Fully Integral 2 Span Curved Girder Bridge Replacement in 72 days

River Road over New Haven River– New Haven, VT

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Project Site

- Town of New Haven, VT
- Population: 1,700
- 1,600 ADT
Project Location
Existing Conditions

- Built in 1935
- 3 span - 176’ (54’-74’-48’) long steel girder bridge
- 20’ curb to curb
- Ancillary Snowmobile Bridge
- Fair/Poor Condition
Alignment

- Increase Site Distance
  - Alignment shift
  - Widening roadway opening
- Minor Re-location of Halpin Rd.
- Widened Shoulder for Snowmobile Access
Hydraulics

- Bridge overtopped below Q100
- Discharge over road at Q100:
  - Significant chase to vertical profile
    - East approach slopes <1%
- Need to eliminate 2 existing wall piers
- Maximize hydraulic opening
Geotechnical Conditions

- Very Poor Soils
  - 40’-75’ depth of Very Soft Clay (WR)
- No Bedrock encountered in 120’
- Scour potential of 15’ at the Pier for Q100
Public Input

- Presented Matrix of Choices, including $$
- 2.5 Month Closure
- Town Chose to Close the Bridge
- Met with Abutters
Design
Superstructure Solution

- Span Length = 164.35’ (2 - 82.2’ spans)
- 730’ Radius Horizontal Curve at Baseline
- 4% Superelevation
- Existing 50 degree skew eliminated
Superstructure

- 32’-6” Out to Out
- 29’-6” Curb-Curb
- 9’ Girder Spacing
- 33 ¾” Curved Steel Plate Girders
  - Metallized
- 8 ½” CIP Deck
- 3” Wearing Course
Substructure Solution

- Deep foundations required
- Precast Integral abutments on 75’ H piles
- 8’ Diameter Monoshaft
  - 120’ Deep
  - Supports 6’ CIP column and Precast Cap
  - Minimizes river obstructions
Substructure

- VTrans Prefers Jointless Bridges
- Integral Abutments w/Steel H-Piles
Pre-Cast Abutment and Wings

- Cavities in Precast to receive H-piles
Pre-cast Pier Cap

- Pre-cast Integral Pier Cap
- Limits Obstruction in River
- Removes cap from frequent high flow levels

- Required girder stubs to be included in precast element
  - Extend 6’ from CL to each side
  - Max 12’ shipping width
Pre-Cast Integral Pier Cap

- Steel Fabricated with 6’ Splices
- Shipped to Pre-cast Yard and Fully Assembled
- Pier Cap Poured – Steel Disassembled and Placed in Field
- Independent Engineer Hired by Contractor to Ensure Coordination
Pre-cast Pier Cap

6" DIAMETER CORRUGATED SLEEVES IN PRECAST BEAM
Pier Cap Details

- 10 #11 BARS WITH PIER CAP
- 9 #11 IN DECK
- 2 #11 BARS BUNDLED (TYP.)
- MECHANICAL COUPLER STAGGERED (TYP.)

- #5 BARS
- #58 BARS
- #6 STIRRUPS
- #8
- GROUT (TYP.)
- #6 HOOP @ 4"
- 5/8" DIA. STUDS
- #6 HOOPS/STIRRUPS 2 EACH SIDE
- 6" DIAMETER CORRUGATED SLEEVES (TYP.)
- 6'0" DIA. COLUMN

- WEARING SURFACE
- CIP DECK
- PRECAST PIERCAP
Pre-cast Pier Cap

- Corrugate Pipe for column dowels
- Circular Ties / Extension of column
- Top of top flange
- Main Cap Reinforcement passing through holes in girder web
- Shear stud matrix on girder webs
- Hoops around stud matrix
Column to Pre-Cast Connection

- 2” Grout Pad w/ ¾” Edge
Complex Analysis

- 3D Analysis model included:
  - Full superstructure
  - Integral Abutment Stem and Piles
  - Integral Pier Cap
  - Monoshaft and column
  - Horizontal curvature and superelevation
  - Staged construction
Construction Schedule

- In-depth Task by Task Schedule
- Balance Practical v. Pushing Contractor
- Incentive/Disincentive
- 72 Days
Construction
Temporary Works – Bridge Open
Bridge Removal Prep - Bridge Closed
Superstructure Removal
Substructure Removal
Drilled Shaft
Drilled Shaft
Drilled Shaft
Drilled Shaft
Drilled Shaft and Integral Abutments
Integral Abutments
Integral Abutments
Pier Column
Steel Erection at Precast Yard
Precast Cap
Steel Erection in Field
Precast Approach Slabs
Bridge Open to Traffic

08.25.2016
Completed Construction

Before

After
Conclusions
Conclusions

- Promised Town No Closure During School
- Improved Hydraulic Condition
- Estimated Cost v. Construction Cost (5%)
  - Due to precast supply/demand
Conclusions

- Balance $$, Pace, and Public Needs
- Innovative Complex Design
- Simple and Elegant Structure
- “This bridge is going to last a long time” – VTrans Chief Engineer
Acknowledgements

• Owner – Vermont Agency of Transportation
• Designer – WSP USA Inc.
• Contractor – CCS Constructors Inc.
• Precaster - JP Carrara and Sons Inc.
• Steel Fabricator – Casco Bay Steel Structures
• Owner’s Rep- Vanasse Hangen Brustlin Inc.
• PCI New England
Questions?

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