Abstract:
High Load Multirotational Disk Bearings were developed back in the early 1970’s as a cost effective and superior performing alternative to pot and spherical bearings. While their successful use on highway bridges has been well documented in numerous publications it should be noted that disk bearings also have an excellent performance history on railroad and transit bridges.

This paper will cover the development of the disk bearing and explore some of the differences in loading criteria of rail and transit bridges and how the disk bearing is well suited to these conditions. Several case histories will be examined in an effort to demonstrate how the disk bearing is able to handle the high live loads and rotations typical with rail structures. Uplift requirements are also common on rail bridges and the disk bearing can be easily adapted for these types of loads.

Notes:
This paper is accompanied by an informative Powerpoint Presentation with numerous photos of in service bearing devices on Railroad and Transit Bridges.
Shear keys are used in bridge abutments to provide lateral restraints to bridge superstructures under normal service loads and limit the permanent deformations under moderate earthquake forces. Current shear key construction practices include shear keys connected to the stem wall monolithically (non-isolated shear keys) or with a construction joint (isolated shear keys). Past experimental data have indicated that the isolated and non-isolated shear keys need repair or replacement after an earthquake event. To address the need of reducing the repair costs and efforts after an earthquake, a specimen which had post-tensioned shear keys was designed with an innovative concept to allow rocking. This presentation will include the design and test results of the post-tensioned shear keys. The tests conducted at UC San Diego showed that these shear keys have good potential for use in practice; their design has a number of beneficial features as compared to the isolated and non-isolated shear keys. First, the on-site construction effort can be reduced since the shear keys can be precast and then transferred to the construction site. Second, the unbonded, post-tensioned, bars allow the shear keys to displace and rotate without damage to the shear keys and the stem wall, and the bars, if not yielded, can restore the shear keys to their original positions. The shear keys can also be designed in such a way that they provide strength and deformation capabilities compatible to the bridge columns.
Abstract:
Chicago Midway International Airport has experienced record-setting levels for passenger activity. With this rapid growth in passengers and the need for additional passenger security checkpoint capacity, the City of Chicago Department of Aviation (“CDA”) has embarked on a new capital project – the Passenger Security Checkpoint and Bridge Expansion project. This project will provide for additional screening lanes, improved passenger queueing layout and new retail concession space. By relieving congestion and improving traffic flow, the time it takes for passengers to travel from curb to gate will be significantly reduced and their experience will be enhanced.

The existing enclosed pedestrian bridge spans between the entry landside terminal and the airside gate terminal, crossing over Cicero Avenue, a state highway. It is 55-feet wide and accommodates the main passenger queue lines, employee queue lines, and dedicated passenger exit path. In order to improve pedestrian flow and access to boarding gates, the CDA proposed significantly expanding the bridge both to the north and south to an overall width of nearly 400 feet.

The design and construction of the newly widened pedestrian bridge required addressing challenges such as limited roadway closures, constraints in overhead clearance for erection of the new structure, and construction staging.

Jacobs Engineering Group has been retained to perform the final design of the pedestrian bridge scheduled to begin construction in 2017. This large expansion project will enhance passengers’ travel experience at Midway Airport by providing significant additional space for security and retail.

Notes:
Eleven (11) existing horizontally curved steel girder bridges were analyzed for load ratings using 3-D refined analyses. The bridges contain complicated geometries, compound horizontal curves, variable roadway widths, and combined straight and curved girders in the same span. This paper will discuss the modelling issues and the complexities encountered when performing a refined analyses of those bridges. Some of the issues related to bridge load ratings, including moment-shear interaction, hybrid girders, non-composite construction, effects of steel box cross girders, and single angle section cross frame members will be discussed. A parametric study was also conducted on the effect of cross frames on bridge load ratings using two bridges that contain single angle sections as cross frame members. The members that were determined to have insufficient capacity were removed sequentially and the models were revised and reanalyzed to determine the performance of the bridges. Cross frame members in steel curved girder bridges are defined as primary components. Progressive analysis shows that the effects of those members on the performance of the bridge highly depend on skew angle of the bridges. Bearings at the obtuse corners of a highly skewed bridge also experienced uplift. Additional analyses needed to address the uplift will also be discussed. Transverse moments typically develop in curved girder bridges in addition to vertical bending moments. At highly skewed supports, lateral bending moments could have significant effects on flexural ratings of the girder.
Abstract:
This presentation would chronicle the bridge replacement design and construction on a New York State Design Build Procurement. The subject site at the bridge is known as the Zoar Valley and is located about 60 miles south of Buffalo, NY. The valley is close to 200 ft. deep and near the bridge, the valley walls are near vertical rock outcrops. The Cattaraugus Creek is designated as a Wild and Scenic River.

The new bridge is a three span continuous steel multi-girder type. The selected spans are 210 ft., 250 ft., and 160 ft. The center span was set to provide adequate floodway for Cattaraugus Creek. The two piers rise from footing foundation 163 ft. and are thought to be the tallest piers in New York State. A downstream dam is to be removed in the future, so pier pile foundations had to be designed without confining stream bed soil. The bridge was evaluated for seismic and wind cases without the confining stream bed soil. A discussion of the foundation alternatives studied will also be included.

The presentation will discuss the design build procedure, load cases governing the design, structural analyses employed, weathering steel for framing, metalizing of fascia girders, and use of mass concrete for substructure concrete. It will also highlight structural analyses of the existing deck truss, with concrete deck removed, in order to make safe for placement of implosion charges. A slide show of construction photographs will be included.

Notes: A video of the implosion of the old bridge will be included.
Corrosion of steel reinforcing bar (rebar) is the most significant cause of concrete bridge failure, resulting in expensive repairs and premature replacements across the country. This presentation will discuss a new, low-cost zinc coating process for reinforcing steel – and how it can contribute to faster bridge construction. The properties of this new coated rebar and its contribution to improvement of concrete performance of bridges will be presented together with the status of related national and international standards.

The Continuous Galvanized Rebar (CGR) coating process is similar to galvanizing of sheet steel. As an in-line process, the bar is fluxed, induction heated and coated with a uniform zinc layer in a matter of seconds. With reduced production time, CGR requires shorter lead times than current corrosion resistant bars. This speed also contributes to lowering the cost of continuously coated rebar. The zinc coating applied is durable and resistant to abrasion that is routine during transport and construction. Additionally, the coating is also highly ductile and can be bent without cracking to diameters of less than 4x the rebar diameter. This property ensures the bars can be pre-fabrication, reducing cost and accelerating construction schedules. When used in pre-cast panels, CGR enables precasters to ensure all bars are accurately bent to the required dimensions, and leaves flexibility to alter design if required by the design team.

Once in the concrete, the zinc coating protects the rebar both as a barrier coating and with the well-known sacrificial properties of a galvanized coating.

An update on recent relevant corrosion studies involving zinc coated reinforcement will be incorporated also with an announcement of a US facility producing continuous galvanized rebar.

**Title:** Optimizing Performance of Zinc Coated Reinforcing Steel in Concrete Structures

**Primary Topic:** Innovative Materials Applications

**Secondary Topic:** Design/Build

**Notes:**

An update on recent relevant corrosion studies involving zinc coated reinforcement will be incorporated also with an announcement of a US facility producing continuous galvanized rebar.

**Co-Author's**

Mike Stroia AZZ Metal Coatings
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This presentation provides an understanding of the process of developing and implementing a near real time monitoring program for a major bridge that crosses over about 3 miles of water, and summarizes the key technologies involved. The presentation also provides lessons learned that are transferable to other bridge projects.

Abstract:

Two multi-span, 3.1-mile long bridges are currently under construction to replace the existing 60-year old Tappan Zee Bridge that crosses the Hudson River in New York. The geology at the site generally consists of thick deposits of soft, organic soils overlain by glacial lake varved clays that are up to 700 feet thick.

High capacity deep foundations consisting of driven end bearing and friction pipe piles are being used to support the new bridge.

An extensive monitoring system was developed to evaluate the impacts of large diameter pile installation on the existing bridge structure. In some cases, new piles were driven within 20 feet of the existing bridge foundations.

The design of the monitoring system considered the complex ground conditions along the length of the bridge, the variable foundation types supporting the existing bridge, and the 3.1 miles of water between shorelines. Existing bridge foundations consisted of partially floating caissons supporting the main span and a combination of steel and timber friction-bearing piles and end-bearing piles for the approach piers. A passenger railroad along the eastern shoreline beneath the bridge and several nearby commercial and residential structures were also monitored during pile installation.

The monitoring system required a number of technologies, including networked automated total stations, GPS base stations, tilt sensors, vibration sensors, and optical cameras. Dedicated cellular modems and processing servers were configured so that monitoring data was available to the design build team and the owner on a near real-time basis.
**Abstract**: A list of construction costs for approximately two dozen major bridges has been developed to provide a benchmark for owners and engineers to draw upon regarding future budgeting considerations. The data features bridges that vary by bid year, material of construction, structure type, geographic region, and project delivery method. The data was compiled using publically-available sources as well as personal experience when applicable. Some trends can be seen in the data that will be of interest to the audience.

**Title**: Major Bridge Construction Cost Trends

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**Technical Merit of Presentation**

1. To provide a benchmark for the industry regarding major bridge construction costs.
2. To probe cost trends across time, geography, bridge type/method of construction, and project delivery method.
3. To develop a generalized function for extrapolating major bridge construction costs (if possible).

**Opening Date?**

**Notes**: I am curious as to whether or not the selection committee considers this subject taboo. IMHO the industry does not have a good track record of predicting major bridge construction costs. The difficulty of compiling this information is one of the primary challenges.
Abstract:
The MD 195 (Carroll Avenue) Bridge over Sligo Creek and Sligo Creek Parkway is an 83 year-old, 3-span, cast-in place reinforced concrete open spandrel arch bridge that is being rehabilitated and is eligible for inclusion in the National Register of Historic Places. The bridge was demolished down to the arch and the new bridge is being built on top of the existing arch. To reduce the construction schedule, the owner's demolition plan was optimized by analyzing the existing arch for the forces induced by the new demolition sequence. In addition, design and installation of a demolition shield was required to protect Sligo Creek from demolition debris.
Abstract:
Four bridges, all spanning major rivers in the Midwest, are the core of this study. The bridges have different spans, widths, arch rise, hanger number and spacing as well as wind bracing arrangements. The spans for these bridges range from 535 feet to just over 900 feet. Static and Dynamic characteristics are reported for each bridge providing bridge engineers with insight to early design information and for dynamic performance to aid in potential structural health monitoring of these bridge types.

Title: Static and Dynamic Characterization of Tied Arch Bridges

Technical Merit of Presentation
The presentation will contain data that will be of use to bridge engineers planning for tied arch bridges, member sizes and weights thus leading to improved cost estimates. Further dynamic features are provided which can be helpful to structural health monitoring efforts.

Abstract:
Four bridges, all spanning major rivers in the Midwest, are the core of this study. The bridges have different spans, widths, arch rise, hanger number and spacing as well as wind bracing arrangements. The spans for these bridges range from 535 feet to just over 900 feet. Static and Dynamic characteristics are reported for each bridge providing bridge engineers with insight to early design information and for dynamic performance to aid in potential structural health monitoring of these bridge types.
Abstract: The major feature of VDOT’s $100M+ Route 29 Solutions project is upgrading the highly-skewed at-grade intersection of two major corridors. The preliminary design called for 103 days of full road closure for the construction of a 400-foot long tunnel and several thousand feet of retaining wall to allow through traffic on Route 29 to flow unimpeded.

Engineers created a system to reclassify the project as a bridge instead of a tunnel and cut the amount of retaining wall in half. A structural system that had never before been constructed in Virginia was developed to allow traffic to continue operating throughout construction and keep the project within limited right of way. Features of the design include prestressed concrete beams that also act as a strut supporting the retaining wall system, a single row of steel piles that double as abutment piles and a soldier wall, and pressure grouted tiebacks outside the bridge limits. Serviceability elements also were designed to ensure long term bridge performance such as a custom deck extension to prevent water penetration and communication conduits placed in the void of prestressed box beams.

Taking advantage of the flexibility allowed by the design-build delivery method, outside-the-box thinking allowed this project to be completed in 50 days, half the time period required. Team collaboration in pre-award discussions generated extensive use of advanced technical concepts that allowed construction to be expedited. The delivery of the fully coordinated design by the construction team led to the owner’s needs and expectations to be exceeded.

Notes: This project is one of the the highest profile projects in Virginia.
Pile freeze, also known as pile setup, is a phenomenon typically encountered when driving piles in saturated fine-grained soils. The geotechnical pile capacity during initial driving can be significantly lower than the design estimate. The geotechnical pile capacity rebounds with time as recorded during pile redrive (re-strike). American Geotechnical and Environmental Services (A.G.E.S.), Inc. has developed a company database of cases in Pennsylvania at which pile freeze occurred during construction. The results of this investigation were initially outlined in an article to be published in the Deep Foundations Institute (DFI) Magazine, January 2017 Issue. This IBC article expands the work previously presented to account for the effects on bridge foundations. By anticipating how geotechnical pile resistance will vary during pile driving operations, Geotechnical/Bridge Engineers could better account for situations in which pile freeze is encountered. Communication between the contractor, owner, and designer is critical in order to ensure pile driving to unexpected depths does not occur as a result of pile setup, resulting in increased unnecessary costs to the owner.

Title: Predicting Pile Freeze on Driven Friction Piles in Pennsylvania

PrimaryTopic: Foundations
SecondaryTopic: Design
Title: Bridge Systems on the New NY Bridge

Abstract:

On the new modern super crossings like the New NY Bridge to replace the Tappan Zee, the bridge systems become the heart beat and lifeline of the bridge. Without bridge systems there would be no power or communication for roadway lighting, ITS traffic signage, or cameras. In this presentation we will focus on the various systems which are part of the New NY Bridge project. These systems include:

- 15kV medium voltage electrical
- LED lighting (roadway, aesthetic and navigation)
- Intelligent traffic signs
- Main span tower elevators
- Lightning protection system
- Fiber optic backbone
- Security systems
- Fire standpipe and compressed air pipe
- Structural health monitoring
- All-electronic toll collection (AETC)
The Laconia Main Street Bridge over the Winnipesaukee River has served as the predominant access for the downtown area since its original construction in the 1920’s. To accommodate increasing traffic volumes and urban development in the 1960’s, the river crossing was widened by adding independent curved bridges onto each side of the original bridge butted with open joints. The width of the bridge parabolically varies along its length from 120-feet at the South Abutment to 400-feet at the North Abutment. The modern day traffic pattern consists of three one-way roads and an intersection being supported by the bridge. After decades of heavy winter-time salt-usage and differential movement, the bridge required rehabilitation due to heavy corrosion of primary superstructure (deck, stringers, and bearings) components.

The rehabilitation design included replacement of 8 of the 62 steel girders and merging the three structures into a single structure with a unified concrete deck and steel framing. Bearings were designed to accommodate differential unified movement in two directions. A deck-over-backwall design was incorporated to avoid open joints. Standard expansion joints were insufficient for multi-directional movement and a modified asphaltic plug joint design was utilized.

With no reasonable detour available, phased construction was developed to maintain vehicular and pedestrian traffic at all times. An aggressive construction schedule was instituted meeting contract requirements to accommodate cultural and tourist events throughout the year. RFI’s and change orders required quick turn around and immediate response from the Engineer. Rehabilitation construction lasted 1.5-years with a total cost of $3.4-million dollars.

This presentation highlights the history, design/analysis, and construction engineering for a unique flared girder bridge. Attendees will be presented with cost-effective and non-traditional design techniques, modified design standards, multidirectional expansion joints and bearings, complex phased construction techniques, timely field decisions and modifications, and lessons learned.

The Laconia Main Street Bridge over the Winnipesaukee River has served as the predominant access for the downtown area since its original construction in the 1920’s. To accommodate increasing traffic volumes and urban development in the 1960’s, the river crossing was widened by adding independent curved bridges onto each side of the original bridge butted with open joints. The width of the bridge parabolically varies along its length from 120-feet at the South Abutment to 400-feet at the North Abutment. The modern day traffic pattern consists of three one-way roads and an intersection being supported by the bridge. After decades of heavy winter-time salt-usage and differential movement, the bridge required rehabilitation due to heavy corrosion of primary superstructure (deck, stringers, and bearings) components.

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Abstract:
The historic Gasparilla Island Swing Bridge is the only access to and from the barrier islands. The replacement of this bridge presented challenging site and budgetary constraints. This paper progresses through the bridge structural, span supporting and span operating systems and how they met the site challenges and constraints.

Title: Gasparilla Island Swing Bridge Replacement

PrimaryTopic: Movable Bridges
SecondaryTopic: Design

Project Information
Name: Gasparilla Island Swing Bridge
Location: Placida, FL

Technical Merit of Presentation
Opening Date: 8/1/2016

They will learn about innovative construction staging and design techniques for the first new swing bridge replacement in FL since 1958, including site and construction challenges.

Abstract:
The historic Gasparilla Island Swing Bridge is the only access to and from the barrier islands. The replacement of this bridge presented challenging site and budgetary constraints. This paper progresses through the bridge structural, span supporting and span operating systems and how they met the site challenges and constraints.
The High Bridge is the oldest standing bridge in New York City, dating to 1848. The bridge is an elevated aqueduct crossing the Harlem River between Washington Heights (Manhattan) and High Bridge (Bronx), and actively served as NYC’s original primary water supply conduit. From the combined effects of discontinuation of use, neglect and vandalism, the bridge was closed to the public in the late 1970's.

In 2012, the New York City Department of Design and Construction (NYCDDC), in conjunction with the New York City Department of Parks and Recreation (NYCDPR), embarked on an ambitious project to reopen the High Bridge as a walking park and vibrant tourist destination. From 2012-2015 the High Bridge underwent comprehensive rehabilitation efforts to transform the 1,400lf steel and masonry multi-arch structure from obsolete eyesore to beneficial use pedestrian promenade, providing safe easy access and an unobstructed NYC observation vista for all who visit. In the process, the original water distribution pipe was preserved as a living classroom. The $49 million project was completed in June 2015.

This paper will provide an overview of the major High Bridge rehabilitation project work tasks and associated successes/failures, including: de-leading of the steel arch; cleaning and repointing of the masonry arches and coping/fascia repairs; removal and replacement of the existing walkway and underlayment; construction of ADA accessible entrance ramps; installation of tie-bar reinforcement in the masonry attic; partial reconstruction of the gate houses; installation of new period railing, safety fence, public bench seating and lighting elements; and aesthetic improvements.
Abstract:
This is a case study of the I-10 bridges over the Pascagoula River in Jackson County, Mississippi. The two-girder system has a unique framing plan where upper and lower lateral braces are used to provide a load path for wind on 16-foot deep box girders. The upper lateral bracing pattern is not uniform across the structure and some bays see force couples develop as live load moves across the bridge. As live load moves across the bridge, the upper lateral braces cycle between tension and compression, causing the bracing and connection plates to produce out-of-plane bending moments on the floorbeam.

Starting in 2013, cracks have been observed in the floorbeam webs at the tip of the upper lateral bracing tab plate and in the weld between the floorbeam web and the upper lateral bracing tab plate. The layout of the unique upper lateral bracing installed for wind load has created live load fatigue cracks in the main structural members. Placement of these braces was intended to carry wind load but the unique framing system combined with the mis-fabricated detail has created fatigue cracks for loads that were not considered in design.

Notes:
Micah Drew, PE Mississippi Department of Transportation 401 North West Street Jackson Mississippi 39201 601-359-7200 mdew@mdot.ms.gov
Corrosion of steel reinforcing bar (rebar) is the most significant cause of concrete failure, resulting in expensive repairs and premature replacement of structures around the globe. A new, innovative, low-cost zinc coating process for rebar is being used to improve performance and life of concrete structures and its use is highlighted in the Nan Gang (South Port) Bridge of Xiang’an Airport.

The Continuous Galvanized Rebar (CGR) coating process is similar to galvanizing of sheet steel. The zinc coating is tough and resistant to abrasion that is routine during transport and construction, and is also highly ductile and can be bent without cracking to diameters of less than 4x the rebar diameter. This property ensures the bars can be coated pre-fabrication, reducing cost and speeding construction schedules. Once in the concrete, the zinc protects the rebar both as a barrier coating and as a sacrificial anode.

Xiamen New Steel has been supplying CGR in China for a number of construction projects including the Shenzhen #11 subway line and the Beijing G7 highway. The most recent project is the Nan Gang (South Port) Bridge of Xiang’an Airport designed by Jiangsu Province Communications Planning and Design Institute. The 912m long bridge connects the Xiang’an Xian Dian District to the Xiang’an Airport, with the eight lane wide main bridge deck spanning 170m over the sea.
Corrosion of reinforced concrete structures is a major issue of durability. This investigation addresses the issue of corrosion in reinforced self-consolidating concrete members. An experimental program has been conducted to investigate the corrosion problem and determine the most effective method to repair deteriorated members. A control reinforced concrete member without the corrosion problem was prepared. Different levels of corrosion in the reinforcing rebars of up to 50% were considered in the current study. Reinforced concrete beams having up to 50% corrosion level were constructed. The beams with the corrosion problem were repaired using carbon fiber reinforced polymer (CFRP) sheets. All of the beams constructed in this study were tested under two concentrated loads until failure. The effectiveness of repairing technique was assessed by comparing between the control beam and the repaired beams in terms of load carrying capacity, deflection, and ductility. A mathematical model has been developed to predict the performance of corroded reinforced concrete members. The model is based on common mathematical models for concrete, CFRP, and steel rebar in the stress-strain relation by taking into account of rebar corrosion. The model has been validated by comparing the results of the model with the available experimental results. The model can be used to predict the performance of reinforced concrete members with a wide range of corrosion levels.
Title: WB-207 & WB-208 Railroad Bridge Replacements over I-76

This presentation will discuss the design, fabrication, and construction challenges encountered due to the railroad’s track geometry, design requirements and construction requirements.

Abstract:

This presentation will discuss the design, fabrication, and construction the 2-Span Thru-Girder WB-207 and WB-208 Railroad Bridges over I-76. The PTC will also provide a preview of the remainder of the BRB Project, including the dual 1,645’ Cast-in-Place Segmental bridges over the Beaver River. The railroad required the use of all bolted connections and a ballasted deck plates for the replacement bridges. The proposed I-76 widening and NS requirements resulted in the WB-207 bridge having 156’ and 90’ spans, 11’ web depth, and lies on 51 and 33 degree AASHTO skews and the WB-208 bridge having 99 and 76 spans, an 8.25’ web depth and lies on 5 and 11 degree AASHTO skews. To accommodate the curved track alignments, the girder spacing ranged between 26’ and 35’. The Thru-Girder superstructures had many critical details due to the geometry. The long spans and sharp skews presented several challenges for the connections between the floor beams and girders. Great care was taken in the geometric layout of the floorbeams, knee braces, angle stiffeners, flange to girder connection angles, and field splices to avoid member interference and to provide bolt clearances. The longitudinal grades are opposite between the two structures, reversing the bearing fixity. This was critical at Abutment 2 which supports the north end of Span 2 of both structures. The steel erection was also difficult due to the girder lengths, pick weights, and skews. Additionally, the railroad required the 150% pick capacity although none of the picks were over the tracks.

Notes:
The Pennsylvania Turnpike Commission (PTC) is conducting the Beaver River Bridge (BRB) Replacement Project in Beaver County, PA. The project consists of the relocation, widening, and full depth reconstruction of approximately two miles of I-76 from MP 12.

Co-Author’s: Brad Updegrave Pennsylvania Turnpike Commission 700 South Eisenhower Boulevard Middletown PA 17057 717-831-7365 bupdegra@paturnpike.com
Abstract:
The traditional role of the Consultant for the design and construction of long span structures has evolved significantly in recent years. This has arisen from the increased complexity of the projects, the need to specifically ensure independent checks, the requirement that both the design and construction are evaluated by independent experts, and the call for experts to supplement the client's staff to supervise "one-off" projects. These roles include those of the General Engineering Consultant for a specific overall project; the Independent Checker of the original design, both in the design/bid/build scenario, as well as the design/build; the independent Quality Assurance for both the design and construction of design/build projects; and the Owners Representative, also for design/build projects. This presentation outlines the history of the emergence of these roles, descriptions of the functions to be fulfilled in each of these activities, and how they fit into the contracting environment. The various roles are illustrated with examples of projects for each of the activities described.

Title: Additional Roles for the Consultant in Recent Developments of Long Span Bridge Design and Construction

Primary Topic: Long Span Bridges
Secondary Topic: Bridge Program Management

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Abstract #: 17-45
Date Received: 9/28/2016
Score: _______

Project Information
Name: Martin Kendall
Location: 22 Cortlandt Street
New York NY 10007

Technical Merit of Presentation
Opening Date?
This presentation will provide an in-depth insight into the additional functions that are required in modern day long span bridge design and construction, over and above the traditional functions of detail design and construction supervision.

Notes:
Co-Author's
Andrew Yeoward CH2M 9191 South Jamaica Street Englewood,
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Abstract:
North Carolina’s Research Triangle is lucky to have an amazing network of pedestrian trails that connect cities and rural areas, offering endless opportunities for city dwellers to get outdoors and enjoy what the Triangle has to offer. Constructing these networks of trails while protecting the natural beauty they intend to showcase can be a challenge, especially for bridge construction. This presentation will demonstrate how Alpha & Omega Group is planning to achieve such a task for the Town of Chapel Hill, North Carolina.

Pedestrian bridges are often small unique structures, located well off the beaten path, and do not follow the usual convention for modern bridge design. As such, they rarely get the same attention as highway bridges, are often overlooked when it comes to advanced contracting and construction techniques, such as Accelerated Bridge Construction. This presentation will display how A&O has applied the years of experience Patrick has acquired with ABC to showcase many of the advantages it can bring. It will also show how A&O explored construction methods, manufacturing, prefabrication, and the design they produced to unify these elements.

When prefabrication is applied to pedestrian bridges, it often manifests itself as massive steel structures with a very homogeneous character, where one pedestrian bridge looks like every other. By coming up with creative designs that offer the same benefits without having to turn to proprietary producers, the character of the engineer can still be shown when they dare to take the challenge of exploring ABC.

Notes:
Patrick comes to Alpha and Omega from the Washington State DOT, where he served as a specialist in Accelerated Bridge Construction. He has spoken numerous times at National Conventions, including twice at the Accelerated Bridge Construction Conference.
Abstract:

Prefabricated crossbeams were a key feature in the construction of one of Washington State’s Megaprojects, the Interstate 5 and Highway 16 interchange reconstruction in Tacoma, Washington. WSDOT built upon past experience, university research, and past implementations of precast substructure components and required the contractor to prefabricate portions of the new structures. They then offered many of the precast crossbeams and columns as an option for a contractor to choose.

While this construction method has been utilized on other projects, it’s never been used on structures of this scale in Washington State. One of the structures with prefabricated bridge elements is a 974’ long, six span precast concrete girder bridge with spans up to 180’ on single column piers and supporting a 27’ wide roadway 80’ in the air. Being in Western Washington, this project is located in a high seismic zone, testing the capacity of the precast construction technology.

This project demonstrated that prefabricated substructure elements have a viable role in bridge construction, and that there is a market for them. With each new large scale precast bridge project, there are fewer and fewer concerns to work out. New lessons, improvements, and innovations were learned on this project for the crossbeams, columns, and the marketability of each.

Unlike the first project phase rebuilding the interchange, the second phase was built after precast substructures became a viable option in Washington State. These projects offer an excellent side by side comparison, both for construction and long term durability.

Notes:

Patrick comes to Alpha and Omega from the Washington State DOT, where he served as a specialist in Accelerated Bridge Construction. He has spoken numerous times at National Conventions, including twice at the Accelerated Bridge Construction Conference.
ROUTE 28 OVER MUDDY CREEK BRIDGE REPLACEMENT

Yihui Peter Wu, P.E, PhD., Alessandra B. Keller. EIT

Tidal flow has been restricted between Muddy Creek and Pleasant Bay for over 40 years, a 94 feet one span bridge was proposed to replace the existing two 2x2 feet culverts to restore 55 acres of fisheries habitat and wetland, improve water quality, enhance the area’s coastal storm resiliency, and open up access between Muddy Creek and Pleasant for vessels without motors.

The proposed bridge is a 94 feet single span steel girder with concrete deck supported by integral abutments carrying Route 28 over the Muddy Creek Harwich/Chatham, MA. To accelerate the construction to meet the Cape Cod regional construction restriction on State Route, PBU (prefabricated bridge superstructure), precast concrete abutments and wing wall panels on H piles were used for construction. Project design detail and criteria, coordination and construction are presented in the paper.

**Notes:**
- Project founded by multi federal agencies and towns of Harwich and Chatham, as part of the Muddy Creek Restoration projects.
- Project in area of critical Environmental concern (ACEC).
- Bridge at coastal line with large scour potential.
- Route 28 is a ma

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### Project Information

- **Name:** Muddy Creek Restoration Bridge Project
- **Location:** Harwich/Chatham
- **Opening Date:** 5/22/2016

### Abstract

**ROUTE 28 OVER MUDDY CREEK BRIDGE REPLACEMENT**

Yihui Peter Wu, P.E, PhD., Alessandra B. Keller. EIT

Abstract:

Tidal flow has been restricted between Muddy Creek and Pleasant Bay for over 40 years, a 94 feet one span bridge was proposed to replace the existing two 2x2 feet culverts to restore 55 acres of fisheries habitat and wetland, improve water quality, enhance the area’s coastal storm resiliency, and open up access between Muddy Creek and Pleasant for vessels without motors.

The proposed bridge is a 94 feet single span steel girder with concrete deck supported by integral abutments carrying Route 28 over the Muddy Creek Harwich/Chatham, MA. To accelerate the construction to meet the Cape Cod regional construction restriction on State Route, PBU (prefabricated bridge superstructure), precast concrete abutments and wing wall panels on H piles were used for construction. Project design detail and criteria, coordination and construction are presented in the paper.
Abstract:

Cost-effective optimized robust scour preventing three-dimensional convex-concave hydrodynamic fairings with attached vortex generators have been designed, developed, extensively tested, and are now available for practical use. These were tested for bridge piers and abutments during a National Cooperative Highway Research Program (NCHRP-IDEA) project. Their particular shape prevents creation of scouring vortices that cause the local scour problem for any river level, speed, and angles of attack up to 45 degrees, unlike other fairing shapes that do not prevent scour. This device exceeds requirements for HEC-23. Cost-effective versions are of stainless-steel or conventionally cast concrete that are attached to an existing or cast as part of the base of a new hydraulic structure above the footing, respectively. The vortex generators energize the decelerating near-wall flow with higher-momentum flow, resulting in a more steady, compact downstream separation and wake and substantially mitigated scour inducing vortical flow. Experimental test results confirm that scouring-vortex-preventing fairings prevent foundation local scour for smaller sediments, wing-wall and spill-through abutments, and full-scale piers, as well as preventing the effects of open-bed scour on foundations.

Other advantages of this robust device over other current approaches are: (1) much lower costs for scour prevention and bridge maintenance; (2) much lower probability of bridge failure; (3) lower river levels due to lower drag and lower flow blockage around the pier or abutment; (4) much lower possibility for debris and ice buildup; and (5) greater protection of piers and abutments against impact loads.

Notes:

General overview and specific application