Bridging the Gap

McNary Bergeron's construction engineering work helps ensure efficient and cost-effective construction

by Craig A. Shutt

McNary Bergeron provided construction engineering for the cast-in-place arch structure and temporary stay-cable system used to support the Hoover Dam Bypass Colorado River Bridge. It was one of the first high-profile projects for the company, which was founded in 2003. All photos: McNary Bergeron & Associates Inc.

Contractors usually call on McNary Bergeron & Associates only when the going gets tough—and that's just the way the company's engineers like it. The firm specializes in taking complex designs and making them more constructible, ensuring the owner and designer's vision becomes reality. That has led the 8-year-old company into some high-profile and extremely challenging concrete projects.

"We usually get involved in projects that are complex," says Scott McNary, a principal in the Broomfield, Colo.-based construction engineering firm. "We work on the problem children, the projects that are difficult to build. And we enjoy those challenges." The company's goal is simple, adds Principal Jim Bergeron, who heads the firm's other office in Old Saybrook, Conn. "Our niche is to help contractors and designers be successful. We can bridge the gap between design and construction because we speak both languages."

The firm was founded in 2003 by McNary and Bergeron along with Jeremy Johannesen. All three had experience with large engineering firms prior to partnering. "We wanted to get back to our roots of working directly with contractors to help them with the construction of complex bridges," Bergeron says. Since easily designed projects seldom need construction engineering support, the engineers usually are working on complex projects. Those often involve concrete construction—or ones that become concrete during the value-engineering process, says Johannesen.

"We do some designing, especially when value engineering is required," he says. "But 90% of our work is construction engineering of existing designs to make them more efficient to build."

Fast Start with Hoover Dam

Most commissions result from relationships with designers or contractors with whom the partners have worked on past projects, McNary explains. Those connections helped them become part of a high-profile project shortly after the firm was created: The Hoover Dam Bypass Colorado River Bridge in Nevada and Arizona.

The company provided construction engineering services for the cast-in-place arch structure and the temporary stay-cable system used to support it. That work included design of the anchorages, towers, and cable construction for the arch ribs as well as the rib shop drawings and an independent review of the form-traveler design.

"There were many challenges involved in bringing that design to fruition," says Johannesen. "We basically worked with the contractor to create a tower and anchorage system that would streamline the concrete construction. The end result worked extremely well."

The company's expertise in arch work paid off when it became involved in the Covered Bridge over the Kennebec River in Norridgewock, Maine, which has just been completed. The project features a cast-in-place concrete tied arch spanning 300 ft. McNary Bergeron provided construction analysis for the new arch and erection plans and procedures, as well as design of the temporary arch shoring and a demolition plan for the existing arches. (See the article on this bridge on page 34.)

"There is nothing similar to this in Maine, or even in most of the country," says Bergeron. "It's a complicated arch structure, but it's very distinctive and memorable."

Contractor Modifications

Much of the work the firm does falls under the heading of "contractor modifications," which it performs for most of its projects, rather than value engineering, which it does less frequently, McNary explains. Construction modifications leave the structural engineering as it is, with only some aspects changing. For value-engineering work, the firm changes the shape or materials being used, making substantial alterations to better suit the contractor's needs and expertise.

An example of construction modifications can be seen in the Route 36 Highlands Bridge over the Shrewsbury River in Monmouth County, N.J. The new design, which replaced a worn-out 1932 structure, was designed as a two-span fixed, four-lane, precast concrete segmental box structure with a 65-ft clearance (raising the previous clearance by 30 ft).

McNary Bergeron helped design the precast concrete cofferdams and support systems for the footing construction and provided integrated shop drawings for precast concrete column and superstructure segments. It also developed and designed the falsework, cantilever-stability system, lifting assemblies, and rigging. All of the components were barged to the site because land access was difficult.

"The key to the project was speed of construction," explains Bergeron. Each of the twin bridges had to be erected in a construction season. The total-precast concrete design allowed portions to be cast in advance and floated to the site for erection. Aesthetics also played a role in the structure type, he notes. "It's a very visible structure, so aesthetics were especially important to the owners."

The firm currently is working on the design for a similar project, the Veterans Memorial Bridge Replacement in Portland, Maine, as part of a design-build team. McNary Bergeron created the constructability review of the twin-bridge superstructure, providing recommendations on segment layout, post-tensioning details, fabrication and erection efficiencies, and alternative erection procedures. The bridge features span lengths up to 250 ft, with precast units by the same precaster used on the Route 36 Highlands Bridge. The bridge was designed to replicate some of the Route 36 bridge plans, allowing the precaster to reuse the forms, thereby saving costs.

"There are often many ways to construct a bridge, and we always steer the design to favor repetition of components to take full advantage of precast concrete's capabilities," says McNary. "These ideas help the contractor be more efficient, which saves money."

Value-Engineering Work

Value-engineering projects include the Nalley Valley Interchange on I-5 through Tacoma, Wash. "We assisted the contractor in procuring the contract by redesigning two expensive steel bridges to more economical concrete structures," says Johannesen. As part of that, the SW Line Bridge was redesigned from a steel tub-girder bridge to a precast concrete segmental box girder design.

"The alignment was well suited to the precast segmental design, so we maintained the alignment but designed the bridge for concrete. We created the basic configuration that best suited the contractor and the precaster for casting and handling the components the whole way through the project." The change also suited the owner because of the extended design life and reduced maintenance.

A dramatic cast-in-place concrete tied arch with steel cable hangers serves as the key visual element on the Covered Bridge over the Kennebec River in Norridgewock, Maine. The design is the first of its type in the state and in the eastern half of the United States. McNary Bergeron provided construction analysis for the new arch, which spans 300 ft.

Projects in Aspire

Projects in which McNary Bergeron participated were featured in the following *ASPIRE*™ articles, which can be viewed in the Magazine section at www.aspirebridge.org:

- San Francisco-Oakland Bay Bridge (Winter 2007)
- Susquehanna River Bridge (Spring 2007)
- Selmon Expressway (Fall 2007)
- Seattle Sound (Spring 2008)
- Maroon Creek (Spring 2008)
- Washington Bypass N.C. (Fall 2008)
- Folsom Lake Crossing (Winter 2009)
- Crosstown Project (Minn.) (Spring 2009)
- Fulton Road Bridge (Spring 2009)
- Galena Creek Bridge (Winter 2010)
- Hoover Dam Bypass, Colorado River Bridge (Spring 2010)
- Route 36 Highlands Bridge (Summer 2010)
- Nalley Valley Interchange (Summer 2011)
- MIC-Earlington Heights Connector (Summer 2011)

Speed of construction was a key reason that McNary Bergeron helped create the all-precast concrete design for the Route 36 Highlands Bridge over the Shrewsbury River in Monmouth County, N.J. Each of the twin bridges were cast and erected in a construction season, providing access year round while construction continued.

The temporary bridge that was to provide access while the new bridge was constructed was value-engineered from a steel design into a precast concrete bulb-tee girder design. "Precasters can cast deck bulb tees with specified camber, so we don't create haunched buildup construction," McNary explains. "The owners liked this design, because it simplified the construction and provided the image that the 'temporary' bridge could last as long as needed."

A design-build contractor will often have a construction engineer on his team. A key reason is the capability to maximize speed of construction, Johannesen adds. "Speed is more important all the time. Owners are looking at all of the costs and realizing that the faster they can complete the project, the more they can save in labor and user costs. We help that by finding ways to do engineering and fabrication of components ahead of time. The more time spent upfront before getting to the site, the more efficient the process will be."

"Speed is a key focus, because almost every project is a replacement project that is in high use already," says Bergeron. "There are few 'new' bridges being built. Almost always, we are taking something down to put up a new structure."

New Techniques Aid Efficiency

The engineers are keeping a close eye on techniques that will help achieve that goal, including the use of self-propelled modular transporters (SPMTs). "There are a number of new pieces of equipment and devices that hold a lot of promise for making it more efficient to construct bridges," Bergeron says.

Advances are being made especially for handling precast concrete components, agrees Johannesen. "Beams and girders are getting larger as creative ways are found to transport and maneuver them," he says. "As soon as cranes get bigger, a new girder is designed to take advantage of their capabilities." Mobile lifting cranes and gantries also are getting more robust, he says.

New equipment will make bridge designs more efficient to build, adds Bergeron. "It always comes down to cost, and if a crane can be used, that's the way to go. So as cranes get more versatile, they become even more popular. Especially when land access is limited, it's important to have other ways to access the site, and better equipment is helping to meet tighter schedules and budgets."

Tendon-grouting with segmental designs has grown in importance, with

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new requirements for post-tensioning systems creating more complexities. "The growing use of duct couplers offers a wide-open field for building a better mousetrap," says Johannesen. The couplers are cast into the concrete during match-casting procedures, and then broken apart so the second coupler can be cast into the next component to ensure an air-tight seal.

Higher compressive strengths that provide longer, lighter concrete spans also offer potential, McNary says. The firm is using more 75-ksi reinforcement in its designs as well as looking closely at "superstrand," which provides a 7% larger cross-sectional area for use with post-tensioning.

Such technologies and techniques will add new weapons to McNary Bergeron's arsenal, helping to meet challenges as bridges grow in complexity. "We are advocates for contractors, to ensure bridges are built efficiently and economically," says McNary. "We can have a big impact on the industry as a whole by working closely with contractors to ensure projects go the way the contractor needs them to go. That can create innovative approaches that others can use."

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

By designing Veterans Memorial Bridge Replacement in Portland, Maine, in a similar style to the earlier Route 36 Highlands Bridge in New Jersey, McNary Bergeron allowed the precaster, who was the same for both projects, to reuse the original forms, saving costs.

Bridges to Prosperity

The founders of McNary Bergeron believe in giving back to their own community and to the world community. They have maximized the use of their own skills while meeting this goal by working with Bridges to Prosperity Inc. The group literally builds bridges between people in underdeveloped countries, via pedestrian suspension bridges. The work helps connect remote areas, making it easier to access food and medical help.

Although mountainous areas provide easy design opportunities for suspension bridges, about half of the organization's bridges span flat flood plains with no natural features from which to suspend bridges. McNary Bergeron saw an opportunity to help overcome that obstacle in 2005, says Jeremy Johannesen, who serves on the organization's Advisory Board. Scott McNary also serves on the group's Executive Board.

"We work with them to design suspension towers so they can get above the water more easily," Johannesen explains. "When problems arise, we work with the contractors to solve them." Frequently, that has included personnel from Flatiron Construction, which began volunteering with the group in 2008. The firm sends young engineers to help build these bridges to gain real-life experience.

An example is the La Pintada suspension footbridge over the Rio Copan in Honduras, which was constructed in the spring of 2010. The four communities that lay beyond the river can now safely cross the waterway during high-water season. "The challenge was immense, but the product incredibly rewarding," Johannesen says. Based on the relationships built during this project, he adds, future Bridges to Prosperity projects in the area may be on the way.

McNary Bergeron's work with Bridges to Prosperity Inc. has included La Pintada suspension footbridge in Honduras. This bridge connects four formerly inaccessible communities. The firm helped design the structural towers that support the bridge on the low-lying plain, which had been an obstacle to creating the bridge previously.

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