Pittsburgh ENGINEER

Quarterly Publication of the Engineers' Society of Western Pennsylvania

SPECIAL IBC EDITION

SUMMER 2010

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IN THIS ISSUE...

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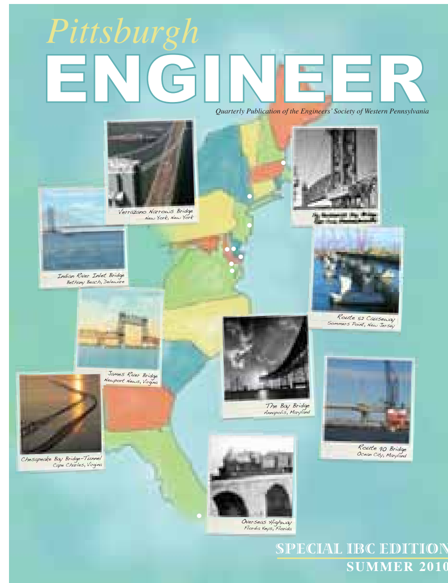
BRIDGES OF THE EAST COAST:

Our Ever Changing Landscape



By: Tom Leech and George Horas

In 1620, the Pilgrims landed at Plymouth Rock. What was the landscape? What were the landmarks that a Pilgrim from across the Atlantic saw along the eastern coastline other than a sandy shore and a lonely glacial erratic.

The year is 1820 – two hundred years later. What were the landmarks of our eastern coastline that a seafarer from across the Atlantic would encounter? For sure, many rudimentary but sentinel light houses, the guardians of the Atlantic were encountered. And perhaps a fledgling settlement at the mouth of the Hudson - if the seafarer entered New York Harbor.

The year is 1920 – three hundred years later. What were the landmarks of our eastern coastline that a seafarer from across the Atlantic was greeted with? For sure, the Statue of Liberty and perhaps the Brooklyn Bridge as many of our ancestors entered New York Harbor.

The year is 2010 – almost four hundred years later. What are the landmarks of our eastern coastline that a seafarer (or air traveler) from across the Atlantic will see along our eastern coastline. Perhaps the magnificent bridges of our eastern coast, such as the Leonard P. Zikam Bunker Hill Bridge – if the traveler enters Boston harbor. Perhaps the Verrazano Narrows Bridge - if a traveler enters New York Harbor. Perhaps the Chesapeake Bay Bridge Tunnel - if the traveler enters the Chesapeake Bay. Or perhaps, the William Powell Bridge if the traveler enters Miami harbor.

This special edition of the *Pittsburgh ENGINEER* Magazine is dedicated to the bridges of our coastal waterways along the eastern seaboard. It is only fitting, that as the International Bridge Conference for 2010 celebrates Maryland as our Featured State, the *Pittsburgh ENGINEER* Magazine celebrates many of the magnificent bridges that we find positioned in a coastal setting, like the bridges of the state of Maryland. Travel with us from Cape Cod, Massachusetts to the tip of the Florida Keys. Explore some coastal bridges in their historical setting, view with wonder our newest additions and envision some dreams in our near future. Along the way, take our quiz.

Thomas G. Leech, P.E., S.E.
Gannett Fleming, Inc.
National Practice Bridge Manager
Guest Editor

George M. Horas, P.E.
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Assistant Guest Editor

CHAIRMAN'S

"Welcome to the IBC"

It is a great honor and privilege to serve as the Chairman of the 27th International Bridge Conference®. The men and women of the Engineers' Society of Western Pennsylvania and the Executive Committee of the IBC have been working tirelessly since the conclusion of the 2009 conference to bring you the finest technical bridge conference in the world. It is truly amazing to me to see the dedication of these people to the practice of bridge engineering, construction, research and education.

For those of you who have never attended the IBC in Pittsburgh, *what are you waiting for?* For those who have attended in the past, know that the program this year will be equally jam-packed with outstanding technical sessions, workshops and seminars and we trust that you will be back.

Highlights of the 27th Annual International Bridge Conference® include:

A Keynote Session with internationally renowned speakers:

- Peter R. Taylor, Ph.D., P. Eng., P.E., Principal, Buckland and Taylor, LTD
- Jim J. Moynihan, AIA, President and C.E.O., Balfour Beatty Infrastructure, Inc.
- Neil J. Pedersen, P.E., Administrator, Maryland State Highway Administration
- Dr. T. Peter Ruane, President and CEO, American Road & Transportation Builders Association
- M. Myint Lwin, P.E., S.E., Director, Office of Bridge Technology (HIBT), Federal Highway Administration
- Malcolm T. Kerley, P.E., Chief Engineer, Virginia Department of Transportation, AASHTO

2010 Featured Agency: Maryland State Highway Administration & Maryland Transportation Authority

This year we welcome the Maryland State Highway Administration & Maryland Transportation Authority as our featured agency. Bob Healy and his staff have planned an exciting and expanded exhibit area and have lined up numerous technical presentations featuring major projects and programs across the state. Presentation topics will include Recent Bridge Mega-Projects, Ongoing Bridge Research, Accelerated Bridge Construction, and Opportunities for Success – Dealing with Recent Bridge "Emergencies".

Jeffrey J. Campbell, P.E.

Integrated Exhibitor's Hall

In 2010, the Exhibitor's Hall will be bigger and better than ever. In order to increase networking opportunities for all attendees, the Technical Sessions will be located in rooms within the exhibit hall itself. This will allow plenty of time for exhibitors and conference attendees to interact between sessions, coffee breaks and lunchtimes. We are anticipating an even larger hall of exhibitors of more than 200 and look forward to breaking our attendance record of more than 1,600 attendees!

Technical Program

The heart and soul of the IBC has been the rich and diverse technical program and this year is no different. More than 75 technical papers were selected from nearly 200 abstracts to create a program for those interested in design, signature spans, maintenance, rehabilitation, inspection, management and accelerated bridge construction.

An outstanding collection of technical papers, poster presentations, workshops and seminars are featured again for young and veteran engineers alike. Our construction workshops will feature the popular "Owners Forum" at which bridge owners from all over the country discuss their upcoming bridge construction programs and challenges.

We are excited to offer seminars on topics ranging from Load Rating of Gusset Plates to Dynamic Testing and Analysis of Bridge Foundations; a full listing can be found on the IBC web site.

A full schedule can be found on our website at **internationalbridgeconference.org**

As you can see, this year's IBC promises to be bigger and better than ever. So come to Pittsburgh, the City of bridges, renew old friendships, begin new ones and enjoy one of the best technical conferences on the planet.

We look forward to seeing you in Pittsburgh this June!

Jeffrey J. Campbell

Jeffrey Campbell is the General Chair of the 2010 International Bridge Conference®. Mr. Campbell is the Vice President, Transportation for Michael Baker, Jr., Inc.

BRIDGE QUIZ

True or False

How Well Do You Know the Buzzards Bay Bridge?

The Buzzards Bay Bridge over the Cape Cod Canal has been considered the railroader's "Gateway to Cape Cod". On the morning of December 29, 1935, a passenger train from Boston to Hyannis was the first train to cross this signature bridge. The present Buzzards Bay Bridge, constructed by the Public Works Administration, is the second bridge constructed at the site. Since 1935 its iconic silhouette, with signature towers and elevated truss span, has dominated the horizon of the south shore of Cape Cod as well as the open water of the Atlantic Ocean. At the time of construction, with a 544 foot main span, elevated 136 feet above high tide, the Buzzards Bay Bridge was the largest vertical lift bridge in the Country.

It remains a silhouette icon. Perhaps you have traveled to Cape Cod and seen it in person. But how well do you know the Buzzards Bay Bridge? Take this short 10 question quiz; test your knowledge of American history, biology, railroad engineering, civil engineering and electrical engineering. The answers are in the back of the magazine on page 29 - but – no peeking!

Photo courtesy of HAER

Buzzards Bay Bridge

Q1. The first vertical lift bridges in the US were designed by Squire Whipple; these lift bridges predate the construction of the Buzzards Bay Bridge. T or F

Q2. The buzzards after which Buzzards Bay is named are not really buzzards at all but osprey. – T or F

Q3. In 1623 Miles Standish of the Plymouth Colony and other Pilgrims dug a small canal in the low lying land between the Manomet and the Scusset Rivers , thus connecting the Atlantic Ocean between the north and south shores of the cape, forming the first Cape Cod Canal. – T or F

Q4. The original purpose of the railroad was to ferry passengers to the cape; this still remains the main source of revenue for the railroad. - T or F

Q5. The counterweight in each tower, weighs approximately 1,000 tons. Each counterweight provides a factor of safety against uplift of approximately one and one half times the weight of the superstructure. – T or F

Q6. It only takes four 150 horsepower motors to lift the entire bridge. – T or F

Q7. The bridge's foundations rest on oak piles. - T or F

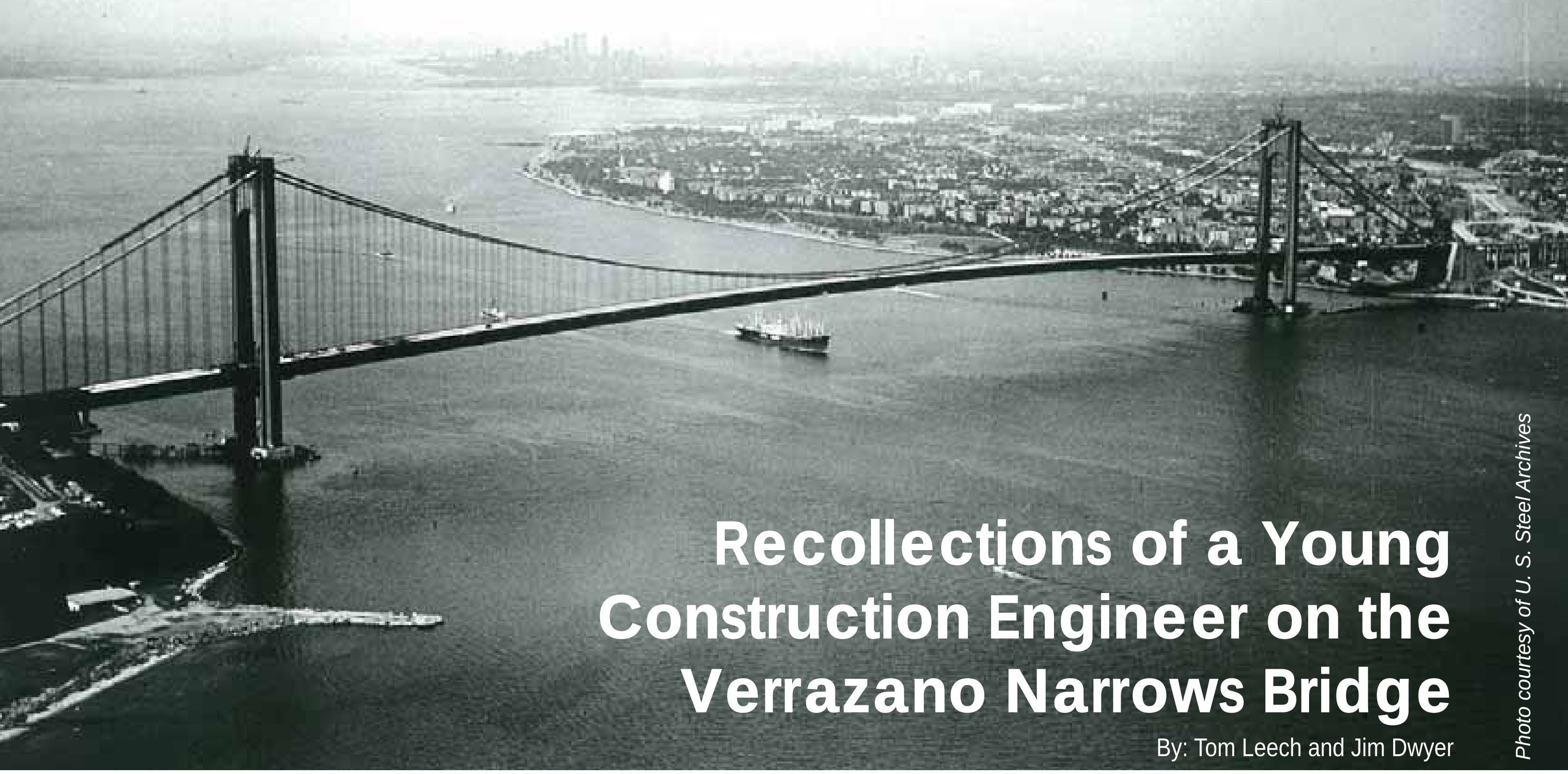
Q8. As the counterweights, to some extent, balance the load of the superstructure, there is in fact very little weight bearing on the foundations. – T or F

Q9. Once the bridge is raised and locked in the fully raised position, bridge control sounds three short blasts, three long blasts and three short blasts of the bridge's horn, to signal marine traffic that the bridge is fully raised. – T or F

Q10. The Buzzards Bay Bridge remains the longest lift span bridge in the United States. – T or F

Photographs are courtesy of HAER, Historical and Archeological Record, Library of Congress.

The year is 1960. A recent graduate of Manhattan College's Civil Engineering program is heading out into the world and his boss says: "Jim, your job for the next year or so is to perform some construction engineering on a somewhat modest construction project – and by the way it's the Verrazano Narrows Bridge."



Recollections of a Young Construction Engineer on the Verrazano Narrows Bridge

By: Tom Leech and Jim Dwyer

Photo courtesy of U. S. Steel Archives

Verrazano Narrows Bridge – Looking North

Jim is Jim Dwyer, one of the five original members of the executive committee of the International Bridge Conference who still serves IBC, and is a long time ESWP member and a former president of ESWP (1993) and former General Chair of IBC (1987). Along with four other IBC Executive Committee members, Jim was recently named Emeritus Member of the IBC and awarded the ESWP Honorary Member designation, recognizing 25 years of service to IBC at the 126th Annual Dinner of ESWP. Here are some of Jim's recollections:

Ed. Where were you living at that time?

At that time, I was living at the north end of Manhattan Island overlooking the Harlem River and the Henry Hudson Bridge. After graduation I worked briefly at American Bridge's Ambridge Plant in Pennsylvania; then within a few months I relocated to Trenton, NJ and then very quickly I arrived in New York City.

Ed. What was your involvement with this monumental engineering project?

My personal involvement with the Verrazano Narrows Bridge project goes back to the early 1960's when I was transferred to the Engineering Department of the division's New York City offices on Broadway in lower Manhattan. The engineering team I was a part of was responsible for the design and development of the procedures and special equipment used to erect the bridge.

Ed. What years did you work there?

I spent 10 years of my career in New York City starting in December of 1956 before ultimately returning to Pittsburgh. The New York office of American Bridge, one of several engineering offices throughout the country, was the office where all engineering related to suspension bridges was assigned.

Ed. What was the state-of-the-art in construction engineering for suspension bridges at that time?

This was the golden era for suspension bridge construction for the New York office of American Bridge. In a period of less than 10 years, work was performed on the on the Delaware Memorial, Walt Whitman in Philadelphia, Ogdensburg and Massina over the St. Lawrence Seaway, the Throgs Neck and Verrazano Narrows in New York City, the 25 de Abril Bridge over the Tagus River and the Angostura Bridge over the Orinoco. I am thankful to have been part of it.

Ed. What technologies were at work at that time?
The most important single structure handled by the New York Office of American Bridge was the Verrazano Bridge. Our contract was to furnish, fabricate and erect the four main cables and suspended steelwork. The cables were composed of 61 strands within a diameter of 36 inches. The cables have a total weight of 38,000 tons and are made up of 145,000 miles of 0.196 inch diameter wire. The engineering team was tasked with the design and development of the procedures and special equipment used to erect the cables and suspended steel. This included design and fabrication of the tramway for spinning the cables and the 20-foot-wide catwalks, cable erection calculations, truss units erection and sequencing, computation of suspender "no load" lengths, guide wire calculations and barge stability calculations used in the delivery of the prefabricated truss units.

Ed. What exactly is cable spinning?
The cable is perhaps the most unique aspect of a suspension bridge. The basic method of cable spinning in 1960 was much the same as it was is 1880. Pairs of spinning wheels shuttle back and forth from both anchorages simultaneously on the same cable, laying down wires parallel to each other in carefully predetermined positions. For the Verrazano Narrow Bridge, we rigged four foot diameter spinning wheels so that each wheel would carry two, not one, loops of wire. It took about 15 minutes for both pairs of wheels to make the trip from one anchorage to another, a distance of 7,200 feet. The cables were laid in a hexagonal pattern of strands that were compacted, banded and wrapped. In a week's time we were able to spin as much as 2,500 tons of cable.

Ed. Can you tell me a few personal highlights?
Jim: At the time of the bridge opening in late 1964, I was overseas. In a phone call my wife told me my 5-year-old daughter told her kindergarten class and teacher that her Daddy had received a medal for building the Verrazano Narrows Bridge, which was the subject of a school newspaper article that week. A medallion was to be given to people who had worked on the bridge by the Triborough Bridge and Tunnel Authority, the owner of the structure. Being met with some doubt, my daughter wanted to take the medal-

lion, which had just arrived, to school to prove she was right. Needless to say, it did *not* happen and to this day I have the medallion, a certificate and a photo of the bridge in a frame.

Ed. Were you involved with any publications on this project at that time?

Not at the time; but... this experience and many others with American Bridge led to a request to prepare and submit a paper on the development of suspension bridge construction techniques for the Journal of Construction Division of the ASCE's 50th Anniversary Issue. It was published in March 1975.

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JOURNAL OF THE CONSTRUCTION DIVISION

FIFTY-YEAR DEVELOPMENT: CONSTRUCTION OF STEEL SUSPENSION BRIDGES

By James D. Dwyer,[1] M. ASCE

INTRODUCTION

A review of the development of the methods used in the construction of suspension bridges over the past 50 yr reveals a progression of changes in the methods used to erect the major elements. The elements affected include the main cables, cable wrapping, towers, and suspended steelwork. These changes will be illustrated by reviewing the erection of several of the major bridges built in the United States during this period. Until recently, the design and construction of long-span suspension bridges has been found primarily in the United States. The majority of these have been built in the period between 1925 and the present. This paper will be limited to a description of parallel wire suspension bridges built in the United States during this period. New design concepts recently used in Europe will be described at the conclusion of the paper.

HISTORICAL DEVELOPMENT

The first suspension bridge in the United States was built in Pennsylvania by James Finley in 1796. He was granted a patent for a cable comprised of a chain of hand-forged links. The bridge had a span of 70 ft and was 13 ft wide. In the years immediately following, many suspension bridges were built using this type of cable.

In 1844, John A. Roebling introduced the use of parallel wire in the main cable and, in 1854, on the Niagara Falls Bridge, he introduced the concept of aerial spinning. During the period between 1844 and 1870, Roebling constructed 10 suspension bridges.

The era of the modern suspension bridge may be considered to have begun with the construction of the Brooklyn Bridge. The design of the bridge commenced

Note.—Discussion open until August 1975. To extend the closing date one month, a written request must be filed with the Editor of Technical Publications, ASCE. This paper is part of the copyrighted Journal of the Construction Division, Proceedings of the American Society of Civil Engineers, Vol. 101, No. CO1, March, 1975. Manuscript was submitted for review for possible publication on November 13, 1974.

[1] Engr., American Bridge Div., United States Steel Corp., Pittsburgh, Pa.

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Ed. What were you most lasting memories; what were your greatest impressions?

I have three very distinct and different memories which have lasted a lifetime. First, believe it or not, the view from a barge with a truss unit in place queuing for erection while the Queen Mary was passing by. She entered the upper bay traveling at a slow rate of speed, in fact almost dead in the water. I still remember her rail crowded with passengers gazing in utter wonder. Second, when chance would have it, and I ascended one of towers, I would take in the view. The view of lower Manhattan from the towers cannot be described. Third, the people I met who were leaders in the profession. These leaders include Milton Brumer, Herb Rothman, Frank Stahl and Jack Kinney, all key members of the (A&W) design team. These leaders also include my mentors on the American Bridge engineering team; these experienced engineers generously shared their knowledge and passion while training the younger staff in the interesting and complex world of construction engineering.

Jim Dwyer, then and now

Photo courtesy of Jim Dwyer

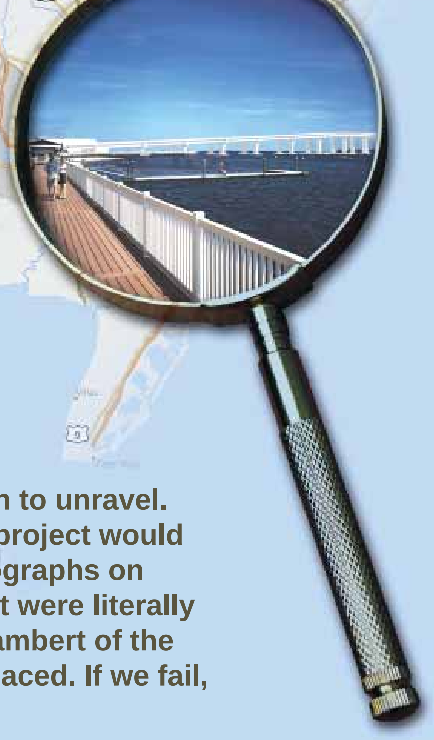
Some Historical Notes

The Verrazano Narrows Bridge is named for Florentine explorer Giovanni da Verrazzano, the first known European navigator to enter New York Harbor and the Hudson River, while crossing the Narrows. Fort Lafayette, constructed during the war of 1812 and renamed in 1825, was a coastal fortification in New York Harbor. The fort was demolished as part of the bridge's construction in 1960; the Brooklyn-side bridge tower now occupies the fort's former foundation. The 13,700-foot-long bridge, designed by Amman & Whitney, marks the gateway to New York Harbor. Its center span of 4,260 feet is the longest of any suspension bridge in the United States. The bridge was the last great public works project in New York City overseen by Robert Moses, the New York State Parks Commissioner.

New Jersey Route 52 Causeway Replacement:

A Customer-Focused Balancing Act

By Mike Sidani, P.E.



The year was 1997. He looked around the room as the discussion began to unravel. Sometimes it seemed that consensus would never be reached and the project would never move forward. To quiet the argument, he placed a series of photographs on the conference table, refocusing attention on the causeway bridges that were literally crumbling into the bay. “Let’s remember why we are here” said Dave Lambert of the New Jersey Department of Transportation. “These bridges must be replaced. If we fail, so will they.”

In 1997, NJDOT was faced with replacement of the deteriorated Route 52 Causeway between Somers Point and Ocean City. Despite the urgency of the project, the nature of the project area made it extremely challenging to develop a conceptual plan that would meet the needs of motorists, satisfy the multitude of permitting agencies, and win the support of the tourist-oriented communities that the bridge connects.

By mid-2009, the first half of the project—replacing the severely deteriorated causeway structures—is completed. Construction is slated to begin soon on the second phase, with overall completion by 2012. In reflection, it was apparent that getting this multifaceted project out of the starting gate and progressing on schedule was a balancing act requiring genuine communication, technical innovation, and common sense problem-solving—all while focusing participants on the urgency of replacing the causeway, originally constructed in 1933.

Cause for Replacement

Somers Point is on mainland New Jersey. Ocean City, a major tourist destination, lies on a peninsula to the southeast. Between the two cities are several small islands and four channels – two of which are navigable, all within Great Egg Harbor Bay. The Route 52 Causeway over the bay consisted of four bridges: two low-level causeway bridges in the middle and a drawbridge at each end.

The 1.1-mile-long causeway bridges were in critical need of replacement. Further, highway and marine traffic had increased dramatically in the 70 years since the bridge was built, and with narrow lanes and no shoulders, backups were common—even when an open drawbridge didn’t halt motorists.

Another safety issue was the potential of storm-driven waves to wash over the low causeways, making them impassable—a major concern since Route 52 is a critical Coastal Evacuation Route.

Conflicting Concerns

The Environmental Impact Statement (EIS) was completed in 2002. Based on the EIS, NJDOT’s intent was to replace the old crossing with a high-level bridge spanning the entire bay. Both Ship Channel and the Intracoastal Waterway would be rerouted by dredging. The Somers Point traffic circle would be replaced with a signalized intersection that could more efficiently handle high traffic volumes coming off the bridge.

Stakeholders agreed that the causeway needed to be replaced as soon as possible, but strong differences of opinion still surrounded the scope of the project, the nature of improvements, and construction methods to be used. Environmental permitting agencies were focused on minimizing impacts, already placing restrictions on construction activity that would severely constrain the schedule and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constructability. The U.S. Army Corps of Engineers and U.S. Coast Guard had concerns about dredging and maintenance of marine traffic. Business owners were worried that construction would cripple vehicle traffic and the tourism on which they relied. Residents were dissatisfied with the nature of the improvements where the bridge touched down in Somers Point and Ocean City. Anglers pushed for angler access along the entire length of the bridge.

The most important task for the EIS team in the early stages was to listen. Outreach involved a steering committee and community partnering team, which had five separate task forces addressing issues from aesthetics to traffic management. The public realized that NJDOT took their concerns seriously and would do what they could to uphold their priorities while advancing the project. The design team then had to develop planning, engineering, and management solutions that satisfied those diverse priorities.

Fixing the Worst First

Clearly, it would be a lengthy process to work out design details and acquire right-of-way for the improvements in Somers Point and Ocean City. Because causeway reconstruction couldn't wait, the project was split into two staggered construction contracts. Contract A replaced the two deteriorated low-level causeway bridges. Contract B encompasses replacement of both drawbridges and improvements at the touchdowns at each end of the bridge, bringing the total project length to 2.8 miles.

Dividing the project into two contracts was also necessary because of the $400 million price tag. The Route 52 Causeway Replacement is one of the largest projects ever undertaken by NJDOT.

Keeping Traffic Moving

A key to building local support was to convince the public that traffic could be maintained during construction. The construction staging identified in the EIS was modified to minimize changes in traffic patterns. The northbound portion of the bridge would be constructed first, with temporary tie-in ramps to the existing highway. The southbound lanes would then be constructed as the 1933 bridges were demolished. Two lanes would be maintained in each direction from May to September—the peak tourist season—and at least one lane in

each direction would remain open during the off-season.

Local confidence grew as the design team outlined the extensive precautions to avoid damaging the old bridge during construction. Residents had reason for concern: The nearby Ocean City-Longport Bridge had to be closed after it settled during construction of its replacement. To avoid a similar problem, the alignment of the new Route 52 Causeway structure was moved about 40 feet to the east to separate the existing Route 52 Causeway from harmful construction activity. The pile-driving methods selected minimized vibrations. Engineers and inspectors would continuously monitor any movement of the old bridge using a system of electronic deflection and strain gauges.

Ultimately, maintenance of traffic and bridge protection strategies were successful and the mayor of Ocean City praised the 2008 tourist season as the city's "best summer ever."

Creating Proper Gateways

Another controversial issue was the location of the Ocean City Visitor's Center, which to be reconstructed as part of the project. The EIS called for relocating the visitor's center from a nearby island into Ocean City proper because constructing it at island level would make the building difficult to see from the bridge. But given the traffic and parking limitations in Ocean City, local leaders much preferred the island location. A two-story visitor's center on the island, elevated to the main bridge was proposed and accepted. The visitor's center will create a visual gateway into Ocean City. Its architectural style will be reminiscent of the historic Ocean City Yacht Club, and its series of decks will serve as a scenic overlook.

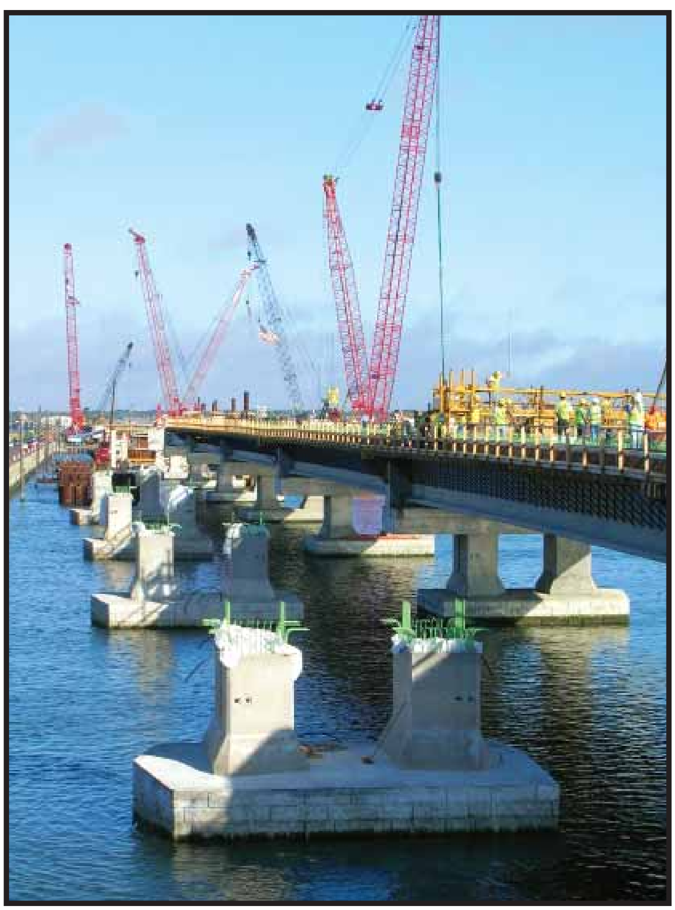
Community partnering also helped build

support in Somers Point, where residents had been concerned about removal of the traffic circle. Renderings illustrated how the new intersection would function. In addition to landscaping, decorative walls, lighting, and walkways that enhanced the look of the area, highway access and negotiated leases of NJDOT right-of-way were adjusted so businesses could retain parking areas. The entire process was one of give and take.

Other elements began to take shape. The middle stretch of the bridge was to be above the flood level but still relatively low, with a 10-foot-wide bicycle and pedestrian lane. Dredging would be minimized. Fishing piers and boardwalks at each island would expand recreational opportunities. Improvements in Somers Point and Ocean City would enhance the roadway's function and aesthetics while taming vehicle traffic and further improving bicycle and pedestrian access. Renovations would capitalize on the Somers Point Mansion historic site, providing parking, walkways, interpretive displays, and landscaping.

Designing to Market Conditions

With support for the project widespread and momentum finally on track, the design went out for bid in fall 2005—just as fuel prices were skyrocketing following Hurricanes Katrina and Rita. Bids came in $60 million higher than expected and were rejected by NJDOT. It was recognized that the project would have to be rapidly repackaged in light of market conditions. NJDOT and its engineer scrutinized the plans and within two weeks formulated several ways to control costs without sacrificing form or function.



The continuous two-mile-long bridge was redesigned—in two intensive months—with a touchdown area at Rainbow Island, reducing the bridge length by 1,700 feet. Highway access to Rainbow Island could then be simplified, which actually increased the number of parking spaces and reduced impacts to wetlands. The bridge's horizontal alignment was shifted slightly to use as much of the existing roadway as possible. Certain work elements were deferred to Contract B.

Instead of traditional girders, the bridges were redesigned with precast concrete segmental boxes, which are faster to construct and require less access from underneath. However, there was only one fabricator in the region that was ready to provide the specialized segmental boxes—most concrete fabricators were consumed by orders from the Gulf region. To increase competition, an alternative superstructure design using the more common prestressed concrete I-girders was also developed.

The revised Contract A1 was advertised in April 2006. This time, bids came in lower than expected, making it possible to proceed with construction.

Managing Environmental Impacts

Environmental restrictions were one of the most significant construction-phase challenges. The project area is important to endangered species and protected birds, fish and shellfish, sea turtles, and plant life. Environmental permits limited the types of construction activity that were allowed

and the locations and brief seasonal windows in which that activity could occur.

From the start, NJDOT held regular interagency meetings to keep environmental agencies informed and demonstrate the team's commitment to protecting natural resources. Where feasible, the team went the extra mile, such as developing plans for bio-engineered shoreline stabilization and preserving nearby open space to help offset impacts. These efforts made environmental agencies more willing to discuss reasonable modifications to restrictions when needed. For example, in-water construction is restricted between April 1st and June 30th; however, the agencies granted permit modification to allow pile installation within watertight cofferdams during the restricted period, which enabled the project to be completed quicker —resulting in fewer net environmental impacts.

> *"This project is so much more than a bridge replacement. We are helping shape Somers Point and Ocean City in a positive way, and better serving motorists, pedestrians, bicyclists, anglers, boaters, and other tourists and year-round residents. This popular area will be even more enjoyable."*
>
> Tony Guerrieri–New Jersey Department of Transportation

Stabilizing Soft Soils

The coastal project location introduced many technical challenges, including dealing with sandy, silty soil conditions. Soft soils were a particular concern under the 900-foot-long ramp from Rainbow Island onto the southbound causeway. To stabilize the embankment rapidly and cost-effectively, vibro concrete columns, which had been used only once before in New Jersey, were used. Concrete columns about 18 inches in diameter that flare out at the top and bottom were driven some 60 feet into the ground, which made the upper layers of soil more dense. Several layers of geotextile—a special heavy duty fabric—and compacted fill were placed across the tops of the columns to transfer the embankment load down to more stable soil layers.

Doing What Works

As the project team looks ahead to Contract B, project leaders say that sustaining the collaborative environment is the most important key to success. Common sense solutions with a collaborative effort of owner, contractor and design are sought.

One of the most important lessons learned is the value of offering contractors alternative designs to encourage competitive bids—a technique already in the works for Contract B.

Michael Baker Jr., Inc. prepared the Environmental Impact Study and was the Engineer Of Record for this project. This article is based on a companion article previously appearing in Volume 3 – Issue 2 of Michael Baker Corporation's company publication, *Signature.* All images provided courtesy of Michael Baker Corporation, New Jersey Department of Transportation, and JMS Visual Communications. Mike Sidani, P.E. is a Project Manager with Michael Baker, Jr., Inc.

INDIAN RIVER INLET BRIDGE REPLACEMENT PROJECT UNDERWAY

By: Tina Shockley

In the second smallest state in the nation, near the resort community of Bethany Beach, a modern marvel is underway. Skanska USA Civil Southeast, a world renowned Sweden-based bridge building company is raising a new Indian River Inlet Bridge.

The existing bridge's piers are being eroded by severe scouring - the product of a manmade high velocity waterway and the corrosive nature of the salty Atlantic Ocean. Collectively, they have reduced the life expectancy of the existing bridge, requiring a new bridge to be built. The new bridge will have all of its piers outside of the water, on land. This means the bridge will be a larger and longer version with an overall total bridge length of 2600 feet, including 900 feet of clear span over the inlet.

The $150 million design-build project was awarded in September 2008 to Skanska because it had the lowest price, highest technical score and most aggressive construction schedule. The bridge is expected to be open to traffic in April 2011, and the project completed by July 2011 – eight months earlier than required by DelDOT. In order to expedite the contract, a design-build contract was established which allows for the design of the bridge to occur simultaneously with the construction. Design plans are about 95% complete, and construction is well underway. The new bridge will have a minimum 100 year life span, and is being supported by 36 inch square precast concrete piles. Due to the dense sand and soft clay layers below ground, the installation of the piles was challenging. However, detailed data collection, quality assurance and persistence paid off. The pile program was completed in the fall of 2009.

With the new bridge, boaters will have up to 45 feet of under clearance, which is 10 feet more than the existing bridge provides. The bridge will have two 12-foot wide travel lanes, a 10 foot wide outside shoulder and a 4-foot wide inside shoulder in each direction. A 12-foot wide protected sidewalk will also be featured on the east side of the bridge.

The bridge will consist of twin 249-foot high pylons on each side of the inlet supporting the two-planes of cable stays on each edge of the structure. The bridge has no support piers in the inlet. The main span of the bridge will be completely supported by the tension exerted on the cable stays.

The bridge, which is being built amidst a state park and recreational resort area, requires the bridge builder to be very cognizant of recreational and environmental impacts during construction. As part of the contract, Skanska must avoid placing any shoring or work platforms in the water crossing while building the structure. One unique aspect of the bridge's construction was that during the design phase of the project, the public provided input on some of the architectural and visual features of the bridge. These included the lighting fixtures for the walkways, the color of the cable stays and the design for the top of the pylons.

Another unique aspect of the bridge is that it is the first time a fiber optic monitoring system

has been used on a bridge of this type. DelDOT and the University of Delaware's Department of Civil and Environmental Engineering are working to incorporate smart bridge technology in order to measure the long-term performance of the bridge.

During the early part of 2010 and into spring, the pile caps will be built at the main pylons. Additionally, concrete edge girders will be placed as construction of the bridge deck begins. Meanwhile, piers and bridge approaches to the main span will be also constructed.

Soon after, deck construction will begin, including the first major concrete pour for the bridge deck. Springtime will bring additional work on the bridge deck, pylon towers, and approaches to the main span, including cable stay erection.

The bridge project has also been a blessing during the recent economic downturn, as is has spurred economic growth for the State of Delaware by bringing construction jobs, increasing revenues for local businesses and benefitting the local tourism industry.

The State is also maximizing the bridge building experience by sharing it with students from

kindergarten to graduate school. Local students are learning about the math, science and technology that is required to build a bridge of this magnitude. Students are able to visit the construction site and learn firsthand from a bridge engineer. By having students come to the site, they gain the "WOW" factor. They see the magnitude of the structure, they meet the bridge builders, and they learn about the math and science concepts being applied as Skanska builds the bridge.

In the end, this bridge will be a useful part of Delaware's transportation infrastructure, and will connect people for generations to come.

Tina Shockley is the Community Relations Officer for the Delaware Department of Transportation, Office of Public Relations
Images courtesy of Delaware Department of Transportation

Fast Track

Replacement of Route 90 Bridge Span

Steel superstructure replacement quickly reopens major connector to Ocean City, MD

By: Tom Wandzilak and Will Pines, P.E.,

The Route 90 Bridge over the Assawoman Bay in Ocean City, Md. is one of two bridges connecting the popular resort town to the Maryland mainland. Carrying 18,000 vehicles per day, the bridge is a key lifeline to commerce for hundreds of the town's businesses and is a major evacuation route for thousands of residents and vacationers.

An Unexpected Closure

When a routine inspection revealed previously undetected structural damage at the bridge's navigational span, the Maryland State Highway Administration (SHA) closed the bridge for emergency repairs. The damaged section of the bridge was discovered during a biannual inspection that showed serious deterioration of the concrete girders, exposing the reinforcing steel to corrosion.

Concern about the ability of the bridge to carry truck loads initially prompted the restriction of vehicles over 6,000 pounds. It was quickly determined that the 85 foot navigational span of the 38-year-old bridge could not be repaired. Instead, it needed to be closed and the section replaced immediately in order to restore the bridge's capability to carry truck loads as soon as possible.

A steel girder superstructure was selected for the span replacement, because it weighed less than other replacement alternatives. This weight reduction eliminated the need for other repairs, thus optimizing replacement costs.

A Quick Reopening

The bridge contractor for the $1.1 million project, working as a subcontractor to Covington Machine & Welding, Inc., was McLean Contracting Co. of Glen Burnie, MD with supplier, High Steel Structures Inc. of Lancaster, PA using expedited procurement for steel fabrication and delivery of the replacement girders.

Forced closing of one of two crossings from the mainland to the island

The first shipment of steel arriving on job site

High Steel was given notice to proceed on October 6, 2009, while the design was being finalized and McLean was mobilizing. Due to the fast track approach, the first shipment of steel arrived at the jobsite on October 27, 2009.

High Steel had the resources available in both material needs and manpower to fit this project into the shop flow, waiving the standard lead times. Having the material already on hand allowed High Steel to dramatically cut fabrication time and begin delivery of the steel only three weeks after notice to proceed.

High Steel's engineering department worked closely with the Design Consultant, URS, and the Maryland SHA to expedite the design and detail drawings approval process. A fabrication project manager was assigned to shepherd the project through fabrication.

Work on the 85-ft portion of the bridge was anticipated to finish in mid-December, 2009. But the bridge reopened on November 24, three weeks early and just in time for the Thanksgiving holiday.

"We were delighted that repairs were completed not only on time, but ahead of time. This benefits the business community and is a vital safety improvement."
Rick Meehan, Mayor, Ocean City, MD.

In addition to the quick fabrication and delivery of the replacement superstructure, the SHA credits several additional factors for the project's early turnaround, including the contract's incentive/disincentive clause and a powerful nor'easter that tore through the area in early November. The crew raced to pour the concrete deck a day before the storm struck, averting a potential one-week delay.

McLean Contracting Co. built the replacement span using the "Cape Fear," a 150-ton water rig friction crane. The crane, mounted on a 68-ft-wide barge, accessed the bay through careful navigation through the 78-ft drawbridge span of the Route 50 Harry Kelley Memorial Bridge, the only other bridge access to the

The "Cape Fear"

Ocean City barrier island from the mainland. The strong currents and meandering channel at the Route 50 Bridge provided even more of a challenge than the narrow clearance.

By mobilizing the large floating crane, McClain Contracting was able to expedite removal of the span by lifting it out in five pieces, with girders, deck and parapets still intact. This crane also allowed erection of the fascia girders in pairs with all of the deck overhang formwork pre-installed.

The construction team faced a number of challenges including bad weather, but met the deadline, realizing true team effort, with thanks to the fast-track work of the Maryland SHA, its consultant, the contractor and his suppliers.

Tom Wandzilak is Business Development Manager with High Steel Structures, Inc., and Will Pines, P.E., is the Project Manager with Maryland SHA assigned to the Route 90 Bridge project.

In a letter to High Steel, SHA's Office of Structures, thanked High Steel for its fast response, citing a similar situation on the Old Severn River Bridge that occurred in 1979: "It is extremely comforting to have a relationship with a firm like yours. We called upon High Steel then, as we did now. A positive reaction to a similar problem by your firm, 30 years later, is a true example of why your firm continues to have such a fine reputation." McLean Contracting also received a letter of appreciation from Maryland SHA citing "… responsiveness and quality of workmanship… and expertise in the water during critical situations."

Photos courtesy of High Steel Structures

More than 80 Firms are currently represented under the Engineers' Society of Western Pennsylvania (ESWP) Corporate Member program. Corporate Memberships in ESWP are available in 3 levels: Gold, Silver and Bronze. Gold members are entitled to 14 individuals, Silver, 9; and Bronze, 5. Annual dues are $2400, $1700, and $1000 respectively. In addition, all Corporate Member firms may add 2 additional individuals in our Under-35 age category at no additional cost. More information can be found at eswp.com. Please contact the ESWP Office for additional details.

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BRIDGES of the Chesapeake

The Rhythm of the Tides

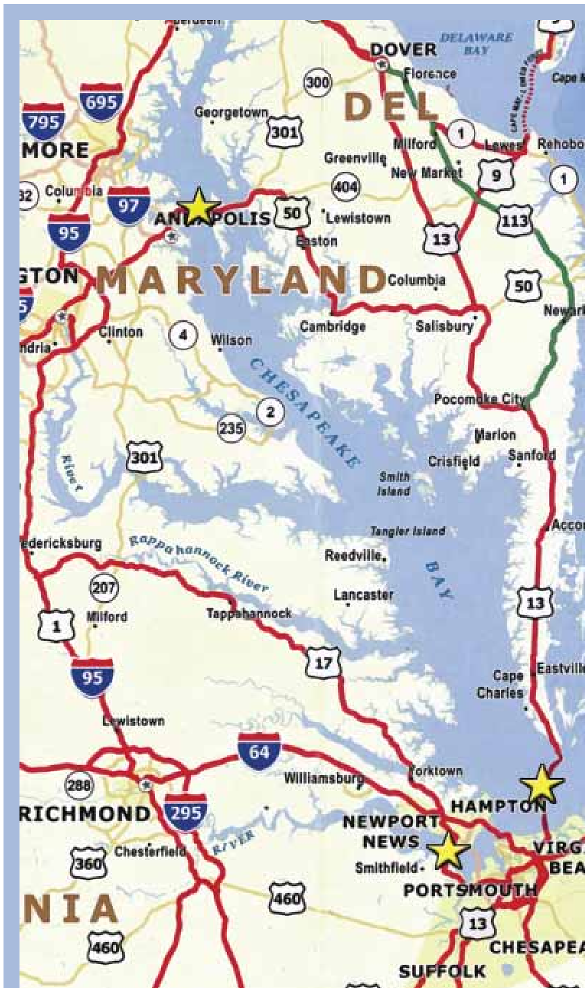
By: Tom Leech

Chesapeake is Tidewater; Tidewater is the Chesapeake. From the colony of Jamestown to the battle of the Monitor and the Merrimac, to the impressive ship yards of Norfolk, the inland waterway of the Chesapeake has been an important transportation node where shipping, rail and highway modes of transportation converge. On the one hand, Mother Nature has been kind to provide a large protected bay, some 3,230 square miles to be precise. On the other hand, Mother Nature has been cruel with her subsurface soils – sands, soft clays and shelly coquinas – leaving a challenge for the both the design and construction of bridges and their foundations – the base upon which the transportation modes must be constructed.

The bridges of the Chesapeake are fascinating. Their lengths are grand. Their construction challenges were many. To appreciate the utility of travel is to appreciate the visible superstructure. But to appreciate the visible superstructure, it is first necessary to understand the regional geology and appreciate the skills of the artisans that constructed the foundations as well as the superstructures of these monumental structures.

From Beyond Earth's Orbit

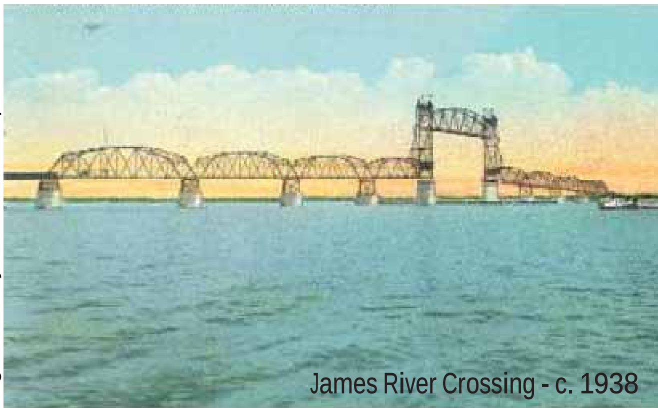
In the mid-Cenozoic Era (35 MYBP), a bolide from outer space impacted the earth's surface near Cape Charles, Virginia. Although not understood until the early 1990's, it is now evident by seismic surveys and deep sedimentary core interpretation that this large meteoritic fireball or possibly a comet, with a diameter greater than one mile, carved a 55 mile wide by 2,000 foot deep crater, the largest in the continental United States. This resulting deep basin became the outlet for the ancient Susquehanna River to the Atlantic Ocean. The effects of the crater have influenced sediment deposition; and even to the present, briny groundwater, associated with the crater, is a problem for many deep water wells in eastern Virginia. With a series of glacial advances and retreats, the ancient Susquehanna carved a route to the coast. At the height of the last glacial epoch, seal level dropped to 450 feet below its present level near Cape Henry. Rising waters from the melting glaciers of the Pleistocene age reached the mouth of the Chesapeake Bay about 10,000 years ago where sea level continued to rise, drowning a series of river beds, until the Bay as we know it today was formed about 3,000 years ago. With subsequent glacial retreat, the valleys drowned to become relatively shallow bays and estuaries underlain by loads of deep sediment – sands, soft clays and shelly coquinas - forming the complex network of bay soils with depths extending to 450 feet near Capes Charles and Henry.



Some Historical Facts:
Chesapeake Bay is a translation of the Powhatan Indian word "chesepiooc" which means "Great Shellfish Bays." At the time of the first European settlement, the tidewater area was inhabited by an estimated 13,000 to 14,000 Powhatan Indians. The first European to enter the Chesapeake Bay region was Spanish explorer Vicente Gonzalez in 1561. In 1605, the French started a colony at Port Royal (now Annapolis). In 1607, the Jamestown settlement was established on the James River. In 1634, Lord Baltimore, who had been granted the land from the Potomac River to the north by the King of England, established the first English colony in Maryland, known as St. Mary's City. The first light house built by the United States was built in 1792 at Cape Henry (named for Henry Frederick, Prince of Wales), marking the entrance to the Chesapeake Bay. (The north and opposite cape was named Cape Charles, for Henry Frederick's younger brother, Charles, the Duke of York.)

Crossing the James River Estuary

The first serious attempt to cross the Chesapeake with a fixed structure as documented in historic Civil War photos. This crossing of the James River Estuary, upstream from its mouth to the Chesapeake was a pontoon bridge constructed in the 1860s. Foundations were avoided; the bay was crossed.



James River Crossing - c. 1938

Image Courtesy of Historic Hampton Roads

The first fixed crossing of the Chesapeake Bay was a two lane bridge with lift span connecting Newport News on the Virginia Peninsula with Isle of Wight County in the South Hampton Roads region. The privately-owned James River Bridge Corporation was chartered by the General Assembly to build a system of bridges across the James River, Chuckatuck Creek, and Nansemond River. The common foundation type in this geological setting at the time of construction was wooden pilings. These large displacement foundations with limited penetration resulted in clusters of pilings at each foundation, especially when a lift span was involved. When completed, the 4.5-mile bridge was the longest bridge in the world over water. The $5.2 million James River Bridge was opened on November 17, 1928 by the press of a button in Washington, D.C., where U.S. President Calvin Coolidge, sitting in the Oval Office of the White House, sent an electric signal to lower into place the upraised lift span over the James River channel.

The bridge, carrying US-17 was replaced with four-lane bridge and was completed in stages from 1975 to 1982. The 415 foot lift span of the replacement structure provides 145 feet of vertical clearance at high tide, a significant increase over the original bridge. Only a small portion of the original bridge remains in use today as a fishing pier.

The Bay Bridge

The second significant fixed crossing of the Chesapeake Bay was an elevated structure constructed south of Annapolis, Maryland, connecting the Maryland peninsula to the mainland. In 1908, private investors in Baltimore advocated the first plans for a trolley bridge crossing the Chesapeake Bay near Baltimore, but the proposal was dismissed. In 1938, the Maryland State Roads Commission determined that the best site for a Chesapeake Bay bridge was between Sandy Point and Kent Island, a four mile link which would replace the ferry from Annapolis to Queen Anne's County, and would provide better service from the Annapolis-Baltimore-Washington "triangle" to the eastern shore. However, World War II intervened and there was no serious consideration for a crossing until hostilities ceased.

Ten years later, construction contracts for the 123 span Bay Bridge, carrying Route 50, were awarded. The bridge featured a sweeping curved alignment and a 1,600 foot main suspension span over the main channel. While the bay is relatively shallow at this location, pilings for the foundations were barged for considerable distances. Never the less the most serious challenge from nature were the high winds associated with the open waterway expanse. Consider that Between 1951 and 1960, Virginia was affected by 16 major storms; the most sever occurring in August of 1955, when Hurricane Connie moved up the Chesapeake Bay and across Baltimore and only five days later, Hurricane Diane moved across central Virginia, Richmond and Washington, D.C. Rain from the two storms set records for the month of August over central and northern Virginia.

By the close of 1950, the two 354-foot main towers, and the concrete anchorages that support the two main cables were completed, with the spinning of the two 14-inch-diameter main cables commencing in early

The Bay Bridge - c. 1951

Baltimore Sun photo by A. Aubrey Bodine

1951. (See photo) To provide additional bracing against the frequent high winds on the bay, stiffening through trusses were placed above the roadway. The roadway sections of the main suspension span were hoisted into place during late 1951. By 1952 the bridge was opened to the public. In 1967, the state recommended that priority be given to a new bridge parallel to the existing crossing, leading some to call the bridge (most ironically, post Watergate) the "Agnew's Double-Cross" after the then-current governor, Spiro Agnew. At present the Bay Bridge carries approximately 65,000 vehicles per day (ADT) on the average weekday; this number swells to as 95,000 vehicles per day on summer weekends.

The Chesapeake Bay Bridge-Tunnel – at the mouth of the Chesapeake

Cape Charles Virginia, to the north and Cape Henry Virginia to the south were separated by the 17 mile mouth of the Chesapeake Bay – literally worlds apart until 1964, when Chesapeake Bay Bridge-Tunnel was opened to traffic. The 42 month construction period included construction of 12 miles of low-level trestle, two one-mile tunnels, four miles of bridges and four man-made islands.

Chesapeake Bay Bridge-Tunnel, c. 1965

Photo courtesy of CBB-T

By the early 1960's very efficient foundation elements were available for complex construction projects in bay settings. The structure, carrying Route 13, is supported by 5,000 precast, prestressed concrete cylinder piles, 54 inches in outside diameter. These thin walled piles (with a 5 inch wall thickness) result in low displacement foundations with optimized penetration resulting in relatively few pile penetrations per substructure unit. The seabed materials enter the void in the center of the piles during pile driving. Piles were manufactured and transported 180 miles from the project site. From a floating barge and crane, the piles, ranging in length of 140 to 180 feet were driven from 80 feet to 150 feet into the bay soils of sands and soft clays. Not anticipated at the time of construction was the potential damage the driving hammer could inflict on the thin walled sections. The resulting hairline fracture zones became catalysts for salt water, chloride intrusion necessitating ultimately jacketed repairs with galvanic cathodic protection completed in 2009.

The 1960's construction was accomplished under the severe conditions imposed by nor'easters, hurricanes, and the unpredictable Atlantic Ocean. During the Ash Wednesday Storm of 1962, much of the work partially completed and the custom-built $1.5-million Big D pile driver was destroyed. In 1965, one year after opening, the two lane facility was selected as one of the Seven Engineering Wonders of the Modern Works and as recently as 2002 Civil Engineering Magazine named it one of the Landmarks in Civil Engineering History. A parallel bridge-tunnel was completed in 1999 increasing the vehicular capacity to four lanes and serving over 3,500,000 vehicles per year.

The View is Tremendous

As one travels down Route 13 from New England to Florida and one travels along the coast of the Delmarva Peninsula towards Virginia, the last water gap, the Chesapeake Bay Bridge-Tunnel appears. As one drives onto the bridge, the ocean comes close and closer. It is beside you, then beneath you. The expanse of the Atlantic Ocean and the Chesapeake Bay opens before you and as you descend in to the tunnel, you plunge into the great shellfish bay, nature's work of art from fireball to complex ecosystem, and transportation wonder.

Thomas G. Leech, P.E, S.E. is Vice President and National Practice Bridge Manager for Gannett Fleming, Inc. and a member of the Executive Committee of the International Bridge Conference.

Protecting the Concrete of Bridge Infrastructure

Waterborne Polyurethane Coatings for Protecting Against Salt and Graffiti

By: Steven Reinstadtler

Waterborne polyurethane coatings have been used in the bridge preservation market for years as an alternative to solventborne systems but early technologies required the bridge coatings engineer to compromise on properties or durability. Additionally, many of these early products still contained high levels of VOC (volatile organic compounds) although touted as waterborne technology. New alternatives have evolved that address these issues and fit well into an overall sustainability plan.

Background

For over 20 years high performance solventborne polyurethane coatings have been employed as a durable, light stable topcoat over a typical zinc rich primer and epoxy midcoat system on structural steel. In many cases, this polyurethane topcoat exhibited good solvent resistance which allowed the surface to be cleaned with organic solvents if graffiti was present. Maintenance personnel would use strong organic solvents applied with rags, brushes, or other means to remove the graffiti paint with little damage or change in gloss occurring to the topcoat.

The same solventborne polyurethane topcoat was not used on the other integral parts of the bridge such as the concrete bridge abutments and pilings. One reason lies in the inherent chemistry of the coating. These topcoats were typically formulated to have a higher gloss level which, when applied to the concrete surfaces, would alter the look of the concrete. For the bridge architect and designer this was an undesirable trait. Additionally, the concrete surfaces were fairly porous which would not allow for adequate coverage of the surface. Therefore when graffiti was applied and subsequently removed, a phenomena called 'ghosting' was observed where some of the graffiti paint remained adhered to the uncoated concrete areas in the pores of the surface. Historically, the most common way that bridge owners dealt with graffiti on concrete was to paint the surface with a less expensive acrylic paint and then deploy maintenance crews periodically to paint over the tagged areas. This resulted in an unsightly patchwork of repainted areas due to lot-to-lot variations in pigmentation as well as the fading of the original coating.

For decades, solventborne polyurethane coatings have been considered the mainstay for high performance coatings used in bridge and architectural applications in coastal areas due to their excellent chemical, mechanical and weathering properties. But increased governmental, regulatory, and sustainability pressures have created a need for coatings technology that would reduce or eliminate VOC, HAPS, heavy metals and/or other environmentally detrimental compounds.[1] In the past decade, the first generation of waterborne polyurethane coatings was formulated and introduced to the market. While offering the chance to replace some of the VOC and solvents with water, many of these coatings still had in excess of 250 g/L of co-solvent. In addition, these coatings often fell significantly short of the solventborne polyurethane standard in chemical, abrasion and UV resistance. This limited their use in many applications. As with most emerging technologies, the learning curve was steep and the second generation of waterborne polyurethane coatings was developed with the goal of meeting or exceeding the

desired traits of the solventborne polyurethane coatings but with significant reductions in VOC and solvent levels. These second generation waterborne polyurethane coatings have achieved the property goals and are primarily waterborne – having only 0-20g/L VOC levels. With a focus on Sustainability and Green Building practices, many bridge owners are requesting products with ultra-low VOC for protecting the concrete portion of their structures in coastal locales from airborne salts, corrosive chemicals, and graffiti.

Existing protocols are well defined for testing coatings for graffiti resistance and physical properties of a bridge coating. For example, the ASTM D6578-00 test protocol characterizes the effects of multiple types of possible graffiti on the coating surface. ASTM 6578-00 looks at several traits such as the type of graffiti paint or marker, the type of cleaning solvent needed to remove the graffiti, and the amount of cycles the surface can be cleaned without change to the coating. One observation that is part of the test protocol is looking for any up-glossing or down-glossing of the coating due to the graffiti or the cleaning solvents.

Discussion

Based on the excellent abrasion, chemical, and weathering resistance data that was observed, several areas of coatings used in the built environment can be targeted. These include light and weather stable topcoats on concrete bridge infrastructure such as abutments, pilings, beams, and segmental precast elements as well as cast-in-place support walls and sight and sound barriers. Over the past few years, an increasing trend has been to promote greener technologies in the construction of America's infrastructure. Proof of these trends comes in three major areas–stricter Federal VOC regulations via the National AIM Rule, increased communication and awareness of environmental issues impacting consumers, and increased sensitivity to solvent odor by building occupants and tradesmen. Changes made by California to its VOC regulations are expected to be adopted by other states. For example, parts of California (SCAQD) instituted a 50g/L limit for residential flooring applications and 100 g/L limit for commercial applications in 2006. These limitations severely restrict the coating systems that can be used in the flooring market.[2] For coatings used as a topcoat, there are several desirable physical properties that are required in order to have an aesthetically pleasing and durable finish. Abrasion and chemical resistance play into the durability equation since many coastal exterior and industrial applications can be exposed to wear as well as common chemicals such as gasoline, brake fluid, acids and bases, and salts. Another desired property for topcoats is the ability to apply the coating system without offensive odors that can disrupt construction or other activities in the adjacent areas.[3]

2K waterborne coatings for graffiti-resistance are under the same scrutiny and tight regulations for VOC as other application areas. In addition to the drivers outlined previously, there is often an additional requirement for graffiti-resistant coatings - the ability to adjust the gloss level while retaining the excellent chemical resistance that is needed for the coating. The external concrete on a bridge is looked at as an integral design element by the architect. The architect envisions a certain look to the structure and does not want to change that look by the addition of a protective coating. Therefore, there has been resistance to the use of other graffiti resistant coatings on the exterior of structures that change the look or gloss level of the coated area. Typically, the undesirable trait is the noticeably higher gloss on the exposed architectural concrete. This has also become a safety hazard identified by some DOTs since nighttime reflected glare from oncoming traffic could be a safety issue. Several DOTs have made low gloss a requirement for their concrete bridge coatings. The waterborne technology discussed here allows the coating to retain the excellent salt, chemical, and graffiti resistance with minimal to no effect on the aesthetics or gloss level of the raw concrete. This is achieved while working with a coating with less than 15 g/L of VOC. Should a designer wish, they can obtain the desired gloss level from glossy to matte with this novel technology.

Conclusions

With the new coatings technologies, it is possible to create true waterborne coatings that meet or exceed the industry standard and expectations for durability and cleanability on coastal zone concrete bridge infrastructure. This can be accomplished while reducing VOC, solvents, and other hazardous substances in accordance with the trends in sustainability and green building practices.

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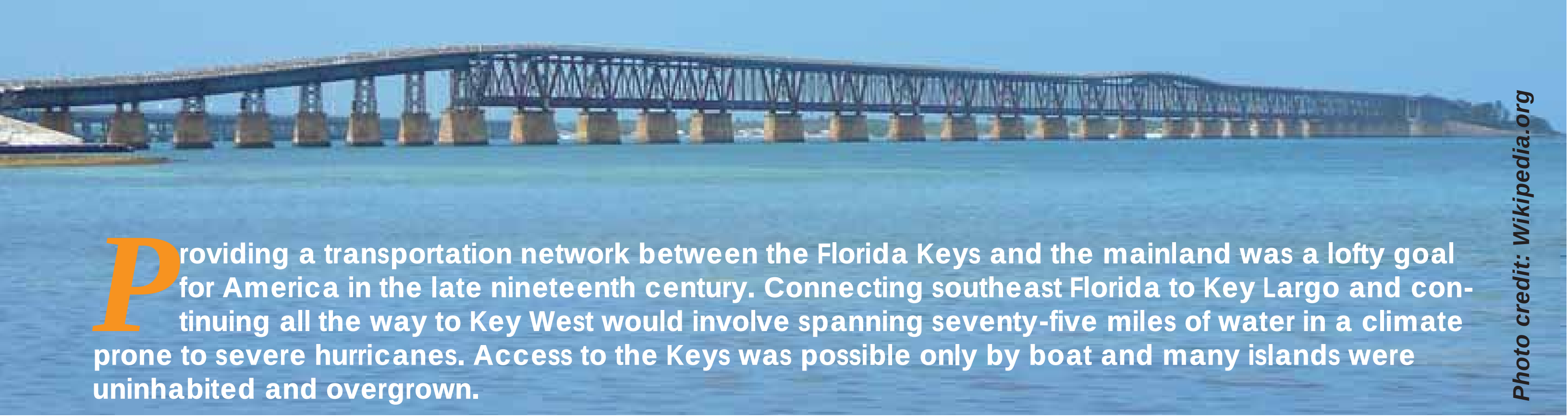
Steven Reinstadtler is the Forward Marketing and Sustainable Technology Manager,Bayer MaterialScience LLC,Pittsburgh, PA USA.

Photos courtesy of Bayer MaterialScience

CONNECTING THE FLORIDA KEYS: The History of the Overseas Highway

By: Kyle Smith



Providing a transportation network between the Florida Keys and the mainland was a lofty goal for America in the late nineteenth century. Connecting southeast Florida to Key Largo and continuing all the way to Key West would involve spanning seventy-five miles of water in a climate prone to severe hurricanes. Access to the Keys was possible only by boat and many islands were uninhabited and overgrown.

Photo credit: Wikipedia.org

Bahia Honda Bridge

In spite of the engineering challenges, there were many reasons to achieve this goal. Up until 1890, the city of Key West had the greatest population in the state of Florida. Construction of the Panama Canal began in 1904 and the proximity of the Keys to the north would allow for a strategic economic and military outpost for the United States in the subtropics. Vast areas of undeveloped land yielded immense potential for real estate development. The demand for this infrastructure was clearly in place.

The Overseas Railroad

The first response to this demand came in 1904 from Henry Flagler, the President of the Florida East Coast (F.E.C.) Railway. Flagler sought to expand the railway from Homestead, just south of Miami, to Key West. Officially called the Key West Extension, it was nicknamed the "Overseas Railroad". Bids were advertised for constructing the extension, and after receiving only one response, Flagler decided to commission his own team to perform construction.

In 1905, construction commenced on the 17 miles of steel bridges and concrete viaducts, the 20 miles of filled causeways and the remainder of the 128 mile circuit. Shallower water permitted the use of the concrete arch bridges, such as the Long Key and Pacet Channel segments. For sections requiring navigational clearance or that were susceptible to higher waves, steel superstructures with elevated piers were preferred. Prominent examples include the 6,803 foot steel plate girder Knight's Key Bridge and the Moser Channel Bridge, which included a 253 foot through truss draw span. The aforementioned structures along with the Pigeon Key Bridge made up the section of railway that would become known as the Seven Mile Bridge.

There were many construction challenges involved with an undertaking of this size. Skilled labor and resources such as coal and fresh water were in short supply. Specialized equipment for each bridge type and water depth was required; this equipment could only be powered by electricity generated in the field. Eight barges served as mobile construction plants, each fitted with excavators, water pumps for the cofferdams, concrete mixers and a 50 foot boom for erection of steel members. Materials were often brought in from great distances, such as steel fabricated by the American Bridge Company in

Courtesy of Florida State Library and Archive

Long Key Viaduct

Pittsburgh and substructure concrete from Germany.

Weather turned out to be another obstacle with the occurrence of three major hurricanes during construction. The first arrived in 1906 following a false alarm from the previous year; the storm forced 145 men out to sea. After the first storm, warnings were taken more seriously, but the second hurricane in 1909 also inflicted serious damage. Five steel girders were forced off their piers into the water. When it was discovered that only two anchor bolts were installed for each girder, a legal battle ensued and the contractor was nearly bankrupted. Despite the setbacks, construction was completed in January of 1912. The project endured seven hundred fatalities and had consumed $20 million, but the Key West Extension was now in operation.

The Overseas Highway

The expansion of the F.E.C. Railway was an important first step in bridging the gap to the Keys. The local economy enjoyed rapid growth of the real estate and tourism industries. Economic prosperity continued into the early 1920's but would plateau soon after. The railway continued to record falling revenue each year, and would never earn a profit. Business also took a major hit with the crash of the stock market in 1929.

The demand for vehicular access to the islands posed another threat to the F.E.C. Railway. Local roads in the Keys to this point were only bridged by ferry services, which were costly and unreliable. The ferries would often bottom out in low tides, causing delays and stranding customers. An effort to construct a 2,800 foot wooden drawbridge to carry traffic from Homestead to Key Largo was met with disaster after a hurricane in 1926. The bridge, which spanned Card Sound, was repaired and completed in 1928. Other bridges, including one that linked Key West to No Name Key, and another that extended the Card Sound route to the Lower Matecumbe Key, were also eventually constructed.

Though progress was being made, travel between the Keys still depended on 28 miles of ferry trips in 1929. Plans for bridges to complete the circuit were finished by 1932 but insufficient funds shelved the project. Two years later, a $10.7 million dollar loan was approved by the Reconstruction Finance Corporation (RFC), an agency created by Herbert Hoover during the Great Depression. The Roosevelt Administration later added a provision to the RFC to provide construction jobs for World War I veterans. As a result, seven hundred veterans were sent to the Keys to complete what became known as the "Overseas Highway".

Before significant progress could be made, expansion of the Overseas Highway was stalled by another devastating hurricane on Labor Day in 1935. As the first of only three Category 5 hurricanes to make landfall in the history of the United States, the hurricane was known thereafter as "The Storm of the Century". Estimates for the death toll were as high as six hundred. Two hundred mile per hour winds obliterated structures and bridges over a ten mile radius. Just before the storm, a relief train was sent to evacuate more than two hundred veterans and their families. The rescue mission was unsuccessful after the twenty foot storm surge derailed the train on the return trip, killing all evacuees on board.

The railroad was near bankruptcy to begin with, and the Labor Day Hurricane dealt the fatal blow. Twenty five miles of railroad embankment over shallow water were completely swept away. After the hurricane, the decision was made to abandon the Key West Extension. The abandoned right-of-way with its low grades and gradual curves would align nicely for a highway, so the planners of the Overseas Highway saw the potential to turn a negative into a positive.

A damage report concluded that the railway bridges were intact and that it was mostly the railroad track that was damaged. With the concrete piers embedded six to ten feet in solid rock, the substructures were structurally sound. The steel plate girders and truss members saw little damage and were well maintained and painted by the railroad. The concrete viaducts were not damaged at all. After this assessment, the Overseas Road and Toll Bridge District purchased 122 miles of the railroad right-of-way for $640,000 plus some cancellation of tax debt. Shortly afterward in 1936, the Public Works Administration granted a $3.6 million loan to modify the railway alignment and provide a continuous highway from Homestead to Key West. The loans were to be repaid by toll revenue from the new highway.

Retrofitting of the bridges progressed smoothly. The original designs were for heavier rail loads so there was some flexibility for widening the narrow railroad bridges. This was usually accomplished by laying floorbeams every ten feet that cantilevered from both sides of the bridge. Reinforced concrete slabs extended the deck over the cantilevers, providing a two lane roadway. For economy, the existing train track rails were reused as roadway barriers in many instances. With the conversion of the bridges complete in 1938, it became possible to drive from the mainland to Key West without taking a ferry.


Courtesy of Florida State Library and Archive

Conversion of a Railroad Bridge to Carry Highway Traffic

The network of roads within the islands was still poorly aligned and narrow. Some of the original Overseas Highway bridges were not wide enough and built with substandard materials. Having a modern highway along the length of the East Coast became a matter of national security after World War II was underway. To address the issue, the federal government agreed to jointly finance an improvement project with the Florida State Road Department. The project was accomplished by expanding the highway over the sections of railroad right-of-way that remained, both on land and at sea. This resulted in a smoother alignment and also shortened the route by 17 miles with the Card Sound and Pirates Cove bypasses. With the improvements complete in 1944, the East Coast was now united by a modern highway, signed as US Highway 1, from Kent, Maine to Key West.

Thirty-seven of the modified railroad bridges were replaced between 1978 and 1983 in a $175 million project. The Seven Mile Bridge was bypassed with a 440 span prestressed concrete box girder structure. At close to 36,000 feet, the new Seven Mile Bridge is the longest of the four segmental bridges used to bypass the original Overseas Highway. Built to withstand 200 mile per hour winds, the new bridges survived Hurricane Andrew in 1992 with only minor damage.

New Life for Old Bridges

Although no longer in service, twenty-three of the original F.E.C. Railway bridges are still standing and were named part of the National Register of Historic Places. Most are visible from the current roadway and are used as fishing piers, but they remain a popular tourist destination. Construction is presently underway to reconnect the fragmented bridges from Key Largo to Key West as a bike trail.


Photo courtesy of placesaroundflorida.com

As the progression of the Overseas Highway carries on, the historical significance of the Overseas Railroad will not be forgotten. With their preservation, these bridges will continue to symbolize the history of transportation in the Florida Keys.

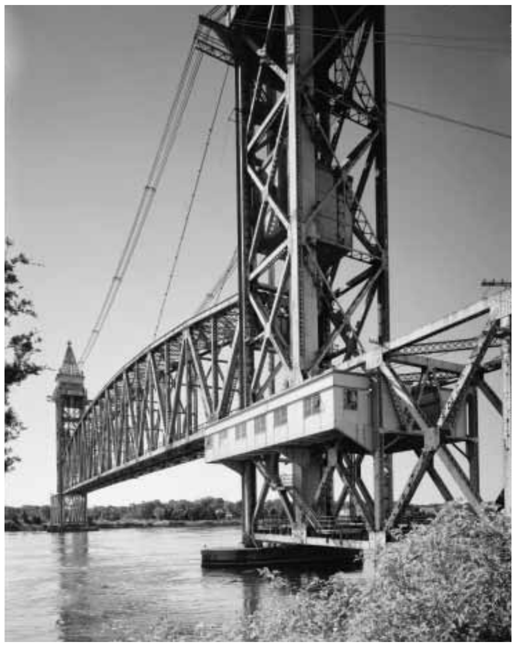
Kyle Smith is a bridge designer in the Pittsburgh Regional Office of Gannett Fleming, Inc.

QUIZ ANSWERS

(Quiz appears on Page 5)

Q1. T – In 1872 Squire Whipple, one of the pioneers of American Bridge Building, began to design and build short lift spans with small rises to cross the canals of New York State.

Q2. T – An osprey, sometimes known as the sea hawk, is a large raptor, a fish-eating bird of prey reaching 24 inches in length with a 72 inch wing span wingspan. It is brown on the upperparts and predominantly greyish on the head and underparts, with a black eye patch and wings.



Q3. F – The idea of constructing such a canal was first considered by Miles Standish of the Plymouth Colony in 1623, and Pilgrims scouted the low-lying stretch of land between the Manomet and the Scusset rivers for potential routes; however, construction of the canal never came to fruition. Many other attempts from the 1790's through the 19th century either ran out of money or were overwhelmed by the project's size. On June 22, 1909, construction finally began for a working canal, albeit beset with many problems, including excavation of mammoth boulders left by the retreat of Ice Age glaciers.

Q4. F – The bridge is used today mostly to haul trash to an incinerator in Rochester, Massachusetts, on the south shore and for occasional dinner train rides.

Q5. F –There is no safety factor involved. The counterweights are carefully sized to approximately equal the dead load of the lift span to facilitate lift with least effort. In fact the counterweights are actually sized slightly less than the dead load of the superstructure (or else the superstructure would never seat).

Q6. T - The lift span is raised and lowered by four 150 horsepower electric motors. It takes about two and- one-half minutes to fully lower and seat the span. The power is sufficient to overcome the slight negative load imbalance plus an additional allowance for snow load on the structure.

Q7. T – The bridge is supported by hundreds of driven oak piles.

Q8. F – In fact there is considerable weight bearing on the foundations, the weight of the superstructure, towers and counterweights (which approximately equal the weight of the superstructure).

Q9. F - Once locked in the fully raised position, bridge control sounds one blast of the bridge's horn to signal marine traffic that the bridge is fully raised. (Three short blasts, three long blasts and three short blasts is international code for SOS.)

Q10. F - The Arthur Kill Railroad Lift Bridge, Staten Island, New York, at span of 559 feet and constructed in 1958, is the longest vertical lift bridge in the United States.

International Bridge Conference®

2010 Bridge Awards Program

By Carl Angeloff, P.E.

The International Bridge Conference in conjunction with Roads and Bridges Magazine, bridge design and engineering Magazine and the Bayer Corporation, annually awards five medals and one student award to recognize individuals and projects of distinction. The medals are named in honor of the distinguished engineers who have significantly impacted the bridge engineering profession worldwide. The student award is named in honor of a former IBC General Chairman, a champion of the student award's program and a friend to the community at large. And this year we additionally have added as special recognition award, as well.

Interest in the IBC awards program is quite robust nationwide and internationally. This year the Awards Committee reviewed more than thirty nominations for the four bridge metal categories alone, half of which were projects nominated beyond the borders of the United States. After lengthy deliberations, the following individuals and projects were deemed worthy of this year's awards.

John A. Roebling Medal

The John A. Roebling Medal recognizes an individual for lifetime achievement in bridge engineering. We are pleased to recognize John M. Kulicki, Ph.D., P.E. as the 2010 Roebling Medal recipient. Upon receiving his doctorate from Lehigh University, Dr. Kulicki joined the firm of Modjeski and Masters where for over 35 years has served in positions from bridge designer, to manger, to principle investigator. Dr. Kulicki has also been active in the design of many notable structures. Currently, he is President and CEO, as well as Chief Engineer. His most notable accomplishment was Principle Investigator for NCHRP 12-33 Project, "Development of a Comprehensive Bridge Specification and Commentary." As an outgrowth of this successful project, Dr. Kulicki was instrumental in the development of the AASHTO LRFD Bridge Design Specifications, First Edition, 1998, as well as offering continuing support to the AASHTO Subcommittee on Bridges and Structures.

George S. Richardson Medal

The George S. Richardson Medal, presented for a single, recent outstanding achievement in bridge engineering, is presented to recognize the Wuhan Tianxingzhou Rail-cum-road Yangtze River Bridge, China. This impressive double deck, cable stayed river crossing carries two tracks of high speed rail and two tracks of freight rail on its lower deck and carries

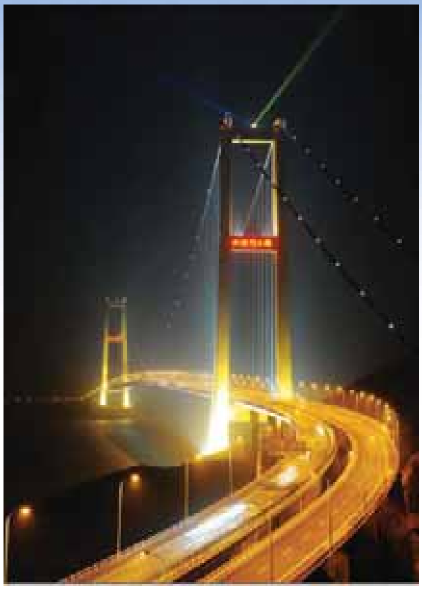
> "... an impressive achievement... handsome ... and rugged... wow! – carries more load than any other bridge in existence ..."
>
> IBC Awards Committee

six lanes of vehicular traffic on its upper deck. The combined dead and live loading is the heaviest in the world. The main structural feature of the bridge is a five

span cable stayed structure with cable stays radiating beautifully from inverted "Y" shaped towers. The 1,650 foot main span and towers are fitted with hydraulic dampers and active magneto-rheological dampers to dissipate seismic and rail interaction stresses and are supported by drilled shafts averaging 340 feet in depth.

Gustav Lindenthal Medal

The Gustav Lindenthal Medal, awarded for an outstanding structure that is also aesthetically and environmental pleasing, will be presented to recognize the Xihoumen Bridge, China. With an overall length of 8,898 feet and a main span of 5,412 feet, this suspension bridge is the second longest in the world and an integral part of a major bridge program consisting



> " ...a major bridge executed with minimum fuss...a record-breaking suspension bridge of graceful proportions...the second Golden Gate Bridge ..."
>
> IBC Awards Committee

of five structures linking islands with the mainland. In an unusual layout for a suspension bridge, the cables fully support one approach span and the main span but "span over" the opposing approach spans to the bridge. This aesthetically pleasing structure is coated with colors of local significance, and features a unique aerodynamic double box girder system to increase dynamic stability based on an extensive wind tunnel testing program.

Eugene C. Figg, Jr. Medal

The Eugene C. Figg, Jr. Medal for Signature Bridges, recognizing a single recent outstanding achievement for bridge engineering, which is considered an icon to the community for which it is designed, will be presented to recognize the George Street Bridge in New Brunswick, New Jersey, USA. Guided by a public outreach program that included input from local government, the public, the Rutgers University and the business community, a project corridor theme

> "... pleasantly blends into its environment...where new technology comes to the fore...a classical expression of beauty and unity..."
>
> IBC Awards Committee

was developed that emphasized a classical style with a rich texture of brick facings consistent with university and community setting. The resulting sixteen span bridge design developed as an interesting juxtaposition of precast concrete arch elements and aesthetic facing treatments to form a handsome classical style structure within a park like setting. The structure is the first structure, in the world, which combined precast concrete arches with lightweight cellular concrete overfill. Harmony with the environment in park and river setting is emphasized with an artificial rock surface treatment, consistent with on-site geology, superimposed on the retaining wall immediately adjacent to the bridge.

Arthur C. Hayden Medal

The Arthur C. Hayden Medal, recognizing a single recent outstanding achievement in bridge engineering demonstrating vision and innovation in special

THE INTERNATIONAL BRIDGE CONFERENCE®

use bridges, will be presented to recognize Riverside Bridge, Cambridgeshire County, UK. This tied arch bridge, which is split to separately accommodate pedestrians and bicyclists, is fashioned to "live up to" the many famous bridges spanning the river in this historically significant area. The deck is curved in the horizontal plane purposely to blend with the meander of the river over which it passes.

> "... startling in its beauty...a modest delight which is fun for users ...simple...subtle...and striking..."
>
> IBC Awards Committee

As rowing is a featured recreational activity on the river, appearance from the river below was as important a consideration as appearance from the deck above. The inclined arch rib makes a purposeful architectural statement while providing the necessary backbone support of the bridge deck. With both pedestrians and bicyclists sharing the structure, sensitivity to vibration was an important concern and the superstructure has been fitted with tuned-mass dampers to mitigate dynamic oscillations.

James C. Cooper Student Award

The James C. Cooper Student Award recognizes undergraduate and graduate students who demonstrate an interest and passion for bridge engineering. The award is presented to winners of a student completion for technical writing and engineering insight. The 2010 Award will be presented to Sarira Motaref of the University of Nevada - Reno for her paper entitled: Seismic Performance of Precast Bridge Columns with Energy Dissipating Joints.

Historic Structure Preservation Award

This year the committee judged one of the award nominations to be special and beyond the traditional guidelines of the medal categories. Given the significance of the project which included the restoration of a historic and iconic river crossing, a special Historic Structure Preservation Award will be given to recognize the Poughkeepsie Highland Railroad Bridge which was converted to a pedestrian walkway as an integral linkage of a 30 mile rails-to-trail conversation. This 19th century engineering marvel, initially constructed in 1873, at a total span of 6,767 feet, was the longest cantilever span ever constructed at the time. Through a USEPA American Rivers Initiative, the structure is reborn as a pedestrian crossing of the Hudson River and offers great vistas of the Hudson River from its bridge deck. The restoration has indefinitely preserved the life of a magnificent and time worthy historic structure. Walkway over the Hudson (**http://walkway.org**), a non-profit organization is the proud owner of the structure.

Carl Angeloff, P.E., is a recently named Emeritus Member of International Bridge Conference Executive Committee and serves as an Awards Committee Member (and past Awards Committee Chair). Mr. Angeloff works for Bayer MaterialScience, headquartered in Pittsburgh, PA.

ARTHUR HAYDEN

Vision, Innovaton, Special Use Structures and the International Bridge Conference®

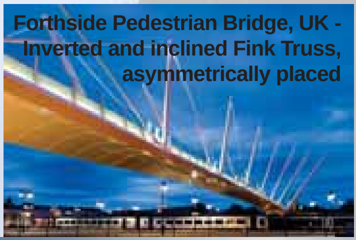
By: Thomas G. Leech, P.E., S.E..
and Conor McGarvey

In the 1930's an MIT graduate and young Westchester County Bridge Engineer, Arthur Hayden and the Westchester County's landscape architect, Gilmore Clark, formed a unique municipal partnership, designing signature short span bridge structures throughout the Westchester County parks and along and over the many "parkways" leading from the new suburbs north of New York City into the metropolis. A majority of these structures were constructed and designed on a principle of the rigid frame bridge, a new principal for the design era. As analysis of these indeterminate structures was complex in an era of "slide rule" computation, Arthur Hayden set out to document systematic rigid frame design principles while at the same time outlining principles to design rigid frame structures with "charm and beauty". The result was his publication of a sentinel textbook simply titled The Rigid Frame Bridge, initially published in 1931, and later republished in 1940 and again 1950. While a majority of the textbook is devoted to understating of the structural form of a rigid frame and developing special solutions of indeterminacy for the "slide rule" era, a significant portion of the book is devoted to architectural principles to guide bridge designers. These principles include:

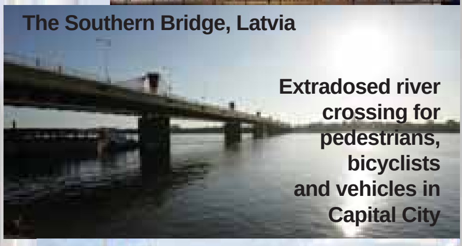
- FITNESS – defined as "strong enough to fulfill its purpose...and simple and honestly portray the materials which go to make it up..."
- BEAUTY – defined as "a simple structure, graceful in outline, expressing at the same time unity in design..."
- UNITY – defined as "... a rhythm over the spanned space...
- SUITABILITY – defined as "in harmony with its surroundings and ... an integral part of a large composition..."

In 2003, the International Bridge Conference®, as a part of its annual awards program, initiated a specific awards category, dedicated to special use structures that best capture the vision of Arthur Hayden and his collaborator Gilmore Clark. The award was purposefully named the Hayden Award which recognizes a single recent outstanding achievement in bridge engineering demonstrating vision and innovation in special use structures. Every year since the inception of the award designation, the IBC has received increasing number of entries into this category. Hayden award nominations come from all reaches of the world; typically there are as many overseas entries as there are continental entries. Award nominations for the year 2010, pictured on this page, have been outstanding with a total of 10 entries in this category alone. Each entry was unique in its own right and included a blend of solid engineering and creative architecture. The Award's Committee had a very difficult time choosing a single winner for the 2010 Hayden Award (announced on page 29); in fact virtually all entries were winners based on the criteria of vision and innovation!

Thomas G. Leech, P.E., S.E. is the 2010 IBC Award's Chairman. Conor McGarvey is the Conference Manager for the Engineers' Society of Western Pennsylvania.



Forthside Pedestrian Bridge, UK - Inverted and inclined Fink Truss, asymmetrically placed



The Southern Bridge, Latvia

Extradosed river crossing for pedestrians, bicyclists and vehicles in Capital City

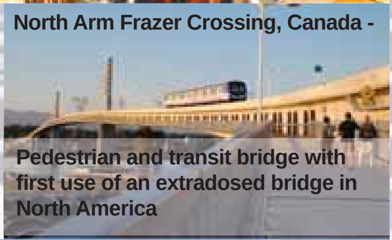
Cathedral Bridge, UK - Single pylon, cable stayed swing bridge for pedestrians – with a form to mimic the scissors and needle in the textile industry

Caernarfon Castle Bridge, UK - Curvilinear pedestrian bridge spanning a dry moat of an historic Welsh castle

The Kurilpa Bridge, Australia - Largest structural application of the "tensegrity" principle

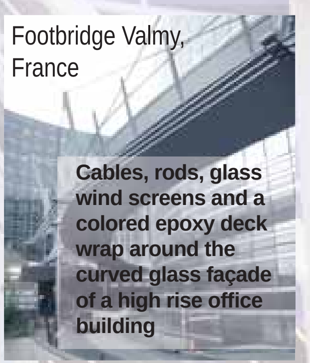
The Stawamus Chief Pedestrian Bridge, Canada

This concrete deck supported by outwardly splayed steel arches



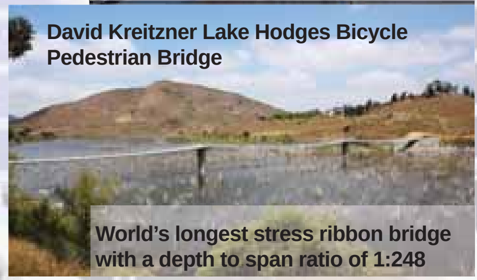
North Arm Frazer Crossing, Canada -

Pedestrian and transit bridge with first use of an extradosed bridge in North America



Footbridge Valmy, France

Cables, rods, glass wind screens and a colored epoxy deck wrap around the curved glass façade of a high rise office building



David Kreitzner Lake Hodges Bicycle Pedestrian Bridge

World's longest stress ribbon bridge with a depth to span ratio of 1:248

Spotlight on ESWP Outreach Programs

By: Mary Linn Theis

Founded in 1995, the ACE Mentor Program is a ground-breaking way of attracting at-risk students, particularly minorities and women, into careers in the integrated construction industry (architecture, construction and engineering.) ACE Mentor is a non-profit, industry-created organization headquartered in Stamford, Connecticut. ACE Mentor's mission is to expose high school students to career opportunities in architecture, construction and engineering, to encourage students to pursue the secondary and post-secondary education necessary for a career in the integrated construction industry and to support the development of basic and technical skills through mentoring relationships. For students who pursue post-secondary education, including registered apprenticeship programs, ACE Mentor also provides scholarship and grant support.

Currently, ACE Mentor Program has 72 affiliates across the United States, covering 192 cities in 36 states. There are approximately 10,000 students and 4,000 mentors involved in our programs.

Locally, in its 3rd year, ACE Pittsburgh currently has approximately 40 high school students involved in ACE Mentor Program from Baldwin High School, Bishop Canevin High School, Northgate High School, Quaker Valley High School, Pittsburgh Public School's Alderdice High School pre-engineering program, Career Connections Charter High School, North Allegheny High School, Seneca Valley High School, and Thomas Jefferson High School.

With a total of 13 educational sessions per year, the Pittsburgh chapter is a well-rounded program that includes site visits, trade visits, and firm visits of multiple disciplines. In addition to the educational sessions, students were also able to participate in the ACE Mentor College and Career Night which was held November 17, 2009 at ESWP. The 2009-2010 program will conclude with a Celebration and Recognition meeting will be held on May 11, 2010 at the Allegheny Intermediate Unit.

Mentors for this year's sessions include representatives from AECOM, Advantus Engineers, Astorino, Chatham University, Civil and Environmental Consultants, FortyEighty Architecture, PJ Dick Incorporated, Peter Margittai Architects, LLC, and Greater PA Regional Council of Carpenters.

Mentor and Executive Director, Anastasia Herk of Astorino has this to say about the program:

"I have been a mentor for ACE Pittsburgh for 3 years. Throughout those three years I have seen the program grow and mature providing new opportunities for the students and mentors each new year. I have seen students come back for the second or third year because they love the program and what it has to offer. Students from our program have received scholarships to colleges for engineering; dreams they found were possible only after attending ACE sessions. I have also seen mentors learn from mentors or even from students in the process creating an environment in which everyone enjoys and can learn.

Through the educational sessions students not only are provided with career information but they can witness the work that architects and engineers do first hand in their firms. They learn how buildings come together during visits to trade schools where they can get their hands dirty building a masonry wall. They learn how dreams and designs on paper are realized in the built environment during construction site visits. These lessons open a wide range of career possibilities for the students, possibilities they may not have known existed and ones as a mentor, you can introduce to them.

The ACE program starts each new year with a project. Session by session the students work on the project adding walls, landscaping, structure, plumbing, etc. They see a building take form as they progress through the program. They learn what it takes to make the paper product a built product. At the end of the year, they get to share this information with their parents, teachers, and friends. As a mentor, you help by providing this information to them and giving them the opportunity to see what they are capable of achieving.

Being a mentor for ACE helps you remember why you chose the field that you are in. We can sometimes get caught up in the mundane tasks of our everyday life but by helping students understand what we do can sometimes remind us as well."

In anticipation of more students and more participation in the coming 2010-2011 school year, a special ACE Mentor Planning Session will be held for all interested ACE mentors in June 2010. For more information on how to get involved, please contact us at WesternPA@acementor.org.

MORE IBC AWARDS

This past year, five members of the International Bridge Conference® (IBC) Executive committee were nominated as Emeritus Members of the IBC Executive Committee and Distinguished Members of the Engineers' Society of Western Pennsylvania. These dual designations recognize twenty-five years of (and in some cases, more) continuous service to the IBC Executive Committee and by extension continuous service to the Engineers' Society of Western Pennsylvania. This recognition of outstanding service was awarded to Mr. Carl Angeloff, Mr. Jim Dwyer, Mr. J. Fred Graham, Jr., (pictured left to right at the Annual ESWP banquet in February, 2010) and to Mr. Herb Mandel and Mr. Lisle Williams. From the IBC Executive Committee and ESWP a special thanks to Fred, Jim, Carl, Herb and Lisle for many, many years of service!

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