The first segment of the California High Speed Rail (HSR) project which extends from Madera County to the City of Fresno is currently under construction. This 29-mile segment through California’s Central Valley is being designed using a design criteria developed specifically for this project. This paper will discuss the design of bridges to meet the track-structure interaction requirements established in this criterion.

All bridges carrying high speed trains are designed to limit bridge deformations and vibrations which can be magnified under trains traveling at speeds up to 250 mph. Excessive deformations and vibrations can lead to numerous issues including unacceptable changes to track geometry, excessive rail stress, reduction in wheel-to-rail contact, dynamic amplification of loads and passenger comfort. Thus, the criteria establishes limits on the dynamic effects produced by the high speed train travelling at such high speeds.

This paper will discuss how a simple four-span bridge supported on pre-cast girders is designed to meet the criteria defined deflection and frequency limits. Results from a frequency analysis, track serviceability analysis, rail-structure interaction analysis as well as the dynamic structural analysis will be presented.

Also discussed will be the track-structure interaction requirements in the European codes and codes of other countries that have been operating high speed trains for the past several years. A comparison between the requirements in the foreign codes and those established for the California HSR project will be presented.

Notes: Track-structure interaction analysis requirements in the CA HSR design criteria are based on Eurocodes. Thus, these requirements have already been tested and verified on the extensive network of HSR bridges in Europe.
In September 2016, HDR completed the initial NTIS inspection of the Lehigh Tunnels on the Northeast Extension for the Pennsylvania Turnpike Commission (PTC). This project consists of an in-depth inspection of both tunnels to include: structural integrity, civil elements, drainage, electrical, mechanical, lighting, and portal buildings conducted in accordance with the July 14, 2015, published version of the National Tunnel Inspection Standards (NTIS). The Lehigh Tunnels were inspected (Initial Inspection) during the first calendar year of the multi-year agreement (September 2016). The Lehigh Tunnels, located at Mileposts A70.26 and A71.56 respectively, in Lehigh and Carbon Counties, consist of two separate tunnels (Tunnel No. 1, Northbound and Tunnel No. 2, Southbound) approximately 4,379' in length. The Number 1 tube was constructed in 1957, with the addition of Tube Number 2 completed in 1991.

This presentation will describe each tunnel inspection as a Case Study, and provide valuable Lessons Learned from the perspective of implementing the Federal requirements of the NTIS, and using the associated FHWA Specifications for the National Tunnel Inventory (SNTI) and FHWA Tunnel Operations, Maintenance, Inspection and Evaluation (TOMIE) Manual. In addition to sharing inspection methods, equipment, and management techniques, this presentation will focus on innovations, ideas, and best practices.

Title: Initial NTIS Inspection of the Lehigh Tunnels Case Study and Lessons Learned

Primary Topic: Tunnels and Tunnel Inspection
Secondary Topic: Asset Management

Project Information

Name: Pennsylvania Turnpike Commission (PTC) In-Depth Inspection of the Lehigh Tunnels
Location: The Lehigh Tunnels, located at Mileposts A70.26 and A71.56 respectively, in Lehigh and Carbon Counties

Technical Merit of Presentation

Opening Date? 9/30/2016

The NTIS mandates initial inspections of all highway tunnels on or before August 13, 2017...24-months following the effective date of the standards. Tunnel owners looking to comply with the NTIS, as well as tunnel inspectors, will benefit from learning what went well and what could have been improved.

Abstract:

In September 2016, HDR completed the initial NTIS inspection of the Lehigh Tunnels on the Northeast Extension for the Pennsylvania Turnpike Commission (PTC). This project consists of an in-depth inspection of both tunnels to include: structural integrity, civil elements, drainage, electrical, mechanical, lighting, and portal buildings conducted in accordance with the July 14, 2015, published version of the National Tunnel Inspection Standards (NTIS). The Lehigh Tunnels were inspected (Initial Inspection) during the first calendar year of the multi-year agreement (September 2016). The Lehigh Tunnels, located at Mileposts A70.26 and A71.56 respectively, in Lehigh and Carbon Counties, consist of two separate tunnels (Tunnel No. 1, Northbound and Tunnel No. 2, Southbound) approximately 4,379’ in length. The Number 1 tube was constructed in 1957, with the addition of Tube Number 2 completed in 1991.

This presentation will describe each tunnel inspection as a Case Study, and provide valuable Lessons Learned from the perspective of implementing the Federal requirements of the NTIS, and using the associated FHWA Specifications for the National Tunnel Inventory (SNTI) and FHWA Tunnel Operations, Maintenance, Inspection and Evaluation (TOMIE) Manual. In addition to sharing inspection methods, equipment, and management techniques, this presentation will focus on innovations, ideas, and best practices.

Notes: The presenter was the Facilitator for the FHWA TOMIE Manual Workshop, conducted in March 2010, and the Principal Investigator and author of the FHWA TOMIE Manual Publication No. FHWA-HIF-15-005, February 2015. He was also the Principal Investigator and author of the FHWA TOMIE Manual.
Design and Construction of a Single-tower Cable-Stayed Bridge Erected by Swing Method

This presentation will introduce the design and construction of a single-tower cable-stayed bridge in Shanghai-Kunming High-Speed Rail. This bridge was constructed by swing method to cross over an existing HSR. We hope our presentation could provide some experiences for the construction of this bridge.

Abstract:

Design and Construction of a Single-tower Cable-Stayed Bridge Erected by Swing Method

The single-tower cable-stayed bridge in Shanghai-Kunming High-Speed Rail (HSR), located on the Up-Link of the Changsha Hub in China, was constructed in the end of 2013. The bridge crossed over the existing Wuhan-Guangzhou HSR line. Since, during the construction phase, equipment and material could not cross over the existing bridge, it was decided to construct the bridges parallel to the existing bridge and to swing it about 22° into place once construction was completed. The rotation process was completed within 30 minutes. The total length of the bridge is 224 m, with a span arrangement of 30 +80 +112 m. The total height of the pylon is 79 m, while the height above the girder is 51 m. This paper describes the design of the bridge including the concrete through girder, the pylon-girder joint, and the structure of the swing system. The construction programs especially the weighing test before the definite rotation are discussed. The use of a rotating spherical pylon base proved to be a successful technique that met the construction challenges.

Notes:

We have no notes on our presentation.

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Abstract:

With a main span of 232' and a rise of 70', the Walnut Lane Bridge majestically crosses Wissahickon Creek in Fairmount Park, Philadelphia, PA. The structure is listed on the National Register of Historic Places and is a contributing resource to the Fairmount Park Historic District. When completed in 1908, the bridge had the longest and highest concrete arch span in the world. The uniqueness of the structure is the arch ribs which were constructed with embedded flat stones with no steel reinforcement. The presentation will document the construction methods used to implement the approved design details while avoiding adverse effects to this engineering marvel. The precast concrete balustrade system with special finish, methods utilized to match complex architectural lines in replacement elements and the need for an engaged consulting party process throughout construction will be discussed.

Title: **The Rehabilitation of the Walnut Lane Bridge**

Primary Topic: Rehabilitation/Preservation

Secondary Topic: Other

Project Information

**Name:** SR 4013; Section WLB. Rehabilitation of a 6 Span Concrete Arch Bridge.

**Location:** Philadelphia, PA

**Opening Date:** 9/27/2016

Technical Merit of Presentation

The Walnut Lane Bridge is a unique historic structure that required special attention to design and architectural details. The presentation will inform the attendees of successful strategies for design, construction and public involvement to be considered when rehabilitating concrete arch structures.

Abstract:

With a main span of 232' and a rise of 70', the Walnut Lane Bridge majestically crosses Wissahickon Creek in Fairmount Park, Philadelphia, PA. The structure is listed on the National Register of Historic Places and is a contributing resource to the Fairmount Park Historic District. When completed in 1908, the bridge had the longest and highest concrete arch span in the world. The uniqueness of the structure is the arch ribs which were constructed with embedded flat stones with no steel reinforcement. The presentation will document the construction methods used to implement the approved design details while avoiding adverse effects to this engineering marvel. The precast concrete balustrade system with special finish, methods utilized to match complex architectural lines in replacement elements and the need for an engaged consulting party process throughout construction will be discussed.

Notes:

The inspection, analysis and development of rehabilitation concepts for this project was presented in a previous paper (IBC-12-24). This presentation will focus on the actual construction and the special methods required by the contractor to complete the

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Abstract:
The Hernando de Soto Bridge on Interstate 40 is a critical link between western Tennessee and eastern Arkansas as it is one of only two main crossings over the Mississippi River in this region. The bridge consists of steel girder and concrete girder approach spans to the east and to the west, with two tied arch spans over the main channel. Over the last decade substantial retrofits have been implemented along the 43 year old structure due to its proximity to the New Madrid fault system. This has included installation of friction pendulum isolation bearings on the piers supporting the two 900 foot long main arch spans. Recently, a long-term monitoring system was installed along the 1800 foot arch section. The objective is to track the position of the structure and member force distribution before, during, and after a seismic event to assess the adequacy of the structure's performance. An instrumentation plan was developed and installed, including 24 vibrating wire strain gages, 6 vibrating wire displacement gages, 30 thermistors, and 4 laser displacement sensors. A real-time visual display of the data was incorporated along with automated alert capabilities. The project will provide both (a) actionable information to the owners (Tennessee Department of Transportation and Arkansas State Highway and Transportation Department) regarding the current performance of critical bridge components and (b) information for decision making after an extreme seismic event.

Notes:
If internet is provided at the venue, then live data will be displayed to the audience.

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The whipping (or whip) effect sometimes occurs on the multi-story structures where a light and soft story is built on top of heavy and stiff stories. In this case, the top story may experience an amplified response under seismic events as compared to a same story built directly on the ground. In bridge engineering, the whipping effect is not normally observed because they don’t usually have important soft structures standing above the surface of the deck. However, recent practices have found the whipping effect may be significant on some unbraced tied arches bridges, especially those carry railway loads. Tied arch bridges often have slender arch ribs built on a heavy and stiff deck system. When the arch rib have transverse frequencies close to that of the deck and substructure, the whipping effect might be high enough to govern the rib design.

This paper investigates the whipping effects on unbraced tied arch bridges. First, the whipping effect is analytically solved as a function of the ratios of masses (M1/M2) and stiffness (K1/K2) between the rib and deck system. The results are then compared to those obtained using multi-degree response spectral analysis (RSA). Both the analytical solution and the finite element RSA analysis find that the rib shear forces and moments can be as high as three times of a similar rib fixed directly to the ground. Various structural measurements to reduce the whipping effect of these bridges are also investigated in the paper.
In 2011 the United Kingdom published the Government Construction Strategy. This outlined a four year strategy to implement Building Information Modeling (BIM) across the entire United Kingdom construction industry. This strategy aimed to promote the use of new technology, focusing on more efficient and collaborative ways of working. The United Kingdom recognized the huge potential benefits of Building Information Modeling and targeted being world leaders in this area by the end of the four year cycle.

Since then, the United Kingdom has invested heavily in developing a clear strategy for Building Information Modeling and this strategy has been extremely successful. The United Kingdom now have a comprehensive set of execution standards to explain how Building Information Modeling should be implemented on a project. Since April 2016, minimum Building Information Modeling deliverables have been mandatory on all government funded projects. These steps have led the United Kingdom to reach their goal of being widely recognized as world leaders in the use of Building Information Modeling.

The United Kingdom also have highly ambitious targets for their construction industry moving forward. Their current 2025 goals focus on 50% faster construction delivery as well as reducing construction and by 33%. One of the key methods that they feel can deliver these radical improvements in efficiency is through the developed use of Building Information Modeling.
The Willow Street Bridge is a four-lane, 610-foot-long structure over the Sweetwater River in Chula Vista, CA and replaces a two-lane, functionally obsolete structure built in 1940. The project is eligible for Federal funding through the Highway Bridge Program (HBP) which covers over 80% of the $17M project costs; however, the design development from initial planning through environmental studies, permitting and final design took over 10 years. This presentation discusses the challenges and lessons learned in completing a complex bridge replacement with challenging foundation conditions, constructability concerns, environmental restrictions and evolving design criteria.

The HBP funding was initially based on an “in-kind” rehabilitation; however, reprogramming as a wider replacement was necessary to avoid future re-work. The reprogramming process required multiple steps to assure full Federal participation which delayed the advancement of the environmental phase while the project scope was established.

Environmental studies and permitting for the project included both California and National requirements. Dual documents were prepared under the oversight of Caltrans and the City of Chula Vista. In addition, permits were obtained through the California Department of Fish and Wildlife, the Regional Water Quality Control Board and the US Army Corps of Engineers.

From a technical perspective, the biggest challenge was designing for the potential liquefaction and lateral spreading within the river channel soils. A large diameter cast-in-drilled-hole pile system with permanent steel casings provided a balance of stiffness and ductility for the bridge but represents about 30% of the total project cost.

Notes:
- Bridge replacement vs. rehabilitation studies
- Seismic design in liquefiable soils
- Processing a California project with federal HBP funding

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Abstract:
Though the years, the need for sustainable practices in construction has increased immensely with environmental concerns accounting for sea level raise and maintenance of structures. In that trend and to demonstrate commitment to sustainability through innovative construction, the University of Miami advisedly chose to construct a pedestrian bridge using concrete elements solely reinforced and prestressed with fiber-reinforced polymer (FRP) composites. In addition to showcasing concrete reinforcing bars made of basalt and glass FRP (BFRP and GFRP), the structure reinforcement features unique configurations such as BFRP continuous close stirrups used in the pier-caps and curbs as well as prefabricated BFRP cages for the auger-cast foundation piles. The main load-carrying members of the bridge are two prestressed concrete double-tee girders with shortened flange overhangs. Each girder stem was prestressed with nine carbon FRP (CFRP) tendons made of 7 strands each. Elements of the bridge were instrumented with vibrating-wire gauges to monitor performance over time and during two load tests conducted on one of the prestressed concrete girders at the precast yard and on the completed structure before opening, respectively. In addition to strain data, deflection measurements obtained after construction show field performance of the bridge to be in accordance with the predicted behavior.

Abstract #: 17-83
Date Received: 9/30/2016
Score: ________

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Title: Construction and Monitoring of the Innovation Bridge
Primary Topic: Pedestrian/Special Purpose Bridges
Secondary Topic: Innovative Materials Applications

Project Information
Name: Hecht Athletics Pedestrian Bridge
Location: University of Miami, Coral Gables Campus, Florida
Opening Date?: 8/22/2016

Technical Merit of Presentation
IBC attendees would benefit tremendously by being exposed to innovative construction presented in a simple structure combining novel materials such as Basalt-, Glass-, and Carbon-Fiber reinforced polymers and novel composite manufacturing technologies (continuous close stirrups and pre-assembled cages) to ensure that degradation due to steel corrosion no longer undermines the longevity of the bridge.

Notes: The power point presentation will contain a 5 minute video illustrating the construction process.

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A bridge has linked the Pittsburgh neighborhood of Greenfield to Schenley Park for approximately 120 years. In 1922, a monumental concrete arch that reflected the city's growth and grandeur of the time was built. By 2010, the historic concrete arch was showing its age. Rehabilitations had stripped some of the bridge's grandeur, and deterioration meant the arch was wrapped with protective netting. A "bridge under the bridge" was even present to further protect the Interstate below from falling debris. It had become apparent that it was time for a new structure to act as Pittsburgh's gateway to the east. With this decision came many challenges, three of which are highlighted in this paper.

First was the prospect of demolishing the existing 274' arch over one of the busiest stretches of Interstate. The existing arch was dropped via high explosives onto the Interstate below and removed in less than 4 days.

Second was providing a new structure that fit the historic nature of the site and provided a grand entrance to Schenley Park. A new 287' steel open spandrel arch was selected to recall the gateway nature of its predecessor. Historic elements of the 1922 bridge, including original architectural pillars and urns, were salvaged prior to demolition and reused on the new structure.

Third was the use of System Redundant Members (SRM) to eliminate the need of future Fracture Critical inspections. Conventional 2-D and rigorous 3-D analyses were used to ensure the loss of these members would not compromise the structure.
Main cables are one of the most critical assets on a suspension bridge, and as such they must be rigorously protected from corrosion. Conventional cable protection methods including painting, oiling and wrapping have proven to be ineffective, allowing water into the cable and creating the catalyst for corrosion and broken wires.

The discovery of significant corrosion and cracked and broken wires in older suspension bridges, as well as early-onset corrosion in some bridges less than ten years old has required a change in preservation strategies. Main cable dehumidification was first introduced on both new and existing bridges in Japan in the late 1990s. The premise of the dehumidification was to maintain the relative humidity within the internal cable environmental below a critical threshold where corrosion practically ceases.

Over the last two decades, the main cables of approximately twenty percent of the global suspension bridge inventory have been dehumidified. This has included bridges in East Asia, Western Europe and most recently, North America. Data from several of the installed systems has demonstrated a sustained reduction in relative humidity below corrosive levels within the cables, as well as a notable reduction in recorded wire breaks. Additionally, subsequent internal cable inspections on some bridges have revealed no significant change in the condition of the wires since dehumidification was installed. Collectively, these findings demonstrate the efficacy of dehumidification.

This paper presents the history of the development of main cable dehumidification and provides details of the increasing application throughout North America.
Abstract: The project consists of the construction of a Pedestrian Bridge over Lake Shore Drive (LSD) & Metra Electric and IC/CN Railroads (RR). The structure is comprised of two main types of steel superstructures; twin arch spans crossover LSD/RR consisting of inclined steel arches that support a 20' wide curved, concrete deck. The arch ribs and two longitudinal ribs supporting the deck, consist of steel pipe sections. Variable depth transverse steel box beams connect the ribs beneath the deck and align with cables supported from the main arch rib. Both arches and decks, spanning over LSD and RR, are inclined in opposite directions to create an elegant look. Approach structures are supported by a single steel deck rib below the center of the 16' wide deck and retained fill approaches supported on MSE walls. At the transition from the 20' wide to the 16' wide deck, a 6' wide staircase is supported by a steel deck rib. The Project possesses many challenges such as, fabrication, shipping and constructability of arch and deck ribs over extremely active RR tracks (263 daily operations with very limited window of available track time) and a major highway carrying 100,000 vpd, existing overhead power and communication lines along RR tracks, limited availability of overall construction access and stringent welding requirements. A temporary bridge is proposed between the catenary lines and RR tracks to allow erection of the structure while the RR tracks remain in service. The structure is modeled in 3-D using CSI Bridge software.

Title: Steel Arch Pedestrian Bridge Design

Primary Topic: Pedestrian/Special Purpose Bridges
Secondary Topic: 3D Modeling

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Opening Date: 4/30/2018

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Score: ________
**Abstract #:** 17-87  
**Date Received:** 9/30/2016  
**Score:**

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**Title:** Liberty Bridge Fire & Emergency Repair Response  
**Primary Topic:** Rehabilitation/Preservation  
**Secondary Topic:** Construction Engineering

**Project Information**  
**Name:** Liberty Bridge Fire - Emergency Repairs  
**Location:** Pittsburgh, PA

**Technical Merit of Presentation**  
**Opening Date:** 9/26/2016

IBC attendees will learn about the performance of complex structural systems and the benefits of 3D analysis in evaluating damaged bridge structures. Design considerations for complex structure jacking operations will be identified.

**Abstract:**

On the afternoon of September 2, 2016, clouds of black smoke filled the Monongahela River valley, as the Liberty Bridge in Pittsburgh burned. The 2,600' deck truss bridge was in the midst of an $80M rehabilitation project when a fire broke out under a key bottom chord member carrying two million pounds of compression. Before it could be extinguished, the fire severely warped and buckled the compression chord, causing the affected truss to shift and redistribute load throughout the structure.  
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 bridge structure axially to restore the global geometry, laterally to correct a rotated truss panel joint, and locally to remove the buckles in the member web due to plastic deformation. This presentation will focus on the initial assessment and 3D modeling of the fire-damaged bridge, development of the jacking frame concept, and an external bracing system for the member during jacking.  
In addition to this topic, we are aware of several other elements of the Liberty Bridge emergency repairs that deserve separate consideration in a presentation. These topics could be grouped to form a session.

**Notes:**

In addition to this topic, we are aware of several other elements of the Liberty Bridge emergency repairs that deserve separate consideration in a presentation. These topics could be grouped to form a session.

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Current industry trends in bridge load ratings acknowledge both the benefits of refined ratings and the added expense. Refined ratings are used sparingly in part because of the added level of resources needed to produce and evaluate analytical models. This additional effort consists of critical broad engineering decisions such as modeling approach and a substantial amount of tedious and error-prone tasks of manipulating a finite element analysis (FEA) program via a Graphical User Interface (GUI) to build and analyze a model. By separating the broad engineering decisions and passing them as input into a series of automated algorithms that carry out model building, analysis and results extraction, the refined rating process can be made much more efficient and consistent. The biggest challenge of automating this process is balancing the flexibility and robustness of the process with the amount of engineering overhead required to develop the necessary input. Once established, an automated process enables a load rating engineer to spend their time studying structural behavior and the effect of modeling decisions or rehabilitation strategies rather than manipulating a GUI. Automation also makes a process completely repeatable and more transparent than traditional refined analysis. This paper discusses the refined rating process, as well as the challenges and benefits of automating this process for multi-girder bridges.
Abstract:
In October 2016, the longest and first multi-span stressed ribbon bridge in Canada was opened to the public in Edmonton, Alberta. The Terwillegar Park Footbridge was designed by Stantec Consulting Ltd for the City of Edmonton and forms a key link in the river valley park system in that city. Although stressed ribbon bridges are relatively common in Europe, there are only a handful constructed to date 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 superstructure is stressed between two abutments which are fixed to the ground using an extensive system of ground anchors. These elegant and durable structures are constructed without expansion joints.

The bridge crosses the North Saskatchewan River with a total structure length of 291.2 m. The 3 span bridge is comprised of spans of 77.0 m - 100.0 m - 85.0 m for a length of superstructure of 262 m. The deck width is 5.3 m (4.5 m clear between hand rails). The deck panel soffit is voided. Using a maximum structural depth of 465 mm, the span-to-depth ratio of the structure is a remarkable 215:1.

In this paper the design and construction process of this innovative and elegant design is described together with lessons learned.

Title: Design and Construction of the Terwillegar Park Stressed Ribbon Footbridge

PrimaryTopic: Pedestrian/Special Purpose Bridges
SecondaryTopic: Other

Notes: This is a follow up to a 2014 paper on the conceptual and preliminary design selection. "Conceptual and Preliminary Design of the Terwillegar Stressed Ribbon Footbridge", International Bridge Conference, Pittsburgh, PA, June 2014
Abstract:
The objective of this study is to evaluate optimum requirements for thicknesses of fiber-reinforced polymer (FRP) wraps to be used to rapidly strengthen deteriorated reinforced concrete piers. Rapid pier rehabilitation and/or strengthening have gained interest in the area of Accelerated Bridge Construction (ABC) due to their advantages such as rapid and easy installation, high strength, and low-maintenance requirements. Especially, the use of FRP wraps for pier strengthening made it possible to reuse substructures for a new ABC bridge project, which could largely reduce the construction time for piers, abutments, foundation, etc. There have been several research to validate the effectiveness of FRP wrap applications for the pier repair and strengthening analytically and experimentally. However, there are still limited guidelines for optimum thickness of FRP wraps used for the rehabilitation of piers. Finite element analyses have been adopted to evaluate the structural behaviors of reinforced concrete piers rehabilitated with FRP wraps. Parametric studies are conducted on a typical bridge piers for vertical and lateral loads. The design parameters considered in the numerical analyses are: 1) shape and size of pier sections; 2) number of rebars; 3) compressive strengths and deterioration of concrete; 4) material properties and number of layers of FRP. Results from this study, therefore, would provide useful guidelines for the design and construction of reinforced concrete piers wrapped by FRP materials.

Title: Analytical Study for Strengthening of Reinforced Concrete Piers using fiber-reinforced polymer (FRP) Wraps

Technical Merit of Presentation
By attending this session, the participants will learn more about the optimum design of reinforced concrete piers rehabilitated with FRP wraps through discussions related to the following.
(1) Understanding of structural behaviors of composite sections (concrete + FRP wraps)
(2) Optimum requirements of FRP layer thicknesses for pier strengthening

Notes:
The pseudo-static method proposed by Okabe and Mononobe (i.e., the M-O method) has been widely used by engineering communities to estimate the seismic-induced earth pressure (SIEP) on walls since its introduction in late 1920s, due to its simplification and ease of use. However, the M-O method is intended for yielding or relatively flexible walls. It would be questionable to directly extend it to non-yielding or massive walls such as bridge abutments. There are some improved approaches for predicting SIEPs for non-yielding walls, proposed by various researchers, but most of them seem difficult to be understood and implemented by engineers. As a result, engineers keep using the familiar M-O method to estimate SIEPs for massive walls, which is a concern. This paper closely examines the suitability of the M-O method first, followed by the proposal of an improved practical method for determining SIEPs for non-yielding walls. The proposal method is verified by the finite element method through cases studies, gives reasonable SIEP values, and easier to understand and use in practice.

**Abstract:**

The proposed method for estimating seismic-induced earth pressures for non-yielding walls is improved, practical, giving reasonable results, and easier to understand and use by engineers.

**Notes:** None
Abstract:
Built in 1967, twin two span continuous steel through girder bridges carry eastbound and westbound commuter trains over Lorain Avenue in Cleveland, Ohio. A large crack in the web of the east fascia girder of the westbound bridge was discovered in August 2005, followed by the discovery of a similar crack in June 2014. As the bridges are fracture critical, have existing web cracks and were constructed prior to the institution of fracture control plans and fracture toughness requirements, Greater Cleveland Rapid Transit Authority (GCRTA) hired Michael Baker International (MBI) to inspect and evaluate the bridges to determine the cause of the observed cracking, compute a load rating, and suggest potential retrofits to mitigate future cracking. Purdue University's S-BRITE Center performed the instrumentation and data collection which consisted of strain gaging the steel superstructure and placing linear position sensors on the bridges. Non-destructive and destructive testing were also performed. Following the inspection and data collection, MBI built a bridge model using 3D finite element software and calibrated it to the bridge using strains collected during the field tests. Once calibrated, the model was then used to understand the web cracking mechanism, predict future potential crack locations, evaluate the feasibility of proposed retrofits and load rate the bridges.

Notes:
This project includes many aspects related to understanding bridge behavior: load testing, creation and calibration of a 3D finite element model, and material testing. The culmination of this project results in a load rating and suggested retrofit for the

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Abstract: The Hathaway Bridge, located in Panama City, Florida, is a precast segmental concrete box girder bridge erected in balanced cantilever construction. It comprises twin structures with total lengths of 3815 and 3384 feet, respectively, with span lengths up to 330 feet. Since its opening in 2004 the bridge has exhibited continuous deterioration of some of the segment joints. The distress was concentrated at joints at or immediately adjacent to the cast-in-place closure pours between precast segmental cantilevers and has now been repaired.

With a width of 80 feet the bridge deck is very wide for a single-cell box. This geometry makes the segments susceptible to temperature-induced bowing introduced during the match-casting process, which affects segment fit. In addition, the long deck span between the webs imposes higher demands on the deck not only in the transverse direction but also in the longitudinal direction. The paper will discuss the mechanisms leading to the joint distress, the repair schemes to restore the structure, and the lessons learned from the project.

Notes:

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Project Information

| Name:          | Hathaway Bridge                  |
| Location:      | Panama City Beach, Florida       |

Technical Merit of Presentation

This is a lessons-learned presentation that discusses a structure that was designed according to the state-of-the-art and constructed by a highly experienced, competent contractor, yet suffered distress. Such a presentation is inherently valuable, because it allows others to learn from the experiences of this project.
Abstract:
In any season the beauty of the New York Mohawk Valley and City of Amsterdam is enjoyed by visitors and residents. The Mohawk Valley Gateway Overlook pedestrian bridge is an exciting addition to the City, extending Riverlink Park and the Erie Canalway Trail. As part of the Rebuild and Renew New York Transportation Bond Act, the $16.5M, 500ft “park over the river” creates a recreational destination and a respite from the City that supports the local economy and connects neighborhoods within Amsterdam. The Overlook is a catalyst for revitalization. It restores Amsterdam’s connection to the waterfront, transforms the area into more vibrant and economically sustainable neighborhoods, and provides improved public access to commercial, residential, cultural and recreational resources.

The bridge creates a unique landmark that exemplifies the City of Amsterdam and the Erie Canalway National Heritage Corridor (ECNHC). The Overlook is a triple curve, three-span continuous structure composed of steel plate girders supported on drilled shafts. It artfully celebrates the river’s setting. The curves and meandering pathway accentuate unfolding views while using interpretive paving patterns to convey the history and culture of Amsterdam.

The bridge unites neighborhoods divided by the river, fosters revitalization of downtown Amsterdam and provides for a variety of seasonal activities that strengthen the community. Every element of the design coalesces to create a regional gateway, destination and interpretive tool that celebrates the mosaic of history, culture and geography in a striking landmark.

Notes: Our team overcame aesthetic design, cost, and environmental challenges. Numerous concepts were proposed and, after public meetings and community visioning sessions, the unusual curved design was approved. Our team designed a steel girder structure that re
Title: Assest of khartoum bridges exspansion joints

Primary Topic: Assest Management
Secondary Topic: Bridge Program Management

Abstract:
Khartoum bridges represent the transportation link for the capital of Sudan cross the river Nile, Blue and white Nile an on going programe initiate to assest the expansion joints of the bridges as bridge management for maintance the main damage was lack of routine cleaning and unproficianal inspectors analysis and recommendation for future assesment was planned

Notes:
Antiant and old bridges needs especail treatment and profetional assestment in good mangement program
Abstract:
Under the effects of solar radiation and atmospheric temperature, the top portion of a tall pier in a high-speed railway bridge could induce noticeable longitudinal and transverse displacements, impacting the bridge and the geometric alignment of rail. Based on the heat transfer theory and track-bridge interaction principle, the field test and finite element model is established to represent the extra-long bridge of China Hefei-Fuzhou High-speed Railway, for studying the temperature gradients and thermal stresses of tall piers under solar radiation. In addition, the effects of the temperature gradients in the longitudinal and transverse bridge directions and uniform temperature rise on geometric alignment were investigated. The data of temperature test indicate that an obvious temperature gradient exists in the cross section of a tall pier; The temperatures along the direction of wall thickness are in negative exponential function distribution, so as the temperatures on the vertical surface near the pier bottom; and Other pier portions display linear variation of temperatures. The longitudinal and transverse horizontal and vertical displacements of a tall pier and the rotation angle at the pier top result from the temperature gradients increase with an increase of pier height. The increase of temperature difference along the bridge longitudinal direction could increase the rail stress, while the temperature gradient in the bridge transverse direction greatly affects the ride performance of rail. It is hopeful that the findings from this study provide some insights on the three-dimensional temperature distribution of a tall pier and the temperature effects on continuously welded rails.

Notes: High speed rail bridge; tall-pier bridge; continuously welded rail; solar radiation; temperature gradient; FE analysis

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Project Information
Name: the cable-stayed bridge in Shanghai-Kunming High-Speed Rail
Location: Changsha
Opening Date? 12/28/2013

Technical Merit of Presentation
The findings from this study provide some insights on the three-dimensional temperature distribution of a tall pier and the temperature effects on continuously welded rails, it may provide some advice to the design value of temperature load.
Upon completion in early 2017, the Arrah-Chhapra Bridge will be the longest extradosed bridge in India. It is now entering the final stages of construction over the Ganges River in the Indian state of Bihar, where this new link is critical to the economic growth and prosperity of the local region. The 4.35 km-long 4-lane bridge is composed of 15 extradose 120m spans over the main river channel and approaches totaling 36 simply-supported 58m spans. Precast box girder segments with constant outside dimensions were used for the full length of the bridge; in the extradose spans these were erected from 16 piers using the balanced cantilever method. The girders are supported by a single plane of cables stressed in a harp arrangement passing through saddles in the slender pylons. The extradosed girder structure is divided into 360m-long sections of continuous units, each containing three piers integrally connected to the superstructure; these piers are founded on 80m-deep caissons and comprise twin blades made thin for longitudinal flexibility. Articulation joints between continuous units are located at midspan and are reinforced by internal steel beams which permit longitudinal thermal movement while providing fixity for other movements. Erection of this bridge faced numerous difficulties due to the relatively undeveloped local infrastructure and extreme climate conditions. The dramatic changes to the river envelope between the monsoon and dry seasons necessitated creative erection and transportation schemes. This paper describes the bridge design and erection, focusing on the challenges overcome by the contractor and the engineering consultant.

No special requirements.
Abstract:
With FHWA requirements in the MAP-21 and FAST Acts for Transportation Asset Management Plans (TAMP) for State DOT’s, AMP is becoming an increasingly popular term in the transportation industry. However, AMP’s may be presented in various forms for serving different functions, ranging from a tactical-level document for meeting regulatory requirements to operation-level software for serving as a decision making tool in bridge system management. This paper discusses an on-going effort for the latter, which 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. The supporting information and the rationales behind the decision trees are based on analyses of historical bridge inspection data, deteriorations of bridge elements over time, maintenance and repair records including costs and condition improvements, as well as risk management and life cycle cost of the bridge inventory system. The MDTA Bridge AMP is developed and implemented in multiple phases. The first phase is to establish a roadmap for how to bridge the gaps between the existing practice and the bridge asset management needs. Subsequent phases develop detailed asset management procedures and programing decision trees and algorithms for implementations on the bridge management software platform. The goal of the Bridge AMP is to serve MDTA as an intelligent decision making tool for managing their bridge facilities for efficient resource allocation and utilization as well as effective risk management throughout their lifecycles.

Title: Development of an Asset Management Plan (AMP) as a Decision Making Tool for Bridge Management

PrimaryTopic: Asset Management
SecondaryTopic: BrIM (Bridge Information Modeling)
Abstract:
This $95M project will provide a second main track to the second-busiest passenger rail corridor in the US, and only freight link to San Diego. The centerpiece is a 1000-foot crossing over the San Diego River. Site conditions including seismically induced liquefaction, soil susceptible to surcharge settlement, and limited shared corridor right-of-way were significant. Design was delivered using a Construction Manager/General Contractor (CMGC) method beginning at the 60 percent design phase. While the CMGC approach benefited the technical design, the primary purpose was to gain schedule efficiencies with a $1B light rail project being designed and constructed with an extended team within a limited 100 foot wide railroad right-of-way.

A multi-span steel through girder structure will be built in two stages for in-line replacement of the existing 900-foot railroad bridge. Rail traffic must be maintained, and USACE levees below must remain intact. The replacement piers are supported on 140-foot deep CIDH piles, in approximately 70 feet of liquefiable alluvium. Piers will be constructed in permanent steel casings that will provide additional strength and ductility to resist seismic loads. For abutments, lateral spreading hazard will be mitigated with ground improvement, and lightweight approach fill walls.

Construction began in March, 2016, and will extend for two years. The paper will focus on design development with the CMGC team, and will include discussion of technical obstacles that were overcome using innovative design methods. Lessons learned regarding the CMGC method and construction within the seismically active San Diego River site will also be presented.

Title: San Diego River Bridge Double Track: Innovative Project Delivery over a Coastal River

Technical Merit of Presentation
Alternative delivery using the CMGC method will be discussed including lessons learned. Importance of communication within design, construction, and contractor will be highlighted. Technical challenges related to river construction, and seismically induced liquefaction/lateral spreading were addressed. Innovative solutions including lightweight fill, and permanent pile casing will be discussed.

Notes:
Additional topics:
Seismic Design
Foundation Design
Innovative Materials Applications

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