Vermont

by Robert S. Young, Vermont Agency of Transportation

Vermont is a mostly rural state, and many of its bridges are one-span structures less than 150 ft in length. Because bridge closures can lead to long detours, the Vermont Agency of Transportation (VTrans) often uses accelerated bridge construction (ABC) techniques to minimize traffic interruptions. Additionally, VTrans works with local communities to set construction schedules that accommodate their time frames.

NEXT Projects and ABC

A key component in most of Vermont's concrete bridges is the Northeast Extreme Tee (NEXT) precast concrete beam, which features a top flange that forms the structural bridge deck, eliminating construction steps so bridges can be quickly opened to traffic.

VTrans first used NEXT beams in 2011, for the construction of a 65-ft span over the Williams River on State Road 103 in Chester. With NEXT beams, the bridge opened to traffic in four weeks. The alternative design would have required a temporary bridge and taken approximately nine months to complete. The minimal disruption to traffic proved that NEXT beams provide benefits, and they are now used regularly.

NEXT beams provided an important tool when VTrans established its Accelerated Bridge Program (ABP) in 2012. ABC offers several benefits in the state, such as eliminating environmental concerns related to temporary bridges, limiting the impact of construction on rights-of-ways and utilities, and reducing burdens on detour routes.

Since ABP's inception, VTrans has constructed or rehabilitated the superstructures on 79 bridges, with another three projects underway and 17 in the planning stage. Since 2012, about 50% of VTrans projects have been undertaken via ABP. ABP emphasizes prefabrication of components and the use of incentive/disincentive contract provisions that encourage new techniques and efficiencies. VTrans's Project Initiation and Innovation Team (PIIT), which was developed in conjunction with ABP in 2012, has developed many techniques to create efficient, consistent, and programmatic alternatives for rehabilitating or replacing deteriorated bridges and culverts.

Tropical Storm Irene

In 2011, Tropical Storm Irene damaged or destroyed many Vermont bridges, including some that had not been scheduled for replacement. The creation of ABP and PIIT and a boost in state funding helped return these bridges to service quickly.

During the storm recovery process, Vermont began using a "corridor" construction technique, in which a series of neighboring bridges are replaced at once. One of the first corridors was in Rochester, where Irene destroyed two of the four bridges and damaged another. VTrans's plan to replace all four bridges allowed one contractor to efficiently mobilize crews and materials. Two of the "Rochester Fast 4" bridges used single-span pretensioned concrete NEXT beams with a precast concrete curtain wall, while another featured an open-bottom arch with a cast-in-place (CIP) concrete subfooting and a precast concrete pedestal wall and concrete arch. (See "Rochester Fast 4 on VT 73," which appeared in the Fall 2016 issue of *ASPIRE*®.) VTrans now uses this corridor approach wherever feasible.

Planning and Feedback

A rolling five-year plan helps determine the state's construction schedule (which Irene upended for several years). Over time, VTrans has become more efficient at setting key milestones in project timetables. To this end, VTrans uses scheduling tools to track every element, including environmental permitting and design progress.

VTrans involves community members in every aspect of projects, including scheduling. For example, VTrans consults trucking firms that may be affected by detours and collaborates

In 2011, Vermont Agency of Transportation built a 65-ft-long bridge over the south branch of the Williams River on State Road 103 in Chester, marking the state's first use of Northeast Extreme Tee (NEXT) precast concrete beams. The NEXT beam has since become a standard design option in the state for fast construction. Photo: Vermont Agency of Transportation.

In an effort to replicate the aesthetics of the original Lime Kiln Bridge over the Winooski River Gorge, which was one of the first open-spandrel arch bridges in the United States, designers used precast concrete beams along with cast-in-place concrete arches, piers, floor beams, and deck. Special attention was paid to the visual depth of the arch spans, the depth of intermediate spans, and the post spacing on railings. Photo: VHB-Vanasse Hangen Brustin.

with towns to ensure that, within reasonable limits, schedules and designs are adaptable to their needs. Some towns in high-tourist areas want to avoid construction in the summer, while others want to build in the summer and avoid disruptions during the school year. Balancing those needs and using ABC helps shorten construction periods for all.

VTrans inspects and plans for local bridges under a Town Highway Bridge Program, and local communities are involved at every step. At about the 30% stage of design, town officials are invited to offer input on the plan and schedule. If a road closure and ABC are chosen, the local share in the project is about 50% less than if the community requires a temporary bridge. Officials are updated one year ahead of construction, and, starting about a month before construction begins, signs and announcements are used to keep communities informed.

VTrans also works closely with contractors to address their scheduling needs. Because ABC creates a higher demand for precast concrete elements, contractors have worried that they might not be able to maintain the same, consistent workforce as the one that typically worked with CIP concrete in the summer. In response to their concerns, VTrans now permits contractors to fabricate simple, nonpretensioned precast concrete elements, such as pile caps and approach slabs. They often cast these elements at the project site, which reduces transportation costs and keeps crews busy. The ABC approach also allows contractors to continue working through the winter. By prefabricating components, contractors can start and finish multiple bridge projects in one season. Previously, a conventional project—a CIP concrete bridge with a temporary bridge—might take two construction seasons to complete.

Design-Build Options

VTrans often works with consultants to develop designs that can be quickly executed. In some cases, a design-build delivery method is used. For example, on Interstate 91 over the Williams River and Green Mountain Railroad in Rockingham, twin narrow, four-span steel-truss bridges in poor condition are being replaced on the same alignment with two four-span structures comprising five lines of precast concrete bulb-tee girders in a 167-245-245-195-ft span configuration. The contract went to the design-build team whose proposal had the best combination of concept and bid price. The 852-ft-long bridges, scheduled for completion in 2020, will be built one at a time and feature two 12-ft-wide travel lanes, a 4-ft-wide left shoulder, and a 10-ft-wide breakdown lane.

An earlier design-build project was the 1036-ft-long Brattleboro Bridge, which consists of three spans of segmental CIP concrete box girders constructed with the balanced cantilever method. This "gateway" bridge over the West River and along the West River Trail features pedestrian viewing platforms and piers with Vermont-inspired stone-formed and stained concrete that blends with the local environment. (The Brattleboro Bridge was featured in the Winter 2018 issue of *ASPIRE*.)

Typical bridges do not feature that level of aesthetic design. However, as older bridges are replaced, VTrans seeks new designs that reflect the original aesthetic concepts. For example, when the Lime Kiln Bridge over the Winooski River Gorge replaced one of last open-spandrel arch bridges in the United States, designers used an open-spandrel arch featuring 80 precast, prestressed concrete beams and CIP concrete arches, piers, floor beams, and deck. The design reflected the aesthetics of the original bridge while upgrading the structure and completing the project with an efficient schedule.

Going forward, Vermont will continue to prioritize techniques to efficiently construct projects and work to ensure communities are on board as projects are developed.

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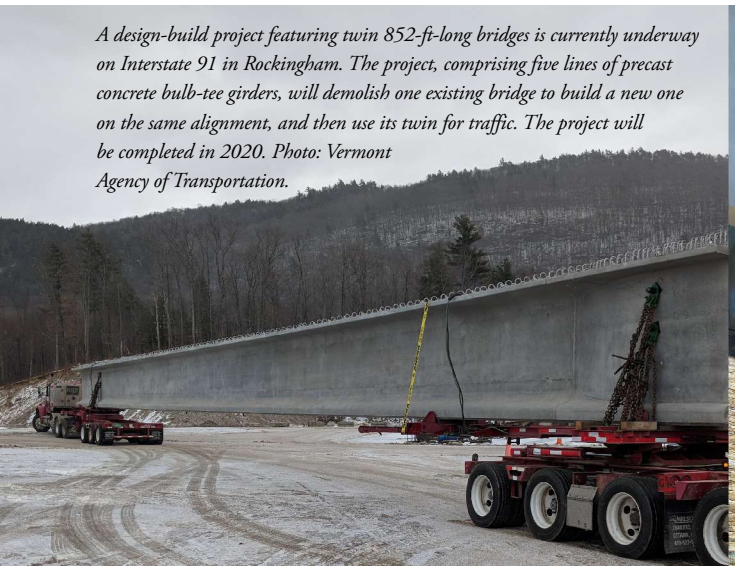
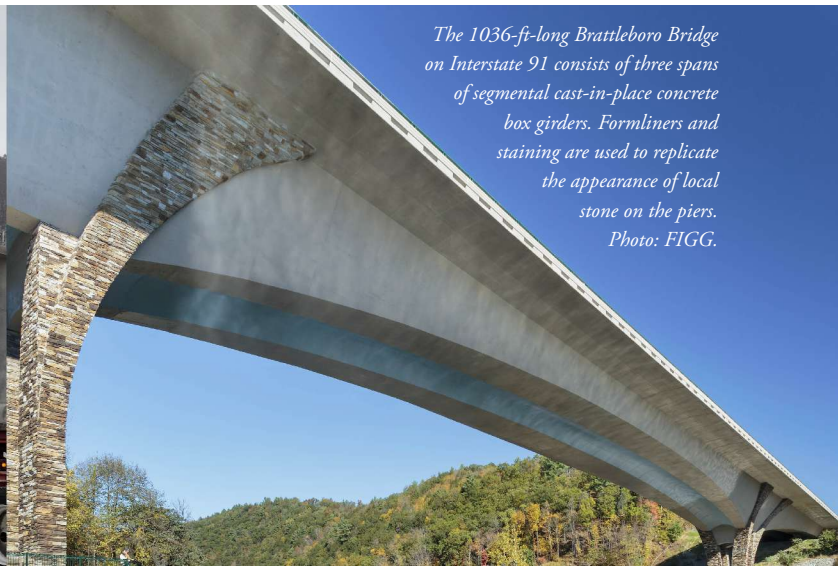


A design-build project featuring twin 852-ft-long bridges is currently underway on Interstate 91 in Rockingham. The project, comprising five lines of precast concrete bulb-tee girders, will demolish one existing bridge to build a new one on the same alignment, and then use its twin for traffic. The project will be completed in 2020. Photo: Vermont Agency of Transportation.



The 1036-ft-long Brattleboro Bridge on Interstate 91 consists of three spans of segmental cast-in-place concrete box girders. Formliners and staining are used to replicate the appearance of local stone on the piers. Photo: FIGG.