34TH ANNUAL INTERNATIONAL BRIDGE CONFERENCE®

TECHNICAL PROGRAM INSIDE

GAYLORD NATIONAL RESORT & CONVENTION CENTER

THE IBC RETURNS TO
THE NATION'S CAPITAL REGION,
JUNE 5-8, 2017
GAYLORD NATIONAL RESORT, NATIONAL HARBOR, MD

REGISTRATION IS NOW OPEN!

To register for the IBC, simply visit https://eswp.com/bridge/registration/

Be sure to indicate the options you wish to reserve, including the IBC Awards Dinner, the IBC Boat Tour, and the Official IBC Conference Proceedings!

EARLY BIRD discount rates are available until May 5!

WELCOME

Welcome to the 2017 International Bridge Conference® (IBC), sponsored by the Engineers' Society of Western Pennsylvania (ESWP) - our 34th annual IBC! 2017 marks our return to National Harbor, MD. The host hotel, Gaylord National Resort & Convention Center, is ideally suited for the ever-growing IBC. The Gaylord will host all events of the IBC, and is located within walking distance of the Woodrow Wilson Bridge along the Potomac River. We are pleased to have Washington, D.C. Department of Transportation, (DDOT) as our Featured Agency to showcase their bridge program. Remember, the IBC is now a four-day event, extending from Monday thru Thursday, June 5–8, 2017!

ARRIVING

Getting to/from the Gaylord National Resort & Convention Center and downtown Washington, D.C. is very easy. There are three major airports in the area:

- Ronald Reagan Washington National (DCA): only 8 miles/15 minutes, we have a dedicated Gaylord shuttle that runs for $18 one way (taxi is about $25)
- Dulles International (IAD): 35 miles/45 minutes, taxi is about $50
- Baltimore-Washington Int'l. (BWI): 37 miles/50 minutes, taxi is about $60

For those who prefer travel-by-train, there is also DC's Union Station, which is only 8 miles from the hotel.

The Gaylord also provides a daily shuttle from 8:00 a.m. – 8:00 p.m. which goes to two stops downtown and is $13 one-way or $20 round trip (stops are located at Union Station and the Ronald Reagan Building/2 blocks from the White House); it is a great way to get downtown and see the sights, or a way to get from Union Station to the Gaylord National Resort.

For guests of the IBC arriving by automobile, you will receive a $10 discount of the prevailing daily parking rates at the Gaylord. In addition to the vast parking available at the Gaylord, there are many other local parking options. Vist http://parking.nationalharbor.com/ for locations, and rates.

LODGING

The IBC has a special block of sleeping rooms reserved at the Gaylord National Resort & Convention Center, host hotel for all IBC events & activities. Rates for a standard room are $254.00 per night, plus applicable taxes & fees. Our special IBC rate includes the resort guest fee (a savings of $18.00/night) which covers in-room internet service, unlimited local & domestic long-distance telephone calls, and access to the resort pool and fitness center. Guests of the IBC also receive a coupon book worth savings of over $100.00. Reservations should be made through the IBC homepage, found here: https://eswp.com/bridge/lodging/

Learn more at www.gaylordnational.com

Address: 201 Waterfront Street National Harbor, MD, 20745 USA

NATIONAL HARBOR'S LOCAL ATTRACTIONS

350 premium acres along the shimmering Potomac. More than 160 enticing shops and 40 delicious restaurants. Eight spectacular hotels with views of downtown D.C. and Old Town Alexandria. Four distinctive waterfront residences. And it's all just a 15-minute drive or water taxi ride from the heart of the nation's capital. Getting around National Harbor has just gotten even easier! The National Harbor Circulator - National Harbor's newest mode of transportation - provides service between the area's hot spots, 7 days a week, 365 days a year and makes stops at Downtown National Harbor, the Gaylord National, Tanger Outlets and the MGM National Harbor. The cost is only $5 for an all-day pass.

National Harbor is directly accessible via the Woodrow Wilson Bridge, the Capital Beltway, I-95, I-495 and I-295—with interchange and multi-lane fly-off ramps exiting exclusively into the community from Maryland, Virginia and D.C. Visit http://www.nationalharbor.com/

SPECIAL NEEDS

The International Bridge Conference® and ESWP support the Americans with Disabilities Act (ADA), which prohibits discrimination against, and promotes public accessibility for those with disabilities. We ask those requiring specific equipment or services to contact the ESWP Conference Department at 412-261-0710, extension 11 and advise us of any such requirements in advance.

CONTINUING EDUCATION CREDITS

By attending the IBC, registered attendees can earn professional development hours (PDHs) to satisfy their continuing education requirements for your P.E., S.E., or P.G. license! The Engineers' Society of Western Pennsylvania (ESWP,) sponsor of the IBC, is an approved provider by both the New York and Florida Board of Licensing, satisfying licensing requirements there, as well as in many other states. All technical sessions and workshops that qualify for PDHs are awarded upon request following the conference. Be sure to check with your Board of Licensing to determine if any particular reporting requirements exist to claim your PDHs. Technical Sessions and Workshops are listed in chronological order on the following pages in this brochure and are subject to change - please check the IBC website for any updates.

EXHIBITS & SPONSORS

The IBC Exhibit Hall is filled with experts in the bridge industry and represents engineering consultants, designers, constructors, special interest groups, service providers and many others. More than 150 booths will offer attendees many opportunities to extend their learning experience beyond the technical presentations made during the conference. Also, networking in the Exhibit Hall is enhanced by the luncheons and receptions presented there and open to all registered attendees.

BOAT TOUR

In partnership with the District of Columbia DOT, the IBC will set sail on Tuesday, June 6 for a river boat tour of some of the region's bridges and monuments. Aboard the Potomac River Boat Company, we depart at 1:00 p.m. and return by 5:00 p.m. Seating is limited so be sure to reserve early! An additional registration fee is required.

REGISTER ON-LINE AT WWW.ESWP.COM/BRIDGE

Full Registration at the IBC includes admission to the Keynote Session, Featured Agency Session, all Technical Sessions, Workshops, and Exhibit Hall (including our Exhibit Hall buffet luncheons & reception). One- or Two-Day Registration includes all sessions and Exhibit Hall functions corresponding to the day(s) selected.

As always, the heart of the IBC is the quality technical presentations described in detail in this guide under "Technical Sessions." We also offer a number of "Workshops" presented by many of our co-sponsors, and other industry-leading groups on an even wider variety of bridge topics.

Register on-line at https://eswp.com/bridge/registration/ Your registration, along with payment, must be received by the Engineers' Society of Western Pennsylvania by Friday, May 26, 2017. Following that date you must register on-site at the conference.

All refund requests must be received in writing. No refunds after May 19, 2017. You will be responsible for the appropriate registration fee if cancellation is not received in a timely fashion.

ABOUT THIS GUIDE

Please note the use of abbreviations in this guide include:

DOT = Department of Transportation

DDOT = Washington, District of Columbia Department of Transportation

ft or ' = foot

m = meters

QUESTIONS?

Loads of additional information is available on our website at eswp.com/bridge or you can scan the QR code. Still have questions? Please contact IBC Manager Kristen Musloe, at the Engineers' Society of Western Pennsylvania; she can be reached by e-mail: k.musloe@eswp.com or by telephone at 412-261-0710, extension 11.

The IBC Technical Program is the heart of the International Bridge Conference®. Attendees come to learn about the latest technical information available in the bridge industry, educate themselves in current technology and applications through attendance in IBC workshops, and network with their peers active in the bridge industry. IBC Technical Sessions consist of white papers (noted as 17-x) that are presented along with a Power Point-style presentation. Each paper is scheduled for 30 minutes (exc. Keynote and Featured Agency sessions), and based on this schedule attendees can move from session-to-session to see and hear presentations of their choice. IBC Workshops (noted as W-x) vary in length and are presented during the IBC by industry experts. The additional time alloted for workshops allow for a more in-depth presentation on a specific topic. (Registrants do not need to pre-select which sessions, papers or workshops you intend to see.)

SKEWED BRIDGES

Monday, June 5; 8:00–10:00 a.m.

IBC 17-1: Effective Cross-Frame Distribution for Straight Steel I-Girder Bridges with Skewed Supports

Telmo Andres Sanchez, Ph.D., ADSTREN Cia. Ltda., Quito, Ecuador; Cagri Ozgur, Ph.D., P.E., HDR Engineering, Albany, NY

The primary function of cross-frames in straight steel I-girder bridges is connecting girders to obtain a stable structural system. During steel erection and deck pour, cross-frames work as lateral supports that stabilize the I-girders and prevent them from lateral-torsional buckling. In addition, in bridges with skewed supports, cross-frames provide a transverse load path, where internal forces are developed and transferred to the girders. These collateral and undesired forces may affect the performance of the overall structure both during construction and in service. This presentation shows different cross-frame patterns and configurations that may be used for the design of skewed steel I-girder bridges that do not affect the primary functions of these elements, while reducing undesired collateral effects.

IBC 17-2: Unique Field Inspection Findings at Sharply Skewed Steel Bridges

Rama Krishnagiri, Rishindran Tharmarajah, P.E., Michael Morales NHI, CBI and Walter Hucal, P.E., Parsons Brinckerhoff, Lawrenceville, NJ; Mula Reddy, New Jersey DOT, Ewing, NJ

Our presentation of field inspection findings discusses sharply skewed steel bridges, and curved bridge decks with skewed supports and/or flared straight steel girders. Steel details, bearing types, support skew, framing details, and girder layout affect the main members and bearings. Special attention is required, particularly at older, horizontally curved decks on steel girders - straight, parallel or flared with staggered cross frames, and rocker type/pinned bearings, as they may be vulnerable to cracking and unseated bearings.

IBC 17-3: Replacing the Mann Ave. Bridge: Innovative Design For a High Skewed Rigid Frame Bridge Using Composite Precast Prestressed Concrete Box Girders On Secant Caisson Walls

Maged William Ibrahim, B.Sc., M.A.Sc., P.Eng., P.E., FEC, Seyyed Nima Mahmoudi and Shelley Huang, P.Eng., WSP-MMM Group, Thornhill, ON, Canada.

The main goal of this project is to replace an existing single-span, skewed overpass to accommodate Ottawa Light Rail Transit loads. A number of geometrical and construction constraints had to be addressed by the new design. The main challenges included dealing with high skew, vertical clearance, aggressive design and construction schedule, and access limitations. The structure consists of secant caisson wall abutments forming rigid frame action with precast prestressed concrete box girders.

IBC 17-4: Design Case Study of a Highly-Skewed Steel Plate Girder Bridge: What Level of Analysis is Required?

Daniel Baxter and Alexandra Willoughby, P.E., Michael Baker International, Minneapolis, MN

Bridge 27W02 will be a highly-skewed steel plate girder bridge over I-35W. Preliminary design was performed using line girder analysis (LGA), while final design of the girders and cross frames was undertaken using 3D finite element modeling (FEM), with flanges modeled as beam elements and webs as shell elements. By comparing the results, this paper will show which aspects of design are satisfactory using LGA, and which require the additional complexity of 3D FEM.

LIBERTY BRIDGE

Monday, June 5; 8:00–10:00 a.m.

IBC 17-5: Emergency Repair of Fire Damage to Liberty Bridge Truss in Pittsburgh

Jonathan Moses, P.E. and Louis Ruzzi, P.E., PennDOT District 11, Bridgeville, PA.

On September 2, 2016 a fire ignited on the Liberty Bridge in Pittsburgh, PA. The bridge was undergoing a two-year, $80 million rehab when sparks ignited piping and tarps that were on the paint containment system. As a result, a bottom chord member buckled due to the intense heat and sustained dead load. Department, contractor, and consultant personnel worked around the clock to develop and implement a repair to reopen the bridge to traffic in 24 days. This paper gives an overall view of the incident, PennDOT's response and incident management.

IBC 17-6: Liberty Bridge Emergency Jacking Frame Design for Repair of Fire-Damaged Member

Jarid Antonio, Ryan Jenkins and Ahmad Ahmadi, SAI Consulting Engineers, Pittsburgh, PA

Fire caused significant damage and displacement to the west truss bottom chord and gusset plates of the Liberty Bridge, a 775' 3-span deck truss in downtown Pittsburgh carrying 55,000 vehicles per day, resulting in immediate closure for collapse concerns. That night, SAI began designing jacking and lateral bracing systems to bypass the damaged chord, facilitate new load path, relieve east truss of overload forces from displacement to reopen Liberty Bridge, and accommodate west truss final repairs.

IBC 17-7: Liberty Bridge Fire & Emergency: Initial Response and Monitoring Plan

Nick Burdette, P.E., Roger Eaton, P.E. and Nick Cervo, P.E., HDR Engineering, Inc., Pittsburgh, PA

As the designer for the rehabilitation work, HDR worked with PennDOT District 11 and several other consultants and universities to orchestrate an emergency repair of the truss. This repair required jacking the damaged bridge chord axially, laterally, and locally. This presentation will focus on the initial damage assessment, initial 3D modeling of the fire-damaged spans, development of the jacking frame concept, and development of the bridge monitoring plan used during jacking.

IBC 17-8: The Liberty Bridge Fire - Global Behavior

Thomas Murphy, Andrew Adams, Christopher Smith and Nohemy Galindez, Modjeski and Masters, Inc., Mechanicsburg, PA

As part of the emergency response, a global 3D analysis of the Liberty Bridge was performed to evaluate the capacity of the bridge after fire damaged a bottom compression chord member. The analysis results were combined with calculated capacities and field measurements of strain and displacement to produce real-time ratings of the main trusses during jacking. Based on the results, the bridge was reopened to traffic following jacking operations.

INSPECTION/ANALYSIS

Monday, June 5; 8:00–10:00 a.m.

IBC 17-9: Thermal Integrity Profiling for Drilled Shafts

Matthew Silveston, Terracon Consultants, Inc, North Charleston, SC

Thermal Integrity Profiling is an emerging technology that is being rapidly adopted by owners across the US to assess the quality of drilled shaft construction. The presentation provides an explanation of the theory as well as several examples that will allow the audience an opportunity to understand the new benefits the test provides as well as its limitations.

IBC 17-10: A 21st Century Retrofit for a 20th Century Bridge: Design of the Winona Bridge Retrofit using Nonlinear Finite Element Analysis

Daniel Baxter and Krista Stippelmans, EIT, Michael Baker International, Minneapolis, MN

This presentation describes the retrofit and analysis of the Winona Bridge, a 1940s-era historic through truss spanning the Mississippi River. The retrofit will allow the bridge to carry today's heaviest permit loads with internal redundancy while preserving the structure's historic character. To maintain appearance, many members are retrofit with high-strength bars concealed within existing steel sections. This required complex nonlinear finite element analysis to establish that the high-strength bars perform as intended with existing steel.

IBC 17-11: 2017 Biennial Inspections of the Fort McHenry and Baltimore Harbor Tunnels for the Maryland Transportation District (MDTA)

David Lynch, P.E., M.ASCE and Jordan Lair, P.E., AECOM, Baltimore, MD; Tekeste Amare, P.E., Maryland Transportation Authority, Baltimore, MD

The implementation of the NTIS brings the operation, maintenance, inspection, and evaluation of tunnels up to the level of bridges and in line with the requirements of MAP-21. This paper discusses the technical, practical, and strategic aspects of tunnel inspections. The perspectives of the inspection team and the tunnel owner are considered and presented to impart a working understanding of the process, purpose, and goals of the NTIS for application at other tunnel facilities.

IBC 17-12: Application of Lean Philosophy in Bridge Inspection

Emal Masoud, Abigail Clarke-Sather, Ph.D. and Jennifer Rightman McConnell, Ph.D., University of Delaware, Newark, DE

This work applies Lean philosophy, originating from manufacturing, to improve the efficiency of bridge inspections. Lean maximizes time on activities that add value to the final output and reduces losses identified as waste. A time log of activities from 22 bridge inspections was collected. Activities include review of documents, mobilization of equipment and personnel to the site, visual inspection, demobilization, and reporting. Findings suggest that reporting often takes more time than visual inspection of bridges.

SPECIAL TOPICS - PEDESTRIAN BRIDGES & TUNNEL INSPECTION

Monday, June 5; 8:00–10:00 a.m.

IBC 17-13: Design and Construction of the Terwillegar Park Stressed Ribbon Footbridge

Reed Ellis, Ph.D., P. Eng. and David MacLaggan, MScE, P.Eng., Stantec Inc., Edmonton, AB, Canada; Jason Reske, M.Eng., P.Eng., City of Edmonton, Edmonton, AB, Canada.

In October 2016, the longest and first multi-span stressed ribbon bridge in Canada was opened to the public in Edmonton, Alberta. Although stressed ribbon bridges are relatively common in Europe, they are not as common in North America. Stressed ribbon bridges can be described as precast concrete structures that are erected segmentally on cables and post-tensioned to achieve a continuous, slender, prestressed concrete structure. The design and construction process is described together with lessons learned.

IBC 17-14: The Francis "Fanny" Appleton Pedestrian Bridge: Maintaining Aesthetics While Improving Pedestrian Comfort

Marian Barth, P.E. and William Goulet, STV Incorporated, Boston, MA

Francis "Fanny" Appleton, wife of Henry Wadsworth Longfellow, will be memorialized with a 750-foot-long "ribbonlike" pedestrian bridge structure. The 222-foot main span is an arched Vierendeel truss. Approach spans are curved tub girders supported by Wye-shaped piers. The design mitigates pedestrian induced vibrations without the use of tuned mass dampers while still meeting the architect's intent. Each element was evaluated for its strength and stiffness in contributing to vibration performance.

IBC 17-15: Construction and Monitoring of the Innovation Bridge

Guillermo Claure, Ph.D., Antonio Nanni and Francisco De Caso y Basalo, University of Miami, Miami, FL

Climate change and maintenance costs demand sustainable construction practices. To demonstrate commitment to sustainability through innovative construction, the University of Miami constructed a pedestrian bridge using concrete solely reinforced with fiber-reinforced polymer (FRP) composites. The reinforcement features basalt and glass FRP (BFRP and GFRP) rebars, unique configurations such as BFRP continuous closed stirrups, prefabricated BFRP cages, and two main double-tee girders prestressed with carbon FRP (CFRP) tendons. Performance is monitored with internally installed vibrating-wire gauges.

IBC 17-16: Initial NTIS Inspection of the Lehigh Tunnels Case Study and Lessons Learned

Brian Leshko, P.E., HDR Engineering, Pittsburgh, PA

This presentation will describe the initial National Tunnel Inspection Standards inspection of the Lehigh Tunnels, two separate bores (circa 1957 and 1991) approximately 4,379' in length on the Northeast Extension (I-476) for the Pennsylvania Turnpike Commission, as a Case Study providing valuable Lessons Learned from the perspective of implementing the new Federal requirements, and sharing inspection methods, equipment, and management techniques, as well as focusing on innovations, ideas, and best practices for all tunnel inspectors.

IBC KEYNOTE SESSION

Monday, June 5; 10:00 a.m.–12:00 noon

The Keynote Session is the official start to the 2017 IBC. This year we are pleased to announce the following presenters:

Leif Dormsjo, Director, District of Columbia DOT (DDOT), Washington, DC

Scott Jarvis, CAHSR Chief Engineer, California High-Speed Rail Authority, Sacramento, CA

Joseph J. Abriatis, CCM, PMP Project Controls Manager, Architect of the Capitol, Planning & Project Management Division, Washington, DC

FEATURED AGENCY SESSION

Monday, June 5; 2:00–5:00 p.m.

The IBC is pleased to welcome the District of Columbia Department of Transportation (DDOT), as the 2017 Featured Agency. In addition to the exhibit display highlighting the bridge program of DDOT, the Featured Agency session provides attendees with the opportunity to learn even more about this dynamic agency and their recent projects. Presentations include:

Bridges in Washington, DC
Dawit Muluneh, P.E., Chief Engineer, District of Columbia DOT (DDOT), Washington, DC

The District's Historic Bridge Structures
Konjit Eskender, P.E., State Bridge Engineer, District of Columbia DOT, Washington, DC

The Frederick Douglass Bridge and South Capitol Street Project
Delmar Lytle, P.E., District of Columbia DOT, Washington, DC

H Street Bridge
Ali Shakeri, P.E., District of Columbia DOT, Washington, DC

Capitol Crossing
Abdullahi Mohamed, District of Columbia DOT, Washington, DC

Long Bridge
Anna Chamberlain, District of Columbia DOT (DDOT), Washington, DC

16th Street and 27th Street Bridge Projects
Paul Hoffman, P.E., District of Columbia DOT, Washington, DC

Active Transportation- The District's Trail Bridges
Jim Sebastian, District of Columbia DOT, Washington, DC

PROPRIETARY

Monday, June 5; 2:00–5:00 p.m.

IBC 17-17: Deep Pipe Pile Cell Foundations Built in Rivers for Expressway Viaduct Widening
Takefumi Takuma, Giken America Corp., Orlando, FL

Pipe pile cell foundations are being constructed to support a new expressway interchange on a viaduct section over rivers flowing through a densely populated part of Tokyo, Japan. The state-of-the-art Gyro Press Method (rotating and simultaneously pressing in the pipe piles) was chosen to drive 60-meter (197-foot) long and 800mm (31.5-in) diameter pipe piles to minimize noise and vibration and to deal with a low overhead clearance.

IBC 17-18: The Inspection Revolution: How a Combined Above/Below Water Hi-Resolution Mapping System is Changing the Way We Assess the Condition of Marine Structures
Mark Farber and Rich Hisert, Ph.D., Innovative Mapping Technologies, LLLP (IMT), Troy, NY

Innovative Mapping Technologies (IMT) utilizes its combined multibeam-LiDAR mapping vessel to characterize structures, below and above the waterline, throughout the New York State Canal System. The high resolution, geospatially referenced, 3D models have become the standard of the inspection program, which previously used divers alone. The new program has produced more accurate and comprehensive inspections with less time on the water, resulting in a higher number of structures completed with lower costs and increased safety.

IBC 17-19: Effectiveness of Added Damping Systems for Structures in Latin America
Carlos Mendez-Galindo, Ph.D., Mageba Mexico, Mexico City, MX; Gianni Moor, Mageba USA, New York, NY; Borja Bailles, Mageba International, New York, NY

Several countries in Latin America have started to implement seismic protection systems based on advanced technologies. The main objective is always to protect people's lives. However, the integrity of the structures and their serviceability immediately after an earthquake are key in the speed of the emergency response. Seismic damping systems provide an alternative to conventional earthquake resistance design, and have the potential for significantly reducing seismic risk without compromising safety, reliability, and economy of structures.

IBC 17-20: Structural Health Monitoring of Cable Stay Bridges as Applied on the New Champlain Bridge in Montreal, Canada

Gianni Moor, Mageba USA, New York, NY; Samy Rassy, Mageba International, New York, NY; Kleidi Islami, Mageba Switzerland, Bulach, Switzerland.

With the continuous optimization of design software, construction technologies and materials, structural design has taken tremendous leaps. However, demonstrating proper structural behavior and providing timely maintenance, more specifically of modern cable stay bridges, remains challenging. This paper introduces the new Champlain Bridge as a case study to demonstrate how the implementation of Structural Health Monitoring (SHM) can help ensure a structure's full life expectancy while also being used to confirm structural models.

ABC, PART 1

Tuesday, June 6; 8:00 a.m.–12:00 noon

IBC 17-21: Accelerated Design/Build of the SEPTA Crum Creek Viaduct

Robert L Lund Jr., P.E., Southeastern Pennsylvania Transportation Authority (SEPTA), Philadelphia, PA; Garrett Hoffman, P.E, FIGG Bridge Engineers, Inc., Exton, PA

The Crum Creek Viaduct Replacement Project is a design/build project that replaced a 121 year old bridge on an existing alignment with a new a new steel girder bridge for the Southeastern Pennsylvania Transit Authority (SEPTA). The new bridge has five spans and is 735' long. The Design/Build Team provided innovative solutions to designing and delivering the new bridge on-time with a fast-paced schedule, which only permitted a eleven-week rail shut down to allow completion of existing bridge demolition, superstructure and deck erection, rail work , catenary electric transmission, and signal system installation. The new bridge girders were assembled on one side of the existing bridge, including the precast deck and were supported by new straddle bents built under the existing bridge while the existing bridge remained in full operation. The lateral slide Accelerated Bridge Construction technique was used to move the new bridge into place.

IBC 17-22: Launching Three Trusses over the BNSF Northtown Rail Yard

Martin Furrer, P.E., S.E. and Greg Hasbrouck, Parsons, Chicago, IL; Jack Yuzna, City of Minneapolis, Minneapolis, MN

Minneapolis' historic St. Anthony Parkway crossing of the BNSF Northtown rail yard with five deteriorating Warren trusses required removal and replacement with a new skewed 305' truss. The railroad required that trusses over mainline tracks be replaced using a launching system. The new truss incorporates unique redundancy measures including eliminating fracture critical steel truss members and gusset plates and using a post-tensioned concrete bottom chord.

IBC 17-23: Design & Construction of a Grade Separated Interchange with a Very Accelerated Schedule

Chris Vaught, P.E., S.E., RK&K, Richmond, VA

The major feature of VDOT's $100M+ Route 29 Solutions project is upgrading the highly-skewed at-grade intersection at Rio Road. Only 103 days of full road closure were allowed for the construction of a bridge and

several thousand feet of retaining wall. A structural system that had never before been constructed in Virginia was developed to allow traffic to continue operating throughout construction and delivered in nearly half of the allowable time and well under budget.

IBC 17-24: 2-Span Continuous Integral Abutment Bridge Replacement Using ABC

Robert Elliott, P.E., CDR Maguire, Pittsburgh, PA; Donald Herbert, P.E., and Jeremy Hughes, P.E., PennDOT District 12-0, Uniontown, PA

This presentation will discuss the ABC of a 206' 2-span continuous integral abutment bridge. Numerous design challenges included constructability, longitudinal and transverse UHPC closure pours, negative moment reinforcing, deflections during precasting, and crane sizing. The presentation will also discuss the unique manner of the bridge erection based on the use of a conventional deck negative moment region rather than a link slab or transverse UHPC joint at the pier.

IBC 17-25: Four California ABC Case Histories Describing Equipment, Techniques, Means And Methods Used To Move Superstructures Via Land

Alfred Mangus, Steve Lee and Greg Kaderabek, Professional Engineers in California Government, Sacramento, CA

Belgian, Dutch and German manufacturers' equipment were utilized to move California bridge superstructures. Multi-wheeled trailers towed with trucks were used to install curved orthotropic steel box girder sections across Interstate I-80. The documentary "A Span in Time" discusses sliding a "football field" sized concrete superstructure replacement. Six weathering steel railroad trusses were installed via a Self-Propelled Modular Transporter. The Roll-Out, Roll-In of 270' double decker steel trusses created the Yerba Buena Island Detour. A table summarizes the issues.

IBC 17-26: Eastbound Nalley Valley Interchange, Marketing Substructures for Precast Bridge Elements

Patrick Gallagher, P.E., Alpha & Omega Group, Raleigh, NC

Prefabricated crossbeams were a key feature in the construction of one of Washington State's Megaprojects, the Interstate 5 and Highway 16 interchange reconstruction in Tacoma, Washington. WSDOT built upon past experience, university research, and past implementations of precast substructure components. This paper displays how WSDOT implemented the use of prefabricated crossbeams, motivating the contractor to explore their application.

IBC 17-27: Redecking of DelDOT BR 1-717, I-95 NB over SR1: Lessons Learned

James Bellenoit and Jon Eberle, AECOM, Mechanicsburg, PA; Jason Hastings, M.C.E, P.E. and Stephen Richter, Delaware DOT, Dover, DE; Elaine Luczka, AECOM, Philadelphia, PA

The replacement of the I-95 NB bridge deck using ABC is presented. The bridge composed of four short, simple spans with 35 degree skew carries four lanes over an arterial. Reuse of steel beams and heavy traffic volumes lead to the use ABC technology. Full-depth precast concrete deck panels with UHPC longitudinal and transverse deck joint details, conventional expansion joints at piers/abutments and a polyester polymer concrete overlay was selected for reasons to be explained.

CONSTRUCTION, PART 1

Tuesday, June 6; 8:00 a.m.–12:00 noon

IBC 17-28: Erecting/Moving/Raising/Floating a 1600-Ton Lift-Span Truss

David Rogowski, P.E. and Josh Crain, Genesis Structures, Inc, Kansas City, MO; Jack Pecora, JF White/Skanska JV, Framingham, MA

This paper highlights the challenges related to the design of the temporary works used to install the new Fore River Bridge (a 328', 1600-ton vertical lift span truss) which was constructed on land on 20' steel towers, rolled onto twin 54'x180' barges with four (16) axle SPMT units, lifted to a final vertical height of 70' above the water with self-raising towers and then floated into position with only 3" of clearance each end.

IBC 17-29: Rehabilitation Design and Construction of the Main Street Bridge

Robert Durfee, P.E., SECB, DuBois & King, Inc., Laconia, NH; Eric Ohanian, P.E., Tighe & Bond, Westwood, MA

The Main Street Bridge consists of three independent superstructures. After decades of heavy winter-time salt-usage and differential movement, the bridge required extensive rehabilitation due to heavy corrosion of deck, stringer, joint, and bearing components. Design included partial replacement of steel girders, framing, and deck modifications to merge the three superstructures into a

single structure. Unique construction and traffic phasing minimized business impacts and accommodated cultural and tourist events throughout construction. Total construction cost was $3.4 million.

IBC 17-30: The Bayonne Bridge Navigational Clearance Project - Main Span Steel Erection

Kevin O'Neill, P.E. and Thomas Rabinko, Siefert Associates, LLC, Naugatuck, CT

This presentation explores the challenges of erecting the steel of the new main span roadway of the Bayonne Bridge through the existing arch while the bridge remained open to traffic during construction; highlighting the surgical erection of new structural elements through the steel arch and suspenders, the analysis of the existing roadway under the load of hydraulic cranes during limited closures, and the design and implementation of custom rigging equipment and various other temporary works.

IBC 17-31: Construction of the Broadway Bridge Arch Spans over Arkansas River

Steve Eads, P.E. and John Boschert, Genesis Structures, Kansas City, MO; Paul Scharmer, P.E. and Cooper Kyhl, Massman Construction Co., Overland Park, KS

The Broadway Bridge connects Little Rock and North Little Rock and spans the Arkansas River. The project was planned to minimize the duration of the roadway closure by incentivizing construction completion over a specific time-limit. Erection of the new spans was performed at high elevation using steel towers supported on deck barges. Following fast-track demolition of the existing bridge, the new spans were floated into position and prepared for deck placement and final construction activities.

IBC 17-32: Innovative Steel Erection Procedure for a Curved Girder Viaduct Over Water and Soft Soils

Michael Marks, P.E. and Zeus Wu, EIC Group LLC, Fairfield, NJ

The erection of this 1000' long curved steel superstructure presented challenges due to the shallow river limiting the location of barge cranes, soft soils impeding crane positioning on land and the 70' high superstructure complicating the configuration of support towers.

Innovative erecting techniques were developed, including rolling tower systems, transverse hanger beams supported on previously erected girders, assembly of girders supported on land and barges, and a rapidly adjustable pipe spreader beam.

IBC 17-33: Brooklyn Bridge Ramp C Pier Replacements

Andrew Ritter, P.E. and Vincent Siefert, P.E., Siefert Associates, LLC, Naugatuck, CT

An innovative temporary support system, for Ramp C to the Brooklyn Bridge, was engineered to replace failing concrete piers with two-piece steel piers. The inventive design was a modular system with custom lifting and handling devices that accommodated tight clearances and variable geometry between five locations. Creative engineering and careful planning allowed the contractor to perform the work using precise and controlled operations, minimize fabrication and on site costs, and not disrupt active traffic above.

IBC 17-34: Carroll Avenue Bridge Demolition

Jolene Fennema, Kiewit, Englewood, CO; Richard Walters, Kiewit, Hanover, MD

The Carroll Avenue (MD 195) Bridge over Sligo Creek and Sligo Creek Parkway is an 83 year-old, 3-span, cast-in-place reinforced concrete open spandrel arch bridge that has been rehabilitated. Everything above the arch was demolished and rebuilt to match the original bridge. The contractor optimized the demolition sequence to reduce schedule and cost. In addition, the project required numerous temporary structures for access and to protect the public and the environment.

DESIGN

Tuesday, June 6; 8:00 a.m.–12:00 noon

IBC 17-35: Replacement of the Historic Greenfield Bridge

William Beining, P.E. and Anthony Ream, P.E., HDR Engineering, Weirton, WV; Patrick Hassett, City of Pittsburgh, Bureau of Transportation and Engineering, Pittsburgh, PA

In replacing the historic concrete arch linking the Pittsburgh neighborhood of Greenfield to Schenley Park, the designers were challenged to recreate a landmark structure while minimizing impacts to the congested Parkway running under the structure. From demolition of the existing bridge, to design and erection of the new 287' steel arch, the challenges were met through careful planning, extraordinary community outreach, and innovative design features that recall the past while embracing the new.

IBC 17-36: Design and Construction of the Sir Ambrose Shea Vertical Lift Bridge Located in Placentia, Newfoundland and Labrador, Canada.

Jack Ajrab, M.Sc., P.E. and Ryan O'Connell, Parsons, Ottawa, ON, Canada; Joanne McCall, P.Eng., P.E., Parsons, Markham, ON, Canada

The new Sir Ambrose Shea Vertical Lift Bridge is located in the Province of Newfoundland and Labrador on the east coast of Canada. The paper will go through the design process of a vertical lift bridge and the various options considered for the foundations, approach spans, lift span, counterweights, and the tubular towers and machine rooms. The durability and reliability features of the design will be presented, as well as construction challenges encountered.

IBC 17-37: Partial Isolation of a Bridge on Interstate 40 in the New Madrid Seismic Zone

Timothy Huff, Ph.D., P.E. and Jonathan Shoulders, Tennessee DOT, Nashville, TN

A Tennessee bridge on Interstate 40 was identified as a candidate for partial isolation. Seismic accelerations place the bridge in AASHTO Seismic Design Category C. Abutment construction is to be integral, with the superstructure at the piers supported on lead-rubber bearings. Ground motion records were selected and scaled to the 2,500 year response spectrum. Nonlinear response history analyses were performed to obtain final design displacements. Large substructure design shear reductions were realized.

IBC 17-38: Garden State Parkway Mainline Bridge over NJ Route 17

Manuel Vera Caraballo, P.E. and David Hicks, P.E., Dewberry, Bloomfield, NJ; Lamis Malak, New Jersey Turnpike Authority, Woodbridge, NJ

Improvements to the GSP Interchange 163 in Paramus, NJ are discussed. Various alternatives of span configuration, span length and skew angle were evaluated for the mainline structure over NJ Route 17. A 235' single-span structure constructed on a 55 degree skew was selected to minimize traffic impacts, and future inspection and maintenance costs. The design and detailing of the bridge considered the structure's span length, severe skew angle, and erection.

IBC 17-39: Virginia's First Long-Span GRS-IBS Project

Ahmad Faqiri, Pennoni Associates, Inc., Herndon, VA

The Mine Road Bridge over Rocky Run, located in the Embrey Mill Community in Stafford County, Virginia, is a 120 foot-long Prestressed AASHTO Bulb-Tee multi-girder bridge supported by Geosynthetic Reinforced Soil-Integrated Bridge System (GRS-IBS). The GRS-IBS allowed the bridge to span long enough to push its abutments to the edge of the wetland. The focus of this paper is to discuss design alternatives, report on the construction activities, and discuss lessons learned.

IBC 17-40: Long-term Performance and Durability of Bridge Beams Prestressed with Innovative Carbon Fiber Reinforced Polymer Strands

Nabil Grace, Ph.D., P.E., FESD and Mena Bebawy, Ph.D., P.E., Lawrence Technological University, Southfield, MI; Kenichi Ushijima, Tokyo Rope USA, Canton, MI

A four-year long extensive research investigation has been executed to evaluate long-term performance of highway bridge beams prestressed with carbon fiber composite cable (CFCC) strands. The investigation included long-term monitoring and testing of unbonded prestressed CFCC strands as well as CFCC pretensioned bridge beams to evaluate long-term characteristics such as creep rupture strength, relaxation, and long-term prestress loss. Test results were used in the design of several highway bridges in Michigan and other states.

IBC 17-41: Bridge Systems on the New NY Bridge

Michael Whalen, P.E., HDR Engineering, White Plains, NY; Marco Buyson, HDR Engineering, Tarrytown, NY

On the new modern super crossings like the New NY Bridge to replace the Tappan Zee, the bridge systems become the heart beat and lifeline of the bridge. In this presentation, we will focus on the various systems which are part of the New NY Bridge project. These systems include power distribution, fiber optic communication, roadway lighting, ITS traffic signage, structural health monitoring, security and mechanical sub systems.

RAIL

Tuesday, June 6; 8:00 a.m.–12:00 noon

IBC 17-42: Field Testing, 3D Modeling, and Load Rating of the Transit Track Bridges over Lorain Avenue

Edward Baznik and Christopher Cummings, Michael Baker International, Cleveland, OH; Robert Connor, Purdue University, West Lafayette, IN; James Stock, Greater Cleveland Regional Transit Authority, Cleveland, OH

Two large web cracks were discovered in a continuous steel through girder bridge that carries commuter trains over Lorain Avenue in Cleveland, Ohio. To determine the likely cause the project team performed inspection, sampling, testing, evaluation and analysis. This information was used in combination with a 3D finite element model to understand the web cracking, predict future cracking, evaluate retrofits and load rate the bridge.

IBC 17-43: West 73rd Street Grade Separation Project – Cleveland, OH

Kirsten Bowen and Kimberly Guice, P.E., Michael Baker International, Cleveland, OH; Julie Meyer, P.E. and Robert Wallace, P.E., Ohio DOT, Garfield Heights, OH

One of the goals of the City of Cleveland's 2004 Lakefront Plan was to enhance neighborhood connectivity with the Lake Erie Waterfront. In order to achieve this goal, a grade separation was proposed with an extension of West 73rd Street under Norfolk Southern's mainline. This presentation will discuss the importance of this project as part of the overall Lakefront plan, design details, challenges of the urban landscape, construction coordination and highlights.

IBC 17-44: WB-207 & WB-208 Railroad Bridge Replacements over I-76

Matthew Macey, P.E., CDR Maguire Inc., Pittsburgh, PA; Brad Updegrave, P.E., Pennsylvania Turnpike Commission, Middletown, PA

The Pennsylvania Turnpike Commission will be widening a 2-mile section of I-76 at the Beaver Valley Interchange. In advance of this total reconstruction project, two overhead Norfolk Southern Railroad bridges were replaced. This presentation will discuss the design, fabrication, and construction of the adjacent 2-Span Railroad Bridges over I-76. The Thru-Girder superstructures had many critical details due to the requirement of all bolted connections.

IBC 17-45: San Diego River Bridge Double Track: Innovative Project Delivery over a Coastal River

Nathan Johnson and Ebrahim Amirihormozaki, Kleinfelder, San Diego, CA

This $95M project will provide a new double-track segment on the second-busiest passenger-rail corridor in the US. The centerpiece is a 1000-foot crossing over the San Diego River. Site challenges included seismically induced liquefaction, soil susceptible to surcharge settlement, and limited shared corridor right-of-way. This paper will describe project delivery using the CMGC approach, technical obstacles that were overcome using innovative design methods, and lessons learned regarding the delivery method and challenging river site.

IBC 17-46: Preserving Railroad History while Upgrading for Modern Service

Steven Deller, P.E. and Michael McGowan, P.E., Gannett Fleming, Inc., Camp Hill, PA; Robert Lund, Jr., P.E., SEPTA, Philadelphia, PA

SEPTA operates on three viaducts over the Cobbs, Darby and Ridley Creeks in Delaware County Pennsylvania. Some of the piers and abutments date to the 1850's when built by the West Chester & Philadelphia Railroad with the wrought iron and soft steel superstructure being built in the 1890's by the Philadelphia, Wilmington & Baltimore Railroad according to PRR specifications. This project replaced track, performed concrete, steel and masonry repairs, built walls and repainted the bridges.

IBC 17-47: Rail-Structure Interaction on the Edmonton LRT River Valley Bridges

Dawn Harrison, Andrew Armstrong and Heros Gnesotto, Arup, New York, NY

The Edmonton Valley Line LRT Project is a $1.8bn PPP project consisting of a 13km transit line. This paper summarizes the methodology used to determine the rail-structure interaction effects for the cable-supported bridge and river viaduct. Unique features of this design include the use of a rail anchor to mitigate rail deflections and the elimination of rail expansion joints along the 470 meters of elevated structure. The design is being led by Arup, Canada Inc.

IBC 17-48: Direct Fixation Design Challenges for the North Metro Rail Line Skyway Bridge

J. Taylor Perkins, P.E., S.E., Stantec, Lexington, KY; Jim Bader, P.E., Stantec, Denver, CO

The North Metro Rail Line Skyway Bridge is a 9,533' curvilinear commuter rail structure with 64 prestressed concrete girder spans that, upon completion, will become Colorado's longest bridge. The structure utilizes a direct fixation deck with continuously welded rail running the full length of the structure. This paper explores the design challenges due to the complex rail-structure interaction and details the unique analysis performed to eliminate the need for rail expansion joints on the structure.

BOAT TOUR

Tuesday, June 6: 1:00—5:00 p.m.

New this year - attendees may choose to take a cruise on the Potomac River to see some of the Capital Region's bridges and monuments. Seating is limited and a separate registration fee is required. The boat departs at 1:00 p.m., and is scheduled to return by 5:00 p.m.

ABC, PART 2

Tuesday, June 6; 2:00–5:00 p.m.

IBC 17-49: Construction of Ecuador's First Launched Steel Girder Bridge

Telmo Andres Sanchez, Ph.D., ADSTREN Cia. Ltda., Quito, Pichincha Ecuador; Mike LaViolette, P.E., P.Eng, HDR Engineering, Pittsburgh, PA; Mario Fiallo, RIPCONCIV Cia. Ltda., Quito, Pichincha Ecuador

This presentation demonstrates the implementation of the incremental launching method in the construction of a steel I-girder bridge in Ecuador. The presentation will include designer and contractor perspectives and will highlight how this approach will advance bridge construction in this challenging construction environment.

IBC 17-50: Fully Integral 2 Span Curved Girder Bridge Replacement in 72 days

Adam Stockin, P.E., WSP | Parsons Brinckerhoff, Manchester, NH; Rebekah Gaudreau, WSP | Parsons Brinckerhoff, Eliot, ME

This ABC project, which consisted of a 164' - 2 span curved steel girder superstructure with integral abutments, was constructed in 72 days. The integral pier cap was prefabricated with portions of the superstructure and was supported on a single column utilizing an innovative grouted connection, which was supported on a mono-shaft. Due to the complex nature of the structural system, a 3D Hybrid Stiffness/Finite Element Model was required for design.

IBC 17-51: Bridges Designed for Disassembly: a Resilient and Sustainable ABC Solution

Sebastian Varela, Ph.D., Freese and Nichols Inc., Forth Worth, TX; Mehdi Saiidi, Ph.D., P.E., University of Nevada, Reno, NV.

A novel structural system was developed to allow bridges to remain fully operational after strong earthquakes and facilitate dismantling and reusing components when bridges reach the end of their useful lifetime. The new system is compatible with ABC and links the concepts of sustainability and resiliency, which intend to utilize natural resources more effectively while minimizing the impact of natural hazards. The investigation involved large-scale shake-table tests on bridge components and systems supplemented by analytical studies.

IBC 17-52: Accelerated Bridge Construction Using Innovative Materials, Designs and Construction Methods

Bijan Khaleghi, Washington State DOT, Tumwater, WA

Developing connections that can accommodate inelastic cyclic deformations and are readily constructible is the primary challenge for ABC in seismic regions. WSDOT has employed innovative bridge design and construction for the reconstruction of a three-span, precast post-tensioned, spliced tub girder bridge in Seattle, Washington. The bridge substructure consists of two intermediate piers utilizing shape memory alloy (SMA) along with engineered cementitious concrete (ECC) in plastic hinging regions of the columns.

IBC 17-53: Bridge Replacement, Route 10/Manhan River, East Hampton, Massachusetts, Utilizing Prestressed Precast Deck Bulb Tee Beams and Ultra High Performance Concrete (UHPC)

Paul White, P.E., P.Eng., LafargeHolcim, Chicago, IL

This replacement project, selected by the Massachusetts Department of Transportation's Accelerated Bridge Construction Program employed the use of precast prestressed concrete deck bulb tee girders with integral deck slab and Ultra High Performance Concrete (UHPC) to connect the tee beam flanges. With the bridge near schools and on bus routes, the replacement of the bridge needed to be done with a majority of the work in summer months with school out. Although the bridge superstructure was installed in a few days (ABC), the foundation retrofits necessitated a total of five months to open the bridge to traffic.

CONSTRUCTION, PART 2

Tuesday, June 6; 2:00–5:00 p.m.

IBC 17-54: East End Crossing: Optimizing Mainspan Erection Cycles

Shawn Woodruff, Parsons Corporation, Prospect, KY; Ben Soule, International Bridge Technologies, Inc., San Diego, CA; Doug VanSlambrook, Walsh Construction, Prospect, KY

The East End Crossing is a cable-stayed bridge near Louisville, Kentucky. The two-tower, three span structure has a 1,200' mainspan, and two 540' backspans. The project team pre-staged significant portions of the back-span, and optimized deck erection cycles during mainspan construction to remove operations from the critical path. Overlapping operations whenever possible was critical to meeting the construction schedule, and required close coordination between construction, engineering and the owner's representatives.

IBC 17-55: East End Crossing: Backspan Girder Launching

Shawn Woodruff, Parsons Corporation, Prospect, KY; Jared Spaans, P.E., S.E., Janssen and Spaans Engineering, Inc., Indianapolis, IN; Doug VanSlambrook, Walsh Construction, Prospect, KY

Over several months in three major stages, the asymmetric, 1600-ton Indiana backspan steel grillage of the East End Crossing cable-stayed bridge was assembled and launched 775' into permanent position over the Ohio River from an adjacent hillside. Temporary supports were used to guide and anchor the steel throughout the course of the launch. Extensive structural checks at each stage were performed to ensure stability and resistance of the permanent members.

IBC 17-56: Reconstruction Challenges of the Historic Georgia Street Reinforced Concrete Arch Bridge

Ebrahim AmiriHormozaki, Ph.D., P.E. and Nathan Johnson, Kleinfelder Inc., San Diego, CA

Thorough reconstruction was recently performed to address rehabilitation and retrofit needs for the historic 102-year-old Georgia Street Bridge and retaining walls. The bridge arch-ribs have three hinges with floating end spans supported on approximately 30' tall anchor-block abutment walls. Adjacent retaining walls create an approximate 670' long grade separated traveled way below the bridge. This paper focuses on construction, including the complex staging, unique materials, hydrodemolition, and a thorough discussion of lessons learned.

IBC 17-57: Route 37 EB over Barnegat Bay - Redecking of the Mathis Bridge

Rama Krishnagiri, P.E. and Steven Esposito, P.E., Parsons Brinckerhoff, Lawrenceville, NJ; George Kuhn, P.E., New Jersey DOT, Trenton, NJ; David Wallis, P.E., Jacobs, Clark, NJ

The presentation is on the construction aspects for a major rehabilitation of this 4860' viaduct, including 176,000 square feet of precast Exodermic decking, 650 bearings, and a mechanical/electrical upgrade. The $60 million project replaces all decking while integrating scuppers, railings, lighting, and safetywalks into the prefabricated deck panels. We will discuss production rates, storage to alleviate creep and shrinkage, staging areas, high early strength closure pours, embedded conduit fittings, bearing replacement sequence, and field issues/solutions.

IBC 17-58: Advanced Materials & Complex Construction Methods on the Lesner Bridge Replacement Project

Robert Bennett, P.E., RS&H, Virginia Beach, VA

Efforts to advance quality standards and the use of high quality materials contribute to the su stainable 100-year design life of the twin, 1,575' long precast segmental bridges comprising The City of Virginia Beach's Lesner Bridge Replacement Project. Designed to utilize both span-by-span and cantilever erection methods, construction began on this locally administered project along Route 60 adjacent to the Chesapeake Bay in 2014 and is scheduled for completion in late 2017 or early 2018.

DESIGN AND CONSTRUCTION

Tuesday, June 6; 2:00–5:00 p.m.

IBC 17-59: Special Detailing for Staged Construction of a Continuous, Reverse Curved Bridge

Michael Liona and Rasmin Kharva, Hardesty and Hanover, LLC, New York, NY; Harold Fink, New York State DOT - Region 11, Long Island City, NY

Staged construction for curved steel girder bridges must consider additional stage related loading and eccentricity conditions. Our bridge dealt with complex geometry of being 7-span fully jointless, reverse curved (with tight 245' radius), and employed a unique partial staging of two spans to minimize construction costs and impacts to the traveling public. We will cover the staging conditions analyzed to allow proper steel fit-up of a curved structure during construction, as well as the FEM developed.

IBC 17-60: Macdonald Bridge Redecking - Construction Engineering Project Status Update

Keith Kirkwood and Dusan Radojevic, COWI, North Vancouver, BC, Canada

The entire suspended superstructure of the Angus L. Macdonald Bridge in Halifax, Nova Scotia is being replaced during evening and weekend closures while traffic runs during the day. Deck segments were locally pre-fabricated and erected into the bridge segment by segment. Concurrently, the bridge deck was raised to allow larger ships to pass underneath. A dehumidification system is being installed on the main cables as each hanger is replaced. This presentation provides an update on the status of the project.

IBC 17-61: Ground Improvement at Approach Embankments of a Railroad Bridge

Suresh Gutta, Ph.D., P.E. and Sebastian Lobo-Guerrero, Ph.D., P.E., A.G.E.S., Inc., Canonsburg, PA; Taylor Towle, Menard USA, Carnegie, PA

For a railroad bridge over SR 19 in Pennsylvania, soft ground conditions were encountered at the proposed approaches. Full height abutments supported on driven piles were proposed for the abutments. Due to existing soft ground conditions, significant settlements were anticipated at the approaches. Overexcavation of soft material or preloading was not feasible due to contaminated soils and limited construction duration. CMCs were used to transfer the loads to the underlying dense layers and limit settlements.

IBC 17-62: Use of Horizontally Curved Precast Concrete U-Girders for Ramp Construction

Don Hammack, P.E., Dewberry Engineers, Orlando, FL; Ted Davidson, P.E., Parsons, Orlando, FL

A unique aspect of the SR 417 interchange was the use of horizontally curved, precast concrete U-girders for three of the ramp bridges. This was the first use of these girders in Florida, and the first standard delivery project in the United States to incorporate curved precast concrete U-girders as the primary design. This presentation will discuss general details of the interchange, analysis procedures used, and the lessons learned from the design and production process.

IBC 17-63: Design and Construction of a Mission Critical Bridge at Vandenberg Air Force Base

Anthony Sanchez, Ph.D., P.E., Gernot Komar and Robert Dameron, Moffatt & Nichol, San Diego, CA

The 13th Street Bridge at Vandenberg Air Force Base provides access for specialized space-launch transporter vehicles over the Santa Ynez River. Because the bridge is "Mission Critical" it must remain in service after major floods and earthquakes. An innovative approach was used to address multiple design challenges, and meet enhanced performance criteria. Deep mono-pile foundations address scour and liquefaction, and special detailing allows the piers and abutments to share seismic loads, which improves seismic performance.

FOUNDATIONS

Tuesday, June 6; 2:00–5:00 p.m.

IBC 17-64: Progressive Tower Foundations

Matt Baughman, P.E., S.E., COWI, Seattle, WA; T.J. (Steve) Zhu, P.Eng., P.E., COWI, North Vancouver, BC, Canada; John Finke, Dr.Eng., P.E., S.E., Jacobs, St. Louis, MO

The Abraham Lincoln Bridge is a 2106' long, 101' wide, 3-tower cable-stayed bridge over the Ohio River in Louisville, Kentucky. The winning solution for this Design-Build contract included an aggressive schedule and innovative foundation design for the bridge. The team faced many challenges during design and construction as a result of the choice to use a single line of large diameter drilled shafts for the tower foundations, including a unique retrofit of a deficient shaft.

IBC 17-65: Verification of Installation and Performance of ACIP Piles for Bridges

Morgan NeSmith, Berkel, Austell, GA

The DFI ACIP Pile Committee, in conjunction with the Florida DOT, completed an ACIP Pile installation monitoring and performance test program in late 2016 to advance the inclusion of ACIP piles in future specifications for bridges by state agencies. Piles of different diameters were installed for compression, tension and lateral testing, and one pile was extracted for visual inspection. This paper presents the pile installation, non-destructive testing and load test results of the program.

IBC 17-66: Saving a Bridge Foundation

Les Chernauskas, P.E., Geosciences Testing and Research, Inc., North Chelmsford, MA; Peter Connors, P.E., MassDOT, Boston, MA

Many bridge foundations are not reused. For a variety of reasons, it is easier to replace rather than reuse the bridge foundations. This presentation focuses on a project where existing pile foundations were reused. Pile resistances were estimated using the wave equation and compared to the factored pile loads determined from Group Analyses. Geofoam lightweight backfill was used to allow reusing the piles. Some piles were exposed, investigated and found to be in pristine condition.

IBC 17-67: Using Load Testing to Save Money and Time on Two Minneapolis Highway Projects

Matthew Glisson, P.E., M.ASCE, Braun Intertec Corporation, St Louis, MO; Morgan Race, Ph.D., P.E., Braun Intertec Corporation, Lenexa, KS; Van Komurka, P.E., D.GE, F.ASCE, GRL Engineers, Inc., Cleveland, OH

The cost and time of performing design-phase load testing or altering the design based on load tests at the start of construction often inhibits load tests. Case histories of two transportation projects in the Minneapolis-St. Paul area demonstrate significant monetary and time savings that come from load testing before or at the start of construction. The I-35W Bridge project utilized a bi-directional load test to reduce shaft lengths, and the TH 610 Completion project employed high-strain dynamic testing to reduce costs and schedule.

IBC 17-68: Reducing Longitudinal Demands on Tall Bridge Piers with an Anchored Abutment

David S. Graham, P.E., Dan Brown and Associates, Sequatchie, TN; Gregory T. Hasbrouck, P.E., Parsons, Chicago, IL; Paul Axtell, P.E., D.GE, Dan Brown and Associates, Overland Park, KS; John Turner, Dan Brown and Associates, Laramie, WY

The Highway 53 relocation project in Virginia, Minnesota, includes a tall bridge across an iron ore mine pit. Longitudinal demands on the piers are reduced by resisting load through an anchored abutment and bracing the top of the piers through the superstructure. The combination of tieback tension and passive resistance allow the abutment to serve as an anchor point. This paper presents the key design considerations from both a geotechnical and structural engineering standpoint.

IBC AWARDS DINNER

Tuesday, June 6; 5:30 p.m.

Don't forget to make plans to join us for a special evening of celebration and commemoration. A separate ticketed registration is required on your registration.

DESIGN/BUILD

Wednesday, June 7; 9:00 a.m.–12:00 noon

IBC 17-69: HSR Viaduct over River Almonte: Design and Construction Control

Guillermo Capellán, Ph.D., MSc, and Javier Martinez Aparicio, Arenas & Asociados, Santander, Cantabria, Spain; Pascual Garcia Arias, IDOM, Madrid, Spain; Pablo Jimenez Guijarro, MSCE, ADIF, Sevilla, Andalucia, Spain

The High Speed Railway link Madrid - Lisbon crosses over River Almonte with a great arch viaduct of high-performance concrete. The main span of the structure reaches 384 m, for a total length of 996 m.Exceptional techniques and structural analysis were developed to reach its design and construction. The arch has been erected by cantilever method with the aid of a temporary cable-stay system. The deck was constructed using an overhead movable scaffolding system.

IBC 17-70: Design of Bridges to Meet Track-Structure Interaction Requirements for CA High Speed Rail Project

Ravi Mathur, Ph.D., P.E., and Ryan Simpson, Parsons, San Francisco, CA

All bridges carrying high speed trains are designed to limit bridge deformations and vibrations which can be magnified under dynamic effects of trains traveling at speeds up to 250 mph. This paper discusses how a simple four-span bridge supported on precast girders is designed to meet deflection and frequency limits established in the design criteria. Results from a frequency analysis, track serviceability analysis, rail-structure interaction analysis as well as the dynamic structural analysis are presented.

IBC 17-71: Design and Construction of an Innovative Curved and Spliced Precast Girder Flyover Bridge in Jacksonville, FL

Gregg Reese and Andrew Mish, Summit Engineering Group/Modjeski and Masters, Littleton, CO

The Ramp 1 Flyover Bridge is being constructed as part of the SB I-95 to EB SR-202 Interchange in Jacksonville, FL. The flyover bridge is a seven-span structure with two lines of curved precast U-girders, spliced and post-tensioned for continuity, and a substructure that includes four precast pier caps. The paper will describe the innovative design features and unique challenges solved during design and construction of this bridge.

IBC 17-72: Tallest Piers in NY, A Design-Build Effort

Edwin S. Anthony, P.E., F.ASCE, Erdman Anthony and Associates, Inc., Rochester, NY

The bridge site is known as the Zoar Valley and is located 60 miles south of Buffalo, NY. The new bridge is a three span continuous steel multi-girder. Spans are 210', 250', and 160'. The center span was set to provide adequate floodway for Cattaraugus Creek. The two piers rise from footing foundation 163' and are the tallest piers in New York State. The project cost was $16.9 million.

IBC 17-73: Fort Lauderdale-Hollywood International Airport South Runway Expansion - Value Engineering Methods

William Hess and Ryan Rapp, HNTB Corporation, Lake Mary, FL; Jeremy McNutt, HNTB Corporation, Kansas City, MO

This $180M design/build project includes massive multi-span runway and taxiway structures up to 850'-wide utilizing post-tensioned deck slabs composite with modified 72-inch Florida I-Beams, and designed for maximum aircraft loading as large as 2.5M pounds associated with 747 and A380 commercial jetliners. Unique design challenges and value-engineering enhancements undertaken during final design will be summarized, including how the structural modeling approach facilitated fast-track design solutions generating both cost and schedule savings.

LONG SPAN/CABLE STAY

Wednesday, June 7; 9:00 a.m.–12:00 noon

IBC 17-74: Suspension Bridge Cable Dehumidification - A Fundamental Change in Preservation Strategy

Shane Beabes, P.E., AECOM, Baltimore, MD; Barry Colford, BSc, C.Eng., FICE and Joshua Pudleiner, P.E., AECOM, Philadelphia, PA

Suspension bridge cables are comprised of high-strength steel wires. Over time, moisture inevitably penetrates into the cable and causes corrosion, cracked and broken wires, as well as contributing to hydrogen-induced stress corrosion cracking. Dehumidification has emerged as an effective method to practically eliminate water and its deleterious effects on the cable. The presentation will discuss the global history of cable dehumidification and its growing application in the United States.

IBC 17-75: Design and Construction of Waterline Footings for the new US 52 Mississippi River Bridge

Greg Hasbrouck, P.E. and Martin Furrer, Parsons, Chicago, IL; Faith Duncan, Illinois DOT, Dixon, IL

Waterline footings have become an increasingly popular choice for large river pier foundations to alleviate issues with the construction of deep and costly cofferdams. This presentation will discuss the unique design and construction aspects that led to the selection of waterline footings for the new US 52 Mississippi River Bridge, as well as the challenges in specifying requirements for this unique construction method in a design-bid-build environment and the construction experience from the field.

IBC 17-76: Design and Erection of the Arrah-Chhapra Ganges River Bridge

Brook R. Robazza, Morgan T. Rowland and Prabhjeet R. Singh, McElhanney Consulting Services Ltd., Vancouver, BC, Canada

Upon completion, the Arrah-Chhapra Bridge will be the longest extradosed bridge in India. The 4.35km-long 4-lane bridge is composed of 15 extradosed 120m spans over the main river channel and 36 simply-supported 58m approach spans. The precast girder segments were erected using the balanced cantilever method and supported by a single plane of harp-arranged cables. This paper describes the bridge design and erection, focusing on the challenges overcome by the contractor and the engineering consultant.

IBC 17-77: Design of a Cable-Stayed Icon: the New Ship Channel Bridge

Mike Perez, P.E., Harris County Toll Road Authority, Houston, TX; Wade Bonzon, P.E., FIGG, Houston, TX

This new signature bridge is the technical and aesthetic centerpiece of the widening of the Sam Houston Tollway where it crosses the busy Houston Ship Channel. The precast segmental concrete cable-stayed bridge features a 1,320′ main span between pylons. It comprises twin structures connected at the main pylons that will be built in phases within the existing ROW. The project includes the demolition of a record-setting 750-foot span segmental concrete box girder bridge.

IBC 17-78: Analysis of The Global Stability Of Slender Piers Of High Bridges

Jose Simon-Talero, Ph.D., Torroja International, Madrid, Spain

A simplified method for taking into account the influence of the deck and the stiffness of all the substructure when calculating the effects of buckling of a slender pier of a high viaduct is presented. It is proposed using iterative first order calculations to take into account the effect of the geometric non linearity, the cracking of the concrete and the elastoplastic behavior of the materials (concrete and reinforcing steel).

LOAD TESTING/INSTRUMENTATION

Wednesday, June 7; 9:00 a.m.–12:00 noon

IBC 17-79: Monitoring the Tappan Zee Bridge During Pile Installation for the Adjacent New NY Bridge

Patrick Mahon, P.E. and Robert Palermo, P.E., GZA GeoEnvironmental of New York, New York, NY

High capacity driven piles are being used to support two new bridges that will replace the Tappan Zee Bridge over the Hudson River. Some new piles were driven within 20 feet of the bridge. A monitoring system was required to evaluate the impacts of pile installation. The system was designed to use networked automated total stations with GPS base stations to overcome the challenge of measuring deflections on the bridge without fixed reference points.

IBC 17-80: Unforeseen Effects of Secondary Members

Natalie McCombs, P.E., S.E. and Samantha Kevern, P.E., S.E., HNTB, Kansas City, MO; Micah Drew, P.E., Mississippi DOT, Jackson, MS

This presentation will cover a case study for a two-girder bridge where lateral braces are used for wind loads on 16-foot deep box girders. Cracks have been observed in the floorbeam webs and welds at the upper lateral bracing connection. Placement of these braces was intended to carry wind load but the unique framing system combined with a mis-fabricated detail has created fatigue cracks for loads that were not likely considered in design.

IBC 17-81: Quantifying The Effects of Localized Corrosion Through the Use of Digital Imaging

Terrence Moran, George Mason University, Woodbridge, VA; David Lattanzi, Ph.D., P.E., George Mason University, Fairfax, VA

This paper reports on the development of a nondestructive evaluation technique for corroded steel. The goal is to better quantify the impacts of localized defects, such as pitting, on the ultimate strength of components. Tensile testing in conjunction with digital image correlation were used to calibrate an image analysis technique that quantifies pitted regions and provides a capacity reduction factor. Analysis indicates that the non-contact image analysis is capable of detecting localized failure modes.

IBC 17-82: Pre-installed Jacking System Prevents Shutdown of Existing Bridge during Adjacent Construction

Heather Scranton, P.E. and Jean Louis Locsin, Haley & Aldrich, Inc., Boston, MA; Mark S.Greenleaf, P.E., Commonwealth Engineers & Consultants, Inc., Providence, RI; Alec Smith, Haley & Aldrich, Inc., Bedford, NH

Given potential settlement of a nearby existing bridge during new bridge construction, a jacking system was installed at existing bents as an initial contract item. Instrumentation consisting of deformation points and strain gages on existing steel members were monitored remotely. During adjacent construction, several bents settled. When strain/movement neared action limits, jacking was implemented. Pre-installed jacks raised the bents quickly back into place without interrupting traffic and helped prevent bridge shutdowns and construction delays.

IBC 17-83: Structural Health Monitoring of the Hernando De Soto Bridge

Matthew Yarnold, Ph.D., P.E., Tennessee Technological University, Cookeville, TN; Justin Alexander, Cooper Steel, Nashville, TN; Tim Huff, Tennessee DOT, Nashville, TN

The Hernando De Soto Bridge has undergone substantial retrofits due to its proximity to the New Madrid fault line and importance to the region. Recently, a monitoring system was implemented which tracks the position of the structure and member force distribution before, during, and after a seismic event. The system provides actionable information to the owners regarding the current performance of critical bridge components and information for decision making after an extreme event.

REHAB, PART 1

Wednesday, June 7; 9:00 a.m.–12:00 noon

IBC 17-84: Renovation of a Historic Burr Arch Timber Truss Bridge

Kevin Sabolcik and Keith Duerling, Baltimore County (MD) Department of Public Works, Towson, MD; Megan Peal, P.E., Wallace, Montgomery & Associates, LLP, Hunt Valley, MD

Baltimore County (MD) Bridge No. B-0004 is a single span, 86′ long, covered timber Burr Arch Truss bridge constructed circa 1865. Due to an increasing number of deficiencies found during routine inspections, a rehabilitation project was undertaken to preserve this historic structure. The project included preliminary studies, federal grant process, public outreach, design, prequalified construction bidding and construction. This presentation will discuss project development, milestone decisions and recommend best practices for future similar projects.

IBC 17-85: "A Walk Above the Harlem River" - The Revitalization of New York City's High Bridge

James Valenti, P.E., Greenman-Pedersen, Inc., Babylon, NY; Ali Mallick, P.E., NYC Department of Design and Construction, New York, NY

The High Bridge is the original water supply conduit and oldest standing NYC Bridge (1848). From effects of neglect, the High Bridge was closed in the late 1970's. In 2012, NYCDDC and NYCDPR embarked on an ambitious project to reopen the Bridge as a walking park/tourist destination. This presentation provides an overview of the rehabilitation work tasks necessary to transform the 1,400′ steel and masonry arch structure from obsolete eyesore to beneficial use pedestrian promenade.

IBC 17-86: Ben Franklin Bridge - Renewing the Ride

Alex Lawrason, P.E., HNTB Corporation, Cherry Hill, NJ; Michael Venuto, P.E., PLS, Delaware River Port Authority, Camden, NJ; John Parola, HNTB Corporation, New York, NY

The $100 million reconstruction of the PATCO tracks across the Ben Franklin Bridge replaced the 30-yr old rail system in its entirety, rehabilitated the supporting structural steel and replaced 47 miles of associated power, signal and communication cables. The majority of the restoration was performed during three separate 2-month track outages. Special schedules were established to allow continuous work on one track at a time, while still maintaining uninterrupted service for the 40,000 daily passengers.

IBC 17-87: The Rehabilitation of the Walnut Lane Bridge

Michael Cuddy, P.E., TranSystems, Philadelphia, PA; Henry Berman, Ph.D., P.E., PennDOT Engineering District 6-0, King of Prussia, PA

The Walnut Lane Bridge which carries State Route 4013 over Wissahickon Creek in Philadelphia, is eligible for listing on the National Register of Historic Places. The 6-span 565′ long, open-spandrel, ribbed, concrete arch bridge is located in Fairmount Park and at the time of its construction in 1908, had the tallest and longest arch span in the world. The arch ribs are constructed of unreinforced concrete with embedded large flat stones. A program of major rehabilitation was performed that included a new deck, sidewalks, replicated precast concrete balustrades with exposed aggregate finish, concrete repairs and ornamental lighting.

IBC 17-88: Route 72 Manahawkin Bay Bridges Project, Rehabilitation of Three Trestle Bridges

Steve Esposito, Joseph Mumber, P.E. and David Rue, WSP | Parsons Brinckerhoff, Lawrenceville, NJ; James Meisterich, WSP | Parsons Brinckerhoff, Philadelphia, PA; Pankesh Patel, New Jersey DOT, Trenton, NJ

Route 72 in NJ is the only vehicular connection from Long Beach Island to the mainland, carrying traffic over Manahawkin Bay. Three structures between 360′ and 480′ each are founded on timber pile bents and require rehabilitation. In-depth condition ratings, including NDT to estimate pile lengths/embedment and the determination of capacities, justified the rehabilitation project that included protective pile jackets, deck resurfacing, and scour countermeasures consisting of stone mattresses. Construction is on-going.

MAINTENANCE/MANAGEMENT

Wednesday, June 7; 2:00–5:00 p.m.

IBC 17-89: Low-Cost Scour Preventing Fairings for Bridges

Roger Simpson, Ph.D., P.E. and Gwibo Byun, Ph.D., AUR, Inc, Blacksburg, VA

Cost-effective optimized versatile scour-preventing three-dimensional convex-concave hydrodynamic fairings with attached vortex generators have been designed, developed, and extensively tested (NCHRP-IDEA) for all types of bridge piers and abutments. They are available for retrofit or new bridge installation for any river level, speed, and angles of attack up to 45 degrees, unlike other countermeasures that do not prevent scour. They exceed HEC-23 requirements, prevent local scour for smaller sediments and the effects of open-bed scour on foundations.

IBC 17-90: Repair, Strengthening, and Re-use of Steel Girder Bridges: Two Case Studies

Brandon Chavel. Ph.D., P.E. and Jacob Wroten, HDR, Cleveland, OH

Bridge repairs and strengthening techniques require careful consideration of the behavior of the structure and load paths through the repairs and construction sequencing. This presentation will discuss two case studies that required unique solutions to repair, strengthen, and modify the steel superstructure: a bridge where the first interior pier was relocated closer to the abutment and the subsequent superstructure strengthening; and a bridge that required a portion of beam replaced due to a full-depth fracture.

IBC 17-91: Development of an Asset Management Plan (AMP) as a Decision-Making Tool for Bridge Management

Y. Edward Zhou, AECOM, Germantown, MD; Ruel Sabellano, P.E., Maryland Transportation Authority, Baltimore, MD; Shane Beabes, P.E., AECOM, Baltimore, MD; Barry Cofford, AECOM, Philadelphia, PA; Jeffrey Heilstedt, AECOM, Chicago, IL

This paper discusses an on-going effort for developing an Asset Management Plan (AMP) as a decision-making tool for bridge system management. It involves development of software tools to assist the Maryland Transportation Authority (MDTA) in making data driven decisions on bridge maintenance, rehabilitation, and forward-looking budgetary planning. Decision trees are based on analysis of historical bridge inspection data, bridge elements deterioration curves, maintenance and repair records, risk management, and life cycle costs.

IBC 17-92: Corrosion Evaluation of 19 bridges in Virginia

Alireza Hedayati, P.E., WSP | Parsons Brinckerhoff, Herndon, VA; Siva Venugopalan, Siva Corrosion Services, Inc, West Chester, PA

Corrosion evaluation studies and plans were provided for 19 bridges in Virginia, including deck and substructure corrosion evaluation for 17 bridges along I-395 corridor in northern VA and two bridges in Salem. The project team provided visual/delamination survey, sounding, clear cover survey, electrical continuity tests, carbonation, chloride profile, petrographic, service life modeling and life-cycle cost analysis. Reports were prepared for the tests/analysis results and repairs recommendations.

IBC 17-93: Earthquake Preparedness and Response; Oklahoma DOT's Proactive Approach for Bridges

Gregg Hostetler, P.E., Infrastructure Engineers, Inc., Edmond, OK; Philip Scott Harvey Jr., Ph.D. and K.K. "Muralee" Muraleetharan, Ph.D., University of Oklahoma, Norman, OK; Steve Jacobi, P.E. and Walt Peters, P.E., Oklahoma DOT, Oklahoma City, OK

In response to a tremendous increase in earthquake activity, the Oklahoma Department of Transportation hired a team of consultant and university professionals in 2015 to develop an earthquake response plan for their bridges. During Phase I the team established an inspection protocol; developed a response plan and post-earthquake bridge inspection manual; developed and delivered post-earthquake bridge inspection training; and evaluated USGS ShakeCast - a program that automates much of the response process.

LONG SPAN/SEGMENTAL

Wednesday, June 7; 2:00–5:00 p.m.

IBC 17-94: Global Analysis and Design of the Approach Structures of the New Champlain Bridge in Montreal

Sevak Demirdjian, P.Eng., M.Eng., SNC Lavalin Inc., Montreal, QC, Canada; Zachary McGain, P.E., International Bridge Technologies, Laval, QC, Canada

The new Champlain Bridge is approximately 3.4 km long and stretches across the St. Lawrence River. It consists of 2044.4 m long west approach, a 528.8 m long cable stayed section over the Saint Lawrence Seaway and 761.6 m long east approach. This paper will focus on elements of the global analysis of the approach steel spans and their substructures including the steel pier caps, precast post-tensioned pier segments and their foundations.

IBC 17-95: Bayonne Bridge Raise the Roadway Project

Roger Haight, P.E., ENV SP. and Matthew Spoth, P.E., WSP | Parsons Brinckerhoff, New York, NY; Chester Werts, P.E., S.E., P.Eng., HDR Engineering, Olympia, WA

The Bayonne Bridge Navigation Clearance Program raises the roadway of the existing Bayonne Bridge to provide 215 feet of navigational clearance. The project rehabilitates the original 1931 steel arch bridge and replaces the aging approach structures on existing alignment using phased structure construction to maintain two lanes of traffic at all times. The presentation includes a brief overview of the arch design and construction, but focuses mainly on the new precast segmental approach structures replacement.

IBC 17-96: Joint Distress in Wide Precast Segmental Box Girder Bridges

Gregor Wollmann, HNTB, Blacksburg, VA; Theodore Zoli, HNTB, New York, NY

The Hathaway Bridge, located in Panama City, Florida, comprises two parallel, precast segmental concrete box girder bridges with 12 and 14 spans, respectively, erected in balanced cantilever construction. Since its opening in 2004 the bridge has exhibited continuous deterioration of the segment joints at and immediately adjacent to the cast-in-place closure pours between precast segmental cantilevers. This paper will discuss the mechanisms leading to the joint distress, the repair schemes to restore the structure, and the lessons learned from the project.

IBC 17-97: Balanced Cantilever Bridges of the Riyadh Metro Project

Douglas Heath, P.E., Latif Ebrahimnejad, Ph.D., and Firooz Panah, P.E., AECOM, Boston, MA

The Riyadh Metro Project is a large infrastructure project in the city of Riyadh, Saudi Arabia. This project involves the design of over 20kM of precast segmental elevated viaduct. Most of the viaduct consisted of simple spans; however at nine locations throughout the project, three span balanced cantilever bridges were used to avoid conflicts on the ground. This paper describes the design of the balanced cantilever bridges and discusses some of the challenges encountered.

IBC 17-98: Latest Development of Uncoated Weathering Steel Bridges in China

Dr. Houxin Wang and Amin Gup, CITIC Metals Co., Ltd, Beijing, China; Kaijian Chen, China Railway Eryuan Engineering Group Co., Ltd, Chengdu, China; Shengqiao Xu, China Railway Engineering Consulting Group Co., Ltd.; Steve Jansto, CBMM-North America, Inc.; Marcus Stuart, CBMM, São Paulo, SAO, Brazil

This presentation focuses on the applications of weathering steels in bridges in China. A railway 430m main span arch bridge over Yarlung Zangbo River and a suspension bridge over a reservoir near Beijing with main span 720m are presented. They both used weathering steels of mainly Q345qENH and Q420qENH without coating, in which Nb is added for comprehensive properties and performances. The steels bring life-cycle cost effectiveness, drinking water protection and other advantages to the two bridge projects.

DESIGN/SEISMIC

Wednesday, June 7; 2:00–5:00 p.m.

IBC 17-99: Evaluation of the Failure of the Universidad Laica Overpass During the Pedernales Earthquake

Lissette Iturburu and Pedro Rojas, Ph.D., Escuela Superior Politecnica del Litoral, Guayaquil, Ecuador; Jose Barros, Universidad Católica de Guayaquil, Guayaquil, Ecuador

This paper discusses the collapse of the Universidad Laica overpass as a result of the Mw. 7.8 Pedernales Earthquake in Ecuador. The overpass was located in downtown Guayaquil at about 150 miles from the epicenter. From comparisons between the seismic demands and the shear capacity of the columns, it is concluded that the columns failed by shear due to pounding between the central span and the cap beam of the two central piers.

IBC 17-100: Design and Rehabilitation of the Historic Albertus L. Meyers Bridge

Justin Baird, P.E., Bryan Spangler, P.E. and Timothy Ainsley, II, P.E., Michael Baker International, Harrisburg, PA

The Albertus L. Meyers Bridge (aka 8th Street Bridge), is a historic gateway located in Allentown, Pennsylvania. The open spandrel arch bridge was constructed in 1913 and was listed on the National Register of Historic Places in 1988. The presentation will cover key components from design through construction of the 2016 rehabilitation. The rehabilitation included partial superstructure replacement and substructure renovation to increase the roadway width while maintaining aesthetics of the historic structure.

IBC 17-101: Truckee River Bridge - Tahoe City, CA: Seismic Analysis and Design of Torsionally Eccentric Cellular Abutments

Jon Emenheiser, P.E. and John Rohner, CH2M, Englewood, CO

The Truckee River Bridge in Tahoe City, California will bypass the city and provide trail access along both sides of the river. The trails will pass below the bridge and through cellular abutments. The abutment cell wall near the river will have openings for river views, resulting in torsional eccentricity. The elements were designed to remain elastic during the design seismic event and detailed to be ductile during a seismic event that exceeds design levels.

IBC 17-102: Design of a Long-Span Suspension Bridge Anchorage System Located in a High Seismic Region and Susceptible to Large Cargo-Vessel Impact

Michael Whitney, Bechtel, Houston, TX; Vahid Zanjani, Ph.D., P.E., McLaren Engineering Group, New York, NY; Robert Baldwin, P.E., S.E., P.Eng., Bechtel, Reston, VA

This paper discusses the design of an approximately 1200m long main-span suspension bridge anchorage system. The bridge is founded within extremely challenging strata consisting of very deep weak clays overlaying extremely incompetent weathered rock of variable depth and highly fractured. The anchorage foundation is composed of large diameter post-tensioned cast-in-place steel-shelled concrete piles, utilizing a unique battered arrangement. The paper highlights some of the unique design and construction aspects of the proposed anchorage system, given the poor soil conditions, to meet the challenging seismic and accident (due to large-vessel impact) design conditions.

IBC 17-103: Seismic Isolation of the Manhattan Approach Ramps to the Robert F. Kennedy Bridge

Andrew Adams, P.E., Modjeski and Masters, Mechanicsburg, PA; Blaise Blabac, Modjeski and Masters, Poughkeepsie, NY

This presentation focuses on the site specific seismic analysis of this unique steel rigid frame structure and the development of a continuous "floating deck" seismic isolation system consisting of both friction and elastomeric isolators. In addition to reducing the demands on seismically vulnerable regions (such as the riveted built-up member connections), use of a continuous deck reduced the number of expansion joints, making for a more maintenance-free structure.

REHAB, PART 2

Wednesday, June 7, 2:00–5:00 p.m.

IBC 17-104: Inspection and Analysis of Deteriorated Masonry Arch Bridges

John Kim, Ph.D., P.E., Michael Baker International, Richmond, VA; Michael Baron and John Zuleger, Michael Baker International, Louisville, KY

Due to their rarity, deteriorated masonry arch bridges are hard to inspect and analyze. This paper will take a deteriorated two-span masonry arch bridge as an example to demonstrate what to inspect, how to collect field data and how to analyze a masonry arch bridge. This paper will present analysis procedures utilizing a simplified method had developed for various bridge owners. A brief discussion on remedial procedures will also be presented.

IBC 17-105: Historic Winona Bridge Through Truss Rehabilitation using the CMGC Delivery Method

Kent Zinn, P.E., S.E., Michael Baker International, Chicago, IL; Daniel Baxter, P.E., S.E., Michael Baker International, Minneapolis, MN, Keith Molnau, P.E.

The $60M rehabilitation and reconstruction of the 2,290' long historic Winona Bridge over the Mississippi River is MnDOT's first use of the CMGC project delivery method for a bridge rehabilitation. The project represents one of the most technically challenging bridge rehabilitations undertaken by MnDOT. A complex analysis was performed to add internal redundancy to all existing fracture critical members and six new deck truss approach spans will be constructed.

IBC 17-106: A Novel Repair for Steel Girder Bridges with Corrosion Damage Utilizing UHPC

Kevin McMullen, Alexandra Hain, and Arash Esmaili Zaghi, University of Connecticut, Storrs, CT

The American Society of Civil Engineers (ASCE) estimates that it would cost over $76 billion to repair or replace the structurally deficient bridges in the USA. Many of these bridges are over 50 years old with steel superstructures that are deteriorating due to heavy corrosion. The locations commonly impacted by corrosion damage are girder ends over bridge bearings due to leaking expansion joints. The girder's bearing capacity may be significantly reduced due to the reduction in plate thicknesses. Conventional methods used to repair corrosion damaged girder ends are costly and time consuming. To address this issue, the feasibility and structural efficiency of a new repair

method using Ultra-High Performance Concrete (UHPC) was investigated. By encasing the corroded part of the girder end with UHPC, a new load path is created allowing forces to be transferred to the UHPC panel via shear studs welded to the undamaged portion of the web plate. The repair may be implemented in situ thus eliminating the need for jacking of the superstructure, lead paint removal, and lane closures, which accounts for the majority of costs in a conventional repair. The versatility of the repair accommodates bridge girders with different geometries and corrosion levels. The UHPC repair is a viable alternative to improve the state of the nation's bridge infrastructure. The promise of this repair was noted by the American Association of State Highway and Transportation Officials (AASHTO) as a "Sweet Sixteen" High Value Research Project and is planned for implementation in the near future.

IBC 17-107: Challenges in Historic Covered Bridge Rehabilitation: Martin's Mill Covered Bridge

Aaron Craig, P.E., P. Joseph Lehman, Inc., Duncansville, PA; Martin Malone, P. Joseph Lehman, Inc., Hollidaysburg, PA

The 2016 Abba G. Lichtenstein Medal-winning Martin's Mill Bridge overcame a history of environmental damage, severe distress, and numerous funding, design and construction challenges. Rehabilitation of this transportation treasure—a Town lattice truss covered bridge—breathed new life into the structure, originally constructed in 1849. The Martin's Mill Bridge maintains its listing on the U.S. National Register of Historic Places.

IBC 17-108: Rehabilitation of Aging Abutments

Robert Barrett, Matthew Birchmier, and Corey Mislinski, GeoStabilization International, Boca Grande, FL

Bridges in North America are becoming unserviceable faster than they can be replaced. This paper presents a new concept in dealing with this mounting crisis. Current practice includes removal and replacement of the abutments and the superstructures. There is now an innovative approach where the old abutment is left intact and used as a form for construction of a new abutment. This process can take as little as a few days and permitting is avoided or minimized. This can be done without significant traffic disruption. Costs are half or less, compared with the typical full removal and replacement, and even less where the existing superstructure is deemed structurally competent for at least a few more years.

WORKSHOPS

IBC workshops are designed to provide in-depth information on a specific topic presented by experts in the field and are loaded with technical content. Each workshop will provide an opportunity for a technical exchange between the students, the instructor and other workshop participants. Workshops also will provide attendees with continuing education credits, except where noted. (Preregistration is not required.)

W-1: Evaluating Internal Redundancy of Existing Built-up Steel Members to Set Hands-on Inspection Intervals

Monday, June 5; 2:00–5:00 p.m.

The objective is to familiarize bridge engineers with newly developed provisions on how to exploit the internal redundancy of existing or new built-up steel members that are presently classified as fracture critical members (FCMs) in order to establish a rational hands-on inspection interval. The provisions are based the results of pooled fund study TPF-5(253). The research shows that built-up members which meet the proposed evaluation procedures are not susceptible to complete member fracture and are therefore should not be classified as FCMs. The examples covered in the course will familiarize engineers with the provisions and how to set a rational hands-on inspection interval that will not lower the safety of the structure.

Speakers: Robert J. Connor, Ph.D., Purdue University, West Lafayette, IN; Francesco Russo, Ph.D., P.E., Michael Baker International, Philadelphia PA; Matt Hebdon, Ph.D., P.E., Virginia Tech, Blacksburg, VA

W-2: International Bridge Engineering Practices

Monday, June 5; 2:00–5:30 p.m.

The objectives of this workshop are to learn of bridge engineering practices from around the world, and to provide a forum for participants to present and discuss innovative bridge design, construction, inspection, maintenance and preservation practices for addressing bridge engineering challenges and opportunities. International speakers will be invited to share their practices for information and discussion. After all the presentations are completed, an "Open Forum" will be scheduled for general discussion of topics presented and other issues of interest to the participants. International bridge engineering practices are quite varied in different parts of the world. There are many good practices and valuable lessons to be learned. Attendees of this IBC workshop will be able to take away ideas and solutions that can be applied to their daily practice of bridge engineering.

Speakers: Myint Lwin, Bridge Engineering Consultant, Seattle, WA, Barry Colford, AECOM, Philadelphia, PA; W. Phillip Yen, IABEE, Centreville, VA; David Jeakle, McElhanney Consulting Services, Inc., Canada; Jiangguo Lv & Houqiang Ji, Anhui Transportation Holding Group LTD, Hefei, Anhui, China; Guillermo Capelian Miguel, Arenas & Associates, Santander, Cantabria, Spain

W-3: Bridge Information Modeling (BriM) Using Bridge Models after the Design Process

Monday, June 5; 2:00–5:00 p.m.

BrIM is a process to plan, design, construct and manage infrastructure assets that involves creating and using intelligent 3D models. Implementation of an effective BrIM strategy that integrates people, processes and technology can greatly improve accuracy and efficiency.

This workshop will explain:

- How BrIM technology and processes is being used on live projects.
- How to create a managed BrIM framework using the OpenBrIM library concept.
- How the information in intelligent bridge models can be used for construction, inspection and maintenance.
- How this process is being implemented in the United Kingdom.

Speakers: Alexander Mabrich, P.E., MSc, Bentley Systems, Sunrise, FL; Andy Lohan, H.W. Lochner, Chicago, IL; Mina Mahdavi, Entech Engineering, PC, New York, NY; Ali Koc, Red Equation Corp., Melville, NY; Mike Bartholomew, CH2M HILL, Corvallis, OR

W-4: Bridge Load Rating and Posting for State-Specific Legal Loads

Monday, June 5; 2:00–5:00 p.m.

State laws governing truck size and weight vary from state to state, leading to the variation of legal loads allowed to operate in different states. In accordance with the National Bridge Inspection Standards, the state-specific legal loads need be considered in bridge rating and posting. The objective of this workshop is to provide awareness to bridge engineers/load raters about the state-specific legal loads, the regulatory requirements, and the methods to rate and post highway bridges for these loads.

Speakers: Lubin Gao, Federal Highway Association, Washington, D.C.

W- 5 Drones, presented in 2 parts

Tuesday, June 6; 2:00–5:00 p.m.

Session 1: Regulation, technology and the future. Unmanned Aircraft Systems (UAS), popularly known as drones, are fast becoming an important tool in the construction industry, including the construction and inspection of bridges. This session will provide an introduction to drones, discuss the current regulatory framework governing the use of drones, and outline the research and innovation in UAS technologies. Regulations governing the commercial use of drones are rapidly evolving in the United States and around the world. This session will discuss the varied local, national and international regulatory landscape, safety and security concerns, current and potential litigation, and what you could do to be in compliance. Current research and potential innovations in the UAS industry will be discussed. The session will outline how drone technology is adapting to handle bridge inspection challenges. Near Earth Autonomy will demonstrate their solution to operate without GPS, which will help navigate safely around and within bridge structures. Research on automated drone inspection that will help enable full coverage of bridge structures, with precision surveys and comprehensive imagery will be presented.

Session 2: UAS: Case Studies - Bridge Inspections & Beyond. Utilizing drones in performing bridge inspections has garnered a great deal of attention in recent years. Several state agencies have initiated pilot programs to determine the practical use of this emerging technology for their inspection programs. The regulations involved have recently changed making the technology more viable. While field test results are generally positive, specific information on when and where a drone is effective remains limited. With this presentation, attendees will better understand the progression of FAA regulations, experience and lessons learned from drone inspection test projects with the state of Connecticut, the Delaware River and Bay Authority and the Rhode Island Turnpike and Bridge Authority, and scenarios where drone use may be practical based on type of structure, location, desired inspection results, efficiency, and time and cost feasibility.

Speakers: Matthew Sullivan, P.E., WSP Parsons Brinckerhoff, Charlton, MA; Sinu M. Pillai, Esq., Saul Ewing, LLP, Pittsburgh, PA; Aslam Siddiqui, P.E., and Michael Patenaude, AI Engineers, Middletown, CT

W-6: FRP Composites Impact to Sustainable Design of Concrete Bridges and Accelerated Bridge Construction

Wednesday, June 7; 9:00 a.m.–12:00 noon
Presented By: American Composites Manufacturers Association

FRP composites are a proven material that has been used in over 500 bridges in North America during the past 2 decades. Consensus standards and codes have demonstrated and provided bridge engineers and owners with innovative and cost effective solutions to rebuild and retrofit bridge structures demonstrating long-term durability ranging from highly corrosive geographical regions from Florida to Canada. Composite features such as light weight, corrosion resistance, and prefabrication have reduced assembly and installation time resulting in lower installation costs and delivery for new construction. In retrofit and rehabilitation situations, composites are faster to install and require minimal disruption to the structure while in service that extends the service life of bridge structures.

This workshop will provide cutting edge material and product advancements on to design and specify FRP products to build steel free concrete structures, use of fiberglass rebar in the first ever cable stayed bridge, and the impact of composites on new techniques for accelerated bridge construction. Attendees will also learn 20-year durability performance of FRP composites and how this will apply to sustainable construction.

Attendees will learn about bridge design, construction, performance and testing using innovative FRP materials and products for concrete bridges, including: 1) bridges designed in Canada and Florida, 2) guidance on writing a special provision for an FRP strengthening project using industry guidelines, and 3) important special applications of bridge protection systems, long-term durability of FRP rebar in concrete bridges and structures and rapid replacement with lightweight bridge deck systems.

Speakers: John Busel, American Composites Manufacturers Association, Arlington, VA; Sam Fallaha, P.E., Florida DOT, Tallahassee, FL; Dr. Brahim Benmokrane, P.Eng., FACI, FCSCE, FIIFC, FCAE, FEIC, University of Sherbrooke, Sherbrooke, QC, Canada; Gregory R. Bond, P.E., Strongwell, Chatfield, MN; Scott Reeve, Composite Advantage, Dayton OH; Dr. Amol Vaidya, Owens Corning-Composite Solutions Business, Granville, OH; Erik Grimnes, Harbor Technologies, August ME; Gregg Blaszak, P.E., Milliken Infrastructure Solutions, LLC, Spartanburg, SC

W-7: Development of Spliced Precast Girder Bridge Technology

Wednesday, June 7; 2:00–5:00 p.m.

The development of spliced precast bridges in the United States has steadily advanced over the last 62 years since the first bridge of this kind was built in Klickitat County, WA in 1954. The concept was developed to increase potential span lengths beyond the limitations of what could be safely shipped to a project site. Since that time numerous bridges have been successfully constructed using this method. Span ranges have exceeded 300' for some for projects. Recent advances include casting of curved U girder sections have made it possible to use precast for medium to long span interchange bridges with complex roadway geometry.

Design standards have been developed for and adopted by the Pennsylvania and Florida DOTs to provide guidance to designers, fabricators and contractors for future projects. The Topics that the Workshop will focus on:

- Historical Development of the concept.
- Design and Analysis Techniques
- Design Details and Construction Practices
- Project Experiences
- Development of Design Aids and Standards

Speakers: Gregg Reese, Summit Engineering Group, Andrew Mish, William Nickas, Reid Castrodale, Castrodale Engineering Consultants, Concord, NC; Tom Macioce, PATC, Harrisburg, PA

W-8: Introduction to Steel Bridge Fatigue and Fracture Design and Evaluation

Thursday, June 8; 8:00 a.m.–12:00 noon

This workshop will provide background on the development of the AASHTO LRFD provisions for fatigue design, evaluation, and fracture control. The workshop will discuss the development and background of the specifications and provide a practical demonstration of the application of the LRFD design and MBE fatigue evaluation procedures for steel bridges. Opportunities to ask questions will be provided throughout. Participants are encouraged to discuss prior and ongoing steel bridge fatigue and fracture concerns and receive feedback from the instructors during the class. The technical content is based on selected material from the newly developed FHWA/NHI Course on Fatigue and Fracture.

Speakers: Francesco Russo, Ph.D., P.E., Michael Baker International, Philadelphia, PA; Brian Kozy, Ph.D., P.E., FHWA, Washington, DC; Karl Frank, Ph.D., P.E., Hirschfeld Industries, Austin, TX

W-9: Closer to Reality - Complex Bridge Analysis Software (Load Rating for Cable-Stayed Bridges)

Thursday, June 8; 8:00–10:00 a.m.

This workshop will present bridge load-rating analysis and modeling software specifically directed to cable-stayed bridges. The presentation will cover LRFR/manual of bridge evaluation specifications for load and resistance factor rating as applied to cable-stayed bridges, and also include details demonstrating how complex modeling is used and how appropriate rating equations are used to meet the intent of the rating philosophies as appropriate for cable-stayed bridges. Finally, this presentation will discuss how to use bridge analysis software for complex bridges including projects such as the Veterans Memorial Bridge where 3-D complex geometry, time dependent material properties, staged construction changing boundary conditions, composite section analysis, member activation/deactivation are described and demonstrated using a complex bridge project example.

Speakers: Craig Finley, Jerry Pfuntner, P.E., S.E., and Ivan Liu, P.E., FINLEY Engineering Group, Tallahassee, FL

W-10: An Overview of the Bridges to Prosperity Program - Planning, Design and Construction of Footbridges in Remote Rural Areas

Thursday, June 8; 8:00–11:00 a.m.

The objective of this workshop will be to give a comprehensive perspective of the planning, design, and construction undertaken on a typical Bridges to Prosperity (B2P) footbridge project. The workshop will cover the perspective of the non-profit agency (Bridges to Prosperity) and discuss their overall program mission, goals, and plans for the future. In addition, the workshop will describe the logistics and effort required to establish a program in a foreign country that results in a program that constructs multiple bridges in one area or country. It will also give a perspective from a partnering consulting firm who recently assisted B2P with a footbridge project in Nicaragua. The overall objective of the workshop will be to educate those who plan to participate in a future B2P project on the specifics of how the projects are undertaken and give insights on what to expect and prepare for on a typical project. An additional objective will be to generate more interest and enthusiasm for this exemplary organization's humanitarian efforts and assist with the ongoing growth of their program.

Speakers: John Dietrick, P.E., S.E., Michael Baker International, Cleveland, OH

W-11: Implementing Bridge Asset Management Systems

Thursday, June 8; 8:00–11:00 a.m.

The workshop will review:

- Alternative approaches to bridge asset management strategic planning. Examples of "big plan" and "small plan" and other alternative bridge asset strategic planning approaches will be discussed and exampled.
- Currently available bridge management systems. Best practices, evaluation criteria and current field examples will be exampled and reviewed.

Opportunity will be provided for participant review, input and discussion.

Speakers: Simon Lewis, Ph.D., AECOM, Philadelphia, PA

W-12: ABC Systems

Thursday, June 8; 8:00 a.m.–12:00 noon

This workshop will introduce new ABC technology and advancements to the bridge industry by industry leaders:

- Easily constructible connections are an ABC challenge in seismic regions. WSDOT has developed a substructure design that incorporates Shape Memory Alloy (SMA) and Engineered Cementitious Concrete (ECC) in plastic hinging regions.
- Accelbridge is a low cost, durable, and quicker to build full depth precast deck system than current methods. Attendees can learn more about engineering principles, and design and construction considerations, and experience from completed construction projects.
- Premanufactured steel bridges and Buried Bridges offer many ABC advantages in terms of design time, material lead times, construction schedule & labor requirements, cost, and quality for low to medium span bridges. Applications and advantages will be demonstrated through a series of case studies.

Speakers: Joel Hahm, P.E. and Sean Johnson, P.E., Big R Bridge, Greeley, CO; Bijan Khaleghi, WSDOT, Tumwater, WA; Eddie He, AccelBridge, Hinsdale, IL

W-13:Ethics in Engineering

Thursday, June 8; 11:00 a.m.–12:00 noon

Engineering ethics is a system of moral principles that sets the obligations of engineers to society, to their clients, and to the profession. It has a basis in the philosophy of science, the philosophy of engineering, and the ethics of technology. Because engineering impacts the quality of life for all people, engineers must perform under a standard of professional behavior that requires adherence to principles of conduct described by established codes of ethics. This workshop will review the development of engineering codes of ethics with a focus on general principles, obligations to society, responsibilities, whistle blowing, and conduct. It will then demonstrate these concepts through an examination of several case studies. This workshop will satisfy one ethics continuing education credit.

Speakers: Elliott Mandel, P.E. and Lusanna Ro, Esq., AECOM DC Metro and Southeast Region, Arlington, VA

THE IBC EXHIBIT HALL

The IBC Exhibit Hall is the place to be for attendees and exhibitors! The IBC Exhibit Hall is located in Prince George Hall B of the Gaylord National Resort, on the lower level of the hotel. Thanks to all of our returning and new Exhibitors, we have more than 150 exhibits for attendees to continue the learning and networking experience of the IBC!

In addition to the many vendor exhibits, the IBC Exhibit Hall hosts the reception during the conference on Monday, and luncheons on Monday, Tuesday, and Wednesday. All registered attendees are welcome to enjoy these events during the IBC. Please visit with our many exhibitors while enjoying these events.

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