

Corven Engineering stays true to its roots while leveraging its expertise to maximize potential

Corven Engineering has its mind set primarily on one goal: providing clients with the best possible, post-tensioned concrete bridge engineering. "We do this by staying focused and maximizing potential within our niche," says founder John Corven, president and chief bridge engineer of the Tallahassee, Fla.-based company.

The firm's expertise in concrete segmental and cable-stayed bridges serves as its foundation. The company leverages that expertise in four areas of work: new designs, construction engineering, inspection and rehabilitation, and developing and sharing technology. "Work in these areas mutually supports the others, solidifies the niche, and keeps us current and relevant," he says.

This approach also provides many entry points for providing engineering services throughout the life of a bridge. "We love to design new bridges and support contractors during construction," Corven adds, "but it is just as important to work with owners to extend bridge life and increase operational capacity."

Corven Engineering's approach to work has diversified its customer base. The firm opened its doors in 2000 working primarily for state departments of transportation. "The biggest change in our company has been the transition to gaining more work with other types of clients," he explains. "The major part of our business now comes from teaming with contractors or larger engineering firms to provide our expertise on large projects."

An example is the company's work on Phase 1 of the Dulles Corridor Metrorail Project in Tysons Corner, Va. Corven is working for Dulles Transit Partners, a



joint venture of Bechtel and Washington Group, on this \$1.8-billion project. Their work focuses on the design and construction support for more than 5 miles of aerial guideways to carry the extension of the Washington Metropolitan Area Transportation Authority (WMATA) system. It includes four types of precast concrete segmental bridge construction. (For more on the project, see the Fall 2011 issue of *ASPIRE*.™)

"Mega-firms were needed for that kind of project," Corven says. "But we are able to help provide cost-effective solutions for specific bridge challenges. That help can involve a specific design feature or the entire bridge design."

Post-Tensioned Designs

Post-tensioned concrete bridges, and segmental bridges specifically, continue to offer great potential for new bridge designs, he notes. "The basic principles of segmental construction are sound. It permits construction where access is extremely difficult, especially

above traffic. It can help protect the environment, keep traffic moving, and provide complex geometry where necessary. It makes a very good choice in those circumstances."

Corven Engineering has worked with clients in a variety of delivery methods, although the designers favor the design-build approach, says Phil Hartsfield, vice president and head of construction engineering. "It allows us to be involved from the beginning and follow the project through to construction." In many cases, he explains, the company's entry point comes on the construction engineering aspects, which brings them to the project after many decisions have been made that could have been made more cost effective if made earlier.

"If we are involved earlier, we can often spot problems that can be resolved before they reach a critical point," he says. "Design-build gives us that early input and lets us work through challenges that arise all the way through the process."

Staying Focused

by Craig A. Shutt



Segmental construction has proven to be an excellent solution for the Dulles Corridor Metrorail Project, located in the congested Washington, D.C., metroplex. Corven worked with Dulles Transit Partners to design and construct the aerial guideway, featuring more than 2700 precast concrete segments. Photo: Dulles Transit Partners.

One such project is the Foothills Parkway Bridge No. 2 now under construction in Blount County, Tenn. This balanced cantilever, precast segmental bridge is being built around

girder bridge in the United States. The three-span, 480-ft-long bridge is anchored by two precast, prestressed concrete adjacent box-beam spans crossing a local road and a railroad.

a steep, rugged mountainside that is environmentally very sensitive. Bell and Associates Construction (prime contractor), VSL (segment erection and post-tensioning), and Corven (engineer of record and construction engineer) collaborated to develop a unique erection trestle and segment walker for segment erection. By working together early, Corven was able to design the bridge with VSL's erection equipment in mind.

Another such project was the Cross Street Bridge in Middlebury, Vt., on which Corven served as the spliced-girder, main-span engineer of record. The structure was the first project in the state to use a design-build format. That delivery method produced a 240-ft-long center span, the longest simple-span, post-tensioned, spliced-

Environmental concerns led to the design, which eliminated a pier in Otter Creek. (For more on this project, see the Winter 2011 issue of *ASPIRE*.)

"Owners are aware of the capabilities of these approaches and are using them more often," says Hartsfield. "Owners are very intelligent and are embracing different delivery methods. Sometimes there are misconceptions that design-build approaches will eliminate every issue early on, but there's still a lot of work to be done. But it does allow you to get the project into construction quicker."

Owners are focusing on speed of construction as a priority, notes Corven. "There is a growing demand for faster delivery, as citizens want projects completed, and they don't get cheaper down the road. Precast concrete, including segmental construction, lends itself well to accelerating bridge construction. We strongly support the federal government's 'Every Day Counts' initiative."

Construction Engineering

The company also provides construction engineering services to a growing number of contractors, adds Hartsfield. "We are finding a lot of success by supporting contractors during construction and ensuring that designs are constructable."

An example can be seen in the work performed on the I-95/I-295 North Interchange in Jacksonville, Fla. The interchange serves as a main access route and is the first major feature seen by tourists and visitors arriving from the north. The precast concrete segmental alternative, built with the balanced-cantilever method, created a third-level



The three-span Cross Street Bridge in Middlebury, Vt., was the first bridge built in the state using the design-build delivery method. Corven provided engineering for the spliced precast concrete girders. Photo: Vanasse Hangen Brustlin Inc.



The 790-ft-long Foothills Parkway Bridge No. 2 near Wears Valley, Tenn., is a precast segmental concrete bridge with span lengths up to 180 ft. Corven supplied design and construction engineering services to Bell & Associates Construction. Photo: Corven Engineering Inc.



The balanced-cantilever method was used to construct the I-95/I-295 North Interchange Ramp in Jacksonville, Fla., for which Corven provided construction engineering services. The bridge features precast concrete segmental box girders in a 10-span continuous configuration with a total length of 2256 ft. Photo: Superior Construction Company.

ramp with a horizontal curvature of more than 90 degrees and a radius of 1250 ft. The thin, curving profile provides a striking entry to the city. (For more on this project, see the Winter 2011 issue of *ASPIRE*.)

Another example currently underway is the \$350-million I-4/Lee Roy Selmon Expressway Interchange in Tampa, Fla. The 12 elevated ramps provide a vital transportation link in downtown Tampa. There are more than 2500 precast segments, consisting of more than 1 million ft² of precast concrete, being used. They are being built with both the balanced-cantilever method, using deck-mounted mobile segment erectors, and the span-by-span method using an overhead gantry.

Corven worked with PCL/Archer Western to improve the constructability, including introducing the deck-mounted erectors. Of the 149 segmental spans, lengths range from 105 to 260 ft with radii as small as 590 ft and cross-slopes up to 10%.

Rehabilitation is Growing

Post-tensioning rehabilitation offers a rapidly growing area of opportunity. "We are working more and more on bridges in service, for which we perform post-tensioning inspections, evaluate problems, and create a rehabilitation plan," Corven says. "It's very interesting work. In addition to the work plan, we have had the opportunity to assist in the needed repair work. We're not afraid to get our hands dirty."

On the Florida Keys Segmental Bridges in Monroe County, Fla., Corven provided in-depth inspections and evaluations of the post-tensioning system, and then performed the needed rehabilitation work. Photo: Corven Engineering Inc.



Corven's 12-Year History

Corven Engineering was formed in 2000 after John Corven left DMJM to take on a project for the FDOT where several post-tensioned tendons had failed. That project began a 12-year history of focusing on post-tensioned and cable-stayed bridges.

Corven began his career in 1979 at Figg & Muller Engineers, where he worked with Philip Hartsfield on a variety of projects. Both men also worked for different periods with Jean Muller in his Paris office. Hartsfield joined Corven in 2006 from Parsons Corp., where he'd been working since his previous firm, Finley McNary Engineers, had been purchased.

Among the projects undertaken by the company, in addition to those mentioned here, are widening the Ramp A Bridge at the I-75/SR 826 Interchange in Miami, the first such widening of a segmental bridge in the United States, and the rehabilitation of more than 70 miles of external post-tensioning tendons in segmental bridges in the Florida Keys.

An example is the work done on four bridges in the Florida Keys: the Channel 5, Long Key, Niles Channel, and Seven Mile Bridges in Monroe County, Fla., for the Florida Department of Transportation (FDOT). The series of concrete segmental bridges, more than 11 miles in length, required an in-depth post-tensioning inspection that led to Corven directing the repair operation. The \$11-million project included inspection of external tendons,

vibration testing, pour-back removals, and non-destructive inspections using endoscopes.

"It was a special project, in which we were permitted to supplement our staff with a contractor to do work together in an 'Inspect/Maintain format' Corven says. "There was no reason for us to inspect the bridges and prepare a set of plans, have FDOT take bids, and then have a third entity inspect the contractor's work. We saved time and money."

With such work, the company's goal is to help achieve or extend a bridge's service life. That will be the result next summer when work is completed on the 943-ft-long Plymouth Avenue Bridge, a segmental concrete design that spans the Mississippi River near Minneapolis. The 29-year-old bridge was the first segmental design built in the state and, due to a drainage system failure, now needs its post-tensioning system repaired. The work will include the phased replacement of concrete while installing new post-tensioning tendons. "When complete, the bridge will return to its original load-carrying capability," he says.

Such rehabilitations often are more challenging than building from scratch, he notes. "It takes time to discover the unique characteristics of the bridge and the means and methods of how it was built, and then engineer a rehabilitation scheme within that framework. It's very rewarding work but very difficult work."

Rehabilitation work offers great potential for the company, he says. "There's not enough money to fix all of our deficient bridges. We're just scratching the surface now. Our goal is to work with owners to develop more innovative repair approaches that will last longer and be more cost efficient." That will involve such techniques as using supplemental post-tensioning and resupporting anchorage locations to provide longer life.

Developing and Sharing Technology

Durability also has become a key focus, as owners look to cut maintenance costs and extend service life. Corven's expertise with evaluations of existing



On the I-4/Lee Roy Selmon Expressway Interchange in Tampa, Fla., Corven is providing construction engineering services to a joint venture of PCL Civil Constructors and Archer Western Construction. The project includes more than 2500 precast segments that vary in width from 30 to 60 ft. Photo: PCL Civil Constructors and Archer Western Construction, joint venture.

bridges has led to a new facet of its niche: production of manuals for federal and state departments, especially related to durability. The procedural guides detail how to install, inspect, grout, and protect tendons to ensure long life.

The company developed the 10-volume "New Directions for Post-tensioned Bridges in Florida" for the FDOT, as well as the "Post-tensioning Tendon Installation and Grouting Manual" for the Federal Highway Administration (FHWA) and LRFD concrete superstructure design courses for the National Highway Institute. The manuals are written by Corven and long-time associate Alan Moreton. The firm is now writing a manual for the design of cast-in-place, post-tensioned concrete bridges for the FHWA.

Creating design manuals along with its other services keeps the firm busy. "We produce a fair amount of work with a small group of professionals," Corven says of the company's 20 employees. "We pride ourselves on being able

to produce a large amount of quality engineering product quickly, whether it's designs, inspection reports, or manuals."

Most satisfying for Corven are repeat clients, "We feel really blessed when a client trusts us to work for them again. We don't take it for granted. It raises the bar for us to do even better this time."

Repeat clients, coupled with the firm's versatility in growing niches, have it poised for more prosperity. "Infrastructure remains a big need, and even in tough economic times, we're still moving forward on building bridges," Corven says. "There are many great opportunities for us to keep doing what we do. The outlook is very positive."

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