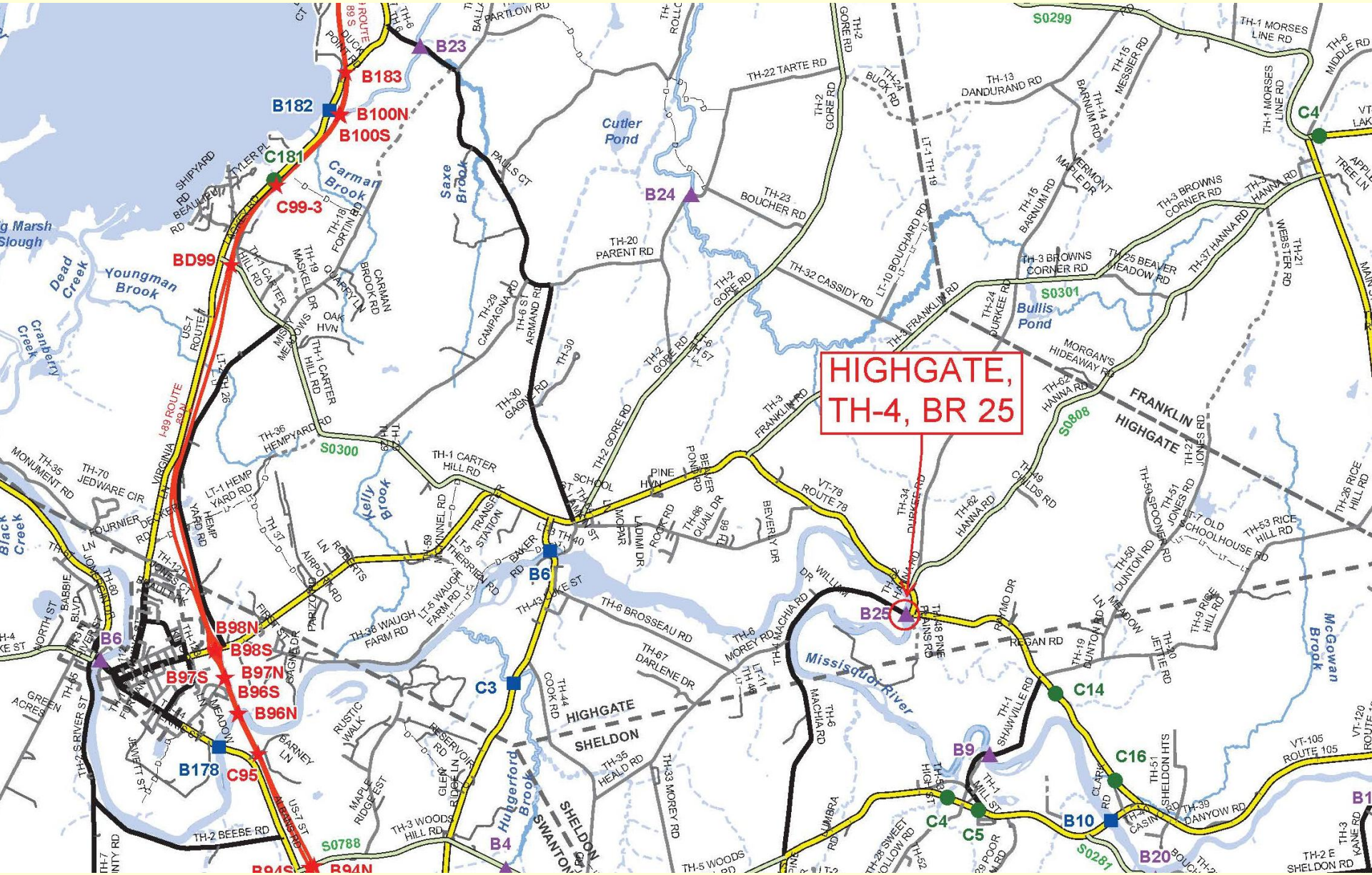
Highgate BO 1448(43)
Bridge 25 on TH 4 (Machia Road) over the Missisquoi River
Alternatives Presentation Meeting

Presented by
Christopher P. Williams, P.E.
Senior Project Manager, Structures Section
Vermont Agency of Transportation
Chris.Williams@State.VT.US

December 19, 2013

PROJECT LOCATION



Meeting Outline

- Purpose of the Meeting
- Structures Section Re-organization
- Existing bridge deficiencies
- Alternatives considered
- Summary and recommendation
- Next Steps

Purpose of Meeting

- Present the alternatives that we have considered
- Explain the constraints to the project
- Help you understand our approach to the project
- Provide you with the chance to ask questions
- Provide you with the chance to voice concerns
- Build consensus for the recommended alternative-

Accelerated Bridge Program

- Began in January 2012
- Bridges are deteriorating faster than we can fix them
- Short-term closures are key
- Impacts to property owners and resources is minimized
- Less impacts = less process = less money = faster delivery
- Accelerated Bridge Construction (ABC) is very efficient
- Accelerated Project Delivery is the result
- Shift from individual projects to programmatic approach
- Goal of 25% of projects into Accelerated Bridge Program
- Goal of 2 year design phase for ABP (5 years conventional)

Project Initiation & Innovation Team

- Part of re-organization in January 2012
- All Structures projects will begin in the PIIT
- Very efficient process
- Look for innovative solutions whenever possible
- Involved until Project Scope is defined
- Hand off to PM to continue Project Design phase

Phases of Development

Project Funded	Project Defined	Contract Award
Project Definition	Project Design	Construction

Identify resources & constraints

Evaluate alternatives

Public Participation

Build Consensus

- Quantify areas of impact
- Environmental permits
- Develop plans, estimate and specifications

Project Background

- The structure is owned and maintained by the Town
- Machia road is a class 2 local road
- Funding will be 80 Federal funds
- State/Local shares will be determined based on alternative selected
- Functionally labeled as a Rural local road
- Posted Speed = 35 mph (Design Speed)
- Existing bridge is a two span Thru Truss
- Bridge length = 292 feet (2 equal spans @ 143 feet)
- Bridge Width = 16 feet +/-
- The bridge was built in 1928 (85 years old)

Historic Considerations

- The bridge is listed on or is eligible for the National Register of Historic Places
- The Historic Metal Truss Bridge Preservation plan in 1998 concluded that it is feasible and prudent to rehabilitate this bridge for limited highway use
- If the bridge is rehabilitated, the Agency will offer the Town a preservation easement to "…assist in preserving and maintaining the Bridge, its historic engineering and architectural features…and its value and significance to the people of Vermont."
- This agreement reduces the local share to $0
- Provided that the town meets their obligations in the agreement, and subject to availability of funds, the Agency also agrees to be responsible for all necessary rehabilitation and restoration costs as long as the bridge remains in highway use

Traffic Data

	“Current Year” 2016	“Design Year” 2036
Average Annual Daily Traffic	**750**	**790**
Design Hourly Volume	**95**	**100**
Average Daily Truck Traffic	**30**	**45**
%Trucks	**4.4**	**6.1**

EXISTING BRIDGE DEFICIENCIES

Inspection Rating Information (Based on a scale of 9)

Bridge Deck Rating	**5 Fair**
Superstructure Rating	**4 Poor**
Substructure Rating	**4 Poor**

Rating Definitions

9 Excellent
8 Very Good
7 Good
6 Satisfactory
5 Fair
4 Poor
3 Serious
2 Critical
1 Imminent Failure

Deficiencies

- **The bridge is structurally deficient and unable to carry design loads**
- **The bridge is too narrow for the roadway classification and design speed**
- **The bridge and approach railing are substandard**
- **The vertical and horizontal alignments are substandard**

Looking east at Bridge approach

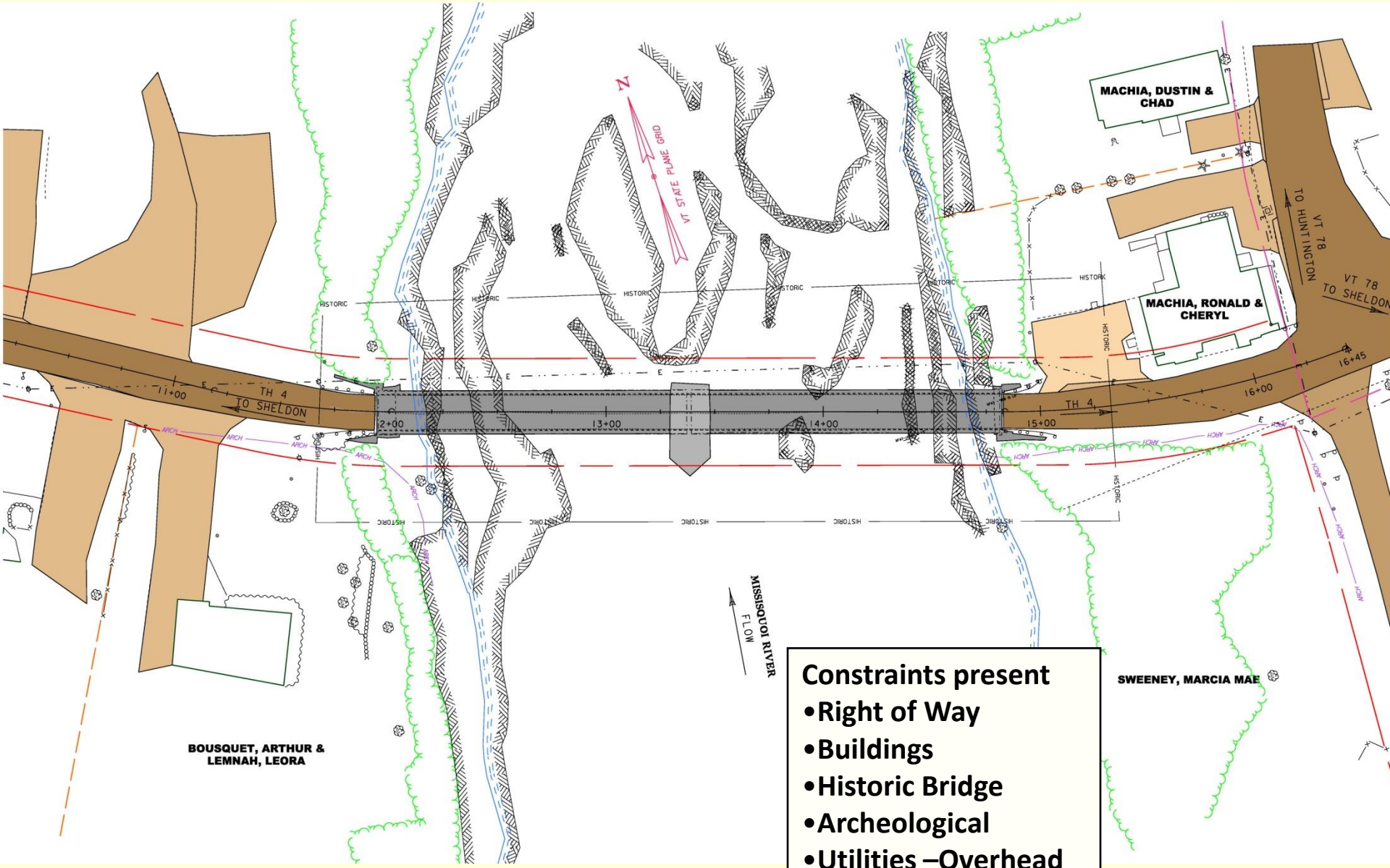
Looking west on Bridge approach

Looking west on bridge deck

East Abutment showing signs of movement

West Abutment showing undermining

Layout Showing Constraints



Constraints present

- **Right of Way**
- **Buildings**
- **Historic Bridge**
- **Archeological**
- **Utilities –Overhead**

Alternatives Overview

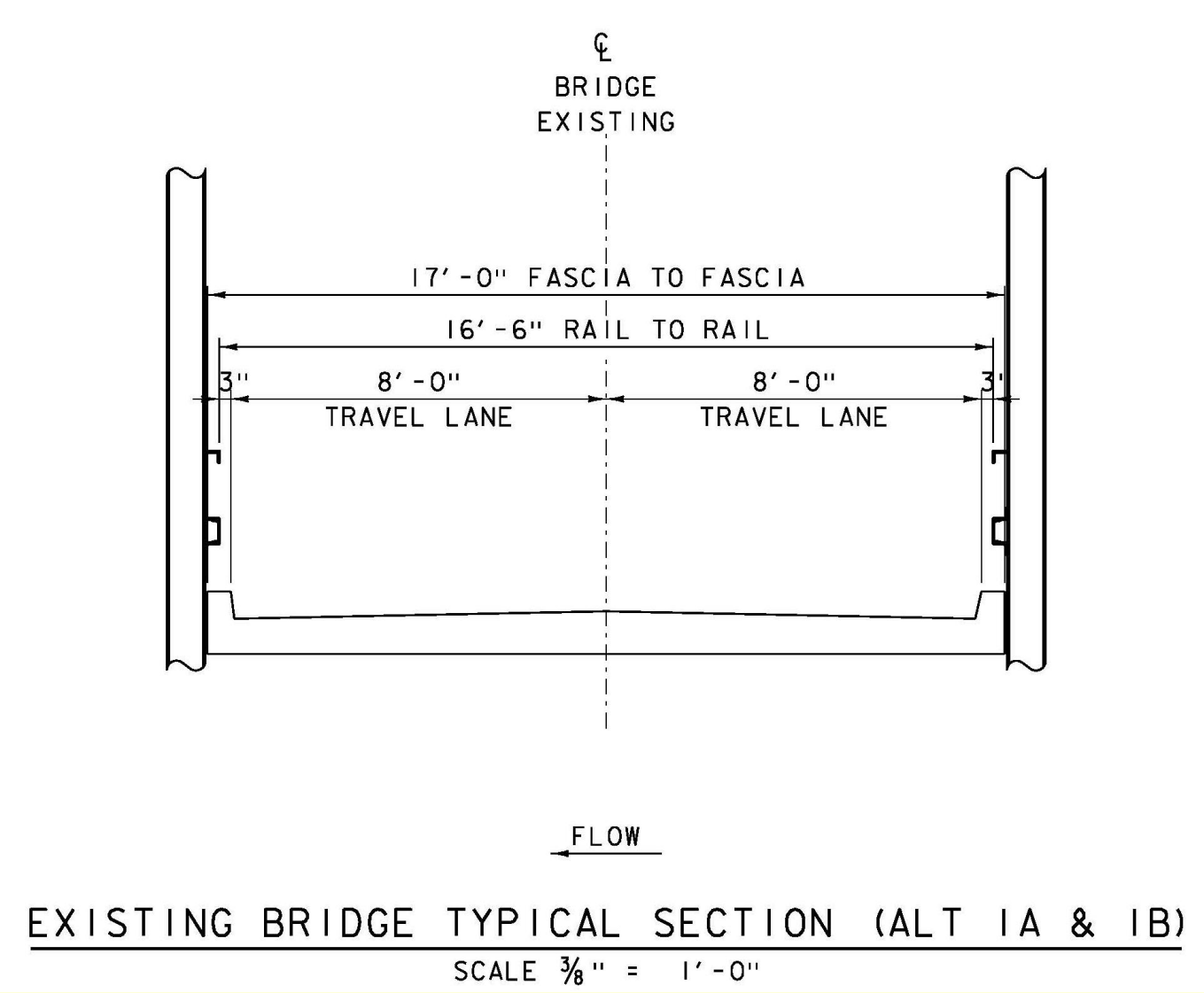
- Rehabilitation of truss – 20 year fix
- Rehabilitation of truss – 40 year fix
- Rehabilitation of truss – Widen truss
- Rehabilitation of truss and add new bridge
- Replacement on existing alignment (State Typical)
- Replacement on new alignment (State Typical)
- Replacement on new alignment (Town Typical)

Note: The method to maintain traffic during construction will be considered separately later in the presentation

Rehabilitation of truss – 20 year fix

- Maintain truss in existing location and configuration
- Load capacity of HS-15 (27 tons) maximum
- Replace east abutment
- Patch/repair west abutment and pier
- Patch or overlay existing deck
- Replace damaged or deteriorated truss members
- Clean and paint truss
- Short term (20 year) solution

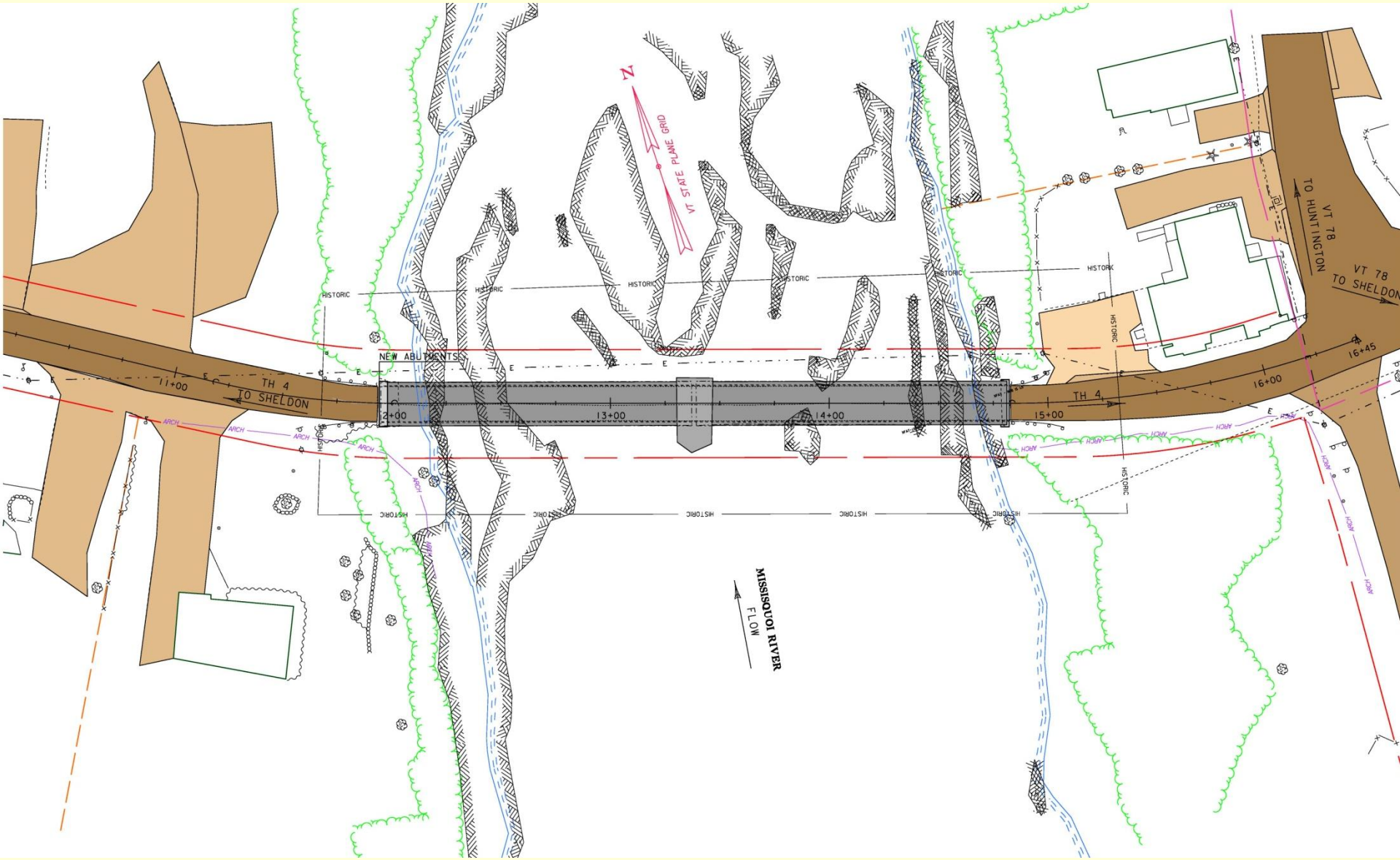
Bridge Typical – Rehabilitations



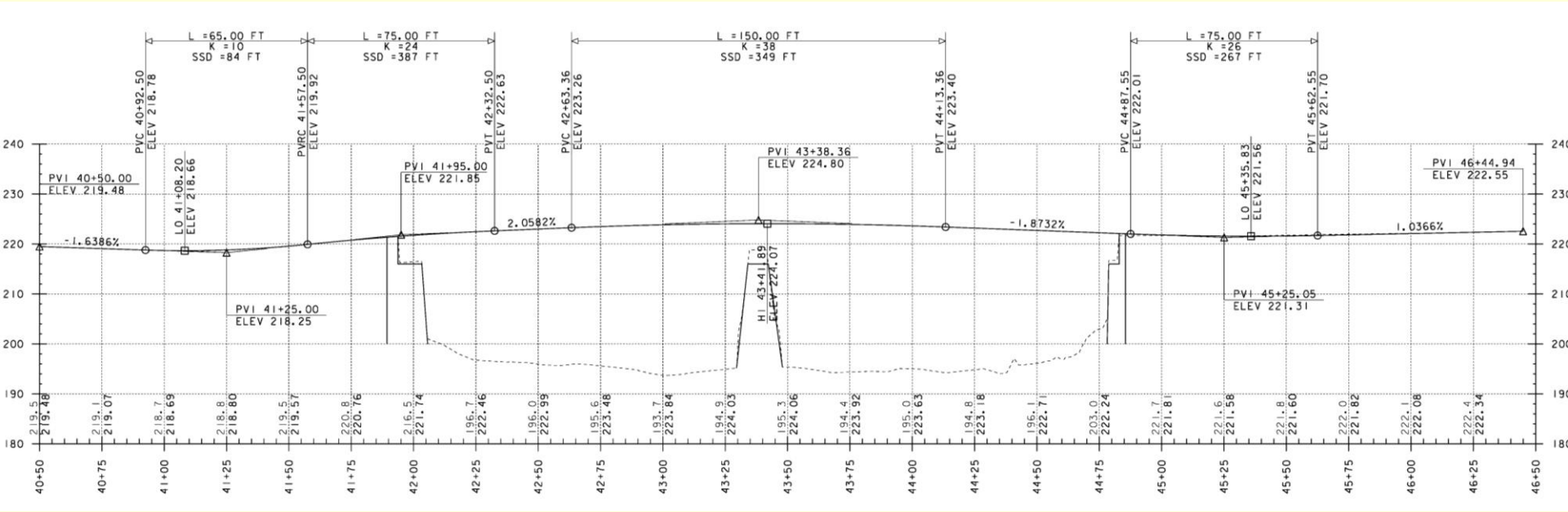
EXISTING BRIDGE TYPICAL SECTION (ALT IA & IB)

SCALE 3/8" = 1'-0"

Layout – Rehabilitation (20 & 40 year fix)



Profile – Rehabilitation (20 & 40 year fix)



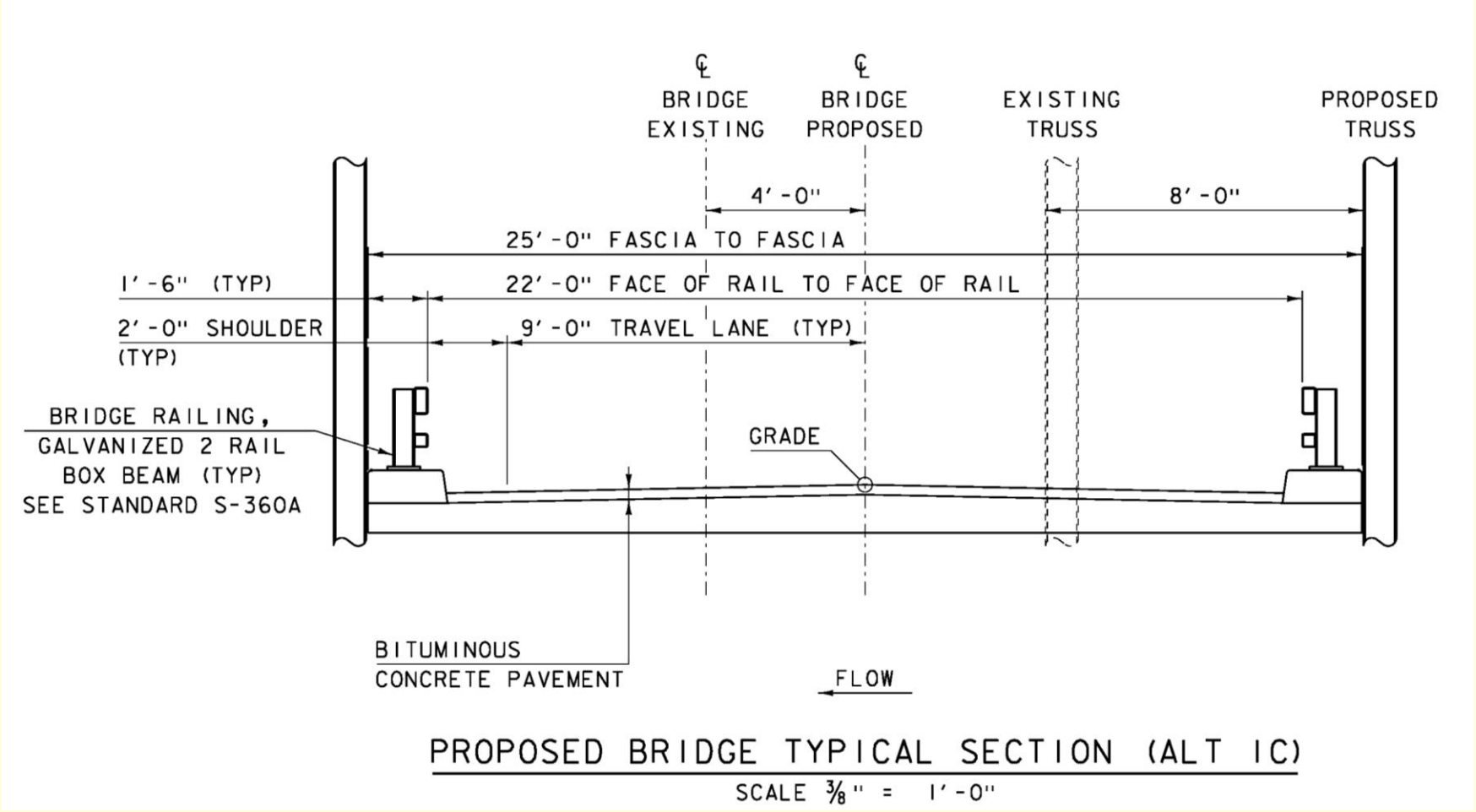
Rehabilitation of truss – 40 year fix

- Same features as 20 year fix but add the following:
- More extensive repairs to west abutment
- More extensive truss member replacement
- Replace deck and pier
- Mid-term (40 year) solution

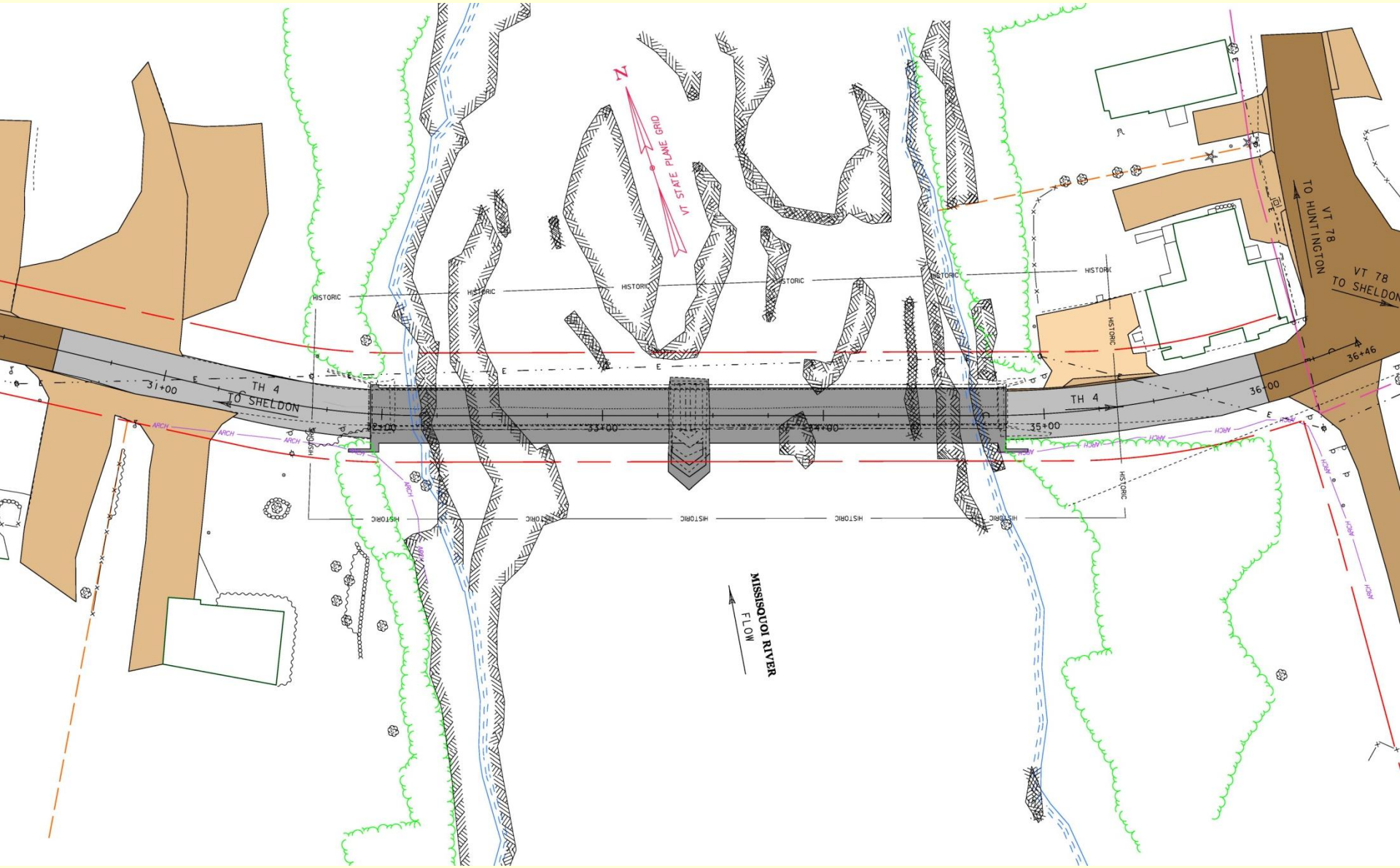
Rehabilitation - Widen Truss

- Similar to 40 year fix but add the following:
- West abutment would remain but be extended
- More truss member replacement
- Entire floor system and deck would be replaced
- Overhead members would be replaced or lengthened
- Mid-term (40 year) solution

Bridge Typical – Widen Truss



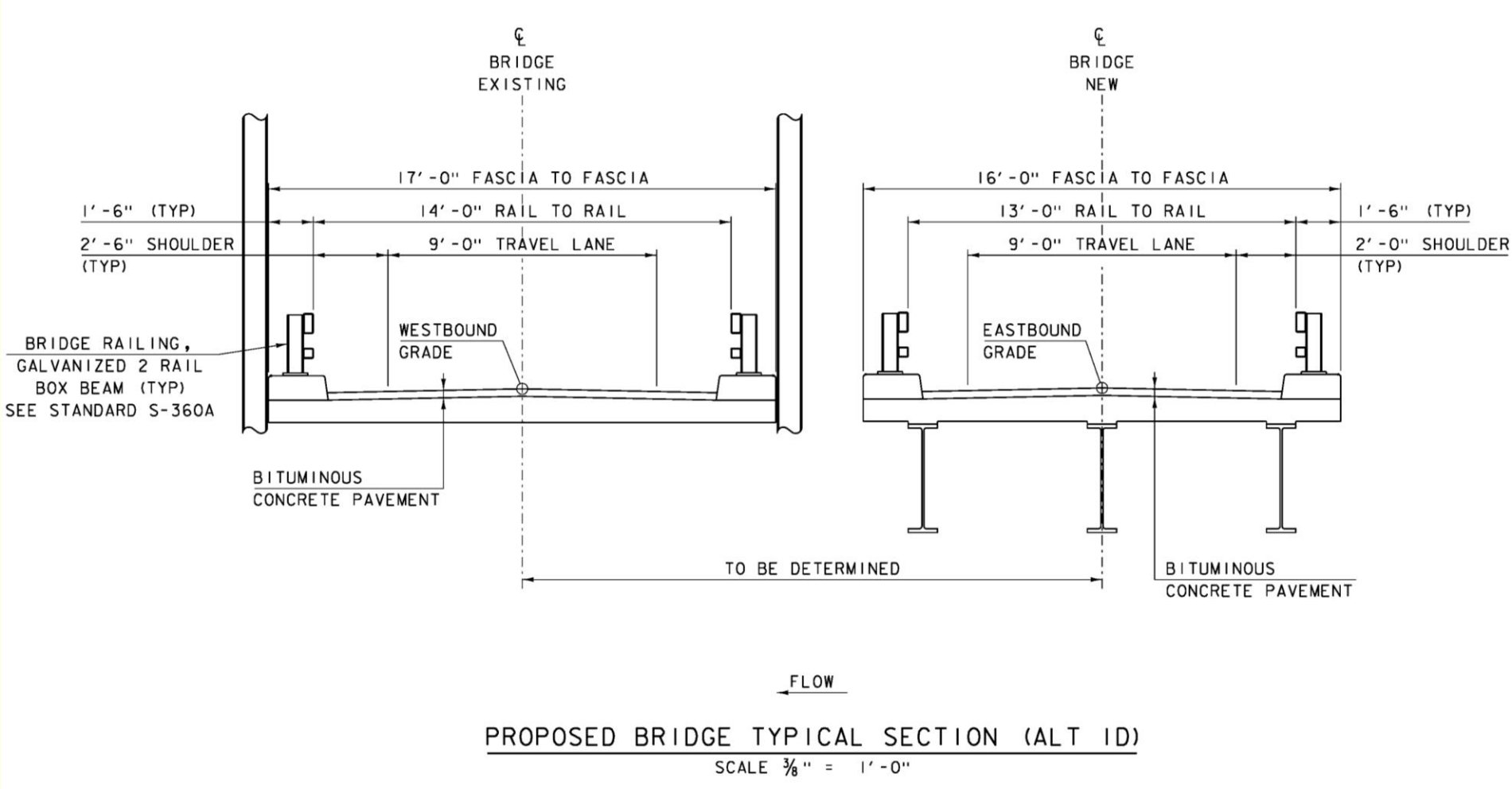
Layout – Widen Truss



Rehabilitation Truss + New Bridge

- Similar to 40 year fix but add the following:
- Construct new (13’ wide) bridge adjacent to truss
- Mid-term (40 year) solution (based on existing truss)

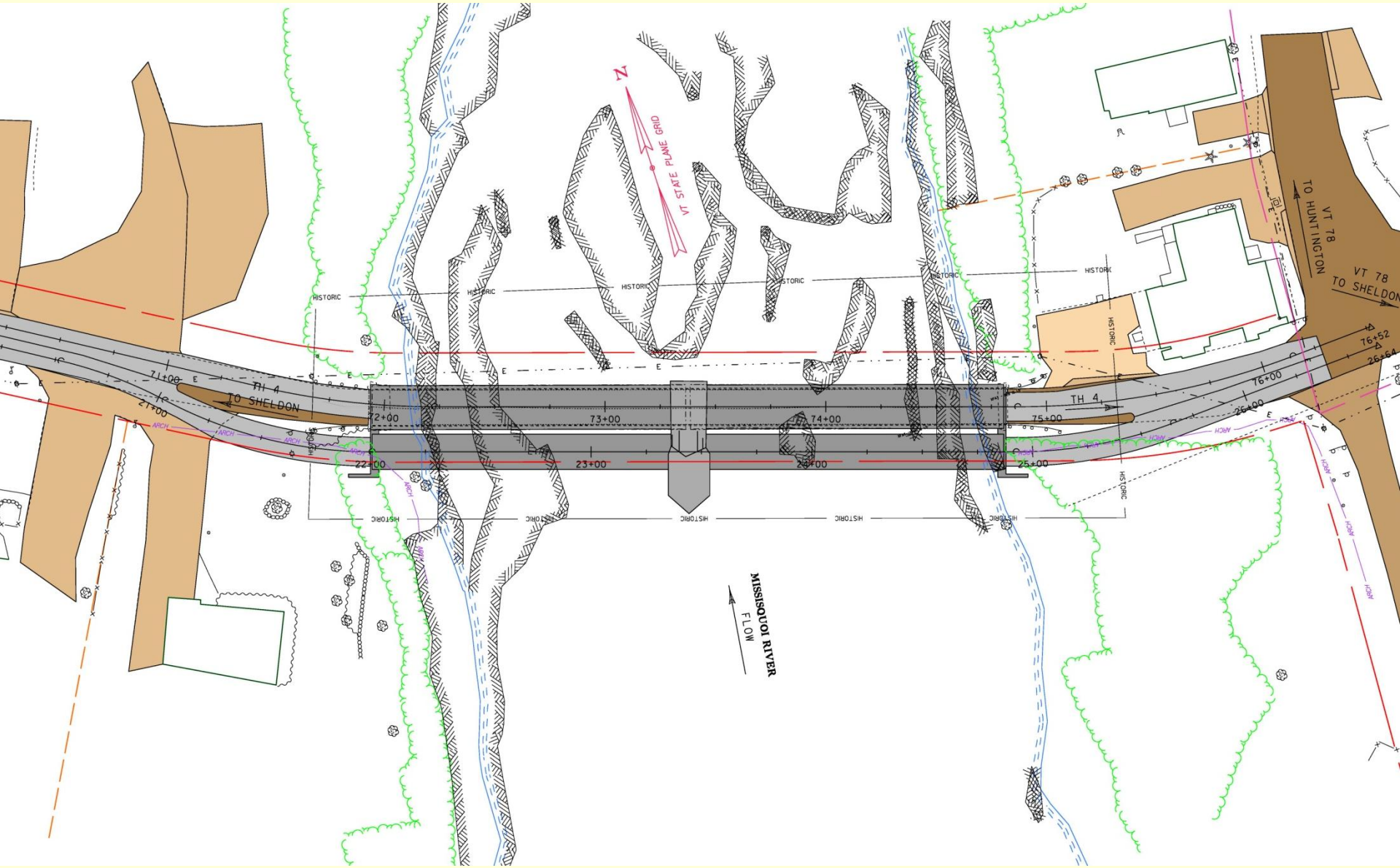
Bridge Typical – Rehab + New Bridge



PROPOSED BRIDGE TYPICAL SECTION (ALT ID)

SCALE 3/8" = 1'-0"

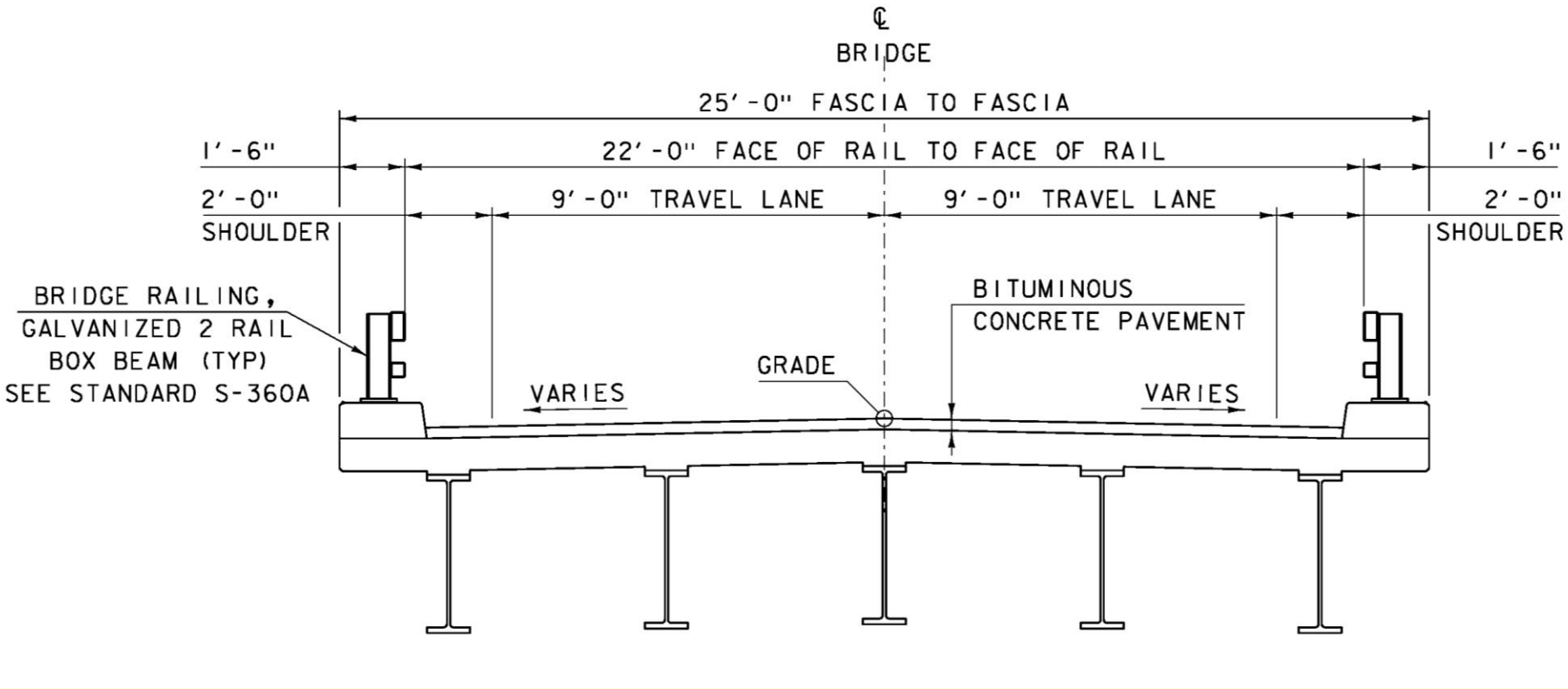
Layout – Rehab + Second Bridge



Replacement on existing alignment (State Typical)

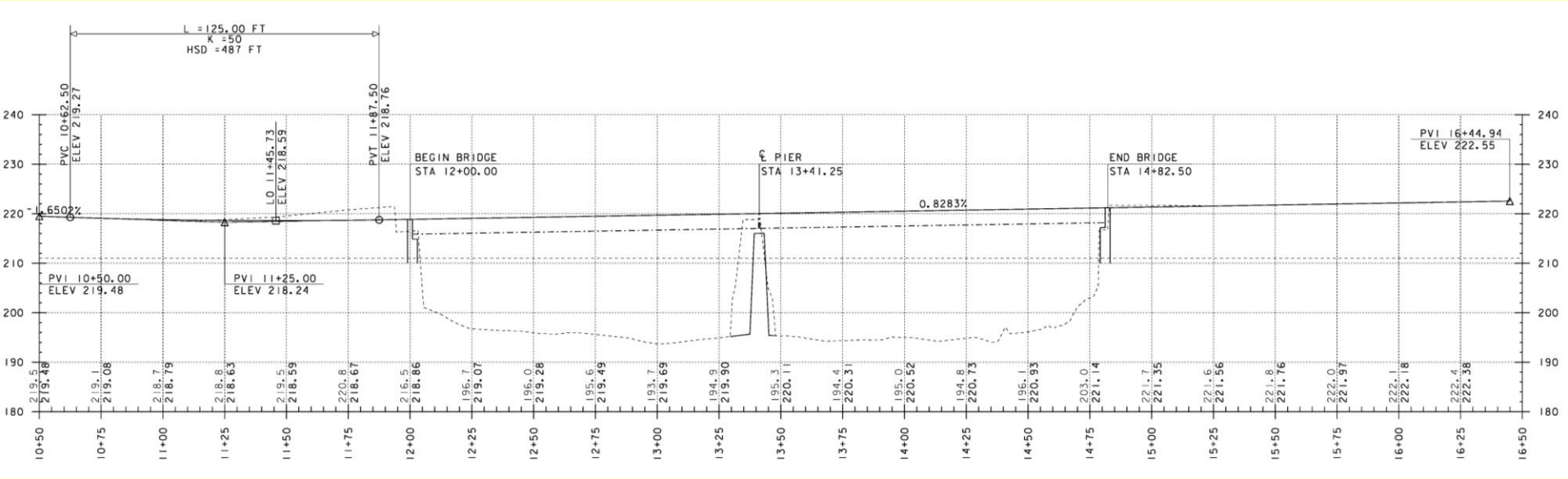
- Construct new 2 span bridge 280’ long (2 spans @ 140’)
- Conventional steel beams and concrete deck bridge type
- 22 feet wide rail to rail (2’ shoulders, 9’ travel lanes)
- Vertical alignment will be improved
- Horizontal alignment will be improved
- Long-term (80 year) solution

Bridge Typical – State Typical



Layout – New Bridge on Existing Alignment

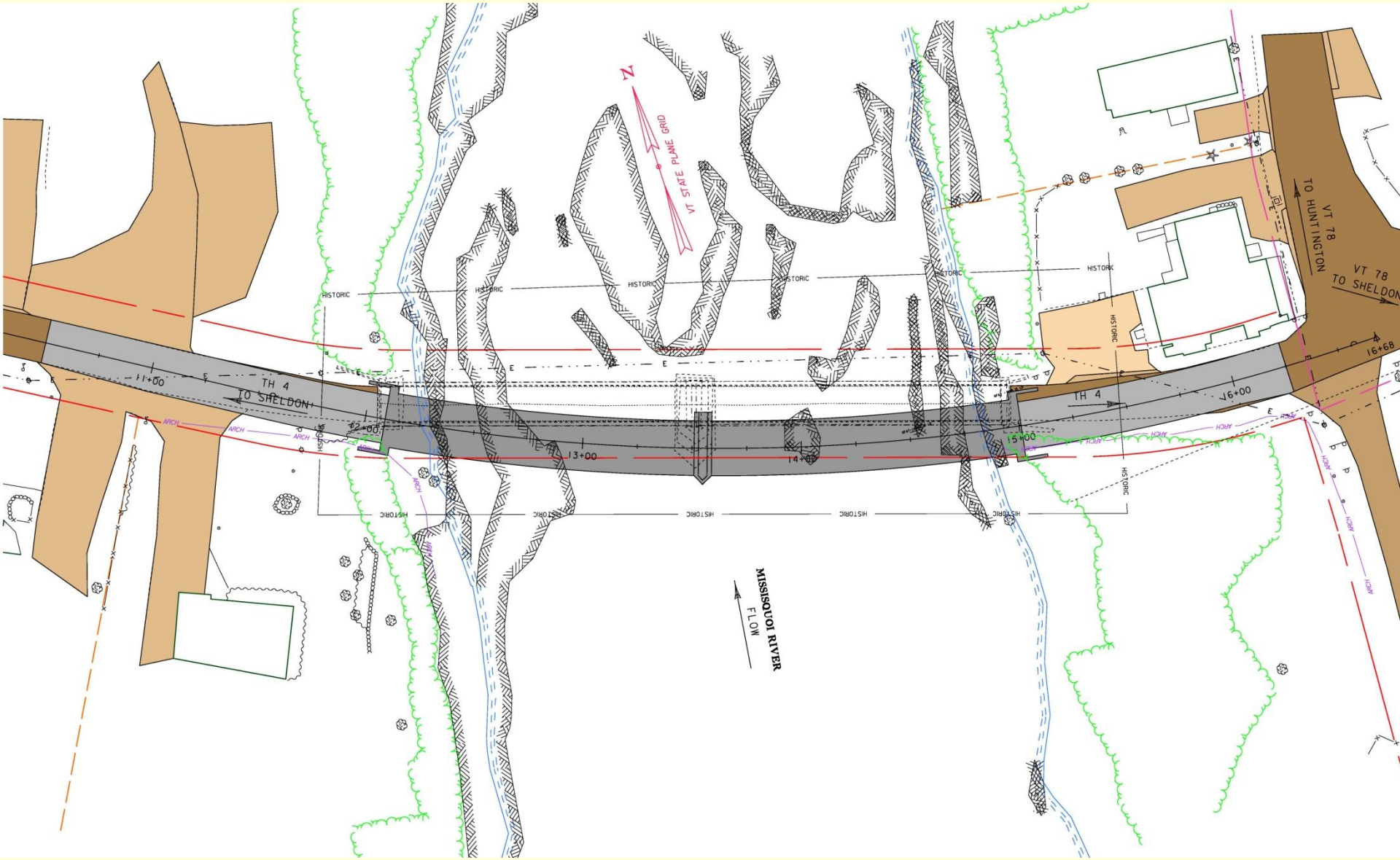
Profile – Replacement on Existing Alignment



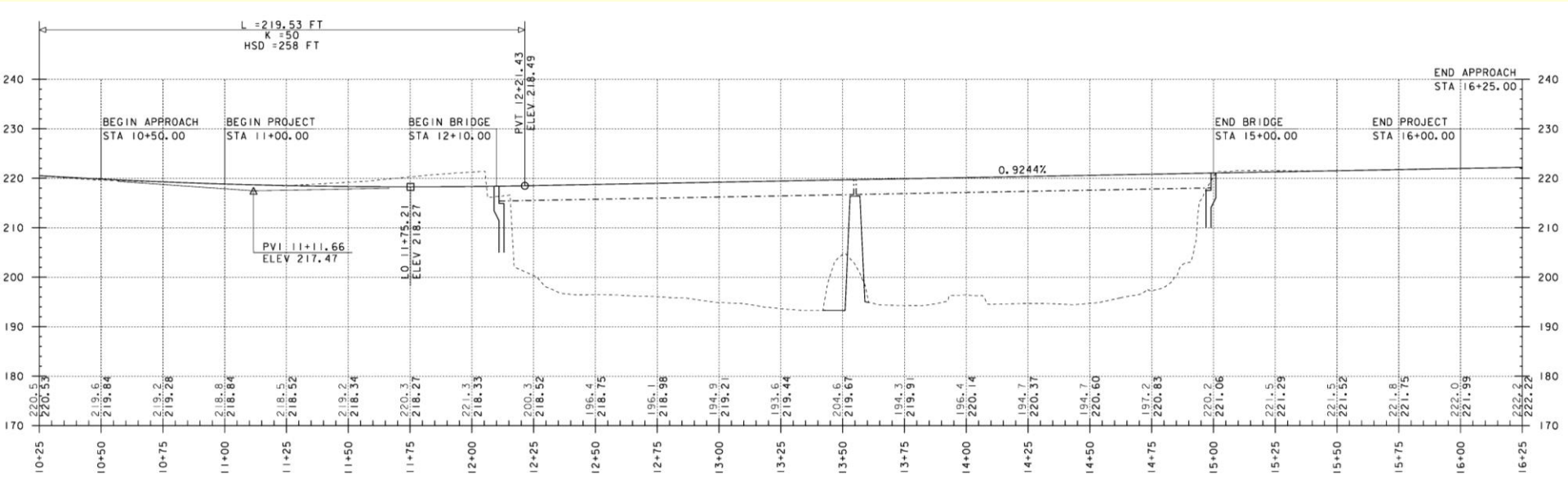
Replacement on new alignment (State Typical)

- Construct new 2 span bridge 290’ long (2 spans @ 145’)
- Conventional steel beams and concrete deck bridge type
- Entire bridge will be on curve
- 22 feet wide rail to rail (2’ shoulders, 9’ travel lanes)
- Vertical alignment will be improved
- Horizontal alignment will be improved
- Long-term (80 year) solution

Layout – New Bridge On New Alignment State Typical



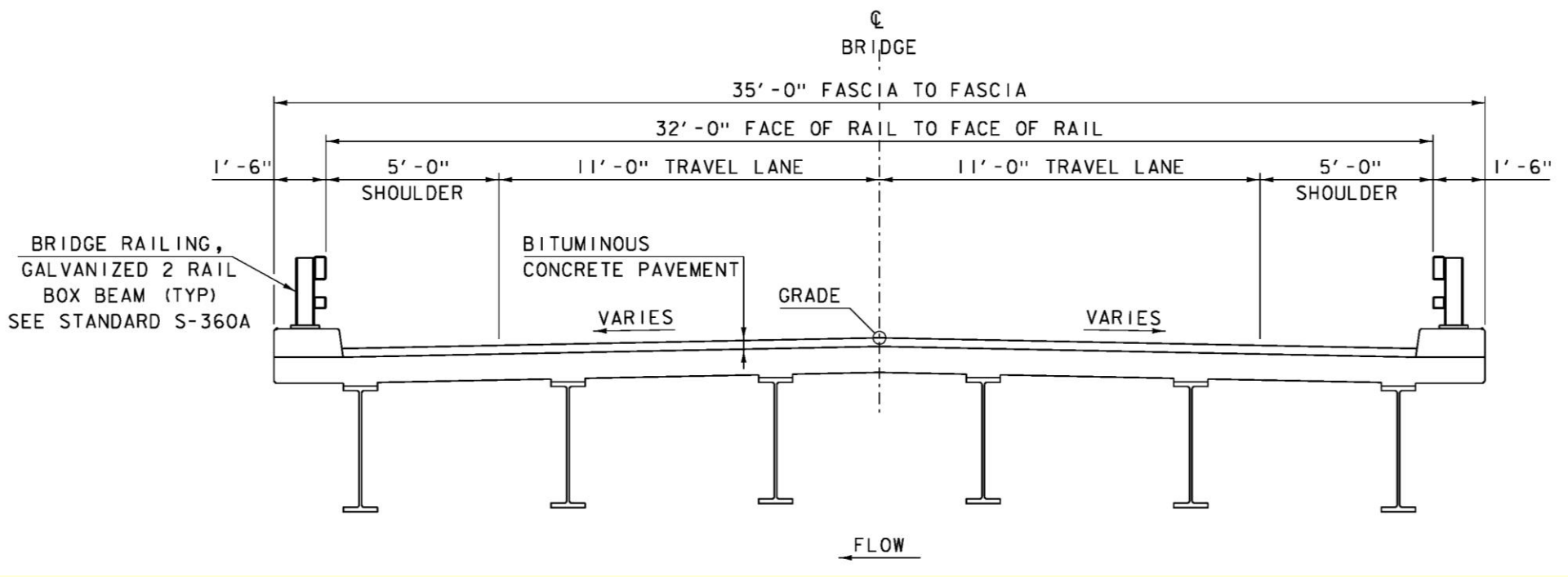
Profile – New Bridge On New Alignment



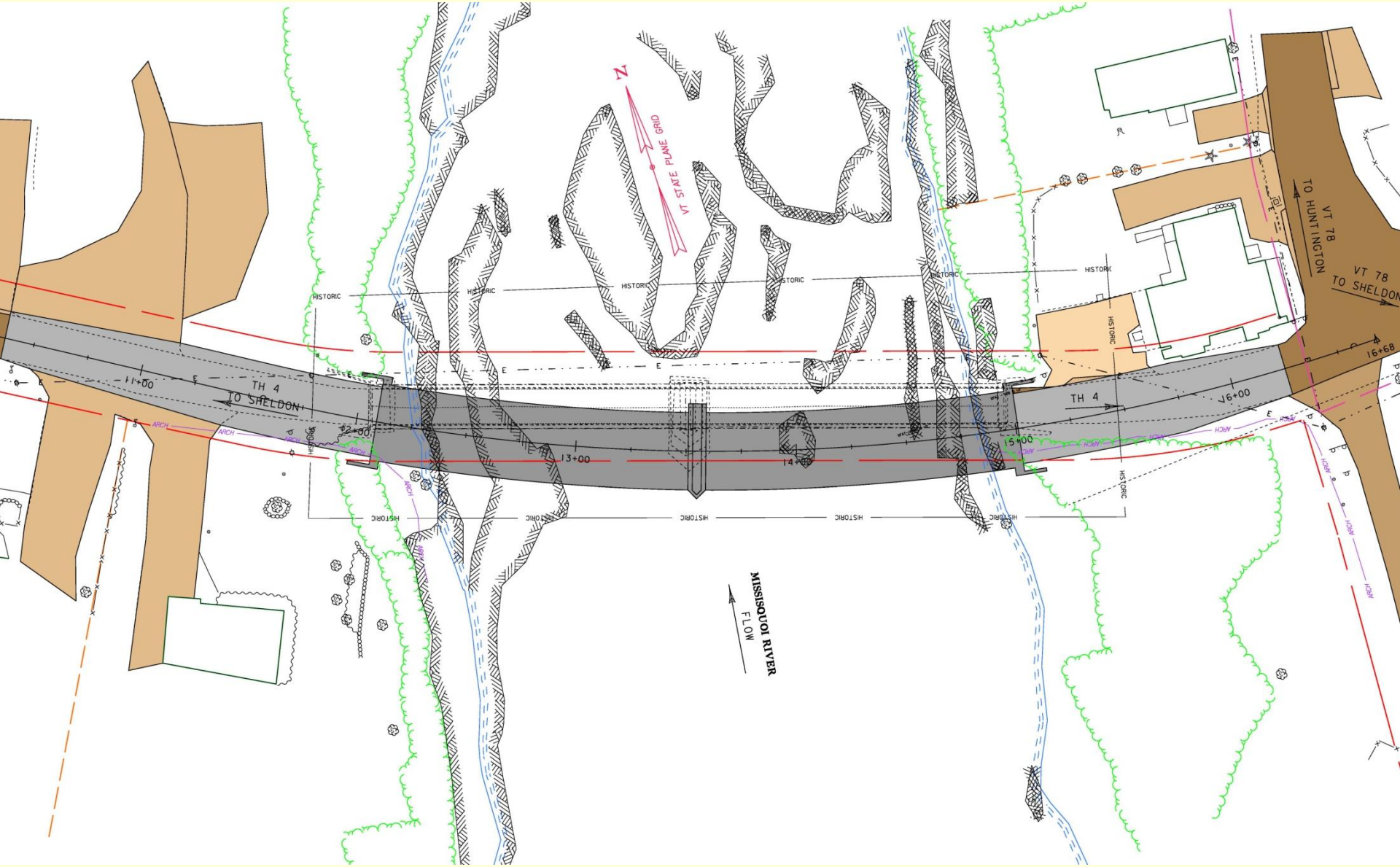
Replacement on new alignment (Town Typical)

- Same as previous replacement option except as follows:
- Town policy requires wider typical section than State requires
- 32 feet wide rail to rail (5’ shoulders, 11’ travel lanes)

Bridge Typical – Town Typical



Layout – New Bridge Off Alignment
Town Typical



Methods to Maintain Traffic

Three general methods available:

- Phased Construction
- Temporary Bridge
- Bridge closure w/ off-site detour

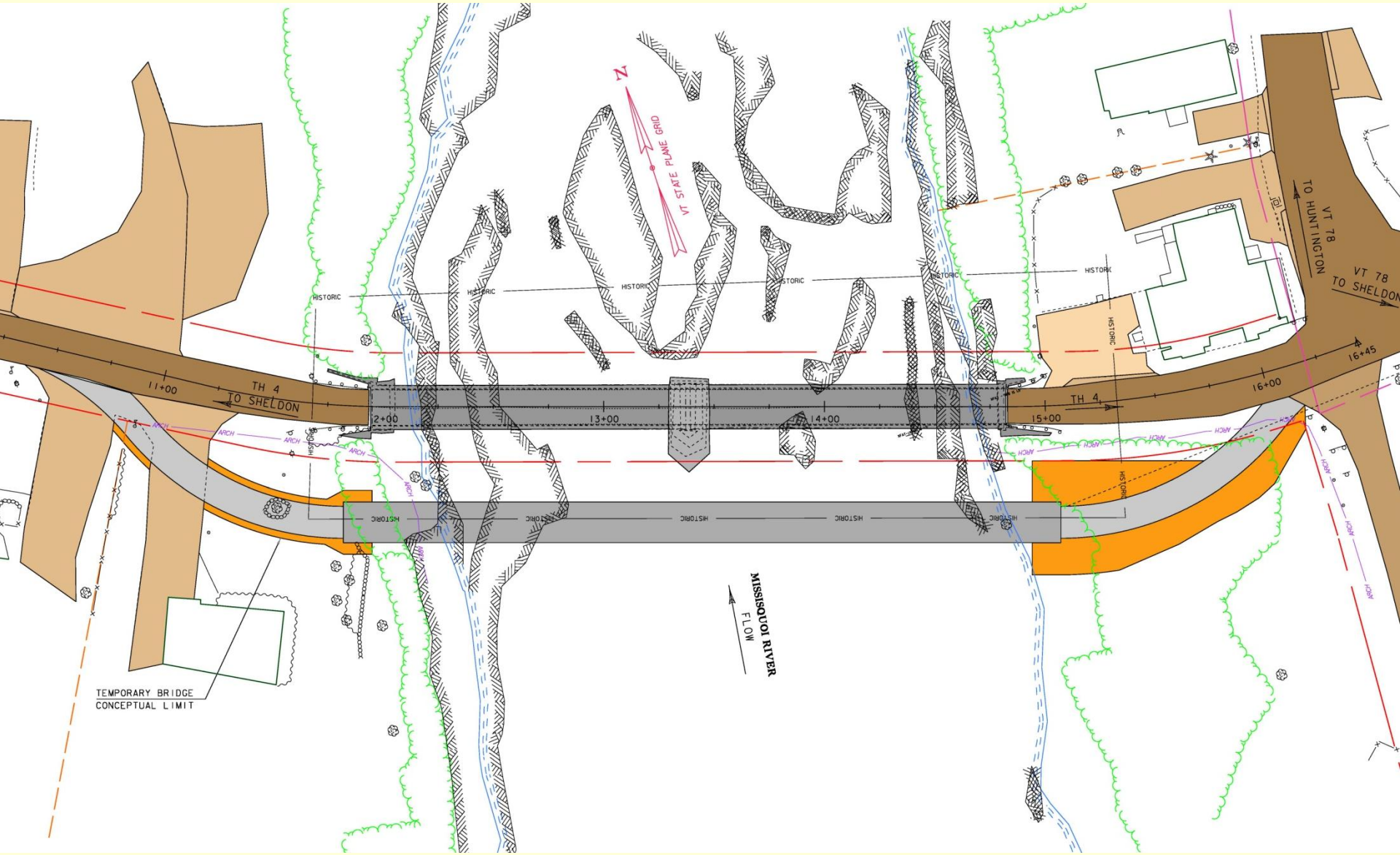
Phased Construction Option

- **Ruled out since not possible for truss bridges**
- Build half new bridge while traffic is on half of old bridge
- Switch traffic on new bridge portion
- Build remainder of new bridge
- One-Way alternating traffic with lights
- Queue lengths and queue times can be inconvenient
- Access to side drives/buildings needs to be considered
- Relatively long construction duration
- Workers & motorists in close proximity – safety concerns
- Can usually be done without ROW acquisition

Temporary Bridge Option

- Construct temporary bridge to maintain traffic
- One-Way alternating traffic with lights
- Queue lengths and queue times can be inconvenient
- Access to side drives/buildings needs to be considered
- Very long construction duration
- Right-Of-Way acquisition is necessary
- Environmental impacts are increased
- Property owner impacts are increased
- Project Delivery time increased
- Project Costs increased-

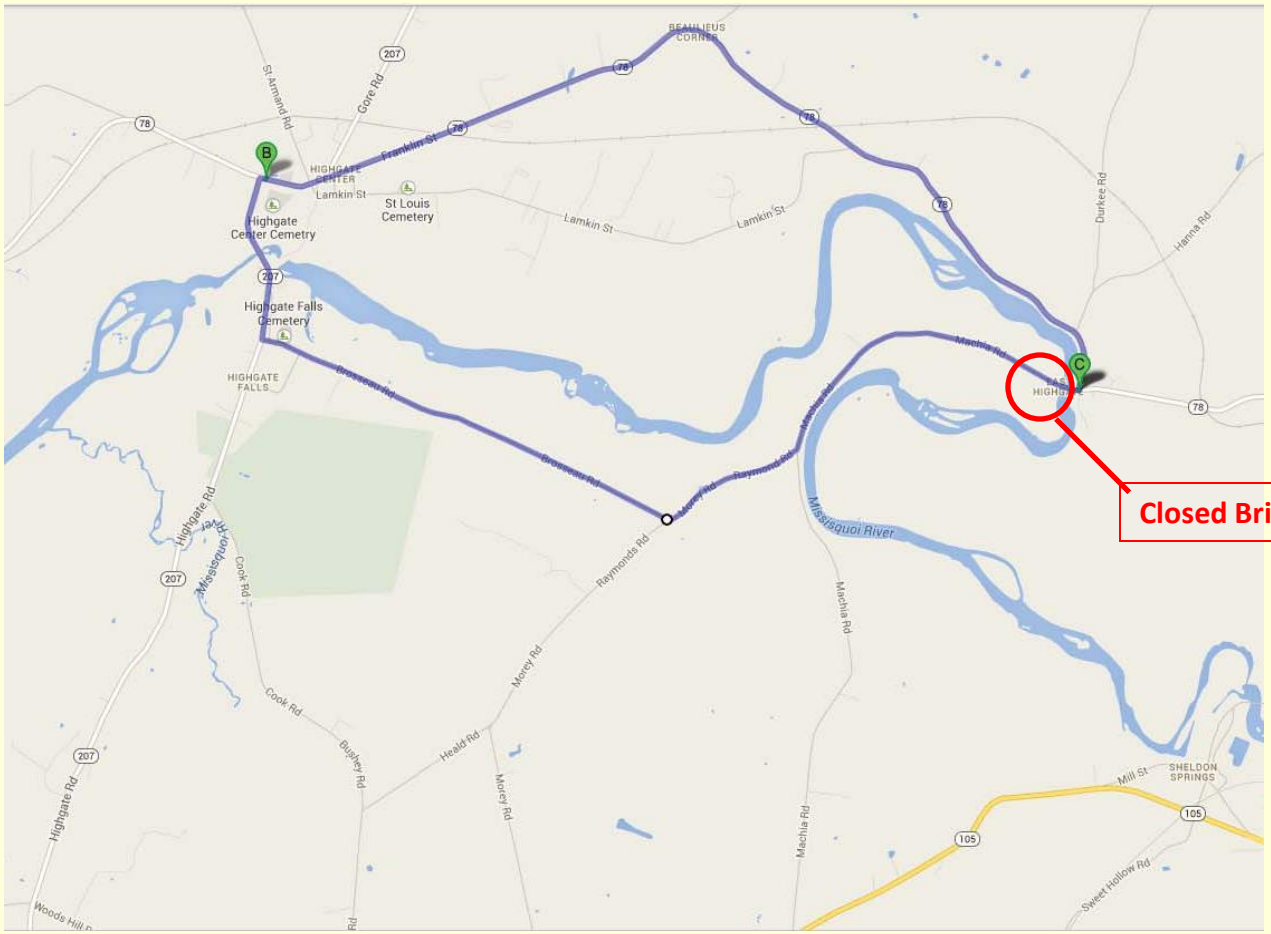
Layout - Temporary Bridge Upstream



Accelerated Bridge Construction with Bridge Closure Option

- Close bridge (time dependent on alternative selected)
- Allow 24/7 construction during bridge closure
- Contract incentives/dis-incentives to encourage contractor
- Contractor will receive more $ if closure is less than stated in the contract
- Community would have input on time of closure (between June 1 and September 1)
- Town will be responsible for detour route (location, signing, installing, maintaining)
- Local share will be cut in half
- Public Outreach to provide advance notice for planning-

Possible Detour Route



Machia Road to VT 78 to VT 207 to Brosseau Road to Morey Road

End to end distance around detour is 8.1 miles (about 16 minutes)

Town is responsible for determining the most appropriate route

Concerned Stakeholders for Bridge Closures

A few groups we commonly hear concerns from:

- Businesses who lose drive-by traffic during the closure
- Schools who have a bus route over the closed bridge
- Motorists who have to travel a longer distance on the detour
- Emergency responders who have to respond quickly
- Owners living near the construction who are concerned with noise
- Owners living along a bypass route that will see increased traffic
- Municipalities who have increased impact to their local roads

Mitigation Strategies for Bridge Closures

Some ideas on how these impacts are often mitigated:

- Allow municipality input on time of year for closure
- Accelerated construction duration including:
  - Allowance for working 24 hours per day and 7 days per week
  - Incentive/Dis-incentive clause to encourage the contractor ($$)
- Noise limits included in contract for night time work
- Signing to notify motorists of business districts open for business
- Grant assistance from Agency of Commerce & Community Development
- Many examples of creative solutions from people impacted-

Alternatives Matrix - Rehabilitations

	20 Year Detour	40 Year Detour	Widen Truss Detour	Widen Truss Temp Bridge	Rehab & New Bridge Phased
Construction w/ CE and Contingencies	$2,684,500	$3,794,300	$5,751,200	$6,823,700	$6,475,300
Preliminary Engineering	$516,300	$729,800	$1,106,000	$1,312,300	$1,245,300
Right of Way	$0	$30,000	$40,000	$60,000	$80,000
Total Cost	**$3,200,800**	**$4,554,500**	**$6,897,200**	**$8,196,000**	**$7,800,600**
Local Share	**$0 (0%)**	**$0 (0%)**	**$0 (0%)**	**$0 (0%)**	**$97,508 (1.25%)**
Design Life (years)	20	40	40	40	40
Typical	0-8-8-0	0-8-8-0	2-9-9-2	2-9-9-2	2.5-9-2.5 2-9-2
Project Development Duration	2 years	4 years	4 years	4 years	4 years
Construction Duration	12 months	18 months	18 months	24 months	24 months
Closure Duration	2 weeks	2 weeks	24 weeks	None	None

Alternatives Matrix – Replacements

	Existing Alignment (State Typ) Detour	Existing Alignment (State Typ) Temp Bridge	New Alignment (State Typ) Detour	New Alignment (State Typ) Temp Bridge	New Alignment (Town Typ) Detour	New Alignment (Town Typ) Temp Bridge
Construction w/ CE and Contingencies	$4,253,600	$5,326,100	$4,407,000	$5,479,500	$5,132,400	$6,204,900
Preliminary Engineering	$818,000	$1,024,300	$847,500	$1,053,800	$987,000	$1,193,300
Right of Way	$30,000	$60,000	$30,000	$60,000	$30,000	$60,000
Total Cost	**$5,101,600**	**$6,410,400**	**$5,284,500**	**$6,593,300**	**$6,149,400**	**$7,458,200**
Local Share	**$255,080 (5%)**	**$641,040 (10%)**	**$264,225 (5%)**	**$659,330 (10%)**	**$307,470 (5%)**	**$745,820 (10%)**
Design Life (years)	80	80	80	80	80	80
Typical	2-9-9-2	2-9-9-2	2-9-9-2	2-9-9-2	5-11-11-5	5-11-11-5
Project Development Duration	4 years	4 years	4 years	4 years	4 years	4 years
Construction Duration	12 months	24 months	12 months	24 months	12 months	24 months
Closure Duration	12 weeks	None	12 weeks	None	12 weeks	None

Conclusion and Recommendation

Alternative Selection

Complete Replacement on new alignment w/ State Typical

- Load capacity meets current standards
- No restrictions for width or height
- Design standards are met
- Long term (80 year) fix

Traffic Maintenance Method

Bridge closure w/ off-site detour & ABC

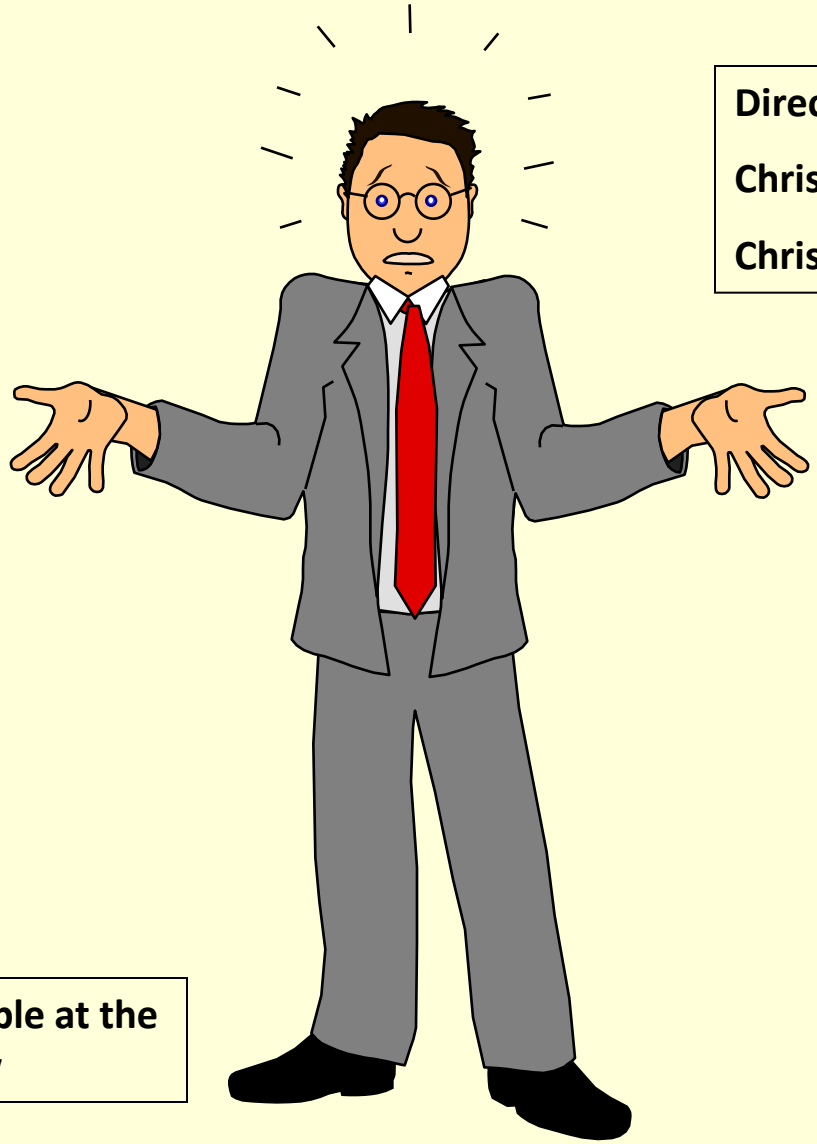
- Detour length, traffic volume and duration are reasonable
- Minimal property owner and environmental impacts
- Has best chance of being expedited
- Reduced local share (5%)

Next Steps

This is a list of a few important activities expected in the near future and is not a complete list of activities.

- Wait for Town response to recommendation on proposed project
- Develop Conceptual plans and distribute for comment
- Begin Environmental Permitting process
- Hold Public Information meeting for proposed project
- Process local agreements
- Project Defined – MILESTONE
- Transfer project to Design Project Manager
- Develop Preliminary plans
- Utility relocation coordination
- Right-of-Way process

Questions



Direct any questions to:

Christopher P. Williams, P.E.

Chris.Williams@State.VT.US

This presentation is available at the web address shown below

https://outside.vermont.gov/agency/vtrans/external/Projects/Structures/98J378