

Evolving with Technologies

The Lesner Bridge in Virginia Beach, Va., consists of twin precast concrete segmental box-girder bridges erected by span-by-span and balanced-cantilever methods. All Photos: RS&H.

RS&H partners with clients and contractors to improve concrete segmental bridge designs and construction engineering, to provide inspection oversight, and to help codify best practices and innovations.

by Craig A. Shutt

RS&H has made a name for itself with its history of design and construction management on concrete segmental bridges. These efforts continue to bring in new projects and help the company expand to new clients, geographies, and markets. As the firm continues its strong growth, it is also helping to improve design and construction concepts by codifying best practices and working on innovations to advance the industry.

"Our work on segmental bridges on the construction management side of our business has gotten our foot in the door with new clients and helped us expand," says Timothy Barry, vice president and bridge construction leader at the Jacksonville, Fla.-based firm. "Clients have noticed our work in that area, and our efforts to advance new ideas have caused owners to seek out our expertise."

The firm, established in 1941, has worked on concrete segmental bridge construction projects with the Florida Department of Transportation (FDOT) since the mid-1980s and has been engaged with the American Segmental Bridge Institute (ASBI) committees and task groups. "Our expertise and FDOT's experience have created a strong partnership that has advanced FDOT's approach to segmental bridges," explains Doug Geiger, senior vice president and construction

management practice director. "FDOT has been a leader in these designs and has encouraged new techniques in the industry."

That encouragement gave RS&H the opportunity to advocate for new concepts and help codify them, adds David Sweeney, chief executive officer. "We evolved and learned best practices as we oversaw segmental bridge construction and saw the advantages they offered. Then we worked with FDOT to improve the details as issues arose. Now, that expertise is helping us expand to other states as we become known for our involvement in best-practice evolution through detail and specification development."

Diversity Drives Innovation

Sweeney believes that RS&H's ability to drive new solutions results from the diversity of its clients and partners. "Few professional-service companies actively work across the range of transportation sectors that serve land, air, and space," he says. "We design roads, bridges, airport terminals, runways, military and commercial launch sites, and a variety of [other] complex projects. Our experience with each of those creates solutions that can work in other areas."

One example is a concrete structure built for the National Aeronautics and Space Administration (NASA)

launch facility in Wallops Island, Va. RS&H's bridge division worked with the aerospace division to design an enplaning ramp that carries the launch vehicle from the roadway grade to the elevated launch position. "Our bridge designers could apply their knowledge to this aerospace project and create a workable and site-appropriate solution," Sweeney explains. "That type of cross-sector application can bring considerable value to our clients and partners across all of the sectors we serve. We take everything we learn across the board and find ways to apply

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it to other sectors." The firm also provides turnkey services from start to finish, notes Geiger. "Our skill set carries the project from inspection of the site and development of design concepts through construction management to the end of construction. Additionally, we provide in-service inspection for bridges, which is required on a two-year inspection cycle, as mandated by most bridge owners. Clients recognize that

we know every aspect of the project, and that adds value for them in any type of project."

RS&H has worked to stay at the forefront of new developments, and it has seen many changes and advancements. "The segmental bridge industry has been changing rapidly since the early 2000s, as it addresses issues and develops new specifications, new practices, and new technologies," says Barry. "We've had a front-row seat and contributed heavily to ASBI to provide input and ideas. New technologies are developing with almost every project, and plans evolve with those [innovations]."

An example is the Interstate 95/Interstate 295/State Road 9A North Interchange Project in Jacksonville, Fla., a precast concrete segmental balanced-cantilever overpass completed in 2010. "Segmental design and construction was instrumental because its longer spans addressed the difficulty in constructing this overpass over existing roadways and on a tight radius to limit right-of-way acquisition," Barry explains.

It was the first structure to require the use of duct couplers for joining post-

tensioning ducts at segment joints. This technology was developed during the project and implemented immediately. It has now become a standard in the industry.

RS&H worked with the owner (FDOT), contractor (Superior Construction of Jacksonville, Fla.), and post-tensioning system supplier as the owner's representative during construction to refine the technology. "It contributed to our role as an industry leader and allowed us to continue growing our segmental experience, helping our clients and expanding our expertise," Barry says. (For more on this project, see the article in the Winter 2011 issue of *ASPIRE*®.)

Collaboration Is Key

Advancements are aided when stakeholders remain open to ideas and the construction team pools its knowledge and works collaboratively, says Sweeney. "Success depends a lot on how open the owner is to change. FDOT has been very progressive, which helps advance new concepts. When we can bring together the right stakeholders to share ideas and consider possibilities, we get the benefit of a lot of new perspectives."

Design-build delivery methods have aided collaboration, but only under the right circumstances. About 15% of the firm's design portfolio features design-build projects. "It's not always the best approach for us," he says. "The key factor is whether we are carrying the proper amount of risk for our level of participation in the project. The sweet spot on design-build for us comes on larger projects with higher construction values. They give us more opportunity to involve more of our resources to drive toward cost-effective solutions in partnership with our contractor teammates."

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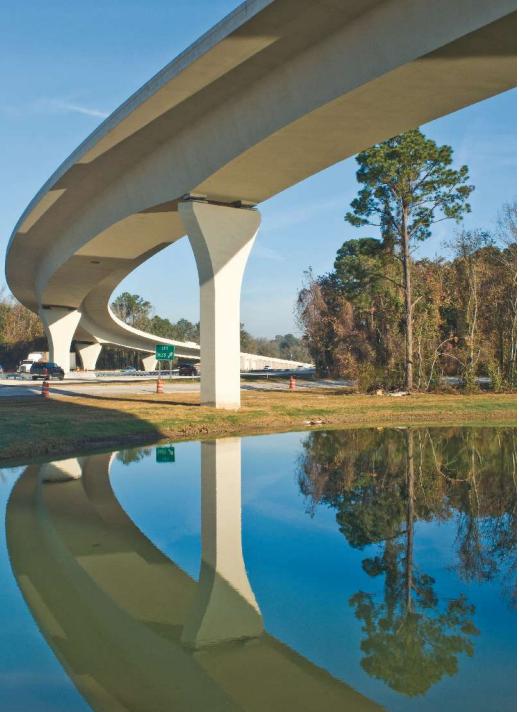
In regard to risk sharing, owners are adding requirements for contractors to accept more responsibility for quality control. "They want to minimize their level of risk factors and bring the contractor into this area more directly," Geiger notes. "As a result, our staff has evolved from doing hands-on testing and inspecting to doing higher-level engineering and providing an observational and advisory function for contractors and owners."

As a result, RS&H's construction engineering and inspection (CEI) management staff includes more engineers. About 45% of the inspection teams are composed of engineers, and 60% of the construction-inspection personnel have engineering degrees. "It has helped us differentiate ourselves because our inspections are done by engineers who understand the design concept and how the end product should perform," Geiger says. "That sets us apart from companies who perform mainly materials testing, as they are performing a different role than what we can provide."

An early design-build project for the firm was the Veterans Memorial Bridge in Martin County, Fla., completed in



RS&H's first design-build project as lead designer was the 19-span Veterans Memorial Bridge in Martin County, Fla., that crosses St. Lucie Waterway. The project features concrete beams and drop-in post-tensioned spliced girders.



The North Interchange Project in Jacksonville, Fla., features a precast concrete segmental box-girder overpass. The concrete segmental design resolved challenges in design and construction created by difficulties with placing the overpass over existing roadways and limited right-of-way. It was the first project to specify duct couplers for joining internal post-tensioning ducts, which is now a standard technique.

2013. Serving as the lead designer, RS&H, working with Archer Western Contractors (Walsh Group), designed the 3100-ft-long structure as a 19-span concrete-beam bridge using Florida I-beams and hammerhead-type piers and drop-in spliced girders. Two 250-ft spans allowed the bridge to cross the St. Lucie Waterway with fewer piers, helping to address the highly sensitive environmental concerns.

The 460 Connector in Breaks, Va., features twin cast-in-place concrete segmental structures that are the tallest in the state. RS&H also assisted the Virginia Department of Transportation with the development of segmental bridge specifications for this and future projects.

"This project was a great success for our design-build practice, which has become a large part of our firm's growth strategy," says Barry. "It reinforced our value and relationships with major contractors and expanded our transportation-client base beyond state and local agencies." The bridge won numerous awards, including a National Award of Excellence from the Design-Build Institute of America.

Environmental Concerns

Terrain issues often lead to creative concepts. On the 460 Connector project in Breaks, Va., RS&H performed CEI oversight of the twin 1733-ft-long cast-in-place concrete segmental box-girder structures erected by the balanced-cantilever method. The tallest bridges in Virginia, they were built from the top down because of the mountainous site.

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"Cast-in-place segmental concrete superstructure construction made the most sense," says Barry. "Access from the ground was difficult, and large girders could not be delivered to the remote construction site. Environmental and site access issues have become a driving force for using segmental concrete and for concrete in general."

The 460 Connector also was significant for RS&H because it represented the firm's first CEI oversight project outside of its home state. "We were chosen,

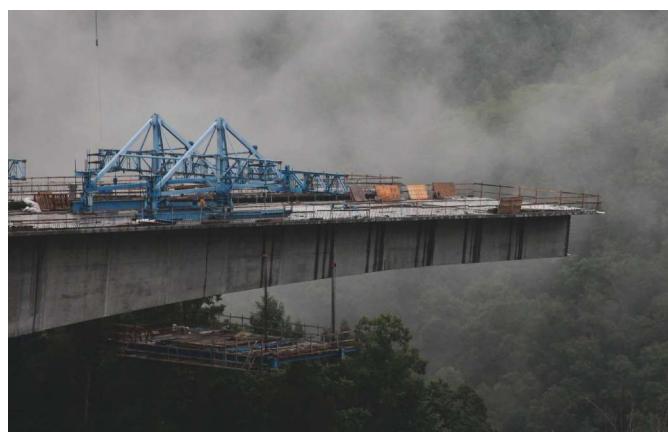
in part, because of the expertise we gained from our segmental experience in Florida," Barry says.

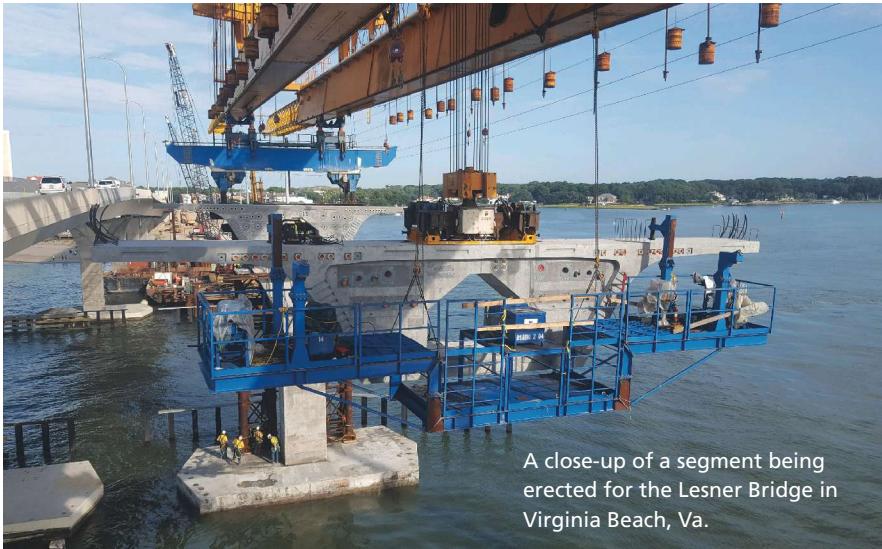
The firm's work went beyond construction oversight, however. "We also were tasked with developing new segmental specifications for the project and for VDOT [Virginia Department of Transportation] as a whole. The project was a significant growth opportunity for us as a firm and grew our segmental reputation as well."

Embracing Innovation

The 460 Connector project led to further expansion in Virginia, including CEI oversight for the Lesner Bridge replacement project. This ongoing project features twin 1575-ft-long precast concrete segmental box-girder bridges for a new client, the City of Virginia Beach. "A concrete segmental design was chosen due to difficult conditions on the site and for aesthetic reasons. This is a significant structure for the city, and both aesthetics and long-term durability were very important to them," Barry says. For RS&H, the project "was significant because it continued our segmental experience on a broader scale and added a new client outside of Florida."

A key element of the project's design was the goal of achieving a 100-year lifespan. The designer, Figg Engineering Group, addressed that goal by specifying high-performance 8-ksi concrete. "It was an unusual product to specify as a production-level concrete," says Barry. Because of the highly aggressive environment adjacent to the Chesapeake Bay, the concrete had to achieve a low





A close-up of a segment being erected for the Lesner Bridge in Virginia Beach, Va.

permeability, requiring testing for every placement. The designer also specified corrosion-resistant reinforcing (CRR) steel. A requirement in Virginia, CRR steel adds to the long-term durability and less steel can be used because of the higher-grade steel used to satisfy the CRR requirements.

"As the owner's CEI consultant, RS&H understands its role with long-term durability by embracing these innovations and providing the level of oversight to ensure they are met," says Sweeney. "We understand that our clients rely on us to make sure they are getting what they paid for."

Innovations continue with every project, such as the Wekiva Parkway Section 6 project just getting underway in Orlando, Fla. Site conditions and environmental concerns made a cast-in-

place segmental box-girder design the best choice, Barry says. The 2068-ft-long structure will be the first in the country to use new post-tensioning technology involving flexible filler instead of grout.

"It was significant for us to be chosen to provide construction oversight for this project, as it signifies our commitment to the industry and our service to our clients to help further the industry by embracing new technologies," Barry says. "It also expands our segmental and major concrete bridge resume, positioning us for further growth."

Geiger also looks forward to digging into this new concept. "The segmental industry continues to move forward with new technologies, and we're right there with them. We take pride in the fact that FDOT is showing great faith in us to oversee this new technology. It could be the future; we don't know

RS&H's Evolving History

RS&H was founded in 1941 by engineers George B. Hills and John F. Reynolds and architect Ivan H. Smith. They decided to combine architectural and engineering capabilities to create a firm that would be more efficient than their separate small firms. With World War II imminent, they focused on military projects, including what would become NASA's Cape Canaveral facility in Florida.

After the war, the firm designed power plants, airports, and industrial facilities, adding offices throughout the Southeast. In the 1960s, it worked closely with NASA's manned spaceflight program and the U.S. Air Force's missile program. Over the next 20 years, it added several subsidiaries and affiliates, increasing staff and offices across the United States.

RS&H returned to an employee-ownership model in 1990. Today, the firm has 1089 employees in 50 offices focused in six markets: transportation, aviation, aerospace, corporate, defense, and health and science. It ranks 70th in *Engineering News Record's* Top 500 Design Firms. It also ranks 11th in *Roads & Bridges'* Top Bridge Design Firms.

yet. But it'll be exciting to see how it works." **A**

For additional photographs or information on this or other projects, visit www.aspirebridge.org and open Current Issue.



Rendering of Wekiva Parkway Section 6 project in Orlando, Fla., which will include new post-tensioning protection technology using flexible filler rather than grout. With construction beginning in late 2017, it is scheduled for completion in spring 2021.