

Fully Integral 2 Span Curved Girder Bridge Replacement in 72 days

River Road over New Haven River– New Haven, VT

Adam Stockin, PE



June 25, 2021

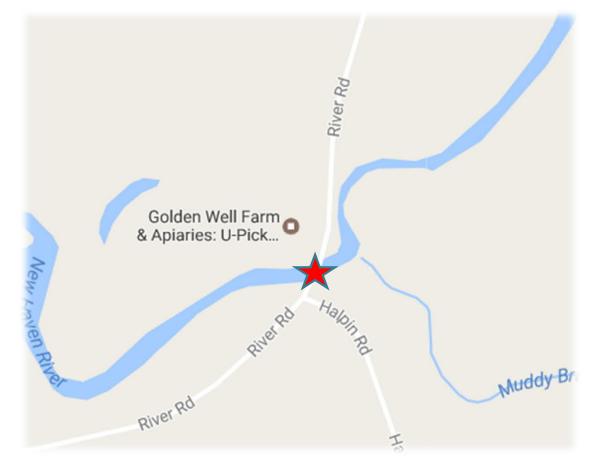
NSD

Project Site



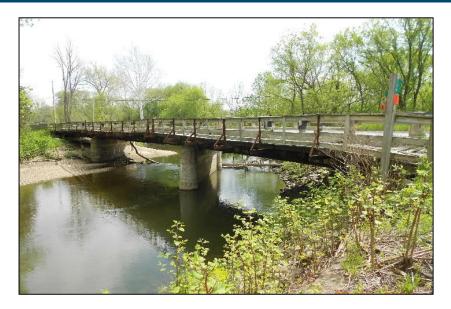
- Town of New Haven, VT
- Population: 1,700
- **1**,600 ADT

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

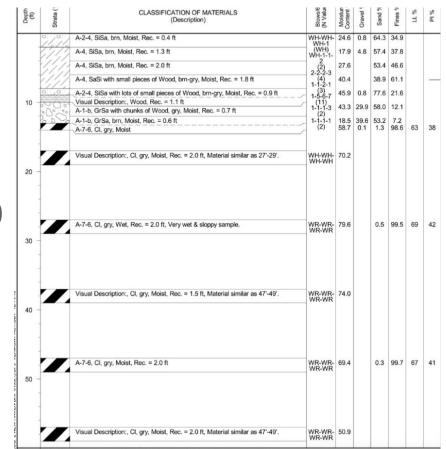
- Bridge overtopped below Q100
- Discharge over road at Q100:
- Significant chase to vertical profile
 –East approach slopes <1%
- Need to eliminate 2 existing wall piers
- Maximize hydraulic opening



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

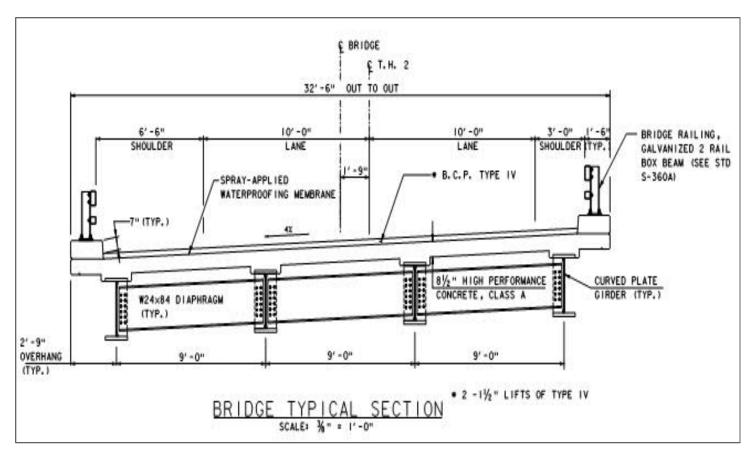
- Span Length = 164.35' (2 82.2' spans)
- 730' Radius Horizontal Curve at Baseline
- 4% Superelevation
- Existing 50 degree skew eliminated



NSD

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

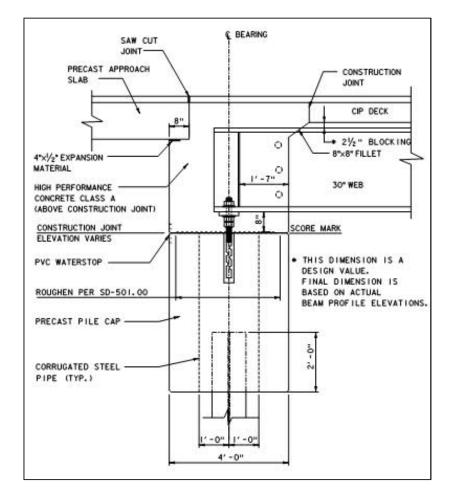
- Deep foundations required
- Precast Integral abutments on 75' H piles
- 8' Diameter Monoshaft
 - -120' Deep
 - -Supports 6' CIP column and Precast Cap
 - -Minimizes river obstructions



Substructure

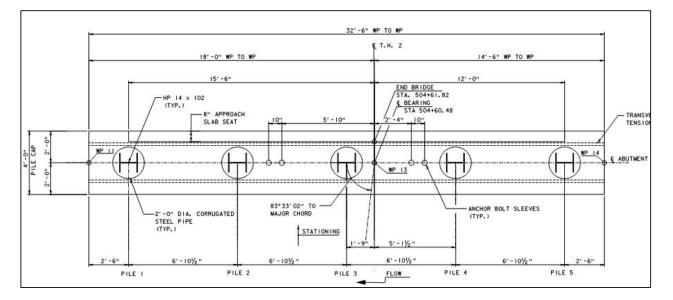
- VTrans Prefers Jointless Bridges
- Integral Abutments w/Steel H-Piles





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

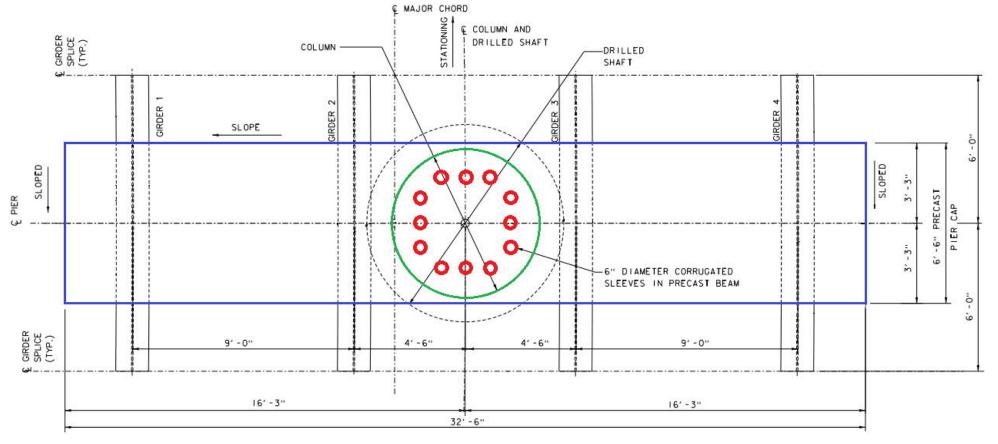
- Steel Fabricated with 6' Splices
- Shipped to Pre-cast Yard and Fully Assembled
- Pier Cap Poured Steel Disassembled and Placed in Field
- Independent Engineer Hired by Contractor to Ensure Coordination



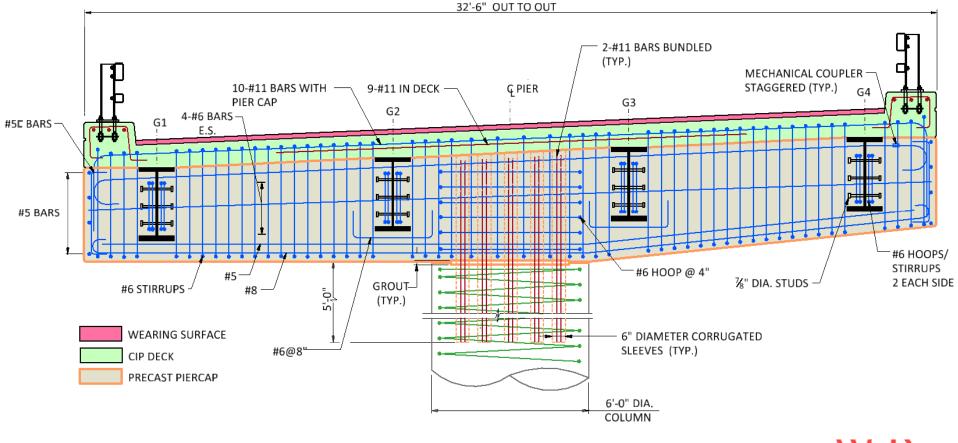




Pre-cast Pier Cap



Pier Cap Details

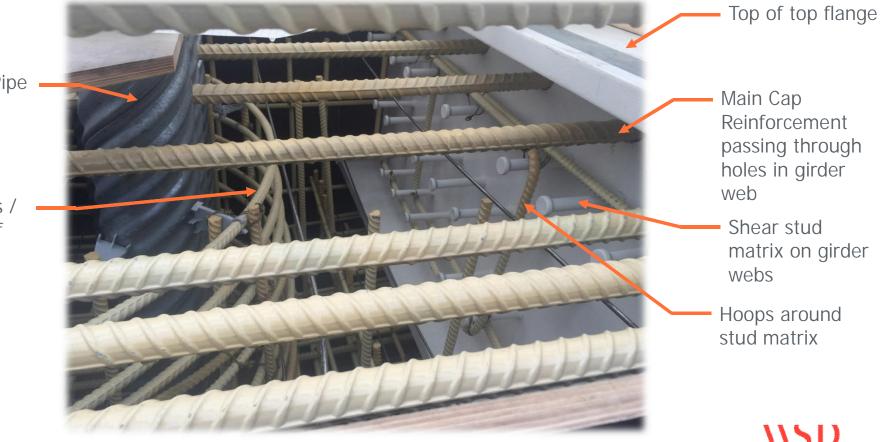


wsp.

Pre-cast Pier Cap

Corrugate Pipe for column dowels

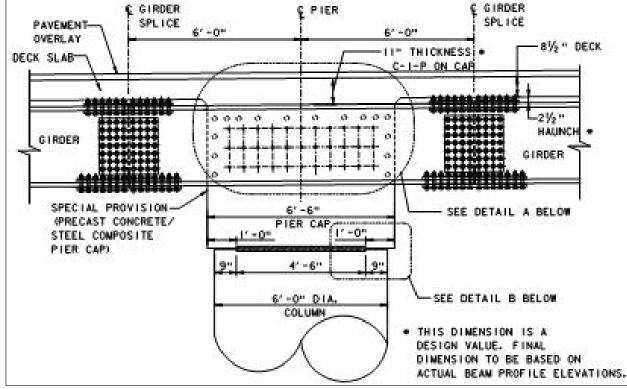
Circular Ties / Extension of column



Column to Pre-Cast Connection

2" Grout Pad w/ ¾" Edge

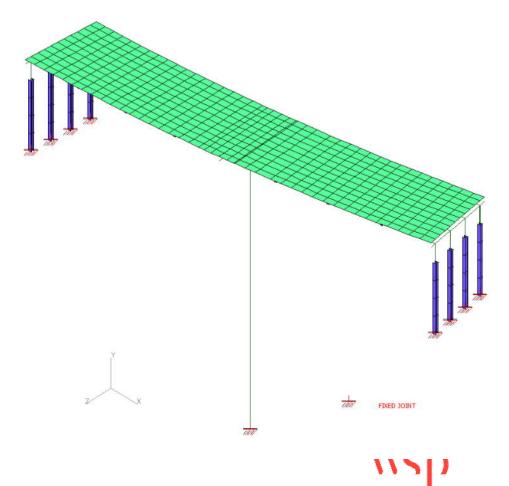




vsp

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

0 Mod	Task Name	Duration	Start	Finish	1 Segmenter 11 November 21 February 1 April 11 June 22 Segmenter 1 November 11 Junuary 22 7/12 8/16 9/30 10/75 1/29 2/70 5/32 6/26 7/31 9/4 10/75 11/29 1/2/2 2/26
2	New Haven Bridge	290 days	Tue 9/1/15	Mon 10/10/16	7/12 8/15 9/29 10/25 13/29 2/5 2/7 3/33 4/17 5/22 6/29 7/31 3/4 10/29 13/25 13/29 2/2 2/2
2	Notice to Proceed (NTP)	0 days	Tue 9/1/15	Tue 9/1/15	9/1/15 gentletics to Proceed (NTP)
	General Submittals	30 days	Tue 9/1/15	Mon 10/12/15	General Submittah
8	Fab. Drawing Submittals	90 days		Mon 2/15/16	Fab. Drawing Submittals
2	Fabrication	85 days	Tue 2/16/16	Mon 6/13/16	- Subrication
1	Existing Bridge Open to Traffic	61 days	Fri 4/1/16	Fri 6/24/16	Existing Bridge Open to Traffic
8 8	PDF Fencing	10 days	Fri 4/1/16	Thu 4/14/16	PDF Feering
- a	Erosion Control & Silt Fence	5 days	Fri 4/15/16	Thu 4/21/16	Forsion Control & Stil Fonce
1					install Floating SNL parties
	Install Floating Silt Barriers	2 days	Fri 4/22/16	Mon 4/25/16	
	Clear & Grub	2 days		Wed 4/27/16	General Grade
	Construct North Side Access Road	3 days		Mon 5/2/16	His Construct North Lide Access Road
	Construct Temporary Rock Platform (Center Pier Area)	4 days		Tue 5/3/16	scale Construct Temperary Rock Platform (Center Pier Area)
	Construct South Side Access Road	2 days	Thu 4/28/16	Fri 4/29/16	+g Construct South Side Access Road
2	South Side Construct Temp. Rock Fill Area	3 days	Thu 4/28/16	Mon 5/2/16	South Side Construct Temp. Rock Hill Area
	New Alignment of Electric & Telephone Lines must be Relocated and In Service	0 days	Mon 6/20/16	Mon 6/20/16	6/20/16) New Alignment of Electric & Telephone Lines must be Relocated and in Service
	Install Bridge Closure Signage	2 days		Fri 6/24/16	g-Install Bridge Closure Signage
8 8	Bridge Crossing Closed to Traffic Detour "IN-USE"	60 days		Sun 8/21/16	Bridge Crossing Obsed to Traffic Detour *IN-USE*
BR B	Close Existing Bridge to Traffic Re-rout Traffic to detour	1 day	Sat 6/25/16	Sat 6/25/16	unclose Existing Bridge to Traffic Re-rout Truffic to detour
8 8	Demo Existing Bridge Superstructure	5 days	Sat 6/25/16	Thu 6/30/16	Han-Demo Existing Bridge Superstructure
8 8	Demo Existing Bridge Superstructure Demo North Abutment Walls & Foundation	2 days	Thu 6/30/16	Set 7/2/16	Department of the second secon
	Perior Rente Abstract Walls & Foundation		Sat 7/2/16	Set 7/2/16 Mon 7/4/16	section of early accurate for the Automatic Value as a contraction of the Automatic Value as a section
	Excavate North Abutment & Wing Wall Area	2 days			Support Automatic Notice Automatic Streng Vill Area
	North Abutment - Drive HP Section Piles	1 day		Tue 7/5/16	Set journ adjustment - Larve the section rise
		2 days	Tue 7/5/16	Thu 7/7/16	
8 6	North Abutment Erect Wingwalls	2 days	Thu 7/7/16	Sat 7/9/16	ag North Abutment Erect Wingwalls
8 6	Backnittenable rate Abernient Area & Abernemaning active mit	a uays	Sat 7/9/16	Mon 7/11/16	Ga Backfill/Grade No. Abutment Area & Add Remaining Stone Fill
8 8	Erect Steel Girders, & Diaphragms	2 days		Tue 7/19/16	Diaphragins
		1 day	Tue 7/19/16	Wed 7/20/16	He final Grading No. Abutment Anna
8 6	Final Grading No. Abutment Area Demo South Abutment Walls & Foundation	2 days	Thu 6/30/16	Sat 7/2/16	burne South Abutment Walk & Foundation
8 8	Demo Existing Bridge Pier & Foundations	2 days	Thu 6/30/16	Sat 7/2/16	an Permo Existing Bridge Pier & Foundations
8 8	Install Drilled Shaft Center Pier	5 days	5at 7/2/16	Thu 7/7/16	Bigging State Stat
8 8			Thu 7/7/16	Sun 7/10/16	Generatives 6 ' & Center Pier Column
6 8				Wed 7/13/16	Care Center Ner CIP Column
	Cure Center Pier CIP Column Install #11 Bars & Grout	1 days		Wed 7/15/16 Thu 7/14/16	C notal 11 Bars & Grout
8 8		1 day			The term Place Cope
	Erect new Precast Center Pier Cap	3 days	Fri 7/15/16	Sun 7/17/16	and a second water water cap by a faily water south Abutternet Mark Ming Wall Areas
	Excavate South Abutment & Wing Wall Area	2 days	Sat 7/2/16	Mon 7/4/16	Section 2 and the section 2 an
	South Abutment - Drive HP Section Piles	1 day		Tue 7/5/16	
	South Abutment Precast Foundation Cap Units	2 days	Tue 7/5/16	Thu 7/7/16	and Sparth Abutment Precase Foundation Cap Units
8 8			Thu 7/7/16	Sat 7/9/16	- ing south Abutment Erect Wingwalls
	Backfill/Grade South Abutment Area & Add Remaining Stone fill	2 days	Sat 7/9/16	Mon 7/11/16	Lackfil/Grade South Abutment Ariu & Add Remaining Stone fill
	Final Grading South Abutment Area	1 day	Mon 7/11/16	Tue 7/12/16	ya Final Grading South Abutment Areja
2 2	Form & Pour Deck Slab & Stem Closure	17 days	Tue 7/19/16	Fri 8/5/16	form & Pour Dack Slab & Stem Closure
8 8	Cure SpanDeck Slab & Stem Closure	10 days	Fri 8/5/16	Mon 8/8/16	Gene SpanDeck Slab & Stem Closure
8 8	Construct E & W Side Bridge Edge Curbs	5 days	Tue 8/9/16	Sat 8/13/16	and - Construct E & W Side Bridge Edge Curbs
6 B	Cure E & W Side Bridge Edge Curbs	10 days	Sat 8/13/16	Wed 8/17/16	Lune E & W Side Bridge Europa
8 8		2 days	Tue 8/9/16	Wed 8/10/16	and North Abutment Approach Slab
8 8	and the second	2 days	Tue 8/9/16	Wed 8/10/16	and South Abutment Approach Slab
8 8			Wed 8/17/16		ge_Bridge Deck & Curb Waterproofing Membrane
8 8		2 days 2 days	Wed 8/1//16 Fri 8/19/16	Sat 8/20/16	The second se
	Bridge Railing and Posts, E & W Sides				see a sub-section of the section of
	Bridge Paving	1 day	Sat 8/20/16	Sun 8/21/16	service participation in the service of the service
	So. Side Replace Existing 18 " Pipe Drains - 2 Locations	10 days	Sat 6/25/16	Tue 7/5/16	
2	Proposed Bridge Open to Traffic	36 days		Mon 10/10/16	Proposed Bridge Open to Traffic
2	Remove Temporary Signs & Install Permanent Signage	4 days	Mon 8/22/16		Benove Temporyry Signs & Install Permanent Signage
2	North & South Sides Roadway Sand Borrow & Crushed Stone	5 days	Fri 8/26/16	Thu 9/1/16	South Sides Roadway Sand Borrow & Crushed Stone
2	North Side Cold Plane	1 day	fri 8/26/16	fri 8/26/16	an North Side Cold Plane
2	South Side Cold Plane	1 day	Mon 8/29/16	Mon 8/29/16	South Side Cold Plane
2	Asphalt Pave Roadway	1 day	Fri 9/2/16	Fri 9/2/16	- Apphalt Pave Apphalt Pave Apphalt
	North Side Permanent Slope Erosion Control & Final Roadway Grading/Edge/See		Mon 9/5/16	Wed 9/7/16	See_North Side (*ermanent Slope Erosion Control & Final Roadway Grading/Ed
	South Side Permanent Slope Erosion Control & Final Roadway Grading/Edge/See		Mon 9/5/16	Thu 9/8/16	- South Side Permanent Stope Erosion Control & Final Roadway Grading/Ed
E.	North Side Guard Ral	3 days	Thu 9/8/16	Mon 9/12/16	North Sid 2 Guard Rall
1	South Side Guard isai	2 days	Fri 9/9/16	Mon 9/12/16 Mon 9/12/16	South Side Georgram
	South side Guardrall Punch List Items				Supervision of south and supervision of the supervi
-		20 days		Mon 10/10/16	10/10/16m / initial Completion
	Final Completion	0 days	Mon 10/10/10	5 Mon 10/10/16	Log Log Job Final Completion



Construction

Temporary Works – Bridge Open







Bridge Removal Prep-Bridge Closed







Superstructure Removal







Substructure Removal

























Drilled Shaft and Integral Abutments



۱۱SD

Integral Abutments







Integral Abutments



Pier Column





vsp

Steel Erection at Precast Yard



Precast Cap







Steel Erection in Field





115

Precast Approach Slabs





Bridge Open to Traffic



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



visp

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





AGENCY OF TRANSPORTATION





Questions?



Adam Stockin, PE Assistant Vice President Supervising Structural Engineer 9 Executive Park Drive Merrimack, NH 03034 (603)263-8879

adam.stockin@wsp.com