Individual Abstract Submissions

Abstract #: 20-51 **Date Received** 10/1/2019 **Score:**

Name: Karl Barth, Ph.D.

Company: West Virginia University
Morgantown WV

Title: **Press Brake Formed Tub Girders Prove Successful in Project with Challenging Site Constraints**

PrimaryTopic: ABC

SecondaryTopic: Innovative Materials Applications

Project Information **Name:**

Location: Ranger, WV

Opening Date? 10/31/2019

Technical Merit of Presentation

Various forms of press brake formed shallow steel tub girders having been gaining broader acceptance and wider use in a number of successful short span applications. This project demonstrates their suitability for projects with complicated constraints such as skew and superelevation

Abstract:

Press-brake-formed tub girder is a new technology for short span bridge applications. In 2009, the Federal Highway Administration (FHWA) challenged the North American steel industry to “develop a cost-effective short span steel bridge with modular components which could be placed into the mainstream and meet the needs of today’s bridge owners, including Accelerated Bridge Construction (ABC).”
The press-brake-formed tub girder system consists of modular galvanized shallow trapezoidal boxes fabricated from cold-bent structural steel plate. The concrete deck is recommended to be precast on the girder and the modular unit can be shipped by truck to the bridge site. However, the bridge can be successfully employed using deck options. The system utilizes standard plate widths and is optimized to achieve maximum structural capacity, with most of the steel in the bottom flange and increased torsional stiffness. It is a closed system, since the girder is closed at the bottom. It is versatile for multiple-deck options.

Most recently researchers from West Virginia University and Marshall University worked on a 5-girder bridge application that was successfully constructed outside of Ranger, WV. The roadway profile incorporated both skew and super-elevation demonstrating its efficiency in situations with various challenging site constraints.

During this project the authors conducted monitoring of the girder fabrication, deck casting and UHPC closure pours during key phases of production, developed rating tools suitable for incorporation in various state DOT rating and inspection applications, and conducted physical testing and subsequent relevant analytical modeling during both erection and live-load.

Notes:

Co-Author's Greg Michaelson, Ph.D. Marshall University

Individual Abstract Submissions

Abstract #: 20-52 **Date Received** 10/1/2019 **Score:**

Name: Joseph Bilotti, P.E.

Company: mageba USA
New York NY

Title: The Effectiveness of Expansion Joint Noise Reduction Solutions

PrimaryTopic:

SecondaryTopic:

Project Information **Name:**

Location:

Opening Date?

Technical Merit of Presentation

This paper shall seek to sensitize bridge engineers to the importance of considering noise from expansion joints early enough in the design process, and to equip them to better consider the issue when doing so, thereby avoiding unexpected problems when their structures open to traffic.

Abstract:

Noise generated by traffic crossing road bridge expansion joints can be a major source of disturbance for local communities and must be carefully considered in planning bridge construction and maintenance projects – especially when specifying expansion joint solutions. The consequences of not adequately considering the potential impact of noise on a community can be substantial, with public relations difficulties and high adaptation or replacement costs. This paper shall explore the subject of noise associated with bridge expansion joints, including as assessment of what types of joint may be considered quiet, and how noisier types – such as modular or single-gap joints – may be made quieter. Findings from noise measurement studies shall be included, providing evaluation of the effectiveness of selected noise reduction measures, and experience from the use of such measures on bridges shall be described.

Notes:

Co-Author's

Individual Abstract Submissions

Abstract #: 20-53 **Date Received** 10/1/2019 **Score:**

Name: Joseph Bilotti, P.E.

Company: mageba USA
New York NY

Title: Sliding Materials in Bridge Bearings and Expansion Joints

PrimaryTopic:

SecondaryTopic:

Project Information **Name:**

Location:

Opening Date?

Technical Merit of Presentation

This paper shall seek to provide attendees with a good introduction to the rather specialized subject of sliding materials in bridge bearings and expansion joints, enabling them to inform themselves better and more efficiently when planning projects and to better specify or implement bearing or expansion joint solutions in their work.

Abstract:

Considering the vital role of sliding materials in the proper long-term functioning of bridge bearings and expansion joints that facilitate movements by means of sliding, it is important that bridge engineers should have a good understanding of the subject – especially with regard to superior modern alternatives, such as UHMWPE, to the traditionally used PTFE. This paper shall explore the subject, with a strong focus on applications in bridge bearings and expansion joints, with reference to such key characteristics as strength (pressure resistance), friction and resistance to wear.

Notes:

Co-Author's

Individual Abstract Submissions

Abstract #: 20-54 **Date Received** 10/2/2019 **Score:**

Name: Jason Ddeflitch

Company: SAI Consulting Engineers, Inc
Pittsburgh PA

Title: Mon Wharf Pedestrian Bridge Design

PrimaryTopic: Pedestrian/Special Purpose Bridges

SecondaryTopic: Design

Project Information **Name:** Mon Wharf Pedestrian Bridge

Location: Pittsburgh, PA

Opening Date? 11/15/2018

Technical Merit of Presentation

Provide a design layout for pedestrian bridge with tight constraints and details for straight girder construction to accommodate grade changes and ramp turns. In addition, details for steel column bents supporting the girders, attached concrete footings, and micropile foundations to minimize footprint and reduce impact to utilities will be discussed

Abstract:

The Mon Wharf Switchback Pedestrian Bridge offers cyclists and pedestrians a fully-lit, ADA-accessible, non-motorized connection between the historic Smithfield Street Bridge and the Mon Wharf Landing trail. Constructino challenges included flooding potential and the the site being constrained by I-376 and the Monongahela River..

The structure is a 607 foot long by 12 foot wide two girder system with a concrete deck on a switchback configuration to minimize foundations and structure footprint. The girders were made continuous from Smithfield Street all the way around the switchback to greatly minimize the number of joints on the bridge.

Steel column bents with steel bracket cantilevers support both the upper and lower ramps. Foundations are supported by micropiles to reduce vibration on the existing brick-lined ALCOSAN line below and facilitate smaller equipment needed during construction.

The girders were fabricated straight to reduce fabrication costs, and grade changes were accounted for by varying the deck haunch over the girders.

The bridge is comprised of six continuous 70 foot spans and a single 100 foot span. The single span passes below the Smithfield Street Bridge and allows foundations to be placed outside the limits of Smithfield Street avoiding interferences during construction. The last 66 feet of the bridge consists of a ramp on a pile-supported concrete footing and side walls.

For the City of Pittsburgh, the Mon Wharf Switchback contributes to the City’s growth and prosperity.

Notes:

Co-Author's Larry Maher SAI Consulting Engineers, Inc

Individual Abstract Submissions

Abstract #: 20-55 **Date Received** 10/2/2019 **Score:**

Name: David Klyce

Company: RK&K

King of Prussia PA

Title: Design and Construction of the SR 22 Bridge Replacments

PrimaryTopic: Design

SecondaryTopic: Construction

Project Information

Name: SR 22, Section 400 Bridge Replacements

Location: Allentown, PA

Opening Date? 09/17/2019

Technical Merit of Presentation

Learn about the unique design approach and construction methods used to overcome the many challenges of replacing these dual multi-span bridges while avoiding impacts to the river, canal, road, and railroads that pass underneath and using staged construction to maintain the high traffic volume carried across the bridges.

Abstract:

As part of the US 22 corridor improvement project in Allentown, Pennsylvania, PennDOT Engineering District 5-0 replaced the severely deteriorated dual Route 22 bridges that span over the Lehigh River, Dauphin Street, the historic Lehigh Canal, and railroads while maintaining the high volume of traffic on Route 22 and all roadway, rail, and recreational boating traffic passing underneath throughout construction.

The existing adjacent 678-foot long, six span and a 516-foot long, four span bridges with fracture critical steel two-girder and floorbeam superstructures carried a total of four traffic lanes. They were replaced with two pairs of wider consecutive dual bridges having prestressed concrete superstructures to carry a total of six lanes. The 640-foot length, five span western dual bridges cross the river and the RJ Corman railroad while the eastern 530-foot length, four-span dual bridges cross the canal, Dauphin Street, and Norfolk Southern railroad.

The new continuous span superstructures pushed the design of prestressed concrete PA Bulb-Tee girders to the limit by using 160-foot maximum length spans. Splayed girders were used to flare the deck width for a variable width ramp acceleration lane on the structure. Deep, drilled foundations were used to construct tall, reinforced concrete hammerhead piers for the new structures in challenging karst bedrock conditions.

Construction of the $30 million-dollar bridge replacement project reached substantial completion in September, 2019. This presentation will highlight the unique challenges and lessons learned during both design and construction from the perspective of the designer, contractor, and the owner.

Notes:

Co-Author's Kamlesh Ashar PA Department of Transportation - Engineering District 5-0

Tom Haag Wagman Construction, Inc

Individual Abstract Submissions

Abstract #: 20-56 **Date Received** 10/2/2019 **Score:**

Name: Brandon Weyant

Company: E.T. Tectonics
Alum Bank PA

Title: FRP Bridge for Pedestrian Usage

PrimaryTopic: Pedestrian/Special Purpose Bridges

SecondaryTopic: Innovative Materials Applications

Project Information **Name:** Advantages of FRP Bridges for Pedestrian Usage

Location:

Opening Date?

Technical Merit of Presentation

This presentation will aim to inform attendees with information on FRP bridge structures who may have not known about the product before attending. It will introduce them to why this material is a good alternative to traditional pedestrian bridge materials, and offer insight as another option to consider when planning future pedestrian bridge projects.

Abstract:

E.T. Techtonics has been at the forefront in the research, design, and construction of Fiber-Reinforced Polymer (FRP) composite bridges and building systems since 1987. In 2016, the company was acquired by its longtime manufacturing partner CPI. The E.T. Techtonics brand trail access bridge sales, engineering and design group resides at the corporate headquarters of CPI in Alum Bank, PA. To date, over 900 pedestrian bridges and walkway systems have been engineered and installed using the E.T. Techtonics fiberglass bridge system. In this discussion, we will look at the advantages of using FRP bridges for pedestrian/ trail way usage. Topics that will be discussed are the cost advantage of using an FRB bridge as opposed to other materials, the strength and maintenance associated with fiberglass over traditional materials, and the installation process advantages that are present in the usage of FRP materials. The talk will also highlight success stories of previous jobs that utilized FRP materials for pedestrian bridges.

Notes:

Co-Author's

Individual Abstract Submissions

Abstract #: 20-57 **Date Received** 10/2/2019 **Score:**

Name: Dan Fitzwilliam

Company: T.Y. Lin International
San Diego CA

Title: Cable Stayed Equestrian Bridge

PrimaryTopic: Pedestrian/Special Purpose Bridges

SecondaryTopic: Cable Stayed Bridges

Project Information **Name:** N. Atwater Multimodal Bridge

Location: Los Angeles, CA

Opening Date? 12/30/2019

Technical Merit of Presentation

Traditional girder bridges typically have a span to depth of 20:1 or 25:1. Cable stayed bridges might push that ratio tc 100:1. Innovative design and the use of tuned mass damping of the superstructure allow this bridge to use a span to depth ratio 130:1.

Abstract:

This will be the first cable stayed bridge in the city of Los Angeles and possibly the first cable stayed equestrian bridge in the world. With a very slender, light-weight deck and relatively heavy equestrian live loads, the bridge's dynamic behavior was a major design consideration. In order to mitigate the potential for resonant vibrations during passage of groups of equestrians, a system of tuned mass dampers was designed for the bridge. The use of tuned mass damping of the superstructure to limit vibrations allow this bridge to use a span to depth ratio 130:1. The deck is divided into two pathways: a twelve foot wide pedestrian side with a hardwood deck and stainless steel mesh railings; and a twelve foot wide equestrian side topped with horse friendly rubber paves and a less transparent wooden picket railing system.
The cable-stayed bridge type is also the first of its kind in Los Angeles. High-stressed cables are incrementally attached to the 125-foot-tall mast and configured in a fan pattern, creating a distinctive element in an otherwise homogenous landscape. To residents in the area, the bridge is a welcome enhancement to the amenities they already know exist. However, its visibility to drivers on Interstate 5 stokes the curiosity of commuters in neighboring communities and cities to come see the bridge, enhancing the opportunity for non-vehicular recreation and outdoor activity. As the first completed symbol of renewal and revitalization, the North Atwater Non-motorized Multimodal Bridge is a champion of community identity and civic pride.

Notes:

Co-Author's

Individual Abstract Submissions

Abstract #: 20-58 **Date Received** 10/2/2019 **Score:**

Name: Joshua Kahan, P.E.

Company: Rummel, Klepper, & Kahl
Baltimore MD

Title: A Splice Girder Bridge for the Wilmington Waterfront

PrimaryTopic: Design

SecondaryTopic: Foundations Topics

Project Information

Name: Christina River Bridge

Location: Wilmington, DE

Opening Date?

Technical Merit of Presentation

The Christina River Bridge is the first Concrete Spliced Girder bridge in the State of Delaware. The presentation will cover the structural design and construction constraints and the benefits of this unique superstructure design. The poor soil conditions along the bridge alignment provided additional complexity to the project design.

Abstract:

The Christina River Bridge Project, owned by the Delaware Department of Transportation, is part of a revitalization effort to improve the Southbridge area of the City of Wilmington, DE. The bridge provides a multi-model connection between the redeveloped Riverfront along the west bank of the Christina River and the industrial Southbridge area on the east bank. The bridge alleviates traffic congestion and improves circulation for the Riverfront by introducing additional access to US-13, I-495 and I-95, while creating the opportunity for development along the east bank.
The Christina River Bridge is three spans, 470-ft long, and 45-ft wide carrying two 11'-0" wide lanes and a 14'-0" wide shared-use path. The necessity for a 150-ft navigation channel, dictated a 180-ft long center span. A Concrete Spliced Girder superstructure was chosen to reduce maintenance requirements and limit superstructure depth. The concrete spliced girders consist of five post-tensioned prestressed concrete bulb-T segments. The approach span End Segments and the center span Drop-In Segment are supported by haunched Pier Segments during construction prior to post-tensioning.
The subsurface soils along the bridge alignment consisted of a thin crust of fill at the ground surface underlain by up to 40-ft of very soft, highly-plastic silt and clay; bedrock was encountered approximately 100-ft below existing grade. With estimated long-term settlements for the approach embankment as high as 41-inches using normal-weight backfill, global stability issues, various geotechnical treatments were considered including ground modification using Controlled Modulus Columns, complete load balancing with Expanded Poly-Styrene, and quarantine of fill embankment.

Notes:

Co-Author's Kimberly Duong, P.E. Rummel, Klepper, & Kahl

Bibek Shrestha, P.E. Rummel, Klepper, & Kahl

Jason Hastings, P.E. Delaware Department of Transportation

Individual Abstract Submissions

Abstract #: 20-59 **Date Received** 10/2/2019 **Score:**

Name: Carson Carney, P.E.

Company: SHAKEY Deicing, LLC
Cranberry TWP PA

Title: Prototype Testing of SHAKEY: A Novel Cable Deicing Method

PrimaryTopic: Cable Maintenance

SecondaryTopic: Rehabilitation/Preservation: Structural Health Monitoring

Project Information

Name: CAIT-UTC-NC55

Location: Rutgers University's Center for Advanced Infrastructure and Technology

Opening Date? 07/26/2020

Technical Merit of Presentation

The cable stay bridge community is searching for a recognized solution to the ice bomb phenomenon. Describing this new solution and presenting the results of its prototype validation testing will assist in providing the interested parties a new approach to the issue.

Abstract:

Within the much broader market of bridge maintenance services exists a distinct issue that has yet to be resolved with a recognized industry standard. The issue is commonly referred to as "ice bombs" as it describes ice that has accumulated on bridge cables that shed off to the roadway below. These ice bombs cause traffic disruptions and property damage that bridge owners and operators are struggling to deal with. Full bridge closures caused by this phenomenon are massively costly to the owners.

The issue most commonly affects cable stay structures in northern latitudes with stay patterns that cross above the roadway although the issue also has been observed on northerly located suspension bridges and even cable stays as far south as South Carolina.
SHAKEY Deicing is teaming with Pennoni Associates Inc. to offer a patented physical deicing system in conjunction with a customizable monitoring system that integrates key environmental and structural data into a predictive modeling system. The integrated system will provide valuable information and tools to bridge operators that will help to minimize disruptions that often occur when ice bombs fall from the cables above during certain cold weather conditions.
SHAKEY and Pennoni have also engaged Rutgers University's Center for Advanced Infrastructure and Transportation (CAIT) to perform validation testing. CAIT's environmental chamber can be adjusted to match any individual bridge's environment and design parameters.
The paper and presentation will describe the proposed solution and results of the prototype validation testing.

Notes:

Co-Author's Jeffrey Purdy, P.E. Pennoni Associates, Inc.

Shane Mott Rutgers University

Individual Abstract Submissions

Abstract #: 20-60 **Date Received** 10/2/2019 **Score:**

Name: Rana Mutashar

Company: TERRADON CORP.
Poca WV

Title: Evaluation, Behaviour and Rehabilitation of Bridge Pier Cap using Ultra High-Performance Concrete (UHPC)

PrimaryTopic: Bridge Maintenance

SecondaryTopic: Rehabilitation/Preservation

Project Information

Name: "MacArthur" Bridge and "Harper Road" bridge

Location: West Virginia

Opening Date?

Technical Merit of Presentation

Show the benefits of using UHPC in bridge repair included pie cap; point out that using UHPC in structure repair increases structure strength without needing to add stirrup and longitudinal reinforcement, show how to model UHPC using a finite element with MIDAS software.

Abstract:

Often, the strategy to rehabilitate existing pier caps to improve structural capacity is to provide additional reinforcement along with standard concrete. Such rehabilitation brings up the concern regarding the bond between the existing and new concrete, and whether the resulting structure will work as one unit to resist the applied loads. However, the use of UHPC has shown promise for this application mainly due to high bond strength and its excellent mechanical properties. This paper investigates the use of UHPC to repair pier caps and improve their capacity. Such procedure was applied to two structures: "MacArthur" Bridge and "Harper Road" bridge located in West Virginia. Field inspection of those bridges indicated that the pier caps had experienced spalls, delamination, and cracks. To investigate the causes of these issues, Non-linear three-dimensional finite element model was developed to simulate the behavior of the existing pier cap under live, thermal, and dead load. The finite element results were validated with inspection observations in terms of crack locations. The results of the analysis indicated that the pier cap flexural and shear capacities were less than actual applied loads. Therefore, a thin layer of UHPC was used to overlay the existing pier cap. New finite element models were developed to represent the performance of the composite section of the existing pier cap and the UHPC layer using different layer thicknesses. Analysis indicated using a 3.5" UHPC overlay would provide the required additional flexural and shear strength to withstand applied loads without additional reinforcement.

Notes:

Co-Author's Jamal Shanaa TERRADON CORP.
Robert Simmons TERRADON CORP.
Joe Saunders TERRADON CORP.

Individual Abstract Submissions

Abstract #: 20-61 **Date Received** 10/2/2019 **Score:**

Name: Gregory Black

Company: AECOM
Philadelphia PA

Title: Retrofit of a Rolling Leaf Bascule Bridge

PrimaryTopic: Moveable Bridges

SecondaryTopic: Moveable Bridges

Project Information **Name:** Retrofit of Bridge BR 3-152, Central Ave Over Broad Creek

Location: Laurel, Delaware

Opening Date? 10/18/2019

Technical Merit of Presentation

This presentation will showcase a novel solution to difficult design and construction challenges that will be of interest to the public as well as engineers, and owners responsible for maintenance or replacement of structurally obsolete thru-girder bridges, whether movable or fixed.

Abstract:

Upgrading an old bascule bridge to handle modern loading can prove difficult when the original structure uses lower grade steel in comparison to modern varieties, and light sections without extra capacity to minimize weight of the bascule leaf.

This paper focuses on the bridge design concepts and detailing developed to retain aesthetic elements of an overhead counterweight rolling leaf bascule “Scherzer” bridge as part of the bridge conversion into a modern fixed crossing. The 100-year-old existing bridge carries Central Ave (Alternate Route 13) over Broad Creek in Laurel, Delaware. Recent inspection and rating of the existing structure required a posting of 13 tons and emergency vehicles were prohibited from access. The waterway serves only small craft without need for bridge openings. The bridge is within the Laurel Historic District and the Delaware Department of Transportation (DELDOT) wanted to retain the major elements of the bridge appearance while providing a functional and low maintenance structure.

Design challenges and solutions presented include the retention and stability of heavily corroded bascule through girders, the temporary and permanent support and stability of the overhead counterweight with track and segmental girders, the development of a new micro-pile supported substructure without impacting bridge hydraulics, the squaring of the skewed-end bascule span, the use of standard bridge railings within a constrained cartway, and the use of concrete bulb-T girders and concrete deck within the tight vertical profile of the existing floorbeams and grating

Design by AECOM in support of the Delaware Department of Transportation

Notes: Construction on this project began in 2018 and will end in fall 2019. Progress photos will be available.

Co-Author's Neil Shemo AECOM
Dan Griffith AECOM

Individual Abstract Submissions

Abstract #: 20-62 **Date Received** 10/2/2019 **Score:**

Name: Sherif Daghash

Company: Michael Baker International
Virginia Beach VA

Title: Deck Slab Closure Effects on Bridge Behavior: James River Bridge Case

PrimaryTopic: Bridge Maintenance

SecondaryTopic: Rehabilitation/Preservation

Project Information **Name:** James River Bridge

Location: Virginia

Opening Date?

Technical Merit of Presentation

The presentation will show the asset management plan covering the maintenance and rehabilitation of the JRB bridge over the next 30 years. It can set an example for long-term maintenance plans for signature bridges.

Abstract:

This paper investigates the James River Bridge (JRB) to determine how many consecutive open bridge deck joints can be eliminated as part of an asset management plan covering the maintenance and rehabilitation of the bridge over the next 30 years. The paper presents the next phase of work as a follow-up to a previous paper (IBC16-07). The JRB, owned and maintained by Virginia DOT, consists of 302 prestressed concrete multi-beam spans and one steel through-truss lift span with a total length of 4.4 miles. The maintenance plan is comprised of both restorative maintenance, to repair deterioration in bridge elements, and preventative maintenance to preserve the bridge and slow future deterioration.

To study the effect of bridge joint elimination on bridge behavior, a three-dimensional finite element model (FEM) was created of four consecutive monolithic prestressed concrete superstructure spans using MIDAS® Civil. One, two, or three consecutive joints were eliminated, using link slabs, in the model to form 2-, 3-, or 4-span units. Link slabs are poured over interior supports to create a continuous bridge deck. Link slabs minimize bridge maintenance and extend the life of existing structure by stopping water leakage through deteriorated joints. However, constructing a continuous deck over an interior support results in additional lateral loads acting on the existing substructure. Force effects on the structure due to uniform temperature and braking loads in combination with the link slabs were analyzed. A summary of the FEM approach, a comparison of the analysis results, and joint elimination recommendations are presented.

Notes:

Co-Author's Daniel Dowling Michael Baker International

Deanna Nevling Michael Baker International

Individual Abstract Submissions

Abstract #: 20-63 **Date Received** 10/2/2019 **Score:**

Name: Zahra Kamranian

Company: Stantec Ltd.
Edmonton AB Canada

Title: Existing Bridges under Truck Platooning

PrimaryTopic: Design

SecondaryTopic: Information Modeling for Bridges, including Data Exchanges and 3D Bridge Desigr

Project Information **Name:** Greenlight
Location: Edmonton
Opening Date? 10/01/2019

Technical Merit of Presentation

This presentation will provide a flavor of the challenges that we are facing in adopting the new technologies.

Abstract:

Industry pioneers are currently developing technology which allows a chain of trucks movement behind a lead truck known as Truck Platooning (TP). The trucks are connected through a variety of wireless connections. The benefits of this technology include improvements to commercial hauling, fuel consumption, insurance premiums, pollution, roadway capacity, and maintenance cost. Most importantly, vehicle collisions due to human error would decrease. Running heavy loads in close succession, however, does put our infrastructure at risk of overloading. With heavy truck loads running in close proximity new analysis is required to ensure that our bridges are safe. This applies not only for the bridge superstructures, but also for the substructures.
Our goal is to perform an assessment of common one span bridges, one three span bridge and a two spans overpass under several platooning. These bridges are representative of current infrastructure, and the span numbers and lengths are reflective of Alberta current bridges. The platoons consist of two, three or four trucks with different gaps. Critical factors which will contribute to this evaluation will include, but is not limited to, bridge span length, number of spans in a bridge, gross vehicle weight, and spacing between the platooning vehicles.
Platoons less critical than Alberta non-permit legal trucks CS1, CS2 and CS3 will be specified. Because bridge engineers normally use these trucks as the basis for load ratings, the outcome of this step will provide recommendations to the regulators for platoons permitting on the existing bridges.

Notes: This study is relevant to new technologies including; Truck Platooning (TP) and Connected Vehicles (CV).

Co-Author's

Individual Abstract Submissions

Abstract #: 20-64 **Date Received** 10/2/2019 **Score:**

Name: Robert Schmidt, P.E.

Company: HDR Engineering
Pittsburgh PA

Title: **Bridge Replacement and Reconfiguration of Access to the Primary Facilities of Moraine State Park in Butler County, Pennsylvania**

PrimaryTopic: Design

SecondaryTopic: Innovative Materials Applications

Project Information

Name: Moraine State Park Access

Location: Moraine State Park – Butler County, PA

Opening Date? 09/07/2018

Technical Merit of Presentation

The project involved the coordination of multiple state and local agencies and provided several innovative solutions to 'typical' PennDOT design projects. The new bridge, realigned road, and interchange improvements were performed with limited funding to maximize access to the park facilities while minimizing the environmental footprint.

Abstract:

Moraine State Park is a 16,725-acre park, which surrounds Lake Arthur in Butler County north of SR 422 and east of I-79. Located approximately 38 miles north of Pittsburgh off I-79 and 15 miles west of Butler on SR 422, the park is a significant public asset with numerous recreational facilities. A majority of these facilities are located along the north shore of the lake having limited access via major routes with primary access using a rural road network. In the late 1990's, Butler County and the Department of Conservation and Natural Resources defined the need for a project to improve access to the Park's north shore and replace the structurally deficient bridge along the access road from SR 422 westbound. Initial funding was identified in 2001, however funding pitfalls stalled the project until 2010 when the project funding was identified and the project was progressed through the design phases and ultimately constructed in 2017/2018. The project scope was fragmented with new structures, ramps, signals, signage, and drainage interlaced with the existing infrastructure. The feature structure is a new 147' single span prestressed concrete PA Bulb-Tee bridge spanning Muddy Creek along new alignment of SR 4017. This structure is significant as access to the myriad of features located along the north shore of Lake Arthur is now facilitated by the realigned roadway and new bridge. The project also reconfigured an existing interchange between SR 422 and West Park Road to allow direct access to the park from SR 422 Eastbound.

Notes: The Project was awarded the "Outstanding Highway Engineering Award" by the Mid-Allegheny chapter of ASHE in 2018.
The project is a more 'typical' scaled Pennsylvania Department of Transportation Project which should appeal to the host state.
Co-Presentation with the Pennsylvania Department of Transportation Project Manager responsible for the project delivery.

Co-Author's Eric Buchan, P.E. PA Department of Transportation | Engineering District 10-0

Individual Abstract Submissions

Abstract #: 20-65 **Date Received** 10/3/2019 **Score:**

Name: Gang Zhang

Company: Virginia DOT
Fairfax VA

Title: Torsional Resistance of Single Drilled Shaft Foundation in Mast Arm Structures

PrimaryTopic: Design

SecondaryTopic: Ancillary Structures

Project Information **Name:**

Location:

Opening Date?

Technical Merit of Presentation

This paper summarizes and compares the commonly used design methods and will encourage discussion on the conservativeness and how those methods can be applicable to different field conditions. The attendee will have a better understand of each method.

Abstract:

With the increase in the traffic volume and hence the arm length of the mast arm (MA) structures, torsion becomes increasingly significant. The drilled shaft was widely used in the construction of MA structures because of advantages of lower cost, small footprint etc. However, the drilled shaft in the MA structure is different from that in bridge foundation because of its relatively large torsional load and non-redundancy. Therefore, the torsional capacity of the drilled shaft foundation of MA needs special attention. However, design methods of torsional capacity vary significant from state to state. Even with the same methods, the selection of parameters is different from agency to agency. This brings wide variance in the length of the drilled shaft. This paper conducts a literature review of several existing approaches of drilled shaft torsional capacities. The performance of different approaches was evaluated by comparing the design results from different soil types and conditions. Recommendations were proposed on the torsional design of MA structures

Notes:

Co-Author's Bo Chen Virginia DOT
Edmund Okerchiri Virginia DOT
Gary Runco Virginia Dept of Transportation

Individual Abstract Submissions

Abstract #: 20-66 **Date Received** 10/3/2019 **Score:**

Name: Fady Kari

Company: Siefert Associates LLC
Naugatuck CT

Title: Erection of Curved Steel I-Girders at LaGuardia Airport

PrimaryTopic: Erection Engineering Standards

SecondaryTopic: Construction Engineering

Project Information **Name:** LaGuardia Airport Central Terminal Building Replacement Project

Location: Queens, NY

Opening Date?

Technical Merit of Presentation

The attendee will learn the different erection schemes used for curved steel I-girder bridges at LaGuardia Airport. The presentation will highlight the construction challenges involved with the stability of curved steel I-girders during erection. Case studies will review the analysis of the curved steel I-girders in each procedure used.

Abstract:

LaGuardia Airport, located in Queens, NY is one of the major transportation hubs in the New York City area. The airport was originally built in 1939 and then expanded in 1964. In 2016, Governor Andrew Cuomo announced construction had started on the outdated airport to better service the over 30 million passengers that travel through it annually. The project is funded by a public-private partnership between the Port Authority of New York and New Jersey and LaGuardia Gateway Partners and was awarded to Skanska Walsh Joint Venture. Construction began in June 2016 and is set to be completed by the end of 2022.

As the 21st busiest airport in the United States, it was imperative that the airport remain fully operational during the construction process. The project scope includes the construction of 24 new bridges within the already busy roadway network into and out of the airport. With a project of this magnitude it is important to consider limiting factors such as site congestion, sequencing, time constraints, traffic and construction cost.

This presentation will go through case studies on various challenges associated with the erection of heavily curved steel I-girder bridges. It will discuss several factors which influence stability of the curved members in their temporary positions as well as methods to combat the inherent instability of these members.

Notes: The presentation will be a collaboration between the construction engineer (Siefert Associates) and the contractor (Skanska Walsh).

Co-Author's Elena Scarmozzino Siefert Associates LLC

Paige Muzzati Siefert Associates LLC

Dave Kulak Skanska Walsh J.V.

Individual Abstract Submissions

Abstract #: 20-67 **Date Received** 10/3/2019 **Score:**

Name: Muhammad Asif Iqbal, P.E. LEED Green Associate

Company: Al Engineers, Inc.
Middletown CT

Title: **Automated Crack Mapping using Digital Imaging Technology (Infrared Thermography Imaging) of the Pearl Harbor Memorial Bridges (00174A & 00174B)**

PrimaryTopic: NBIS/NTIS Inspections

SecondaryTopic: Cable Stayed Bridges

Project Information

Name: Bridge Inspection & Evaluation

Location: Connecticut

Opening Date? 07/15/2019

Technical Merit of Presentation

Using this infrared imaging technology both mobile and stationary applications significantly reduced the field inspection time and costs associated with direct visual or sounding inspections which took months to map all the cracks inside and outside of the post tensioning prestressed concrete segmental box girders. Clear, scaled, and CAD-compatible high-resolution imagery outputs can be a baseline to monitor the future propagation in length and width of each detected deficiency. This technology will really aid to the inspection process to accurately identify the deficiencies with less inspection time and cost.

Abstract:

Condition ratings of bridge components in the Federal Highway Administration (FHWA)'s Structural Inventory and Appraisal database are determined by bridge inspectors in the field, often by visual confirmation or direct-contact sounding techniques. However, inspectors face challenges in limitations to access, unsafe working conditions, and rebuke from the negative impacts of lane closures for visual and hands-on inspections. This paper describes an alternative methodology to obtaining informative and diagnostic inspection data for concrete bridge elements. The technology uses high-resolution visual imaging technology to locate, classify, quantify, and monitor the surface cracks in concrete surfaces.

The methodology was applied in State of Connecticut to the Pearl Harbor Memorial Bridges (hereinafter referred to as Q-Bridges) to inspect the following elements: 1) the superstructure (interior and exterior of prestressed precast concrete box girders), 2) Latex Modified Concrete (LMC) bridge deck-top, and 3) substructure (interior and exterior of tower piers, exterior of anchor piers). As there are no one-size-fits-all solutions for scanning the varied types of concrete surfaces called for in this project, multiple types of technologies were implemented to photograph the concrete surfaces for each element without implementing conventional inspection techniques (i.e., Hammer sounding, chain dragging, sketching, etc.).

The latex modified concrete on the deck-top was scanned by a vehicle-mounted visual and thermographic camera at 50 mph (the posted speed limit for the roadway which the bridge carried) without any lane closure. The interior and exterior faces of the superstructures and substructures were photographed from stationary locations to generate a complete crack (>= 0.2 mm or 0.0078 inches) map. Both mobile and stationary applications significantly reduced the field inspection time associated with direct visual or sounding inspections. Clear, scaled, and CAD-compatible high-resolution imagery outputs can be a baseline to monitor the future propagation in length and width of each detected deficiency. A narrative of findings and lessons learned from the experience Connecticut is described here as a successful example. To validate the accuracy of delamination detection by the visual and infrared scanning, findings were proofed by visual and physical sounding of the target structures.

Notes: Condition ratings of bridge components in the Federal Highway Administration (FHWA)'s Structural Inventory and Appraisal database are determined by bridge inspectors in the field, often by visual confirmation or direct-contact sounding techniques. However, inspectors face challenges in limitations to access, unsafe working conditions, and rebuke from the negative impacts of lane closures for visual and hands-on inspections. This paper describes an alternative methodology to obtaining informative and diagnostic inspection data for concrete bridge elements. The technology uses high-resolution visual imaging technology to locate, classify, quantify, and monitor the surface cracks in concrete surfaces.

Co-Author's Masato Matsumoto, P.E. Nexco

Individual Abstract Submissions

Abstract #: 20-68 **Date Received** 10/3/2019 **Score:**

Name: Jack Ajrab

Company: Parsons
Ottawa ON Canada

Title: Design Challenges of a Unique Conventional Highway Bridge that Swings

PrimaryTopic: Moveable Bridges

SecondaryTopic: Design

Project Information

Name: St. Peter's Canal Swing Bridge

Location: Nova Scotia - Canada

Opening Date? 11/16/2017

Technical Merit of Presentation

This presentation will benefit bridge engineers and movable bridge specialists as it will discuss the technical challenges encountered during design of this bobtail swing bridge. It will discuss the detailing of the various components and the rationale behind the design decisions taken.

Abstract:

The St. Peter’s Canal Swing Bridge is an unequal arm swing bridge located in Cape Breton, Nova Scotia. It was built as a replacement to an existing through truss swing bridge that had reached the end of its useful life after 80 years in service. The uniqueness of this bridge is attributed to the design of its superstructure, which is comprised of twin trapezoidal box girders with a composite, cast-in-place concrete deck, which is unconventional for a movable bridge. The 1000 metric tonne superstructure is supported on a single spherical plain bearing. This paper will focus on the bridge design challenges encountered, including accommodating a complex horizontal alignment with superelevation, an asymmetrical transverse cross-section with a sidewalk on one side of the deck, the design and detailing of a fracture critical pivot beam supporting the entire structure when the bridge is in the open position, balancing the structure, and designing for the reversal of stresses during operation.

Notes:

Co-Author's Ryan O'Connell Parsons

Individual Abstract Submissions

Abstract #: 20-69 **Date Received** 10/3/2019 **Score:**

Name: Joe Knapp

Company: Genesis Structures
Kansas City MO

Title: ABC Replacement of the BNSF Wind River Bridge No 58-8

PrimaryTopic: ABC

SecondaryTopic: Construction Engineering

Project Information

Name: Reconstruction of Bridge No. 0047-0058.800

Location: Carson, WA

Opening Date? 08/06/2019

Technical Merit of Presentation

The presentation will provide insight to the ABC processes used on the project and the steps taken to minimize potential construction issues during the railway closure and bridge change out.

Abstract:

The Burlington Northern Santa-Fe (BNSF) Railroad Bridge No. 58-8, is located along the Northern bank of the Columbia River Gorge between Portland and Hood Mountain Oregon. As part of BNSF's continued rail improvements throughout the Pacific Northwest, the circa 1900's 200 ft thru pin style truss bridge over the conflux of the Wind River was replaced with a new 260ft ballasted thru truss bridge. This presentation will focus on the 12-hr float-out/float-in period of a 32-hr track closure. Construction methods used for the execution of the main span change out will be discussed, including the erection of the new truss off-site, marine transportation upriver and through a navigational lock and dam, development of the floating systems for the float-out and float-in, the design of the strand jack lifting towers used as part of the float-in, the design of a unique ballasting system for the float-out and the demolition of the existing truss. The presentation will also highlight the coordination required between multiple entities including the owner, engineer of record, other prime contractors on the project, the U.S. Army Corp of Engineers and Bonneville Power Administration.

Notes: Being located on the Columbia River, the presentation will contain large amounts of scenic photos and drone videos throughout the construction process.
Mr Knapp and Mr Izatt will be presenting

Co-Author's Kyle Izatt Advanced American Construction

Alan Bloomquist Burlington Northern Santa-Fe Railway

Individual Abstract Submissions

Abstract #: 20-70 **Date Received** 10/3/2019 **Score:**

Name: Julian Jesso

Company: Embry-Riddle Aeronautical University
Daytona Beach FL

Title: **Probability-Based Superload Model for Bridge Design and Evaluation**

PrimaryTopic: Information Modeling for Bridges, including Data Exchanges and 3D Bridge Desigr

SecondaryTopic: Bridge Maintenance

Project Information **Name:** Heavy Load Effects on Florida's Infrastructure

Location: Daytona Beach, Florida

Opening Date? 01/14/2019

Technical Merit of Presentation

The superload model can be used in any state to determine the necessary precautions to lengthen bridge life spans while the demand in transportation continues to increase. The existing Florida data on I-95, I-75, and I-10 can be combined with other state's data on these highways, expanding the scope countrywide.

Abstract:

Over the past two decades, super heavy vehicles, or superloads, are utilized to transport heavy loads, such as prestressed concrete girders, automotive presses, transformers, wind turbine components, or other heavy loads. Since these superloads have a significant effect on the bridges in comparison with the regular permit vehicle, they should be subject to special consideration in design, evaluation, and maintenance planning process. Despite the great research effort that has been made to improve the superload permitting process, limited studies have been performed on the characterization and modeling of superload. Superload has its own distinct characteristics that differ from other vehicle loads. Thus, there is a need to better understand the characteristics of superload and to develop an advanced probability-based model for bridge design and evaluation.

In this paper, the major focus is to develop a probability-based live load model for superload using advanced gradient boosting machine (GBM) learning algorithms. Weigh-in-Motion data collected from 31 sites in Florida over 10 years was used as the database for this study. The raw data has been processed with a newly developed procedure and the superload data was extracted. A comprehensive probability-based modeling technique that was developed using GBM with regression, classification trees, and time series modeling addresses the unique features of superload data. Utilizing the established modeling process, a probability-based superload model was developed for bridge design anc evaluation.

Key Words: Weigh-In-Motion, Superload, Probability, Bridge Design, Bridge Evaluation

Notes:

Co-Author's Dan Su Embry-Riddle Aeronautical University

Individual Abstract Submissions

Abstract #: 20-71 **Date Received** 10/3/2019 **Score:**

Name: Mark McCoy

Company: DSI

Bolingbrook IL

Title: **Monitoring of First Circular (reusable) Bridge**

PrimaryTopic: Software Applications

SecondaryTopic: Fabrication Methods

Project Information **Name:** Circulair Viaduct

Location: Kampen, Netherlands

Opening Date? 11/01/2018

Technical Merit of Presentation

This presentation will provide a conceptual overview of the circular bridge approach with a focus on the Infrastructure Health Monitoring (IHM) system used to validate the design principles.

Abstract:

The Dutch Government for Infrastructure, Rijkswaterstaat, has the ambition to work ‘circular’ (i.e. reusable) by 2030. This means that the traditional way of working, including the way bridges are built, is no longer applicable. The lifecycle process from design stage to execution and through demolition needs to change.

The circular bridge engineers designed a bridge that utilizes standardized concrete blocks that have a 200 year lifespan. These blocks are connected like Lego pieces and are posttensioned (PT) in the longitudinal and transversal directions. Then, after the lifespan of the bridge is complete (~40 years), these blocks can be de-installed and re-used again at another location, hence the term ‘circular’.

A pilot circular bridge was built using this concept, and it was necessary to monitor the performance of the bridge to validate the design principles and to overcome the rule that posttensioning always needs to be bonded in the structure. This, in the Eurocode, is called ‘design by testing’. In order to validate, an Infrastructure Health Monitoring (IHM) system was installed and consisted of several components; camera control of the vehicles passing, direction and speed of vehicles, temperatures, bending of the bridge, and the bird-gapping between the blocks. Also, as part of the IHM system, alerts and alarms were programmed to be sent to the engineers if measurements exceeded pre-defined thresholds.
This presentation will provide a conceptual overview of the circular bridge approach with a focus on the IHM system used to validate the design principles.

Notes: As part of presentation, if possible, we'd like to show a time-lapsed video of the bridge construction (~2:30 min).

Co-Author's Chris Fielding DSI

Individual Abstract Submissions

Abstract #: 20-72 **Date Received** 10/3/2019 **Score:**

Name: Lissette Iturburu

Company: University at Buffalo, the State University of New York
Buffalo NY

Title: Evaluation and Load Rating of Steel Bridges with Web Corrosion

PrimaryTopic: Rehabilitation/Preservation: Service Life Design

SecondaryTopic:

Project Information

Name: Grant for the study of corrosion in bridge steel girders by the Association for Bridge Construction and Design

Location:

Opening Date?

Technical Merit of Presentation

The attendees will learn about challenges, common practices and assumptions in load rating steel girders with corrosion, suitability of these assumptions and AASHTO LRFD Bridge Design Specification equations for girder evaluation and modeling methods for live load distribution and buckling analyses.

Abstract:

Steel girder bridges are prone to corrosion, particularly near girder web-bottom flange interfaces and at girder ends, where deicing agents accumulate. Section losses may change failure modes over time, leave sections vulnerable to undesirable failure modes such as buckling or alter load distribution between girders. This paper investigated load distribution and remaining capacity of W-shaped steel bridge girders that have web section loss or web-flange separation due to corrosion. Buckling capacity, moment capacity, shear and moment live load distribution factors were obtained for girders with different localized section loss amounts and locations, using finite element analyses. The capacities and live load distribution factors were compared with predictions of AASHTO LRFD Bridge Design Specifications, making varying assumptions on remaining web thickness. Accuracy and conservatism levels of these assumptions were evaluated, using an actual bridge with measured corrosion damage as a case study. The results showed that the thickness of the corrosion was a key parameter affecting girder capacity. Load distribution to girders may be impacted particularly for shear, when there is multiple girders with web-flange separation.

Notes:

Co-Author's Animesh Dutta University at Buffalo
Pinar Okumus University at Buffalo

Individual Abstract Submissions

Abstract #: 20-73 **Date Received** 10/3/2019 **Score:**

Name: Michael Davidson

Company: University of Florida
Gainesville FL

Title: Directionality of Soil Resistance for Design-Oriented Lateral Load Analysis of Bridge Piers

PrimaryTopic: Foundations

SecondaryTopic: Software Applications

Project Information **Name:**

Location:

Opening Date?

Technical Merit of Presentation

Attendees will be made aware of the importance of incorporating certain aspects of lateral soil-structure interaction into routine modeling and analysis of bridge pier foundations. The concept of directionality will be defined, and then demonstrated for multiple cases (single-piles, pile-groups), when subjected to lateral loads over a range of load-orientations.

Abstract:

A common component of bridge design is to ensure that adequate strength is available for bridge piers to resist lateral loads. However, depending on the orientations of piers within a given bridge, design requirements may lead to scenarios where lateral loads must be considered at (horizontal) orientations that deviate from transverse and longitudinal directions of the bridge pier foundations. For example, if a bridge pier—with underlying pile group—possesses a skew angle relative to the overlying superstructure, then resultants of horizontal bearing reactions atop the pier may induce motions in the underlying bridge pier foundation that do not align (in plan-view) with the rows of piles. When using the beam on nonlinear Winkler foundation (BNWF) approach to model such scenarios, it is important to account for “directionality” in the distributions of nonlinear lateral soil-resistance springs (i.e., the p-y springs). Directionality signifies that, throughout embedded portions of the bridge pier model, the orientations of p-y springs align with the respective (resultant) orientations of horizontal motions. If directionality is excluded from the analysis, it may lead to differences in computed response up to 20% in extreme cases. In the following, the benefits of accounting for directionality in modeling lateral soil-structure interaction behaviors are investigated. Using design-oriented analysis software, lateral loadings across a range of orientations are analyzed for models of single-pile and pile-group configurations. Based on the configurations analyzed, conditions are identified where accounting for directionality are of particular importance. In addition, considerations for group effects (e.g., p-multipliers) are presented.

Notes:

Co-Author's Jeffrey Svatora HDR
Gary Consolazio University of Florida
Henry Bollmann University of FL

Individual Abstract Submissions

Abstract #: 20-74 **Date Received** 10/3/2019 **Score:**

Name: Frank Artmont

Company: Modjeski and Masters
Mechanicsburg PA

Title: **Emergency Response and Repair of State Route 6 Bridge over French Creek following Over-Height Vehicle Strike**

PrimaryTopic: Design

SecondaryTopic: Emergency Response

Project Information **Name:**

Location:

Opening Date?

Technical Merit of Presentation

This presentation will allow attendees to learn various tactics for successfully rehabilitating a damaged structure on a compressed time schedule.

Abstract:

In January 2019, an over-height vehicle struck and damaged a portion of a through-truss bridge carrying State Route 6 over French Creek in northwestern Pennsylvania. The vehicle impacted and severed the bottom chord of the end portal frame and damaged the bottom chords of the next two interior sway frames of the seven panel Pratt truss span. The main truss verticals were dragged inwards and along the direction of motion as a result of their connections with the interior sway frames, severely damaging these critical members and jeopardizing the ability of the structure to carry loads. The structure was immediately closed to all traffic.

Modjeski and Masters (M&M) was asked to assess the capacity of the structure in its damaged state, determine whether the bridge could be reopened at a reduced posting, and develop repair plans if necessary. Using finite element analysis incorporating field measurements, M&M determined that the damage to the verticals was too severe to reopen the structure and that repairs were required. A scheme was developed using temporary verticals and hydraulic jacks to return the truss to pre-accident geometry and replace the damaged verticals. Damaged members were typically replaced in-kind, and construction load limits for each stage were also determined to avoid overloading the structure. This presentation will highlight the design stage work on the project, including the initial response, finite element analysis, and development of the repair schemes, which enabled the structure to be successfully repaired and reopened in under three months from the accident.

Notes:

Co-Author's Andrew Adams Modjeski and Masters
Hadi Kenarangi Modjeski and Masters
Christopher Smith Modjeski and Masters
Mark Bredl Pennsylvania DOT District 1-0

Individual Abstract Submissions

Abstract #: 20-75 **Date Received** 10/3/2019 **Score:**

Name: Michael Sprinkel

Company: VTRC/VDOT
Charlottesville VA

Title: **Use of Carbon Fiber Composite Wrap and External Post-tensioning to Strengthen Prestressed Concrete I- beams in the Hampton Roads Bridge Tunnel Approach Spans**

PrimaryTopic: Rehabilitation/Preservation

SecondaryTopic: Innovative Materials Applications

Project Information

Name: Rehabilitation of Hampton Roads Bridge Tunnel Approach Spans

Location: Rehabilitation of Hampton Roads Bridge Tunnel Approach Spans

Opening Date? 06/01/2018

Technical Merit of Presentation

Information will be provided on the strengthening of deteriorated prestressed concrete beams using Carbon fiber composite wrap (CFCW) and external post-tensioning (PT).

Abstract:

The prestressed beams in the Hampton Roads Bridge Tunnel Approach Spans were fabricated about 1960 (west bound lane) and 1970 (east bound lane). The spans are 50-ft and 75-ft respectively. The brackish water environment has caused corrosion and failure of the bottom strands and deterioration and spalling of the cover concrete in many beams. A project to strengthen 30 of the more deteriorated beams is underway as an alternative to posting or replacing the bridges. Carbon fiber composite wrap (CFCW) and external post-tensioning (PT) are being used to strengthen the beams. Prior to construction, a mockup was done of one 50-ft and one 75-ft beam to demonstrate the contractor had the materials, equipment and staff to successfully do the external PT. The tendons outside the 75-ft beam was filled with grout and the tendons outside the 50-ft beam was filled with flexible filler. This paper describes the results obtained from the 2 mockups and the anticipated increase in strength to be obtained from application of the CRCW and external PT.

Notes:

Co-Author's Tony Ledesma WSP
Andrew Zickler Virginia DOT