dominant form in spans ranging from 100m



St Croix Bridge, Stillwater, Minnesota, USA, Length 1024 m



St Croix Bridge, View along the deck



St Croix Bridge, View from the water

One of the very recent developments in the cable stayed form is the extradosed bridge which only emerged as a concept in 1988. The cables of an extradosed bridge act partially as post-tensioning for the bridge deck and also traditional cable stays which provide vertical support. While there are now more than 100 extradosed bridges worldwide there are only four in North America. The recently completed St Croix Bridge in Minnesota designed by COWI is an example of this interesting new form of cable stayed bridge. Don will discuss the development of this bridge form and describe the design and features of the St Croix Bridge.