

TAKING THE LEAD

Kiewit adapts to new delivery methods, new technologies, and changing requirements to build bridges ranging from the simple to the complex

by Craig A. Shutt

When the state of Missouri Department of Transportation (MoDOT) revamped its entire highway bridge system in 2009, it presented a Kiewit-led, joint-venture, design-build team with a significant challenge: replace 554 bridges in four years while the state refurbished 248 existing bridges simultaneously. The team not only met the goal but finished in 3½ years, completing one bridge every 1.6 working days. To accomplish that feat meant adapting to new delivery methods, creating detailed strategic plans, and thinking in innovative ways. Such capabilities help Kiewit adapt to new challenges every day.

"In general, the more complex, difficult, and technical the project is, the better we compete for the business," says Ralph

Salamie, project sponsor (a management position) for Kiewit. "Certainly, we compete and win our share of the smaller, more traditional infrastructure projects. But we're very competitive for the larger, more complex projects."

Missouri's \$685-million, design-build Safe & Sound Bridge Improvement Program certainly fits that bill. The state's initial plan called for the winning bidder to design, build, finance, and maintain all 802 bridges for 25 years. But when bids were considerably higher than anticipated, MoDOT removed the bridges that needed rehabilitation and repackaged the remainder as one large design-build project. Kiewit's joint-venture team built 63 of the 554 bridges and managed subcontractors for the rest.

For more details, see the Spring 2013 issue of *ASPIRE*.™

More Delivery Methods

Such unusual delivery methods are becoming more common, Salamie notes. "We still do a lot of rip-and-read work, but more is design-build, which gives us the ability to control the process." They're also seeing construction manager/general contractor (CM/GC) work grow and have been involved in several P3 (Public-Private Partnerships), in which they team with, or even act as, developers to arrange the financing and long-term operations of a project. "We have had to become more engaged in the process of design, project financing, and long-term operation and maintenance of our alternative delivery projects."



The \$1.2-billion San Francisco Oakland Bay Bridge Skyway Segment was built by a joint venture led by Kiewit. The 1.2-mile-long, 14-span, twin precast concrete segmental bridges feature 452 precast concrete segments, the largest weighing as much as 750 tons. All Photos: Kiewit.

These new delivery approaches lead owners to look beyond lowest-bid pricing and more heavily weigh other factors. Kiewit has capitalized on the innovative opportunities of alternative delivery projects to increase its win ratio, Salamie says. "More owners want the 'best value' option, which includes cost but also looks at benefits in maintenance and design life."

Evolutions in delivery methods are changing Kiewit's approach to projects, notes Jim Thomsen, who served as project manager for Kiewit's contract with the Missouri Safe & Sound Bridge Improvement Program. "On design-build projects, our construction team is integrated with the design team to ensure constructability and operational efficiency. Design risks and quantity growth are identified, tracked, and mitigated throughout the design process."

The new methods impact the company's personnel and risk-mitigation decisions, notes Salamie. "Given the increase in alternative-delivery methods, we have made changes in the skill sets of our management. We have added designers and design coordinators to our staff to optimize and manage the design process and improve constructability."

That became necessary on design-build projects, as the company was given responsibility for the design process. "No longer is the bridge design a black box for our construction team, where all

bidders take the same set of drawings and work up an estimate," he explains. "We now have joint ownership of the design with the designer, where our team's design can be the biggest differentiator in our competitive bid. We expect our construction team to have a working knowledge of the design, and take responsibility for both design and construction."

With the trend towards larger and more diverse infrastructure projects, Kiewit has been able to take advantage of its company structure to bring in the most qualified management and equipment from across the company to pursue and build the work. Notes Salamie, "when it comes to infrastructure work, there is no skill set that we can't provide within our diverse organization."

Environmental Concerns Grow

Environmental concerns also are growing in importance, making projects more complex and impacting bid decisions. "Environmental compliance, safety, and the legal side of overall compliance consume an ever-increasing percentage of our project staff's duties," says Salamie. "In today's world of project management, our staff has to be part designer, part environmental engineer, part safety specialist, and part lawyer."

Maryland's Intercounty Connector (ICC) project shows the requirements



The \$550-million, 7-mile-long Intercounty Connector Contract B project in Maryland features 10 precast concrete bridges that had to pass over sensitive stream valleys and two local watersheds.

needed today. The Kiewit-led MD200 Constructors' \$550-million bid for Contract B consisting of 7 miles of the 18.8-mile-long project—said to be the highest monetary contract the state has ever awarded—was won due to its proposed environmental-management program. The bid was slightly higher than others, but "the owners were searching for the team that offered the best value for this high-profile and highly debated, design-build contract," said Gwyon Nelson, the Kiewit sponsor who served as the ICC-B project manager.

The environmentally sensitive project crosses stream valleys and two local watersheds with specific stream-closure periods. "With no tested designs to fall back on, we had to determine what a project with such ambitious environmental goals would look like," says Nelson. The project included 10 bridges, built using precast concrete components.

Cost control becomes a key aspect of complex projects, notes Salamie. "Material escalation is a consideration for all our project pursuits, especially for steel components on long-duration projects."

Kiewit's 130 Years of Service

Kiewit traces its history to 1884, when two brothers formed a masonry contracting partnership in Omaha, Neb. Now, 130 years later, it's grown into one of the largest construction and mining companies in North America.

The firm entered the heavy and highway construction markets during the Great Depression as building construction disappeared. It also grew during World War II, as it took on a variety of projects for the military, including barracks, airfields, and other facilities throughout the west.

Its government work continued through the Cold War years. Kiewit played a key role in building the interstate highway system, especially some of its most difficult sections.

In the 1980s, Kiewit made significant investments in ventures outside its core businesses, with an emphasis on energy and telecommunications. During the 1990s, it became a leader in design-build and engineer-procure-construct delivery methods.

Today, through its operating companies, Kiewit generates revenues of more than \$11 billion and is consistently ranked among the top five contractors by *Engineering News-Record*. It is one of the largest employee-owned businesses in the country.

Kiewit's Bridge to Prosperity

Nine Kiewit employees traveled to Nicaragua in February to put their bridge-building skills to work for the citizens of Cinta Verde near the rural El Limon River. The project, sponsored by Bridges to Prosperity, used concrete footings and anchor blocks along with steel towers and a timber deck, to link the village to schools, medical care, and markets on the other side of the river. It also served as a training exercise to teach the village's 300 people to build more bridges.

Kiewit's construction team faced the challenges of building with primitive materials and tools, overcoming language barriers, and living with no electricity, says Kiewit's Ralph Salamie, project manager. "Kiewit's culture thrives on strong values, and we share our bridge-building talents with people in need."

Bridges to Prosperity has built more than 70 footbridges in 18 countries. Ten bridges are planned for Nicaragua in 2014. The Cinta Verde Bridge took about 10 days to construct.

Kiewit and its partner, International Bridge Technologies (IBT), each contributed \$25,000 to design and construct the 115-ft-long suspension footbridge. The volunteers paid their own travel expenses and contributed a week of time, with Kiewit donating a second week for each volunteer. Kiewit employees raised another \$2000 to deliver maps, textbooks, sports equipment, and supply kits to the local school.

Mitigating risk also requires picking subcontractors and design partners carefully. "For design-build projects, we look for design teams with proven track records of minimal 'design growth,' maintaining a schedule, and understanding the constructability side of the design," says Salamie. "We involve our experienced builders at bid time to review each element,

ensuring we won't have to modify the final design for constructability reasons." Kiewit also includes a second-check design team to mitigate the risk of errors.

Concrete Use Increases

These evolutions have led to specifying concrete materials more often. "My experience on every design-build project

has been that our first choice is to go with concrete, due to its speed, cost, and shorter lead times than structural steel," says Thomsen.

The emphasis on service life also has driven this preference, says Oscar Antommattei, senior concrete engineer. "We see a trend among clients wanting a longer service life, so we are pushing concrete to provide more performance," he says. "We look at cementitious materials, durable aggregates, and obtaining a lower water-cementitious materials ratio to achieve this. We evaluate various concrete mix designs, because each region of the country has different materials that create unique challenges to achieve workable mixes that can also meet service life requirements. It can be challenging to get the right mix design."

That's another benefit of the design-build method, he notes. "In design-build, we can look at the entire structure to find ways to combine techniques to protect against corrosion and improve service life." These can include adding post-tensioning and providing alternatives to traditional reinforcement, such as epoxy-coated reinforcement and, more recently, galvanized or stainless steel options.

Kiewit used self-propelled modular transporters to move a cast-in-place, post-tensioned box-beam structure with a curved shape into place in one day on Pecos Street over I-70 in Denver, Colo. During one weekend closure, the existing bridge was demolished, the bridge travel path was constructed with metal plates and fill material, the bridge was moved into place, and the travel path was removed.





Kiewit combined concrete segmental and cable-stayed technology to design and build the Portland-Milwaukie Light-Rail Transit Bridge for TriMet in the Portland, Ore., metro area.

Concrete components also are helping to meet owners' tighter scheduling demands. "Accelerated bridge construction techniques have become a trend throughout the industry," says Thomsen. "Project owners are seeing the value in bridge construction while minimizing the impact to the traveling public. Prefabricating components and delivering standardized pieces have helped achieve those goals."

Adds Antommattei, "Precast concrete can provide significant benefits relating to the schedule. Multiple elements can be fabricated rapidly and in advance of their need: then stored and held until the job requires them. Additionally, precast concrete elements are fabricated under more controlled placement conditions and under strict quality-control measures, which helps ensure that strength and durability requirements are met."

Concrete Capabilities Expand

"Concrete bridge elements are heavier than comparable steel components, but as high-performance concrete pushes the limits to higher and higher strengths, members are getting

progressively more slender and lighter, improving the competitive advantage of concrete structures," said Salamie.


Span lengths also are increasing, he adds, which is expanding the market for concrete girders. "Bulb-tee girders made of high-performance concrete let us extend lengths to 200 ft and beyond. That opens up more opportunities for concrete bridges, which we used to cap at about 120 ft."

Those spans are carrying more than vehicles today, with pedestrian bridges growing in use and light-rail applications becoming popular. "We're seeing more transit projects with elevated guideways when there's no space for them at ground level," says Salamie.

One of the most innovative of those projects is being built for TriMet in the Portland, Ore., metro area, which awarded Kiewit a \$119-million design-build contract for the Portland-Milwaukie Light Rail Transit Bridge. When completed in 2015, it will be used by light-rail trains, buses, streetcars, bicyclists, and pedestrians. The cast-in-place segmental, cable-

stayed bridge was chosen for its minimal environmental impact and aesthetics.

"Combining concrete segmental technology with relatively new cable-stayed technology presented many unique challenges to our design and construction team," says Salamie. Segmental bridge designs are growing in popularity, Salamie says. "Concrete segmental and cable-stay construction can add benefits if there is restrictive access for falsework or erection equipment, such as over water or wide roadways."

Such innovations will keep Kiewit competitive even as new demands and new delivery systems arise. "We're doing more segmental and cable-stayed bridges and other types of unusual designs, but our bread and butter remains the simple span girder bridge," Salamie says. That may be the only thing that's simple about the projects Kiewit builds today. 

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