FOCUS

Inspiring Creativity

PCL's desire to tackle complex projects encourages creativity and innovation as it meets evolving challenges of risk management, project delivery methods, and others

by Craig A. Shutt

A 100-year design life was required for the I-91 Brattleboro Bridge improvement project, Brattleboro, Vt. The bridge replaces two steel-truss bridges over the West River with a single cast-in-place concrete segmental bridge built using balanced-cantilever construction with form travelers. All Photos and Renderings: PCL.

PCL has advanced considerably since its founding 110 years ago in Saskatchewan, Canada, but one aspect hasn't changed: Its ambition and desire to take on new challenges and work on the most complex bridge projects possible. The philosophy leads most frequently to building concrete designs as the firm handles an evolving array of challenges.

"We enjoy working on complex bridges, and we're not ashamed to say that we think we're pretty good at building them," says Jim Schneiderman, area manager for the firm's Mid-Atlantic office in Raleigh, N.C. "PCL has a very strong bench of technical expertise, so anything that is challenging and complex is a good fit for us."

Adds Ankur Talwar, district manager for the Transportation Infrastructure Group based in Seattle, "Our goal is to be a value-added company. That usually leads us to more sophisticated delivery methods that allow more contractor involvement and engagement." Schneiderman agrees. "Just being the low-bidder on a design-bid-build project isn't a good win strategy for us. We prefer more involvement in the design process so we can help innovate and create an efficient project."

'Just being the low-bidder on a design-bid-build project isn't a good win strategy for us.'

Bridge owners are seeing the benefits of leveraging those talents, as more are using alternative delivery methods, including design-build, construction manager/general contractor (CM/GC), and public-private partnerships (P3). "CM/GC fits our culture very well," says Gayle Grady, district manager in the Tampa, Fla., office. "It gives us the opportunity to plan and implement construction means and methods along with delivery of the project. The owner has the opportunity to gain knowledge of the project's design and how it will be delivered to them. It absolutely aids constructability."

Grady currently is working on her third CM/GC project, in Hartford, Vt., in which the existing north and south bridges carrying Interstate 91 (I-91) over U.S. Route 5 are being replaced using the lateral slide technique. New bridge abutments will be built while traffic continues, then the new bridges will be slid into place over two weekends. The project will be completed in June 2016. "These ABC [accelerated bridge construction] techniques are a good example of the innovation and adaptability that our clients seek," she says.

She also is working on the I-91 Brattleboro Bridge improvement project, which involves replacing two steel-truss bridges over the West River in Brattleboro, Vt., with a single cast-in-place concrete segmental bridge built using balanced-cantilever construction with form travelers. The bridge, created under the design-build format, will have a design life of 100 years and feature a 515-ft-long main span and 263- and 258-ft-long back spans. It will be built on 66-in.-diameter drilled-shaft foundations with aesthetic piers replicating Vermont's iconic stone. "Our goal is to develop an iconic, gateway structure that provides an aesthetically pleasing, high-quality, environmentally sensitive, sustainable bridge."

"We are capable of working in any format the client is most comfortable with," says Talwar. "These new approaches require higher staffing

requirements upfront, but the end result is a reduction in costs and faster scheduling. Those usually are the owner's main drivers."

Brainstorming Sessions

When PCL first decides to pursue a project, a variety of personnel are involved, including designers, field personnel, and superintendents, who brainstorm ideas. "We look at how we can be creative and win the job with efficiencies," says Schneiderman. "We challenge ourselves to be more innovative, which owners like. We look for ways we can provide better, faster, and smarter solutions."

Typically, the team focuses on refinements to the client's drawings that will save money, adds Talwar. "We look to minimize the number of traffic phases and make the structure more efficient, which will save money or allow it to be shifted to landscaping and other amenities."

As projects become more complex, the firm has increased the number of joint-venture programs. "Often the key criteria to partnering is to find a common culture between firms," Talwar says. "We also look for complementary resumes and skill sets. We want to integrate, but we want to learn how the other company approaches challenges. It allows us to cross train and see who we mesh well with."

PCL recently participated in a joint venture with Granite Construction on the SR 520 Eastside Transit & HOV design-build project in Bellevue, Wash. The project, completed in 2014, widened 2.6 miles of roadway and added an high-occupancy vehicle (HOV) lane, interchanges, and other amenities. The project includes three urban green-scaped freeway lids, which are concrete structures that bridge two communities over a highway and include decorative and landscaping elements. It also featured two vehicle bridges, three pedestrian bridges, two pedestrian tunnels, retaining walls, transit stations, and eight fish culverts. The structures were built with precast concrete and cast-in-place concrete designs.

Concrete Preferred

The complexity of designs and alternative delivery methods, coupled with an emphasis on ABC techniques, plays well to PCL's expertise with concrete bridge designs. "We definitely have a preference for using concrete," says Schneiderman. "It plays to our expertise and has been our preferred material throughout our history. One of our first bridge projects in the United States was a precast segmental design, and we've gained a lot of experience with it in the 30 years since."

A key reason comes from the number of projects in coastal environments. "Concrete is favored there due to its durability and low maintenance costs compared to steel," he says. Grady agrees. "The majority of our structures are designed with concrete," she says. "We've done a lot of great concrete jobs through the years. We like concrete."

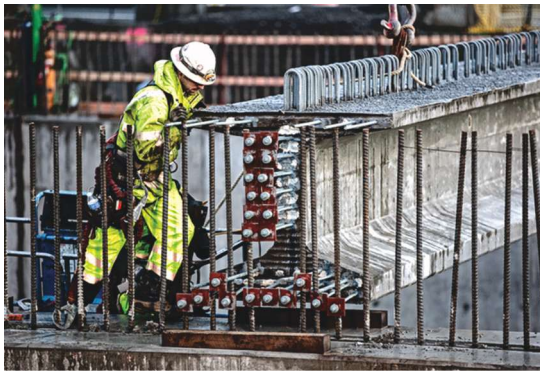
'We've done a lot of great concrete jobs through the years. We like concrete.'

One unique concrete project underway currently is the Flagler Memorial Bridge replacement in West Palm Beach, Fla., which includes a bascule bridge with long precast concrete approach spans. The approaches, which will be constructed in the spring of 2015, feature some of the first and largest precast concrete haunched beams to be used in the state. "They are absolutely magnificent beams," Grady says.

Concrete also helped PCL's design-build team create a design that was 30% lower in cost than any other proposal to replace the Herbert C. Bonner Bridge in Dare County on Hatteras Island, N.C. The $215-million, 2.8-mile-long project

PCL worked in a joint venture with Granite Construction on the SR 520 Eastside Transit & HOV design-build project in Bellevue, Wash. The project featured three lids, two vehicle bridges, three pedestrian bridges, two pedestrian tunnels, retaining walls, transit stations, and eight fish culverts.

The SR 520 Eastside Transit & HOV design-build project, completed in 2014, included a variety of precast concrete and cast-in-place concrete designs.



Erection of a girder on the SR 520 Eastside Transit & HOV project.

A rendering of the precast concrete bridge proposal by PCL's design-build team on the Herbert C. Bonner Bridge in Dare County on Hatteras Island, N.C. The cost was 30% lower than any other proposal. It consists of precast concrete segmental box-girder units main span and approaches constructed of Florida I-beams with cast-in-place concrete decks.

features multiple 350-ft-long main spans and extensive low-level approach spans. The main span units feature a precast concrete segmental box-girder design, while the approaches consist of 96-in.-deep Florida I-beams with cast-in-place concrete decks. Precast concrete cylinder piles support the structure.

The main span units' balanced-cantilever, post-tensioned, box-girder design resulted from the complex environmental restraints in the Oregon Inlet, a highly dynamic and constantly shifting inlet, with scour up to 80 ft, says Schneiderman. "We knew this was a signature bridge requiring expertise in a variety of fields and special attention to its durability." Stainless-steel reinforcement and corrosion-inhibiting admixtures were specified to help meet the 100-year service-life requirements.

'We're seeing more 100-year service-life requirements.'

Longer Service Life

"We're seeing more 100-year service-life requirements due to owners' increased focus on durability and longer specified design life, both resulting from a desire for reduced long-term maintenance costs," says Schneiderman. Talwar agrees, noting that, especially on the West Coast, seismic concerns also are a growing issue with which concrete structures can help. "Seismic issues have to be considered in every project in the west."

Extension of the design life also leads to demands for stricter quality control, which frequently leads the designers to precast concrete options. "Owners are shifting more of the quality control to contractors," Schneiderman says. "We are often required to hire inspectors to do the testing that DOTs [departments of transportation] used to do. The DOTs will spot-check those results, but we perform all the sampling and testing required to ensure a quality product."

Adds Talwar, "Clients realize the importance of quality control to achieve higher quality that better ensures durability. Precast concrete gives us that quality control by casting in the plant under controlled conditions."

Owners also are looking to concrete designs to aid with environmental concerns. "Environmental restrictions have definitely become stricter," says Schneiderman. "That, combined with an emphasis on quality control, are two of the biggest changes we've seen in recent years." In some cases, the new approach adds benefits. At the Bonner Bridge project, for instance, the existing bridge will be demolished, and the pieces will be barged to three sites located 10 miles out to sea and sunk to create reefs and fish habitats. "It's a good approach all around, because it gives us a place to dispose of the old bridge, and it creates new wildlife habitat. We can dump the pieces in as large of a size as we can handle."

Environmental conditions played a key role in the design of the Broad Avenue Bridge replacement project over the Flint River in Albany, Ga. The existing condemned bridge was replaced with a cast-in-place concrete, segmental box-girder bridge. The river contains several endangered species, creating strict environmental regulations.

The bridge features four spans, with the longest span at 320 ft. Three of the spans will be constructed by cast-in-place balanced cantilever with form travelers. The fourth span will consist of cast-in-place concrete box girders constructed on falsework. The piers, which are founded on 66- and 72-in.-diameter drilled caissons, will feature large architectural brick inlays.

"The environmental conditions were reflected in the design of our temporary works and the construction approach," says Grady. "We always work with a high regard for protecting the environment. That's becoming more ingrained as younger engineers come along, as they're sensitive to that need already. It becomes part of the planning process from the beginning as a standard aspect." That includes both the permanent structure and the construction process, she notes. "Owners don't want to inconvenience the public or have the landscape damaged during construction. That pushes us to be more collaborative to inspire creativity."

Environmental (and funding) concerns also are leading more DOTs to renovate bridges rather than replace them entirely. "Rehab is becoming more of a factor in projects," says Schneiderman. "Funding is scarce and DOTs want to allocate funds to impact as many projects as possible to buy more time until they need to do a replacement. They also are looking for longer post-construction warranties, which become a bigger factor in the RFPs [requests for proposals]. They are very savvy in balancing all of the needs in their budgets."

Rehabilitation can be more difficult than building from scratch due to the uncertainties of the condition of the

Environmental conditions played a key role in the design of the new four-span Broad Avenue Bridge over the Flint River in Albany, Ga.

The Broad Avenue Bridge consists of cast-in-place concrete segmental box girder, with three of the spans constructed with form travelers.

existing structure until work is well underway. "We typically bid such projects with a unit-price estimate based on piece count due to the number of variables," Schneiderman says. "Needs often develop as we get into it and find more deterioration than expected. It's a more dynamic environment than a replacement project."

Offices Expanding

The company has been expanding its reach in recent years, with the Bonner Bridge acting as a "seed project" to establish the firm's presence in North Carolina. Where most of the company's work had been in the Southeast, the projects mentioned here show they also are operating in the Middle Atlantic, Northeast, and Northwest. "We have a desire to grow our heavy-civil construction group. The Bonner Bridge project brought us to North Carolina, and now we want to leverage that to continue to grow."

As PCL grows, it recognizes that major challenges lie ahead. One of them will be recruiting young talent. "The biggest challenge I see in constructing complex projects today and in the future will be finding the qualified staff to build them," says Schneiderman. "We are seeing field superintendents retire at a faster rate than they are being replaced by younger talent. This is a challenge that will continue for the foreseeable future. I believe that we, as an industry, must continue to promote field management as a career choice for up-and-coming professionals."

110 Years of Service

Ernest Poole founded his construction company in Saskatchewan, Canada, in 1906 and incorporated as Poole Construction Co. Ltd. in 1913. The firm survived the Great Depression by expanding into highway and irrigation work.

In 1948, Ernest's sons John and George purchased the company and formed Poole Engineering jointly with Peter Kiewit Sons of Omaha, Neb., to pursue highway and airport work, as well as large joint venture projects. The partnership ended in 1958, and the firm became PCL Construction in 1979.

In 1975, Poole entered the U.S. market, opening an office in Denver (now its headquarters city). Offices were added in Florida and Arizona in 1986. In 2011, it achieved a record low Lost-Time Frequency Rate of 0.03.

Today, PCL generates commissions of more than $6 billion from all of its operations. Its group of independent construction companies is owned by its more than 4400 employee shareholders in the United States, Canada, and Australia.

That new workforce will face great challenges as demands grow. But it also will have a remarkable arsenal of weapons with which to work. "The scanning and modeling technology that is now available, and is continuing to grow, is a great aid in bidding and building projects," Schneiderman says. "It wasn't that long ago that this type of technology was considered exotic and 'cutting edge.' Now, it's standard operating procedure for us on every project. Our workforce is constantly adapting to keep up with the industry."

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