

# Engineering in Constructability

STV has stayed on the cutting edge of constructible concrete designs through involvement in challenging projects and collaborative approaches that ensure knowledge is shared

by Craig A. Shutt

STV has gained recognition for its expertise with spliced, post-tensioned concrete girders and other long-span concrete designs, and for innovating to meet schedule, cost, and environmental challenges, among others. Today, the firm has spread its influence through partnerships with designers and contractors, and by helping to codify techniques.

"We've been on the cutting edge of improvements and changes to long-span concrete bridges for a long time," says Stu Matthis, vice president of corporate development and facilitator of STV's national bridge practice. Matthis joined the New York-based company in 2005, when his firm, Ralph Whitehead Associates (RWA), was acquired by STV. By adding that company's expertise to STV's own, its reach expanded into the southeast United States from RWA's Charlotte, N.C., base, where Matthis has worked since 1982. (For more on STV's growth, see the sidebar.)

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"Contractors often come to us once they have won a construction bid to tap into our expertise and service for enhancing constructability and economics on long-span bridges," he says. "They also look to us during the design phase for ideas to meet challenges."

The company became involved with spliced-girder concepts in the mid-1980s through Reid Castrodale, who worked on staff for many years (and now serves as managing technical editor for *ASPIRE*<sup>SM</sup>).

"Reid obtained his PhD and wanted to explore high-tech bridge capabilities. He helped us pursue some major projects and became a technical advisor on many of our concrete projects. We picked up the ball from there." Today, about 60% of the company's bridge work involves concrete designs.

The firm's reputation was enhanced in September 2003 when NCHRP (National Cooperative Highway Research Program) Report 517 (Project 12-57), "Extending Span Ranges of Precast, Prestressed Concrete Girders," was completed by RWA, with technical input from several other experts in the field. "That was a watershed event for us," Matthis says. "It staked our claim to having expertise with spliced girders and being on the cutting edge of improvements and changes in the industry. It put us on the map in that regard."

## Railroads Are Key Clients

Many of the firm's innovative designs have been created for railroad clients, a major focus for both STV (passenger) and RWA (freight rail) before the two merged. "We've worked for all the Class I railroads over the years," Matthis says. That work complemented STV's nationwide resume for mass transit projects, including projects for the Massachusetts Bay Transportation Authority, the Chicago Transit Authority, and the New York Metropolitan Transportation Authority. That category remains a solid growth market, he notes.

"We've been able to capitalize on opportunities in the Southeast that didn't exist when we began our transit work. At the time, there were only a

Ironworkers align the couplers for the post-tensioning bars as they set the precast concrete column cap segment at pier 7 for the Roslyn Viaduct. Photo: Renata Magoc.





Speed was the critical component in STV's design for the CSX Transportation railroad bridge in Bay St. Louis, Miss., which was destroyed by Hurricane Katrina in 2005.

Photo: STV.

few lines in the region, such as Atlanta and Miami. Now, we've worked on lines in Charlotte, Raleigh, Hampton, Va., and other areas."

Such work, while typically providing more flexibility for design solutions, presents different challenges than other transportation projects. State departments of transportation (DOTs) often have structured design requirements, including their own manuals and software. Priorities often are different too.

"Railroads are motivated mostly by scheduling and safety, due to their vulnerabilities and the potential nature of accidents. Precast concrete's production schedules and speed of erection are major benefits."

One example where speed was of the essence is the CSX Transportation Railroad Bridge in Bay St. Louis, Miss., which was destroyed by Hurricane Katrina in 2005 (see Spring 2007 *ASPIRE*). With train detours estimated to cost \$1 million per day, CSX needed the 10,050-ft-long structure back online quickly. STV used American Association

American Association of State Highway and Transportation Officials' (AASHTO) Type IV prestressed concrete beams with a cast-in-place concrete deck helped bring the CSX Transportation railroad bridge back into service in only 156 days, before construction had even begun on the highway bridge in the foreground. Photo: STV.

of State Highway and Transportation Officials (AASHTO) Type IV prestressed concrete beams with a cast-in-place concrete deck to restore service in only 156 days, before construction had begun on the adjacent highway bridge. The precast concrete producers delivered about 60 beams per week when construction got underway. "We used as much precast concrete in the design as possible" notes Dan Doty, STV's chief railway bridge engineer.

Speed has become a driving force for bridges of all types. "We're definitely using more accelerated bridge construction [ABC] techniques today," Matthis says. "We're a big supporter of the Every Day Counts program from FHWA [Federal Highway Administration]." Matthis served on an AASHTO/American Council of Engineering Companies/FHWA task



## STV's 100+ Years of Experience

STV's oldest predecessor firm, Seelye Stevenson Value & Knecht, was founded in New York, N.Y., in 1912 (as Elwyn E. Seelye & Co.) as a structural engineering firm. Over the years, the firm's disciplines grew to include mechanical, electrical, and civil engineering. Another predecessor firm, Sanders & Thomas, was founded in Pennsylvania in 1945 and performed process and industrial engineering.

In 1968, the combined Sanders & Thomas' companies merged with manufacturer Voss Engineering Co. to form STV Inc., a holding company that ultimately evolved to contain STV Group. Later acquisitions included Lyon Associates (1983), which added international capabilities in several key foreign cities, and STV Environmental and STV Architects, both in 1990.

STV Construction Services was formed in 1994 to undertake design-build contracts, while STV/Silver & Ziskind was added that same year to supply architectural expertise for criminal justice, education, and healthcare facilities. In 2006, STV acquired Ralph Whitehead Associates, a southeast-regional consulting civil and transportation engineering firm.

Today, STV Group is a 100% employee-owned firm and is ranked 20th in *Building Design + Construction's* list of top construction and project management firms and in their Top 10 engineering firms in transit, government, K-12, and multifamily sectors.



The I-85 Yadkin River Veterans Memorial Bridge near Salisbury, N.C., featured dual 2900-ft-long structures. Photo: Aerophoto.

force on ABC, which took a high-level approach to the concept. “Our goal was to streamline environmental permitting and allow construction to begin quicker and be more efficient,” he says. “Permitting is a key part of the scheduling process.”

Permitting often goes faster when bridges can span waterways with fewer piers, he notes, leading to longer concrete spans. “Agencies typically want to avoid water obstructions whenever possible, and DOTs are definitely looking at new ways to complete bridges faster and more economically. Those elements often can be helped by more streamlined permitting.”

ABC aided the design and construction of the U.S. Route 29/70 bridge over the Yadkin River, part of a larger \$140 million design-build project for the North Carolina DOT that replaced deteriorated northbound lanes in a tight, environmentally sensitive area. With the southbound bridge on one side carrying four separate phone/cable lines, and a major overhead transmission line and freight railroad bridge on the other, there was little room to operate.

The new 873-ft-long bridge features seven spans of prestressed concrete bulb-tee girders made continuous for live load. The superstructure was constructed by moving a crane along each span as it was completed, using a top-down approach. “We came up with a concept that wasn’t contemplated in the environmental documentation,” he says. “It assumed you had to get

beside the bridge to build it. We found it would be much quicker to avoid that and work from the top down.”

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Another portion of the project, the Interstate 85 (I-85) Yadkin River Veterans Memorial Bridge near Salisbury, N.C., featured dual 2900-ft-long structures with 77-in.-deep prestressed concrete bulb-tee girders (see Winter 2014 *ASPIRE*). These girders, which are from the family of girders developed by the Prestressed Concrete Committee on Economic Fabrication (PCEF), were up to 140 ft long and were also made continuous for live load. Railroad tracks and multiple environmental constraints, including a reservoir with wetlands on each side of the river, severely limited access to the site from the north, west, and east. Prefabrication of components helped alleviate congestion and sped up construction.

### Design-Build Growing

The I-85 Yadkin River Veterans Memorial Bridge project was completed via a design-build contract, which has become more popular, Matthis says. “Design-build is becoming more prevalent, as it is schedule-driven. We’re seeing clients using it in return for a faster schedule. They can easily understand how it speeds

up the process by being able to overlap design and construction. Most states are now involved, to some extent.”

The firm often teams with both Flatiron Construction and Lane Construction on such projects, as it did on the I-85 Yadkin River Veterans Memorial Bridge project, especially when precast concrete designs provide the best alternative. “Lane owns a PCI-certified prestressed concrete plant, Prestress of the Carolinas. So when we pursue projects, we can often value-engineer them to precast concrete girders and take advantage of their in-house facility.”

He also has seen public-private partnerships (P3) gaining popularity. “We see more potential for P3 projects, but they place us in a more subordinate role than we are accustomed to serving,” he says. “It’s definitely a different way of working and a different chain of command.”

Another growth market has been inspection and rehabilitation, as bridge owners look to extend their limited funds to add efficiency. “Our inspection services are mostly carried out in the Northeast due to the nature of bridge design,” he explains. “The weather and maintenance needs deteriorate bridges much quicker and more rehabilitation work is required.”

STV provided construction inspection services on the Roslyn Viaduct project on New York Route 25A over Hempstead Harbor in Nassau County, N.Y. The original bridge was determined to be

too deteriorated to renovate, so a new structure, featuring precast concrete haunched box girders, was designed (see Fall 2009 *ASPIRE*).

## Stakeholder Input Increasing

With both rehabilitation and replacement projects, gathering and incorporating feedback from all stakeholders has become a key consideration. "People are savvier today and know how to influence designs to suit their needs," Matthis says. Organizations such as the Southern Environmental Law Center influence many designs and bring up issues that must be addressed. "They're concerned that states are building too many infrastructure projects and not paying close enough attention to environmental issues." Such factors create a delicate balance between speeding up projects to reduce user costs and ensuring all environmental concerns are met.

**'The level of stakeholder involvement is much higher compared to 20 years ago.'**

The firm's engineers often take part in stakeholder-coordination programs through meetings, workshops, online reviews, and other formats. "Feedback

programs have become much more robust, especially on larger projects," he says. "The level of stakeholder involvement is much higher compared to 20 years ago." These programs often are client-driven, he notes. "But if we show we can facilitate them, it's a positive for our consideration in the project. Owners expect this input today and want the team to be sensitive to these needs."

The I-85 Yadkin River Veterans Memorial Bridge, for instance, required input from the owner, local citizens, the U.S. Army Corps of Engineers, North Carolina Division of Water Quality, Duke Energy, Norfolk Southern Railway, North Carolina Railroad, and the Federal Energy Regulatory Commission.

## On the Cutting Edge

This range of needs and challenges motivates STV's designers to stay abreast of new developments with concrete materials. "We try to stay on the cutting edge and are always interested in new techniques," Matthis says. "We were one of the first to use lightweight concrete in North Carolina on a routine basis for bridge decks. We expect it will be used in girders soon, too. Any use will benefit where there is a sizable dead load."

Span lengths also will increase, he says. "We're definitely looking to concrete for longer spans. We're



The I-85 Yadkin River Veterans Memorial Bridge was built on a site with multiple environmental constraints, severely limiting access from the north, west, and east. Photo: STV.

already pushing the limits on concrete strength. People chuckle at the notion of 5 ksi today, but that used to be standard. Now, with the addition of materials like fiber reinforcement, post-tensioning techniques, epoxy-coated reinforcement, and corrosion inhibitors, more improvements are possible."

STV also intends to continue to expand via mergers, like the one with RWA, which added new expertise and regional coverage. "We're definitely looking for acquisitions throughout our divisions on an active basis," he says. "We're looking at more all the time." Those mergers will help the company remain on the cutting edge and extend its experience so it can innovate as new challenges arise. 



STV provided construction inspection services on the Roslyn Viaduct project on New York Route 25A over Hempstead Harbor in Nassau County, N.Y. The bridge was replaced with a design featuring precast concrete haunched box girders that reflects the character of the original structure. Photo: Rich Lorenzen.