HAMPTON ROADS BRIDGE TUNNEL
APPROACH TRESTLE REPAIRS

CFRP Prestressed Beam Repairs

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Project Orientation

• Hampton Roads Bridge Tunnel (HRBT) carries I-64 across Hampton Roads.
• All repair work was done to the two southern approach trestles.
• HRBT trestles were opened 1957 (WB) and 1974 (EB).
Project Location
Trestle

Approximately 9000LF of trestle, each way

Clearance is near low tide
Critical Link with Critical Needs

• The channel over the tunnel is major international cargo and US Navy passage.
• Severe Deterioration was noted during routine inspections
• Additional issues were noted during patching operations;
  • Line girder rating required posting.
  • Grid analysis eliminated need for posting if deterioration stopped
• Several alternatives were evaluated for repairs.
  • Due to lack of familiarity with proposed repair approaches and a wide range of loss of section several approaches were proposed
Serious deterioration

The solution at this level was not a wrap. This was repaired with external PT.

Worst examples of strand loss
Repair Selection

- External PT was eventually designed for the worst conditions where additional capacity was required to meet service and strength level conditions.
- Wrap was designed for beams which passed service level requirements but required additional capacity for strength.

Beams in 1957 were similar to Type 3 with Gr 250 7/16” dia. SR strands. In 1974 similar to Type 4 with Gr 270 ½” dia SR strands.
Mock up beams

- Mock ups were proposed for PT using beams which had been stored on site since construction.
  - 2 1957 beams and 2 1974 beams were retrieve for PT markup
  - Contractor asked to retrieve an extra beam for CFRP (making total of 5 beams. A formal mockup was added for CFRP wrap during construction
  - Beams were salvaged from a nearby bridge to increase the testing sample.
Lessons from CFRP Mockup

- Anchor at ends of CFRP repair was difficult to install due to the sharp inside corner at the web to flange transition.
- Contractor asked to build up epoxy; that was rejected due to thermal incompatibility.
- VDOT proposed an alternative wrap layout to reduce pullout when wet, contractor rejected.

Contractor and VDOT agreed to single piece covering horsetail anchors.
Lab testing

- VDOT has several additional structures with similar exposures for which these repair types are being considered.
- Getting information related to the efficacy for restoration of load was considered important enough to warrant follow up testing (testing coming August 2019).
CFRP Installation.

• The patching was under a separate contract (using shotcrete)
• Drilled holes for the horsetail anchorages were made easier by use of pachometer to determine rebar location
• Installation was fairly easy. It was complicated by an inside curve on both sides with sharp corners
  • A proposal was submitted for a build up to soften the radius with an epoxy build up. This was rejected due to the change in the properties in thick epoxy layer. An alternative to lap multiple layers to avoid the

Shotcrete patching

Surface prep for CFRP after patching
CFRP Installation
CFRP Installation
CFRP Installation
I was not able to get final step. Last step is to seal beam and CFRP wrap repair.
Closing thoughts

VDOT is very satisfied at the conclusion of the construction process.

Installation went very quickly and smoothly with no significant hiccups during the wrap installation.

We are waiting for confirmation from the Lab.

We have other major structure where this is potentially a solution to extend the life of the superstructure.

The trestles will be removed from service by 2024.
Questions?

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