Vermont Agency of Transportation

REQUEST FOR PROJECT REVIEW

RFPR version 4.0.a.

PROJECT INFORMATION

Proj. Name and Number: WATERBURY BO 1446(40)

EA No.: 1446040 PPMS: 93J040

Project Manager: Laura Stone

Program: Structure Phase: Scoping Report

District: District 5 If Multiple Districts Specify

Traffic Signal: No Precast Elements: No

DOCUMENTS FOR REVIEW AND FILES LOCATION

PLANS FILE LOCATION : M:\Projects\93J040\Structures\Scoping\Waterbury BR 36 Draft Scoping Report.pdf

ESTIMATE FILE LOCATION :

FILE LOCATION :

FILE LOCATION :

FILE LOCATION :

TIME LINES

SUBMITTED: 04-28-2021

DEADLINE: 05-21-2021

COMPLETED:

INVITEES FOR REVIEW

- MOB Districts
- Operations and Safety Bureau — Included in all projects
- Support Services Bureau
- MAB Bicycle and Pedestrian Program Unit
- PDB Right-of-Way
- PDB Structural Section
- PDB Survey Section
- PDB Utility Section
- PDB Highway Safety & Design
- PDB Environmental Section
- PDB Hydraulics Section
- CMB Construction Section
- CMB Materials Testing and Certification Section
- CMB Geotechnical Engineering Section
- AMP Budget and Programming — Include on all reviews that include bridges within the Project Limits
- AMP NBIS Inspections and Budget — Include on all reviews that include bridges within the Project Limits
- AMP Rumble Stripes — See Notes at the bottom of this sheet.
- FHWA — Include on all PoDI and WCRS Projects
- Rail Bureau
- VRS
- Aviation
- Civil Rights
- Policy and Planning Bureau
- PPAID Permitting Services
- Regional Planners
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Review Focus Notes:
If anyone has been forgotten on this review, please forward and comment by the time frame allowed.

Bridge 36 is a Town-owned bridge located on TH-2 (Stowe Street) over Thatcher Brook located approximately 150 feet from the intersection with VT Route 100. The existing bridge is a single span concrete T-Beam bridge constructed in 1928. The existing 42' span bridge has a deck rating of 5 (Fair), superstructure rating of 5 (Fair), and substructure rating of 5 (Fair). The recommended scope is to replace the existing bridge on a slightly improved alignment with traffic maintained on an off-site detour. The new bridge would feature a third lane for the NB right turning movement and a sidewalk constructed on the upstream (east) side of the bridge for connection with planned improvements to pedestrian facilities.

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Online Shared Review

Waterbury BO 1446(40)
Bridge #36
Scoping Study

Project Definition

Stowe Street over Thatcher Brook

4/27/2021

Prepared for:

Vermont Agency of Transportation (VTrans)

Prepared by:

Stantec Consulting Services (Stantec)
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Sign-off Sheet

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Prepared by ____

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Reviewed by ____

(signature)

Thomas Knight PE

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1.0 EXECUTIVE SUMMARY

This report summarizes a scoping study to evaluate alternatives for improving the intersections of Stowe Street / VT Route 100 (VT 100) and Stowe Street / Lincoln Street as well as Bridge 36 which carries Stowe Street over Thatcher Brook in the Town of Waterbury.

Traffic, Roadway and Pedestrian Accommodations:

Evaluation of the traffic, turning geometry and intersection site distances concluded the following:

- The addition of a northbound right turn lane to Stowe Street would reduce queuing lengths of the VT 100 / Stowe Street Intersection and improve the level of service.
- This right turn lane would also help accommodate turning geometry of the Link Bus that services the Park and Ride on Lincoln Street.
- A truck turning apron is proposed at the southwest corner of the bridge to accommodate the turning radius of the link bus making the right turn from Lincoln Street on to Stowe Street toward VT 100.

The Town's preference is to include a sidewalk on the upstream (east) side of the bridge for connection with planned improvements to pedestrian facilities on the southern side of VT 100. Evaluation of the site constraints and geometry suggest a configuration that ties into the existing Stowe Street sidewalk with a crosswalk at the northern terminus of North Street.

Bridge Alternatives:

Several bridge alternatives were evaluated. Bridge replacement was considered more cost effective than rehabilitation or repair. A buried structure is a good fit for the complex roadway geometry at the site and is the most cost effective bridge alternative considered.

Utility Relocations:

Overhead and underground utilities would need to be relocated; coordination should take place early in the design phase.

Traffic Control:

The recommended method of traffic control is to close the bridge for 60-90 days and maintain traffic on an offsite detour. The detour for this project location would add approximately 0.2 miles to the through route and have an end-to-end distance of 1.8 miles.

Maintaining pedestrian traffic with an offsite detour is actually quite challenging. The limited access designation of the VT 100 overpass at the I-89 Exit 10 interchange precludes pedestrian use of that route as the offsite detour route for pedestrians due to safety concerns. The most viable route is likely: Lincoln

Street ➔ Waterbury Community Path ➔ Laurel Road ➔ VT Route 100 ➔ Stowe Street, which has an approximate length of 1.1 miles. Another possibility that should be considered for providing connectivity is contracting with a shuttle service to ferry passengers from VT 100 to the Waterbury Village during construction.

2.0 INTRODUCTION

Stowe Street connects VT Route 100 to the north, with the Village of Waterbury to the south. The northern-most part of Stowe Street includes a signalized intersection with VT 100, and a STOP-controlled intersection with Lincoln Street, connected by a 175 ft. segment crossing Thatcher Brook via Bridge 36. Bridge 36 is a town-owned bridge located on Stowe Street approximately 110 ft. south of the junction with Vermont 100. The current bridge is in need of rehabilitation or replacement. The bridge is situated between two busy intersections and decisions regarding the proposed work on the bridge should consider the context of the adjacent intersections. The purpose of this project is to evaluate improvements in the area and define the scope and limits of work for a bridge repair, rehabilitation or replacement project.

3.0 BACKGROUND

A feasibility study for Waterbury Bridge 36 was undertaken in 2018 by Central Vermont Regional Planning Commission (CVRPC), in partnership with the Town of Waterbury, to document existing conditions, and identify opportunities for improvements at two intersections and the bridge between them, at the northern terminus of Stowe Street, in the Town of Waterbury, Vermont. Public input was received during a local concerns meeting held by the project team, as well as through a Local & Regional Input Questionnaire. Existing conditions were documented, including field observations and follow-up analyses, for traffic operations and safety, roadway geometry, and bridge condition inspection and assessment.

Improvements identified to consider include: pedestrian accommodations at the Stowe Street / VT 100 intersection; a dedicated right-turn lane for the Stowe Street approach to this intersection; geometric improvements for the STOP-controlled intersection of Lincoln Street / Stowe Street; and rehabilitation or replacement options for Bridge 36, the town-owned bridge carrying Stowe Street over Thatcher Brook, between the intersections with VT 100 and Lincoln Street.

One notable conclusion of the existing conditions study was that the wetlands or wetland buffers are not located within the anticipated project area. Class I wetlands were identified on the Vermont Agency of Natural Resources (VANR) map, however, Stantec's environmental scientist located and flagged the estimated wetland boundary, and the actual limits are not in the immediate vicinity of anticipated disturbance.

Background information, including existing physical and environmental conditions, were documented to understand the need for and potential impacts of improvements. Team members researched and reviewed available information, solicited input from the Town and project stakeholders, and completed a field review of the project area. Sources of information include site visits, inspection reports, route logs, an

Operations Input Questionnaire, a Local & Regional Input Questionnaire, a Local Concerns Meeting, and previous studies, including the Colbyville Pedestrian/Bicycle Scoping Study.

3.1 PROJECT AREA

The project area is centered around Bridge 36, where Stowe Street passes over Thatcher Brook. The project area also includes the intersection of VT 100 / Stowe Street and Stowe Street / Lincoln Street, as shown in Figure 1.

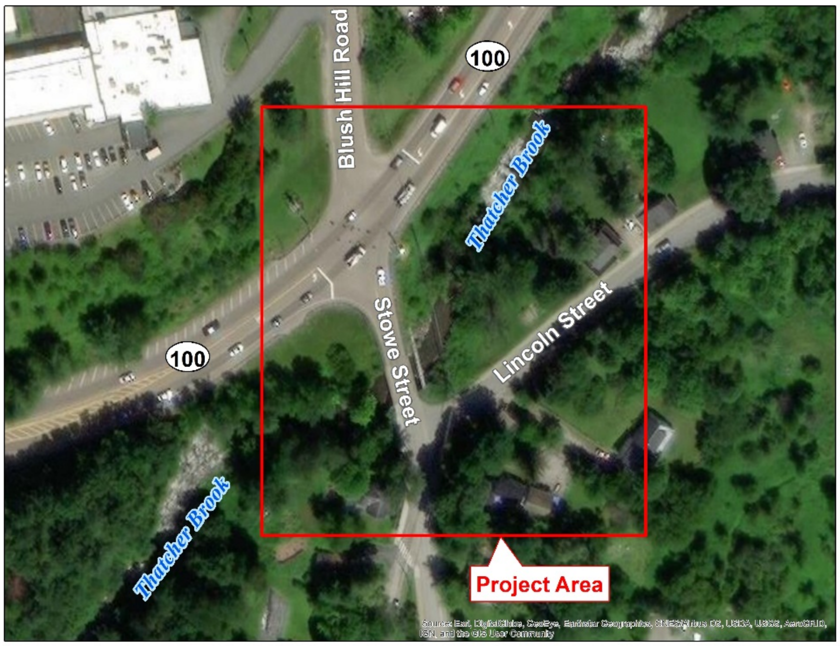

Figure 1 Project Location Plan

3.2 CLASSIFICATION

Roadway Classification (Stowe Street):	Local Town Road
Bridge Type:	Concrete T-Beam Bridge
Bridge Length:	42 feet
Existing Skew:	9 degrees (ahead right)
Year Built:	1928
Ownership:	Waterbury
Maintenance District:	District 5

3.3 ROADWAY DESCRIPTIONS

Existing conditions within the project area are shown in Figure 2 – Existing Conditions Layout. The existing bridge and roadway width is too narrow for the roadway classification, pedestrian and cycle traffic, and traffic volumes. Commuter buses making turning movements onto Lincoln Street often utilize the bridge sidewalk or cross the centerline. Stowe Street continues south as a principally residential street to Main Street (US 2) in Waterbury Village. Lincoln Street is a two-lane roadway that provides access to a Park and Ride Lot, and to numerous intersecting residential streets. The area accessed by Lincoln Street has a second connection to VT100 via Perry Hill Road/Kneeland Flats Road/Guptil Road.

Stowe Street is a Class 2 Town Highway, two-lane variable width roadway, with 0- to1-foot shoulders along the 175-foot distance between the Lincoln Street and VT 100 intersections. There is a sidewalk on the west side of the bridge, which continues southerly along Stowe Street towards downtown Waterbury. The Stowe Street roadway width, which is 22 feet on Bridge 36, widens north of the bridge due to the corner radii at VT 100 and Stowe Street. There is continuous guardrail on both edges of the Stowe Street roadway, from VT 100 to the bridge, where the parapet is continuous across the bridge. Guardrail continues on both sides of Stowe Street from the bridge to Lincoln Street. The Stowe Street vertical profile rises by approximately 8 percent from Lincoln Street to VT 100. The pavement markings on Stowe Street between VT 100 and the bridge consist of a double yellow centerline, white edge lines, and a stop line on the approach to VT 100. The intersection of VT 100 and Stowe Street is traffic signal controlled. Lincoln Street, near Stowe Street, has approximately the same 22-foot width. As Lincoln Street slopes down to Stowe Street, there is approximately 75 feet of guardrail on the northerly side of the road, wrapping around the corner with Stowe Street to the bridge, protecting the slope down to Thatcher Brook. Pavement markings on Lincoln Street, near the intersection with Stowe Street, consist of a white edge line on the north side of the street connecting to the sidewalk curb. There are no pavement markings on Stowe Street at the intersection with Lincoln Street. Lincoln Street is STOP sign controlled on its approach to Stowe Street. The Stowe Street approaches are not controlled.

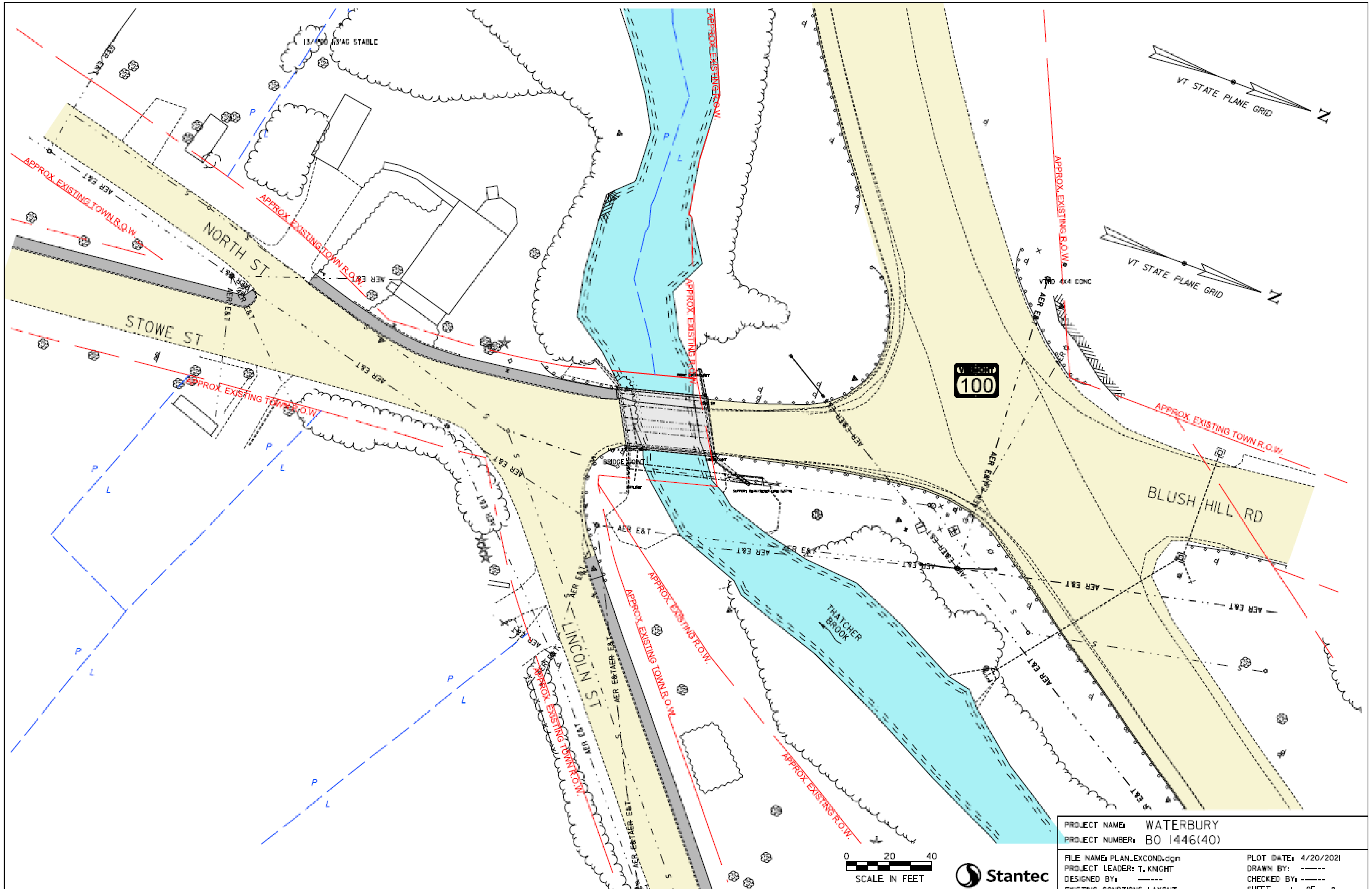

Figure 2 Existing Conditions

3.4 TRAFFIC

A traffic study of the project area was performed by Stantec in 2018 and updated in 2020. Traffic analyses completed by Stantec in 2018 (attached) were updated by Stantec for the intersections of Stowe Street at VT 100 and Lincoln Street at Stowe Street in Waterbury, Vermont, based on recent traffic data collected and adjusted for 2020, and a design year of 2045.

Turning movement counts (TMCs) were collected by the Vermont Agency of Transportation (VTrans) at VT 100/Stowe Street in July 2016. These volumes were adjusted to 2020 by Stantec using an annual growth factor of 1.02 per the VTrans Continuous Traffic Counter Report (The Redbook) based on 2016 traffic data. Stantec collected TMCs at Lincoln St/Stowe Street in November 2020. These volumes were adjusted to account for the reduced traffic volumes due to the COVID pandemic, using a factor of 1.2 per discussions with VTrans, to approximate pre-COVID traffic volumes. This 20% increase is based on a VTrans comparison of data collected by Automated Traffic Signal Performance Measures (ATSPMs) during Indigenous Peoples Day weekend in 2020 vs 2019. Volumes were balanced between both intersections, displayed in Figures 3 and 4.

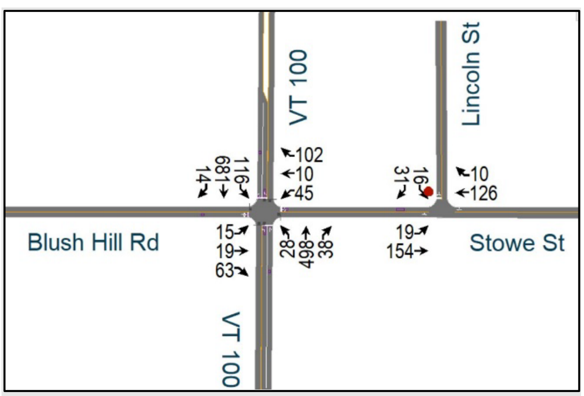

Figure 3 Existing 2020 AM

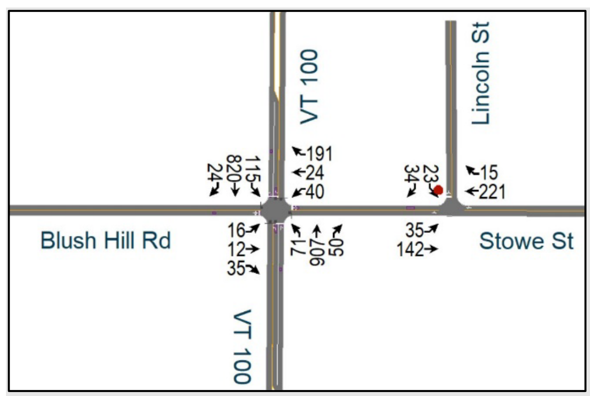

Figure 4 Existing 2020 PM

Operating level of service (LOS) is a term used to describe the quality of traffic flow on a roadway. It is an aggregate measure of travel delay, travel speed, congestion, driver discomfort, convenience, and safety based on a comparison of roadway capacity to travel demand. Operating levels of service are reported on a scale of A to F, with LOS A representing the best operating conditions (little or no delay to motorists) and LOS F representing the worst operating conditions (long delays and with traffic demands sometimes exceeding roadway capacity). Delay criteria are shown in Table 1 below.

Table 1 Signalized Intersection Level of Service Criteria

Level of Service	Average Delay per Vehicle (Seconds)
A	≤10.0
B	10.1 to 20.0
C	20.1 to 35.0
D	35.1 to 55.0
E	55.1 to 80.0
F	>80.0

The intersection peak hour operating levels of service were calculated following procedures described in the *2010 Highway Capacity Manual* and as applied by the Synchro software package. The Stowe Street and Lincoln Street intersection is close to VT 100 (175 feet) and queuing back from VT 100 queues past Lincoln Street during peak hours due to the operation of the traffic signal, as observed in person and shown in the capacity analysis results from Synchro software. The VT 100/Stowe Street traffic signal operates on an 88-second cycle during the morning peak hour and 96-second cycle during the evening peak hour as part of a coordinated traffic signal system on VT 100. Analysis of the existing conditions provides results as presented in Table 2. Analysis results indicate that while the VT 100 intersection operates at Level of Service B or C, the northbound Stowe Street approach operates at LOS E during the evening peak hour with queues of up to 10 vehicles which pass beyond the Lincoln Street intersection. The Lincoln Street unsignalized intersection is affected by those queues but otherwise would operate at LOS B.

Table 2 Existing (2020) Capacity Analysis Results

Time Period	Stowe Street at VT 100		Stowe Street WB Approach to VT 100			Lincoln Street at Stowe Street
	Overall LOS	Overall V/C	LOS	V/C	95Th Queue	LOS
AM	B	0.63	D	0.58	5 veh.	B
PM	C	0.89	E	0.90	10 veh.	B

LOS = Level of Service; V/C = volume to capacity ratio; 95th Queue = 95th percentile queue; RTL = Right Turn Lane

3.5 CRASH HISTORY

Stantec reviewed the crash history on Stowe Street at the Lincoln Street and VT 100 intersections. VTrans records were obtained for the 5-year period between 2012 and 2016. During this time there were no crashes reported at the Lincoln Street intersection. At the VT 100 intersection, a total of eight crashes were reported. Six were rear-end type crashes and four rear-end crashes occurred on the northbound VT 100 approach. One rear-end crash occurred on the Stowe Street approach to VT 100. None of the crashes resulted in personal injury. The crash rate is computed as 0.19 crashes per million vehicle miles. The statewide crash rate for local streets is 1.43 in rural areas and 2.62 in urban areas.

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 in Vermont and is related to the functional class of a highway and whether it is located in an urban or rural area. The VTrans High Crash Report: Sections and Intersections 2012-2016 does not list this segment of Stowe Street or either intersection within the project area.

3.6 TURNING GEOMETRY

Figure 5 illustrates the turning geometry of the link commuter bus when making turns between Stowe Street and Lincoln Street. The current existing geometry of the intersection of Stowe Street and Lincoln Street results in commuter buses crossing over to the oncoming traffic lane on both streets for right turns onto Stowe Street. The existing geometry also results in commuter buses turning left onto Lincoln Street from Stowe Street driving up onto the bridge sidewalk and crossing over to the oncoming traffic lane on Lincoln Street.

Stantec developed a design with a wider (3-lane) configuration of Stowe Street north of the Lincoln Street intersection to better accommodate these movements turning movements, and that roadway geometry is shown in Figure 5 superimposed over the existing conditions.

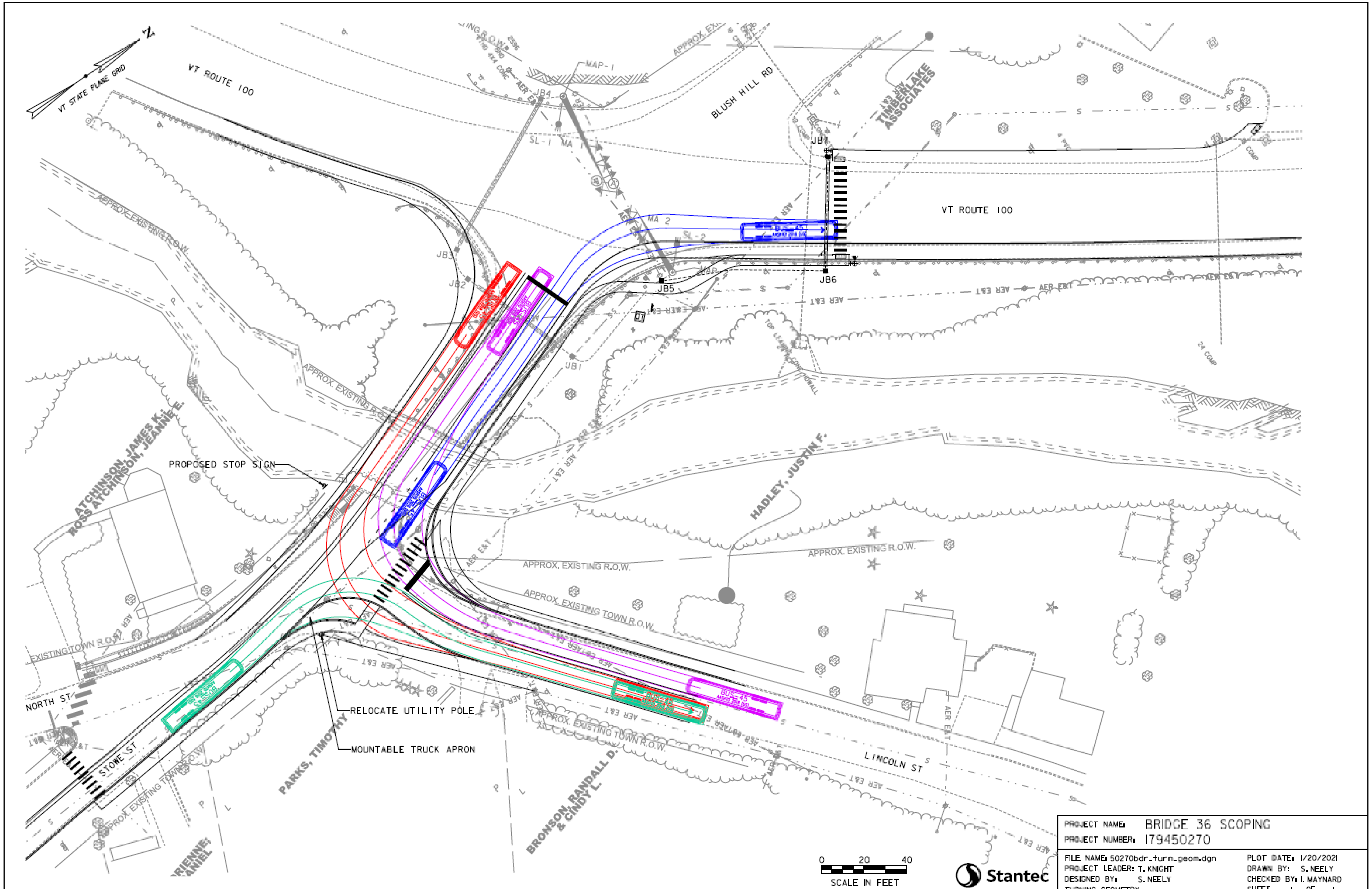

Figure 5 Link Bus Turning Geometry

3.7 SIGHT DISTANCE – LINCOLN STREET STOP CONDITION

Vehicles at the STOP sign, on the Lincoln Street approach to the STOP controlled intersection with Stowe Street, have terrain and vegetation obstructions within their sight triangle that prevent them from seeing vehicles approaching from the left. Figure 6 displays the AASHTO recommended sight lines for this movement, indicating 280 FT of visibility along the Stowe Street alignment, looking to the driver's left, for a vehicle at the STOP sign. Figure 7 displays actual sight lines, indicating only 70 FT of actual visibility along the Stowe Street alignment, looking to the driver's left, for a vehicle at the STOP sign, due to the terrain and vegetation obstructions shown. These obstructions are partially located outside of the road Right of Way, on the southeasterly corner of the intersection. This condition forces motorists to pull substantially forward past the STOP sign in order to see oncoming traffic from their left. This condition causes conflict when commuter buses are making a left-turn onto Lincoln Street from Stowe Street.

As part of the scoping process, Stantec developed an intersection configuration that improves the site distance and turning geometry for the Lincoln Street Stop Condition and that configuration is shown with the associated site triangles in Figure 8 that follows.

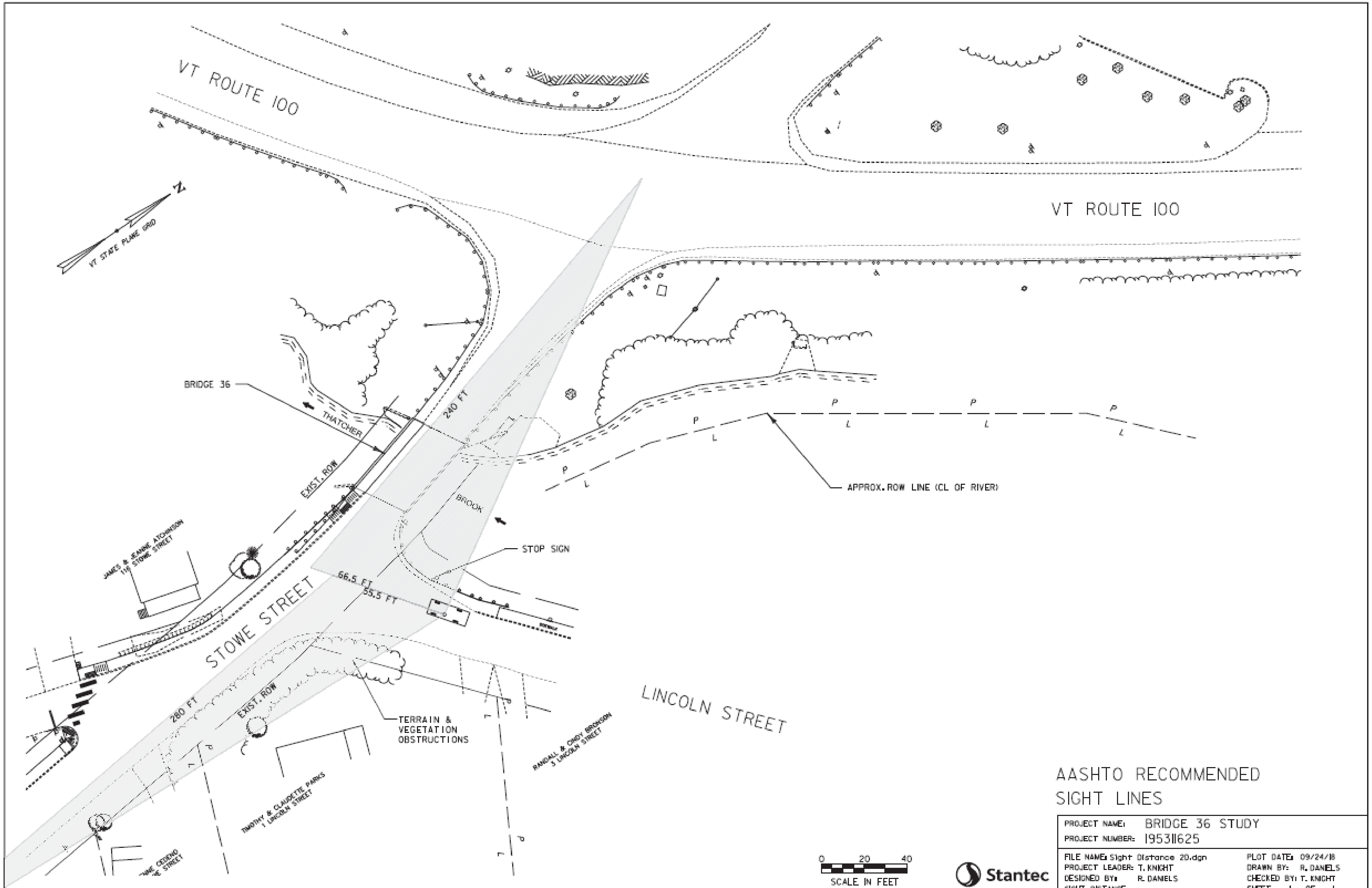

Figure 6 AASHTO Recommended Sight Lines, Existing Geometry

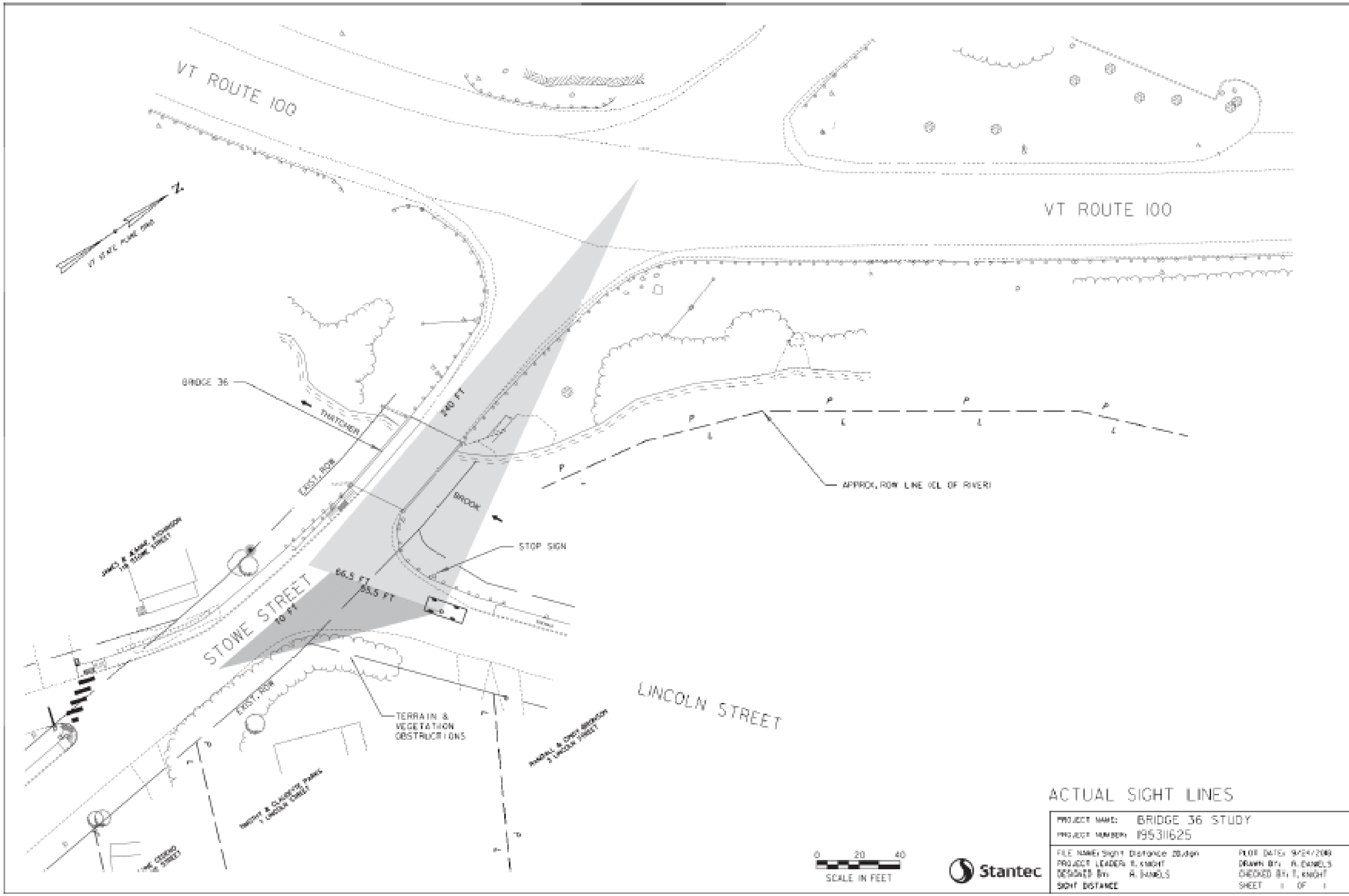

Figure 7 Actual Sight Lines with Existing Geometry

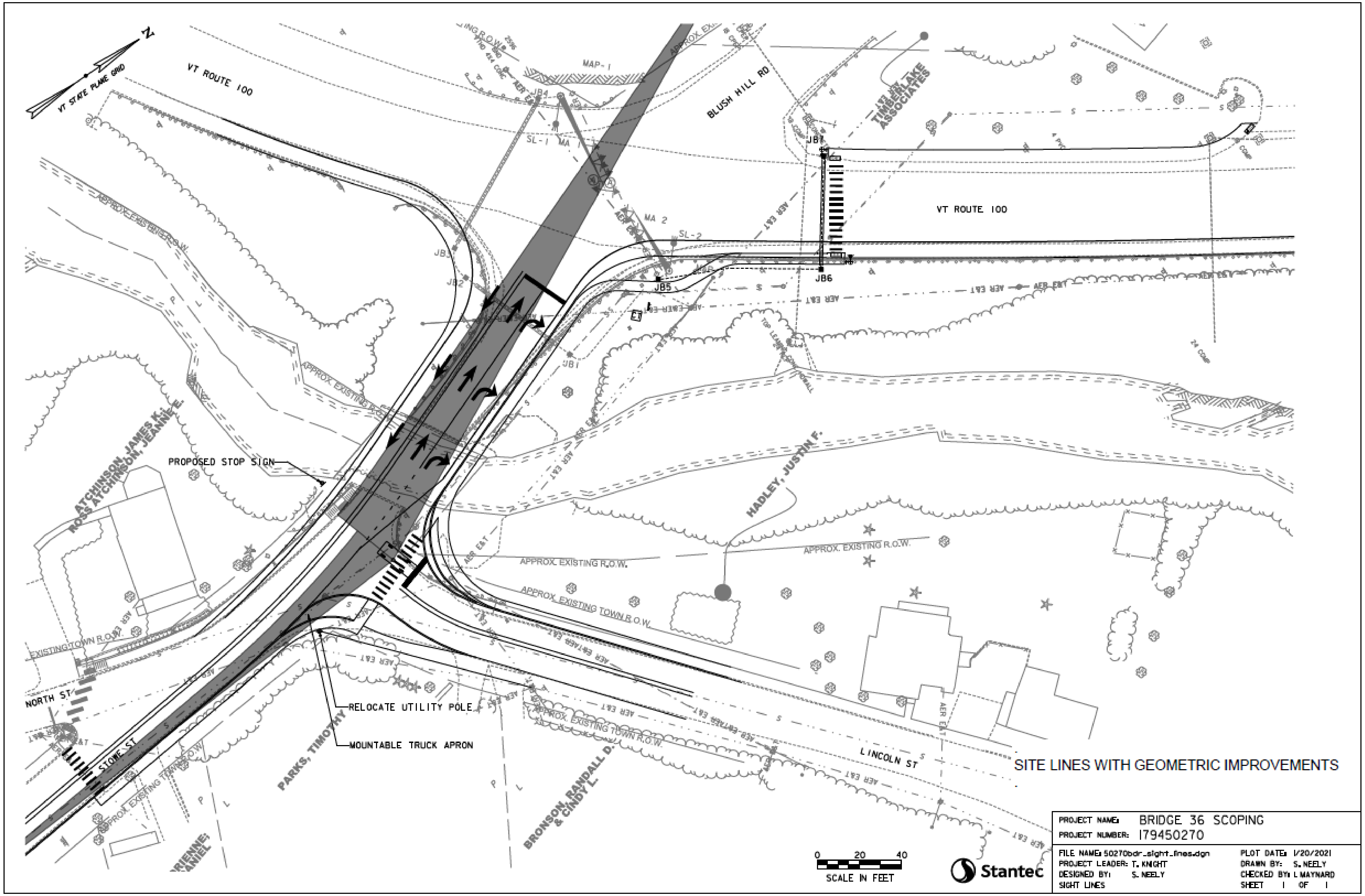

Figure 8 Sight Lines with Geometry Improvements

3.8 BRIDGE INSPECTION REPORT SUMMARY

VTrans conducts Bridge Safety inspections on a biennial basis to meet the National Bridge Inspection Standards (NBIS). As part of that process, VTrans rates the condition of various elements within the bridge using a numeric rating that corresponds to the condition of the element. Based on recent inspections, VTrans has opted to reduce the inspection frequency for the structure to annual. This change reflects the fact that this bridge is nearing the end of its service life and is likely to begin deteriorating more rapidly than it has in the past. The following is a summary of VTrans recent inspection history for Bridge 36:

When interpreting the inspection history, please note the following:

- NBIS defines the criteria for the numeric condition rating, but there is an accepted tolerance associated with the subjective nature of assigning a numeric value to the bridge element condition. In general, if a bridge were inspected by 2 different inspectors, you can expect that the numeric rating assigned to a given element would be within a numeric value of 1 of a numeric rating from another independent inspector. Thus, if one inspector were to rate the bridge as a "5 Fair", it would be acceptable for another independent inspector to rate that element as a "4 Poor", or perhaps a "6 Satisfactory", and still be within the accepted precision of the NBIS.

- Inspectors sometimes make anecdotal comments regarding the anticipated longevity of the structure and/or the need for repair or replacement of the structure at large. Engineers would take the inspector's comments under advisement when determining the need for repair or replacement of the structure, but these comments are understood to be somewhat subjective, as no inspector or engineer can predict the longevity of bridge elements with certainty. The anecdotal predictions are intended to highlight the degree of attention that is warranted for maintenance of the element.

Deck Rating:	*5 Fair*
Superstructure Rating:	*5 Fair*
Substructure Rating:	*5 Fair*
Channel Rating:	*6 Satisfactory*

Inspection History:

04/12/2018 - Special 12-month inspection of the concrete deck. The deck surface needs cold planning and repaving, as it is getting quite rough. The deck and sidewalk could use some patch repair work when the wearing surface is removed. The northwest wingwall is degrading with some heavy scaling and needs repair to prevent erosion of the approach fill material behind it. The deck is showing its age (90 years) in certain spots, but overall appears generally sound at this time. The deck rating will be raised back up to a 5, as fair for now. However, since the bridge is slowly degrading and extensive repairs are not advised, plans should be made to upgrade the bridge in its entirety in the next 10 to 20 years. ~ MJ/JS

9/6/2017 Deck has advanced to poor with heavy saturation bay 2, other areas along deck soffit also has saturation but not as severe. Failures along the deck is possible. Superstructure & substructure continues to deteriorate at steady pace. Abutment 1 upstream wing has very heavy scaling. Structure should be considered for full replacement. Structure will be moved to 12-month frequency inspection. MJK AC

09/09/15 Fair condition, structure continues to deteriorate along deck soffit, T beams and abutments. Structure should be considered for recon or replacement. MJK SP

09/06/13 Deck & T beams continue to deteriorate at a slow pace, approaches need to be shimmed. Structure should be considered for replacement in the next 10 +/- years. Recent repairs to fix undermining is a big improvement. MJK FE

05/05/11 Fair condition. Deck soffit has areas of saturation and t-beams are breaking down with cracking and spalling with exposed rebar. Structure should be replaced in near future. MJK & PH

05/08/09 - The bridge is in fair to satisfactory condition. - The deck and tee beams continue to deteriorate. Full depth holes could occur any time, any place in the deck; especially in bay 2. Abutment 2's approach guard rail needs repair. DCP

Stantec's bridge engineers conducted a site visit in August 2018 to verify the inspection findings in the current VTrans Bridge inspection report dated 4/12/2018. Stantec concurs with the findings of the inspection report, however, they noted that the Town of Waterbury has made repairs to the northeast wingwall and the adjacent corner of the north abutment since the April inspection.

3.9 HYDRAULICS

VTrans developed a preliminary hydraulics analysis with recommended span lengths and hydraulic capacities for proposed improvements. The existing structure does meet current standards of the VTrans Hydraulic Manual but does not meet state stream equilibrium standards for bankfull width. The report associated with this analysis recommends a minimum clear span of 45 feet for any new structure.

3.10 UTILITIES

The existing identified utilities consist of the following:

Municipal Utilities

- An existing sewer main runs from a sewer manhole (SMH) near the signal control cabinet at the southeast corner of the intersection of VT Route 100 and Stowe Street. The sewer then runs south paralleling Stowe Street about 10 feet from the shoulder on the upstream side before daylighting to parallel the bridge on a separate structure. It appears that north of the bridge, the sewer main is encased in concrete for about a 15-foot length; this needs verification. The sewer main crosses Thatcher Brook and into a manhole before crossing Lincoln Street and continuing down the east side of Stowe Street.
- Traffic signal conduit runs under Stowe Street for the signal at the intersection of VT Route 100, Stowe Street and Blush Hill Road, approximately 60 feet south of the intersection. An electrical utility wire runs from the pull box on the east side of Stowe Street to the signal cabinet located south of the intersection.
- A storm sewer collects runoff from catch basins on each side of Blush Hill Road, just north of the intersection with VT 100, crosses VT 100, and discharges into Thatcher Brook upstream of the bridge. A storm sewer also collects runoff from a catch basin on the south side of Lincoln Street and a catch basin located approximately 100 feet east of the intersection of Lincoln Street and Stowe Streets before daylighting into Thatcher Brook, upstream of the bridge.
- An existing 12-inch water main is buried below Thatcher Brook, upstream of Bridge 36, and runs along Stowe Street and Lincoln Street. Water lines are located in the area of the intersection of Stowe Street and VT 100, with valve boxes.
- A fire hydrant is located approximately 50 feet south of the bridge and across from Lincoln Street.

Public Utilities (Overhead)

- Overhead utilities run along the east side of Stowe Street. Utility poles are located: southeasterly of the intersection of Route 100 and Stowe Street; a guy pole crossing Stowe Street northerly of the bridge; approximately 40 FT easterly of the northerly corner of the Lincoln Street and Stowe Street intersection; and on the southerly corner of the Lincoln Street and Stowe Street intersection.

The impact of the construction project to the sewer, water and overhead utility lines and poles will depend on the size and scope of the proposed bridge structure and will likely require relocation or temporary support. Coordination with the Municipality and public utility company will be necessary during design of any construction project. If replacement is pursued, carrying the existing sewer on the bridge should be considered.

3.11 RIGHT OF WAY

There are existing 3-rod (49.5 ft) (approximate) rights of way centered on both Stowe Street and Lincoln Street. The Right-of-Way boundary for Route 100 varies by location. The southern Route 100 Right-of-Way boundary is located at the middle of Thatcher Brook on either side of the bridge. Due to the large amount of Right-of-Way clearance on the north side of the bridge, no permanent or construction easements should be required. On the south side the bridge, Stowe Street Right-of-Way is within 12 feet of the bridge fascia and may require additional Right-of-Way acquisition. The existing Right-of-Way is plotted on the Existing Conditions Layout Sheet (Figure 2).

As discussed earlier regarding sight distance obstructions for the Lincoln Street STOP condition, there are existing terrain and vegetation obstructions on the southeasterly corner of the Stowe Street / Lincoln Street intersection. Those obstructions appear to be partially located outside of the Town Right-of-Way.

3.12 RESOURCES

The environmental resources present at this project are shown on the Existing Conditions Layout Sheet (Figure 2) and are as follows:

Biological

Wetlands/Watercourses

Wetlands or wetland buffers are not located within the project area. Class I wetlands were identified on Vermont Agency of Natural Resources (VANR) map; however, Stantec's environmental scientist located and flagged the estimated wetland boundary. The boundary is located approximately 370 feet upstream of the project site, thus, the wetland and the wetland buffer are outside of the project limits. A figure depicting this location is included in the appendix of this report.

Impact below OHW/Fisheries/AOP

Thatcher Brook is the only regulated natural resource in the immediate project area and only impacts below ordinary high water (OHW) are regulated. Thatcher Brook is a tributary to the Winooski River. The current structure passes fish and other aquatic organisms. Thatcher Brook is not classified as Essential habitat or a Navigable Waterway. In-stream construction would be limited to between July 15 and October 1 under Section 404 Corp of Engineers Permit unless a Category 2 general permit is obtained.

Species / Habitats of Special Concern

The Northern Long Eared Bat is the only species with habitat of special concern. No other threatened or endangered species were identified within the project area.

Agricultural Soils / Floodplains

The project area is within a mapped flood hazard area located along the river. No agricultural soils have been identified within the project area.

Hazardous Materials

According to the Vermont Agency of Natural Resources (VANR) Vermont Hazardous Sites List, there are numerous hazardous waste sites located near the project area. It is anticipated that none of these sites will be impacted. A list of hazardous sites in the project area can be found in the appendix.

Historic

The bridge is in the northern end of the Mill Village Historic District, with ordinary houses and a mill, dating back to the 19th century. Some of the houses and the mill remain in existence today, although converted into modern houses and a commercial space. The project area will not be impacting either the houses nor the mill.

Archaeological

There are no known or apparent archaeological resources given the rural nature of the river upstream and more developed nature downstream. However, the downstream mill and houses date to the 19th century and should be considered archaeological sites.

Stormwater

Bridge 36 is south and downhill of the intersection of Stowe Street and VT Route 100. The runoff from the road between the bridge and the intersection runs down and off the road under the transition barrier onto the substructure at the north end of the bridge. Due to the heavy rutting in the bridge surface, stormwater also ponds on the bridge deck and freezes in the winter.

4.0 COMMUNITY ENGAGEMENT

4.1 LOCAL CONCERNS MEETING AND QUESTIONNAIRE FINDINGS

Residents at the local concerns meeting held July 17th, 2018 expressed the following safety concerns regarding the Stowe Street intersection with Lincoln Street:

- Sight distance from the stop sign location on Lincoln Street is poor, and traffic needs to pull partially out onto Stowe Street in order to see oncoming vehicles.
- Vehicles often exceed the speed limit and residents are concerned that speeds are excessive in the residential area beyond the Lincoln Street intersection.
- Due to the poor sight distance of traffic maneuvering from Lincoln Street, traffic is often not focusing on pedestrian traffic and pedestrians feel unsafe crossing the road.
- Residents noted the narrowness of the sidewalk and minimal separation from traveling public feels unsafe.

Safety issues presented in the Operations Input Questionnaire

- Narrowness of the bridge and alignment causes vehicles to utilize the sidewalk to turn left onto Lincoln Street. Likewise, traffic turning right onto Stowe Street often crosses centerline to turn.
- When snow falls, plowing operation pushes snow onto the sidewalk. Current configuration of the railing does not allow snow to be pushed over bridge. Sidewalk plowing operation pushes some snow into roadway, causing bridge to retain more snow.
- Snow plows with wings are not able to drive over bridge without crossing centerline.

5.0 PURPOSE AND NEED

The following ***Draft*** **Purpose and Need Statement** summarizes what the project is intending to accomplish and for what reasons.

Purpose: The purpose of the project is to provide a safe crossing of Thatcher Brook for the traveling public, including pedestrians and bicyclists and to address the current structural deficiencies and ongoing deterioration of the bridge.

Need: Recognizing the importance of this route in the transportation system for the Town of Waterbury and the surrounding communities, the following needs for the project have been identified:

- The existing concrete beams and deck are in fair to poor condition, with holes and heavy wheel rutting in the pavement.
- The concrete sidewalk is spalling, particularly in interface with roadway.
- The beams are cracked and spalled where previous repairs have failed to bond. There are large delaminated areas throughout the deck and beams, and large spalled areas with exposed rebar.
- The T-beams continue to deteriorate, spall, and crack due to corrosion of the reinforcement.
- The approach railing and bridge rail do not meet the current standard.
- The existing bridge width is inadequate to accommodate turning movements of the commuter bus that regularly uses the bridge to access the Park and Ride on Lincoln Street.
- The bridge is not wide enough to accommodate cyclists on the roadway shoulder.
- The adjacent intersection with Lincoln street has inadequate sight distance to the north.

6.0 DESIGN CONSIDERATIONS

6.1 BRIDGE DESIGN CRITERIA

The design standards for this bridge project are the Vermont State Design Standards, dated October 22, 1997. Minimum standards are based on an ADT of 3,330 (2043), a DHV of 475 and a design speed of 25 mph for a local town road.

Table 3 Bridge Design Criteria

Design Criteria	Source	Existing Condition	Minimum Standard	Comment
Approach Lane and Shoulder Widths	VSS Table 6.3	11'/0' (22')	11'/3' (28')	Substandard
Bridge Lane and Shoulder Widths	VSS Section 6.7	10'/0' (20') with 5' sidewalk	11'/2' (26')	Substandard
Clear Zone Distance	VSS Table 6.5	Bridge and guardrail located in clear zone	7' fill / 7' cut (1.5 behind curb)	Substandard
Banking	VSS Section 6.12	Normal Crown	8% (max)	No super elevation on low speed urban streets
Speed		25 mph (Posted)	25 mph (design)	
Horizontal Alignment	AASHTO Green Book Table 3-10b	R = ∞	R_{min} = 2370' @ NC	
Vertical Grade	VSS Table 6.6	-1.02% (max)	7% (max) for level terrain	
K Values for Vertical Curves	VSS Table 6.1	Ksag = 209	20' crest / 30' sag	
Stopping Sight Distance	VSS Table 6.1	TBD	150'	
Bicycle/Pedestrian Criteria	VSS Table 6.8	No shoulder	3' Shoulder	Substandard for Bicycles
Bridge Railing	Structures Design Manual Section 13	Concrete railing	TL-2	

Design Criteria	Source	Existing Condition	Minimum Standard	Comment
Hydraulics	VTrans Hydraulics Section	To be determined in later study	Pass Q_{50} storm event with 1.0' of	Substandard
Structural Capacity	SM, Ch. 3.4.1	Not Structurally Deficient, but current condition is deteriorating.	Design Live Load: HL- 93	

6.2 PEDESTRIAN AND RIGHT-TURN LANE ACCOMMODATION CONSIDERATION

Traffic analyses completed by Stantec in 2018 (included in appendix) were updated by Stantec. Analyses were updated to inform the design of the bridge replacement for Bridge 36, along with associated intersection improvements at Stowe Street/VT 100 and Stowe Street/Lincoln Street. Intersection improvements include pedestrian phasing accommodations for a future crossing of VT 100 on the southbound approach and the addition of a dedicated right-turn lane for the northbound Stowe Street approach to VT 100. Impacts to the coordinated traffic signal systems along VT 100 were not analyzed. Conditions analyzed include existing conditions and six scenarios for future conditions:

Stantec analyzed six alternatives for the VT 100 / Stowe Street intersection for the year 2045. These alternatives include:

- 2045 Baseline (No pedestrian accommodation and no right turn lane)
- 2045 Northbound Right-Turn Lane
- 2045 Concurrent Pedestrian Phase (Only pedestrian accommodation)
- 2045 Concurrent Pedestrian Phase and Northbound Right-Turn Lane
- 2045 Exclusive Pedestrian Phase (Only pedestrian accommodation)
- 2045 Exclusive Pedestrian Phase and Northbound Right-Turn Lane

Future traffic conditions for the year 2045 (25-year horizon) were determined by adjusting 2020 volumes to 2045 using a growth factor of 1.13, per the VTrans Continuous Traffic Counter Report (The Redbook), based on 2020 traffic data. Future 2045 volumes are displayed in Figures 9 and 10. No known specific land use development projects were identified.

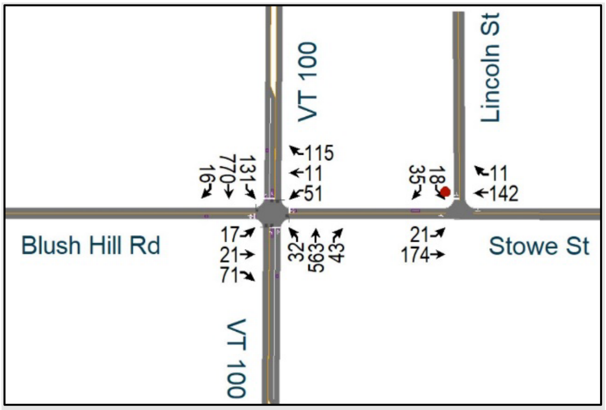

Figure 9 Future 2045 AM

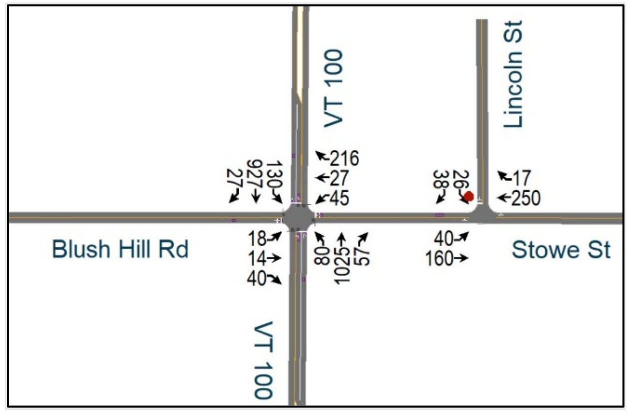

Figure 10 Future 2045 PM

Future conditions are expected to include pedestrian improvements to the VT 100/Stowe Street intersection. It is expected that VT 100 will be crossed just north of the intersection accommodated with pedestrian phasing, signal heads and pushbuttons. Both concurrent and exclusive pedestrian phasing were analyzed. In addition, a second approach lane on Stowe Street at VT 100 was analyzed. This lane would operate as a dedicated right-turn lane as it would be intended to accommodate 75 percent of the traffic on the Stowe Street approach. Existing phase splits were maintained from existing timing plans, while cycle lengths were adjusted for future conditions.

Future analyses of the year 2045, presented in Table 4, indicate overall operating conditions at the Stowe Street/VT 100 intersection in terms of level of service are expected to remain at LOS B during the morning peak hour for the baseline condition or with concurrent pedestrian phasing or exclusive pedestrian phasing with a dedicated northbound right-turn lane. During the evening peak hour, the intersection is expected to operate at an overall LOS D for the baseline condition or with concurrent pedestrian phasing. The concurrent pedestrian phase does result in more green time for the northbound approach and correspondingly a reduced v/c ratio for the northbound Stowe Street approach. Exclusive pedestrian phasing reduces the 2045 AM and PM LOS for the Stowe Street approach to F.

The benefit of a northbound right-turn lane for the Stowe Street approach was analyzed. The northbound approach experiences queuing today that extends beyond Lincoln Street during peak periods. Future traffic growth and the addition of the pedestrian phasing are expected to exacerbate this queuing. A right-turn lane that would extend over Bridge 36 would mitigate both the future growth and exclusive pedestrian phasing impacts on the northbound approach. The right-turn lane would also help accommodate the Link Bus turning onto and off Lincoln Street from Stowe Street for the Waterbury Park and Ride, maintaining a more compact approach for that intersection.

Motorists making a right turn onto VT 100 from Stowe Street may not expect pedestrians crossing at this location, due to the setting of the intersection along this portion of VT 100 and low pedestrian volumes. Combined with the large turning radius and corresponding higher turning speeds, this may be an issue for a concurrent pedestrian phase. An exclusive pedestrian phase is better suited here.

Other approaches to the VT 100 / Stowe Street intersection were checked for impacts for each scenario. The eastbound approach is not expected to experience significant impacts for any of the scenarios. For the northbound and southbound approaches during the AM peak, LOS is expected to remain the same for all scenarios, while the v/c ratio is expected to remain close to the baseline or to improve. For the northbound and southbound approaches during the PM peak, LOS is expected to remain the same or improve for all scenarios; v/c ratio is expected to improve for all scenarios except for the exclusive pedestrian phase only scenario, which is expected to experience an increase in v/c ratio.

Future baseline 95th percentile queue lengths for the northbound and southbound approaches show potential impacts to the adjacent intersections along VT 100, particularly the I-89 northbound off ramp. The northbound approach is expected to experience an increase in 95th percentile queues, by about 16%, for the exclusive pedestrian phasing with right turn lane scenario during the PM peak hour, compared with the baseline. Capacity analysis worksheets are provided in the appendix.

Table 4 Future (2045) Capacity Analysis Results

Scenario	Time Period	Stowe Street at VT 100		Stowe Street WB Approach to VT 100			Lincoln St at Stowe Street
		Overall LOS	Overall V/C	LOS	V/C	95^{Th} Queue	LOS
Baseline	AM	B	0.73	E	0.74	7 veh.	B
	PM	D	1.03	F	1.07	12 veh.	B
RTL	AM	B	0.69	C	0.49	3 veh.	B
	PM	C	0.93	D	0.58	5 veh.	B
Concurrent Ped Phasing	AM	B	0.72	D	0.66	6 veh.	B
	PM	D	1.01	F	0.96	12 veh.	B
Concurrent Ped Phasing and RTL	AM	B	0.69	C	0.49	3 veh.	B
	PM	D	0.93	D	0.49	4 veh.	B
Exclusive Ped Phasing	AM	C	0.73	F	0.94	9 veh.	B
	PM	E	1.05	F	1.28	15 veh.	B
Exclusive Ped Phasing and RTL	AM	B	0.68	D	0.66	4 veh.	B
	PM	C	0.94	D	0.81	6 veh.	B

LOS = Level of Service; V/C = volume to capacity ratio; 95^{th} Queue = 95^{th} percentile queue; RTL = Right Turn Lane

7.0 TRAFFIC MAINTENANCE DURING CONSTRUCTION

The Vermont Agency of Transportation reviews each new project to determine suitability for the 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 closure period with faster construction techniques and incentives to contractors to complete projects sooner. The Agency considers the closure option on all projects where rapid reconstruction or rehabilitation is feasible. The use of prefabricated elements in new bridges will also expedite construction schedules. This can apply to decks, superstructures, and substructures. VTrans Accelerated Bridge Construction Program has demonstrated that accelerated construction often provides enhanced safety for the workers and the traveling public by removing traffic from the immediate vicinity of the construction work while maintaining project quality.

7.1 OPERATION 1: OFF-SITE DETOUR

This option would close the bridge on Stowe Street and depending on the limits of work, may also limit access to Lincoln Street. Traffic would be rerouted to an offsite detour. Since the bridge is located on a Class 2 Town Highway, it would be the responsibility of the Town of Waterbury to choose the preferred detour route, and to sign it according to the MUTCD Manual.

The anticipated detour route is: Stowe Street ➔ VT Route 100 ➔ US 2 (west) ➔ Union Street ➔ back to Stowe Street. This route has an end-to-end distance of 1.4 miles. Stantec collected traffic counts and did a preliminary evaluation of the US 2 to Union Street turning movement with traffic re-routed through this detour route. There is a possibility that the additional volume turning left from US 2 onto Union Street may cause a queue that impedes movement through the VT100/US 2 roundabout. Therefore, routing traffic from Stowe Street ➔ VT Route 100 ➔ US 2 (west) and ➔ back to the southern terminus of Stowe Street with adjustments to the timing of the Stowe Street/US 2 signal timing may be required.

Pedestrian Routing

Since there is a sidewalk on the existing bridge, a pedestrian detour may be necessary. The above route includes a section of VT Route 100, over Interstate 89 that does not have sidewalks and the interstate ramp configuration is not ideal for pedestrian traffic. One possible pedestrian detour route is: Lincoln Street ➔ Waterbury Community Path ➔ Laurel Road ➔ VT Route 100 ➔ Stowe Street. Another possible, but longer, pedestrian detour route is: Lincoln Street ➔ Perry Hill Road ➔ Kneeland Flats Road ➔ Guptil Road ➔ VT Route 100 ➔ Stowe Street. This route is 7.0 mi end to end, which is excessive for pedestrians. Another possibility is contracting with a shuttle service to ferry passengers from VT 100 to the Waterbury Village during construction.

A map of these detour routes can be found in the Appendix.

Considerations that will require community input during the alternatives phase include:

- Providing an alternate temporary location for the Waterbury Park and Ride
- Maintaining pedestrian access at the site during construction
- Access to Lincoln Street
- Emergency services response time to Lincoln Street
- School bus access to Thatcher Brook Elementary School

Advantages: This option would eliminate the need for phasing construction and a temporary bridge, which would significantly decrease cost and time of construction. This option reduces the time and cost of the project both at the development stage and construction. The Town of Waterbury would reduce their local share by 50% for choosing to close the bridge during construction per ACT 153.

Disadvantages: Traffic flow would not be maintained through the project site during construction. Maintaining pedestrian mobility through the project area will be difficult. Further alternatives would need to be considered for Park and Ride users, pedestrian traffic and school bus traffic.

7.2 OPERATION 2: PHASED CONSTRUCTION

Phased construction is the maintenance of traffic on the existing bridge while building the proposed structure one lane at a time. This allows keeping the road open during construction, while having minimal impacts to adjacent property owners and environmental resources. Given the narrow width of the existing structure, and limited length for queuing traffic on the VT 100 side of the bridge, phased construction is not preferred at this site due to safety and functional concerns.

7.3 OPERATION 3: TEMPORARY BRIDGE

The existing roadway geometry accompanied with the proximity of the VT Route 100 intersection, make constructing a temporary alignment sufficient for transit traffic and larger vehicles very tight. Permanent or temporary Right-of-Way would need to be acquired and utilities and existing signals relocated. The location of a temporary bridge further upstream of the existing would result in having Stowe Street offset from the current intersection resulting in complication with queuing traffic and traffic flow through both VT 100 intersections (Blush Hill and a temporary Stowe Street Intersection).

Significant additional costs would be incurred to use a temporary bridge, including the cost of the bridge itself, installation and removal, restoration of the disturbed area, and the time and money associated with the temporary Right-of-Way. If used, a two-way temporary bridge would be appropriate based on the daily traffic volumes. Including a temporary bridge to accommodate pedestrians, may be a viable option.

7.4 OPERATION 4: TEMPORARY PEDESTRIAN BRIDGE

Adding a temporary pedestrian facility is a feasible option. It should be noted that the Town of Waterbury not be able to reduce their local share by 50% for choosing to close the bridge during construction. Including a temporary pedestrian bridge also negates the option for a reduced local share under ACT 153.

8.0 ALTERNATIVES DISCUSSION

8.1 ROADWAY IMPROVEMENTS AND PEDESTRIAN CONNECTIONS TO EXISTING AND PROPOSED SIDEWALKS.

As discussed above, Stantec developed a design for roadway and intersection improvements that would improve intersection turning geometry, site distance and improve the level of service at the intersections. This plan includes a right-turn lane.

The Town has expressed interest in providing a sidewalk as part of any crossing improvements and would prefer having the sidewalk on the upstream side of the bridge to tie in with planned pedestrian improvements on the south side of VT 100 east of the VT 100 intersection. Moving the sidewalk to the upstream fascia raises questions about how to tie into the existing sidewalk network on the west side of Stowe Street south of the bridge. Stantec developed a potential sidewalk configuration that continues the sidewalk on the east side of Stowe Street until reaching the northern terminus of North Street, where it would be connected with a cross-walk.

This configuration is depicted in Figure 11 which is referred to as a common feature plan intended to summarize proposed roadway improvements for all but “build” alternatives being considered.

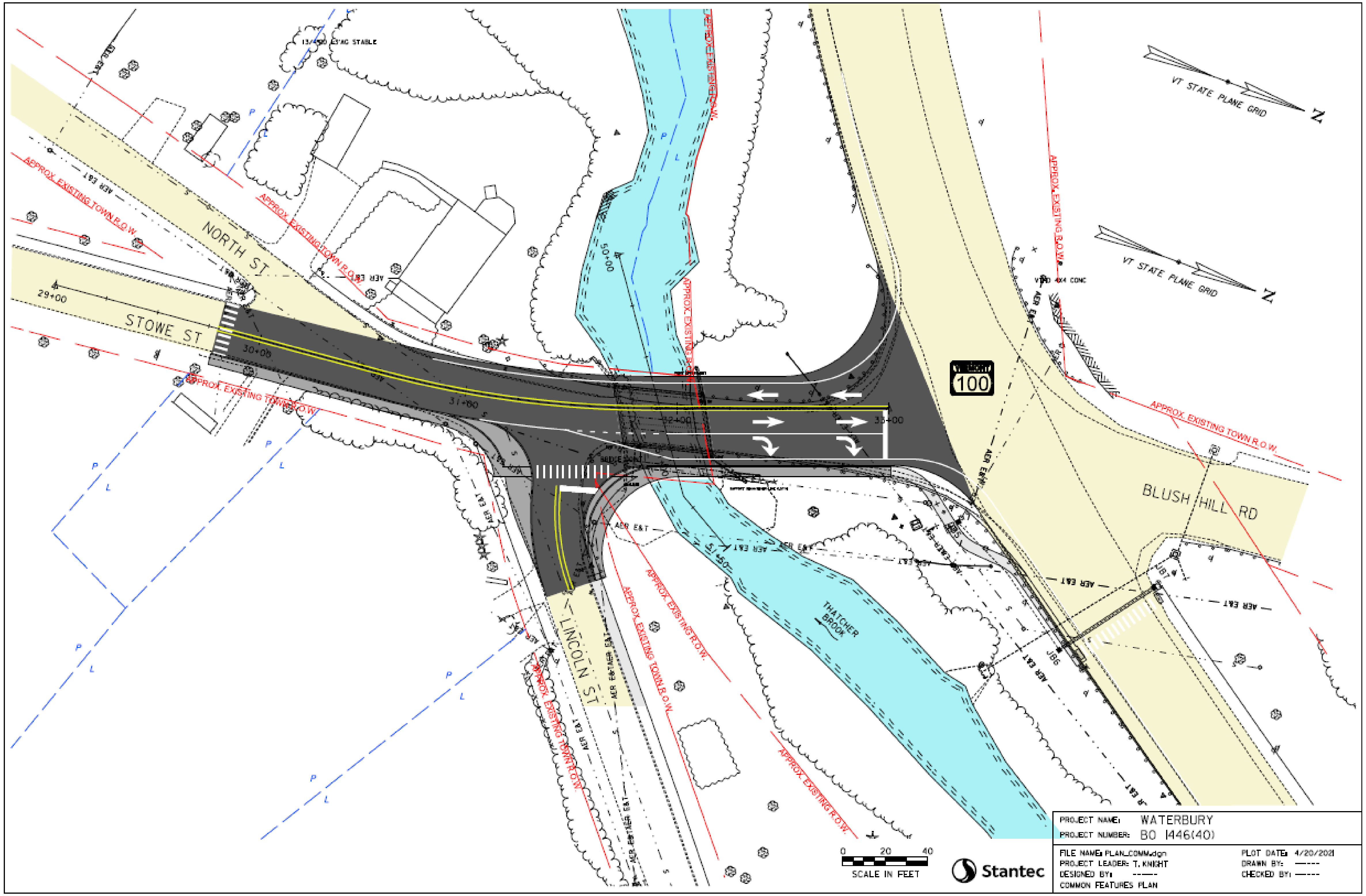

Figure 11 Common Features to all Build Alternatives Considered

8.2 NO ACTION

Bridge 36 is a 1928 Concrete T-Beam structure. During the 2018 NBIS inspection, the 90-year old structure was rated to be in fair condition. While the structure is not in danger of an imminent collapse, it would need to be replaced in the near future. If no action is taken, then the structure would likely need to be taken out of service. This alternative is not recommended.

8.3 ALTERNATIVE 1: SUPERSTRUCTURE AND SUBSTRUCTURE REPAIRS

In order to keep Bridge 36 in service, superstructure repairs would likely be needed within the next 5-10 years. The concrete on the T-beams have begun spalling and delaminating in multiple areas. The deck exhibits signs of unsound concrete and saturation. In 2017, the deck was rated as poor but was changed to fair in 2018 after it was sounded.

The proposed superstructure repairs would consist of removing deteriorated concrete from the deck and patching these areas with new concrete and galvanic anodes. In addition, any exposed reinforcing steel and delamination on the concrete T-Beams would need to be repaired using an overhead patching material. The costs of patching the superstructure are not significant; however, a considerable amount of the project costs would be because of traffic control, containment of debris, and contractor mobilization. Due to the age, current condition of the structure, and its exposure to moisture, any repairs would result in limited improvements to the service life. This combined with the project costs does not make repairing the superstructure a cost-effective option. The goal of these repairs would be to extend the service life of the structure if replacement is not a viable option. This alternative is not recommended.

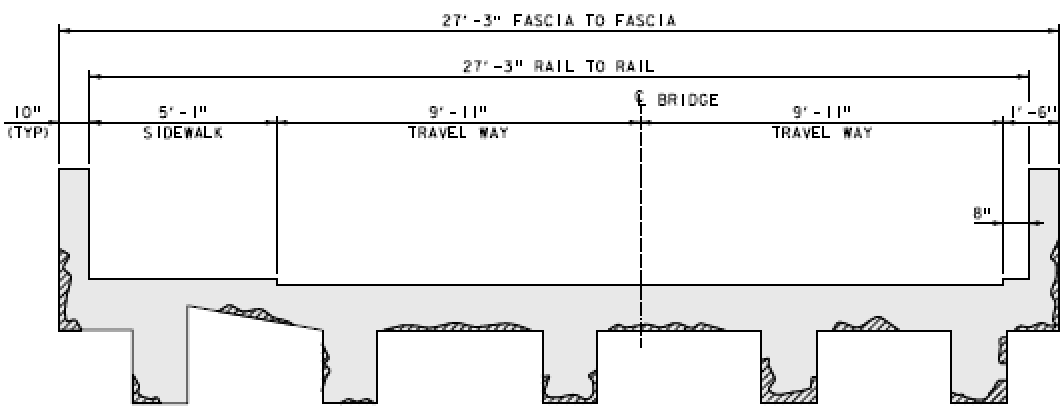

Figure 12 Alternative 1 - Typical Bridge Section

Advantages: This alternative would temporarily extend the service life of the structure with a minimal construction cost and would have less impacts to traffic and the adjacent properties and resources.

Disadvantages: The existing structure does not meet ANR Bank Full Width, however it still meets VTrans Hydraulics Standard. While this alternative does marginally increase the service life, it is not significant and results in a high annualized cost.

Maintenance of Traffic: This alternative may be constructed under phasing or short-term lane closures. A temporary bridge and off-site detour are also possible but not recommended.

8.4 ALTERNATIVE 2: SUPERSTRUCTURE REPLACEMENT WITH WIDENED SUBSTRUCTURE

This alternative would involve removing the existing superstructure and backwall in its entirety, as well as removing upstream and downstream portions of the existing substructure. The substructure would be widened to accommodate a wider superstructure and the new alignment and roadway configuration. The bridge superstructure would be replaced with a conventional steel beam and concrete deck superstructure.

As noted earlier, the existing structure meets VTrans Hydraulics Standards but does not meet the Agency of Natural Resources Bank Full Width criteria. Since the existing substructure is likely founded on bedrock, scour would not be an issue with the proposed structure and the hydraulics can be considered satisfactory despite not meeting bank full width.

In order to reconstruct the existing abutment to accommodate the new superstructure, the existing wingwalls would need to be removed along with a portion of the abutment that lies within the bridge seat. The new portions of the substructure would be constructed on spread footings and their length would be extended significantly in order to support the widened structure and roadway configuration. Overall, the existing substructure was noted to be in fair condition with most of the deterioration occurring on the wing walls, which would be removed. However, it is unlikely that the service life of the existing portions of the substructure would line up with that of the superstructure due to its age and current condition. This makes this option less practical from a cost standpoint and, overall, is not recommended.

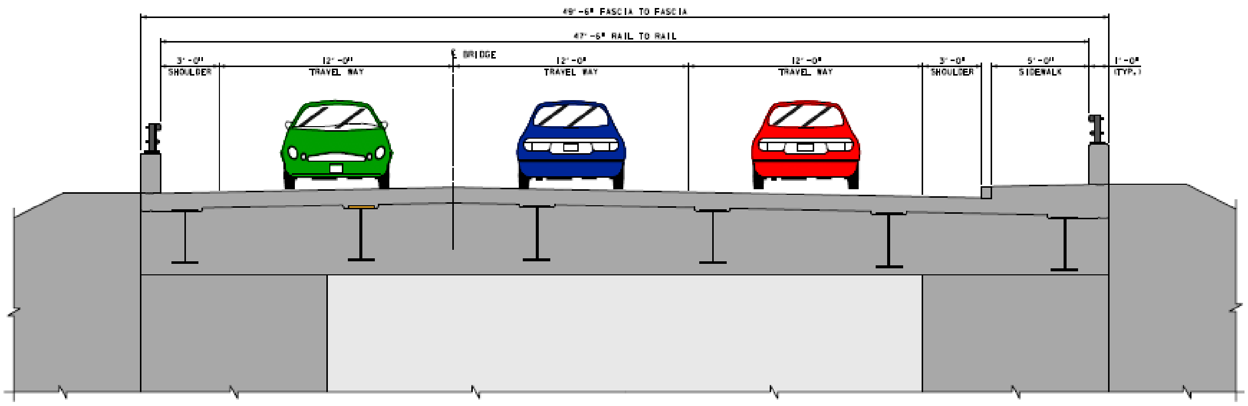

Figure 13 Alternative 2 - Typical Bridge Section

Advantages: This alternative would extend the service life of the structure and address the structural issues of the existing bridge. Roadway and intersection improvements are compatible with this approach. It also has a lower up-front construction cost than both full bridge replacement options.

Disadvantages: The existing structure does not meet ANR Bank Full Width. While this alternative does increase the service life, the new superstructure would have a design life that exceeds that of the substructure resulting in higher annualized costs than the two full replacement options.

Maintenance of Traffic: It is recommended that this option is constructed with traffic maintained on either a temporary bridge or an off-site detour with the offsite detour being the preferred option.

8.5 ALTERNATIVE 3: BRIDGE REPLACEMENT – BURIED STRUCTURE

This alternative would involve the removal of the existing structure in its entirety and replacing it with a buried concrete structure. The new structure would have a 100-year design life. The proposed structure would have a minimum hydraulic width of 50'-" with a 15'-4" rise measured from the bottom of the streambed. The proposed structure would meet the ANR Bank Full Width criteria of a minimum clear span of 45'-0". The proposed structure length would be approximately 72'-0" to accommodate the widened roadway, new alignment, and channel skew.

Buried structures have significant maintenance advantages over conventionally constructed. Due to the soil above the concrete surfaces, they are less exposed to chlorides and other elements that accelerate the deterioration of bridges. Buried structures also lack any expansion joint further reducing the maintenance involved by removing a high-maintenance element of bridges. Because of the advantages of maintaining the structure over its design life and its low annualized cost, this is the preferred alternative.

Structure Type: For the purposes of this scoping study a CONSPAN precast arch was investigated as the preferred structure type. These structures have been commonly used in Vermont with success. However, other structure types can be feasibly used at this site. For example, a composite arch bridge system may be a viable option that should be considered later in design.

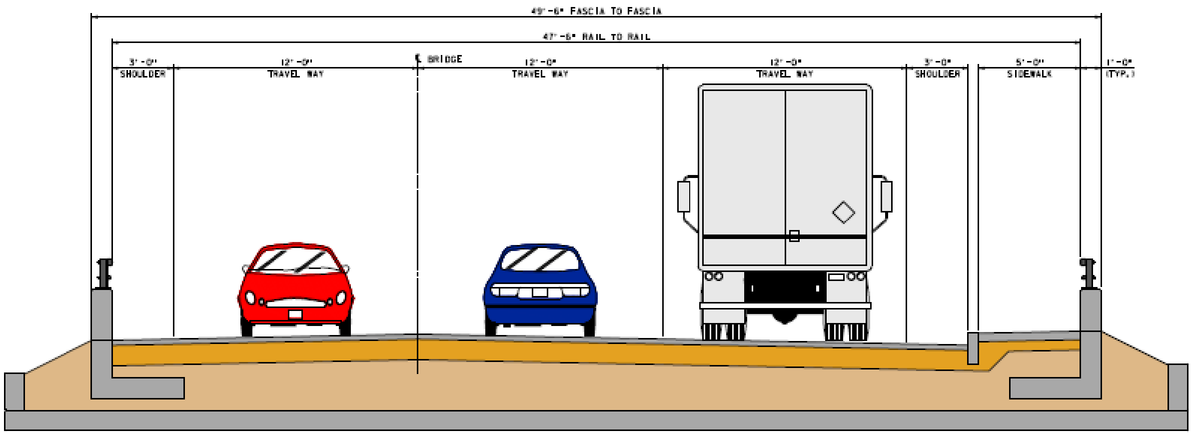

Figure 14 Alternative 3 - Typical Bridge Section

Advantages: This alternative has the longest service life and the lowest annualized costs of the proposed alternatives. Buried structures also have minimal exposure to chlorides and have less long-term maintenance associated with them. Since the structure is mostly precast concrete, it has a shorter construction duration than a conventional bridge replacement, minimizing the impacts to vehicular and pedestrian traffic. The new bridge can also be constructed with the new roadway configuration, creating a safer and more efficient intersection.

Disadvantages: This alternative has a higher up-front construction cost and would impact the adjacent properties.

Maintenance of Traffic: It is recommended that this option is constructed with traffic maintained on either a temporary bridge or an off-site detour with the offsite detour being the preferred option.

8.6 ALTERNATIVE 4: BRIDGE REPLACEMENT – STEEL BEAM SUPERSTRUCTURE

This alternative would replace the existing Concrete T-Beam structure with a Steel Beam Superstructure on a new foundation. In order to meet bank full width, the new structure should have a minimum clear span of 45'-0". A skew of 15 degrees is recommended to match the stream alignment. For the purposes of this scoping study, a 65'-0" long span was considered. Beyond the structure's hydraulics, the longer span has several advantages. Setting the abutments back from the channel reduces the need for dewatering by utilizing the existing abutments. The increased length also reduces the overall wingwall length and provides a better fit to the existing channel. These cost savings negate the increased costs from a longer bridge length.

Superstructure Type: A conventional steel structure with a cast-in-place concrete deck is the recommended option for this alternative. Due to the high curvature of the deck fascia, this would make precast concrete a costly and impractical alternative. Prefabricated Bridge Units would also be difficult to use as the deck ends would likely require a splayed girder. The uneven weight distribution from the splayed girder would complicate the erection and details of the PBU's. Since this project would either use a short off-site detour or a temporary bridge, there is little advantage to accelerating the construction of the project.

Substructure Type: Bedrock appears to be visible near the streambed and it is likely that shallow bedrock is located at the project site. Borings should be taken to determine the depth of bedrock. Both reinforced concrete abutments and integral abutments may be feasible substructure options. If dewatering is necessary for the construction of the spread footings, consideration should be given to pre-drilling for integral abutment piles to reduce construction costs.

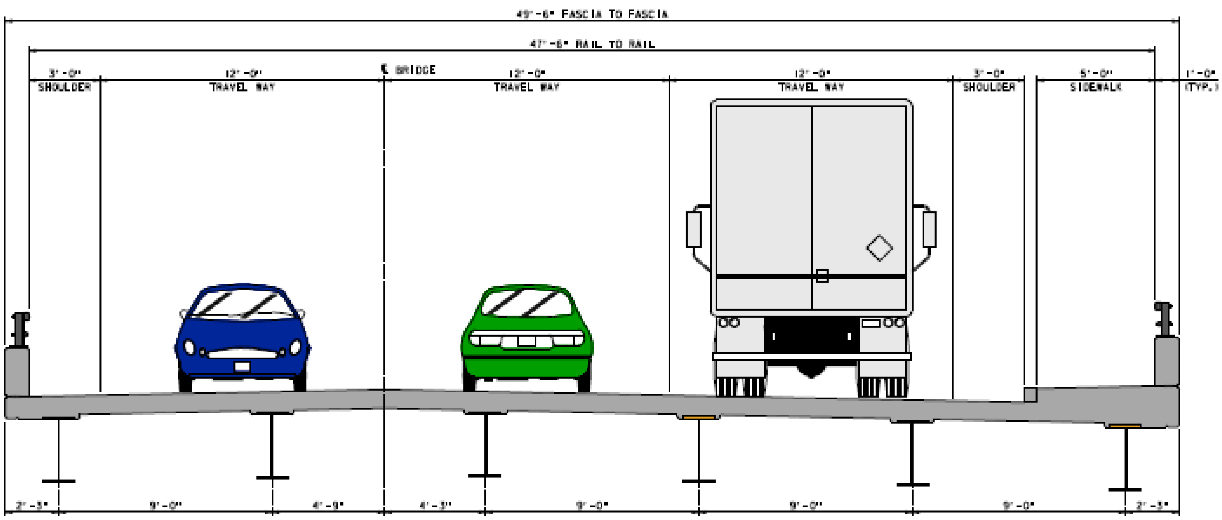

Figure 15 Alternative 4 - Typical Bridge Section

Advantages: This alternative has a 100-year design life with low annualized costs. The new bridge can also be constructed with the new roadway configuration, creating a safer and more efficient intersection.

Disadvantages: This alternative has a higher up-front construction cost and higher life cycle costs due to maintenance than the Bridge Replacement – Buried Structure Alternative. Construction activities would impact the adjacent properties.

Maintenance of Traffic: It is recommended that this option is constructed with traffic maintained on either a temporary bridge or an off-site detour with the offsite detour being the preferred option.

8.7 ALTERNATIVES EVALUATION MATRIX

Waterbury BO 1446(40)		Do Nothing	Alt 1a	Alt 2a Offsite Detour	Alt 2b Temporary Bridge[4]	Alt 3a Offsite Detour	Alt 3b Temporary Bridge[4]	Alt 4a Offsite Detour	Alt 4b Temporary Bridge[4]
			Superstructure Rehabilitation	Superstructure Replacement, Widened Existing Substructure		Bridge Replacement - Buried Structure		Bridge Replacement - Steel Beam Superstructure	
COST[1]	Bridge Cost	$0	$250,000	$1,000,000	$1,000,000	$1,400,000	$1,400,000	$1,500,000	$1,500,000
	Removal of Structure	$0	$0	$50,000	$50,000	$150,000	$150,000	$150,000	$150,000
	Roadway	$0	$0	$500,000	$500,000	$500,000	$500,000	$500,000	$500,000
	Maintenance of Traffic	$0	$120,000	$75,000	$300,000	$75,000	$300,000	$75,000	$300,000
	Construction Costs	$0	$370,000	$1,625,000	$1,850,000	$2,125,000	$2,350,000	$2,225,000	$2,450,000
	Construction Engineering & Contingencies	$0	$70,000	$330,000	$370,000	$430,000	$470,000	$450,000	$490,000
	Total Construction Costs w CEC	$0	$440,000	$1,955,000	$2,220,000	$2,555,000	$2,820,000	$2,675,000	$2,940,000
	Preliminary Engineering[2]	$0	$90,000	$390,000	$440,000	$510,000	$560,000	$540,000	$590,000
	Right of Way	$0	$0	$20,000	$30,000	$20,000	$30,000	$20,000	$30,000
	Total Project Costs	**$0**	**$530,000**	**$2,365,000**	**$2,690,000**	**$3,085,000**	**$3,410,000**	**$3,235,000**	**$3,560,000**
	Annualized Costs	$0	$35,333	$47,300	$53,800	$30,850	$34,100	$32,350	$35,600
TOWN SHARE			$26,500	$59,125	$134,500	$154,250	$341,000	$161,750	$356,000
TOWN %			5%	2.5%	5%	5%	10%	5%	10%
SCHEDULING	Project Development Duration[3]		4 years	4 years	4 years	4 years	4 years	4 years	4 years
	Construction Duration		2 Months	6 Months	9 Months	6 Months	9 Months	6 Months	9 Months
	Closure Duration (If Applicable)		N/A	3 Months	N/A	3 Months	N/A	3 Months	N/A
Engineering	Typical Section - Roadway (feet)	21'	21'	42'	42'	42'	42'	42'	42'
	Typical Section - Bridge (feet)	21'	21'	42'	42'	42'	42'	42'	42'
	Geometric Design Criteria		No improvement	Meets Standards	Meets Standards	Meets Standards	Meets Standards	Meets Standards	Meets Standards
	Traffic Safety	No Change	No Change	Improved	Improved	Improved	Improved	Improved	Improved
	Alignment Change	No Change	No Change	Yes	Yes	Yes	Yes	Yes	Yes
	Bicycle Access	No	No	Yes	Yes	Yes	Yes	Yes	Yes
	Pedestrian Access	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Hydraulics	Substandard	Substandard	Meets Standards	Meets Standards	Meets Standards	Meets Standards	Meets Standards	Meets Standards
	Utilities	No Change	No Change	Relocation of Aerial and Buried	Relocation of Aerial and Buried	Relocation of Aerial and Buried	Relocation of Aerial and Buried	Relocation of Aerial and Buried	Relocation of Aerial and Buried
Other	ROW Acquisition	No Change	No Change	Yes	Yes	Yes	Yes	Yes	Yes
	Road Closure	N/A	No	Yes	No	Yes	No	Yes	No
	Design Life	<10 Years	15	50	50	100	100	100	100

[1] Costs are estimates only, used for comparison purposes.
[2] Preliminary Engineering costs are estimated starting from the end of the Project Definition Phase.
[3] Project Development Durations are starting from the end of the Project Definition Phase.
[4] A vehicular Temporary Bridge is assumed. A Pedestrian Temporary Bridge may be substituted for a reduced cost.

9.0 CONCLUSIONS AND RECOMMENDATIONS

To be updated after the Alternatives Presentation.

APPENDICES