ABC SOLUTION TO BRIDGE IN WOODSTOCK VERMONT

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The Vermont Agency of Transportation (VTrans) coordinated with local officials to replace the superstructure of structurally deficient Bridge 51 carrying Vermont Route 4 over the Kedron Brook in Woodstock, Vermont. The Town Selectboard was familiar with VTrans' Accelerated Bridge Program and determined very early in the process that Accelerated Bridge Construction (ABC) techniques should be utilized to minimize impacts to area businesses and regional traffic. The challenges of the site required working next to adjacent buildings attached to the historic bridge with a sharp skew. The development of a connection detail that removed transverse post tensioning allowed the bridge to be constructed in 21 days.

ABC Flexibility

10,000 vehicles a day travel through the Village of Woodstock where the Selectboard manages the needs of both the local businesses and the transportation use of the Route 4 corridor. Woodstock Village is populated with visitors year round and the thought of construction happening in the hart of the village was a big concern. Accelerating construction activities was an obvious choice, but closing the road off to patrons was not well received. The big advantage of short duration project is the Town could choose a construction window when business traffic was slow. It was decided that the month of April worked best.

Traffic Control for Tourism

Vermont Route 4 is a part of the National Highway System (NHS) connecting the east and western parts of the State of Vermont. Bridge 51 is located in a section of the highway in the Village of Woodstock where the infrastructure is owned and maintained by the Village. The ruling members of the Board did not want truck traffic traveling through the local streets of the village, but they did not want to discourage tourist from entering the Village. A truck detour would reroute tracker trailers 40 miles around Bridge 51. At turning locations signs were added to the detour package indicating that Woodstock Village was open to encourage tourist to stay on Vermont Route 4. Service trucks and cars still had access through a local detour once they entered the Village. Local police were not shy to issue tickets to tractor trailers that "missed" the truck detour signs.

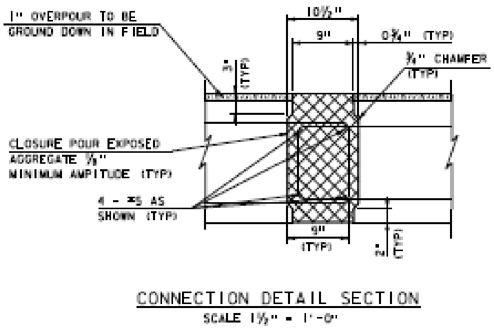
Village Construction

Once the community was on board with ABC. The design challenge could begin on the details of superstructure replacement. The existing bridge was a 1935 custom made concrete T-beam shaped to fit between existing buildings constructed on the edge of the channel.. The design span was 34ft on the downstream side and 50 ft on the upstream side. Prestress concrete solid slabs would be ideal for the span length, but the bridge had varying skews from 39 and 49 degrees. This would have made transverse post tensioning extremely difficult and time consuming, so a longitudinal closure pour connection was developed. A UHPC joint was considered early on in the design, but the high cost and coordination with an out of state subcontractor would be too high a risk for the schedule.

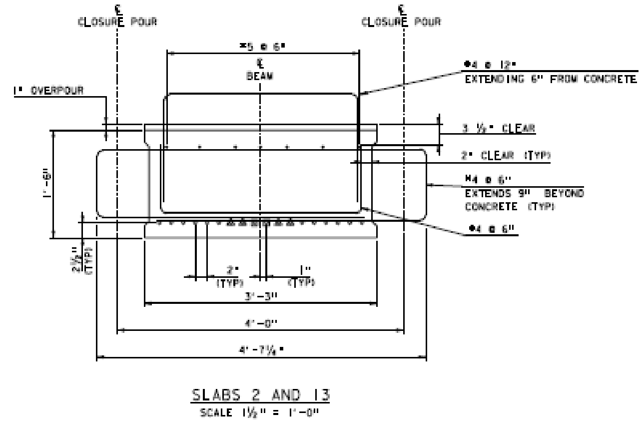
Connection

The longitudinal joint consisted of #4 bars with two bends that protruded beyond the edge of the solid slab. This was a simple modification of a U-bar or hairpin connection commonly used in ABC construction. The bars were aligned to stagger along the joint and 4 longitudinal straight bars were located in the void after beam placement.

Longitudinal Closure Joint



Solid Slab Prestressed Beam with protruding U-bars



Existing Conduit To Be Lowered

Solid Slabs Placed

Underground Utilities

The existing bridge supported several underground utilities. Some could be abandoned but 5 conduits contained the region's communication wire network and were located in one bay of the existing T-beam. The conduits could not be relocated around or over the site and time did not allow for splicing through the new slabs. Since the thickness of the slabs were shallower than the T-beams at 18 inches, the bridge seat would need to be raised. This created a space where the conduits could be lowered and cast into the new bridge seat.

Cast-in-place

Yes, Vermont uses cast-in-place concrete on ABC projects. The new bridge seat and longitudinal closure pours were cast with non-proprietary high performance rapid setting concrete that reached design strength in 24 hours. A specification was developed early in the Program and has been very successful.

Large Skew Prestress Beams

The beams were placed on three bearing pads, two on one side and one on the other to achieve even bearing. The prestressing in the beams combined with the large skewed ends twists the beams out of plane when released. The three points of bearing prevent the need to shim for even contact.

First beam over utilities encased in bridge seat

Aesthetic Bridge Rail

Historic Bridge Rail and Building

After the slabs were installed a cast-in-place concrete sidewalk and bridge rail were constructed that complimented the historical character of the Village. The NHS designation required a Test Level 3 bridge rail. One aesthetic rail was already crash tested to meet both design and permitting needs of the project as well as approval from the Village. There were also concerns with the close proximity of construction activities to an adjacent historic building. Vibration monitoring was another permit requirement and care was taken to avoid damage to the building's sensitive stone foundation.

Summary of ABC success

The following tasks were performed for the Woodstock Village Bridge 51 replacement and can be used on any ABC project:

Project Manager

- Early public outreach - buy-in on closure duration and time of year
- Permitting coordination – Involve resource management early and have them involved in public meetings to determine critical path for project delivery
- Advertise early – allow time for Contractor to prepare and be successful

Project Engineer

- Use details that meet the schedule – specify curing times and note required strengths for sequencing
- Minimize details that require subs or move sub work outside of the closure period
- Construction schedule review – consult geotechnical, bridge, and construction engineers to develop reasonable schedules during design phase.

Contractor

- Submit schedules and discuss work plan and fabrication drawing submittal process shortly after award
- Identify subcontractors and suppliers on the critical path and schedule early

Resident Engineer

- Staff the project appropriate for the schedule
- Promote knowledge transfer with design engineers participating in the field to assist Resident Engineers