STATE OF VERMONT
AGENCY OF TRANPORTATION

Scoping Report

FOR

Hartford IM 091-2(79)
I-91, Bridge 43N & 43S over US 5

January 29, 2013

I. Contents

I. Site Information

These bridges are located on I-91 in an urban area of Hartford and span US 5 between Sykes Mountain Avenue and Veterans Drive. There is a significant amount of traffic below the bridge on US 5 as well as on the bridge on I-91. While there are trees and grass buffers within the State Right of Way adjacent to the bridges, the site is surrounded by commercial districts composed of service related businesses. The existing conditions were gathered from a combination of a Site Visit, the Inspection Report, the Route Log and the existing topographic data. See the correspondence in the Appendix for more detailed information.

Roadway Classification	Rural Principal Arterial - Interstate
Year of Construction	1966
Bridge Type	3 span rolled beam bridge
Bridge Length	202'
Width of Bridge	37.3' (43N) & 42' (43S)
Width of Roadway Approach	39' (43N) & 47' (43S)
Ownership	State of Vermont

Traffic

A traffic study of this site was performed by the Vermont Agency of Transportation. The traffic volumes are projected for the years 2015 and 2035.

Bridge	AADT		DHV		%T		%D		ADTT		ESALs	
	2015	2035	2015	2035	2015	2035	2015	2035	2015	2035	(2015 ~ 2035)	(2015 ~ 2055)
43N	7600	9100	1200	1500	10.0	14.8	100	100	1000	1800	7,165,000	17,331,000
43S	11,500	13,900	1500	1900	10.5	15.5	100	100	1200	2200	7,704,000	18,573,000

US 5 traffic data were procured from the 2010 Route Log AADT. Between Sykes Mountain Avenue and Veterans Drive there was an AADT of 14,900 in 2008 and 13,200 in 2010. These numbers indicate that approximately twice as much traffic is on US 5 near the bridges than travels on I-91N over the bridge.

Design Criteria

The design standards for this bridge project are the Vermont State Standards, dated October 22, 1997. Minimum standards are based on a DHV > 400 and a design speed of 55 mph.

Design Criteria	Source	Existing Condition	Minimum Standard	Comment
Approach Lane and Shoulder Widths	Green Book Chapter 8.2	4'-12'-12'-10' (N) 4'-12'-12'-12'-6' (S)	4'-12'-12'-10' (N) 4'-12'-12'-12'-6' (S)	
Bridge Lane and Shoulder Widths	Green Book Chapter 8.2	4'-12'-12'-9.25' (N) 4'-12'-12'-12'-2' (S)	4'-12'-12'-10' (N) 4'-12'-12'-12'-6' (S)	Similar
Clear Zone Distance	VSS Table 3.4	Clear or Shielded	26' fill / 16' cut	
Banking	VSS Section 3.13	5.2%	8% (max)	
Speed		55 mph (Posted)	55 mph (Design)	
Horizontal Alignment	AASHTO Green Book Table 3-10b	R=2546'	R_{min}=2350'	
Vertical Grade	VSS Table 3.5	3.1%	5% (max) for rolling terrain	
K Values for Vertical Curves	VSS Table 3.1	K = 233 crest (N) & 314 crest (S)	150 crest 100 sag	
Vertical Clearance Issues	VSS Section 4.8	15'-2" under	14'-3" (min)	
Stopping Sight Distance	VSS Table 3.1	709'	450'	
Bicycle/Pedestrian Criteria	VSS Table 4.7	None	N/A	Limited access highway
Bridge Railing	Structures Design Manual Section 13	Aluminum Rail	TL-4	Substandard

Inspection Report Summary

	43 N	43 S
Deck Rating	5 Fair	7 Good
Superstructure Rating	5 Fair	3 Serious
Substructure Rating	6 Satisfactory	6 Satisfactory

(43 N) 4/25/12 The trough under the finger plate joint needs to be replaced. The beams need extensive cleaning and painting. The joint areas continue to leak along the east end onto the suspended beam seat areas, allowing for continued section loss, especially in beam 6. Immediate attention is needed not only to prevent/repair the deterioration of the beams but also to prevent further spalling around the joint areas. The broken anchor bolts in beams 3 and 4 along pier 2 need to be repaired. JWW

(43 N) 10/05/10 The pavement overlay is in need of full replacement. A few posts and rails along both bridge and approach rails are in need of repairs. The east fascia area is in need of concrete removal of delaminations that pend spalling. Concrete patching in needed on the northeast corner area of the abutment No.2 stemwall. Several seating areas of the suspended span need repairs on the the retaining ears, replacement of bent or broken bearing connection bolts throughout. Heavy touch-up painting is needed on several steel members throughout. Beam No.6 on the south seat of span No.2 is in need of critical repairs to the web and bottom flange areas of the suspended beam. The deck may develop thru holes in the not too distant future. Servi-Lift inspection performed on 10/27/2010. Please refer to Critical Maintenance Report dated on 10/27/2010. PLB

(43 S) 04/25/2012 Cantilever beams No.7 off of both piers are in need of repairs. One section of bridge guardrail along the right side needs beam rail and post repairs or replacement. The left transition guardrail of approach No.1 is in need of repairs. PLB

(43 S) 10/05/10 The east fascia area needs removal of concrete delaminations that pend spalling. Concrete patching in needed on the northeast corner area of the abutment No.2 stemwall. Servi-Lift inspection was performed on 10/27/2010. Beam No.7 on the south seat of span No.2 is in need of critical repairs. The bent bearing seat bolts on beam lines 2 and 4 of the north seats are in need of replacement or installment. Please refer to Critical Maintenance Report dated on 10/27/2010. PLB

Hydraulics
No hydraulics information was gathered for this dry crossing.

Utilities
There is a major aerial crossing on I-91 at mm 70.025 +/- that does have fiber optics on it. There is sewer and water on US 5. Fiber optic marker flags were seen on US 5 running under the bridges. See Appendix for a drawing provided by Stantec for another project.

Right Of Way
The existing Right-of-Way (ROW) is extensive in this area and shown on the Layout sheet. Only a small portion in the southeast quadrant of the area shown on the plans is outside of the ROW. No additional ROW would need to be obtained for any of the alternatives considered in this report.

Environmental Resources
Agricultural
Prime agricultural soils are not present at this project.

Archaeological
No Archaeological Resources have been identified at the site.

Biological
No regulated natural resources were found in the immediate area.

Hazardous Materials
No hazardous materials were identified in the project area.

Historic
Bridges 43N&S are on the interstate system and are exempt from Section 106 and therefore not considered historic. There are no adjacent historic properties.

Stormwater
No stormwater concerns were identified for the project site.

II. Maintenance of Traffic

The Vermont Agency of Transportation is in the process of finalizing an Accelerated Bridge Program, which focuses on faster delivery of construction plans, permitting, and Right of Way, as well as faster construction of projects in the field. One practice that will help in this endeavor is closing bridges for portions of the construction period, rather than providing temporary bridges. In addition to saving money, the intention is to minimize the length of construction with faster construction techniques and incentives to contractors to complete projects early. The Agency will consider the closure option on most projects where rapid reconstruction or rehabilitation is feasible. The use of precast elements in new bridges will also expedite construction schedules. This can apply to decks, superstructures, and substructures. Accelerated Construction should provide enhanced safety for the workers and the travelling public while maintaining project quality. The following options have been considered:

Option 1: Temporary Bridge

The standard maintenance of traffic option based on the length of the bridges and the traffic volumes at this location would be a two lane temporary bridge. There is sufficient Right of Way located along this section of I-91 that the bridge could be located east of the bridges while the northbound bridge is under construction and west of the bridges while the southbound bridge is under construction.

Advantages: A temporary bridge maintains traffic along the existing corridor during construction.

Disadvantages: There are extra costs associated with constructing or launching temporary bridges. Changes in traffic patterns can increase the probability of accidents and the increased time associated with constructing temporary approaches and launching the temporary bridges puts the construction workers at increased risk for accidents. A temporary bridge on the east side of the project area would require tighter radii on the approaches and a corresponding decrease in the design speed limit to maintain a safe approach. This decrease in speed would cause slight traffic delays.

Option 2: Phased Construction

Another method of maintaining traffic along the corridor during construction is to build a new structure one lane at a time, or in phases. The existing bridge is wide enough and a recent paving project was constructed in phases proving that it is a possibility in this location.

Advantages: This would provide the advantage of a temporary bridge by maintaining traffic along the existing corridor during construction. In addition, the costs of maintaining traffic during phasing should be less expensive than maintaining traffic with a temporary bridge.

Disadvantages: While the time and cost required to construct a phased project may be less than that required to construct a project with a temporary bridge, the time required to construct a phased construction project is still longer than a project constructed without phasing, because some of the construction tasks have to be performed multiple times and cannot be performed concurrently. The costs of construction also increase over unphased work because of this increase in the length of time, the additional inconvenience of working around traffic, and the effort involved in coordinating the joints between the phases. Once again, while the corridor will be open to traffic during construction, traffic will still be delayed and disrupted by the reduction in the number of lanes and by construction vehicles and equipment entering and exiting the site.

The construction workers and equipment will still be in close proximity to vehicular traffic increasing the probability of accidents.

Option 3: On-Site Detour with Crossovers

Another method for maintaining traffic on parallel structures with multiple lanes of unidirectional traffic is creating a crossover in the median before and after the structures to get all traffic off one structure and on to the parallel structure. This option is rarely available for most projects, because most non-interstate structures in Vermont do not have parallel bridges. The possibilities on interstates may even be limited based on site distance, traffic patterns or obstructions in the median. With a reduced design speed or a potential stop condition for traffic merging south at exit 11 and traffic merging north at exit 10, it would be possible to maintain traffic at this location with crossovers. Two way traffic would be moved to the southbound bridge during construction of the northbound bridge and two way traffic routed to the northbound bridge while construction occurred on the southbound bridge.

Advantages: This would provide the advantage of a temporary bridge or phased construction by maintaining traffic along the existing corridor during construction.

Disadvantages: The costs associated with maintaining traffic with crossovers in this location rivals those for maintaining traffic with temporary bridges. Similar to the disadvantages for a temporary bridge, changes in traffic patterns can increase the probability of accidents and any maintenance of traffic plan that keeps traffic and construction workers in close proximity for extended durations puts the construction workers at increased risk for accidents. While the corridor will be open to traffic during construction, traffic will still be delayed and disrupted by the reduction in the number of lanes, potentially reduced speed through the construction zone, potential stop conditions at the exits and by construction vehicles and equipment entering and exiting the site.

Option 4: Off-Site Detour

This option would close the section of I-91 near the bridges to through traffic for a limited time during construction. The detour would utilize US 5 from exit 9 to 11 for traffic traveling north and south along I-91 and use US 4 to access I-89. The through distance on this detour is almost identical at 10.5 miles, however the estimate time for getting from exit 9 to 11 on US 5 increases to 20 minutes from the 10 minutes it takes on I-91.

Advantages: The costs associated with signing the detour are much lower than the construction costs associated with the other maintenance of traffic options. By detouring traffic away from construction activities, it creates a safer working environment for the construction workers. By not constructing the structure in phases, there will be no vibrations or deflections from adjacent traffic to affect the quality of the closure pours joining the phases. By not requiring the construction and removal of temporary approaches, temporary bridges and temporary crossovers, the length of construction can be reduced over those other options.

Disadvantages: Traffic will not be maintained along the existing corridor for a limited portion of construction. Through traffic will see an increase in travel times during the closure period.

III. Alternatives Discussion

The following were identified as issues that should be addressed at this site: the deck on the northbound bridge is in need of rehabilitation or replacement, the girders on the southbound bridge are in need of rehabilitation or replacement and the bridge railing is substandard for the type, volume and speed of traffic at this location. There are additional minor repairs that have been identified for correction, such as joint repair or replacement, substructure patching and bolt replacement. All of these minor issues should be addressed with any option that includes construction at this site.

While any repair or replacement option can be performed on one bridge without affecting the other structure, there are two things to keep in mind that make considering the structures together a reasonable approach. One, both bridges utilize the cantilever span design that is prone to the fatigue issue found in the southbound bridge necessitating the Critical Maintenance Report (See Appendix for report). Because the southbound bridge sees a higher number of ESALs than the northbound bridge, it is reasonable to assume that the northbound bridge will experience the same fatigue issue in a couple of years when the number of fatigue cycles approaches the critical number experienced by the southbound bridge. Two, while it is not necessary, it would be ideal to have both structures have the same life remaining at the end of any work, so that any mobilization costs associated with a future project could be used to address both bridges at the same time.

Alternative 1: No Action

It must be reasonable to assume that no repair or rehabilitation would be required on a structure during the next 10 years in order for a no action alternative to be justifiable. As was mentioned previously because of the Critical Maintenance Report, it is reasonable to assume that both structures will require at least minor repair or retrofitting within the next 10 years. If that is the case, the rehabilitation should be done during this review cycle and this alternative will not be considered further in this report.

Alternative 2: Membrane and Pave

The 2010 inspection report indicates that the pavement overlay should be replaced. Since that time, a paving project has come through this location and rectified the pavement issues on this bridge. This alternative for extending the remaining life of the bridges is not available anymore and will not be considered further.

Alternative 3: Rehabilitation

Deck Repair or Replacement

Extensive sections of the fascia along with localized delaminations on interior portions of the deck on Bridge 43 N could use repair. The quantity of deck patching or replacement required on 43 N is approaching the threshold where a complete deck replacement would be more cost-effective. Bridge 43 S, on the other hand, is in relatively good shape and could be maintained with relatively minor patching at this time.

Superstructure Steel

At a minimum, the structural steel should be cleaned and painted on both bridges and structural retrofits performed on the beams at the joints, including the cantilever abutment ends. There are two types of retrofits that can be performed on the cantilevered beam ends on this project.

The first type is a safety retrofit. This involves providing some type of underslung catcher or beam seat under the joint to function as a secondary support should the original connection fail. These types of retrofit do not actually rectify the situation; they only act to prevent catastrophic failure. In addition, any underslung unit deeper than approximately 11” would cause clearance issues under the bridge.

The second method of repairing the cantilevered beam end is replacing the existing connection with a new modified configuration. The most common method of connecting two girders at this location along a span is through the use of web and flange splices. The traditional concern with creating a continuous span out of three simple spans is the additional movement that needs to be accommodated at the bridge seats on the piers. However, each structure is only 202 feet long and would not experience excessive amounts of thermal movement; the corroded state of the existing connection most likely does not allow complete unrestricted expansion and contraction; and low resistance bearing could be installed if the design showed these additional stresses to be a concern. An additional consideration at this location is the construction sequence. The supported span would need to be temporarily shored during construction which would cause a lane shift on US 5. There is room to accommodate these shifts and still maintain traffic on US 5 during construction, but it adds a safety and inconvenience aspect to the maintenance of traffic plan which was not previously mentioned. Any traffic impacts on US 5 are significant given that the traffic volumes are similar on I-91 and US 5 in this location and approach 14,000 vehicles per day.

Superstructure replacement

Both of the structural steel retrofit options have some disadvantages. Once the beam ends have been addressed, the remaining steel still needs to be cleaned and painted. Cleaning and painting the existing steel in place would need to be done in phases while the traffic on US 5 is shifted from side to side to keep the painters a safe distance away from the vehicles. After one adds the cleaning, painting and containment costs to the contract, it becomes reasonable to consider replacing the steel beams rather than rehabilitating them. There is no good way to replace steel beams while preserving the existing concrete deck, and on Bridge 43 N, the deck has deteriorated to a point where one would not want to keep the existing deck anyway. Thus, if one is replacing the steel beams to rectify the fatigue and painting issues, the entire superstructure should be considered for replacement.

Rehabilitation Synthesis

Bridge 43 N could be rehabilitated by splicing and cleaning and painting the steel beams and replacing the concrete deck. This should provide another 25 years of service to the structure. Bridge 43 S would be best served by replacing the entire superstructure. Since the substructure units are in relatively good shape, replacing the superstructure and patching the substructures should provide an additional 40 years of service for Bridge 43 S.

For a slight premium in construction costs, but a reduction in complexity and inconvenience to the traveling public, Bridge 43 N could have the entire superstructure replaced to bring both bridges up to the same standard of remaining service life. This alternative would rectify all of the identified issues with both structures and will be the rehabilitation alternative considered moving forward.

Alternative 4: Complete Bridge Replacement

It seems counterintuitive to consider replacing an entire bridge when the substructure units are in relatively good shape and the costs for replacing a complete 200 foot long bridge would be greater than replacing the superstructure on a 200 foot bridge. However, the costs for constructing an entire 100 foot long bridge and constructing a 200 foot long superstructure should be closer together. In addition, the remaining service life for a complete bridge replacement should be longer than the remaining service life for a superstructure replacement only. Eliminating substructure units and joints will also cut down on potential maintenance issues in the future as well.

For these crossings, there are no hydraulic constraints imposing a minimum bridge length and the roadway typical requirements for US 5 under the bridges in question do not preclude the installation of several 100 foot long bridges in this location.

For these reasons, complete bridge replacements will be considered further in this report. Because the most appealing maintenance of traffic option is an off-site detour, and off-site detours are most palatable when the construction duration over which the detour is in effect is minimized, several rapid bridge construction techniques will be considered for the complete replacement options.

All of the replacement options would have the abutments constructed as completely as possible while maintaining traffic on the existing structures. To prove the concept and determine relative costs, a potential abutment construction sequence is detailed here. The existing abutments will be shored with temporary cut walls to provide room between the existing abutments and piers to construct the new abutments. The southern abutments will be MSE retention structures and the northern abutments will be semi-gravity cantilever walls cast on bedrock. The most efficient and easiest configuration of wingwalls to construct would be in-line with the abutments connecting the northbound and southbound bridges between the structures. Stem and wall construction will progress as far towards the bottom of the existing beams as possible, with backfilling progressing concurrently on the MSE walls and after the cantilever walls are constructed.

Once the abutments have been built up to this point, there are several options for finishing the substructures and placing the superstructure on top.

Lateral Slide

A lateral slide consists of constructing an entire superstructure adjacent to the location where it is intended and physically pushing or pulling the structure into its design location along lubricated rails. This could take place in the same location mentioned for the temporary bridges, to the east of the northbound bridge and to the west of the southbound bridge. The backwall and remaining portion of the substructure can be constructed with the superstructure before being slid into place.


Figure 1: Lateral Slide

[Images from “Accelerated Bridge Construction - Experience in Design, Fabrication and Erection of Prefabricated Bridge Elements and Systems” from FHWA (2011).]

Self-Propelled Modular Transporters (SPMT)

One of the disadvantages of utilizing a lateral slide in this location is that the construction still needs to take place over US 5. There are some height restrictions and worker safety issues when construction occurs over busy highways. There are several methods of constructing the bridge in a safer, less restricted environment before moving it into place. One of those methods utilizes SPMTs. Similar to a lateral slide, SPMT placement requires that the entire superstructure is constructed near but not in its intended location. Instead of sliding the superstructure into place, it is lifted off its temporary blocking, moved a short distance to its design location, and lowered into place. The backwall and remaining portion of the substructure can still be constructed with the superstructure before being moved into place.

Figure 2: SPMT transporting a bridge superstructure

Prefabricated Bridge Units (PBU)

Another method of constructing the bridge in a safer and less restricted environment than over US 5 is to build the bridge in pieces and deliver those pieces to the construction site to be joined together to form the bridge. These bridge superstructure pieces are referred to as Prefabricated Bridge Units, or PBUs. Depending on the weight restrictions of the cranes being used and the construction sequence anticipated, the backwall, remaining substructure and bridge railing can be attached to the PBUs before being lifted into place. If the remaining substructure cannot be attached before lifting, that substructure unit can be prefabricated and lifted into place before the PBUs are placed. (See next page for an image of a PBU being lifted into place.)

Figure 3: PBU being lifted into place

Scheduling

During the closure period, the following items of work need to be accomplished before the road can be reopened to traffic: removal of the old superstructure and portions of the substructure that will interfere with the new superstructure, placement of the top of the new substructure, placement of the new superstructure, backfilling to finish grade between the new and old abutments, placement of approach slabs, and placement of pavement. It is assumed that during the closure period US 5 will remain open to traffic. The following schedules include hour long closures of US 5 during night work and lane shifting during other periods in the construction process.

Superstructure Removal

There are three spans on both the north and south bound bridges. The typical section of the northbound bridge contains 6 beams while the southbound typical section contains 7 beams. The following sequence assumes that components must be lifted out of position rather than demolished in-place to avoid falling debris hitting traffic below. It is further assumed that a maximum of two beams per span can be removed at one time. Thus, the southbound bridge will require 12 lifts to remove the superstructure. Assuming an hour and a half for preparation, including concrete cutting, diaphragm detachment and bearing loosening and another one half hour for the lift, swing, set and move, necessitates 2 hours per removed segment and approximately 24 hours to remove the existing superstructure. Conceivably, multiple segments could be removed at the same time and the seventh beam on each span would not require any preparation work, but this slop in the schedule can account for any unforeseen issues which arise during the removal process.

Another method of removal the existing superstructure is sliding it out, similar to sliding the new superstructure into place. The caveat is that there is not enough room between the bridges to slide the entire old structure out of the way before moving the new structure into place. However, one or two beams could be removed from the bridges before the slide is initiated to make room for the new structure. Since sliding a structure takes approximately 3 hours to complete, even adding 6 hours to remove several exterior beams would save potentially 15 hours from the abovementioned construction sequence. One could gain back those additional 6 hours by removing the exterior beams before the road closure began.

Substructure Removal

The suspended spans will need to be removed before the end spans. Once one of the end spans is removed, the process of removing the pier cap can be initiated. Rather than start the pier cap removal process during this stage, it would be better to remove this from the critical path by one of several methods. One method of starting the process sooner is to construct a temporary bent under the bridge while traffic is still on the bridge and remove portions of the cap then. Another method to remove the substructure removal from the critical path is to construct the new superstructure to be the same depth or slightly shallower than the existing superstructure so no substructure removal is required before placing the new superstructure.

Remaining Substructure Placement

All of the proposed rapid construction techniques can include the remaining portion of the substructure integrally with the superstructure, or the substructure caps can be lifted into position with one lift each before the superstructure components are placed. One can add a maximum of 2 hours to the construction sequence.

Superstructure Placement

Moving a structure by laterally sliding it takes about 3 hours. Moving a structure utilizing SPMTs would take about 5 hours to complete. Placing a new superstructure with PBUs would require slightly more time than just swinging out the old units and slightly less time than preparing the old units for removal. Assuming one hour per unit would entail approximately 12 hours to place the new superstructure units. Then, the closure pour sections would need to be formed and poured and cured. The pour and cure can be done concurrently with other work, so the critical path would include an extra 6 hours of preparation and forming for the closure pour on the PBUs. This brings the total PBU installation time to 18 hours.

Backfilling

Once the superstructure is placed, the remaining backfilling operation can begin immediately. Even if closure pours need to be completed, non-reactive material such as galvanized plate or high density plastic could be used as forming material and left in place after construction. There remains about 385 cubic yards of material to be placed between each of the new and existing abutments. It is assumed that placing and sufficient compacting the backfill material, rather than the delivery of the material, is the critical path in this process. Calculating 15 minutes to place and sufficiently compact each 8 yards of material equates to approximately 12 hours to backfill behind each abutment.

Approach Slab Placement

The approach slabs should be comprised of multiple precast slab units which can be grouted on the end opposite the abutment to provide full contact support. Assuming 3 hours to set the units and 3 hours to pour the grout and allow it to reach strength would result in another 6 hours per abutment.

Paving

There should be at least one lift of pavement on the approach fill before the interstate is opened back up to traffic. This will require a large mobilization effort for a small quantity of pavement, but should not take more than 4 hours to pave the approaches.

Schedule Summary

The minimal closure time for the options mentioned above would be 28 hours for sliding both the existing and new structure out and in, backfilling, setting approach slabs and paving. The maximum amount of time for the options mentioned above is approximately 66 hours for lifting the existing structure out and placing PBU units in the new structure. Allowing a 24 hour cure period for the closure pour between the PBUs would add an additional two hours, making the higher end estimate 68 hours for a closure without any contingency time. This would equate to closing I-91 from noon on Friday to noon on Monday twice to replace the two bridges at this location. This entails several months of construction work before each closure for preparation work and several months of construction after each closure for finish paving, striping and railing on the top and removing the existing substructures below.

Replacement Synthesis

Based on the length of time required to construct the bridge in its final location with PBUs and the as yet unknown quality of closure pours only being allowed to cure for 24 hours before being opened to traffic, this is not the preferred method of replacement construction. SPMTs require expensive specialized equipment to move a structure into place; there was a recent SPMT failure in Maryland; lateral slides are possible in this location; and there is no time savings involved in using SPMTs in this location. Therefore SPMT installation is also not a preferred alternative for replacing the bridges utilizing a road closure. This leaves utilizing lateral slides for removing the existing structures and installing the new bridges as the preferred alternative when utilizing a road closure during construction, and the alternative that will be considered further in this report.

IV. Alternatives Summary

There are four options for maintaining traffic during this project; three rehabilitation alternatives; 1 complete replacement alternative; and at least 3 methods of getting superstructures into their final location. Trying to turn all of the options into an all-inclusive cost matrix would get overwhelming. Thus, the one preferred rehabilitation option and the one preferred replacement option will be compared in the matrix, and ballpark costs will be given for the various other methods and alternatives for comparison purposes.

Maintenance of Traffic Costs

Option	Type	Description	Project Specific Construction Costs
1	Temporary Bridge	$500,000 per bridge	$1,000,000
2	Phased Construction	10% premium on bridge costs @ $1.5 million per bridge plus signs and barricades	$400,000
3	Cross-over	2 cross-overs for both bridges	$750,000
4	Off-site Detour	1 sign package plus UTOs, etc	$100,000

Table 1: Ballpark Maintenance of Traffic Costs

The lowest construction cost maintenance of traffic options are the detour and phased construction. Both have impacts on the user, but initial numbers indicate that the user costs are very similar for both options. The detour costs were calculated as a 2½ day closure which adds 10 minutes to the travel time, yielding $91,000 in user costs per bridge. The phased construction costs assume that 3 phases are required at 4 weeks per phase with an additional travel time of 18 seconds for traffic merging and construction activities yields $92,000 in user costs per bridge.

Superstructure installation method costs

The baseline method of installing the superstructure is using a crane to lift the PBUs into place. These costs are included in the baseline bridge costs. The additional costs required to install the superstructures using lateral sliding or SPMTs are as follows. The extra engineering and temporary supports required for a lateral slide are approximately $75,000 per bridge, or $150,000. The costs paid to an SPMT subcontractor would be around $100,000 per bridge, or $200,000.

Rehabilitation Costs

Type	Notes	Project Specific Construction Costs
Deck Repair	Type II on 30% of Bridge 43S = $150,000 Type III on 75% of Bridge 43N = $350,000	$500,000
Deck Replacement	Removal = $150,000 / bridge Railing = $75,000 / bridge Rebar & Concrete = $600,000 / bridge	$1,650,000
Beam Paint	Containment = $100,000 / bridge Cleaning & Painting = $150,000 / bridge	$500,000
Beam Retrofit	Cleaning, Steel, Installation, Temporary Supports, etc for 13 beams	$150,000

Alternative 3c: Superstructure Replacement using Phased Construction

This is the baseline alternative that will rectify all of the known deficiencies. It consists of removing the existing superstructure; patching the substructure units; and replacing everything from the bearings up to the bridge and approach rail.

Alternative 4a: Complete Replacement with Off-site Detour

This alternative is based on one long weekend closure, from Friday afternoon to Monday afternoon, for each bridge being replaced. Work will be done before the closure to build a large portion of the new abutments and work will be performed after the closure to remove the old piers and pave the bridges. During the closure, the existing superstructure, approach slabs and top portions of abutments will be removed and the new superstructure with top portion of the abutments will be moved into place by laterally sliding it. The new bridge is proposed to be a single span 130 foot long bridge with a 30° skew from the major chord. This longer, than the originally proposed 100 foot span, and skewed superstructure is proposed in order to fit the new substructure units between the existing piers and abutments. The surrounding road work may include the removal of Entrance Ramp A, per the Pedestrian Improvement Study, if that makes it easier to remove the existing structure and install the new bridge.

V. Cost Matrix

Alternative 3c, Superstructure Replacement using phased construction, and 4a, Complete Replacement with Off-site Detour, will be considered below. A high level comparison of the costs and engineering considerations for each of the alternatives still under consideration is given below.

Hartford IM 091-2(79)		Alt 3c Superstructure Replacement		Alt 4a Complete Replacement	
		Bridge 43N	Bridge 43S	Bridge 43N	Bridge 43S
COST[1]	Bridge Cost	$1,100,000	$1,243,000	$1,372,000	$1,640,000
	Removal of Structure	$109,000	$123,000	$251,000	$284,000
	Roadway	$277,000	$294,000	$450,000	$480,000
	Maintenance of Traffic	$185,000	$199,000	$125,000	$125,000
	Construction Costs	$3,530,000		$4,727,000	
	Construction Engineering + Contingencies	$706,000		$945,000	
	Total Construction Costs w CEC	$4,236,000		$5,672,000	
	Preliminary Engineering	$635,000		$851,000	
	Right of Way	$0		$0	
	Total Project Costs	$4,871,000		$6,523,000	
SCHEDULING[2]	Project Development Duration	3 years		3 years	
	Construction Duration	4 months	4 months	9 months	
	Mobility Impacts	12 weeks	12 weeks	2 weeks	
ENGINEERING	Typical Section - Roadway (feet)	4-12-12-10	4-12-12-12-6	4-12-12-10	4-12-12-12-6
	Typical Section - Bridge (feet)	4-12-12-9.25	4-12-12-12-2	4-12-12-10	4-12-12-12-6
	Geometric Design Criteria	No Change		Meets Standard	
	Traffic Safety	No Change		Similar	
	Alignment Change	No Change		No Change	
	Bicycle Access	No Change		Potential Improvement on US 5	
	Hydraulic Performance	Not Applicable		Not Applicable	
	Pedestrian Access	No Change		Potential Improvement on US 5	
	Utility	No Impact		No Impact	
OTHER	ROW Acquisition	No		No	
	Road Closure	No		(2) 2½ day periods	
	Design Life	40 years		80 years[3]	

[1] Costs are estimated and should only be used for comparison purposes.
[2] Preliminary Engineering costs and Project Development durations are estimated starting from the end of the Project Definition Phase.
[3] Interstate structures should be designed and detailed for 100 years, but the uncertainty of future maintenance, material properties and future needs do not warrant using the higher number for comparison purposes.

VI. Conclusion

The recommendation is to proceed with Alternative 4a, Complete Replacement with Off-site Detour.

For an extra $1.6 million, or approximately 33% more, one can get longer lasting, less maintenance prone structures installed. As the alternatives are framed now, the duration of the mobility impact should be significantly reduced for the complete replacement, even though the construction duration should be similar for the two alternatives. However, the superstructure alternative could utilize the same lateral slide techniques to reduce the mobility impacts of that alternative as well. At a minimum, it is felt that the superstructure units of these bridges should be replaced. It appears that there is sufficient benefit to replacing the substructure units and eliminating the joints on the superstructure to justify the extra cost of that alternative.

The proposal includes two new 130 foot long single span steel superstructures constructed next to the existing structures utilizing prefabricated units and slid into position during a 60 hour closure period for each bridge. There should be restrictions in the contract to reduce the duration of construction over US 5 to increase the safety to the workers and minimize the disruption to traffic travelling under the structures. Traffic on US 5 can be shifted north and south during construction to create a larger staging area near the substructure units. Any closures on US 5 should be limited to an hour, take place during night work and not coincide with the I-91 closures. Interstate 91 traffic will be detoured on US 5 for approximately 10.5 miles during these closure periods. The new abutments will be placed between the existing piers and abutments before the closure period; the northern abutments will be composed of semi-gravity cantilever walls while the southern abutments will be composed of MSE walls. The existing piers will be removed after the closure period.

VII. Appendices

- Site Pictures
- Location Map
- Bridge Inspection Reports
- Critical Maintenance Reports
- Boring Sheets from Record Plans
- Natural Resources Memo
- Archaeology Memo
- Historic Memo
- Utilities Memo
- Portions of Draft Pedestrian Improvement Study
- Detour Routes and I-89 Access
- Plans
    - Typical Sections
    - Layout
    - Profile
    - Phasing Plans
    - Lateral Slide Plans

Localized Deck Deterioration

Joint Deterioration

Cracking around Beam Support

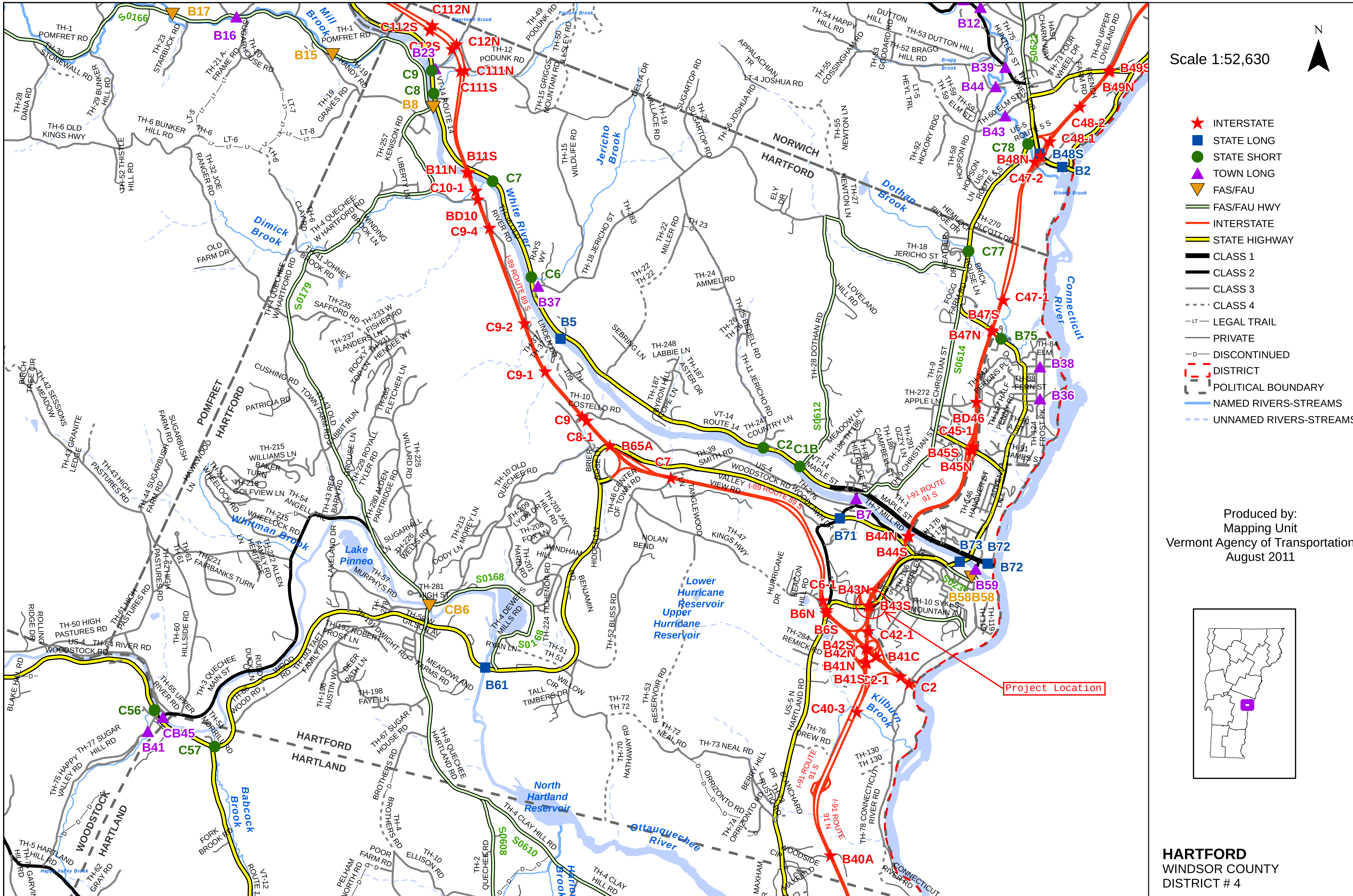
Paint Deterioration

Looking North along I-91

Looking South along I-91

Looking East along US 5

Looking West along US 5



Scale 1:52,630
N
INTERSTATE
STATE LONG
STATE SHORT
TOWN LONG
FAS/FAU
FAS/FAU HWY
INTERSTATE
STATE HIGHWAY
CLASS 1
CLASS 2
CLASS 3
CLASS 4
LEGAL TRAIL
PRIVATE
DISCONTINUED
DISTRICT
POLITICAL BOUNDARY
NAMED RIVERS-STREAMS
UNNAMED RIVERS-STREAMS
Produced by:
Mapping Unit
Vermont Agency of Transportation
August 2011
Project Location
HARTFORD
WINDSOR COUNTY
DISTRICT # 4

STRUCTURE INSPECTION, INVENTORY and APPRAISAL SHEET

Vermont Agency of Transportation ~ Structures Section ~ Bridge Management and Inspection Unit

Inspection Report for HARTFORD **bridge no.:** 0043N **District:** 4

Located on: I 00091 ML **ove** I 91 OVER US 5 **approximately** I 91 EXIT 11 **Owner:** 01 STATE-OWNED

CONDITION

Deck Rating: 5 FAIR

Superstructure Rating: 5 FAIR

Substructure Rating: 6 SATISFACTORY

Channel Rating: N NOT APPLICABLE

Culvert Rating: N NOT APPLICABLE

Federal Str. Number: 200091043N14082

Federal Sufficiency Rating: 80.2

Deficiency Status of Structure: SD

AGE and SERVICE

Year Built: 1966 Year Reconstructed: 0000

Service On: 1 HIGHWAY

Service Under: 1 HIGHWAY

Lanes On the Structure: 02

Lanes Under the Structure: 02

Bypass, Detour Length (miles): 00

ADT: 012800 % Truck ADT: 13

Year of ADT: 1998

GEOMETRIC DATA

Length of Maximum Span (ft): 0100

Structure Length (ft): 000202

Lt Curb/Sidewalk Width (ft): 0.7

Rt Curb/Sidewalk Width (ft): 0.7

Bridge Rdwy Width Curb-to-Curb (ft): 37.3

Deck Width Out-to-Out (ft): 42

Appr. Roadway Width (ft): 039

Skew: 30

Bridge Median: 1 OPEN MEDIAN

Min Vertical Clr Over (ft): 99 FT 99 IN

Feature Under: HIGHWAY BENEATH STRUCTURE

Min Vertical Underclr (ft): 15 FT 02 IN

STRUCTURE TYPE and MATERIALS

Bridge Type: 3 SP ROLLED BEAM

Number of Approach Spans 0000 Number of Main Spans: 003

Kind of Material and/or Design: 4 STEEL CONTINUOUS

Deck Structure Type: 1 CONCRETE CIP

Type of Wearing Surface: 6 BITUMINOUS

Type of Membrane 2 PREFORMED FABRIC

Deck Protection: 0 NONE

APPRAISAL *AS COMPARED TO FEDERAL STANDARDS

Bridge Railings: 1 MEETS CURRENT STANDARD

Transitions: 1 MEETS CURRENT STANDARD

Approach Guardrail 1 MEETS CURRENT STANDARD

Approach Guardrail Ends: 1 MEETS CURRENT STANDARD

Structural Evaluation: 5 BETTER THAN MINIMUM TOLERABLE CRITERIA

Deck Geometry: 5 BETTER THAN MINIMUM TOLERABLE CRITERIA

Underclearances Vertical and Horizontal: 3 INTOLERABLE, CORRECTIVE ACTION NEEDED

Waterway Adequacy: N NOT OVER WATER

Approach Roadway Alignment: 5 BETTER THAN MINIMUM TOLERABLE CRITERIA

Scour Critical Bridges: N NOT OVER WATERWAY

DESIGN VEHICLE, RATING, and POSTING

Load Rating Method (Inv): 2 ALLOWABLE STRESS (AS)

Posting Status: A OPEN, NO RESTRICTION

Bridge Posting: 5 NO POSTING REQUIRED

Load Posting: 10 NO LOAD POSTING SIGNS ARE NEEDED

Posted Vehicle: POSTING NOT REQUIRED

Posted Weight (tons):

Design Load: 5 HS 20

INSPECTION and CROSS REFERENCE

X-Ref. Route: US5

Insp. Date: 042012 Insp. Freq. (months) 24 X-Ref. BrNum: 0071A

INSPECTION SUMMARY and NEEDS

4/25/12 The trough under the finger plate joint needs to be replaced. The beams need extensive cleaning and painting. The joint areas continue to leak along the east end onto the suspended beam seat areas, allowing for continued section loss, especially in beam 6. Immediate attention is needed not only to prevent/repair the deterioration of the beams but also to prevent further spalling around the joint areas. The broken anchor bolts in beams 3 and 4 along pier 2 need to be repaired. JWW

10/05/10 The pavement overlay is in need of full replacement. A few posts and rails along both bridge and approach rails are in need of repairs. The east fascia area is in need of concrete removal of delaminations that pend spalling. Concrete patching in needed on the northeast corner area of the abutment No.2 stemwall. Several seating areas of the suspended span need repairs on the the retaining ears, replacement of bent or broken bearing connection bolts throughout. Heavy touch-up painting is needed on several steel members throughout. Beam No.6 on the south seat of span No.2 is in need of critical repairs to the web and bottom flange areas of the suspended beam. The deck may develop thru holes in the not too distant future. Servi-Lift inspection performed on 10/27/2010. Please refer to Critical Maintenance Report dated on 10/27/2010. PLB

10/17/08 This structure is in poor to fair condition. The bituminous pavement wearing surface is in poor condition with numerous map cracks. The

STRUCTURE INSPECTION, INVENTORY and APPRAISAL SHEET

Vermont Agency of Transportation ~ Structures Section ~ Bridge Management and Inspection Unit

Inspection Report for HARTFORD | **bridge no.:** 0043S | **District:** 4

Located on: I 00091 ML **ove** I 91 OVER US 5 | **approximately** I 91 EXIT 11 | **Owner:** 01 STATE-OWNED

CONDITION

Deck Rating: 7 GOOD

Superstructure Rating: 3 SERIOUS

Substructure Rating: 6 SATISFACTORY

Channel Rating: N NOT APPLICABLE

Culvert Rating: N NOT APPLICABLE

Federal Str. Number: 200091043S14082

Federal Sufficiency Rating: 36

Deficiency Status of Structure: SD

AGE and SERVICE

Year Built: 1966 **Year Reconstructed:** 0000

Service On: 1 HIGHWAY

Service Under: 1 HIGHWAY

Lanes On the Structure: 03

Lanes Under the Structure: 02

Bypass, Detour Length (miles): 00

ADT: 012800 **% Truck ADT:** 13

Year of ADT: 1998

GEOMETRIC DATA

Length of Maximum Span (ft): 0100

Structure Length (ft): 000202

Lt Curb/Sidewalk Width (ft): 0.7

Rt Curb/Sidewalk Width (ft): 0.7

Bridge Rdwy Width Curb-to-Curb (ft): 42

Deck Width Out-to-Out (ft): 47.7

Appr. Roadway Width (ft): 047

Skew: 22

Bridge Median: 1 OPEN MEDIAN

Min Vertical Clr Over (ft): 99 FT 99 IN

Feature Under: HIGHWAY BENEATH STRUCTURE

Min Vertical Underclr (ft): 17 FT 10 IN

STRUCTURE TYPE and MATERIALS

Bridge Type: 3 SP ROLLED BEAM

Number of Approach Spans 0000 **Number of Main Spans:** 003

Kind of Material and/or Design: 4 STEEL CONTINUOUS

Deck Structure Type: 1 CONCRETE CIP

Type of Wearing Surface: 6 BITUMINOUS

Type of Membrane 2 PREFORMED FABRIC

Deck Protection: 0 NONE

APPRAISAL *AS COMPARED TO FEDERAL STANDARDS

Bridge Railings: 1 MEETS CURRENT STANDARD

Transitions: 1 MEETS CURRENT STANDARD

Approach Guardrail 1 MEETS CURRENT STANDARD

Approach Guardrail Ends: 1 MEETS CURRENT STANDARD

Structural Evaluation: 3 INTOLERABLE, CORRECTIVE ACTION NEEDED

Deck Geometry: 4 MEETS MINIMUM TOLERABLE CRITERIA

Underclearances Vertical and Horizontal: 5 BETTER THAN MINIMUM TOLERABLE CRITERIA

Waterway Adequacy: N NOT OVER WATER

Approach Roadway Alignment: 8 EQUAL TO DESIRABLE CRITERIA

Scour Critical Bridges: N NOT OVER WATERWAY

DESIGN VEHICLE, RATING, and POSTING

Load Rating Method (Inv): 2 ALLOWABLE STRESS (AS)

Posting Status: A OPEN, NO RESTRICTION

Bridge Posting: 0 POSTING REQUIRED

Load Posting: 10 NO LOAD POSTING SIGNS ARE NEEDED

Posted Vehicle: POSTING NOT REQUIRED

Posted Weight (tons):

Design Load: 5 HS 20

INSPECTION and CROSS REFERENCE

X-Ref. Route: US5

Insp. Date: 042012 **Insp. Freq. (months)** 24 **X-Ref. BrNum:** 00071

INSPECTION SUMMARY and NEEDS

04/25/2012 Cantilever beams No.7 off of both piers are in need of repairs. One section of bridge guardrail along the right side needs beam rail and post repairs or replacement. The left transition guardrail of approach No.1 is in need of repairs. PLB

10/05/10 The east fascia area needs removal of concrete delaminations that pend spalling. Concrete patching in needed on the northeast corner area of the abutment No.2 stemwall. Servi-Lift inspection was performed on 10/27/2010. Beam No.7 on the south seat of span No.2 is in need of critical repairs. The bent bearing seat bolts on beam lines 2 and 4 of the north seats are in need of replacement or installment. Please refer to Critical Maintenance Report dated on 10/27/2010. PLB

10/17/08 This structure is in good to poor condition. The deck wearing surface is in fair condition with some cracks in random areas and pending pot holes. The superstructure is in poor condition in the suspends span of span #2. there is some heavy rust scale in the bearing areas of the suspended span. Beam #7 is the worst. There are paper thin areas around the bearings and web and beam stiffeners in the suspended span. There is a 2" crack in the web next to the bearing area of beam #7 on the pier #1 side. This area needs repair due to the section loss. The keeper plate is missing on the bearing of beam #7. there are some broken swedge bolts in the suspended span in places. DGP

BRIDGE INSPECTION - CRITICAL MAINTENANCE REPORT

Hartford	I 91	43 NB	4	I 91 over US 5	3 Span Rolled Beam
TOWN	ROUTE	BRIDGE	DISTRICT	FEATURE CROSSED	TYPE OF STRUCTURE

PROBLEMS FOUND:

SUPERSTRUCTURE

1. Repair Beam/Girder
   Location:
   Est. Quantity
   Urgency of Repair Coding:

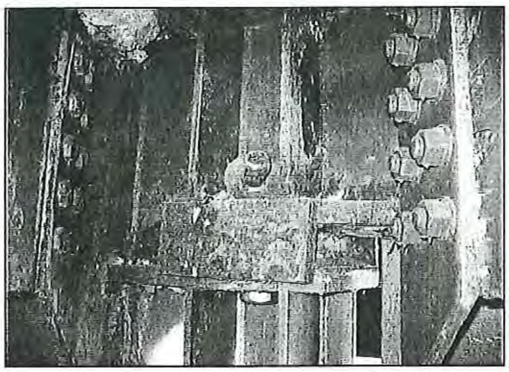
2. Repair/Replace Brg Devices — Swedge bolt busted off at suspended span
   Location:
   Est. quantity - Each:
   Urgency of Repair Coding: Needs to be addressed

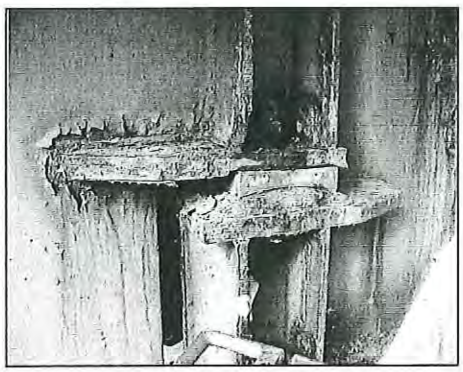
3. Minimum Vertical Clearance
   Location:
   Est. quantity - Each:
   Urgency of Repair Coding:

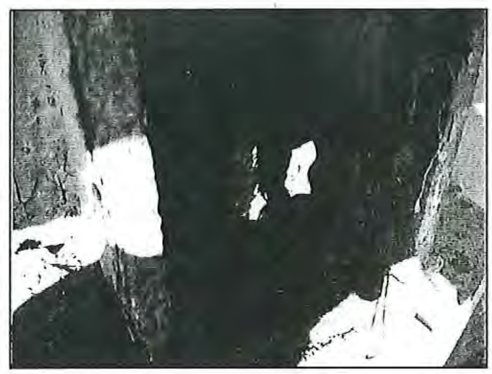
ACTION TAKEN:

____

DTA's INITIALS & DATE ________________







Note: **Critical** (Immediate action required) **Semi-Critical** (Timely action required) **Needs to be Addressed**

INSPECTOR: **Doane Preedom and Justin White**

INSPECTION DATE: **10/17/08**

INSPECTOR COMMENTS:

Swedge bolt has busted out at beam #4 (west side) at pier #1 in the suspended span bearing. The bolt needs replacing. Broken swedge bolts were also noted in the bearing of beams #3 and #4 (west side) at pier #2 of the same suspended span. There is heavy rust scale in some of the other swedge bolts in both ends of the suspended span. Consideration should be given to replacing these bolts at the same time. There is minor to moderate section loss in members at suspended span which is caused by the leakage of the joints. The beam ends at the suspended spans need extensive cleaning and painting to prevent any further section loss in the members.

Return a copy of this form to Structures Division and Director of Operations after repairs have been completed.

Signatures:

Structures Program Manager — Date

Wayne Gammell, MTA OPS District 6
Gary Schelley, OPS HQ
NBIS File via PMT and Inspector

BRIDGE INSPECTION - CRITICAL MAINTENANCE REPORT

Hartford	I 91	43SB	4	I 91 over US 5	3 Span Rolled Beam
TOWN	ROUTE	BRIDGE	DISTRICT	FEATURE CROSSED	TYPE OF STRUCTURE

PROBLEMS FOUND:

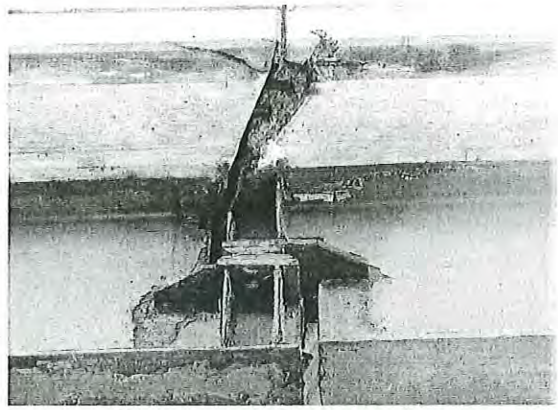
SUPERSTRUCTURE

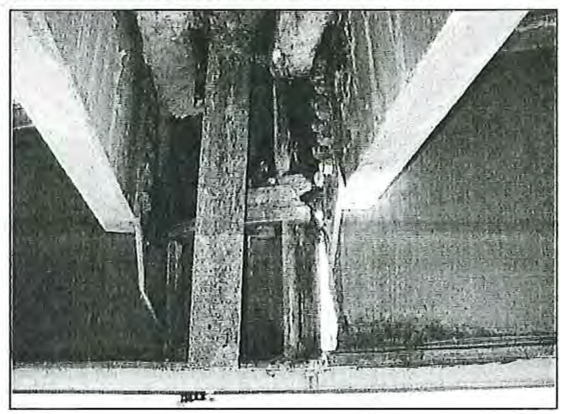
1. Repair Beam/Girder — Heavy rust scale in the beams at splice
   Location:
   Est. Quantity
   Urgency of Repair Coding: Needs to be addressed

2. Repair/Replace Brg Devices — Swedge bolt busted off at suspended span
   Location:
   Est. quantity - Each:
   Urgency of Repair Coding: Needs to be addressed

ACTION TAKEN: ______________________

DTA's INITIALS & DATE ______________________





Note: **Critical** (Immediate action required) **Semi-Critical** (Timely action required) **Needs to be Addressed**

INSPECTOR: **Doane Preedom and Justin White**
INSPECTION DATE: **10/17/08**

INSPECTOR COMMENTS: **Some beams have heavy rust scale with section loss in the webs and flanges located on the ends at the suspended spans due to the leakage of the joints. A swedge bolt has busted out at beam #4 (west side) at pier #1 in the suspended span bearing and needs replacing. There is heavy rust scale in some of the other swedge bolts in both ends of the suspended span. Considerations should be given to replacing these bolts at the same time. Beams need extensive cleaning and painting at the suspended spans to deter more deterioration and stop any holes from forming.**

Return a copy of this form to Structures Division and Director of Operations after repairs have been completed.

Signatures: ______________________ Structures Program Manager 11/18/08 Date

Wayne Gammell, MTA OPS District 6
Gary Schelley, OPS HQ
NBIS File via PMT and Inspector

BRIDGE INSPECTION - CRITICAL MAINTENANCE REPORT

Hartford	I-91	43 N&S	4	I-91 over US 5	3SP Rolled Beam
TOWN	ROUTE	BRIDGE	DISTRICT	FEATURE CROSSED	TYPE OF STRUCTURE

PROBLEMS FOUND:

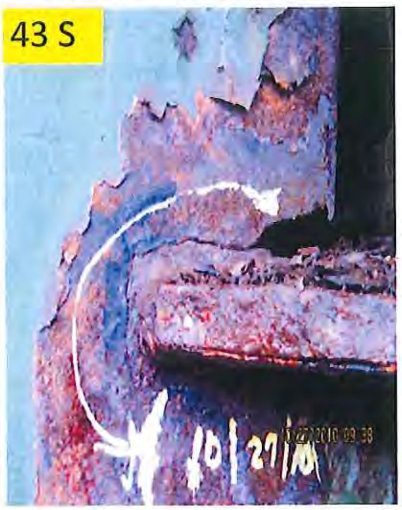
SUPERSTRUCTURE

ACTION TAKEN:

1. Repair: East exterior Beams — **Reinforce Webs on both 43 N/S**
   Location: Sp.2 So. seat area 43S — **Bot. web of cantilevered Bm No.7.**
   Location: Sp.2 So.seat area 43N — **Bot. web of cantilevered Bm No.6.**
   Est. Quantity 2 beams — **Bm(s). No.7S & 6N (Both in Sp. No.2)**
   Urgency of Repair Coding: — **Critical**

2. Add or Replace Bolts — **Replace all broken or bent seating bolts.**
   Location: Along all seating areas — **Suspended span**
   Est. quantity - Each: — **28 seats total to check**
   Urgency of Repair Coding: — **Critical**

DTA's INITIALS & DATE ____________



South Seat Area of Span No.2

North Seat Area of Span No.2

Note: **Critical** (Immediate action required) **Semi-Critical** (Timely action required) **Needs to be Addressed**

Inspector(s) : **Peter Bergeron and David Kimball**
Inspection Date : **10/27/10**

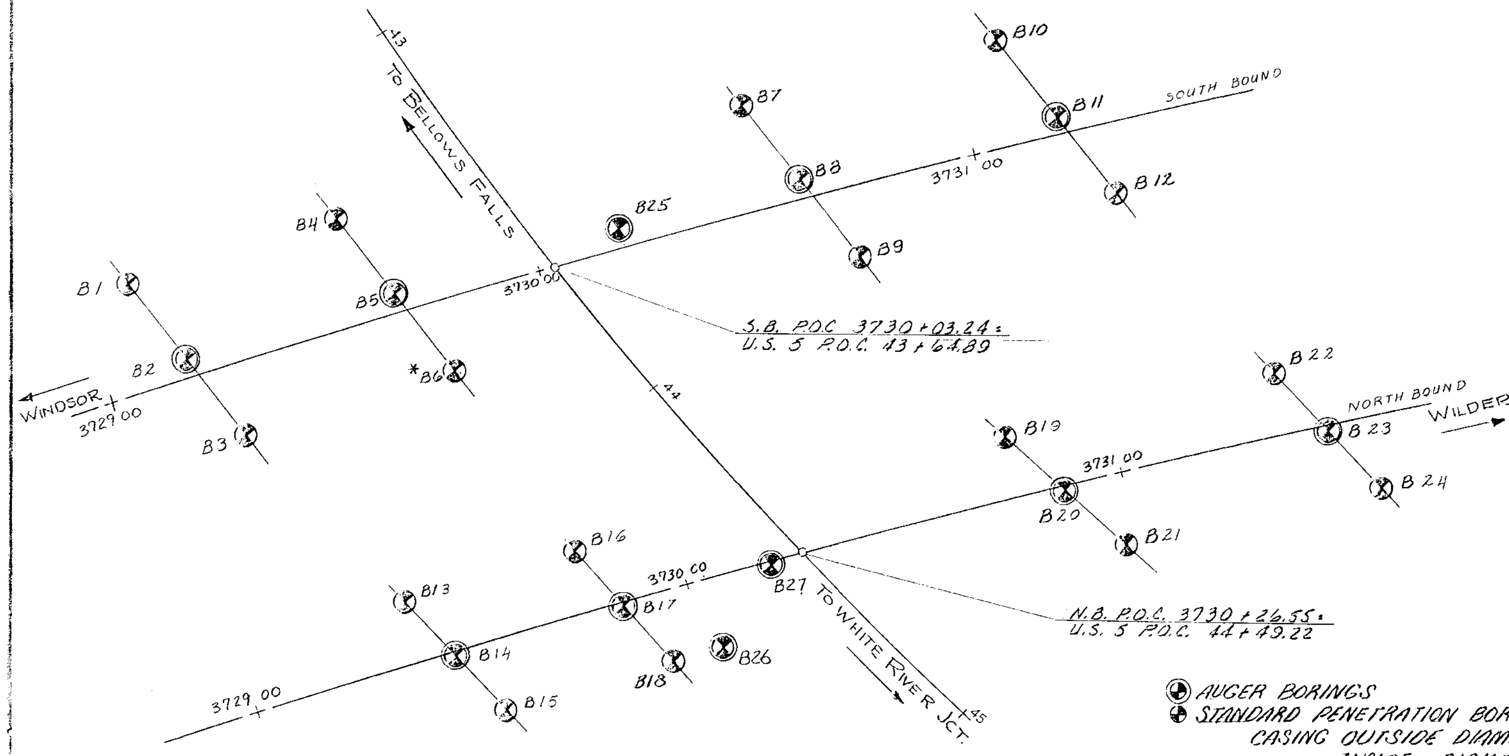
Inspector(s) Comments :

The seat areas in both pictures above are in need of critical and timely repairs. It is suggested that full height reinforcement plates be added to the webs of both these areas. The plate should be shaped to fit between the center bearing stiffener plate to the first full height connection plate of the diaphragm beam (nearest the affected area). Welding and all preparation procedures for these repairs shall conform to field welding manual per Maintenance Division. Shoring of the suspended span should be considered during repair operations.

Return a copy of this form to Structures Section and Director of Operations after repairs have been completed.

Signature: Wm. M. H[signature] 2/24/11
Structures Program Manager — Date

Bill Sargent, OPS District 6
Tod Kimball, FHWA
NBIS File via PMT and Inspector

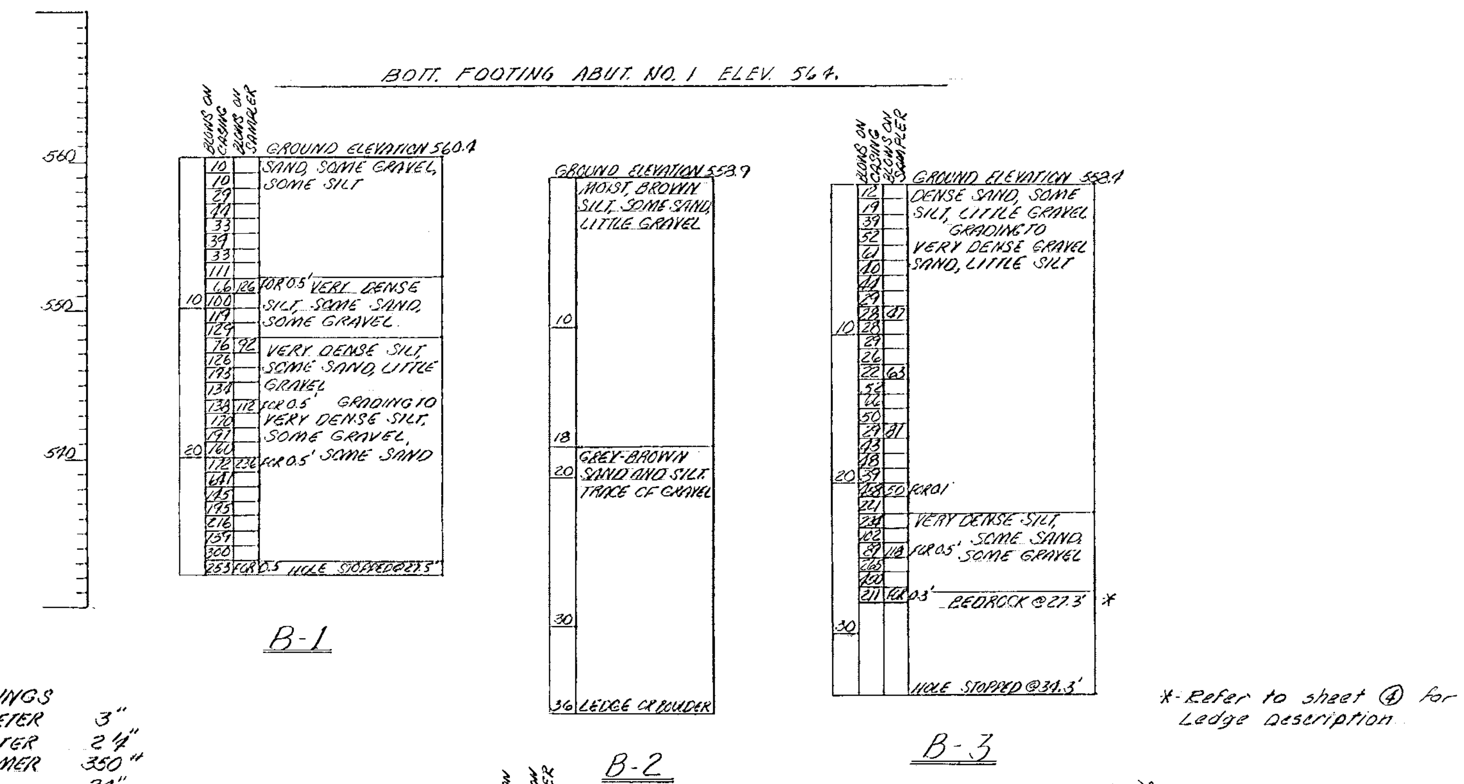


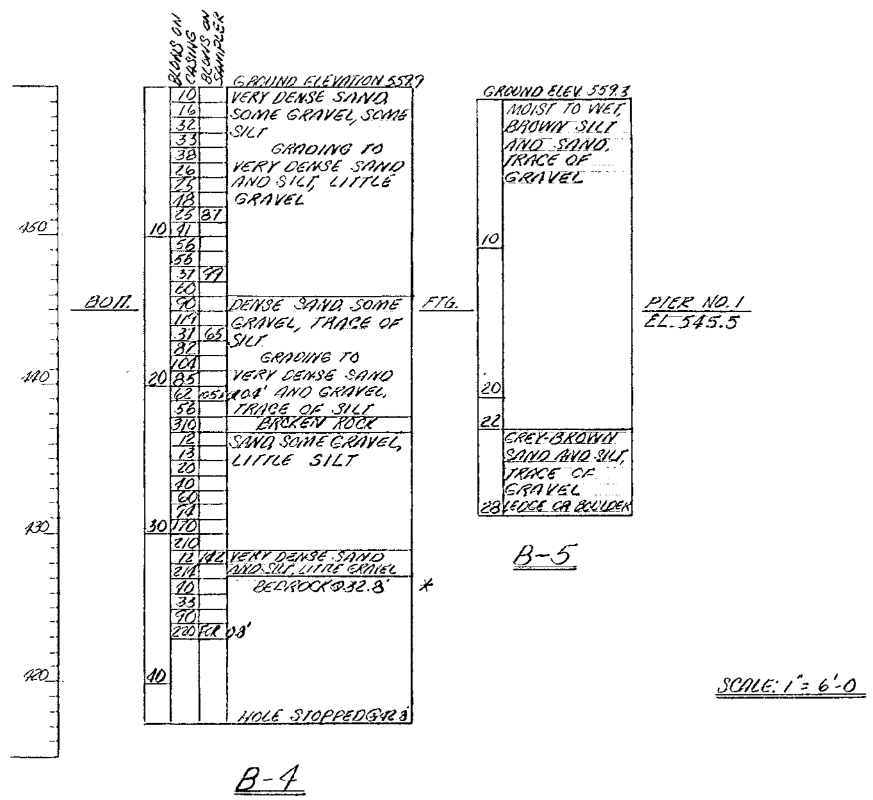
AUGER BORINGS
STANDARD PENETRATION BORINGS

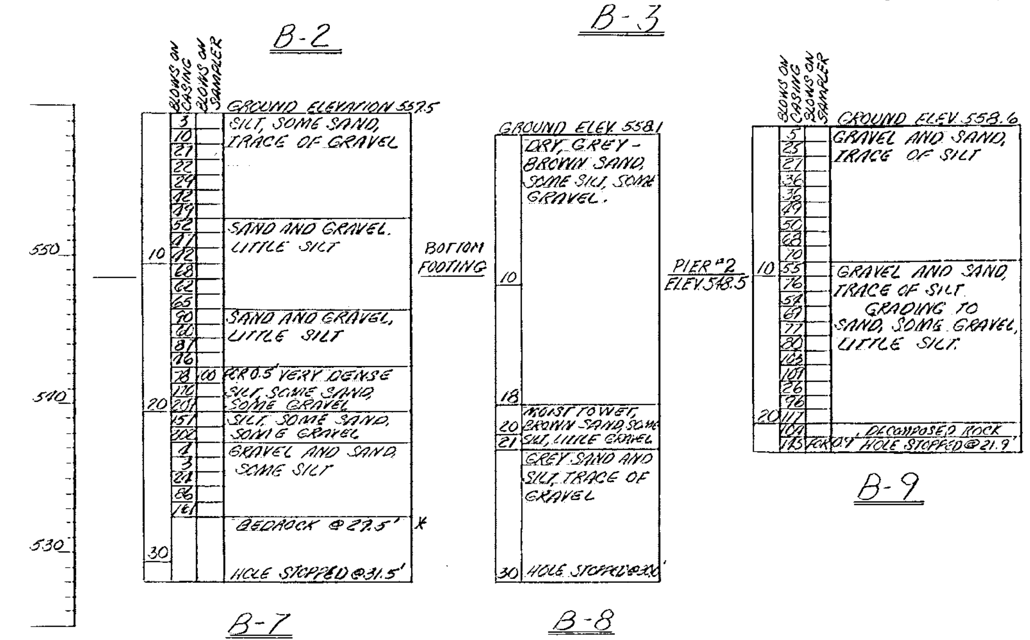
CASING OUTSIDE DIAMETER	3"
INSIDE DIAMETER	2½"
WEIGHT OF HAMMER	350"
HAMMER FALL	24"
SAMPLER OUTSIDE DIAMETER	2"
INSIDE DIAMETER	1⅜"
WEIGHT OF HAMMER	140"
HAMMER FALL	30"

BORING PLAN LAYOUT

SCALE 1"=20'-0







Additional Auger Borings (not plotted)

Station	Offset	Ground Elevation	Depth to Bedrock or Refusal
3731+30 NB	16' Lt.	561.8	14.0'
3731+43 NB	4' Rt.	562.3	10.0'
3731+56 NB	33' Rt.	563.6	10.0'

BORING NO	STATION	OFFSET FROM ℄
	SOUTH BOUND	
B1	3729+12	24 Lt
B2	3729+19	4 Lt
B3	3729+26	16 Rt
B4	3729+60	24 Lt
B5	3729+67	4 Lt
*B6	3729+75	16 Rt
B7	3730+53	24 Lt
B8	3730+62	4 Lt
B9	3730+70	16 Rt
B10	3731+11	24 Lt
B11	3731+20	4 Lt
B12	3731+29	16 Rt
	NORTH BOUND	
B13	3729+39	14 Lt
B14	3729+46	1 Rt
B15	3729+53	16 Rt
B16	3729+78	14 Lt
B17	3729+85	1 Rt
B18	3729+92	16 Rt
B19	3730+77	14 Lt
B20	3730+87	1 Rt
B21	3730+97	16 Rt
B22	3731+38	14 Lt
B23	3731+47	1 Rt
B24	3731+56	16 Rt

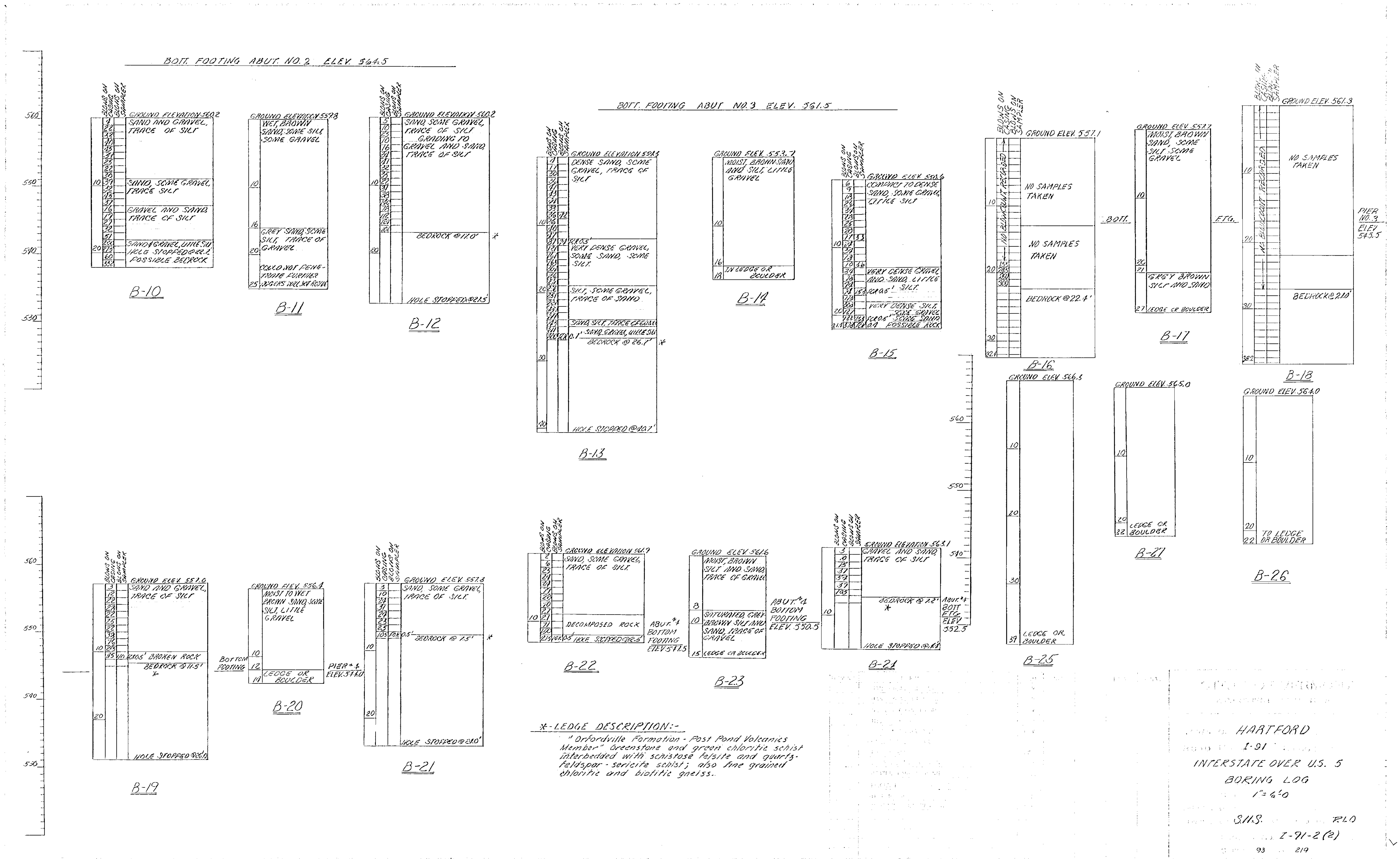
* BORINGS NOT TAKEN

ITEM NO.	ITEM	UNIT	NET	OVERRUN	TOTAL	FINAL
106-A	CHAN. EXCAV. OF EARTH	C.Y				
106-B	CHAN. EXCAV. OF ROCK	C.Y				
106-C	UNCLASS. CHAN. EXCAV.	C.Y				
107	STRUCT. EXCAV.	C.Y				
301 B	CONC. CLASS B (MOD)	C.Y				
302	REINF. STEEL	LBS.				
307	[illegible] ASB. COATING	[illegible]				
502-B	TREATED TIMBER PILING	L.F.				
504	SPLICES FOR STEEL PILING	EA				
501	STEEL PILING	L.F.				
502-A	UNTREATED TIMBER PILING	L.F.				

STATE OF VERMONT
DEPARTMENT OF HIGHWAYS

TOWN OF HARTFORD
ROUTE NO I-91 LOG STA.
INTERSTATE OVER US 5
BORING PLAN
SCALE AS SHOWN
SURVEYED BY
DRAWN BY Tessier ASHB CHECKED BY R.B.H. & RLO
PROJECT NO. I 91-2 (2)
SHEET 92 OF 319

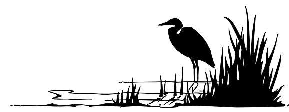
BR 104 of 124



BOTT. FOOTING ABUT. NO.2 ELEV. 564.5
BOTT. FOOTING ABUT. NO.3 ELEV. 561.5
BLOWS ON CASING
BLOWS ON SAMPLER
GROUND ELEVATION 560.2
SAND AND GRAVEL, TRACE OF SILT
SAND, SOME GRAVEL, TRACE SILT
GRAVEL AND SAND, TRACE OF SILT
SAND & GRAVEL, LITTLE SILT
HOLE STOPPED @ 22.1' POSSIBLE BEDROCK
B-10
GROUND ELEVATION 559.8
WET, BROWN SAND, SOME SILT SOME GRAVEL
GREY SAND, SOME SILT, TRACE OF GRAVEL
COULD NOT PENETRATE FURTHER
B-11
GROUND ELEVATION 560.2
SAND, SOME GRAVEL, TRACE OF SILT GRADING TO GRAVEL AND SAND, TRACE OF SILT
BEDROCK @ 17.0'
HOLE STOPPED @ 21.5'
B-12
GROUND ELEVATION 558.5
DENSE SAND, SOME GRAVEL, TRACE OF SILT
VERY DENSE GRAVEL, SOME SAND, SOME SILT
SILT, SOME GRAVEL, TRACE OF SAND
SAND, SILT, TRACE OF GRAVEL
SAND, GRAVEL, LITTLE SILT
BEDROCK @ 26.1'
HOLE STOPPED @ 40.1'
B-13
GROUND ELEV. 553.7
MOIST, BROWN SAND AND SILT, LITTLE GRAVEL
IN LEDGE OR BOULDER
B-14
GROUND ELEV. 556.6
COMPACT TO DENSE SAND, SOME GRAVEL, LITTLE SILT
VERY DENSE GRAVEL AND SAND, LITTLE SILT
VERY DENSE SILT, SOME GRAVEL, SOME SAND
POSSIBLE ROCK
B-15
GROUND ELEV. 557.1
NO BLOWCOUNT RECORDED
NO SAMPLES TAKEN
NO SAMPLES TAKEN
BEDROCK @ 22.4'
B-16
BOTT. FTG.
GROUND ELEV. 557.7
MOIST, BROWN SAND, SOME SILT, SOME GRAVEL
GREY BROWN SILT AND SAND
LEDGE OR BOULDER
B-17
GROUND ELEV. 561.3
NO SAMPLES TAKEN
BEDROCK @ 21.0'
PIER NO.3 ELEV. 545.5
B-18
GROUND ELEV. 566.3
LEDGE OR BOULDER
B-25
GROUND ELEV. 565.0
LEDGE OR BOULDER
B-27
GROUND ELEV. 564.0
TO LEDGE OR BOULDER
B-26
GROUND ELEV. 557.0
SAND AND GRAVEL, TRACE OF SILT
BROKEN ROCK
BEDROCK @ 11.5'
HOLE STOPPED @ 26.0'
B-19
BOTTOM FOOTING
GROUND ELEV. 556.4
MOIST TO WET BROWN SAND, SOME SILT, LITTLE GRAVEL
LEDGE OR BOULDER
B-20
PIER #4 ELEV. 541.0
GROUND ELEV. 557.8
SAND, SOME GRAVEL, TRACE OF SILT
BEDROCK @ 7.5'
HOLE STOPPED @ 21.0'
B-21
GROUND ELEVATION 561.7
SAND, SOME GRAVEL, TRACE OF SILT
DECOMPOSED ROCK
HOLE STOPPED @ 12.5
B-22
ABUT. #4 BOTTOM FOOTING ELEV. 547.5
GROUND ELEV. 561.6
MOIST, BROWN SILT AND SAND, TRACE OF GRAVEL
SATURATED, GREY BROWN SILT AND SAND, TRACE OF GRAVEL
LEDGE OR BOULDER
B-23
ABUT. #4 BOTTOM FOOTING ELEV. 550.5
GROUND ELEVATION 563.1
GRAVEL AND SAND, TRACE OF SILT
BEDROCK @ 7.2'
HOLE STOPPED @ 16.6'
B-24
ABUT. #4 BOTT. FTG. ELEV. 552.5
*-LEDGE DESCRIPTION:-
"Orfordville Formation - Post Pond Volcanics Member" Greenstone and green chloritic schist interbedded with schistose felsite and quartz-feldspar-sericite schist; also fine grained chloritic and biotitic gneiss.
HARTFORD
I-91
INTERSTATE OVER U.S. 5
BORING LOG
1" = 6'-0
S.H.S.
RLO
I-91-2 (2)
93
219

BR 105 of 124

AGENCY OF TRANSPORTATION **OFFICE MEMORANDUM**



TO: Lee Goldstein, Environmental Specialist

FROM: John Lepore, Transportation Biologist

DATE: April 2, 2012

SUBJECT: Hartford IM 091-1 (66)

The purpose of this memorandum is to let you know that I completed my initial review of this project and found no regulated natural resources in the immediate area as the project involves the interstate over US 5 in an area which has been severely altered.

If you have any questions about this review, come see me…

~ John ~

VERMONT

Jeannine Russell
VTrans Archaeology Officer
State of Vermont
Environmental Section
One National Life Drive
Montpelier, VT 05633-5001
www.aot.state.vt.us

Agency of Transportation

[phone] 802-828-3981
[fax] 802-828-2334
[ttd] 800-253-0191

To: Lee Goldstein, VTrans Environmental Specialist

From: Jeannine Russell, VTrans Archaeology Officer
via Brennan Gauthier, VTrans Assistant Archaeologist

Date: 5/23/2012

Subject: Hartford IM 091-2(79) – Archaeological Resource ID

Lee,

I've completed my initial resource identification for Hartford IM 091-2(79). A desk review conducted on 5/15/2012 as part of the 2012 GPS scoping initiative was adequate to identify potential resources in the project area. There are *no archaeological resources* present in the APE, and likewise no concerns for archaeology.

Please feel free to contact me with any questions or concerns.

~Brennan

Brennan Gauthier
VTrans Assistant Archaeologist
tel. 802-828-3965
Brennan.Gauthier@state.vt.us

From: O'Shea, Kaitlin
Sent: Thursday, April 12, 2012 4:40 PM
To: Goldstein, Lee
Cc: Williams, Chris; Newman, Scott
Subject: Pilot Project - Hartford IM 091-2(79) Historic Resource ID

Good afternoon,

I have completed the historic resource ID for Hartford IM 091-2(79): Bridges 43N&S are on the interstate system and are exempt from Section 106 and therefore not considered historic. There are no adjacent historic properties.

This resource ID is part of the GPS/GIS Pilot Project. As discussed, initial review for historic resources is completed via desk review (maps, bridge inspection photos, Google Earth) and can be determined to have no historic resources without site visits. Other projects will require a site visit in order to determine if there are historic resources located within the project area. Historic resources will continue to be identified on a map and scanned for the project files. When appropriate, historic resources will be mapped by the GPS in order to compare and contrast the effectiveness and application of these resource ID procedures.

I am keeping a spreadsheet for these pilot projects which outlines review methods, resource notes, resource ID and how the ID is submitted (GPS data, email memo, resource map, etc.) I'll bring this to the next project meeting.

Let me know if you have any questions.
Thanks,
Kaitlin

Kaitlin O'Shea
Historic Preservation Specialist
Vermont Agency of Transportation

802-279-0869
Kaitlin.O'Shea@state.vt.us

Fillbach, Tim

From: Driscoll, Kristin
Sent: Tuesday, September 25, 2012 1:40 PM
To: Williams, Chris
Subject: RE: Hartford IM 091-2(79) I 91, Bridges 43N/S - Request For Information
Attachments: water-sewer-US 5 Hartford.pdf

Chris,
I realize you will be updating Artemis soon for the end of the month, I hope this information does not come too late.
As far as Utilities on I-91, there is a major aerial crossing at mm 70.025 +/- that does have fiber optics on it.
There is sewer and water on US 5. I do not expect those would be affected, just wanted to mention it. I have attached a pdf of a cadd drawing provided by Santec for another project.
I did want to mention, that at the same time I have been going to scoping meetings for US 5 in the same area looking at adding a sidewalk and bike lane from VA Cutoff to Sykes Ave, consequently under the bridge. A lot of talk has been going on about what could be done to make it safer, including (pie in the sky) changing the ramps and aligning them with the proposed round-a-bout at Sykes Ave. Although, I realize this would be costly (and probably a shot in the dark), we happen to be looking at all the projects independently at the same time. It is a LTF project and Kevin Russell is the lead. Please let me know if you need any more information .
Thanks

Kristin Driscoll
Vermont Agency of Transportation
Utilities and Permits, Project Supervisor
One National Life Dr.
Montpelier, VT 05633-5001
Tel. (802)828-0511
Fax(802)828-5742
Kristin.driscoll@state.vt.us

From: Keller, Craig
Sent: Thursday, August 30, 2012 1:24 PM
To: Driscoll, Kristin
Cc: Gilman, Theresa
Subject: FW: Hartford IM 091-2(79) I 91, Bridges 43N/S - Request For Information

---

From: Williams, Chris
Sent: Thursday, August 30, 2012 1:08 PM
To: Keller, Craig; Petrovs, Harry
Cc: Fillbach, Tim
Subject: Hartford IM 091-2(79) I 91, Bridges 43N/S - Request For Information

<u>Hartford IM 091-2(79) I 91, Bridges 43N/S</u>

There will be no survey on this project and we will use LiDAR information to complete our scoping report.

Request For Information (RFI) for the following tasks:

030.01.04 Utilities - Existing
030.01.05 ROW - Existing


VA HOSPITAL
BUSKEY, RAYMOND A.
PERRY, GAIL D.
JWT REALITY
HARTFORD LAND COMPANY
MCDONALD'S RESTAURANT
SPILLANE, SUSAN C.
VALLEY LAND CORPORATION
VTRANS
BOB PERKINS INC.
CHA BUTSON WHITE RIVER JUNCTION LLC / BUTSON HOTEL MANAGEMENT
LARKIN FAMILY PARTNERSHIP

US Route 5/I-91 Exit 11 Bicycle and Pedestrian Improvements Scoping Study

Hartford, Vermont

September 18, 2012

DRAFT

Prepared for:

Town of Hartford, Vermont

Department of Planning and Development Services
Hartford Municipal Building, 2nd floor
171 Bridge Street
White River Junction, VT

Prepared by:

Stantec Consulting Services Inc.

55 Green Mountain Drive
South Burlington, VT

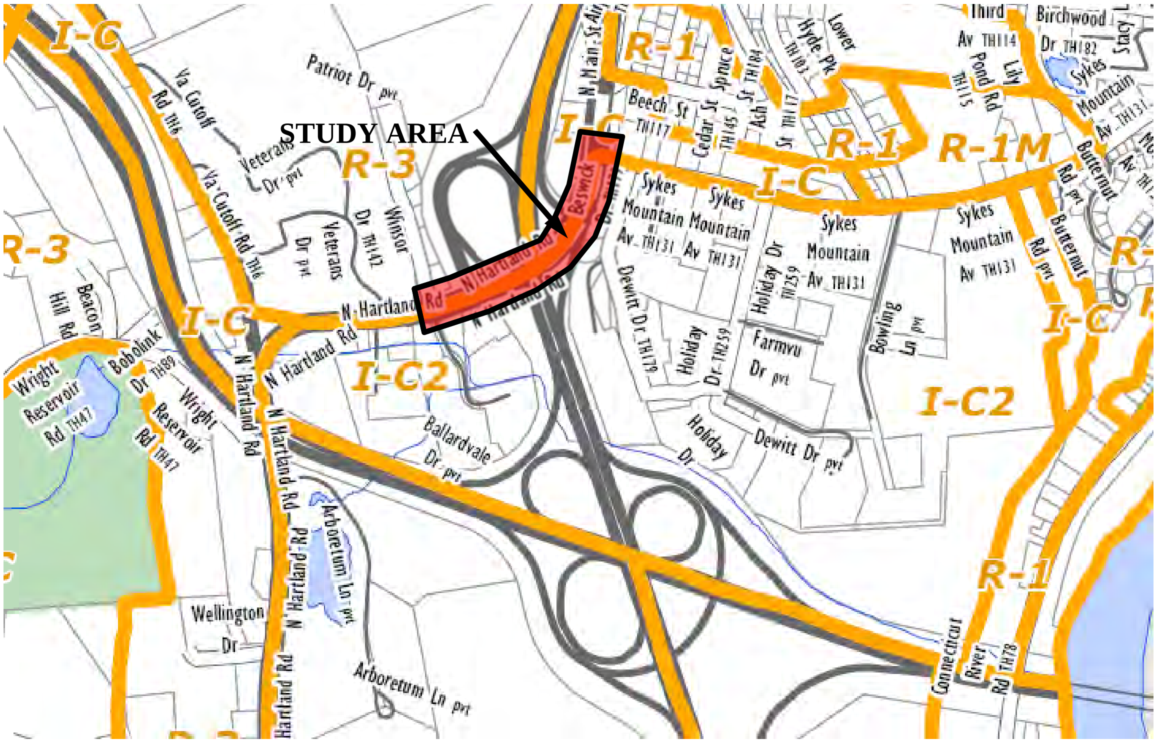


Figure 3 - Hartford Zoning District map within vicinity of project study area. Project study area shown in red. Map clipped from map entitled "ZONING DISTRICTS Hartford, VT: Adopted 10/14/08"

2.4 Transportation Facilities

2.4.1 Bicycle/Pedestrian

Currently, there are no sidewalks or dedicated bicycle facilities on US Route 5 within the project limits to link the two . In spite of the lack of pedestrian facilities, there is significant pedestrian activity that passes through the interchange area. A well-worn path exists on the outside of the guardrail under the I-91 overpass and along the shoulders of US 5. Over 170 pedestrians were observed walking along US 5 during a pedestrian count from 6 am to 6 pm conducted by VTrans in June 2010. Very little bicycle use of the corridor has been observed likely due to the interchange geometry, high traffic volumes and speeds, wide travel lanes and lack of adequate bicycle facilities.

New sidewalk on the south side of US Route 5 from Arboretum Lane to Ballardvale Drive is currently in the engineering phase and is anticipated to be constructed in 2013 US Route 5/Sykes Mtn Avenue intersection improvements consisting of a roundabout and a 10' wide shared-use path are also currently in the engineering phase and are anticipated to be constructed in the next 2 to 3 years. The study area links these two projects.

US Route 5 is identified as a regional bicycle route. Providing pedestrian and on-road bicycle facilities on US Route 5 from the VA Cutoff Road to Sykes Mountain Avenue received a #2 priority ranking in the *Town of Hartford Pedestrian and Bicycle Plan, 2009*. In addition, construction of sidewalks along US Route 5 within the study area is specifically mentioned in the *Hartford Master Plan 2012.*

2.4.2 Roadways and Intersections

US Route 5 is a major collector State Highway with approximately 6,600 vehicles per day south of the I-91 Interchange and 13,200 vehicles per day north of the interchange. The number of lanes and lane widths vary significantly through the study area. The overall width of the roadway varies significantly from 45' under the I-91 overpass to 82.5' between Ramp C and Sykes Mountain Avenue. The right-of-way width varies significantly and is abundant due to the presence of the I-91 Interchange.

Item	US Route 5
Classification	Major Collector
Posted Speed (mph)	40
AADT (vpd)	6,600 – 13,200
Trucks %	4 - 9%
Road Width	45'-82.5'
Right-of-Way Width	Varies

Table 1 - US Route 5 Roadway Characteristics

Roadways that intersect US 5 in the study area are shown on Figure 2 and include:

- I-91 Ramps B/F
- I-91 Ramp A
- I-91 Ramp C
- I-91 Ramp D
- Sykes Mountain Avenue
- Ballardvale Drive/Windsor Drive.

Existing roadway and intersection characteristics are summarized as follows.

Ballardvale/Windsor Drive to Ramps B/F
Route 5 between Ballardvale Drive and Ramps B/F has four lanes consisting of a travel lane and a left-turn lane in each direction as shown on Figure 2. Lanes are 12' wide. The existing paved shoulders are approximately 2' wide and are inadequate for bicycle lanes.

Ballardvale Drive is a dead end street that serves numerous hotels and other local businesses. Windsor Drive is a dead end street that serves a small number of residences. There are no commercial drives within the study area.

Ramp B is utilized by vehicles travelling westbound on US Route 5 to access I-91 northbound. Ramp F is utilized by vehicles exiting I-91 southbound onto Route 5. A stop sign controls vehicles exiting Ramp F .

Figure 11 - Route 5 looking westbound toward Ramp D (on right).

2.4.3 Traffic

VTrans estimates the 2010 Annual Average Daily Traffic (AADT) for the section of US Route 5 south of the interchange up to Ballardvale Drive to be 6,600 vehicles per day and north of the interchange from Ramp C to be 13,200 vehicles per day. AADT's for each of the ramps are as follows:

I-91 Interchange	AADT (veh/day)
Ramp F	2200
Ramp B	2000
Ramp A	3800
Ramp C	7000
Ramp D	1900

Table 2- AADT's for I-91 Interchange Ramps

Based on 2010 turning movement counts performed by VTrans in the study area, there are approximately 7-9% heavy trucks during the AM Peak Hour and 4% heavy trucks during the PM Peak Hour.

Intersection capacity analysis was completed using Synchro 8.0 software to obtain a baseline of existing performance. The baseline analysis is used to determine if the proposed bicycle and pedestrian improvements increase queues or delays at the intersections. For discussion purposes, the capacity analysis is identified by two major intersections located in the study area: US Route 5/Ramp B/Ramp F and US Route 5/Ramp C/Ramp D.
The results of the analysis are summarized in Table 3. Existing traffic counts indicate hourly traffic volumes on US 5 are highest during the morning peak from 7:00-8:00 AM. Therefore, the analysis was limited to the AM Peak Hour. The results of the Synchro analysis are included in the appendix.

		AM Peak Hour			
Intersection	Peak Hour/Approach/Lane Group	V/C Ratio	Delay (sec)	LOS	95th %ile Queue (ft)
US 5/Ramp B/Ramp F	SB Left and Right (Ramp F to US 5)	0.77	52	F	142 (6 veh)
	EB Left (US 5 to Ramp B)	0.22	9	A	21 (1 veh)
US 5/Ramp C/Ramp D	NB Left (Ramp C to US 5)	0.80	46	E	169 (7 veh)

V/C Ratio = Volume-to-capacity ratio; Delay = Average delay per vehicle in seconds; LOS = Level of Service.

Table 3 - Baseline Operational Performance for Route 5 Intersections

The analysis indicates that Ramp F operates at a level of service (LOS) of F under existing traffic conditions. Although, the ramp operates at a LOS F, the analysis indicates the volume to capacity ratio is less than 1.0 and the 95th percentile queue length is approximately six vehicles. Improvements proposed for this intersection cannot increase delays already experienced at Ramp F.

The traffic analysis indicates that the left-turn lane on Ramp C operates at a level of service (LOS) E under existing traffic conditions. Improvements proposed for this intersection cannot increase delays already experienced at Ramp C.

2.4.5 Crash History

High Crash Locations

VTrans maintains a listing of High Crash Locations (HCL) within the state. A 0.3 mile highway segment or intersection must have at least 5 crashes over a 5-year period and the actual crash rate (number of crashes per million vehicles) must exceed a critical crash rate to be classified as an HCL. The critical crash rate is based on the average crash rate for similar highways.

The *VTrans High Crash Report: Sections and Intersections 2006-2010* lists one intersection of US 5 and Sykes Mountain Avenue as an HCL. There are no sections within the project study area listed as an HCL. The crash history at this HCL is summarized in Table 5. The VTrans High Crash Report is contained in the appendix.

Sykes Mountain Avenue/US5 Intersection							**2006-2010**
Ranking	Mile Marker	ADT	Crashes	Fatalities	Injuries	Actual / Critical Ratio	Severity Index
#72	3.050-3.080	17534	28	0	3	1.269	$14,511

Table 4 - High Crash Locations Summary

As noted earlier, the Sykes Mountain Avenue is expected to be constructed as a modern roundabout which will improve the intersection safety performance.

Crash Summaries

A General Yearly Summary Crash Listing for the period January 1, 2006 to December 31, 2010 within the study area (Mile Marker 2.740 - 3.050) is summarized in Table 4. It is VTrans policy to report crashes on federal aid highways involving injuries, fatalities, or those that exceed $1,000 in property damage. The VTrans listing is contained in the appendix.

Area	US 5 MM-MM	Crash Type					
		Rear End	Broad-side	Side-swipe	Head-on	Un-known	Total
Ballardvale Dr. to Ramp F	2.68-2.90	6	6	4	0	1	15
Ramp F to Ramp C/D	2.90-3.00	2	2	1	0	1	6
Ramp C/D to Sykes Mtn Ave.	3.00-3.07	2	6	3	1	2	14
TOTAL		**10**	**14**	**8**	**1**	**4**	**35**

Table 5 - US Route 5 Crash Summary

The data indicates that the greatest percentage of reported crashes on US 5 is broad-side and rear-end collisions. Rear end collisions are typically associated with stop and go traffic and traffic signal operations.

The broadside type crashes are typically associated with turning traffic at intersections. The greatest number occur in the area of Ramp F and Ramp D/Sykes Mountain Avenue intersections and involve mostly left turning traffic.

Approximately 20% of the reported crashes along US 5 were sideswipes. Typically, these involve vehicles changing lanes and/or driver confusion. Project area factors contributing to this include high traffic volumes and lane changes at the west approach of the Sykes Mountain Avenue intersection.

In addition to the crashes reported on US 5, many crashes have been reported on the interchange ramps. Table 6 summarizes the crashes.

Area	Crash Type						
	Rear End	Broad-side	Side-swipe	Head-on	Single Vehicle	Un-known	Total
Ramp A/B	14	0	0	0	0	0	14
Ramp C	2	0	0	0	0	0	2
Ramp F	1	0	0	0	0	0	0
TOTAL	**17**	**0**	**0**	**0**	**0**	**0**	**17**

Table 6 – Exit 11 Ramps Crash Summary

All collisions reported on the ramps were rear end collisions likely associated with exiting traffic on Ramp C and Ramp F or the merging condition at Ramp A and Ramp B. A majority of these accidents were reported to be due to driving too fast or following the vehicle in front too closely. The current I-91 Ramp A and C geometries promote high motor vehicle speeds and include

4.0 Purpose and Need Statement

The Purpose and Need statement summarizes what the study is intending to accomplish and for what reasons. The Purpose defines the problem to be solved. The Need provides the data to support the Purpose. The Purpose and Need Statement is a fundamental requirement for projects that will pursue federal funding; and sets the stage for developing alternative solutions to the transportation problem.

Working with the Town and VTrans; and using the input received at the Local Concerns meeting, the following Purpose and Need statement was developed.

Purpose:

The purpose of this project is to transform the Interstate 91, Exit 11 Interchange area from a transportation facility that gives sole consideration to motor vehicles to one that balances motor vehicle mobility and safety with pedestrian/bicyclist accessibility, mobility and safety.

Need:

The project needs include the following:

1. Sidewalk along the project corridor. Currently, pedestrians walk on the roadway shoulders or just off the road. A sidewalk along the south side of Route 5 will link proposed sidewalks located at each end of the corridor that are currently in design.

2. Substantial and consistent shoulders or bike lanes for use by cyclists along the project corridor. With an Average Annual Daily Traffic (AADT) of 13,200 vehicles moving and a speed limit of 40 mph, the lack of these facilities discourages bicycle use through the corridor.

3. Clearly defined lanes with reduced and consistent widths for motorists. Numerous lane configurations and excessive widths, 12' plus, encourage high motor vehicle speeds without consideration for bicyclists and pedestrians.

4. Improved ramp geometry. The current ramp A and ramp C geometries promote high motor vehicle speeds and include merging conditions. Crash histories reveal sideswipe and rear-end collisions at these locations which may be a result of the ramp geometries.

5. Motor vehicle mobility. Proposed bicycle and pedestrian improvements must not substantially decrease intersection performance along the corridor and not detrimentally impact traffic operations on Interstate 91.

5.3 Recommended Alternative

Based on public input, the alternatives evaluation, stakeholder consensus, and the need to balance benefits, impacts, and costs, the recommended alternative is Alternative 3 with Options A-2 and C-1. Figure 17 graphically depicts this alternative. The other alternatives do not fully achieve the project purpose and need or come at too great of an expense in terms of cost and property owner impacts. Alternative 3 is the preferred alternative for the following reasons:

- Satisfies the purpose and need of the project.
- Provides dedicated bicycle and pedestrian facilities linking the facilities on either end of the study area that are currently in design.
- Reduces motor vehicle speeds of traffic exiting Ramp C which has the potential to reduce the number and severity of vehicle crashes due to the weaving condition on US Route 5 between Ramp C and Sykes Mountain Avenue.
- Eliminates Ramp A which has the potential to reduce the number and severity of vehicle crashes due to the existing merge condition of Ramp A and Ramp B.
- Maintains existing intersection operational performance and does not create traffic mobility issues on US Route 5, I-91 or the ramps.
- A traffic signal can easily be added to Ramp B/F and Ramp C intersections to address operational deficiencies.
- Results in minimal impact to natural and cultural resources.
- Does not require extensive permitting.
- Maintenance does not overburden VTrans or the Town

5.4 Alternatives Presentation Meeting

An Alternatives Presentation Meeting was held on August 16, 2012 at the Hartford Municipal Building. The purpose of the meeting was to present the alternatives developed including the recommended alternative, and solicit public comment. Many comments at the meeting were received, and notes from the meeting are contained in the appendix. The consensus from those in attendance was that the recommended alternative, Alternative #3 with Options A-2 and C-1 should be pursued. Alternative #2 should be pursued as a short-term solution if a near-term (1-3 years) resurfacing project is planned. The VTrans Pavement Management group indicated that this segment of Route 5 is currently not planned to be repaved in the next four years.

5.5 VTrans District #4 Review

A meeting with VTrans District #4 was held on September 17th, 2012. The purpose of the meeting was to review the alternatives including the recommended alternative with the VTrans District; and discuss maintenance considerations. The consensus at the meeting was that the alternatives will not involve substantially increased maintenance effort over the existing conditions.

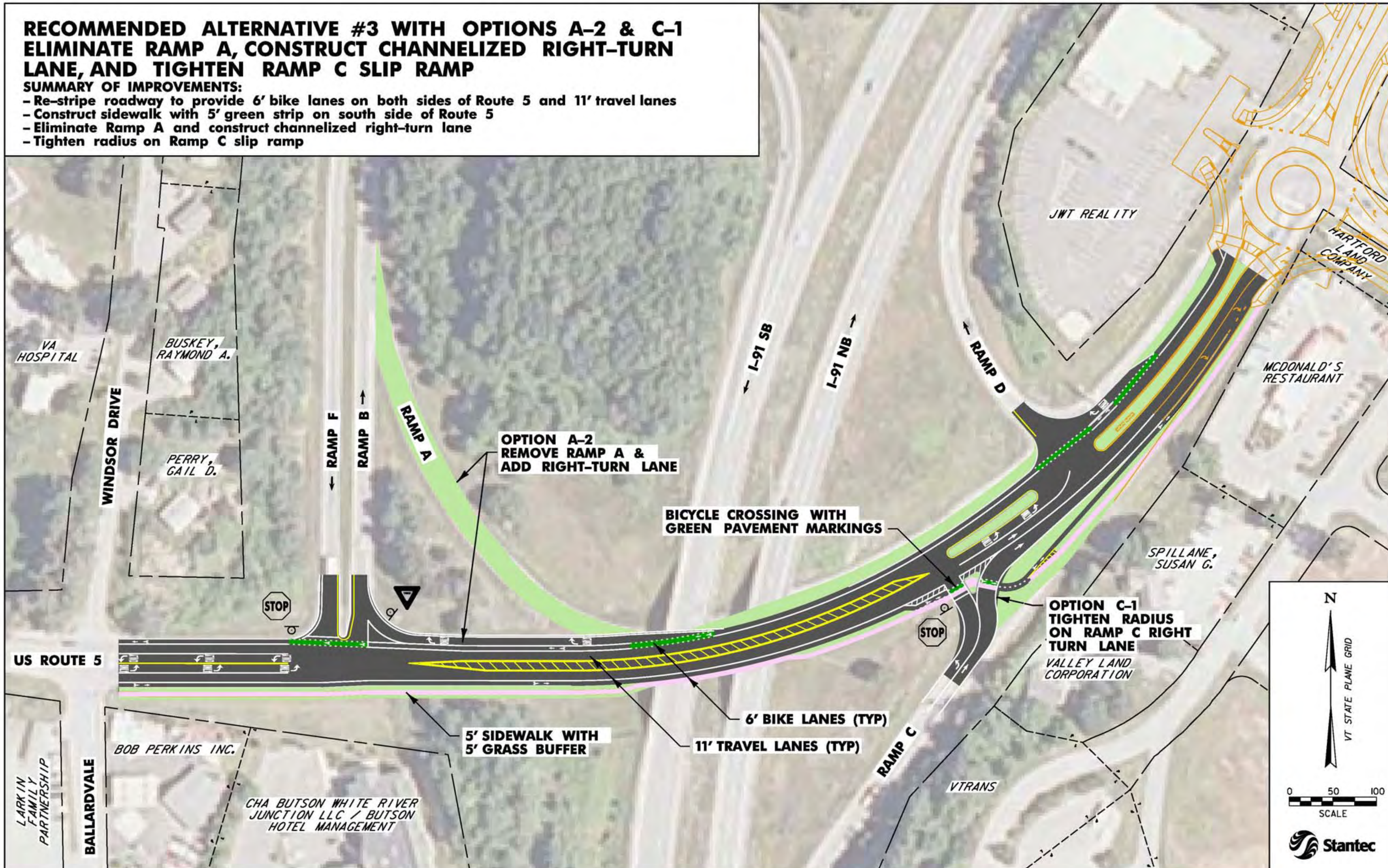
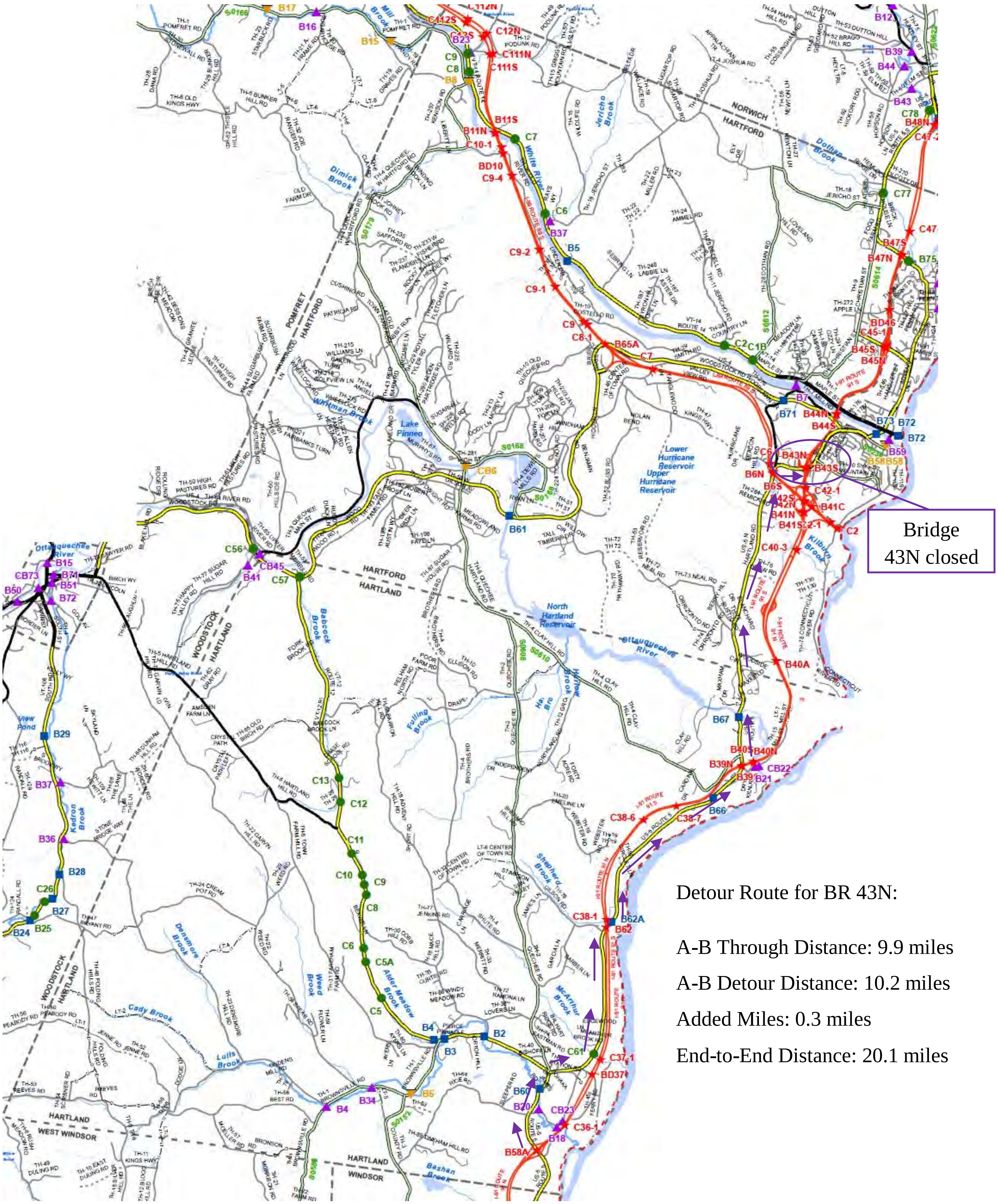


Figure 17 - Recommended Alternative



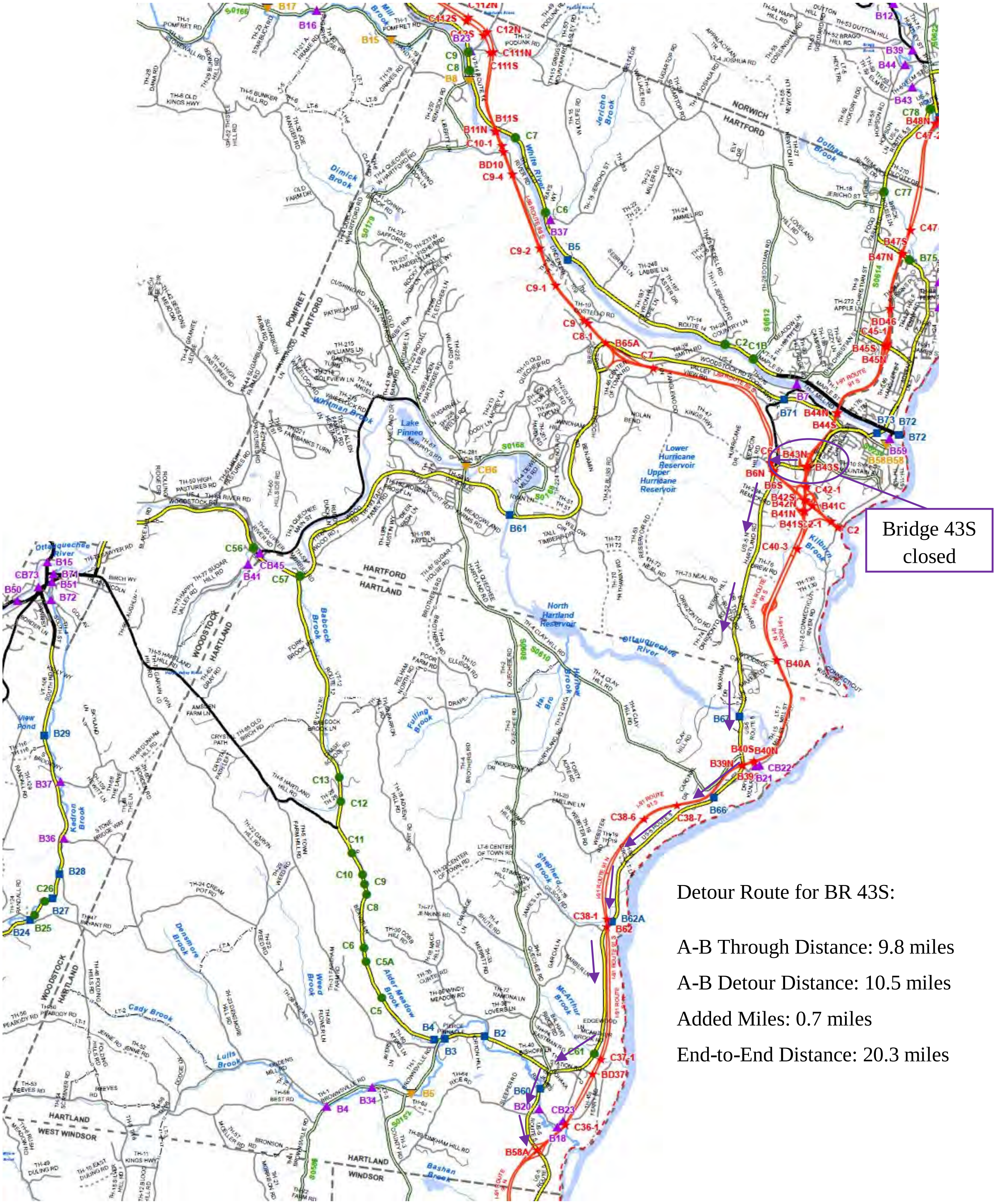
Detour Route for BR 43N:

A-B Through Distance: 9.9 miles

A-B Detour Distance: 10.2 miles

Added Miles: 0.3 miles

End-to-End Distance: 20.1 miles



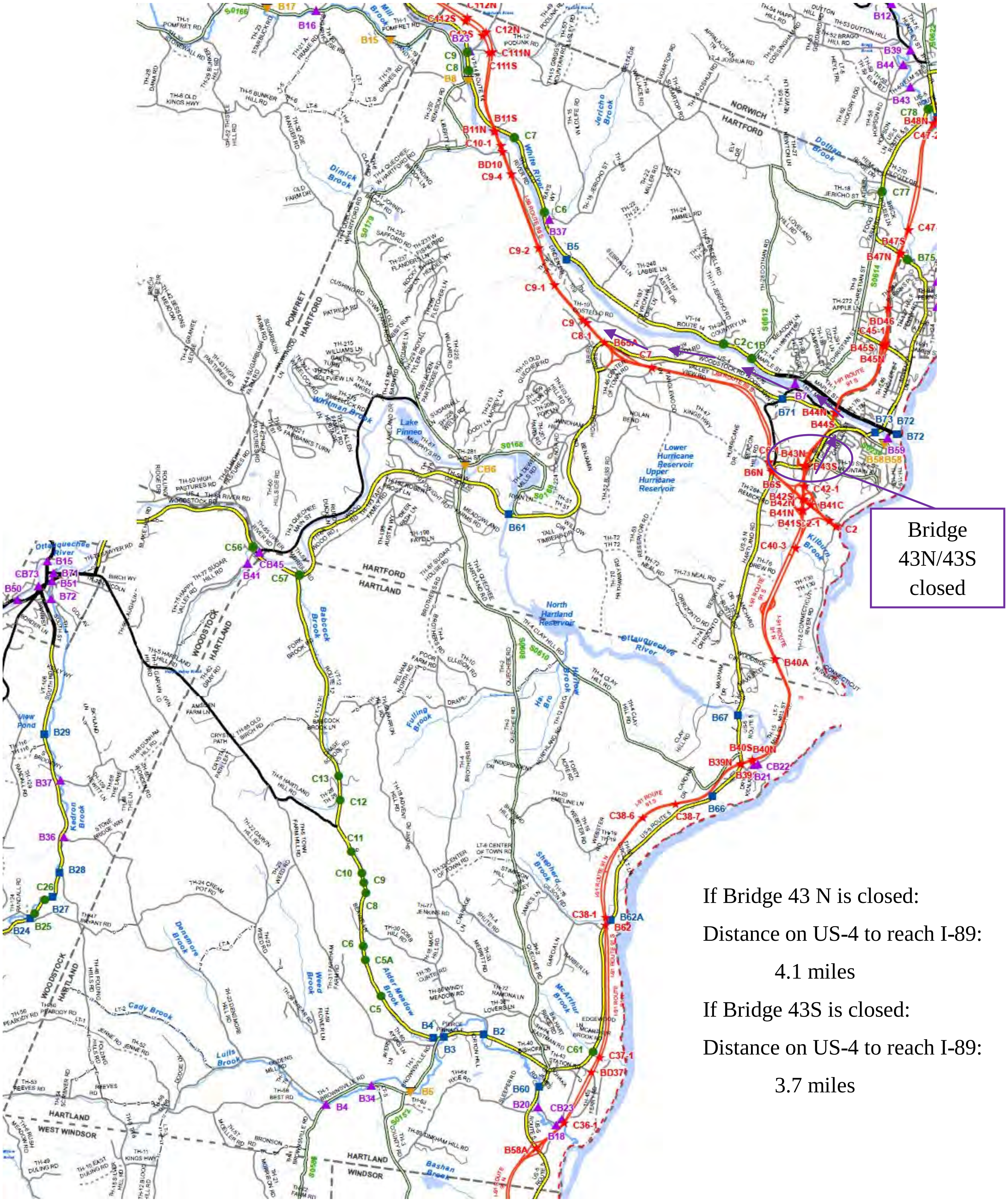
Detour Route for BR 43S:

A-B Through Distance: 9.8 miles

A-B Detour Distance: 10.5 miles

Added Miles: 0.7 miles

End-to-End Distance: 20.3 miles



If Bridge 43 N is closed:

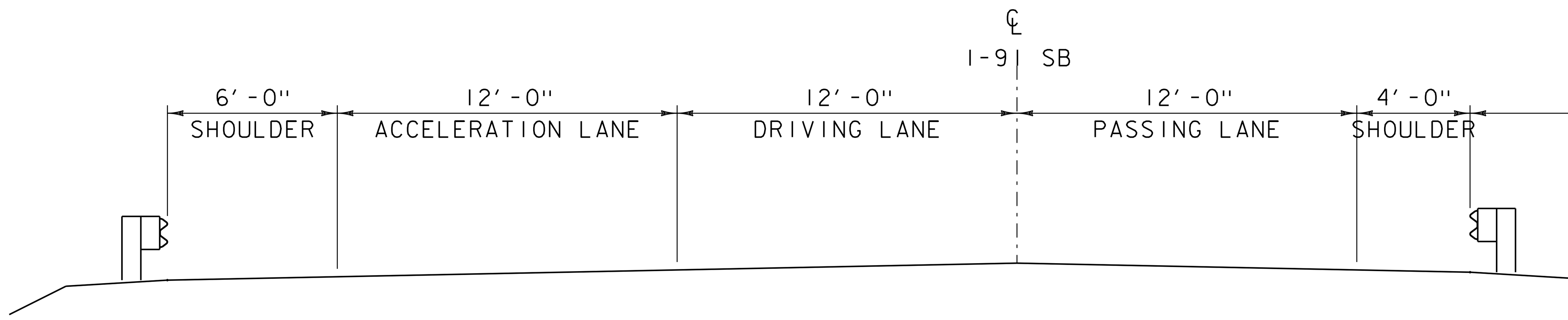
Distance on US-4 to reach I-89:

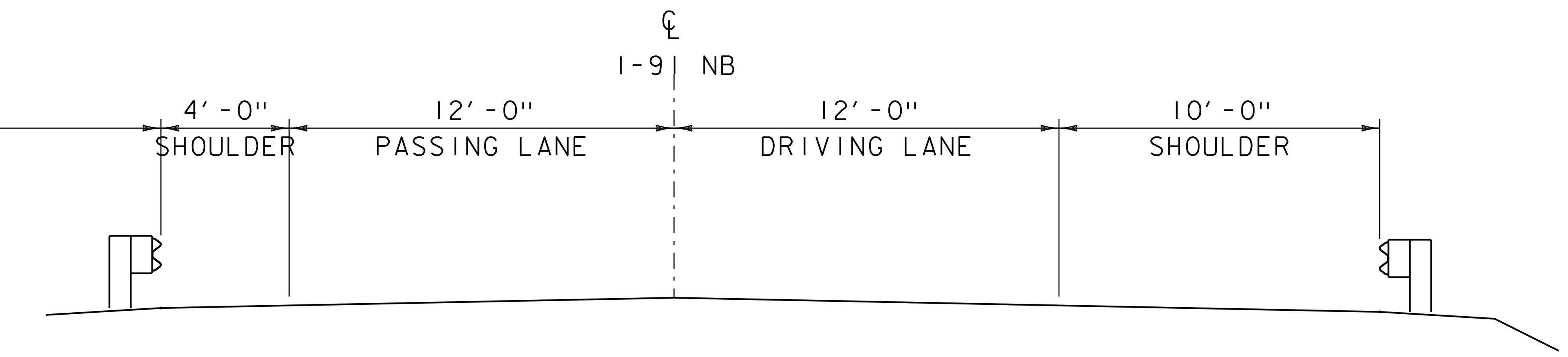
4.1 miles

If Bridge 43S is closed:

Distance on US-4 to reach I-89:

3.7 miles



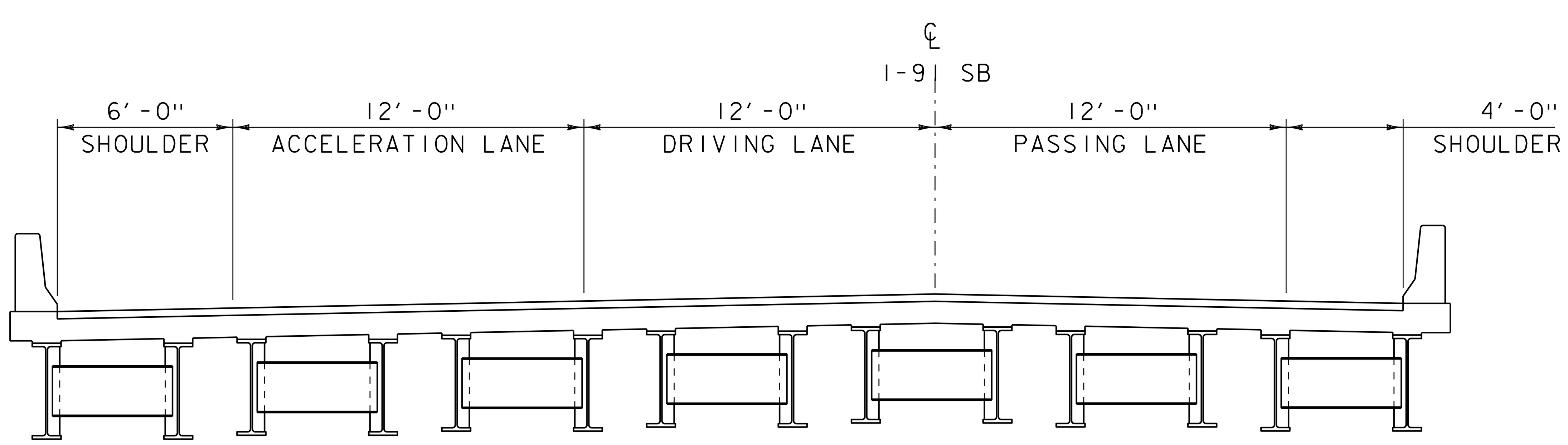


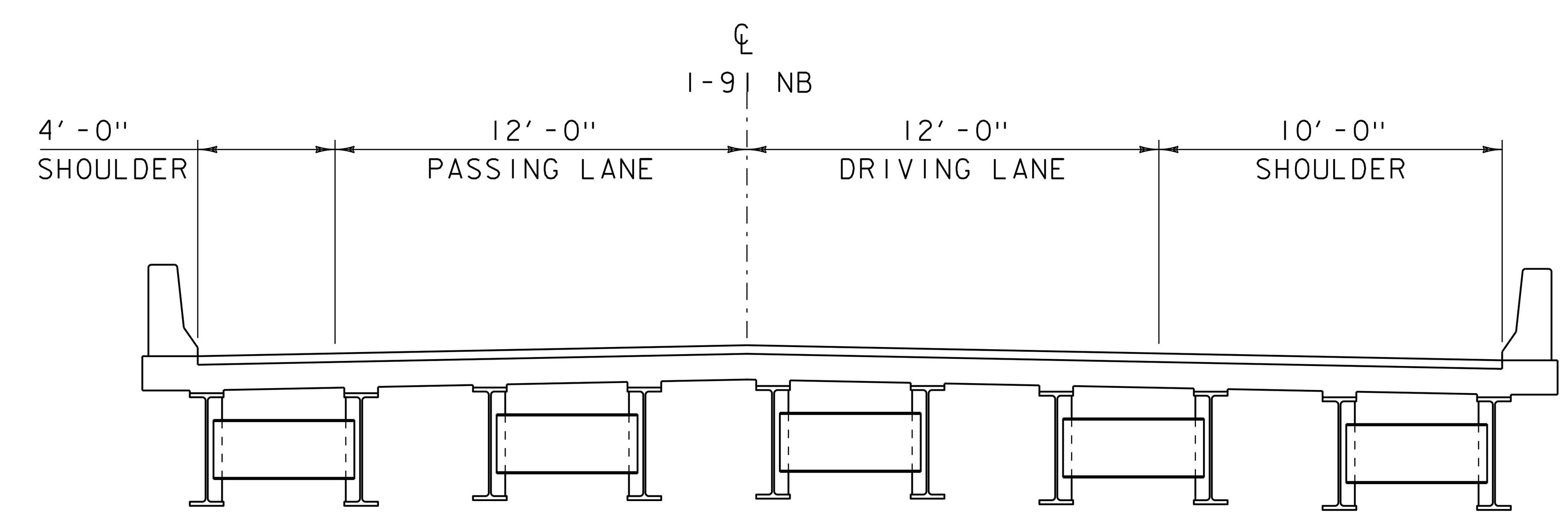
I-91 SOUTHBOUND TYPICAL SECTION

SCALE: 1/4" = 1'-0"

I-91 NORTHBOUND TYPICAL SECTION

SCALE: 1/4" = 1'-0"





BRIDGE 43S TYPICAL SECTION

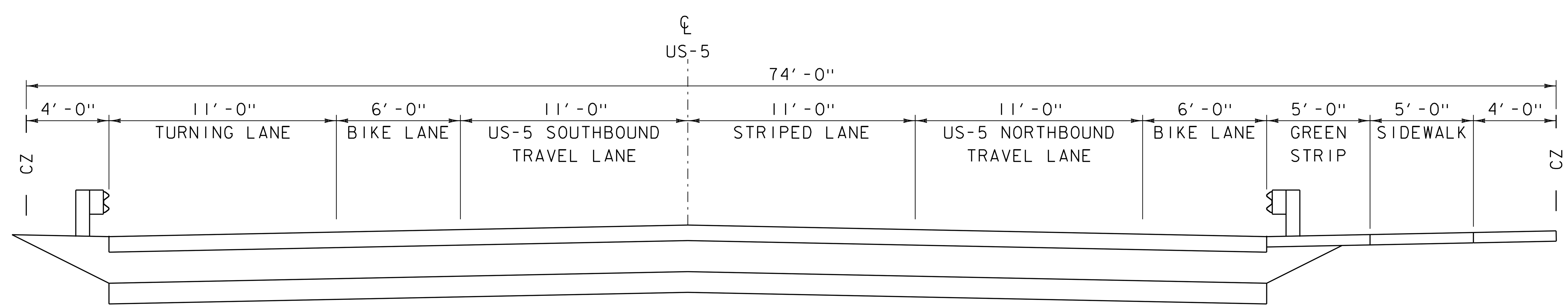
SCALE: 1/4" = 1'-0"

BRIDGE 43N TYPICAL SECTION

SCALE: 1/4" = 1'-0"

PROJECT NAME: HARTFORD
PROJECT NUMBER: IM 091-2(79)

FILE NAME: 12a132\s12a132typical.dgn	PLOT DATE: 21-DEC-2012
PROJECT LEADER: C.P.WILLIAMS	DRAWN BY: D.D.BEARD
DESIGNED BY: ------	CHECKED BY: ------
INTERSTATE TYPICAL SECTIONS	SHEET 1 OF 9



US 5 TYPICAL SECTION

SCALE: 1/4" = 1'-0"

PROJECT NAME: HARTFORD	
PROJECT NUMBER: IM 091-2(79)	
FILE NAME: l2al32\sl2al32typical.dgn	PLOT DATE: 21-DEC-2012
PROJECT LEADER: C.P.WILLIAMS	DRAWN BY: D.D.BEARD
DESIGNED BY: ------	CHECKED BY: ------
US-5 TYPICAL SECTION	SHEET 2 OF 9

PROJECT NAME: HARTFORD	
PROJECT NUMBER: IM 091-2(79)	
FILE NAME: i2a132\s12a132bdr.dgn	PLOT DATE: 21-DEC-2012
PROJECT LEADER: C.P.WILLIAMS	DRAWN BY: D.D.BEARD
DESIGNED BY: T.FILLBACH	CHECKED BY: ------
LAYOUT SHEET	SHEET 3 OF 9

I-91 SOUTHBOUND PROFILE

SCALE: HORIZONTAL 1"=20'
VERTICAL 1"=10'

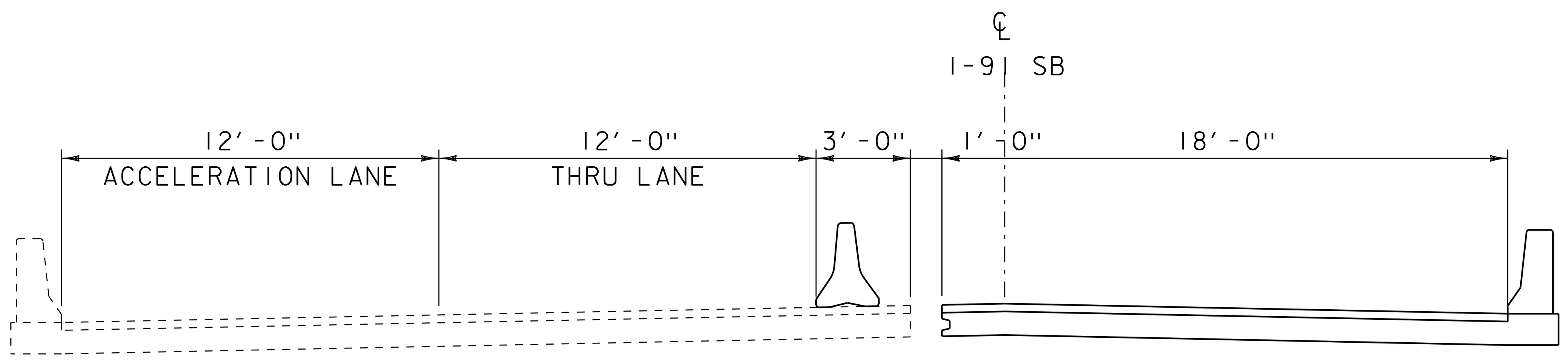
I-91 NORTHBOUND PROFILE

SCALE: HORIZONTAL 1"=20'
VERTICAL 1"=10'

PROJECT NAME: HARTFORD
PROJECT NUMBER: IM 091-2(79)

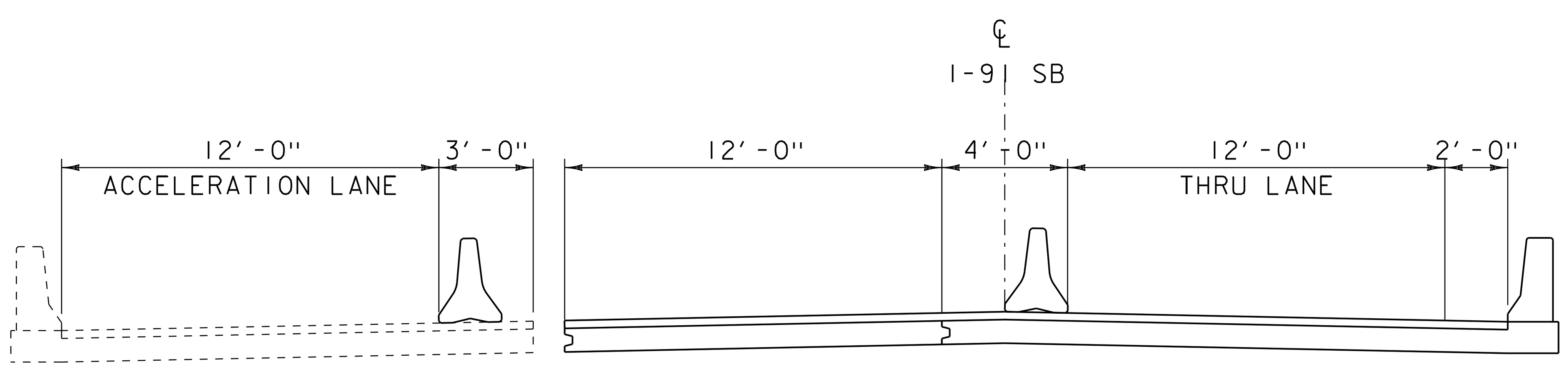
FILE NAME: 12a132\sl2a132profile.dgn
PROJECT LEADER: C.P.WILLIAMS
DESIGNED BY: T.FILLBACH
INTERSTATE PROFILES

PLOT DATE: 21-DEC-2012
DRAWN BY: D.D.BEARD
CHECKED BY: ------
SHEET 4 OF 9



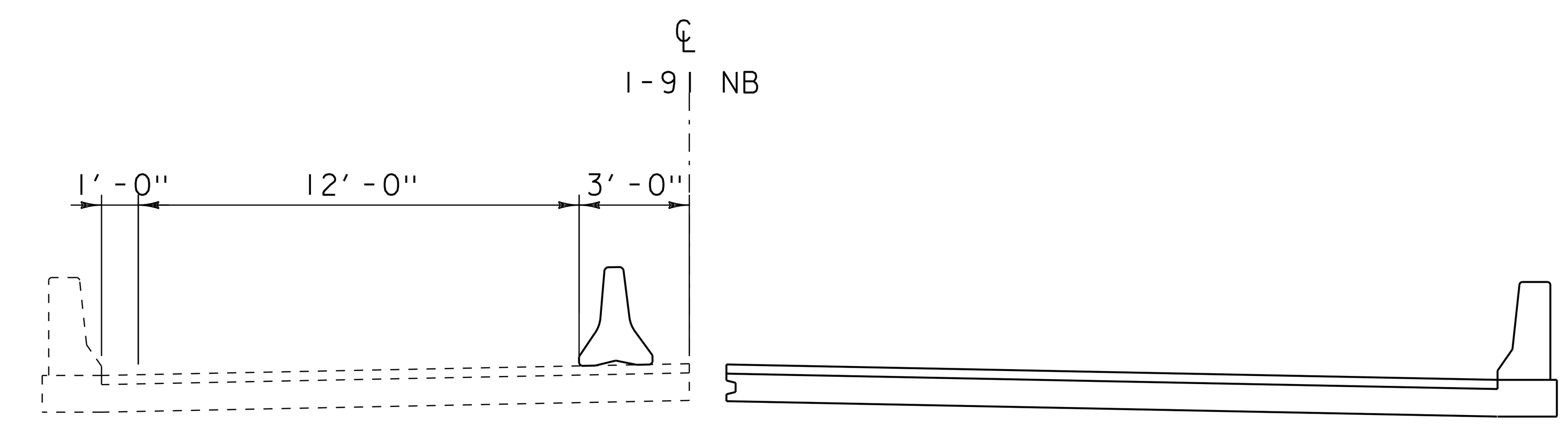
BRIDGE 43S PHASE 1 TYPICAL SECTION

SCALE: 1/4" = 1'-0"



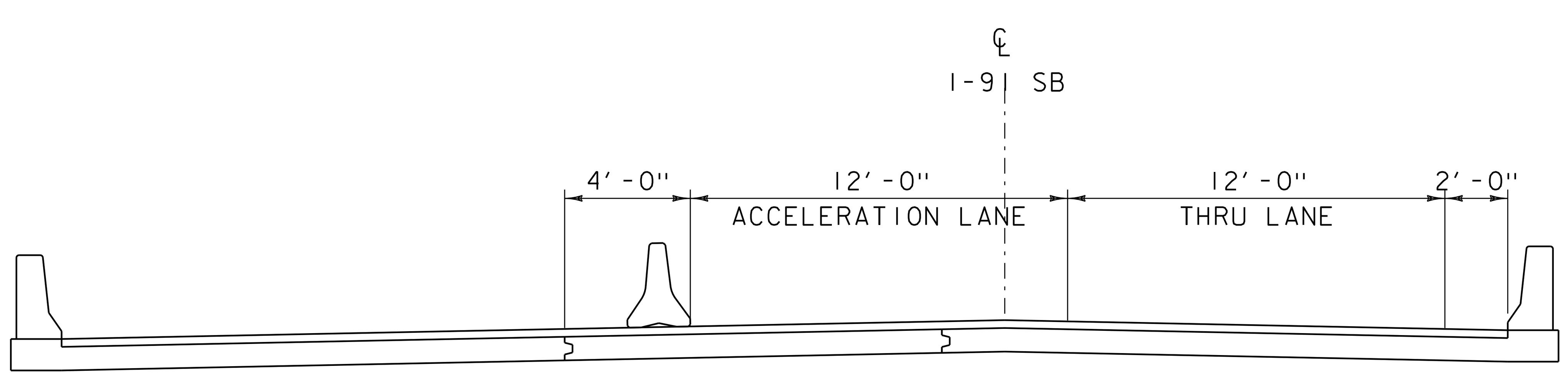
BRIDGE 43S PHASE 2 TYPICAL SECTION

SCALE: 1/4" = 1'-0"



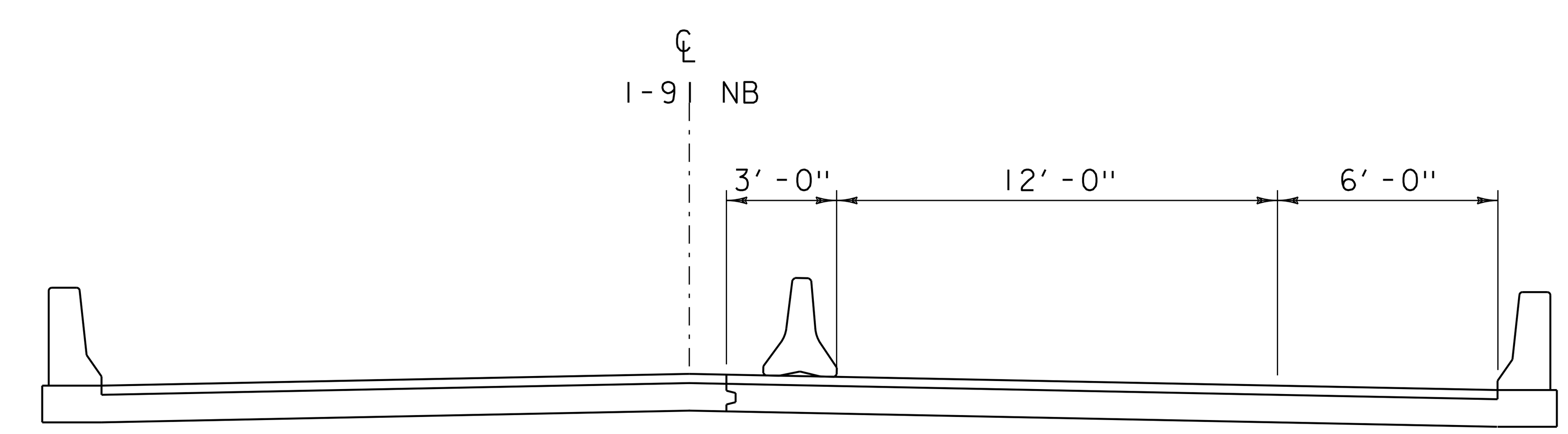
BRIDGE 43N PHASE 1 TYPICAL SECTION

SCALE: 1/4" = 1'-0"



BRIDGE 43S PHASE 3 TYPICAL SECTION

SCALE: 1/4" = 1'-0"



BRIDGE 43N PHASE 2 TYPICAL SECTION

SCALE: 1/4" = 1'-0"

PROJECT NAME: HARTFORD
PROJECT NUMBER: IM 091-2(79)

FILE NAME: l2al32\sl2al32typical.dgn
PROJECT LEADER: C.P.WILLIAMS
DESIGNED BY: ------
INTERSTATE TYPICAL SECTIONS

PLOT DATE: 21-DEC-2012
DRAWN BY: D.D.BEARD
CHECKED BY: ------
SHEET 5 OF 9


STEPS 1-4
LATERAL SLIDE SEQUENCE
1) START WITH EXISTING BRIDGES
2) ADD TEMPORARY SUPPORTS OUTSIDE NORTHBOUND BRIDGE
3) CONSTRUCT NEW NORTHBOUND BRIDGE ON TEMPORARY SUPPORTS
4) REMOVE EXTERIOR GIRDER AND TRIBUTARY DECK ON EXISTING BRIDGE
5) CLOSE NORTHBOUND ROAD - SLIDE EXISTING BRIDGE OUT AND NEW BRIDGE IN
6) REMOVE EXISTING BRIDGE AND TEMPORARY SUPPORTS
7) ADD TEMPORARY SUPPORTS OUTSIDE SOUTHBOUND BRIDGE
8) CONSTRUCT NEW SOUTHBOUND BRIDGE ON TEMPORARY SUPPORTS
9) REMOVE EXTERIOR GIRDER AND TRIBUTARY DECK ON EXISTING BRIDGE
10) CLOSE SOUTHBOUND ROAD - SLIDE EXISTING BRIDGE OUT AND NEW BRIDGE IN
11) REMOVE EXISTING BRIDGE AND TEMPORARY SUPPORTS
149+00
150+00
151+00
249+00
250+00
251+00
PROJECT NAME: HARTFORD
PROJECT NUMBER: IM091-2(79)
FILE NAME: 12a132/Structures/latslide.dgn
PLOT DATE: 29-JAN-2013
PROJECT LEADER: C. Williams
DRAWN BY: T. Fillbach
DESIGNED BY: T. Fillbach
CHECKED BY: ------
Lateral Slide Sequence
SHEET 11 OF 14


STEPS 5-6
152+
151+00
150+00
149+00
251+00
250+00
249+00
LATERAL SLIDE SEQUENCE
1) START WITH EXISTING BRIDGES
2) ADD TEMPORARY SUPPORTS OUTSIDE NORTHBOUND BRIDGE
3) CONSTRUCT NEW NORTHBOUND BRIDGE ON TEMPORARY SUPPORTS
4) REMOVE EXTERIOR GIRDER AND TRIBUTARY DECK ON EXISTING BRIDGE
5) CLOSE NORTHBOUND ROAD - SLIDE EXISTING BRIDGE OUT AND NEW BRIDGE IN
6) REMOVE EXISTING BRIDGE AND TEMPORARY SUPPORTS
7) ADD TEMPORARY SUPPORTS OUTSIDE SOUTHBOUND BRIDGE
8) CONSTRUCT NEW SOUTHBOUND BRIDGE ON TEMPORARY SUPPORTS
9) REMOVE EXTERIOR GIRDER AND TRIBUTARY DECK ON EXISTING BRIDGE
10) CLOSE SOUTHBOUND ROAD - SLIDE EXISTING BRIDGE OUT AND NEW BRIDGE IN
11) REMOVE EXISTING BRIDGE AND TEMPORARY SUPPORTS
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PLOT DATE: 29-JAN-2013
PROJECT LEADER: C. Williams
DRAWN BY: T. Fillbach
DESIGNED BY: T. Fillbach
CHECKED BY: ------
Lateral Slide Sequence
SHEET 12 OF 14

STEPS 7-9
LATERAL SLIDE SEQUENCE
1) START WITH EXISTING BRIDGES
2) ADD TEMPORARY SUPPORTS OUTSIDE NORTHBOUND BRIDGE
3) CONSTRUCT NEW NORTHBOUND BRIDGE ON TEMPORARY SUPPORTS
4) REMOVE EXTERIOR GIRDER AND TRIBUTARY DECK ON EXISTING BRIDGE
5) CLOSE NORTHBOUND ROAD - SLIDE EXISTING BRIDGE OUT AND NEW BRIDGE IN
6) REMOVE EXISTING BRIDGE AND TEMPORARY SUPPORTS
7) ADD TEMPORARY SUPPORTS OUTSIDE SOUTHBOUND BRIDGE
8) CONSTRUCT NEW SOUTHBOUND BRIDGE ON TEMPORARY SUPPORTS
9) REMOVE EXTERIOR GIRDER AND TRIBUTARY DECK ON EXISTING BRIDGE
10) CLOSE SOUTHBOUND ROAD - SLIDE EXISTING BRIDGE OUT AND NEW BRIDGE IN
11) REMOVE EXISTING BRIDGE AND TEMPORARY SUPPORTS
151+00
150+00
149+00
251+00
250+00
249+00
PROJECT NAME: HARTFORD
PROJECT NUMBER: IM091-2(79)
FILE NAME: 12a132/Structures/latslide.dgn
PLOT DATE: 29-JAN-2013
PROJECT LEADER: C. Williams
DRAWN BY: T. Fillbach
DESIGNED BY: T. Fillbach
CHECKED BY: ------
Lateral Slide Sequence
SHEET 13 OF 14

LATERAL SLIDE SEQUENCE

1) START WITH EXISTING BRIDGES
2) ADD TEMPORARY SUPPORTS OUTSIDE NORTHBOUND BRIDGE
3) CONSTRUCT NEW NORTHBOUND BRIDGE ON TEMPORARY SUPPORTS
4) REMOVE EXTERIOR GIRDER AND TRIBUTARY DECK ON EXISTING BRIDGE
5) CLOSE NORTHBOUND ROAD - SLIDE EXISTING BRIDGE OUT AND NEW BRIDGE IN
6) REMOVE EXISTING BRIDGE AND TEMPORARY SUPPORTS
7) ADD TEMPORARY SUPPORTS OUTSIDE SOUTHBOUND BRIDGE
8) CONSTRUCT NEW SOUTHBOUND BRIDGE ON TEMPORARY SUPPORTS
9) REMOVE EXTERIOR GIRDER AND TRIBUTARY DECK ON EXISTING BRIDGE
10) CLOSE SOUTHBOUND ROAD - SLIDE EXISTING BRIDGE OUT AND NEW BRIDGE IN
11) REMOVE EXISTING BRIDGE AND TEMPORARY SUPPORTS

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Lateral Slide Sequence	SHEET 14 OF 14