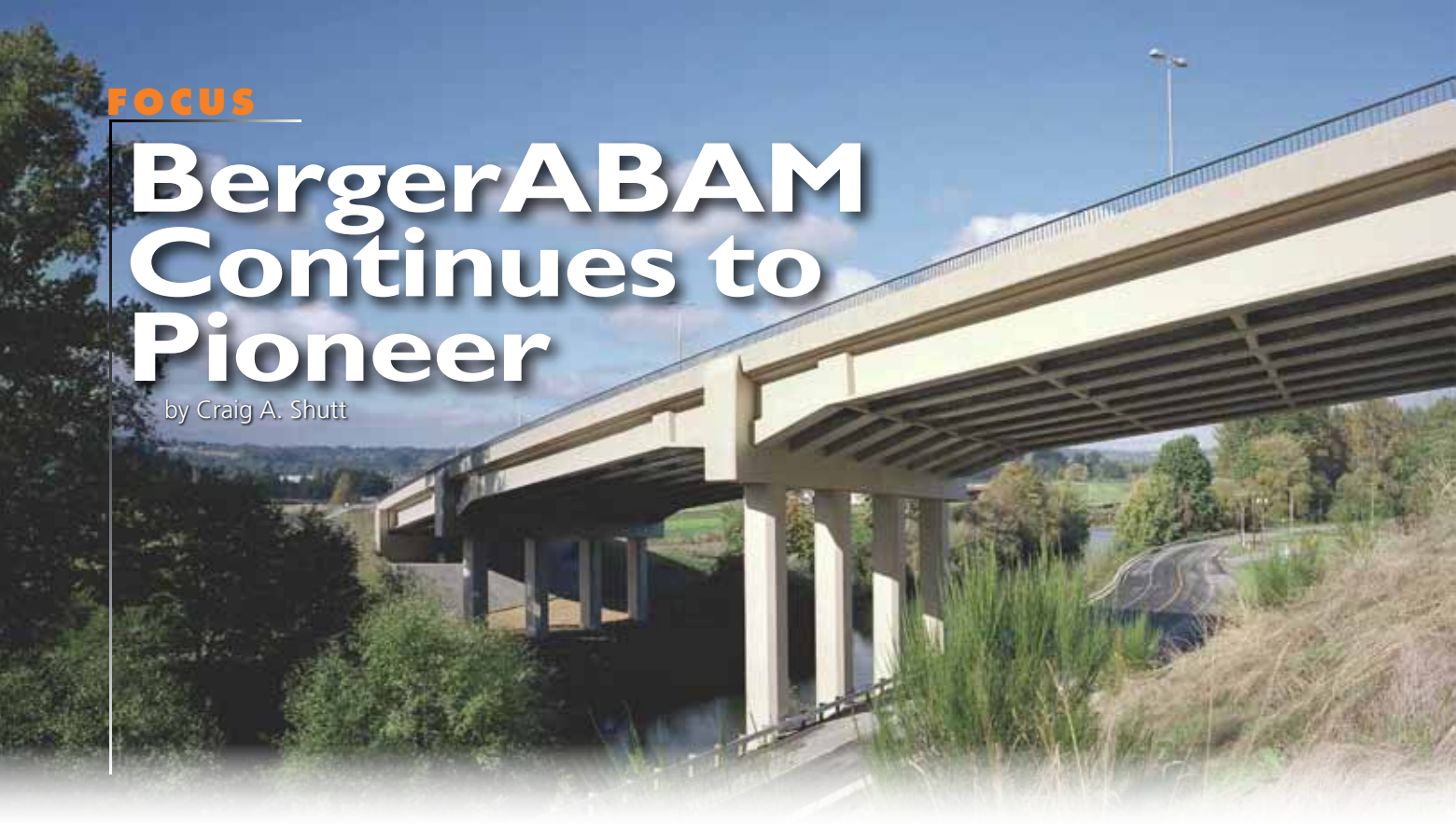
FOCUS

BergerABAM Continues to Pioneer

by Craig A. Shutt



A precast, prestressed concrete spliced girder design was used in the Don E. Wickstrom Bridge in Kent, Wash., to avoid any piers or falsework in the river. The girders feature 60-ft-long variable-depth haunched segments balanced on the piers. All photos: BergerABAM.

One of the first firms involved with prestressed concrete looks to new innovations

In the 1950s, the founders of BergerABAM created a revolutionary instrumentation and testing procedure to validate the use of prestressed concrete, thereby ushering in a new era for bridge construction. Today, the firm remains a leader in the use of prestressed concrete for a variety of projects, including routine and first-of-its-kind applications for transportation, marine, and building structures. And, with its eye firmly set on the challenges facing the industry, it plans to continue to innovate with concrete in the future.

"Concrete is generally considered more durable than steel and requires less maintenance, especially in a marine environment," says Bob Fernandes, vice president of BergerABAM's Public Works & Transportation Department. "The use of prestressed concrete allows the use of longer spans when required."

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Although clients benefit from the firm's technical expertise with concrete, they are also looking for other qualities when they hire the firm, he says. "Each client is different, but I suspect the qualities they appreciate most are the ones that our founders used to succeed: creativity and persistence. Our company was founded by individuals who were entrepreneurs and contractors. We have a design-for-construction mentality and we enjoy overcoming obstacles."

Constructability is a critical ingredient for today's projects, he notes. "The need goes beyond a bridge's actual design to include a strong sensitivity to environmental concerns. Due to an increasingly complex regulatory environment, we are generally required to document the entire construction process in great detail in order to secure permits for the project. Obviously, this needs to be done early in the process if the design is to be completed in an efficient manner."

In some cases, the firm is required to engineer aspects of the construction process, which it previously left to the contractor, to ensure the client can follow through on commitments made to the regulatory agency issuing the permits.

"Following through and helping the contractor execute the design are also important," adds Chuck Spry, senior project manager, with BergerABAM's Public Works & Transportation Department. "Wherever possible, we try to be open to project improvements suggested by contractors that are consistent with the client's goals for the project and the permits. In some cases, we have been able to get permits altered to implement a contractor's ideas that benefit the project. As

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The Elwha River Bridge in Clallam County, Wash., combines a cast-in-place segmental concrete bridge with a precast concrete pedestrian bridge hung beneath the structure. The three-span bridge separates vehicle traffic from pedestrians using the Olympic Discovery Trail.

projects become more complex and have more requirements, we need good relationships with the contractor to ensure the design becomes reality."

Devising designs that meet all the owners' needs has been foremost since the firm's inception. BergerABAM's heritage dates to 1951. Concrete Engineering Co., which would become Concrete Technology Corp., was founded by brothers Art and Tom Anderson. Using his innovative instrumentation (strain gauge) and testing program, Art proved prestressed concrete was reliable to early skeptics on the Walnut Lane Bridge in Philadelphia. Built during 1949 and 1950, the bridge became famous for its first use of prestressed concrete in a structure built in the United States, leading to many more bridges using this innovative technique.

Art's work ultimately led to the founding of Anderson, Birkeland, Anderson and Mast, shortened to ABAM Engineers in 1966. It became an affiliate of The Louis Berger Group Inc. in the late 1980s, creating BergerABAM. "The firm essentially was founded due to the Walnut Lane Bridge, and bridges have been a major focus of our work ever since," says Bob Mast, senior principal and the last remaining namesake partner. (For more on the company's history, see the sidebar.)

Long Spans Reduce Impact

Long spans are becoming more popular to reduce environmental impact and to simplify complex geometries at interchanges, where ramps and junctions create traffic congestion. This has been aided by the Washington State Department of Transportation (WSDOT) devising its own precast concrete girder shapes, which it encourages designers to use.

Longer spans and more slender girders are heavier and more difficult to handle than shorter shallower girders. This challenge has required the industry to develop new engineering practices. Mast has added to that body of knowledge, having worked at BergerABAM for over 50 years, including serving as president from 1972 to 1986. Among his contributions has been intensive study to develop standards and procedures for handling long precast concrete beams to ensure their stability during transport and erection.

"The ways that long and heavy components are shipped have really changed, which has had an impact on what's possible for bridge designs," Mast says. "There is much more availability of specialized equipment to ensure that large, complex pieces can be handled easily. When I began, the absolute limit for transporting components on the highway was 60 tons. Now it's double that, and we're pushing 200-ft for long plant-made beams."

An example of the creative use of precast concrete to construct longer spans is the Don E. Wickstrom Bridge, a precast concrete spliced-girder design, created for the City of Kent, Wash. A key reason for selecting the precast concrete option was that the city did not want any piers, or even falsework, to impact the Green River. The site also did not have good access.

The design allowed the delivery and erection of precast concrete in reasonable sizes so they could be site-assembled into the final structure. The bridge also required a curving alignment on a 9% grade, adding challenges. The three-span bridge includes a 183-ft-long main span using 7-ft-deep WSDOT super girders.

The firm also uses cast-in-place concrete to build slender and longer spans. A creative example is the State Route 509 (SR 509) Bridge that spans I-705 and the

On the State Route 509 interchange that spans I-705 and the BNSF Railway track in Tacoma, Wash., BergerABAM created a curving, elevated single point urban interchange, the first in Washington state and one of the first in the country. The structure features cast-in-place, post-tensioned concrete box girders with variable-depth webs.

BergerABAM value-engineered the design for a new bridge spanning SR 520 in Redmond, Wash., to connect a new Microsoft campus with the original one. Although the city envisioned a steel-plate girder bridge, BergerABAM used precast, prestressed concrete girders, 83 in. deep with an 8-in.-thick, cast-in-place concrete deck. The large, flat surfaces provided landscaping and trail amenities to enhance aesthetics.

BNSF Railway mainline tracks in Tacoma, Wash. The bridge supports an elevated single-point urban interchange (SPUI), the first elevated SPUI designed in the state of Washington and one of the first in the country. The superstructure is a cast-in-place, post-tensioned concrete box girder with superelevation, variable-depth webs, and complex geometry. It shows the material's ability to be formed into almost any shape.

The SR 509 Bridge created a combination of needs for long spans to clear railroad tracks, vertical clearances over the railroad, and freeway restricted design options, Spry says. Cast-in-place concrete girders with curved exterior webs were used, with the overall bridge measuring 340 ft wide and 320 ft long with scalloped cutouts. "We had to completely rethink how we prepare design drawings in order to communicate the complex reinforcement requirements to the contractor on this project," he explains. "In retrospect, this was really an early example of using computers to create three-dimensional models of the structure in order to build it."

Speed Becomes a Focus

In all types of projects, the designers are seeing more emphasis on speed of construction to minimize user costs and traffic congestion. The firm's focus on constructability aids this process.

BergerABAM is taking that focus further through a grant from the Federal Highway Administration's Highways for LIFE Technology Partnerships Program. The grant is being used to develop a precast pier system for accelerated bridge construction (ABC) in high-seismic areas. Dr. Lee Marsh, seismic specialist with BergerABAM, is managing the project, with a team comprising WSDOT, the University of Washington, Concrete Technology Corp., and TriState Construction. A demonstration project for the pier system will be constructed for WSDOT in 2011.

Marsh is also leading a team that is developing a synthesis of practice for the National Cooperative Highway Research Program in Washington, D.C. The synthesis will summarize the innovative techniques for applying ABC concepts in moderate to high-seismic areas and will recommend the next steps the bridge industry should take to make ABC a reality in these areas.

The firm recently completed a notable project in Redmond, Wash., in which additional attention was paid to accelerating construction while creating a dramatic design. BergerABAM devised a unique design for a roadway that crossed SR 520 at a skew of 70 degrees. Offset spans allowed the structural framing to be skewed at 30 degrees and provided additional surface area for landscaping and park-like amenities. The resulting design was a cost-effective solution that ideally suited the goal of the project, which was to connect the Microsoft campuses on both sides of SR 520.

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To speed construction, precast concrete columns were used, minimizing construction time for an intermediate pier in the medians. "High-seismic forces require close attention to the connections," says Spry. Meeting those requirements, while also incorporating ABC concepts, necessitates the proper balance to ensure all needs are met.

The Tacoma Spur, designed by BergerABAM for the Washington State Department of Transportation, involved more than 14,500 lineal ft of elevated post-tensioned concrete box girder freeway bridges and a complex interchange connecting the downtown business district with I-5 in Tacoma, Wash. The design included 2200 linear ft of retaining wall on a difficult sloping site.

Innovations Continue

The firm continues to look to innovative approaches, including combining materials and girder types to create the most effective designs. "We're combining post-tensioned concrete box girders on end spans and precast, prestressed concrete girders over waterways more often to meet individual project needs," says Fernandes. Recently, designers combined 210-ft-long, post-tensioned concrete box girders over a railroad site with precast, prestressed concrete girders for the approaches.

In the case of the Elwha River Bridge in Clallam County, Wash., the firm combined precast concrete and cast-in-place concrete to achieve multiple user goals. The bridge features cast-in-place segmental concrete spans that support a precast concrete pedestrian bridge hung beneath the main structure.

The bridge was built with two end spans of cast-in-place concrete formed on falsework while two center, cantilevered sections were placed with a form traveler. For the pedestrian bridge underneath, which connects to the Olympic Discovery Trail, precast concrete panels were suspended from the main superstructure, while precast concrete deck bulb-tee girders were used for the section that runs perpendicular to the main structure. (For more on this project, see the Spring 2010 issue of *ASPIRE*.™)

"We're proud of the way we're combining materials to maximize their effectiveness and eliminate expansion joints," says Fernandes. "We primarily use precast, prestressed concrete girders and post-tensioned concrete box girders, but there are many ways to combine those to get the most out of them."

Innovative designs will continue to be required, Spry notes, but BergerABAM's designers are up to the challenges. "There are a lot of people here who have spent all of their careers with the company, even though they had a lot of other options. That's one reason we have succeeded. Each generation has passed down its knowledge and created a strong working environment that gives us continuity and encourages us to innovate."

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

BergerABAM completed a type, size, and location study and prepared plans, specifications, and cost estimates for the replacement of two bridges and approach roadway along Valley Avenue in Tacoma, Wash. The new 662-ft-long, four-span, Valley Avenue Bridge design includes a 215-ft-long, cast-in-place, post-tensioned concrete box girder main span that cantilevers 30 ft beyond piers to support the ends of precast, prestressed concrete girder approach spans.

Prestressed Concrete Inspires BergerABAM

Arthur Anderson learned about the potential of prestressed concrete while providing instrumentation for the 150-ft-long, full-scale test beam used for the Walnut Lane Bridge in Philadelphia, Pa., in 1949. That insight eventually led to the founding of ABAM.

Seeing opportunity, Anderson joined with his brother Tom, also a contractor, to form Concrete Engineering Co. That company later became Concrete Technology Corp., a precast concrete manufacturer that remains an industry leader. The brothers, both with advanced engineering degrees, discovered they were conflicted out of bidding on engineering projects, so they created a sister company called Anderson & Anderson Consulting Engineers to design prestressed concrete projects.

The firm thrived by creating small, prestressed concrete bridges for logging companies that originally constructed only short-term timber bridges. "It's always more difficult to introduce new ideas to large groups, so the smaller the unit, the easier new ideas will be accepted," says Bob Mast, senior principal, about starting out on small projects. From there, the firm developed strong relationships with a number of city and county officials, who took advantage of the company's turnkey capabilities and innovative approaches.

Hal Birkeland joined the firm in 1957 as a partner, and Mast joined in 1959 as a junior engineer, becoming a partner in 1963. They became Anderson, Birkeland, Anderson and Mast, creating ABAM Engineers. A downturn in two key markets—offshore and transit—during the late 1980s led to the affiliation with The Louis Berger Group Inc., which owns 51% of the firm's stock, with the rest owned by BergerABAM key employees.

Today, BergerABAM operates six offices (Federal Way, Seattle, and Vancouver, Wash.; Portland, Ore.; Las Vegas, Nev.; and Houston, Tex.) with over 200 employees. In addition to its transportation (roadway, bridge, and transit) department, it also operates waterfront and marine, offshore and energy, building, planning, and natural resources, construction administration, and underwater services sectors. Revenues are approximately $37.4 million.