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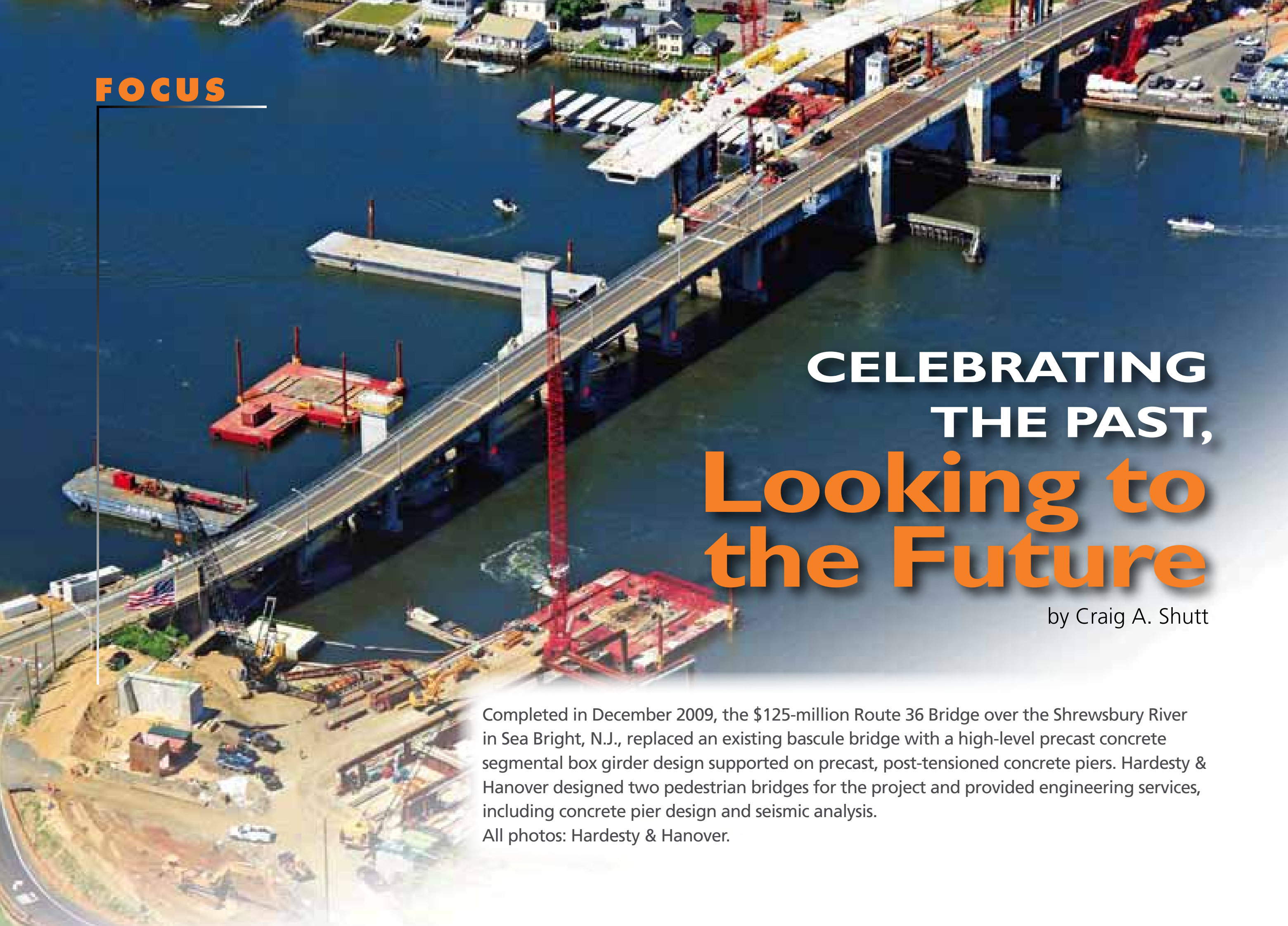

CELEBRATING THE PAST, Looking to the Future

by Craig A. Shutt

Completed in December 2009, the $125-million Route 36 Bridge over the Shrewsbury River in Sea Bright, N.J., replaced an existing bascule bridge with a high-level precast concrete segmental box girder design supported on precast, post-tensioned concrete piers. Hardesty & Hanover designed two pedestrian bridges for the project and provided engineering services, including concrete pier design and seismic analysis.
All photos: Hardesty & Hanover.

Hardesty & Hanover enters its 125th year with innovative techniques for designing bridges that are more durable, faster to construct, and more aesthetically pleasing

Bridge engineering has changed drastically since Hardesty & Hanover opened its doors in 1887. Founder Dr. J. A. L. Waddell was a leader in reinforced concrete and steel bridge design and held the patent for the first modern vertical-lift bridge design and other movable-bridge innovations. The firm's work still includes many movable bridges, but expansion into other sectors has enabled its designers to implement new techniques and innovations.

"We are experienced in all types of bridges, both fixed and movable," says Glen Schetelich, a partner in the New York-based engineering firm's Hoboken, N.J., office. The firm's engineers have focused primarily on mid- to short-span bridges, which have involved a range of challenges dealing with terrain, environmental concerns, owners' growing needs, and additional community input.

"Our clients look to us because of the depth of service we provide," adds Keith Griesing, director of engineering. "Many companies are technically capable of creating bridges, but they aren't as attuned to the client's needs as we are. Our goal is to partner with our clients and understand their challenges so we can first deliver a service and ultimately create the best product for them. Our project managers stress communication and teamwork."

Assessing Original Designs

The firm's long history has allowed it to return to some of its original designs. "We have a long history of building durable structures," notes Tim Noles, a partner in the Sunrise, Fla., office. "Having the original plans for a project can be beneficial during rehabilitation work, because it gives us insight into the original intent. Frequently, the owners themselves no longer have copies of the plans."

The firm has extensive history with rehabilitation, often analyzing bridges to determine if they can be preserved. "In some cases, we try to rehabilitate a bridge in kind, with improvements to meet current AASHTO criteria," Noles notes. "But often we replace a movable bridge with a new high-level, fixed bridge." That is happening more

The new $43 million precast concrete bridge along Route 35 over the Shark River in Belmar, N.J., extends 2000 ft using 17 spans of AASHTO girders, including a main span of 170 ft. The bridge, which replaced a bascule bridge that disrupted traffic to beachfront communities, is 84 ft wide and carries four lanes of traffic.

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today, Schetelich adds. "The federal government especially is looking to replace movable bridges, if it's feasible."

For instance, the Route 36 Bridge over the Shrewsbury River in Monmouth County, N.J., a 75-year-old double-leaf bascule bridge, was replaced with a high-level structure consisting of precast concrete segmental box girders and precast, post-tensioned concrete piers. The new bridge increases clearance to 65 ft along this main corridor to New Jersey's eastern beaches and the national park at Sandy Hook. Hardesty & Hanover designed two adjoining pedestrian bridges and provided geotechnical engineering, foundation and segmental concrete pier design, scour and seismic analysis, and utility relocation and access. More details of this project are provided in the Summer 2010 issue of *ASPIRE*.™

A similar replacement occurred with the former Route 35 Bridge over Shark River in Belmar, N.J., where a low-level bascule bridge was replaced by a 2000-ft-long, high-level, prestressed concrete bridge with AASHTO girders comprising 17 spans, including a main span of 170 ft.

Community Input Increases

Movable bridges often are replaced due to the growing focus on user costs, which have become a key priority for bridge owners. This concern often leads to more community input on each aspect of the project. "Some projects require a lot of community outreach, and, in those cases, we serve as the owner's partner," explains Griesing. "We can answer the technical questions, but we also understand the owner's goals and can represent those to the community. Today, engineering represents one small part of the puzzle in moving a project from its concept to completion."

That was a key challenge for the new design of the Roslyn Viaduct project along Route 25A over Hempstead Harbor in Roslyn, N.Y. The 29-span, pin-and-hanger steel viaduct was replaced with twin concrete segmental box-girder bridges built using the balanced-cantilever method. The 2200-ft-long viaduct and its 2775-ft-long approach roadway and ramps were replaced in staged construction including innovative design schemes to minimize traffic congestion. More details of this project are provided in the Fall 2009 issue of *ASPIRE*.

The New York State Department of Transportation set up a Bridge Task Force that met monthly with community groups and concerned citizens. "We really got to know the people most involved, and they learned about us," says Griesing. "The repetition created a more relaxed atmosphere so we could discuss concerns more informally."

The meetings included new ideas garnered from the groups and handouts that showed the current plan. "This was a new approach to a project for me, and it required a different set of skills than engineers typically use," he says. "But I expect it will occur more often with bridge owners."

The biggest concerns were the construction process and disruptions, he notes. "It was interesting to me that they were more interested in the 'how' than in the 'what,' " he says. "The construction staging, scheduling, and interaction with the work on a daily basis were key parts of the process."

Aesthetics a Growing Priority

Aesthetics also was a concern on the Roslyn Viaduct, as it often is in such meetings, he adds. "Owners are realizing that aesthetics have a great value to a community, particularly as older, established bridges are replaced. Citizens want a proportionate structure that reflects the community and the surrounding environment. It's going to be there for a long time, and those concerns have to be taken seriously. You have to partner with the community to get it right," says Greising."

That's especially important for many structures in Florida, adds Noles. "It's a national trend, but Florida is a leader in creating aesthetically pleasing bridges. That's because of its tourist industry and the many bridges along the coast, where they are landmarks in the community. The state wants its bridges to make an impression, because they add to the scenic landscape and can have a financial impact."

That was certainly the case when Hardesty & Hanover redesigned the Sanibel Island Causeway over San Carlos Bay in 2006. The firm first conducted an in-depth inspection of the existing double-leaf, Hopkins Trunnion-type bascule bridge with accompanying steel-stringer flanking spans.

Then it developed construction plans and specifications to implement the recommended high-level fixed bridge, consisting of precast, prestressed

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concrete Florida bulb-tee girders spanning a maximum of 144 ft over 21 spans for a total length of 2996 ft. The substructure features canted-leg reinforced concrete piers founded on precast, prestressed concrete piles. The substructure was designed for vessel-collision impacts and a 100-year storm scour. See the related article, "Concrete Bridges in Lee County, Florida," in the Spring 2009 issue of *ASPIRE*.

"The biggest challenge was working with citizen groups to create a design that satisfied their concerns and met the owner's needs," says Noles. Its impact on the skyline was a particular concern, as were aesthetic treatments and colors for railings, MSE walls, and other visible elements. "We invited the community to provide ideas and incorporated many of them into the design during a 3-month process."

Maintenance is Key

Owners also are guarding their long-term budgets more than ever. That often leads to concrete structures. "We've been designing bridges to LFRD standards to last 75 years, but 100 years is becoming more common," says Griesing. "That requires a more robust design, along with key improvements on a case-by-case basis to lower the allowable stresses. Most officials realize that focusing on short-term savings is not a good strategy anymore."

Adds Noles, "Many owners prefer concrete, because they won't have to paint it, even with new painting systems that extend paint life. Concrete bridges can result in lower maintenance costs than steel bridges."

Concrete bridges also are being considered more often due to the speed with which they can be built once the site is available. Precast concrete components in particular can reduce the amount of time needed for road closures, even if they don't speed up the overall design-to-completion time, notes Griesing. "They provide a more intense impact for a shorter duration, which officials like."

Preconstruction activity has increased, he adds, because it keeps the site clear and open for longer. "New York State likes precast concrete projects," he says. "They like the prefabrication aspect, as well as the shop-level quality of the components and the amount that can be done in a short time once the pieces arrive at the site."

Using the NEXT Beam

The firm recently worked with PCI Northeast, a chapter of the Precast/Prestressed Concrete Institute to incorporate a new mid-size girder for span lengths of 50 ft to 80 ft, into one of its projects. The beam, called the Northeast Extreme Tee (NEXT) girder acts as a simple span under dead load and continuous under live load with the use of a cast-in-place closure at the pier.

The firm used the beams as part of its rehabilitation of the Kew Gardens Interchange in Queens, N.Y., which consists of the Van Wyck Expressway, Grand Central Parkway, and the Jackie Robinson Parkway. The Queens Boulevard Bridge in this complex will feature a two-span, NEXT-beam structure, providing a form for a lightweight cast-in-place concrete deck, saving substantial time during construction. Beam lengths will run between 68 ft and 88 ft. The beams and girders utilize concrete with a specified compressive strength of 10,000 psi.

The design of the $127-million precast concrete Roslyn Viaduct project over Hempstead Harbor in Roslyn, N.Y., was developed with input from a Bridge Task Force that included local public officials and appointed representatives of community groups. Those discussions included the replacement bridge and pier types, staged construction, traffic noise concerns, aesthetics, environmental impact, business impact, and other factors.

The $29-million Sanibel Island Causeway over San Carlos Bay in Florida consists of a precast concrete high-level, fixed structure that replaced a bascule bridge. The new design, spanning a maximum of 144 ft over 21 spans for a total length of 2996 ft, features prestressed concrete Florida bulb-tee girders. The substructure consists of canted-leg reinforced concrete piers founded on prestressed concrete piles.

New Concepts Proliferate

Hardesty & Hanover's designers are looking at other innovations in concrete bridge design as well. These include lightweight concrete, especially for decks, as in the Queens Boulevard Bridge, and a variety of concrete additives, such as silica fume, fly ash, and calcium nitrite to add durability by inhibiting moisture penetration and corrosion. They also are using more epoxy-coated reinforcement to increase durability. "There are some new products on the horizon that we expect will help increase durability," says Schetelich. "We are always looking for new ideas and working with manufacturers to find new concepts."

That includes an increased use of self-consolidating concrete (SCC), adds Griesing. New York State in particular has been using more SCC. "They like the flowability," he explains. "As precast concrete shapes become more complex, they require more reinforcement including additional post-tensioning. SCC can ensure there are no voids as the interiors become more crowded. The smooth finish is also very desirable."

Increased seismic forces are leading to more heavily reinforced components, which encourages the use of SCC, says Schetelich. Those requirements are impacting many elements, including piers. "As the codes tighten, I expect we'll see more reinforcement needed, which will lead to increased use of SCC."

The firm's engineers intend to continue to use new technologies, in conjunction with their long history and knowledge of existing bridges, to aid their clients in creating innovative designs. "New segmental concepts are providing new ways to meet challenges, and there are other techniques that are gaining ground now," says Griesing. "They give us more flexibility in meeting challenges and add more tools for us to use."

For more information on this or other projects, visit www.aspirebridge.org.

Building on 125 Years

The firm that would one day become Hardesty & Hanover was founded by Dr. J. A. L. Waddell in 1887 in Kansas City, Mo. He believed his firm could succeed only if it was owned and operated by innovative and passionate engineers like himself.

That philosophy continues today, following the announcement in September that the company has formed a strategic alliance with Thornton Tomasetti Inc. in New York to collaborate on the evaluation and engineering of transportation infrastructure and movable structures. The two companies have worked together in the past on an informal basis, notably on the replacement for the drive system for the five retractable roof panels at Miller Park in Milwaukee, Wis.

Waddell's company became Waddell & Hendrick in 1899, followed by Waddell & Harrington in 1907 and Waddell & Son in 1917. It moved to New York City in 1920, and became Waddell & Hardesty in 1927 when Shortridge Hardesty was made a partner. The name changed a final time in 1945 when Clinton D. Hanover joined the firm.

Among the company's signature structures is the South Halsted Street Bridge in Chicago, built in 1894, which became the prototype for vertical-lift bridges. Other early structures included the Arroyo Seco Bridge in Pasadena, Calif. (1913), the Goethals Bridge and Outerbridge Crossing in New York (1928), the Marine Parkway Bridge in New York (1937), and the Rainbow Bridge to Canada from New York (1941).

Hardesty & Hanover today operates 13 offices worldwide with more than 250 employees.

The new Queens Boulevard Bridge in the Kew Gardens interchange in Queens, N.Y., will feature the Northeast Extreme Tee (NEXT) beam developed by PCI Northeast. The beam offers a modified tee shape that creates advantages while utilizing concrete with 10,000 psi compressive strength.