FOCUS

Vanasse Hangen Brustlin—

Building Bridges and Partnerships

by Craig A. Shutt

Focus on constructability creates close relationships throughout the team

Growing stakeholder needs, more challenging terrain, and new technologies require designers to work closer with everyone on the construction team. These trends play to the strengths of Vanasse Hangen Brustlin Inc. (VHB) in Watertown, Mass., where close collaboration is seen as a core strength.

"When we founded the business more than 30 years ago, the principals of VHB wanted to create a consulting practice that broke out of the typical model," says Bob Brustlin, president and CEO. "No longer was it possible to succeed in our business with only technical skills. Process knowledge, an awareness of the context of the project, and political acumen were also needed."

No Design Cocoons

A high level of collaboration has become critical, says Christopher D. Baker, principal and national director of structural engineering. "Necessity is the mother of much invention these days," he notes. "The biggest change in the industry is that we're not in a little cocoon as designers today, where we go into a room and return with a design that we give to others to construct. Interaction and collaboration are real, and they create more efficient designs."

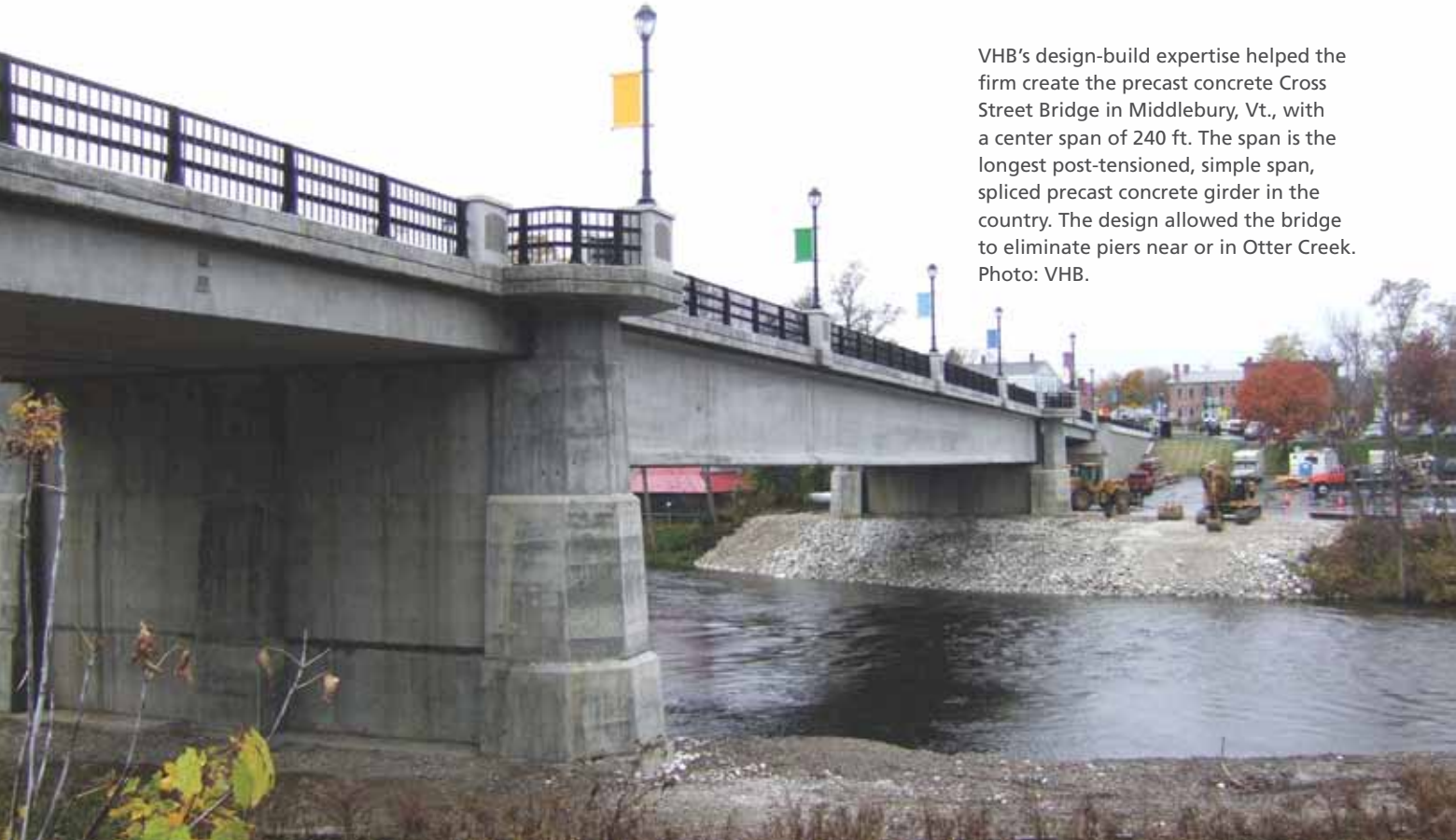
The key to designing and building successful bridges today is "building trust with collaborators and the community," he says. "It's a different world today, and there are many more 'stakeholders' with specific needs. That requires everyone to work on the same page and to use everyone's expertise to its fullest."

Emphasizing collaboration encourages the firm to work in a design-build format. "Clients expect us to find the most cost-effective approach, whatever that requires," Baker says. "So we really drill into costs and ask our partners for more efficient ideas." The firm works with contractors as part of a design-build team and also produces documents for design-build teams on behalf of owners, including the Departments of Transportation for Rhode Island, Vermont, New Hampshire, and Massachusetts.

"The design-build process creates deep relationships for us, which are important today," Baker says. "These integrated relationships help us understand all the needs on the project, even when we do design-bid-build projects."

Cross Street Bridge

Those relationships came to the fore on the Cross Street Bridge in Middlebury,



VHB's design-build expertise helped the firm create the precast concrete Cross Street Bridge in Middlebury, Vt., with a center span of 240 ft. The span is the longest post-tensioned, simple span, spliced precast concrete girder in the country. The design allowed the bridge to eliminate piers near or in Otter Creek. Photo: VHB.

The new Route 103 Bridge over York River in York, Maine, features two 55-ft-long end spans and five 80-ft-long interior spans that use four 36-in.-deep Northeast Extreme Tee (NEXT) beams. The bridge provides the first use of this new girder design, which has wider stems to support higher design loads. Photo: VHB. Inset photo: Dailey Precast.

Vt., the state's first major design-build transportation project. The project used only local funding—$16 million worth—to create a three-span, 480-ft-long bridge consisting of precast concrete girders. The 240-ft main span, the longest precast, post-tensioned, simple span, spliced concrete girders in the country, eliminated the need for any piers near Otter Creek.

"This project was very much in keeping with the trend of clients and owners wanting to stretch the envelope in design and construction," says Mark A. Colgan, principal and director of transportation engineering. "No one takes 'no' for an answer. Instead, we ask if there is a way to make this work that's never been done." (For more, see the case history in *ASPIRE*™ Winter 2011 issue, page 32, and the city profile in the Spring 2011 issue, page 44).

The firm performs constructability reviews on its projects, Baker notes. It also has created three-dimensional reviews of crane placements to ensure every angle has been thought through for efficiency. "We don't do means-and-methods construction documentation to direct the contractors," he explains.

'It's a different world today, and there are many more 'stakeholders' with specific needs.'

"But we use our understanding of those techniques to help us improve constructability."

First NEXT Beam

In some cases, the firm produces dual documentation so owners can offer alternative designs to bidders. That resulted in an innovative approach for the Route 103 Bridge over the York River in York, Maine, completed in November 2010. The seven-span bridge features precast concrete Northeast Extreme Tee (NEXT) Beams, their first use in the United States.

The NEXT beam is similar to a standard double-tee beam except the stems are wider to accommodate bridge-design loads and to facilitate accelerated bridge construction, explains Steven Hodgdon, project manager. "The NEXT beam offers significant advantages over typical stringer-beam bridges," he says. "It may soon become a standard bridge system for medium-span bridges." (For more, see the Creative Concrete Construction article in *ASPIRE* Spring 2011 issue, page 46.)

A significant aspect of the design was that VHB provided an alternative design using standard precast concrete box beams. "Five of six bidders bid the NEXT-beam design," Hodgdon says. "It shows that we could produce bids competitive with standard designs in the first try with a brand new cross section. That provides a real stride forward in creating bridges with minimal risk, and it results from everyone trusting the participants."

Missisquoi Bay Bridge

Another project created with the dual-design approach was the Missisquoi Bay Bridge in Alburg, Vt., which replaced a badly deteriorated 1938 steel drawbridge. The 3600-ft, 23-span design, which featured a precast concrete trapezoidal segmental box beam design, is the longest bridge in Vermont. A steel design also was provided, with two complete sets of drawings.

VHB helped streamline the design process and overcome environmental issues, reducing the permitting

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process to 5 years while incorporating design ideas that saved costs and future maintenance. The design team performed extensive permitting, including National Environmental Policy Act (NEPA) documentation and nine additional regulatory agencies.

"We had to overcome a number of challenges, including poor soil conditions, tight permit windows, and contentious water-quality issues," says Baker. "And we had to design an economical structure for an environmentally sensitive area and in a timely manner. This is the type of project where design-build can turn the corner on making dual-design effective."

VHB's efforts to ensure the most cost-efficient design extend to collaborators in other areas of the country. This is aided by the company's 20 offices along the East Coast. "Our transportation, land-development, and environmental professionals collaborate across offices and regions," says Brustlin. "'Integrated Services' is more than just a slogan—it is how we tackle every challenge."

Little Bay Bridge

That network aided the alternatives provided for Little Bay Bridge in Dover, N.H. To ensure efficiency, the New Hampshire Department of Transportation (NHDOT) allowed dual designs in steel and precast concrete. For the most economical option, VHB created a precast, post-tensioned bulb-tee girder alternative (which was selected) but allowed substitutions of Florida or Virginia bulb tees.

"Through our offices in New England, Virginia, and Florida, we talked with precasters to ensure they could deliver girders if needed," Baker explains. VHB even sent preliminary drawings to several fabricators to ensure the design could be produced. "We presented the documents knowing the alternatives could be fabricated, delivered, and constructed."

The goal with such efforts is to speed up construction. "The biggest trend today certainly is 'Get It Done,'" he says. "Everything we do emanates from that goal. Accelerated bridge construction (ABC) techniques are moving forward in many states, and they are driving a lot of discussions. Some states have a toe in the water, but others have dived in." Colgan agrees. "Everyone is asking how we can do things faster."

Lower Plains Bridge

Accelerated construction was used for the Lower Plains Road Bridge in Middlebury, Vt., which was destroyed by a powerful storm in August 2008. VHB not only had to design a replacement structure rapidly but consider the needs of four property owners, accommodate a river with flows of more than 16 ft^3/second, coordinate aerial utility relocation, and include a waterline replacement project. The structure also had to be built during the Vermont winter.

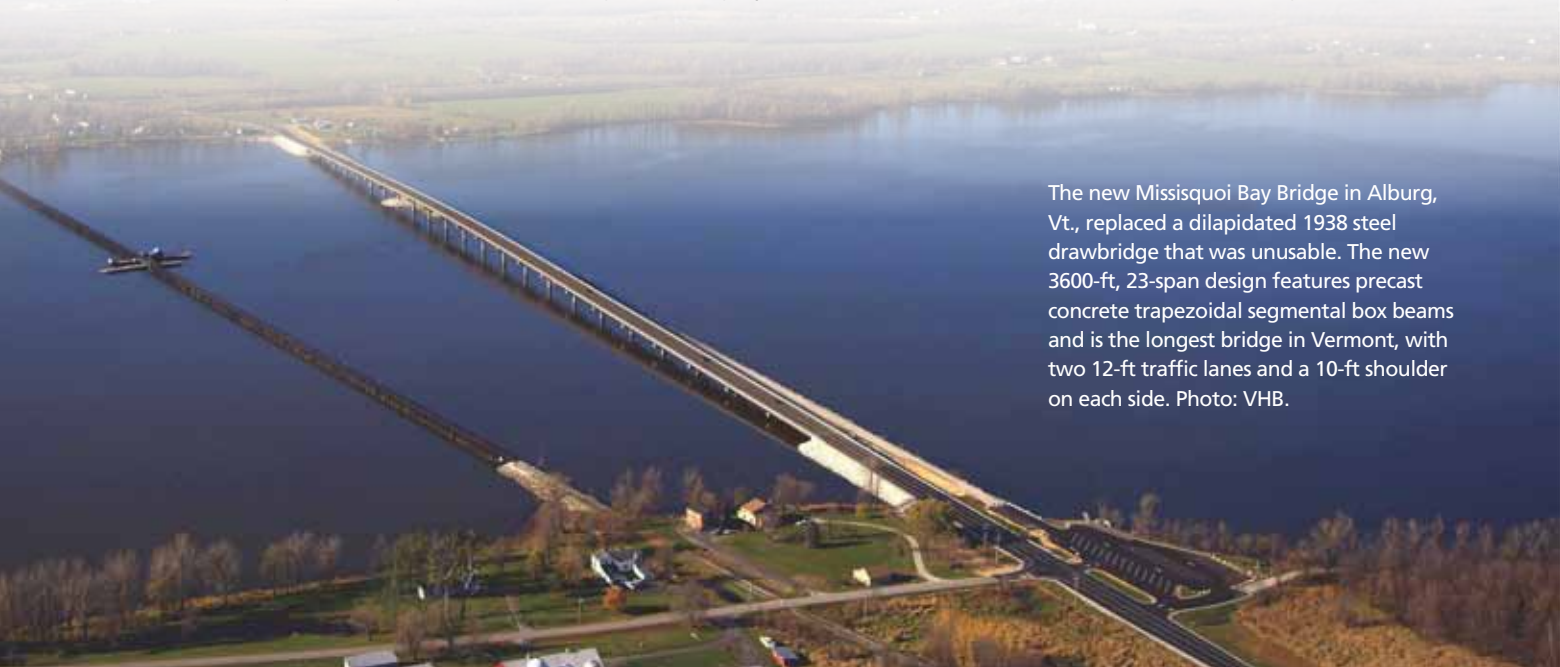
The designers created a single-span, precast concrete box-beam design with a shallow superstructure to accommodate the new water line. Precast and cast-in-place concrete options were provided for the abutments to accommodate ABC techniques. The design was bid by five contractors on January 12, 2009, and the new precast concrete bridge opened on May 5, 2009, on time and under the bid price of $936,000.

"The combination of a new generation of managers at the owner level and an interest in getting things built quicker has opened the floodgates to more creativity and innovative design, fabrication, and construction," says Colgan. "Precast concrete allows many options for overcoming cold-weather substructure construction and keeps crews busy in winter. As we all do these projects more, it will become the norm to build a bridge in a few months in the right applications."

Lime Kiln Bridge

VHB's focus on innovation also extends to replicating the look of existing bridges, a growing challenge in New England, where many bridges have historic backgrounds. An example is the Lime Kiln Bridge in Colchester, Vt., the only open-spandrel concrete arch bridge in Vermont and one of the first in the country.

The 300-ft-long bridge, built in 1913, was rebuilt by combining precast concrete box beams and voided-deck beams with cast-in-place concrete



The new Missisquoi Bay Bridge in Alburg, Vt., replaced a dilapidated 1938 steel drawbridge that was unusable. The new 3600-ft, 23-span design features precast concrete trapezoidal segmental box beams and is the longest bridge in Vermont, with two 12-ft traffic lanes and a 10-ft shoulder on each side. Photo: VHB.

Creative techniques featuring a combination of precast concrete box beams and slabs, plus cast-in-place concrete arches allowed VHB to replicate the look of the original 1913 Lime Kiln Bridge at the Winooski River Gorge in Vermont. The combination replicated the original decorative geometrical features and ornamental railings, while adding safety and durability. Photo: VHB.

elements. "This was a very innovative design, with nice clean lines of solid slabs and box beams," says Colgan. "We continue to receive compliments for the success it was and the beautiful structure it is." (For more, see the Fall 2008 issue of *ASPIRE*, page 44).

The Vermont Agency of Transportation (VTrans) considered rehabilitating the structure, but that would have provided only 20 more years of service, Baker notes. And durability and life-cycle costs are driving factors today. "There are few dollars for construction and even fewer for long-term maintenance," he says.

VHB runs life-cycle cost analyses on each project to ensure owners know their true costs. "When you design a bridge with a 75-year life span and you can show that a concrete option will have little maintenance while a steel option will need to be painted in years 20, 40, and 60, it's an easy choice. Owners understand the long-term consequences."

New Techniques Growing

VHB's designers are encouraged by new techniques coming along. "High-performance concrete is becoming more standard, with 6000 to 8000 psi design compressive strengths more commonplace," says Baker. "We're moving closer to 10,000 psi, although we haven't used it yet." High-performance concrete also is being used for its durability and low permeability rather than just strength, he notes, and new polymers and admixtures are aiding that capability.

"These ideas fit VHB well, because we always try to innovate," he says. "Innovation in our industry used to be glamorous, mostly for isolated applications. But now, owners really want to get things done, and that demands new approaches to design cheaper, quicker, faster, and with less impact. Innovation is no longer just cute, and prestressed and precast concrete are a big part of that."

The biggest challenge, says Brustlin, comes in rolling with the punches and staying on top of key markets as they grow. "VHB is in a good situation, because we balance private and public bridge work well, and public work has been strong due to the stimulus funding and enlightened thinking in some states, which has made infrastructure projects robust." As that has begun to slow, the firm is focusing on transportation technology and the transit-and-rail market, which is especially strong in New England.

Brustlin also sees the bridge market as a bright spot in the coming years. "We have close relationships with states where there is a strong appetite to fund reconstruction and create replacement bridges. We feel good about 2011 and even better about what is coming, especially as the private sector revives."

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

VHB's Historic Roots

Although VHB was founded in January 1979, its structural-engineering practice has roots going back 50 years. In 1987, the firm purchased the well-established Congden, Gurney, Towle Inc., which had been designing bridges since the 1950s, including some of the first prestressed concrete bridges in Massachusetts.

VHB was formed as Vanasse/Hangen Associates when Rich Hangen and Bob Vanasse, along with John Kennedy, Bill Roache and Bob Brustlin, opened a traffic-planning and engineering firm in Boston. Brustlin became a partner in the early 1980s, creating VHB. Vanasse left in 1990 to start his own land-development company, while Hangen retired and now serves on VHB's board.

Today, the firm employs 900 people in 20 offices working on projects involving transportation, land-development, and environmental aspects of complex infrastructure and development initiatives.

The company focuses on four key territories, says Bob Brustlin, president and CEO: New England, New York, Washington, D.C., and Florida. In each area, recent acquisitions have bolstered the firm's standing. "Our goal is to be the prominent provider in our key markets rather than expand out beyond our capabilities."