

To: Matthew Bogaczyk, Project Manager

From: Nathan Phillips, Asset Management Bureau

Date: February 22, 2021

Subject: Richmond - Bolton STP 2924(1), US2 Reclaim Project, PIN 10C254

1 New Project Summary Purpose:

The purpose of this New Project Summary is to create awareness of the transportation issues and concerns that may exist in this corridor. This document is not intended to define or scope this project, rather, it is intended to be a high-level review of the asset, maintenance, safety and local concerns along the project area. The Asset Management Bureau has reviewed relevant information along the corridor and contacted our Agency partners in Maintenance, Project Delivery, Geotechnical, and Operations and Safety to inform the contents of this document. While other issues may become apparent as the project progresses through the various design phases, the intent is to provide a basic framework for the project as it begins the early design phases.

This New Project Summary is intended to provide background information and recommendations for this project. Treatment recommendations are based on output from the Pavement Management System and are recommended based on the fiscal constraint of the Agency's budget. A detailed onsite field review has not been performed prior to preparing this New Project Summary. Information resources are noted as appropriate in each section. Where Mapillary video images are referenced, they are from 2018.

This project is included in the Paving Program of FY 2021 Governor's Recommended Transportation Programming. Funding has been included to begin design in Fiscal Year 2020 with Construction anticipated to begin during the 2022 construction season.

2 Project Location:

This project is located on United States Route 2 (US2) in the towns of Richmond and Bolton. The project extends from Richmond mile marker 0.000 to Bolton mile marker 1.860 (ETE 48.647 to 56.886). The total project length is approximately 8.239 miles. The project limits begin at the Williston-Richmond town line and end approximately three quarters of a mile west of Bolton Village. See Figure 1 below.

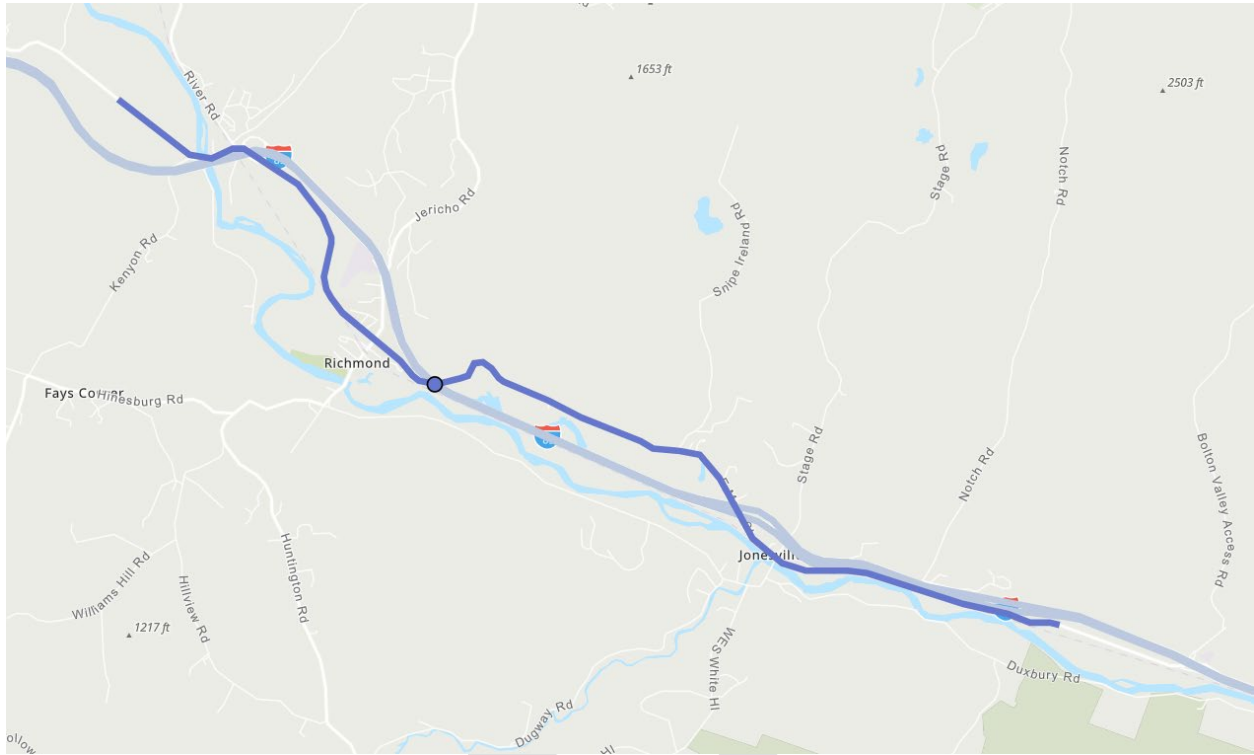


Figure 1

Current and future projects in the area are listed below in Table 1.

Project Name	Project Number	Expected Construction Season	Description
District 5	BM20502	2020	Bundled bridge preservation /maintenance project for strategic repair of Colchester US-2, bridge #18A over I-89 (bridge #79) and Richmond US-2, bridge #29 over I-89 (bridge #54).
Statewide – Northern Region	STP CRAK(40)	2020-2021	Crack sealing in the Northwest and Northeast Regions.
Richmond	BM20504	2020	Bridge maintenance on bridge #24 located in Richmond on US 2 at MM 0.702 to replace joint at abutment #1
Statewide	IMG MARK(118)	2021 - 2022	Installation of new pavement markings, centerline and edge lines on interstate highways and ramps and US 4.
Richmond	IM 089-2(52)	2022-2024	Replacement of Bridge no. 29 on US-2 in Richmond over I-89.
Richmond	STP CULV(58)	2023-2024	Rehabilitation of culvert PID #64501 on US-2 in Richmond at MM 2.25.

Table 1 Projects in the area

Where they are scheduled for the same construction season, coordination between this paving project and the above projects should begin in the early design phase and continue throughout the project timeline.

3 Purpose and Need:

The purpose of this project is to rehabilitate the existing US2 roadway within the project limits. There is significant cracking and deterioration of the pavement throughout the project limits. Most of this portion of US2 is built on top of the original concrete slab roadway constructed circa 1930, although there are areas, mostly where the roadway is in close proximity to the interstate, where the concrete slabs have already been removed. See map included in Appendix as Figure 2 showing in pink where existing concrete slabs are to the best of our knowledge believed to still exist. As noted in section 8.1 below, approximately 36% of the project length is currently rated as very poor or poor. The need for this project was identified based on the VTrans pavement management system. The primary purpose of this project is to address the pavement condition, however, other deficient highway assets, that are within the project limits and within the State right of way, may be considered for incorporation into this project.

4 Recommended Pavement Treatment and Estimated Cost:

Based on the results obtained from the VTrans pavement management system, a Reclaim treatment is recommended for this corridor. This recommendation is based on the condition of the highway, traffic volumes, funding constraints, and historic knowledge of the segment. Currently (December, 2020), removal of the buried concrete slabs that were constructed as part of the original roadway is planned wherever feasible. Based on historical data for Reclaim projects, this project is estimated to cost approximately \$2,580,000 per mile for a total anticipated construction cost of \$21.2475 million.

5 Corridor Considerations:

5.1 Functional Classification:

Based on the [VTrans Functional Classification Map](#), the functional classifications of US2 within the project limits are as follows:

Town	FMM	TMM	Functional Classification
Richmond	0.000	0.943	Minor Arterial
Richmond	0.943	1.217	Principal Arterial (on NHS)
Richmond	1.217	6.379	Minor Arterial
Bolton	0.000	1.860	Minor Arterial

Table 2 Functional Classifications within project limits

5.2 Customer Service Level:

Based on the [VTrans Highway Customer Service Level Map](#), the customer service levels of US2 within the project limits are as follows:

Town	FMM	TMM	Customer Service Level	CSL Description
Richmond	0.000	6.379	Tier 4	Local Connector
Bolton	0.000	1.860	Tier 4	Local Connector

Table 3 Customer Service Levels within project limits

5.3 Speed Limit Data:

Based on a review of the [Vermont Speed Zones Map](#), the Posted Speed Limits on US2 within the project limits are as follows:

Town	FMM	TMM	Speed Limit
Richmond	0.000	0.570	50 mph
Richmond	0.570	2.400	40 mph*
Richmond	2.400	3.080	30 mph*
Richmond	3.080	3.910	40 mph*
Richmond	3.910	5.750	50 mph
Richmond	5.750	6.379	40 mph
Bolton	0.000	1.860	50 mph

Table 4 Speed Limits within project limits

Note: * indicates speed limits per revised official Speed Limit Certificate dated 12/16/2020.

5.4 Traffic Data

Based on the [2019 AADT Report](#), the AADTs for US2 within the project limits are as follows:

Town	FMM	TMM	AAADT	Predicted DHV
Richmond	0.000	0.943	3,187	380
Richmond	0.943	0.984	12,022	1,300
Richmond	0.984	1.014	8,591	990
Richmond	1.014	1.151	11,400	1,200
Richmond	1.151	1.217	11,878	1,200
Richmond	1.217	2.727	8,330	950
Richmond	2.727	6.200	4,120	480
Richmond	6.200	6.379	1,924	-----
Bolton	0.000	1.860	1,924	-----

Table 5 2019 Traffic Data within project limits

Note: Where AADT > 2,000, DHV is needed for use in the Vermont State Standards. Therefore, a Predicted DHV has been determined based on information contained in tables in "The Redbook" correlating AADT to DHV. For each AADT, the DHV using the Seasonal Factor Group for Rural Non Interstate roadways is tabulated here.

5.5 Bicycle Usage Data

This entire segment of US2 is designated a High Use/Priority corridor for bicycle travel based on the [VTrans Bicycle Corridor Priority Map](#) from the VTrans On-Road Bicycle Plan.

The [Bicycle Level of Comfort Map](#) from the VTrans On-Road Bicycle Plan assigns ratings to segments of Vermont roadways based on a number of factors related to the level of comfort of bicyclists using the roadway.

One of the factors used to determine the Bicycle Level of Comfort Rating is whether the roadway segment is designated as rural or urban. Roadway segments are designated as rural unless they are located within a Federal Aid Urban Boundary and/or within a designated

Downtown/Village Center in which case they are designated as urban. Portions of US2 within the project limits are within the designated Richmond Village Center.

The rating system for rural roads is dependent on daily traffic volume, percentage of truck traffic, and paved shoulder width. The current rating system for urban roadways is dependent on number of travel lanes and posted speed limit and therefore is unaffected by paved shoulder width.

The Bicycle Level of Comfort Map shows that most of US2 within the project limits is rated as either “Comfortable for experienced and confident bicyclists.” (score of 3) or “Comfortable for most adult bicyclists.” (score of 2). However, there are a few segments that are rated as “Uncomfortable for most bicyclists.” (score of 4). The Mile Marker limits for these segments, as well as the Bicycle Level of Comfort ratings and scores and the urban/rural designation, are tabulated below:

Town	FMM	TMM	Bicycle Level of Comfort Rating	B.L.O.C Score	Urban/Rural
Richmond	0.900	0.943	Uncomfortable for most bicyclists	4	Rural
Richmond	0.950	0.986	Uncomfortable for most bicyclists	4	Rural
Richmond	1.183	1.217	Uncomfortable for most bicyclists	4	Rural
Richmond	1.497	2.677	Uncomfortable for most bicyclists	4	Rural

Table 6 Locations where L.O.C. Score = 4

The section of US2 from Richmond MM 0.000 to MM 0.627 is part of the Cross Vermont Trail. For most of the rest of US2 within the project limits, the Cross Vermont Trail closely parallels the roadway, generally running along town roads located just to the south of Route US2.

In 2014, a comprehensive [Vermont Route 2 Bicycle and Pedestrian Scoping Report](#) was completed that focused on ways to improve bicycling and walking conditions primarily on the segment of US2 between the Richmond Park & Ride and Richmond village. The report considers many different alternatives, most of which are different alignments of shared use paths, although there are also foot path alternatives and on-road alternatives. The report concludes that the preferred alternative - long-term recommendation is a shared use path with an alignment that generally parallels the west side of Route 2. The report notes that this alternative, although it is the Town’s preferred alternative, has a major hurdle to clear in that it relies on use of the railroad right-of-way and the railroad is not currently interested in allowing use of its ROW for this purpose. The report also concludes that “The preferred short-term alternative is that the Town should work with VTrans to maximize as much as possible the width of the paved shoulders to be added to Route 2 as part of the upcoming repaving project...” and that “With encouragement from the Town, VTrans might be able to create continuous four-foot-wide shoulders from the Park & Ride to the Village.”

Recommendations: See section 5.6.1 below for recommended type of bicycle accommodation and for other bicycle related recommendations.

5.6 Geometric Considerations:

5.6.1 Corridor Function:

US2 within the project limits is a two-lane highway and is generally in a rural setting, however, it does include interchanges with Interstate 89 and two villages:

- From Richmond MM 0.943 to MM 1.217 is a complicated stretch of road that includes the signalized intersection of US2 with VT 117, the northbound entry and exit ramps to Interstate 89, the signalized intersection with the I89 southbound exit ramp and the Richmond Park & Ride, and the southbound I89 entry ramp. This section of US2 is a part of the National Highway System. Most of this segment has an AADT of over 11,000.
- From Richmond MM 2.490 to MM 2.986 is the village of Richmond. This area has a high density of residential properties and driveway accesses. Within the greater village, from Richmond MM 2.677 to MM 2.986, has been designated as the Richmond Village Center. In addition to many residential properties and driveway accesses, this portion of US2 also includes a church, and a large variety of commercial businesses including, but not limited to, office buildings, a gas station/convenience store, a dance studio, a community television station, a restaurant, an outdoor outfitter, and an animal hospital.
- From Richmond MM 6.08 to MM 6.19 is the hamlet of Jonesville. This area is still generally rural, however there is a small concentration of residential properties, a few businesses including a motorcycle shop and a vehicle towing company, and a post office. A long term goal of the Richmond Town Plan is to attract and focus commercial activity in Jonesville.

Recommendations: Given the mostly rural context and the geometry and topography of US2 within the project limits, the most appropriate type of bicycle accommodation is a paved roadway shoulder.

Due to the complexity of the segment from Richmond MM 0.943 to MM 1.217, and the limited ability to widen the roadway in this area (see section 5.6.4 below), this area may benefit from bike lanes and other signing/markings changes to clearly delineate safe paths for bicyclists and to highlight potential conflict areas. Early in this project's design phases, the VTrans Bicycle and Pedestrian Program Manager should be consulted for more specific recommendations.

In Richmond village, bicycle accommodations should be in accordance with the current best practices in a village setting per review of the VTrans Bicycle and Pedestrian Program Manager.

See section 5.6.5 (below) for specific recommendations for paved shoulder widths.

5.6.2 Typical Existing section:

Based on the applicable Route Logs, the existing paved roadway widths, travel lane widths, and paved shoulder widths for US2 within the project limits are as follows:

Town	FMM	TMM	Existing Paved Roadway Width	Existing Travel Lane Widths	Existing Paved Shoulder Width
Richmond	0.000	0.667	33 feet	11 feet	2.0 – 4.0 feet
Richmond	0.667	0.746	26 feet	11 feet	2.0 feet
Richmond	0.746	0.900	30 - 32 feet	11 feet	4.0 – 5.0 feet
Richmond	0.900	0.943	26 feet	12 feet	1.0 feet
Richmond	0.943	1.020	40 - 50 feet	10 - 11 feet	4.0 – 6.0 feet
Richmond	1.020	1.130	34 feet	11 feet	6.0 feet
Richmond	1.130	1.185	40 - 43 feet	11 feet	5.0 feet
Richmond	1.185	1.217	39 feet	11 feet	3.0 feet
Richmond	1.217	1.500	32 feet	11 feet	5.0 feet
Richmond	1.500	2.520	28 feet	11 feet	3.0 feet
Richmond	2.520	3.360	30 – 32 feet	11 feet	4.0 - 5.0 feet
Richmond	3.360	4.520	26 feet	11 feet	2.0 feet
Richmond	4.520	4.900	28 feet	11 feet	3.0 feet
Richmond	4.900	5.510	26 feet	11 feet	2.0 feet
Richmond	5.510	6.379	28 - 30 feet	11 feet	3.0 – 4.0 feet
Bolton	0.000	0.155	28 feet	11 feet	3.0 feet
Bolton	0.155	1.860	30 – 38 feet	11 feet	4.0 – 8.0 feet

Table 7 Existing Sections

NOTE: Existing paved shoulder widths noted above are determined from the applicable Route Logs by subtracting the travel lane widths from the roadway width and assuming equal shoulder widths on each side of the roadway.

5.6.3 Design Standard Guidance:

For the purposes of standardization and consistency, the Vermont State Design Standards have been used in preparing this NPS to provide guidance for minimum lane and shoulder widths. These standards are used throughout Vermont for many types of projects, however, paving projects may not have the ability to achieve the full Vermont state standards in all areas, especially for width.

For rural segments with a Minor Arterial functional classification, Table 4.3 of the Vermont State Design Standards (VSS) has been used to determine guidance values for minimum lane widths. VSS Table 4.7 has been used to determine guidance values for minimum paved shoulder widths to accommodate shared use by bicycles.

For urban segments with a Minor Arterial functional classification, Section 4.5 of the Vermont State Design Standards (VSS) has been used to determine guidance values for

minimum lane widths. VSS Table 4.8 has been used to determine guidance values for minimum paved shoulder widths to accommodate shared use by bicycles.

For rural segments with a Principal Arterial functional classification, Table 3.3 of the Vermont State Design Standards (VSS) has been used to determine guidance values for minimum lane widths. VSS Table 3.7 has been used to determine guidance values for minimum paved shoulder widths to accommodate shared use by bicycles.

Table 8 below, for each segment of US2 within the project limits, summarizes the functional classification, design speed, and DHV data, and the minimum lane and shoulder widths based on the Vermont State Standards.

Town	FMM	TMM	Functional Classification	Speed Limit (mph)	DHV	Minimum Lane Width (ft)	Minimum Paved Shoulder Width
Richmond	0.000	0.570	Rural Minor Arterial	50	370	11	4
Richmond	0.570	0.943	Rural Minor Arterial	40	370	11	3
Richmond	0.943	1.217	Rural Principal Arterial	40	>400	11	3
Richmond	1.217	2.400	Rural Minor Arterial	40	>400	11	3
Richmond	2.400	3.080	Urban Minor Arterial	30	>400	10 - 11	4 ^{b, c, d}
Richmond	3.080	3.910	Rural Minor Arterial	40	>400	11	3
Richmond	3.910	5.750	Rural Minor Arterial	50	>400	11	4
Richmond	5.750	6.200	Rural Minor Arterial	40	>400	11	3
Richmond	6.200	6.379	Rural Minor Arterial	40	1,924 ^a	11	2
Bolton	0.000	1.860	Rural Minor Arterial	50	1,924 ^a	11	4

Table 8 Vermont State Design Standards data

Notes: ^a indicates value is AADT, not DHV

^b indicates width may be reduced by 1 foot in uncurbed areas.

^c indicates width is for areas where there is no adjacent on-street parking. Where parking exists, special consideration must be given to achieve safe accommodation for bicycles

^d indicates that where shoulder width adjacent to curb < 5 feet, recessed drainage inlets or curb inlets should be used

5.6.4 Discussion of Segments:

Richmond MM 0.000 to MM 0.627: This segment currently has shoulders that vary from 2.0 to 4.0 feet. As noted previously, this segment of US2 is part of the Cross Vermont Trail and therefore can be expected to have more bicycle and pedestrian use than other roadway segments. As this is mostly a long, flat, straight section of roadway, a minimum roadway width of 30 feet (11 foot lanes and 4 foot shoulders) is believed to be adequate and appears feasible in this segment.

Richmond MM 0.627 to MM 0.900: Over 70% of this segment currently has 4 foot or wider shoulders. A minimum paved roadway width of 30 feet (11 foot lanes and 4 foot shoulders) appears feasible for most of this segment although there are a number of constraints in this

area that may limit the feasible roadway width. The most obvious, Bridge #24, the truss bridge over the Winooski River, has a 30 foot curb-to-curb roadway width. As discussed below in Section 5.10, Stormwater, there is permitted stormwater infrastructure that cannot be disturbed along the roadway in this area. Finally, the proximity, and lower elevation, of Johnnie Brook Road may limit the width of shoulder that can be provided along a portion of the southbound side.

Richmond 0.900 to 0.943: This segment of US2 includes Bridge #25 over the railroad tracks which has a curb-to-curb width of 28'-7". The existing lane widths are 12 feet and the existing paved shoulder widths are 1 foot. This segment is rated as "Uncomfortable for most bicyclists" (score of 4) on the Bicycle Level of Comfort Map. Reviewing the background data embedded in the Level of Comfort Map for this segment, the pertinent factor is the one foot paved shoulder widths. If this area was to have at least 2 foot wide shoulders, it would then meet the criteria for a rating of "Comfortable for experienced and confident bicyclists" (score of 3) and if it was to have at least 3 foot wide shoulders, it would then meet the criteria for a rating of "Comfortable for most adult bicyclists" (score of 2). Based on the curb-to-curb width, 11 foot lanes and 3 foot paved shoulders appear feasible for this segment.

Richmond 0.943 to 1.020: This segment of US2 is a very complicated section of roadway that includes the signalized intersection with VT117 and also includes the I89 Northbound entrance and exit ramps. The existing lane widths vary from 10 to 11 feet, the existing median widths vary from 0 to 8 feet, and the existing paved shoulder widths vary from 3 foot to 8 feet.

There are a number of pinch points in this segment. In most of this area, the roadway has been elevated significantly with fill and it appears that a large amount of earthwork would be required to widen the roadway. Traffic signal poles and street light poles also limit the amount of widening that is feasible in this area.

From MM 0.950 to MM 0.986 is rated as "Uncomfortable for most bicyclists" (score of 4) on the Bicycle Level of Comfort Map. Reviewing the background data, the limiting factor in this area is the 4 foot paved shoulder width. Due to the high AADT, 6 foot or wider shoulders would be required to improve the Level of Comfort score (assuming truck traffic is less than 10% of traffic stream). This amount of widening does not appear feasible. Although the amount of widening necessary to improve the Level of Comfort score does not appear feasible, a somewhat wider shoulder is still preferred by most bicyclists.

Due to the complexities of this area, it is not possible to provide "typical" recommended lane and shoulder widths. Generally, 10 or 11 foot lane widths, a 4 foot "desired" shoulder width, and a 3 foot minimum shoulder width at pinch points appears feasible for most of this segment.

Richmond MM 1.020 to MM 1.130: No comments.

Richmond 1.130 to 1.217: This segment of US2 is a somewhat complicated section of roadway that includes the signalized intersection with the Richmond Park & Ride and the I89 Southbound exit ramp and also includes the I89 Southbound entrance ramp. The existing lane widths are 11 feet, the existing median widths vary from 8 to 11 feet, and the existing paved shoulder widths vary from 3 foot to 5 feet.

From MM 1.185 to MM 1.217 is rated as “Uncomfortable for most bicyclists” (score of 4) on the Bicycle Level of Comfort Map. Reviewing the background data, the limiting factor in this area is the 3 foot paved shoulder widths. Due to the high AADT, 6 foot or wider shoulders would be required to improve the Level of Comfort score. This amount of widening does not appear feasible. Although the amount of widening necessary to improve the Level of Comfort score does not appear feasible, a somewhat wider shoulder is still preferred by most bicyclists.

Over 60% of this segment currently has 5 foot or wider shoulders. A minimum paved roadway width of 32 feet (11 foot lanes and 5 foot shoulders) or 43 feet (11 foot lanes, 5 foot shoulders, and 11 foot turning lane) appears feasible for this segment.

Section 6.2, High Crash Locations, below, includes a recommendation that construction of a left turn lane into the Park & Ride be considered for inclusion in this project. See Section 6.2 for additional information.

Richmond MM 1.217 to MM 2.500: This segment extends from just east of the Park and Ride to the northern edge of Richmond Village. Almost 80% of this segment currently has 3 foot shoulders and the remainder has 5 foot shoulders.

As noted previously in Section 5.5, the 2014 Vermont Route 2 Bicycle and Pedestrian Scoping Report evaluated many different alternatives for improving bicycling and walking conditions from the Park & Ride to Richmond village and concluded that that “The preferred short-term alternative is that the Town should work with VTrans to maximize as much as possible the width of the paved shoulders to be added to Route 2 as part of the upcoming repaving project” and that “With encouragement from the Town, VTrans might be able to create continuous four-foot-wide shoulders from the Park & Ride to the Village.”

Most of this segment, from MM 1.500 to MM 2.500, is rated as “Uncomfortable for most bicyclists” (score of 4) on the Bicycle Level of Comfort Map. Reviewing the background data, the limiting factor in this area is the 3 foot paved shoulder widths. Due to the high AADT, 6 foot or wider shoulders would be required to improve the Level of Comfort score. This amount of widening does not appear feasible. Although the amount of widening necessary to improve the Level of Comfort score does not appear feasible, a somewhat wider shoulder is still preferred by most bicyclists.

Based on the local desire as expressed by the Town of Richmond (both directly in meetings and in numerous planning documents), the High Use/Priority corridor designation, the very high AADTs, and the unfavorable Level of Comfort score of most of this segment, a minimum roadway width of 32 feet (11 foot lanes and a minimum shoulder width of 5 feet) in this area appears feasible in the scope of this Reclaim project although this width will not be achievable at Bridge #28 (29'-6" curb to curb) and may not be achievable where US2 is adjacent to Riverview Cemetery (approx. MM 2.07 to MM 2.25) and where the roadway is immediately adjacent to the railroad tracks (approx. MM 2.23 to MM 2.40).

Richmond MM 2.500 to MM 2.940: This segment represents the portion of US2 that is within Richmond village and which also has a sidewalk on at least 1 side of the roadway. Due to the existing sidewalks, curbing, and line of utility poles, increasing the width of the shoulders in this segment is generally not feasible.

From MM 2.500 to MM 2.677 is rated as “Uncomfortable for most bicyclists” (score of 4) on the Bicycle Level of Comfort Map. Reviewing the background data, the limiting factor in this area is the 3 - 4 foot paved shoulder widths. Due to the high AADT, 6 foot or wider shoulders would be required to improve the Level of Comfort score. As noted above, widening of this roadway segment is not feasible.

Based on input from District 5 personnel, parking along US2 within the village area is an important issue, especially during winter maintenance work, that needs to be clarified and brought into compliance with the MUTCD. This is especially an issue during winter maintenance work such as plowing and sanding. Currently, although vehicles are parked along significant portions of the roadway, there are no pavement markings or signs present to delineate parking spaces or the extents of allowed parking. Review of the shoulder widths and parking circumstances throughout this segment is as follows:

Richmond MM 2.500 to MM 2.610: This area has paved shoulder widths of approximately 4 foot shoulders and has raised curbs on each side of the roadway. Roadside parking is not believed to be a problem in this area.

Richmond MM 2.610 to MM 2.710: This is the area immediately west of the main intersection with Bridge Street and Jericho Road. The paved shoulder on the eastbound side of the roadway is approximately 4 feet wide and has a raised curb. Parking is not believed to be a problem on the eastbound side. On the westbound side, the paved shoulder tapers from approximately 4 feet wide at MM 2.610 to approximately 10 feet wide at MM 2.710 (at the intersection) and has a raised curb. Vehicles park on the westbound shoulder, most commonly in the vicinity of the intersection, however there are no parking related pavement markings or signs delineating parking spaces or the extents of allowed parking. From a review of Mapillary images and Google Maps images (see October, 2018 Google image included in the Appendix as Figure 3), it can be observed that sometimes cars park in the shoulder at least all the way down to the church. It is noted that the shoulder width at this point just barely allows a car to be fully out of the travel lane. As noted in Section 6.2 below, there has been at least one crash involving, per the crash report, a same direction sideswipe of a truck “illegally parked” on US 2 westbound near Baker Street. The westbound shoulder in this area is approximately 5 feet wide.

Richmond MM 2.710 to MM 2.940: This is the area immediately east of the main intersection with Bridge Street and Jericho Road. The parking situation is even less clear in this area. Again, on both the westbound side and the eastbound side, there are no parking related pavement markings or signs delineating parking spaces or the extents of allowed parking. The [Richmond Village Parking Study \(2007\)](#) specifically recommended that “On-street spaces along East Main Street should be formalized to encourage parking in this section of the village.” On the westbound side of the roadway, there is generally a narrow paved shoulder, then a narrow gravel buffer strip and then a paved sidewalk. These 3 features are typically all at essentially the same elevation as the roadway surface as there is no curbing. As shown in Mapillary images (see July, 2018 Mapillary image included as Appendix, Figure 4), vehicles typically are parked off the shoulder on this side, blocking the sidewalk. This can create significant issues for pedestrians, especially those with disabilities. The same

situation occurs on the eastbound side, although in some areas, the gravel buffer strip is wider, so that the sidewalk may only be partially blocked. See July, 2019 Google Maps image and July, 2018 Mapillary image which are included as Appendix, Figures 5 & 6.

Richmond MM 2.940 to MM 6.379: Approximately half of this segment currently has 3 foot or wider shoulders. A minimum roadway width of 30 feet (11 foot lanes and 4 foot shoulders) appears feasible for most of this segment although it will not be achievable at Bridge #33 (28'-0" curb to curb) and may not be achievable at some locations in Jonesville due to the proximity of houses to the roadway.

Bolton MM 0.000 to MM 1.860: Over 80% of this segment currently has 4 foot or wider shoulders. A minimum paved roadway width of 30 feet (11 foot lanes and 4 foot shoulders) appears feasible for most of this segment although it may be difficult to achieve on the right side between Bolton MM 0.02 and MM 0.12 due to the proximity of the railroad tracks.

5.6.5 Recommendations:

The recommended widths noted in the table below should be provided where reasonably achievable and within the scope of this project. The recommended minimum paved roadway widths, travel lane widths and minimum paved shoulder widths at the different roadway segments are as follows:

Route	FMM	TMM	Recommended Minimum Paved Roadway Width	Recommended Travel Lane Widths	Recommended Minimum Paved Shoulder Widths
Richmond	0.000	0.627	30 feet	11 feet	4.0 feet
Richmond	0.627	0.900	30 feet	11 feet	4.0 feet
Richmond	0.900	0.943	Maintain Existing	11 feet	3.0 feet (Minimum)
Richmond	0.943	1.020	Maintain Existing (+/-)*	10-11 feet	4.0 feet*
Richmond	1.020	1.130	Maintain Existing	11 feet	5.0 feet (Minimum)
Richmond	1.130	1.217	32 feet / 43 feet	11 feet	5.0 feet
Richmond	1.217	2.500	32 feet	11 feet	5.0 feet
Richmond	2.500	2.940	Maintain Existing / 30 feet (Minimum)	11 feet	Maintain Existing / 4 feet (Minimum)
Richmond	2.940	6.379	28 feet	11 feet	4.0 feet
Bolton	0.000	1.860	28 feet	11 feet	4.0 feet

Table 9 Roadway Width Recommendations

NOTE: * Indicates Paved shoulder widths should be made as close to 4 foot wide as feasible with little or no increase in existing paved roadway width.

When considering widening of the roadway, the need to acquire more ROW instead of leaving over-steeped slopes in place should also be considered as over-steeped slopes can cause tension cracks to develop.

If widening shoulders along the entire roadway segment is not feasible, priority for upgrading should be given to the segment from Richmond MM 1.15 to MM 2.50 as this has been identified as a priority by the Town of Richmond, both directly in meetings and also in numerous planning documents.

Also, because the segment from Richmond MM 1.215 to MM 2.50 has been identified as a priority by the town, if there are significant pinch points in an otherwise consistent shoulder, such as potentially at Bridge #28, consideration should be given to installing a “NARROW SHOULDER” warning sign.

It is strongly encouraged that VTrans work with the Town of Richmond to clearly delineate the extents of legal parking throughout Richmond village and bring it into compliance with the MUTCD. Perhaps more importantly, delineation of areas where parking is not allowed is also strongly encouraged. As this is a state maintained highway, any proposed designation of a “NO PARKING” zone requires the approval of the Vermont Traffic Committee.

One approach that could be discussed with the town would be to provide for parking on only one side of the roadway. This may allow room to have wider shoulders while also allowing space to park without being on the sidewalks.

As part of the process of addressing the parking issues, consideration should be given to installing a means of preventing vehicles from parking on the sidewalks between MM 2.71 to MM 2.94, such as curbing or vertical delineators.

It is recognized that resolving the parking issues along US2 to the satisfaction of both VTrans and the Town of Richmond could be difficult.

One possible solution that is reasonable to discuss with the Town of Richmond would be for the Town to take over a portion of US2 as a Class 1 Town Highway. Designation as a Class 1 Town highway means the Town takes over management and most maintenance of the roadway and has much more flexibility regarding maintenance and roadway design features such as speed limits, on street parking, crosswalk locations and placement of signs, although there are specific limitations on this design flexibility. VTrans provides annual compensation for Class 1 roadways via Town Highway Aid.

Additional information regarding Class 1 Town Highways, the benefits and responsibilities conferred on the town by this reclassification of a roadway, and a step by step guide to evaluating potential reclassification, is available in this [VTrans White Paper](#).

For purposes of discussion, it is assumed that the portion of US2 within the developed extents of Richmond village (from MM 2.48+/- to MM 3.07+/-) would be considered for Class 1 reclassification. In addition to maintenance of the pavement surface, some of infrastructure in this section for which the Town would take over maintenance responsibility includes the following:

- (1) traffic signal (consisting of 2 – 4 way signal heads)
- (0) bridges
- (32) small culverts
- (21) drop inlets

- (12) street lights
- signs

The existing traffic signal infrastructure at the main intersection could be an important factor for the Town while considering reclassification. Per the White Paper, the primary reason for hesitancy among some towns considering reclassification is that maintenance and operation of traffic signals becomes the responsibility of the town. Most towns do not have any experience or training to operate traffic signals although there are private contractors who can be hired to provide this service, and this is what is done by most municipalities who have traffic signals on their Class 1 highways.

5.7 Pedestrian Usage

The only sidewalks along US2 within the project limits are within Richmond Village. Concrete sidewalk and curbing are on both sides of the roadway from Richmond MM 2.50 to MM 2.72. Paved sidewalks without curbing are on both sides of the roadway from Richmond MM 2.72 to MM 2.94.

As noted above, it appears that vehicles are typically parked along both shoulders from MM 2.71 to MM 2.94 and that these vehicles often block some or all of the paved sidewalk in these areas. This can create significant issues for pedestrians, especially those with disabilities.

The only crosswalks along Route 2 within the project limits are also in Richmond Village, at MM 2.718, at the main 4-way intersection with Bridge Street and Jericho Road. At this intersection, there are pedestrian crosswalks at each leg of the intersection. In all 4 directions, there is pedestrian signal infrastructure consisting of separate steel posts supporting pedestrian push buttons and "WALK" signals.

Recommendations:

It is recommended that all crosswalks be restriped with durable pavement markings as part of this project.

Section 5.6.5 above includes recommendations to address current parking issues and prevent vehicles from parking on the existing sidewalks between MM 2.71 to MM 2.94.

Section 8.3 below includes a recommendation for full replacement of the traffic signals at the US2/Bridge Street/Jericho Road intersection. If signal replacement is included in this project, it should be verified that all pedestrian features at the intersection are fully compliant, including accessibility considerations.

See Section 8.3, Traffic Signals & ITS, for additional information regarding the pedestrian signal system.

For the remainder of this segment, based on the rural nature of this corridor and a review of pertinent crash data and regional plans, it does not appear necessary to include additional pedestrian accommodations within the scope of this Reclaim project.

5.8 Rail Trail Crossings:

There are no rail trail crossings, or associated work, within the project limits on US2.

5.9 Environmental Liability:

AMB has been in contact with the Pollution Prevention and Compliance Section to obtain information about environmental liabilities on this segment of US2 and will update this NPS if this information is received. If no information environmental liabilities information is included in the Final Draft of this NPS, AMB recommends that the Project Manager contact the Pollution Prevention and Compliance Section directly for their input on this project.

5.10 Stormwater:

The Water Quality Unit of the VTrans Maintenance Bureau has reviewed US2 within the project limits and has provided the following information:

There are two areas within the project limits that have permitted stormwater infrastructure.

The first location is generally near Bridge #24, the steel thru truss over the Winooski River at Richmond MM 0.71. There are permitted swales on the south side of the roadway along both the west and east approaches to the bridge. These swales are indicated by the green dashed lines in Figure 7 of the Appendix. There is also a disconnection area (flat grassed area where water sheet flows) on the north side of the roadway to the east of the bridge. This area is circled in red in the previously referenced image. The swales and the disconnection area are required by permit and should not be damaged by roadway reclamation work or by the parking or storage of vehicles or equipment.

The 2nd location is at the Park and Ride at Richmond MM 1.150. This area has a system of permitted swales around much of the perimeter of the parking lot. These swales are indicated by the red dashed lines shown in Figure 8 of the Appendix. These swales are required by permit and should not be damaged by the parking or storage of vehicles or equipment.

Another issue to be aware of is the potential for unpermitted tie ins located in Richmond village. If unpermitted ties ins are found, the VTrans Water Quality Unit recommends to “disconnect them or permit them”.

6 Safety Review:

The VTrans Public Crash Data Query Tool has been used to review crash data for US2 within the project limits and to compile the statistical data below. The Safety Section of the Operations and Safety Bureau has also reviewed US2 within the project limits and they have provided input on the following 3 sections.

6.1 Roadway Segment

A 5 year review reveals that in the period 2015 – 2019 inclusive, there were a total of (121) crashes on US2 within the project limits.

- Injury Type:
 - (1) Fatal crashes
 - (24) injury crashes
 - (79) Property Damage Only crashes

- (17) crashes with no information (most likely non-reportable crashes by law enforcement based on minimal estimated property damage)
- Collision Type:
 - (22) crashes did not note collision type
 - Of the remaining (99) crashes,
 - (33) were single vehicle
 - (7) were head on
 - (22) were rear end
 - (19) were broadside
 - (16) were sideswipe
 - (2) were other
- Impairment
 - (17) crashes did not note impairment information
 - Of the remaining 104 crashes,
 - (7) involved alcohol impairment
 - (1) involved drug impairment
- Involvement:
 - (0) crashes involved pedestrians
 - (0) crashes involved bicyclists
 - (3) crashes involved collisions with deer
 - (1) crash involved collision with moose
 - (2) crashes involved a heavy truck
 - (6) crashes involved a motorcycle
- Time of Year
 - 62 (51%) of the crashes were in the winter months (November- April)
 - 59 (49%) of the crashes were in the summer months (May – October)
- Road Conditions:
 - (24) crashes did not note specific road surface conditions
 - Of the remaining (97) crashes,
 - 31 (32%) noted snow/slush/ice conditions
 - 11 (11%) noted wet conditions
 - 55 (57%) noted dry conditions
- Weather Conditions:
 - (26) crashes did not note specific weather conditions
 - Of the remaining (95) crashes,
 - 19 (20%) noted freezing precipitation
 - 8 (8%) noted rain

Recommendations:

Section 5.6.5 (above) includes recommendations for wider paved shoulders which could help with recovery if a vehicle starts to go off the road and therefore, they could reduce the potential for lane departure crashes.

6.2 High Crash Locations

This corridor had (8) High Crash Locations (HCLs) identified in the 2012-2016 HCL Report.

High Crash Location – Richmond MM 0.553 – 0.853

- For the HCL period (2012-2016 inclusive), there were 6 crashes at this location
 - (1) resulted in injury, and (5) were property damage only
 - (1) was rear end, (4) were sideswipe, and (1) was other
 - (2) crashes involved a heavy truck
 - (1) crash involved a pedestrian
 - (0) crashes involved a bicyclist
 - (1) crash involved alcohol
 - (2) crashes occurred in work zones
 - (2) crashes (33%) occurred in the winter months
 - (5) crashes (83%) noted the road surface condition as dry
 - all (6) crashes noted the weather condition as clear or cloudy
- A 10-year review (2010-2019 inclusive) of this HCL indicates (13) crashes at this location
 - (3) resulted in injury, and (10) were property damage only
 - (1) was single vehicle, (6) were rear end, (5) were sideswipe, and (1) was other
 - (2) crashes involved heavy trucks
 - (1) crash involved a pedestrian
 - (0) crashes involved a bicyclist
 - (1) crash involved alcohol
 - (5) crashes occurred in the winter months
 - (0) crashes noted the road surface condition as snow/slush/ice
 - (0) crashes noted freezing precipitation

Of the (13) crashes at this HCL in the 10-year review period, (5) of the crashes involved a westbound vehicle rear-ending or same-direction-sideswiping a vehicle waiting to turn left onto Kenyon Rd. Four of these crashes have occurred in the last 4 years. These crashes represent all of the crashes that have occurred at this HCL in the last 4 years.

Recommendations:

VTrans guidance for the installation of a left turn lane at an unsignalized intersection suggests that a left turn lane should be considered if there have been 5 correctable left turning crashes over a 5 year period or an average of 1 per year. Over the last 4 years, at the intersection with Kenyon Road, there has been an average of 1 crash per year that could have been mitigated by a left-turn lane. Therefore, a left turn lane should be considered at this location, although it may be difficult to fit in due to the proximity of the bridge and the elevated nature of the roadway at this point.

Consideration should also be given to moving the westbound combined intersection/curve warning sign further west (closer to the bridge) and to adding a Kenyon Road name plaque to the sign.

High Crash Location – Richmond MM 1.100 – 1.180 (Intersection with I89 and Park & Ride)

- For the HCL period (2012-2016 inclusive), there were (12) crashes at this location
 - (3) resulted in injury, and (9) were property damage only
 - (3) were single vehicle, (5) were rear end, (3) were broadside, and (1) was sideswipe
 - (0) crashes involved heavy trucks
 - (0) crashes involved a pedestrian

- (0) crashes involved a bicyclist
- (1) crash involved alcohol
- (9) crashes (75%) occurred in the winter months
- (1) crash noted the road surface condition as snow
- (1) crash noted the weather condition as freezing precipitation
- A 10-year review (2010-2019 inclusive) of this HCL indicates 15 crashes at this location
 - (3) resulted in injury, and (12) were property damage only
 - (3) were single vehicle, (6) were rear end, (5) were broadside, and (1) was sideswipe
 - (0) crashes involved heavy trucks
 - (0) crashes involved a pedestrian
 - (0) crashes involved a bicyclist
 - (1) crash involved alcohol
 - (9) crashes (60%) occurred in the winter months
 - (1) crash noted the road surface condition as snow/slush/ice
 - (1) crash did not note weather condition; of the remaining (14) crashes, (1) crash noted freezing precipitation

This HCL includes the 4-way intersection with the Southbound exit ramp of I89 and the Richmond Park and Ride. Almost all of the crashes in this HCL occurred at this intersection. Prior to 2014, this intersection was controlled with stop signs for vehicles entering US2. Since 2015, this intersection has been controlled by traffic signals for all 4 directions.

In the 4 full years since the signals were installed (2016-2019 inclusive) there has been 4 crashes at this HCL. Two of these crashes involved a vehicle from the southbound interstate exit ramp attempting to cross US2 into the Park and Ride and colliding with a vehicle traveling westbound on US2.

During the District meeting for this project, District Maintenance personnel indicated that they receive many complaints about the lack of a left turn lane into the Park and Ride and that the number of complaints about / requests for a left turn lane seems to be increasing within the past year. It was also noted that the need for a turn lane at this intersection was documented as a Corridor Need in May, 2015 (See Section 7.1). Based on the wearing away of the pavement markings visible in 2018 Mapillary images and in 2019 Google images, it appears that many drivers turning left already move over into the painted island to avoid blocking the intersection, effectively creating their own left turn lane.

Based on personal experience from Safety Section personnel, when the light turns green for the I 89 Southbound exit ramp and for the Park & Ride, vehicles turning left off the ramp often do not yield to people making a right out of the Park & Ride.

The intersection with the I 89 Southbound exit ramp has a wide radius for traffic turning east onto US 2 and this allows excessive speeds coming off the ramp.

Recommendations:

To help reduce crashes and to address complaints, installation of a left turn lane should be considered for the US 2 eastbound direction at the intersection with the Park & Ride. This consideration process should be in accordance with VTrans guidelines and should include a traffic analysis of this location.

To reduce speeds of vehicles coming off the ramp, reducing the radius off the ramp for going eastbound on US2 should be considered.

High Crash Location – Richmond MM 2.353 – 2.653

- For the HCL period (2012-2016 inclusive), there were (9) crashes at this location
 - all (9) crashes were property damage only
 - (3) were single vehicle, (4) were rear end, (1) was broadside, and (1) was sideswipe
 - (0) crashes involved heavy trucks
 - (0) crashes involved a pedestrian
 - (0) crashes involved a bicyclist
 - (1) crash involved alcohol
 - (7) crashes (77%) occurred in the winter months
 - (5) crashes (55%) noted the road surface condition as snow or slush
 - (1) crash noted the weather condition as freezing precipitation
 - (7) crashes (77%) occurred in the day
- A 10-year review (2010-2019 inclusive) of this HCL indicates (14) crashes at this location
 - (2) resulted in injury, and (12) were property damage only
 - (3) were single vehicle, (6) were rear end, (3) were broadside, and (2) were sideswipe
 - (0) crashes involved heavy trucks
 - (0) crashes involved a pedestrian
 - (0) crashes involved a bicyclist
 - (1) crash involved alcohol
 - (10) crashes (71%) occurred in the winter months (3 crashes (29%) in January)
 - (6) crashes (43%) noted the road surface condition as snow/slush/ice
 - (2) crashes noted freezing precipitation

The crashes in this HCL are all located in the eastern quarter of the HCL segment which is also the portion of this segment which is within Richmond village.

The most common crash pattern at this HCL is crashes that involve a vehicle stopped in the roadway. There have been 6 rear end crashes, however, review of the crash reports indicates that 3 additional single vehicle crashes were lane departure crashes that were the result of evasive actions taken to avoid rear ending a stopped car. Many of these 9 crashes are clustered at the intersections of US 2 with Baker Street and Millet Street. These residential sideroads are narrow and appear relatively difficult to distinguish from driveways. As can be seen by comparison of July, 2018 Mapillary images and July, 2019 Google Maps images, the STATEWIDE – NORTHWEST STPG SIGN(63) sign project (see Section 8.2 for additional information) in 2019 replaced the street signs for these two streets and the signs were made larger and the text on the signs was made much larger and more legible.

One crash was a same direction sideswipe of a truck that, according to the crash report, was “illegally parked” along US 2 westbound travel lane near Baker Street “where there are no designated parking spaces”. The westbound shoulder in this area is approximately 5 feet wide. The operator was a Richmond resident.

The trees planted in the green strip between the roadway and the sidewalk on the Eastbound side impede sight lines for seeing vehicles entering the roadway from driveways on this side.

Also, more specifically, in July, 2018 Mapillary images and July, 2019 Google Maps, the Eastbound advance traffic signal warning sign at Richmond MM 2.61 is hidden from view by foliage until you get very close to the sign.

See Section 5.6.4 above for discussion of relevant parking issues within Richmond village.

Recommendations:

As noted above, safety improvements that improve awareness that vehicles may be stopped in the roadway to turn onto Baker Street or Millet Street have already been made by replacing the street signs for these streets with ones that are much larger and more legible.

Possible improvements that should be considered to improve visibility of the Eastbound advance traffic signal warning sign at MM 2.61 include, at a minimum, moving the sign and eliminating the foliage. It appears likely that trees in this area would need to be removed, not just trimmed, in order to ensure the sign is visible as it is approached.

The trees in the green strip on the Eastbound side should be trimmed of lower branches to improve visibility of vehicles entering US2 from driveways on this side.

See Section 5.6.5 above for recommendations regarding the resolution of parking issues within Richmond village.

High Crash Location – Richmond MM 2.690 – 2.770 (Intersection w/ Bridge St. & Jericho Rd)

(NOTE: PER 2012-2016 HCL Report, crashes on Bridge Street & Jericho Road between MM 5.12 and MM 5.18 are included in this HCL.)

- For the HCL period (2012-2016 inclusive), there were (24) crashes at this location
 - all (24) crashes were property damage only
 - (1) crash did not note crash type; of the remaining (23) crashes, (1) was single vehicle, (8) were rear end, (6) were broadside, (3) were sideswipe, (2) were other, and (3) were rear-to-rear crashes while backing up
 - (1) crash involved a heavy truck
 - (0) crashes involved a pedestrian
 - (0) crashes involved a bicyclist
 - (3) crashes involved alcohol
 - (9) crashes (38%) occurred in the winter months
 - (3) crashes did not note road surface condition; of the remaining (21) crashes, (1) crash (8%) noted the road surface condition as snow/slush/ice
 - (2) crashes did not note weather condition; of the remaining (22) crashes, (2) crashes noted freezing precipitation
- A 10-year review (2010-2019 inclusive) of this HCL indicates (43) crashes at this location
 - (2) resulted in injury, (38) were property damage only and (3) were “non-reportable”
 - 6 crashes did not note crash type; of the remaining 37 crashes, 2 were single vehicle, 11 were rear end, 12 were broadside, 6 were sideswipe, 3 were other, and 3 were rear-to-rear crashes while backing up
 - 1 crash involved a heavy truck
 - (1) crash involved a pedestrian
 - (0) crashes involved a pedestrian
 - 1 crash involved a motorcycle

- 3 crashes did not note impairment information; of the remaining 40 crashes, 4 crashes (10%) involved alcohol
- 16 crashes (37%) occurred in the winter months
- 7 crashes (16%) occurred in December
- 8 crashes did not note road surface condition; of the remaining 35 crashes, 1 crash (3%) noted the road surface condition as snow/slush/ice
- 8 crashes did not note weather condition; of the remaining 35 crashes, 2 crashes (6%) noted freezing precipitation

This HCL includes the main intersection in Richmond village of US2 with Bridge Street and Jericho Road. Although this HCL is located at the main intersection in Richmond village, only 9 of the 43 crashes occurred while traveling through the intersection. The remaining crashes occurred while stopped / stopping for the traffic signals or were not directly related to the intersection. (Note: For 4 crashes, a narrative was not included in the crash report). Crash patterns observed in the crashes that are directly related to traveling through the intersection are discussed below.

- 7 of the 9 crashes in the 10 year review period that are directly related to traveling through the intersection involved a left turn. The most common characteristics of these crashes are as follows:
 - 2 crashes in the 10 year review period involved a northbound vehicle on Bridge Street turning left onto US2 and hitting an southbound vehicle continuing straight after coming from Jericho Road
 - 2 crashes involved an eastbound vehicle on US2 turning left and hitting a westbound vehicle on US2 continuing straight through intersection

Crash patterns observed in the crashes that are not directly related to traveling through the intersection are discussed below.

- 13 crashes in the 10 year review period involved a vehicle either entering or exiting the Cumberland Farms onto either US2 or Bridge Street. These crashes are further characterized as follows:
 - 5 crashes involved vehicles backing out of the Cumberland Farms onto either US2 or Bridge Street
 - 5 crashes involved a westbound vehicle on US2 stopped to turn left into Cumberland Farms (Note: In 3 of these crashes, the westbound vehicle had just turned left off of Bridge Street and was rear ended by the car behind it).
 - 2 crashes involved a northbound vehicle on Bridge Street turning left into Cumberland Farms
 - 1 crash involved a vehicle pulling out of Cumberland Farms onto US2
- 12 crashes involved vehicles backing up into another vehicle. These crashes are further characterized as follows:
 - 5 crashes involved vehicles backing out of the Cumberland Farms onto either US2 or Bridge Street
 - 3 crashes involved vehicles backing up in the roadway because they overshot the stop bar at the intersection
 - 2 crashes involved vehicles backing up while trying to turn around
 - 2 crashes involved vehicles backing while either entering or exiting a parking spot

- 6 crashes involved a vehicle either entering or existing a parking spot.
- 4 crashes involved a vehicle stopped in the roadway being rear ended.

The Safety Section of the Operations and Safety Bureau looked at this intersection in December 2017 and produced collision diagrams (see Appendix, Figures 9 & 10), that match the 2012-2016 HCL period. As a result of this review, a shorter cycle length was implemented and a span wire mounted sign “Opposing Traffic May Have Extended Green” facing Jericho Road was installed. Three crashes occurred at this intersection from 2018-2019.

At a virtual meeting with VTrans staff held to discuss this project on October 22, 2020, the Town of Richmond expressed a desire for a left turn lane/signal from Bridge Street onto US2. Due to the proximity of the brick building on the south side of the intersection and the Cumberland Farms parking lot on the north side, establishing a turn lane here will be a very difficult task and would not be completed as part of this project. If this is an ongoing concern for the Town, it may make sense to consider the feasibility of a turn lane as a separate project. In any event, it seems prudent to have the design and detailing of this project done in a manner to best accommodate a future “Left Turn off Bridge Street” project.

Recommendations:

Due to the highly developed nature of this “downtown” location, there are not many feasible options for safety improvements at this HCL.

The most feasible method of providing safety improvements at this HCL is by upgrading the traffic signals. As noted in Section 8.3 below, full replacement of the existing traffic signals infrastructure, including the installation of new mast arms, is recommended at this intersection.

It is recommended that a left turn phase from Bridge St be included in the programming of these new signals.

All aspects of this project (including the traffic signal infrastructure) in the area around the US2 / Bridge Street / Jericho Road intersection should be designed and detailed to best allow for the addition of a left turn lane on Bridge Street as part of a possible future project.

If the Town expresses an ongoing concern regarding a left turn lane onto US2 from Bridge Street, consideration should be given to initiating a feasibility study of this left turn lane as a separate project.

Recommendations made in Section 5.6.5 (above) for the resolution of parking issues on US2 within Richmond village are also applicable at this segment.

High Crash Location – Richmond MM 3.253 – 3.553

- For the HCL period (2012-2016 inclusive), there were (5) crashes at this location
 - (1) resulted in injury, and (4) were property damage only
 - all (5) were single vehicle
 - (0) involved heavy trucks
 - (0) crashes involved a pedestrian
 - (0) crashes involved a bicyclist
 - (1) crash involved alcohol
 - (1) crash involved a motorcycle
 - all (5) occurred in the winter months

- (3) crashes (60%) noted the road surface condition as snow or ice
- (2) crashes (40%) noted the weather condition as freezing precipitation
- A 10-year review (2010-2019 inclusive) of this HCL indicates (8) crashes at this location
 - (3) resulted in injury, and (5) were property damage only
 - (6) were single vehicle, (1) was head on, and (1) was sideswipe
 - (0) crashes involved heavy trucks
 - (0) crashes involved a pedestrian
 - (0) crashes involved a bicyclist
 - (1) crash involved alcohol
 - (1) crash involved a motorcycle
 - (6) crashes (75%) occurred in the winter months
 - (3) crashes (38%) noted the road surface condition as snow/slush/ice
 - (2) crashes (25%) noted freezing precipitation

The (8) crashes at this HCL within the 10 year review period all appear to have occurred in the vicinity of the S curves that are located between Richmond MM 3.41 and MM 3.66. There are also vertical curves occurring along with the horizontal curves. The crashes were all lane departure crashes and at least 3 crashes involved crossing the center line. Three of the crashes happened on an icy or slushy surface. The rest of the crashes were due to driver error.

In 2012 Google Maps and 2014 thru 2018 Mapillary images, the following traffic signs related to the curves were visible:

- Eastbound, there is a reverse curve warning sign located at MM 3.378 that depicts relatively shallow curves and the signpost also includes an advisory 35 MPH speed limit sign.
- Westbound, there is a reverse curve warning sign located at MM 3.700 that depicts relatively shallow curves and the signpost also includes an advisory 35 MPH speed limit sign.
- Westbound there is a curve warning sign located at MM 3.940
 - The smaller curve, centered at MM 3.47, has 1 large arrow sign in both directions.
 - The large curve, centered at MM 3.590, has 4 chevron signs in both directions.

As noted by review of July, 2019 Google Maps images, the following changes have been made to the signage at these curves as part of the STATEWIDE – NORTHWEST STPG SIGN(63) project in 2019:

- The location of the eastbound reverse curve warning sign was moved approximately 200 feet east, to MM 3.417, to be closer to the curves. The reverse curve warning sign has been replaced with a similar sign depicting 90 degree curves and the advisory speed limit sign has been revised to be 30 MPH.
- Westbound, the reverse curve warning sign has been replaced with a similar sign depicting 90 degree curves and the advisory speed limit sign has been revised to be 30 MPH.
- Westbound the curve warning sign has been moved approximately 500 feet west, to MM 3.845, to be much closer to the curves.
- The smaller curve, centered at MM 3.47, still has (1) large arrow sign in both directions.
- The large curve, centered at MM 3.590, now has (5) chevron signs in both directions.

There is a lot of tall vegetation along the inside of these two curves that greatly reduces sight distances and also shades the roadway which is likely to be contributing to icing conditions in this area. Clearing this vegetation and sloping the bank back would improve site distances and help drivers be more aware of the curves as they approach them. This would also reduce the potential for icy conditions by reducing shading of the roadway.

The narrow shoulders in these curves do not allow much room for recovery in lane departure events. Providing wider shoulders would allow more room for possible recovery.

The lack of a ditch along the inside of these curves is also likely contributing to icing conditions either by allowing additional moisture to flow onto the roadway, or at least by allowing existing moisture to remain on the roadway. A properly sized continuous ditch would reduce the potential for moisture remaining on the road surface and creating an icing condition.

Recommendations:

As this is a Reclaim project, providing superelevation of the roadway is a feasible option that is recommended at these S curves to help reduce lane departure crashes.

The following safety improvement measures are recommended, where feasible, along the Westbound side from Richmond MM 3.430 to 3.510 and along the Eastbound side from Richmond MM 3.52 and MM 3.56:

- clearing trees and other growth and excavating the existing bank back
- establishing an adequately sized continuous ditch throughout the curves
- establishing four foot wide paved shoulders throughout the curves
(as previously recommended for throughout this segment in Section 5.6.5)

It should be noted that large, steep ledge outcroppings are visible along most the Westbound area noted above, so a significant amount of ledge removal may be necessary to achieve the above recommendations. Obtaining additional right of way may be required to achieve these recommendations but it should be considered at this location.

It appears a couple of small bedrock outcrops may be encountered while excavating the bank in the Eastbound area noted above.

Centerline Rumble Strips, recommended throughout the rural portions of this project in Section 6.3 (below), will help reduce crashes in these curves that involve crossing the centerline.

A High Friction Surface Treatment should also be considered at this location.

Because of the combination of horizontal and vertical curve, upsizing the curve warning signs and the chevrons should be considered.

High Crash Location – Richmond MM 4.853 – 5.153

- For the HCL period (2012-2016 inclusive), there were (6) crashes at this location
 - (1) was a fatality, 2 resulted in injury, and 3 were property damage only
 - (4) were single vehicle, 1 was head on, and 1 was rear end
 - (4) crashes involved motorcycles
 - (0) crashes involved a pedestrian
 - (0) crashes involved a bicyclist
 - (1) crash involved drugs

- (1) crash occurred in the winter months
- (1) crash did not note road surface condition; all (5) of the remaining crashes noted the road surface condition as dry
- All (6) crashes noted the weather condition as either cloudy or clear
- A 10-year review (2010-2019 inclusive) of this HCL indicates 14 crashes at this location
 - 1 was a fatality, 5 resulted in injury, and 8 were property damage only
 - 8 were single vehicle, 4 were head on, 1 was rear end, and 1 was sideswipe
 - 6 crashes involved motorcycles
 - (0) crashes involved a pedestrian
 - (0) crashes involved a bicyclist
 - (7) crashes occurred in the winter months
 - (1) crash did not note road surface condition; of the remaining (13) crashes, 5 crashes (38%) noted the road surface condition as snow/slush/ice
 - 3 crashes (33%) noted freezing precipitation

The majority of crashes at this HCL within the 10 year review period have occurred in the vicinity of the reverse curve that is located between MM 4.853 and MM 5.020. Most of the crashes were lane departure crashes and at least 4 crashes involved crossing the center line. Five of the crashes happened on an icy or slushy surface.

There is a lot of tall vegetation along the inside (Westbound) of the large curve that greatly reduces sight distances and also shades the roadway which is likely to be contributing to icing conditions in this area. Clearing this vegetation and sloping the bank back would improve sight distances and help drivers be more aware of the curves as they approach them. This would also reduce the potential for icy conditions by reducing shading of the roadway.

This area is constrained by ledge on the westbound side and the guardrail on the eastbound side. The shoulders are narrow on both sides (the westbound shoulder is approximately 1 foot wide) which does not allow much room for recovery during lane departure events. Providing wider shoulders would allow more room for possible recovery.

The lack of a ditch along the inside of this curve is also likely contributing to icing conditions either by allowing additional moisture to flow onto the roadway, or at least by allowing existing moisture to remain on the roadway. A properly sized continuous ditch would reduce the potential for moisture remaining on the road surface and creating an icing condition.

Based on 2018 Mapillary images, this reverse curve has advance curve warning signs, that include 35 mph advisory speed limit signs, in both directions (Eastbound at MM 4.816 and West bound at MM 5.207). There are also (3) chevron signs along the curve in both directions. As noted by review of July, 2019 Google Maps images, it does not appear that any signage changes were made at these curves as part of the 2019 sign project.

Recommendations:

As this is a Reclaim project, superelevation is a feasible option that is recommended at the curves in this HCL to help reduce lane departure crashes at these locations.

The following safety improvement measures are recommended, where feasible, along the Westbound side from Richmond MM 4.940 to 5.010:

- clearing trees and other growth and excavating the existing bank back

- establishing an adequately sized continuous ditch throughout the inside of the curve
- establishing four foot wide paved shoulders throughout the inside of the curve (as previously recommended for throughout this segment in Section 5.6.5)

It should be noted that large ledge outcroppings are visible along the Westbound side at this location, so a significant amount of ledge removal may be necessary to achieve the above recommendations. Obtaining additional right of way may be required to achieve these recommendations but it should be considered at this location.

Centerline Rumble Strips, recommended throughout the rural portions of this project in Section 6.3 (below), will help reduce crashes in these curves that involve crossing the centerline.

A High Friction Surface Treatment should also be considered at this location.

High Crash Location – Richmond MM 5.253 – 5.553

- For the HCL period (2012-2016 inclusive), there were (5) crashes at this location
 - (2) resulted in injury, and 3 were property damage only
 - (3) were single vehicle and 2 were rear end
 - (1) crash involved a motorcycle
 - (0) crashes involved a pedestrian
 - (0) crashes involved a bicyclist
 - (3) crashes occurred in June, the other (2) occurred in July
 - all (5) of the crashes noted the road surface condition as dry
- A 10-year review (2010-2019 inclusive) of this HCL indicates (7) crashes at this location
 - (2) resulted in injury, and (5) were property damage only
 - (5) were single vehicle, and (2) were rear end
 - (1) crash involved a motorcycle
 - (0) crashes involved a pedestrian
 - (0) crashes involved a bicyclist
 - (1) crash involved a moose
 - (1) crash involved alcohol
 - (2) crashes occurred in the winter months
 - (3) crashes (43%) occurred in June
 - (2) crashes (29%) noted the road surface condition as snow/slush/ice
 - (2) crashes (29%) noted freezing precipitation

Four of the crashes in this HCL during the 10 year review period were lane departure crashes and at least two of these crashes occurred at the curve near Lily Pond.

In 2012 Google Maps and 2014 Mapillary images, there are no warning signs at this curve. In 2016 and 2018 Mapillary images, this curve has advance curve warning signs in both directions (eastbound at MM 5.242 and eastbound at MM 5.378) and these signposts also include advisory speed limit signs (35 MPH eastbound and 40 MPH westbound). As noted by review of July, 2019 Google Maps images, the curve warning signs are present, but the advisory speed limit signs were removed as part of the 2019 sign project.

Two of the crashes in this HCL occurred when a vehicle rear ended another vehicle stopped in the roadway to make a turn into a driveway.

Recommendations:

As this is a Reclaim project, superelevation is feasible and is recommended at the curve near Lily Pond to help reduce lane departure crashes at this location.

Centerline Rumble Strips, recommended in Section 6.3 for throughout the rural areas of this project, will help reduce lane departure crashes which involve crossing the centerline.

High Crash Location – Richmond MM 6.153 – Bolton MM 0.074

- For the HCL period (2012-2016 inclusive), there were (5) crashes at this location
 - (1) resulted in injury, and 4 were property damage only
 - (1) was rear end, 1 was broadside, 2 were sideswipe, and 1 was other
 - (1) crash involved a motorcycle
 - (0) crashes involved a pedestrian
 - (0) crashes involved a bicyclist
 - (1) crash (20%) occurred in the winter months
 - all (5) of the crashes occurred during the day with dry road surface conditions
- A 10-year review (2010-2019 inclusive) of this HCL indicates (12) crashes at this location
 - (1) resulted in injury, (10) were property damage only and (1) was “non-reportable”
 - (2) crashes did not note crash type; of the remaining (11) crashes, (2) were single vehicle, (1) was head on, (1) was rear end, (3) were broadside, (2) were sideswipe, and (1) was other
 - (1) crash involved a motorcycle
 - (0) crashes involved a pedestrian
 - (0) crashes involved a bicyclist
 - (6) crashes (50%) occurred in the winter months
 - (2) crashes did not note road surface condition; of the remaining (10) crashes, (3) crashes (30%) noted the road surface condition as snow/slush/ice
 - (2) crashes did not note weather condition; of the remaining (10) crashes, (4) crashes (40%) noted freezing precipitation and (1) crash (10%) noted rain

At least half of the crashes at this HCL during the 10 year review period occurred at the 4 way intersection with Cochran Road and Stage Road. Four of these crashes involved a vehicle on Cochran Road either failing to yield, or failing to stop at all, at the intersection with US2. In all four of these crashes, the vehicle from Cochran Road hit a westbound vehicle on US2.

When approaching this intersection from the south on Cochran Road, the intersection is hidden by a vertical curve in Cochran Road that occurs right near the intersection. There is an advance warning sign indicating that there is an upcoming stop sign. The approach to the intersection from this direction is also complicated by the at-grade railroad crossing #247-319R immediately adjacent to the intersection. The rail crossing is so close to the intersection that the stop line on the pavement is located on the south side of the rail crossing which puts it approximately 70 feet back from the edge of the travel lane on US 2. Also, it should be noted that 2019 Google Maps images show vehicles parked along Cochran Road and US2 in the vicinity of this intersection. It appears that people are parked in these locations while swimming in the river. Parked cars along this area of US2 could potentially obstruct the view of oncoming US2 traffic while approaching on Cochran Road, although none of the crash reports noted this as a factor.

One of the crashes at this HCL during the 10 year review period occurred when a driver backed up on Stage Road, hitting another vehicle, after mistakenly pulling off US2 onto Stage Road while looking for a specific address. From a review of 2018 Mapillary images and 2019 Google Maps images, the street name plaque for Stage Road was replaced and made larger and much more legible as part of the 2019 sign project.

Recommendations:

It is strongly recommended that safety improvements be made that will provide additional warning of the intersection and stop sign when approaching the US2 intersection from Cochran Road. Possible safety improvements that should be considered, if they are determined to be within the project scope, include, at a minimum, the following:

- install an additional stop sign on the left-hand side of Cochran Road
- install permanent “STOP” pavement marking near to the stop sign
- install permanent stop bar markings
- install permanent “STOP AHEAD” pavement markings near the advance stop warning sign
- install a “STOP AHEAD” warning sign in addition to or replacing the existing advance stop warning sign
- review the size and location of the existing advance stop warning sign

Another safety improvement that should be considered is an advance warning intersection sign with a street name plaque for westbound traffic on US 2.

6.3 Centerline Rumble Strips:

To reduce the number of centerline crossing crashes, centerline rumble strips (CLRS) are being considered on all State and US Routes. It is current (December, 2020) VTrans policy that CLRS are considered where:

- Pavement width is 28 feet or greater (with a minimum of 3-foot wide paved shoulders)
- Speed limit is 45 mph or higher
- Annual Average Daily Traffic is 1500 vehicles per day or greater

CLRS should also be considered in locations where the above criteria are not met but the crash history indicates a pattern of head-on, sideswipe, or single vehicle crashes.

CLRS are not considered where there are closely spaced residences located within 100 feet of the roadway centerline.

For purposes of completing a preliminary, simplified, assessment of the suitability of CLRS for US2 within the project limits, it is assumed that a paved width of at least 28 feet can be achieved in all areas.

Approximately 53% of this project’s length is comprised of rural areas that meet the 3 principal criteria noted above for installation of CLRS.

Most of remaining portion of the project length, although it does not meet the speed limit criteria, is still rural in nature, and does not have closely spaced residences located within 100 feet of centerline.

The 2 remaining areas not included in the above are the segment in Richmond village and the segment in Jonesville. The segment in Richmond village does not meet the speed limit criteria, is densely populated, and has closely spaced residences located within 100 feet of centerline.

The segment in Jonesville does not meet the speed limit criteria, is more densely populated than the adjacent rural areas, and has short sections where there are closely spaced residences located within 100 feet of centerline.

Recommendations:

Based on the above review, and the presence of many horizontal curves, the installation of CLRS as part of the scope of this project is recommended throughout the project limits except in Richmond Village and in Jonesville where closely spaced residences are located within 100 feet of the roadway centerline. Final decisions regarding the specific roadway extents where CLRS are to be included in this project should be made in accordance with all Agency guidelines in effect at the time of roadway design.

7 District Needs:

The most up to date information regarding district needs has been used in the preparation of this NPS, however, this corridor should be reviewed with District staff again just prior to the start of design to identify any additional current corridor needs which should be considered. The District staff should also be included in all project reviews throughout the design of the project.

7.1 Needs from Corridor Needs Database:

Based on a review using the Corridor Need Viewer, there are 16 locations where a corridor need has been identified along US2 within the project limits. Table 10, below, lists these corridor needs. It is recommended that, early in the project’s design phases, each item be explored further and/or considered for inclusion in the project:

Town	Mile Marker	Issue Category	Issue Description	Action Needed
Richmond	0.94	Roadway	Guardrail is always being damaged and rarely as an crash report accompanying it	New guardrail configuration
Richmond	1.15	Safety	Need turn lane, traffic backs up in morning	Restripe road, adject shoulders need lights
Richmond	2.25	Culvert	Original stone box has been extended with pipes, catches debris during heavy rains	
Richmond	3.22	Bridge	Concrete from bridge #29 falls	General maintenance
Richmond	2.41 (3.629)	Culvert	Culvert PID 64456, electric fence wire running through culvert, district is trying to take care of line	Culvert replacement
Richmond	3.68	Slope	Major slope failure. Been fixed at least twice. Guardrail starting to tilt back. Roadway is sloping. In a dangerous spot. Currently the fix has been to stabilize with medium to large material	Permanent stabilization
Richmond	3.85 (3.835)	Culvert	24in Culvert Failed, Metal	Replace Culvert
Richmond	3.90	Slope	Off of bridge start of slope failure on WB	Stabilization
Richmond	3.90	Bridge	Bridge #31 - poor condition by inspection	General Maintenance
Richmond	4.00	Slope	Slope failure, been fixed at least once , large and medium material has been used to stabilize slope.	
Richmond	4.25 (4.264)	Culvert	PID #64450 separation on ends of culvert and sinkhole above pipe inlet	Re Attach End Segments Or Full Replacement If Needed

Richmond	4.30 (4.350)	Safety	Rock is close to road, can be a safety concern	Chip Away Ledge To Allow Safety Of Plow And Drivers As Well As Ditchline
Richmond	4.33 (4.377)	Culvert	Slope failure above culvert, have been fixed once with large stone, bank is starting to erode from stream.	Slope Stabilization With Larger Material
Richmond	5.30 (5.272)	Culvert	Erosion around culvert	Bank/Slope Stabilization
Bolton	0.05	Slope	Multiple washouts along EB	More Stabilized Fix, Large Stone And Vegetation To Hold Everything In
Bolton (Richmond)	0.10 (6.310)	Slope	Cribbing type retaining wall has failed	New Retaining Wall

Table 10 District Needs from Corridor Needs Database

7.2 Needs from District Meeting:

A District Needs Meeting was held with District 5 staff as part of the development of this NPS. Table 11, below, lists pertinent issues and other information discussed during the meeting. It is recommended that, early in the project's design phases, each item be explored further and/or considered for inclusion in the project:

Town	Mile Marker	Notes
General		District noted that there are numerous culverts, especially east of Richmond Village, where culvert inlets and outlets are near edge of pavement already and these areas cannot be widened without extending or replacing these culverts
General		Wherever culverts need to be extended, especially stone box culverts or concrete box culverts, the District would prefer full replacement instead of extending the existing culvert with metal pipes. They believe that most of the culverts that would need extending are old and probably already in relatively poor condition.
General		District recommends against widening shoulders significantly unless the roadway base is also extended to adequately support the roadway. Shoulders with side slopes that are too steep will break up and are a high maintenance issue.
General		District recommends that the invert and outlet locations of culverts be taken into account when considering widening the roadway so the shoulders aren't vertical in these areas which creates problems with shoulder material filling in the inlets & outlets
General		District supports widening shoulders to be 4 feet if that can be done with consideration to the above two recommendations
General		District's preference is for replacement guardrail to be W beam guardrail.
General		District will send a list of their concerns including areas where clearing is needed
General		District expressed concern about utility poles being left immediately adjacent to paved shoulders if shoulders are widened. It was noted that widespread relocation of poles is not feasible but individual poles may be relocated if they are a safety concern
General		District asked whether curb board would be installed as part of this project in areas where slope stabilization work is being done
General		District recommends that all guardrail installed in areas with slope stability concerns have extended (maybe 8'-0"?) posts
General		There is a buried fiber optic line running along the roadway throughout the US 2 corridor that will need to be located and considered in design and construction.
Willison	5.75	Bridge #23 - Culvert is in very poor condition and rusted out walls are crushing causing a dip in the road. Inspection Report notes that it is highly probable that a significant dip/sinkhole could develop in the westbound lane.
Richmond	0.000 - 0.550	Removal of built-up berms along shoulders is needed - soil is higher than pavement and water ponds in this area.
Richmond	0.940	Corridor Need - guardrail issue - Tractor trailers turning right towards Williston from VT 117 have smashed the guardrail here numerous times and the District keeps fixing it. Can the guardrail at this corner be looked at and redesigned? Maybe make corner wider, more gradual?

Richmond	0.950	Box culvert - wingwalls have fallen in and bank is eroding - District has done a couple of temporary fixes - needs slope stabilization from bottom to top
Richmond	0.950	Bridge #26 - Very long culvert with beaver problems - have removed dams numerous times - District looking for any help they can get - sometimes dams built within the culvert - maybe install trash racks on end to at least keep them out of actual culvert.
Richmond	1.150	Corridor Need – Need a turn lane - District gets many complaints about lack of left turn into Park & Ride & complaints/requests seem to be increasing in the last year
Richmond	1.253	Small culvert #64516 - Inlet and outlet wingwalls are detached and collapsing.
Richmond	1.275	District has recently encountered some potential settling due to buried slabs at this location.
Richmond	1.450	Retaining Wall - RW0029 - needs soil & vegetation removed from base of wall, needs overgrown trees removed from on top of wall as roots are starting to grow into wall and will cause / are causing damage
Richmond	1.470 - 1.520	On Westbound side, District would like vegetation removed in this area.
Richmond	1.790-1.810	Small culvert #? - concrete box inlet is near edge of shoulder - will probably need to be extended or replaced if shoulder is widened - District would prefer replacement
Richmond	1.808	Small culvert #64508 has the beginning of concrete erosion at inlet and has 1 bad part of box wall at outlet
Richmond	1.910	Bridge #28 - wingwalls are tipping
Richmond	2.012	Small culvert #64504 - inlet is very near edge of shoulder - culvert will probably need to be replaced or extended if shoulder is widened
Richmond	2.23 - 2.44	Proximity of railroad in this area is a potential issue for shoulder widening and for drainage improvements. Road ROW and Railroad ROW believed to overlap in some/most of this area and it is believed that railroad ROW takes precedence. Also, it is believed that some drainage infrastructure, such as DI's, is shared between road and railroad. District would appreciate any help we can give them in improving drainage and addressing ROW concerns in this area
Richmond	2.250 - 2.270	Corridor Need - Small culvert #64501 – Original stone box has been extended with pipes - catches debris during heavy rains - needs to be reviewed and addressed - District would prefer replacement
Richmond	2.430 - 2.490	District would like vegetation removed in this area - along northbound side - a lot of overhanging vegetation
Richmond	2.467	Small culvert #64499 is heavily plugged with sediment
Richmond	2.500 - 2.930	District would like the parking situation in Richmond village to be much more clearly defined, both west of Bridge Street (MM 2.500 - MM 2.720) and east of Bridge Street (MM 2.720 - MM 2.930). It is not clear where on-street parking is allowed. Currently, winter road maintenance (plowing) is especially problematic due to vehicles parked along the roadway through Richmond village. District would like a very clear delineation of where parking is / is not allowed. In areas where parking should not be allowed, District recommends NO PARKING signs. Should there be a maintenance agreement to clear snow from areas where parking is going to be allowed?
Richmond	2.720 - 2.930	If on-street parking is allowed, the District would like vertical curbing installed in those same areas - however, effects of added curbing on the drainage system would need to be investigated. It was also noted that curbing typically is not included in paving projects but it could be considered.
Richmond	2.900	Utility poles on Eastbound side are already very close to roadway - would be even closer to edge if shoulder is widened - District has hit these poles before while plowing - District requests they be moved further off road
Richmond	2.900 - 2.928	Parking lot for business's retail store immediately adjacent to Eastbound side has approximately 115 foot wide access onto roadway. District wonders if this access could be reduced to be more in line with a typical current access standard? Note that this business also has good access to the back of the building through the access drive at MM 2.990.
Richmond	3.430 - 3.510	Ledge outcropping along inside of curve (Westbound side) is immediately adjacent to roadway - should be removed for safety / will need to be removed to widen shoulder in this area / also needs to be removed to be able to establish a decent ditch in this area - currently water ponds in this area and freezes as it is cold in this area due to the exposed ledge
Richmond	3.449	Small culvert #64458 - inlet is plugged - at outlet, headwall is leaning
Richmond	3.470 - 3.510	District would like the pulloff on Eastbound side paved - Note there is now a new driveway access for a house in this area so may not be feasible to have a pulloff here still - need to field verify
Richmond	3.610 - 3.750	Corridor Need - On Eastbound side, slope stabilization is needed - guardrail is tipped back - significantly in some areas (MM 3.670 to MM 3.740 appears to be the most tipped) - pavement cracking in shoulder -slope stabilization work has been done at this location previously
Richmond	3.629	Corridor Need - Small culvert #64456 has severe rusting - also an electric fence line running through it - action needed per Corridor Need's database is "Culvert Replacement"
Richmond	3.660 -3.760	District would like vegetation removed in this area - along Westbound side
Richmond	3.712	Small culvert #64455 - original pipe from when road was built - is very rusted

Richmond	3.760 - 3.770	Ledge outcropping on Westbound side immediately adjacent to roadway should be removed for safety / to widen shoulder / to establish a better ditch
Richmond	3.835	Corridor Need - Small culvert #64454 - 24" metal pipe has rusted through and failed - action needed per Corridor Need's database is "Culvert Replacement" - per District this is an original pipe from when road was built
Richmond	3.900	Corridor Need - Slope stabilization needed at banks on both sides of Bridge #31 - slope failure is starting to erode bank
Richmond	3.980 - 4.170	Corridor Need - On Eastbound side, slope stabilization is needed - guardrail is tipped back - significantly in some areas (MM 3.980 to MM 5.050 appears to be the most tipped) - pavement cracking in shoulder -slope stabilization work has been done at this location previously
Richmond	4.400	Along Westbound side, District would like tree clearing in this area and wider, deeper ditches established in this area to reduce the amount of water flowing across the road surface and contributing to slope stabilization problems on the Eastbound side
Richmond	4.264	Corridor Need – Small Culvert#64450 – concrete headwall and wingwalls have collapsed – concrete has eroded and rebar is exposed - end of culvert is very close to road - District has already extended inlet due to a cave-in on side of road - is a concrete box culvert the District has put a plastic pipe into - further extension would probably be required if shoulders are widened
Richmond	4.350	Corridor Need - Ledge outcropping on Westbound side immediately adjacent to roadway should be removed for safety / to widen shoulder / to establish a better ditch
Richmond	4.350 - 4.400	Corridor Need - On Eastbound side, slope stabilization is needed - guardrail is tipped back - significantly in some areas - bank is starting to erode from stream - District has already fixed once with large stone
Richmond	4.377	Small culvert #64448 - inlet wing walls are in very poor/critical condition - outlet walls slightly eroded
Richmond	4.570 - 4.590	On Westbound side, District would like ditching done across lawn area to improve drainage - also not sure if there is a culvert across driveway at MM 4.59 - if there is, it's totally plugged - water ponds here and goes over the road
Richmond	4.930 - 5.010	District would like vegetation removed in this area - along Westbound side to improve site distances around inside of curve
Richmond	4.960 - 5.000	Ledge outcropping on Westbound side immediately adjacent to roadway should be removed for safety / to widen shoulder / to establish a better ditch
Richmond	5.272	Corridor Need – Small Culvert #64436 - erosion around culvert inlet – original 15" CMP
Richmond	5.357	Small Culvert #64435 - banks are vertical at end of culvert - will probably need an extension if shoulders are widened - existing pipe has been slip lined with 20" HDPE
Richmond	5.490 - 5.560	Along Eastbound side, slope stabilization may be needed as it appears that shoulder and edge of travel lane are settling and tilting away from main road bed - NOTE: this may also have to do with the approximate edge of buried original concrete slabs that may exist in this area
Richmond	5.720 - 5.790	On Eastbound side, District would like guardrail moved back off the roadway to help with winter maintenance difficulties
Richmond	5.780 - 5.810	On Westbound side, District does NOT want pulloff paved
Richmond	6.070	A piece of concrete, probably part of the wingwall, is visible in the stream bed.
Richmond	6.070 - 6.110	Along Eastbound side, District would like vegetation removed in this area
Richmond	6.070 - 6.110	Along Eastbound side, would like a better ditch established to help with water runoff
Richmond	6.300 -6.320	Corridor Need - On Westbound side - existing retaining wall RW0031 - if work is done to remove or replace this structure, make sure to take into account that there is now a house and driveway upslope from the retaining wall
Richmond	6.330	Along Eastbound side, the District thinks the break in guardrail needs to be maintained for access to land along railroad tracks
Bolton	0.000 - 0.110	Corridor Need - On Eastbound side, slope stabilization is needed - guardrail is tipped back - significantly in some areas (MM 0.050 to MM 0.100 appears to be the most tipped) - have had multiple washouts
Bolton	0.110 - 0.230	Along Westbound side, need to establish / re-establish deeper, wider ditch
Bolton	0.115	DI may need height adjustment due to grading / ditching associated with new house construction nearby - DI is not taking all the water it should be
Bolton	1.410 - 1.440	On Eastbound side, District would like pulloff paved
Bolton	1.590 - 1.655	On Eastbound side, District would like pulloff paved
Bolton	1.701	Very long, very deep culvert with a beaver dam causing an obstruction in the pipe that is blocking the flow of water

Table 11 District Needs from District Needs Meeting

8 Condition of Assets along Corridor:

It is the intent of this New Project Summary to highlight the assets below as an opportunity for AMP, HS&D and Maintenance to discuss recommendations on how to address (or not to address) these assets prior to the paving project.

The most recent inspection data available at the time (September, 2020) has been used in the preparation of this NPS. However, because the assets discussed below are inspected at regular intervals (with the interval varying from 2 years to 5 years depending on asset type), the inspection data used in the preparation of this NPS will be dated by the time design work begins. Also, it is noted that available inspection data is not always complete.

Therefore, to ensure that the most up to date asset condition information is utilized in design, it is recommended that in this project's early design phases, the condition of all long structures, short structures, small culverts, guardrails, retaining walls, and rock cuts within the project limits be reviewed in the field.

As part of the process, AMB, HS&D and Maintenance should agree upon a general implementation plan for the culverts along this corridor. This implementation plan could consider a variety of appropriate treatments options including do-nothing, cleaning and inspection, general maintenance (if applicable), repair, replacement as part of the scope of the project or replacement as part of a separate project.

The overall condition of assets along the corridor has been evaluated and is described in the sections below.

8.1 Pavement:

Most of US2 within the project limits is built on top of the original concrete roadway constructed circa 1930. The original concrete slabs have already been removed in some areas. These areas are generally where US2 is in close proximity to the interstate. See map included as Figure 2 of the Appendix which shows in pink where concrete slabs are believed to still exist.

Based on 2018 pavement data obtained using the AMB SK1 web mapping tool, the pavement condition for this segment varies from Good to Very Poor with the following distribution: Good (2.253 miles, 27%), Fair (2.986 miles, 36%), Poor (2.6 miles, 32%), and Very Poor (0.4 miles, 5%).

The last pavement treatments on US2 within the project limits are outlined in Table 12:

Town	FMM	TMM	Project	Year	Treatment Type
Richmond	0.000	0.603	Williston-Richmond STP2105	2002	CP 100, LEVEL 15IVm+35IIIIm
Richmond	0.603	0.746	Williston-Richmond STP2105	2002	CP 50, LEVEL 15IVm+35IIIIm
Richmond	0.746	0.822	Williston-Richmond STP2105	2002	LEVEL 15IVm+35IIIIm
Richmond	0.878	4.277	Richmond District Pave	2014	DISTRICT PAVE FULL WIDTH
Richmond	4.277	5.732	Richmond District Pave	2012	DISTRICT PAVE FULL WIDTH
Richmond	5.738	6.177	Richmond District Pave	2014	DISTRICT PAVE FULL WIDTH
Richmond	6.190	6.379	STP0284(16)S	2001	MAINLINE 18" SAND BORROW + 18" DGCS + 4.5"Is + 2"IIIs, SHOULDERS 4.5"Is + 2"IIIs
Bolton	0.000	0.100	Richmond-Bolton STP 9356	1993	OVERLAY 1.5"
Bolton	0.100	1.865	Bolton District Pave	2015	DISTRICT PAVE FULL WIDTH

Table 12 Pavement Treatment History

8.2 Traffic Signs & Pavement Markings:

Along US2 within the project limits, all existing signs were replaced with new signs as part of the project STATEWIDE – NORTHWEST STPG SIGN (63) during the 2019 construction season.

Recommendations:

As the signs will be less than 5 years old at the anticipated construction time of this project, “wholesale” sign replacement of existing signs is not recommended on this project.

Section 6.2, HCL Richmond 3.253 to 3.553, includes a recommendation to consider upsizing the curve warning signs and the chevrons.

Section 6.2, HCL Richmond 6.153 to Bolton 0.074, includes a recommendation to consider a number of changes and improvements to the signage and pavement markings in the vicinity of the Cochran Road intersection with US2. See Section 6.2 for additional information.

All new pavement markings along this corridor should consist of durable lane markings and stenciling (where necessary).

8.3 Traffic Signals & ITS:

Based on the Vtrans Traffic Signal Map and a review using Mapillary, there are 3 existing state owned traffic signals within the project limits; all 3 are in Richmond.

Signal MS580 is located at Richmond MM 0.950 at the intersection of US2 and VT117.

Signal MS584 is located at Richmond MM 1.15 at the 4 way intersection of US2, the I89 Southbound exit ramp, and the Park & Ride. As noted in Section 6.2 above, District

Maintenance personnel indicated that they receive many complaints about the lack of a left turn lane into the Park and Ride at this intersection.

Signal MS576 is located at Richmond MM 2.715 at the main 4-way intersection of US2 with Bridge Street and Jericho Road in the middle of Richmond village. In addition to the (2) 4 way traffic signals, there is also pedestrian signal infrastructure in all 4 directions consisting of separate steel posts supporting pedestrian push buttons and "WALK" signals. As noted in Section 6.2 above, the Town of Richmond has expressed a desire for improvements at this intersection with regards to northbound vehicles turning left off Bridge Street onto US2.

Recommendations:

The Traffic Signal Unit has the following recommendations regarding work on traffic signals or ITS devices within the project limits that should be included as part of the scope of this project:

Signal MS580 (@ Richmond MM 0.950; intersection of US2 and VT117)

- New Detection, Preemption, Communications, and Cabinet is recommended with an estimated cost of approximately \$100,000.

Signal MS584 (@Richmond MM 1.15; 4 way intersect. of US2, I89 SB exit ramp, & Park & Ride)

- New Detection, Preemption, Communications, and Cabinet is recommended with an estimated cost of approximately \$100,000.
- Section 6.2 above includes a recommendation that installation of a left turn lane for US2 eastbound traffic turning into the Park & Ride should be considered for inclusion in this project. The existing signal infrastructure will need to be revised if construction of a left turn lane is ultimately included in the project.

Signal MS576 (@ Richmond MM 2.715; 4-way intersection of US2, Bridge St. & Jericho Road

- Full Replacement with Mast Arms recommended with an estimated cost of approximately \$350,000. Although full replacement of the traffic signals, including installation of new short mast arms on all 4 legs, is preferred, it is recognized that this may not be feasible due to significant site constraints imposed by the locations of existing buildings, sidewalks, access drives, and parking.
- if the existing pedestrian signal heads do not already have countdowns, they should be included with any upgrade to the pedestrian signal infrastructure
- Section 5.7 above includes a recommendation that if signal replacement is included in this project, it should be verified that all pedestrian features at the intersection are fully compliant, including accessibility considerations.

Section 6.2 above includes a recommendation that all aspects of the new traffic signal infrastructure in the area around the US2 / Bridge Street / Jericho Road intersection be designed and detailed in this project to best allow for the addition of a northbound left turn lane on Bridge Street as part of a possible future project.

- Section 6.2 above includes a recommendation that all aspects of the new traffic signal infrastructure in the area around the US2 / Bridge Street / Jericho Road intersection be

designed and detailed in this project to best allow for the addition of a northbound left turn lane on Bridge Street as part of a possible future project.

- Section 6.2 above also includes a recommendation that a left turn phase from Bridge St be included in the programming of the new signals.

8.4 Railroad Crossings:

There are no railroad crossings, or associated work, on US2 within the project limits. However, as previously mentioned in Section 6.2, railroad crossing #247-319R of the New England Central Railroad is on Cochran Road approximately 70 feet from the Cochran Road intersection with US2 at Richmond MM 6.190. Per the [Railroad Crossing Inspection App](#) on VTransparency, the surface condition of this crossing is GOOD.

8.5 Structures:

A review utilizing Geocortex indicates that there are 5 short structures and 4 long structures on US2 within the project limits. A summary of the structures is as follows:

Bridge#	Town	MM	Type	Structure Length (ft)	Deck Width (ft)	Deck or Culvert Rating	Last Inspected
B24 Long	Richmond	0.710	Steel Thru Truss	356	33	VERY GOOD NOTE: Bridge Maintenance project Richmond BM020504 completed in late 2020 replaced the joint at abutment #1.	7/16/2019
B25 Long	Richmond	0.920	3 Span Rolled Beam	120	30	VERY GOOD	5/31/2019
B26 Short	Richmond	0.950	RC Box	10	----	SATISFACTORY	11/19/2015
B28 Short	Richmond	1.910	Concrete Slab	11	30.5	FAIR	11/19/2015
B29 Long	Richmond	3.220	8 Span Rolled Beam	497	35	SATISFACTORY NOTE: Strategic repairs will be done with project District 5 BM020502 planned for construction in 2020. Proposed scope includes repaving the bridge, installation of a fascia catch system, and minor repairs to one pier. NOTE: Bridge will be replaced with new bridge with project Richmond IM 089-2(52) planned for construction in 2022-2024.	4/23/2020
B31 Short	Richmond	3.920	RC Box	8	----	FAIR	11/19/2015
B32 Long	Richmond	5.150	Precast Rigid Frame	29	33	VERY GOOD	5/31/2019
B33 Short	Richmond	6.070	Concrete slab	9	29.5	SATISFACTORY	11/19/2015
B34 Short	Bolton	0.330	CGMPP	11	----	SATISFACTORY	11/19/2015

Table 13 Structures within project limits

These structures are inspected on a regular schedule by the VTrans Bridge Inspection team. Long structures are inspected every 2 years and short structures are inspected every 5 years. Inspection reports detailing structure condition, needed repairs, and needed maintenance are available for review at the [VTransparency website](#).

Recommendations:

The Bridge Inspection Unit has the following recommendations and comments regarding work on the long and short structures listed above that should be included in the scope of this Reclaim project:

Bridge#	Town	Mile Marker	Recommendations/Comments
24 Long	Richmond	0.710	As noted in the summary above, the joint at Abutment #1 was replaced as part of a bridge maintenance project in late 2020. This bridge was reconstructed in 2013 and has a bare deck. Other than possible paint touch up to protect the steel, no other maintenance activity is needed at this time.
25 Long	Richmond	0.920	The last maintenance activity, deck paved with partial or full membrane and joint repair, was done in 2015. Latest inspection indicated 4" of asphalt on bridge deck. It is recommended that some of this extra pavement be removed as part of the milling process. Minor concrete repairs are needed to address the spalling of the south end of the backwall at abutment #2 caused by runoff along the open joint. This structure has 2 plug joints that will need to be replaced with this project.
26 Short	Richmond	0.950	Structure has approximately 22 feet of average cover. No recommendations for this structure beyond routine mill and fill.
28 Short	Richmond	1.910	The last maintenance activity, deck paved with partial or full membrane, on this concrete slab was done in 2014. Spalling on the upstream side of abutment #2 should be repaired and the downstream wingwalls anchored.
29 Long	Richmond	3.220	As noted in the summary above, this bridge is scheduled to be paved as part of an interim maintenance project in late 2020 and is scheduled to be replaced by 2024. Therefore, there are no recommendations at this time. However, it is recommended that this bridge be revisited as the this project develops to see what, if anything, is needed to improve ride on the existing bridge while the new bridge is being constructed.
31 Short	Richmond	3.920	Structure has approximately 8 feet of average cover. No recommendations for this structure beyond routine mill and fill. Note: Although this work would likely beyond right-of-way limits and out of scope, the the outlet wingwalls need repair and riprap needs to be added for bank stability.
32 Long	Richmond	5.150	This structure was built in 2017. Latest inspection indicated approximately 2" of asphalt on bridge deck. No recommendations for this structure beyond routine mill and fill. This structure has 4 plug joints that will need to be replaced with this project.
33 Short	Richmond	6.070	The last maintenance activity, deck paved with partial or full membrane, was done in 2014. Erosion at the wingwalls has created wash around the guard rail posts which should be repaired and rail height checked to make sure if conforms to current standard.
34 Short	Bolton	0.330	Structure has approximately 5 feet of average cover. No recommendations for this structure beyond routine mill and fill. Note: Although this work would likely beyond right-of-way limits and out of scope, the beaver dam (inlet) and tree (outlet) should be removed.

Table 14 Structures Recommendations

At all long structures, general cleaning and debris removal should be done on all joints, scuppers, and downspouts.

At all structures where a Level and Overlay treatment is being considered, the shorter effective height of the bridge railing, due to the added pavement thickness, must be checked for conformance with the standard guardrail height requirements. A Mill and Fill treatment or adjustment of the railing (if possible) may be necessary to maintain required height.

All long and short structures should be reviewed in the field as described in Section 8.0.

8.6 Small Culverts:

A review utilizing the AMB SK1 mapping tool indicates that within the project segment there are a total of (123) small (ie., less than 6' in diameter) culverts.

For 23 of these culverts, most of the inspection information, including depth of fill information for all of them, is not available. This includes all 18 culverts from Richmond MM 2.601 to MM 2.795 in the middle of Richmond village. These 18 culverts are assumed to be part of a stormwater system and are assumed to be located between drop inlets as grade is level throughout this area and there is nowhere for these culverts to daylight. Although size information is not complete, the available information seems to indicate that at least 6 of these 23 culverts are undersized based on the 18" minimum diameter design standard with 4 culverts being very undersized at 12" or smaller diameter.

The remaining 100 small culverts are split into two groups for purposes of this report: shallow culverts (with a reported depth of fill over the pipe of 5 feet or less) and deep culverts (with a reported depth of fill over the pipe of greater than 5 feet).

Shallow culverts are reviewed in depth in this report as their shallow depth can be considered a contributing factor to the anticipated life of the pavement and they are also more likely to have few, or no, right of way or environmental issues. Of the 100 culverts within the project segment for which depth of cover information is available, 64 are shallow small culverts. Of these shallow culverts, 54 have 1 or more of the following deficiencies:

- culvert undersized based on the 18" minimum diameter design standard
- inlet, barrel, or outlet condition rated "CRITICAL", "POOR", or "FAIR"
- inlet, barrel, or outlet sediment rated "PLUGGED", "HEAVY", or "MODERATE"
- outlet erosion rated as "SEVERE" or "MODERATE"
- structural rating rated "ACTION NEEDED – RED"

Table (15) below summarizes the condition data for the (54) shallow small culverts described above.

Deep culverts, due to their greater depth of fill, are unlikely to affect the anticipated life of the pavement and often involve larger scope projects (ie., deeper, wider excavations and including ROW and environmental issues) to address their deficiencies. Of the 100 culverts within the project segment for which depth of cover information is available, 36 are deep small culverts. Of these deep culverts, (13) have 1 or more of the following deficiencies:

- culvert undersized based on the 18" minimum diameter design standard
- inlet, barrel, or outlet condition rated "CRITICAL", or "POOR"
- inlet, barrel, or outlet sediment rated "PLUGGED", or "HEAVY"
- outlet erosion rated as "SEVERE"
- a deficiency noted within inlet comments or outlet comments

Table (16) below summarizes the condition data for the (13) deep small culverts with one or more of the deficiencies noted above.

DRAFT

PID	TOWN	MM	SIZE (in)	MATERIAL	LENGTH (ft)	INLET CONDITION	BARREL CONDITION	OUTLET CONDITION	INLET SEDIMENT	BARREL SEDIMENT	OUTLET SEDIMENT	INLET EROSION	OUTLET EROSION	LAST INSPECTED	COMMENTS
64516	RICHMOND	1.253	48	RCP	61	FAIR	GOOD	FAIR	LIGHT	LIGHT	LIGHT	NONE	NONE	6/14/2017	Inlet - 1 wingwall detaching/collapsing Outlet - 1 wing wall detaching Outlet - BR27
64515	RICHMOND	1.297	N.A.	OTHER	97	GOOD	UNKNW	FAIR	LIGHT	UNKNW	MODERATE	NONE	NONE	9/25/2018	Inlet - not your typical inlet. grates
64511	RICHMOND	1.711	N.A.	CMP	53	UNKNW	UNKNW	UNKNW	PLUG	UNKNW	PLUG	NONE	NONE	9/25/2018	Inlet - flat ground Outlet - buried
64510	RICHMOND	1.747	15	CMP	30	GOOD	GOOD	GOOD	MOD	UNKNW	HEAVY	NONE	NONE	9/25/2018	General - Ditching project? Inlet - sediment from gas line dig (subcon) Outlet - sediment from gas line dig (subcon)
64509	RICHMOND	1.793	N.A.	HDPE	31	FAIR	UNKNW	UNKNW	HEAVY	UNKNW	PLUG	NONE	NONE	9/25/2018	General - Ditching project? Inlet - needs sediment removal Outlet - needs sediment removal
64507	RICHMOND	1.804	15	RCP	32	FAIR	FAIR	FAIR	LIGHT	UNKNW	LIGHT	NONE	NONE	9/25/2018	Inlet - rusty. conc retaining blocks
64508	RICHMOND	1.808	N.A.	RCP	35	FAIR	CRIT	GOOD	LIGHT	LIGHT	LIGHT	SEVERE	LIGHT	7/24/2019	Structural Rating - ACTION NEEDED - RED Inlet - beginning of conc erosion Outlet - 1 bad part of box wall
64506	RICHMOND	1.847	15	CMP	30	POOR	UNKNW	UNKNW	MODERATE	UNKNW	PLUG	NONE	NONE	9/25/2018	Inlet - pipe folded inward Outlet - Buried
64503	RICHMOND	2.065	15	CMP	69	FAIR	UNKNW	POOR	MODERATE	UNKNW	LIGHT	NONE	NONE	9/25/2018	Outlet - Recently ditched
64500	RICHMOND	2.416	30	CMP	47	POOR	CRIT	POOR	HEAVY	HEAVY	HEAVY	MODERATE	MODERATE	7/24/2019	Structural Rating - ACTION NEEDED - RED Inlet - flared wing walls
64499	RICHMOND	2.467	15	CMP	31	GOOD	GOOD	GOOD	MODERATE	MODERATE	PLUG	NONE	NONE	4/15/2020	Outlet is 10 feet from opening Heavy sediment
64478	RICHMOND	2.797	15	CMP	18	POOR	UNKNW	UNKNW	MODERATE	UNKNW	UNKNW	NONE	NONE	4/15/2020	Inlet - rusted thru
64476	RICHMOND	2.797	15	PVC	32	GOOD	UNKNW	GOOD	MODERATE	UNKNW	LIGHT	NONE	NONE	9/25/2018	General - Part of DI system Inlet - DI
64479	RICHMOND	2.797	15	RCP	31	UNKNW	UNKNW	GOOD	UNKNW	UNKNW	HEAVY	UNKNW	NONE	4/15/2020	Inlet - not in use? buried di?
64475	RICHMOND	2.8	N.A.	PVC	15	FAIR	UNKNW	UNKNW	HEAVY	UNKNW	UNKNW	NONE	NONE	6/12/2017	Outlet - pvt tie in
64473	RICHMOND	2.918	12	PVC	9	GOOD	UNKNW	GOOD	NONE	NONE	NONE	NONE	NONE	6/12/2017	
64474	RICHMOND	2.926	18	CMP	90	GOOD	UNKNW	FAIR	MODERATE	UNKNW	HEAVY	NONE	NONE	9/25/2018	
64472	RICHMOND	2.945	18	RCP	5	GOOD	GOOD	GOOD	HEAVY	HEAVY	LIGHT	NONE	NONE	4/15/2020	Outlet - one solid conc block
64468	RICHMOND	2.954	15	CMP	81	GOOD	UNKNW	GOOD	LIGHT	NONE	NONE	NONE	NONE	6/12/2017	Inlet - 18" steel extension
64469	RICHMOND	2.971	30	CMP	159	GOOD	UNKNW	FAIR	LIGHT	UNKNW	LIGHT	NONE	NONE	4/15/2020	
64467	RICHMOND	2.986	30	CMP	73	FAIR	FAIR	FAIR	MODERATE	LIGHT	NONE	NONE	NONE	6/9/2017	Outlet - ties into another system
64470	RICHMOND	2.987	30	CMP	29	GOOD	FAIR	FAIR	LIGHT	NONE	NONE	NONE	NONE	6/9/2017	
64466	RICHMOND	3.016	15	RCP	32	GOOD	FAIR	POOR	MODERATE	UNKNW	HEAVY	NONE	NONE	9/25/2018	Outlet - almost plugged
64465	RICHMOND	3.04	15	CMP	72	GOOD	UNKNW	UNKNW	LIGHT	UNKNW	MODERATE	NONE	NONE	9/25/2018	Inlet - rocks partially blocking entrance

															Outlet – Richmond Fire Department
64459	RICHMOND	3.355	36	RCP	37	<u>FAIR</u>	<u>FAIR</u>	<u>FAIR</u>	NONE	<u>MODERATE</u>	<u>MODERATE</u>	NONE	NONE	6/9/2017	Inlet - deteriorating concrete wing wall
64458	RICHMOND	3.449	18	CMP	41	<u>FAIR</u>	GOOD	GOOD	<u>PLUG</u>	<u>MODERATE</u>	<u>MODERATE</u>	NONE	NONE	6/9/2017	Inlet - buried for long time. di? Outlet – Sink hole near shoulder lean hw
64457	RICHMOND	3.541	<u>15</u>	CMP	24	<u>POOR</u>	UNKNW	<u>POOR</u>	<u>MODERATE</u>	UNKNW	<u>MODERATE</u>	NONE	NONE	9/25/2018	Inlet - mangled. rocks in pipe Outlet – poison parsnips
64453	RICHMOND	3.848	<u>15</u>	CMP	21	<u>FAIR</u>	<u>FAIR</u>	GOOD	LIGHT	UNKNW	<u>MODERATE</u>	NONE	NONE	9/25/2018	
64450	RICHMOND	4.264	36	RCP	38	GOOD	GOOD	GOOD	NONE	NONE	NONE	NONE	NONE	6/9/2017	Structural Rating – ACTION NEEDED – RED Inlet - eroding conc. rebar, concrete head wall and wing walls have collapsed as of 3/13/20. Structure needs work
64449	RICHMOND	4.323	<u>15</u>	CMP	35	GOOD	GOOD	GOOD	LIGHT	NONE	NONE	NONE	NONE	6/9/2017	Inlet - mitered flared wing walls Outlet – wing walls
64447	RICHMOND	4.515	<u>15</u>	CMP	31	<u>FAIR</u>	UNKNW	UNKNW	<u>MODERATE</u>	UNKNW	<u>PLUG</u>	NONE	NONE	9/25/2018	General – Ditching project? Inlet – rusted Outlet - buried
64446	RICHMOND	4.572	<u>15</u>	CMP	43	GOOD	GOOD	GOOD	NONE	LIGHT	LIGHT	NONE	NONE	6/9/2017	
64445	RICHMOND	4.593	<u>15</u>	HDPE	26	<u>FAIR</u>	UNKNW	<u>FAIR</u>	<u>HEAVY</u>	UNKNW	<u>HEAVY</u>	NONE	NONE	9/25/2018	Inlet - uphill to in. standing h2o Outlet – Needs ditching
64444	RICHMOND	4.654	<u>12</u>	HDPE	44	UNKNW	GOOD	GOOD	UNKNW	UNKNW	NONE	UNKNW	NONE	9/25/2018	Inlet - Buried under grass
64441	RICHMOND	4.667	<u>12</u>	HDPE	31	GOOD	GOOD	GOOD	NONE	UNKNW	NONE	NONE	NONE	9/25/2018	
64442	RICHMOND	4.671	18	HDPE	62	GOOD	GOOD	GOOD	<u>MODERATE</u>	UNKNW	LIGHT	NONE	NONE	9/25/2018	Inlet - Grass debris Outlet – connects with cross culvert
64443	RICHMOND	4.679	18	CMP	32	<u>FAIR</u>	UNKNW	GOOD	NONE	<u>MODERATE</u>	<u>HEAVY</u>	NONE	NONE	6/9/2017	Inlet - mitered/cracked wing walls Outlet - hw/jct box outletting h2o
64438	RICHMOND	4.887	18	CMP	54	GOOD	<u>FAIR</u>	<u>FAIR</u>	NONE	NONE	NONE	NONE	NONE	6/9/2017	Outlet - damaged
64436	RICHMOND	5.272	<u>15</u>	CMP	54	<u>FAIR</u>	GOOD	GOOD	<u>HEAVY</u>	UNKNW	LIGHT	LIGHT	NONE	6/9/2017	
64433	RICHMOND	5.403	18	CMP	29	<u>FAIR</u>	GOOD	GOOD	NONE	UNKNW	LIGHT	NONE	NONE	9/25/2018	
64431	RICHMOND	5.473	<u>15</u>	CMP	45	GOOD	GOOD	GOOD	NONE	LIGHT	LIGHT	NONE	NONE	6/9/2017	
64430	RICHMOND	5.528	18	CMP	53	<u>POOR</u>	UNKNW	<u>FAIR</u>	<u>MODERATE</u>	UNKNW	<u>MODERATE</u>	NONE	NONE	9/25/2018	Outlet – Murray Drive
64429	RICHMOND	5.552	<u>15</u>	CMP	29	<u>FAIR</u>	UNKNW	<u>FAIR</u>	<u>MODERATE</u>	UNKNW	<u>MODERATE</u>	NONE	NONE	9/25/2018	
64428	RICHMOND	5.601	<u>15</u>	CMP	45	GOOD	<u>FAIR</u>	GOOD	LIGHT	LIGHT	LIGHT	NONE	NONE	6/9/2017	
64427	RICHMOND	5.637	18	CMP	24	<u>FAIR</u>	UNKNW	<u>POOR</u>	<u>MODERATE</u>	UNKNW	<u>MODERATE</u>	NONE	NONE	9/25/2018	
64426	RICHMOND	5.664	<u>15</u>	HDPE	41	GOOD	GOOD	GOOD	<u>MODERATE</u>	UNKNW	<u>MODERATE</u>	NONE	NONE	9/25/2018	
64425	RICHMOND	5.695	<u>15</u>	HDPE	33	GOOD	GOOD	GOOD	LIGHT	UNKNW	<u>HEAVY</u>	NONE	NONE	9/25/2018	Outlet – Edgewood Lane
64424	RICHMOND	5.781	<u>12</u>	CMP	56	<u>FAIR</u>	<u>FAIR</u>	GOOD	NONE	NONE	LIGHT	NONE	NONE	6/9/2017	
64423	RICHMOND	6.016	<u>15</u>	HDPE	59	GOOD	UNKNW	GOOD	LIGHT	UNKNW	LIGHT	NONE	NONE	9/25/2018	General – Becoming overgrown around pipe

64415	BOLTON	0.115	<u>15</u>	CMP	40	GOOD	GOOD	GOOD	LIGHT	NONE	NONE	NONE	NONE	6/9/2017	Outlet – sink hole right by shoulder
64414	BOLTON	0.147	<u>15</u>	RCP	36	GOOD	FAIR	GOOD	MODERATE	UNKNW	LIGHT	NONE	NONE	9/25/2018	Outlet – 18” out ext
64410	BOLTON	0.495	<u>15</u>	CMP	64	GOOD	GOOD	GOOD	NONE	MODERATE	MODERATE	NONE	NONE	6/9/2017	
64406	BOLTON	0.857	36	CMP	36	GOOD	GOOD	FAIR	LIGHT	LIGHT	LIGHT	LIGHT	SEVERE	7/24/2019	Outlet – Bolton Notch Road
64404	BOLTON	1.189	42	CMP	64	FAIR	GOOD	GOOD	NONE	UNKNW	NONE	LIGHT	NONE	9/25/2018	Outlet – ties into RR system

Table 15 Deficient Shallow Culverts

PID	TOWN	MM	SIZE (in)	MATERIAL	LENGTH (ft)	INLET CONDITION	BARREL CONDITION	OUTLET CONDITION	INLET SEDIMENT	BARREL SEDIMENT	OUTLET SEDIMENT	INLET EROSION	OUTLET EROSION	LAST INSPECTED	COMMENTS	FILL DEPTH
2180	RICHMOND	0.025	<u>12</u>	PVC	43	GOOD	GOOD	GOOD	NONE	LIGHT	LIGHT	NONE	NONE	6/15/2017		10
2179	RICHMOND	0.168	<u>12</u>	PVC	45	GOOD	GOOD	GOOD	LIGHT	LIGHT	NONE	NONE	NONE	6/15/2017		10
64502	RICHMOND	2.214	<u>12</u>	PVC	45	GOOD	UNKNW	GOOD	NONE	UNKNW	NONE	NONE	LIGHT	6/14/2017		15
64501	RICHMOND	2.273	18	PVC	105	GOOD	UNKNW	GOOD	LIGHT	LIGHT	LIGHT	NONE	NONE	6/14/2017	Inlet - debris in pipe. Needs cleaning Outlet - continuous to RR 3x3 stone box	20
64464	RICHMOND	3.08	48	CMP	133	FAIR	FAIR	FAIR	NONE	NONE	NONE	NONE	NONE	6/9/2017	Inlet - not a lot of piping. bot rusty Outlet - conc diversion wall	25
64456	RICHMOND	3.629	54	CMP	77	GOOD	GOOD	UNKNW	LIGHT	UNKNW	UNKNW	NONE	NONE	6/9/2017	Inlet - some tree growth. BR30 Outlet - BR30. active flow. rusting pip	10
64455	RICHMOND	3.712	<u>15</u>	CMP	57	GOOD	GOOD	GOOD	MOD	LIGHT	LIGHT	NONE	NONE	6/9/2017	Outlet - original pipe very rusted	20
64454	RICHMOND	3.835	24	CMP	60	FAIR	FAIR	FAIR	NONE	NONE	NONE	NONE	NONE	6/9/2017	Inlet - rusting thru	10
64452	RICHMOND	3.918	-99	RCP	51	FAIR	GOOD	FAIR	LIGHT	UNKNW	LIGHT	LIGHT	LIGHT	9/25/2018	Inlet - stream alignment? conc eroding Inlet - wing walls very poor/critical	10
64448	RICHMOND	4.377	42	CMP	42	GOOD	GOOD	GOOD	NONE	LIGHT	LIGHT	NONE	NONE	6/9/2017	Outlet - bot of walls slightly eroded	10
64437	RICHMOND	5.14	18	CMP	63	GOOD	GOOD	GOOD	NONE	LIGHT	LIGHT	NONE	NONE	6/9/2017	Outlet - bottom rusted completely thru	10
64422	RICHMOND	6.068	72	RCP	29	FAIR	FAIR	FAIR	LIGHT	LIGHT	LIGHT	LIGHT	LIGHT	6/9/2017	Inlet - Concrete starting to erode Outlet - deteriorating w-walls. br 33	10
64407	BOLTON	0.805	18	CMP	119	FAIR	FAIR	FAIR	LIGHT	LIGHT	LIGHT	NONE	MOD	6/8/2017	Inlet - undersized? Outlet - round conc into stone box. RR	15
64401	BOLTON	1.529	18	CMP	138	GOOD	UNKNW	UNKNW	NONE	UNKNW	UNKNW	NONE	UNKNW	6/8/2017	Inlet – can't see light thru pipe	50

Table 16 Deficient Deep Culverts

Recommendations: As part of the scope of this Reclaim project, it is recommended that:

- all culverts should be reviewed in the field as described in Section 8.0 with additional emphasis being put on the 23 culverts (most within Richmond village) for which condition information is not available
- the culverts with deficiencies (which are noted in the tables below) should be cleaned out, and potentially video inspected.
- a general culvert implementation plan as described in Section 8.0 should be developed

8.7 Drop Inlets/Catch Basins:

A review utilizing the AMB SK1 mapping tool indicates that within the project roadway segment there are (44) drop inlets. Of these drop inlets, (9) have 1 or more of the following deficiencies:

- drop inlet condition rated “CRITICAL” or “POOR”, or “FAIR”
- brick collar condition rated “CRITICAL”, “POOR”, or “FAIR”
- sediment rated “PLUGGED”, “HEAVY” or “MODERATE”

The table below summarizes the condition data for the (9) drop inlets described above:

DI ID	Town	MM	Condition	Brick Collar Condition	Sediment	Last Inspected	Condition Comment
122633	Richmond	0.619	Fair	None	Moderate	9/28/2018	Had to dig out Sept 2018
14091	Richmond	2.785	Fair	None	Light	12/18/2013	
14086	Richmond	2.800	Fair	None	Heavy	6/12/2017	Starting to get plugged
14081	Richmond	3.141	Fair	None	None	6/9/2017	
14078	Richmond	4.679	Good	None	Heavy	6/9/2017	
14075	Richmond	6.204	Fair	None	None	6/9/2017	
14074	Richmond	6.248	Fair	None	None	6/9/2017	
14072	Richmond	6.292	Fair	None	None	6/9/2017	
14065	Bolton	1.286	Fair	None	None	4/14/2020	

Table 17 Deficient Drop Inlets

Recommendations: As part of the scope of this Reclaim project, it is recommended that:

- all drop inlets should be reviewed in the field as described in Section 8.0
- any drop inlet or catch basin that is considered a roadside obstacle of safety issue should be addressed
- the elevations of affected drop inlets should be evaluated for adjustment if the scope of this project includes changing grades or banking

8.8 Guardrails:

A review utilizing the AMB SK1 mapping tool indicates that within the project limits there are 50 runs of guardrail with an approximate total length of 22,617 linear feet. Of these individual guardrail runs, (7) have 1 or more of the following deficiencies:

- Guardrail Run condition rated “VERY POOR” or “POOR”

- Begin Treatment condition rated “BAD”
- End Treatment condition rated “BAD”

The table below summarizes the condition data for the (7) guardrail runs described above:

Object ID	Town	FMM	TMM	Side	Length (ft)	Begin Treatment Condition	Run Condition	End Treatment Condition	Last Inspected
7849	Richmond	1.24	1.28	R	214.37	G	Good	BAD	10/23/2015
8942	Richmond	1.289	1.229	L	313.4	BAD	Fair	G	10/23/2015
7640	Richmond	1.29	1.39	R	564.57	G	POOR	G	10/23/2015
6474	Richmond	1.519	1.509	L	41.28	G	POOR	BAD	10/23/2015
10699	Richmond	3.64	3.78	R	675.61	G	POOR	G	10/23/2015
967	Richmond	4.37	4.42	R	252.82	G	POOR	G	10/23/2015
7964	Bolton	0.374	0.329	L	239.12	G	POOR	G	10/23/2015

Table 18 Deficient Guardrails

The (5) guardrail runs which are in “Poor” condition represent 8% of the total guardrail length.

Recommendations: As part of the scope of this Reclaim project, it is recommended that:

- all guardrails should be reviewed in the field as described in Section 8.0
- the District's preference is for all replacement guardrail to be W beam guardrail.
- guardrail should be designed per current Agency policies and engineering instructions.

8.9 Geotechnical Assets:

8.9.1 Retaining Walls:

A review utilizing the Geocortex Viewer indicates that on US2 within the project limits there are 2 retaining walls that are summarized below:

Structure #	Town	FMM	TMM	Wall Type	Material	Average Height	Length (ft)	Condition Rating	Last Inspected
RW0029	Richmond	1.450	1.510	Bin Wall	Concrete Plank	4.5	325	6	4/19/2019
RW0031	Richmond	6.300	6.320	Bin Wall	Concrete	4.0	138	3	4/19/2019

Table 19 Retaining Walls within project limits

These retaining walls have been inspected within the last 1½ years by the VTrans Bridge Inspection Unit. Inspection Reports detailing retaining wall condition, needed repairs, and needed maintenance are available for review [here](#).

RW0031 has been in poor condition for quite a few years and has major section loss throughout the entire length of the structure. The 2019 inspection report for this wall noted that this structure should be replaced. This wall was also identified in 2015 in the Corridor Needs database as a retaining wall that has failed and the ACTION NEEDED was noted as “New Retaining Wall”.

Recommendations:

The Bridge Inspection Unit has the following recommendations for work on these retaining walls that should be included in the scope of this project:

RW0029 - Conduct routine maintenance and clear away brush.

NOTE: See District comments and recommendations regarding this retaining wall in Section 7.2.

RW0031 – Structure should be removed and replaced, or the structure should be removed and the bank sloped back to eliminate the need for the retaining wall.

NOTE: See District comments regarding this retaining wall in Section 7.2.

All retaining walls should be reviewed in the field as described in Section 8.0.

8.9.2 Rock Cuts:

A review utilizing the Corridor Needs Viewer indicates that on US2 within the project limits there are 18 rock cuts; 17 are ranked C and 1 is ranked B. Available data for the 1 rock cut ranked B is summarized below:

Rock Cut #	Town	MM	Travel Direction	Cut Location	Final Ranking
2094/2063	Bolton	1.617	Westbound	RIGHT	B

Table 20 Rock Cuts within project limits

Recommendations:

Section 6.2 (above) includes recommendations that ledge outcroppings be removed along the inside of horizontal curves at 3 locations. Significant amounts of ledge removal may be required at 2 of these locations to achieve the recommended safety improvements.

Sections 7.1 and 7.2 (above) include details of 4 areas where the District recommends that ledge outcroppings immediately adjacent to the roadway be removed.

It is also recommended that the 1 rock cut with a B ranking noted above be considered as noted below.

It is recommended that, early in this project’s design phases, each of the areas noted above be explored further and/or considered for inclusion in the project.

All rock cuts should be reviewed in the field as described in Section 8.0.

8.9.3 Slopes:

It is our understanding that the Project Manager has already requested pertinent recommendations and other information regarding slopes from the Geotechnical Engineering Section.

Recommendations:

Sections 7.1 and 7.2 of this NPS include descriptions of (8) areas within the project limits where the District has indicated there appears to be a slope stability issue. It is recommended that, early in this project’s design phases, each of these areas be explored further and/or considered for inclusion in the project.

9 Planning Documents Review

9.1 Flood Risk

As this is a Reclaim project, it may be feasible, depending on amount of work required, to consider addressing some flood risk issues as part of the project. Therefore, the [Vermont Statewide Highway Flood Vulnerability and Risk Map](#) has been used to review flood risks and vulnerabilities along this segment of US2.

In the map, road segments and long structures have been rated using Flood Risk Categories and Flood Risk Scores. The Flood Risk Scores are themselves comprised of a Flood Vulnerability Score (which also determines a Vulnerability Category) and a Transportation Criticality Score (which also determines a Criticality Category). Flood Risk Scores, Flood Vulnerability Scores, and Transportation Criticality Scores are all based on a 0-10 scale. The Flood Vulnerability Score is a measure of a roadway segment's vulnerability to inundation, erosion, and deposition and the Transportation Criticality Score is a measure of the importance of a roadway segment in the network.

For this report, review has been limited to only those road segments and long structures that are rated as being in the "HIGH" Flood Risk Category and / or the "HIGH" Flood Vulnerability Category. The "HIGH" Flood Risk Category is assigned to road segments and long structures that have a Flood Risk Score of between 8 and 10. The "HIGH" Flood Vulnerability Category is assigned to road segments and long structures that have a Flood Risk Score of between 9 and 10.

Bolton MM 0.305 to MM 0.855 - Although this segment is rated in the "MODERATE" Flood Risk Category with a Flood Risk Score of 6, the underlying Flood Vulnerability Category is rated "HIGH" (with a Generalized Vulnerability Score of 10). The underlying Transportation Criticality Category is rated "LOW" (with a Generalized Criticality Score of 2). The underlying Vulnerability Scores making up the Generalized Vulnerability Score are as follows: Inundation – ISCORE = 4, Erosion – ESCORE = 9, Deposition – DSCORE = 9.

Bolton MM 1.100 to MM 1.860 – This segment is rated as being in the "HIGH" Flood Risk Category with a Flood Risk Score of 8. For this segment of US2, the underlying Flood Vulnerability Category is also rated "HIGH" (with a Generalized Vulnerability Score of 10). The underlying Transportation Criticality Category is rated "MODERATE" (with a Generalized Criticality Score of 6). The underlying Vulnerability Scores making up the Generalized Vulnerability Score are as follows: Inundation – ISCORE = 4, Erosion – ESCORE = 9, Deposition – DSCORE = 8.

9.2 Town Plans & Regional Plans

Local and Regional Planning documents were reviewed to determine if there are issues that should be considered as part of the scope of this Reclaim project.

1. Relevant findings from a review of the [Town of Richmond, Vermont, 2018 Town Plan](#):
 - "... increased volumes and congestion are causing problems on certain key commuter routes and choke points – such as the Route 2 and Bridge Street intersection, which also has the worst safety rating in town."

- “Work with VTrans to adjust the signaling at the Route 2/Bridge Street intersection to improve traffic flow and safety rating ...”
- “Richmond has long held a goal of improving bikeability and walkability, and it was one of the most common themes during the visioning process ... biking and walking is increasingly popular among many residents. Richmond has a sidewalk system in the village area, which helps improve safety and vibrancy downtown, but there is no dedicated infrastructure to support biking or walking outside the village, or to make these options safer.”
- “Work with VTrans to prioritize rebuilding Route 2 (Main Street) including sidewalks and bicycle/pedestrian accommodation.”
- Several studies, including our Bridge St. Bicycle and Pedestrian Feasibility Study, and the Route 2 Scoping Study, detail specific recommendations and locations for bike lanes, signage, sidewalk extensions, and other high-priority improvements.
- “Improvements to transportation infrastructure are also expensive, but can be minimized by integrating them into other planned upgrades (such as paving projects or bridge replacements) and by using pop-up design demonstrations to test and refine designs before final installation.”
- “Work with partner agencies and organizations to identify and test (through pop-up demonstrations or other means) best practices in bike and pedestrian safety and implement low-cost improvements that have been identified such as better signage and road markings”
- “Support the construction of sidewalks and bike paths or line striping for cyclists on State ... projects.”
- “Implement pedestrian and bike traffic signage in the village and heavily bike-trafficked areas”
- “Work with...the Agency of Transportation to add/expand Park and Ride facilities in Richmond and neighboring towns to provide alternatives to the Richmond Park and Ride that is currently of inadequate capacity. Identify possible additional Park and Ride capacity space in Richmond, such as on the south side of the I89 interchange with a pedestrian crossing light at the existing interchange traffic light.”

2. Relevant findings from a review of the [Vermont Route 2 Bicycle and Pedestrian Scoping Report \(2014\)](#):

NOTE: This report is 280 pages long and evaluates many different alternatives for improved walking and bicycling conditions between Richmond Village and the Richmond Park and Ride. Most of the alternatives are different alignments of shared use paths, although there are also foot path alternatives and on-road alternatives. Only some basic background information and the final recommendations that are directly pertinent to the reclaim project are included below.

- The purpose of the Route 2 bicyclist and walker project is to create improved walking and bicycling conditions between Richmond Village and the Richmond Park & Ride, especially for commuters, and to consider better bicycling and walking access and connections to the other destinations within or adjacent to the Study Area, including the Richmond Elementary School and Camels Hump Middle School.
- The roadway surface is in poor condition throughout the project area. VTrans intends to reclaim the roadway in 2017 with the Richmond-Bolton STP 2924(1) project. Current

plans (2014) for the reclaiming include widening the shoulders to at least three feet wide and up to four feet wide where possible.

- The Route 2/Jericho Road/Bridge Street intersection is signalized and includes crosswalks and pedestrian signals. There is considerable pedestrian activity at the intersection, especially in the morning and afternoon as school children are walking to the schools north of the intersection on Jericho Road. During the discussion of community concerns at the start of the project, public work session participants expressed concern about pedestrians, especially children going to and from school, trying to cross Route 2 and being cut off by turning vehicles from the cross streets. The report includes a recommendation to explore adding a short lead phase for pedestrians crossing Route 2 which would allow them more time to cross the road as well as make them more visible to motorists making the turn.
- The preferred alternative - long-term recommendation is a shared use path with an alignment that generally parallels the west side of Route 2. This alternative, although it is the Town's preferred alternative, has a major hurdle to clear in that it relies on use of the railroad right-of-way and the railroad is not currently interested in allowing use of its ROW for this purpose.
- "The preferred alternative - short-term recommendation (because it may take many years for the NECR to agree to the use of its right-of-way for a shared use path) is that the Town should work with VTrans to maximize as much as possible the width of the paved shoulders to be added to Route 2 as part of the upcoming repaving project (the No Action Alternative). This paving project will include three-foot wide shoulders at a minimum between the Village and the intersection with the Interstate eastbound access ramp. With encouragement from the Town, VTrans might be able to create continuous four-foot-wide shoulders from the Park & Ride to the Village."
- "The wider paved shoulders that will be included in the reclaiming of Route 2 will also complement the proposed shared use path and provide a wider choice of facilities to potential walkers and bicyclists."

The proposed initial implementation steps contained within the report that may be pertinent to the reclaim project are as follows:

- "Work with VTrans to add four-foot paved shoulders to the upcoming reclaiming project."
- "Work with VTrans to establish an eventual acceptable pedestrian crossing of Route 2 at Baker Street and at the entrance to the Richmond Land Trust parcel."
- "Work with VTrans to install SHARE THE ROAD signs and sharrows on Route 2 in the Village between the Baker Street and Bridge Street intersections."
- Work with VTrans to review / modify the signal timing at the Route 2/Jericho Road/Bridge Street intersection to provide more protected crossing conditions for pedestrians crossing US2. The main concern is a lack of protection from right or left turning vehicles during the concurrent pedestrian phase of the traffic signal. A short leading pedestrian interval for pedestrians crossing Route 2 would allow them more time to cross the road as well as make them more visible to motorists making the turn.

3. Relevant findings from a review of the [Richmond Village Parking Study \(2007\)](#):

- “On-street spaces along East Main Street should be formalized to encourage parking in this section of the village.”
 - The US 2 driveway for the office building on the southeast corner of US 2 and Jericho Road should be closed to allow for one more parking space on that side of the street and a bulbout should be provided at the corner. The parking lot for that building is currently served with an access on Jericho Road. Closing the US 2 driveway is consistent with sound access management practices which discourage placing driveways too close to intersections while encouraging access on side streets, like Jericho Road, when possible. The Town should discuss this recommendation with the owner of the building.
 - ...the sidewalks should be upgraded....to provide enhanced connections to the village core.”
4. Relevant findings from a review of the [Town of Bolton, Vermont, 2017 Bolton Town Plan](#):
- While there are many trails in Bolton, the town has no sidewalks or bike paths.
 - The Chittenden County Regional Planning Commission’s Active Transportation Plan recognizes US 2 as a significant bicycling route as well, and indicates that VTrans should improve the road’s safety for bicyclists when it is next repaved.
5. Relevant findings from a review of the Draft FY2021-2024 Transportation Improvement Plan (TIP):
- This project, Richmond-Bolton STP 2924(1), is included in this TIP.
 - Project District 5 BM20502 is included in this TIP.
 - Project Richmond STP CULV(58) is included in this TIP.
 - Project Richmond IM 089-2(52) is included in this TIP.
6. Relevant findings from a review of the [Active Transportation Plan, Chittenden County, \(2017\)](#):

Most of this plan looks at active transportation planning on a county-wide level. Therefore, only specific information relative to US 2 in Richmond and Bolton is included in this review.

- “The project team also asked the public to show which routes they would like to walk or bike within Chittenden County: Wikimap users identified 337 routes on which they would like to walk or bike.” The 4th most commonly identified route was US2 in Richmond.
- The Active Transportation plan (ATP) identifies six projects/corridors within Chittenden County as having both high priority and high feasibility. These segments are all also identified as “High Priority” segments by the VTrans On-Road Bicycle Plan. Project #2 is US2 from South Burlington to Bolton. For the portion in Richmond and Bolton, the following was noted:
 - “The section of US2 between VT117 in Richmond and approximately the Bolton Valley Access Road is a very popular biking route. Although there are currently no TIP projects in this segment, VTrans evaluates paving candidates each year and a future project is likely.”
 - “CCRPC conducted a scoping study in 2014 of bike-ped connections between the Exit 11 Park-and-Ride lot and Richmond Village. The scoping study made long,

medium and short term recommendations. CCRPC should work with Richmond to implement the recommendations.”

7. Relevant findings from a review of the [Metropolitan Transportation Plan \(2018\)](#):

Most of this plan looks at transportation planning on a county-wide level. Therefore, only specific information relative to US2 in the towns of Richmond and Bolton is included in this review.

- “... congestion is ... an issue in the morning peak hour at the Bridge Street/US2 intersection in Richmond.”
- “Bicycle and pedestrian travel is relatively low in the eastern part of the corridor, although adequate shoulder widths on US2 through Bolton make for relatively safe conditions. Moving closer to Burlington, the level of bicycle and pedestrian travel increases... Richmond ... has some shoulder choke points especially between the Village and I-89 Exit 11. ...US2 ... through Richmond ... (is) scheduled for repaving in the near future and, to the extent feasible, additional shoulder width will be designated for bike lanes.”
- The Metropolitan Transportation Plan project list includes as a Park and Ride project in Bolton, the US2/Bolton Access Road Park & Ride project, and lists it as a need identified in a Scoping or Planning Study, as having a medium time frame, and an estimated cost of \$50,000.
- The Metropolitan Transportation Plan project list includes as a Bike and Pedestrian project in Richmond, the US2 Path – Park and Ride to Richmond Village project, and lists it as a need identified in a Scoping or Planning Study, as having a long term time frame, and an estimated cost of \$3.388 million.

Recommendations: The goals from the town and regional plans listed above that will be considered as part of this project are as follows:

- “Work with VTrans to prioritize rebuilding Route 2 (Main Street) including... bicycle/pedestrian accommodation.”
- “Work with VTrans to add four-foot paved shoulders to the upcoming reclaiming project.”
- Work with VTrans to review / modify the signal timing at the Route 2/Jericho Road/Bridge Street intersection to provide more protected crossing conditions for pedestrians crossing US2. The main concern is a lack of protection from right or left turning vehicles during the concurrent pedestrian phase of the traffic signal. A short leading pedestrian interval for pedestrians crossing Route 2 would allow them more time to cross the road as well as make them more visible to motorists making the turn.
- “On-street spaces along East Main Street should be formalized to encourage parking in this section of the village.”

10 Regional Planning Commission Input

Section reserved for input received from review by Regional Planning Commission.

11 Summary of Recommendations

Project Location: Coordinate this paving project with the projects listed in Table 1.

Pavement Treatment: Reclaim with removal of buried concrete slabs wherever feasible.

Bicycle Usage: The recommended type of bicycle accommodation is a paved roadway shoulder. See Typical New Section (below) for specific paved shoulder width recommendations.

The segment from Richmond MM 0.943 to MM 1.217 may benefit from bike lanes and other signing/markings changes to clearly delineate safe paths for bicyclists and to highlight potential conflict areas. Early in this project's design phases, the VTrans Bicycle and Pedestrian Program Manager should be consulted for more specific recommendations.

In Richmond village, bicycle accommodations should be in accordance with the current best practices in a village setting per review of the VTrans Bicycle and Pedestrian Manager.

Typical New Section: See Table 9 for recommended paved lane widths and shoulder widths.

If widening shoulders along the entire roadway segment is not feasible, priority for widening should be given to the segment from Richmond MM 1.15 to MM 2.50 as this has been identified as a priority by the Town of Richmond.

It is strongly recommended that the extents of legal parking be clarified throughout Richmond village as discussed in Section 5.6.5 above. It is recognized that resolving the parking issue along US2 to the satisfaction of both VTrans and the Town of Richmond will probably be difficult.

Pedestrian Usage: All crosswalks should be striped with durable pavement markings as part of this project.

As part of addressing the parking issues, consideration should be given to installing a means of preventing vehicles from parking on the sidewalks between MM 2.71 to MM 2.94, such as curbing or vertical delineators.

If signal replacement at the US2/Bridge Street/Jericho Road intersection is included in this project (see Traffic Signals & ITS section below), it should be verified that all pedestrian features at the intersection are fully compliant, including accessibility considerations.

Environmental Liability: See Section 5.9.

Stormwater: See Section 5.10.

High Crash Location – Richmond MM 0.553 – 0.853

The following safety improvements should be considered:

- Installation of a westbound left turn lane at the intersection with Kenyon Road

High Crash Location – Richmond MM 1.100 – 1.180 (Intersection with I89 and Park & Ride)

The following safety improvements should be considered:

- Installation of a eastbound left turn lane at the intersection with the Park & Ride. It is recommended that this consideration process start with a traffic analysis of this location.
- reducing the radius off the I89 southbound ramp for going eastbound on US2

High Crash Location – Richmond MM 2.353 – 2.653

The following safety improvements are recommended:

- Resolution of parking issues on US2 within Richmond village as recommended in Section 5.6.5.

High Crash Location – Richmond MM 2.690 – 2.770 (Intersection w/ Bridge St. & Jericho Road)

The following safety improvements are recommended:

- Upgrading the traffic signals. As noted in Section 8.3, full replacement of the existing traffic signals infrastructure, including the installation of new mast arms, is recommended.
- Planning for a future left turn lane. All aspects of this project (including the traffic signal infrastructure) in the area around the US2 / Bridge Street / Jericho Road intersection should be designed and detailed to best allow for the addition of a left turn lane on Bridge Street as part of a possible future project.
- Addition of a left turn phase from Bridge St in the new signal infrastructure
- Resolution of parking issues on US2 within Richmond village as recommended in Section 5.6.5.

The following safety improvements should be considered:

- If the Town expresses an ongoing concern regarding a left turn lane onto US2 from Bridge Street, consideration should be given to initiating a feasibility study of this left turn lane as a separate project.

High Crash Location – Richmond MM 3.253 – 3.553

The following safety improvements are recommended:

- Superelevation at the S curves
- Clearing trees and other vegetation along the Westbound side from Richmond MM 3.430 to 3.510 and along the Eastbound side from Richmond MM 3.520 and MM 3.560
- Excavating the existing bank back at the same limits as above
- Establishing an adequately sized continuous ditch throughout the curves
- Establishing 4 foot wide paved shoulders throughout the curves
- It is noted that large, steep ledge outcroppings are visible along most the Westbound area noted above, so a significant amount of ledge removal may be necessary to achieve the above recommendations. Obtaining additional right of way may be required to achieve these recommendations but it should be considered at this location.
- A couple of small bedrock outcrops may be encountered while excavating the bank in the Eastbound area noted above.
- CLRS

The following safety improvements should be considered:

- A High Friction Surface Treatment
- Upsizing the curve warning signs and the chevrons

High Crash Location – Richmond MM 4.853 – 5.153

The following safety improvements are recommended:

- Superelevation at the curves
- Clearing trees and other vegetation along the Westbound side between Richmond MM 4.940 and MM 5.010
- Excavating the existing bank back at the same limits as above
- Establishing an adequately sized continuous ditch throughout the curves
- Establishing 4 foot wide paved shoulders throughout the curves
- It is noted that large ledge outcroppings are visible along the Westbound side at this location, so a significant amount of ledge removal may be necessary to achieve the above recommendations. Obtaining additional right of way may be required to achieve these recommendations but it should be considered at this location.
- CLRS

The following safety improvements should be considered:

- A High Friction Surface Treatment

High Crash Location – Richmond MM 5.253 – 5.553

The following safety improvements are recommended:

- Superelevation at the curve near Lily Pond
- CLRS

High Crash Location – Richmond MM 6.153 – Bolton MM 0.074

It is strongly recommended that safety improvements be made that will provide additional warning of the intersection and stop sign when approaching the US2 intersection from Cochran Road. Possible safety improvements that should be considered, if they are determined to be within the project scope, include, at a minimum, the following:

- install an additional stop sign on the left-hand side of Cochran Road
- install permanent “STOP” pavement marking near to the stop sign
- install permanent stop bar markings
- install permanent “STOP AHEAD” pavement markings near the advance stop warning sign
- install a “STOP AHEAD” warning sign in addition to or replacing the existing advance stop warning sign
- review the size and location of the existing advance stop warning sign

Another safety improvement that should be considered is installation of an advance warning intersection sign with a street name plaque for westbound traffic on US 2.

Rumble Strips: The installation of Center Line Rumble Strips (CLRS) is recommended throughout the project limits except in Richmond Village and in Jonesville where closely spaced residences are located within 100 feet of the roadway centerline. Final decisions regarding the specific roadway extents where CLRS are to be included in this project should be made in accordance with all Agency guidelines in effect at the time of roadway design.

District Needs: See Section 7.1, Table 10 for a list of Corridor Needs which have been documented by District staff. See Section 7.2, Table 11 for a list of District Needs issues which were conveyed by District staff at the District Meeting held for this project. It is recommended that early in this project's design phases, each item in the two tables noted above should be explored further and/or considered for inclusion in the project:

Traffic Signs & Pavement Markings: "Wholesale" sign replacement of existing signs is not recommended on this project. See Section 8.2 for discussion of where new signs are recommended or should be considered. All new pavement markings along this corridor should consist of durable lane markings and stenciling (where necessary).

Traffic Signals & ITS:

Signal MS580 – New Detection, Preemption, Communications, and Cabinet recommended with an estimated cost of approximately \$100,000.

Signal MS584 – New Detection, Preemption, Communications, and Cabinet recommended with an estimated cost of approximately \$100,000. Regardless of whether these upgrades are included in the project, the signal infrastructure will need to be revised as required if construction of a left turn lane for US2 eastbound traffic turning into the Park & Ride is incorporated into this project.

Signal MS576 – Full Traffic Signal replacement with new short mast arms on all 4 legs is recommended. Although this is preferred, it is recognized this may not be feasible due to significant site constraints imposed by the locations of existing buildings, sidewalks, access drives, and parking. If the existing pedestrian signal heads do not already have countdowns, they should be included with any upgrade to the pedestrian signal infrastructure. All aspects of the new traffic signal infrastructure in the area around the US2 / Bridge Street / Jericho Road intersection should be designed and detailed in this project to best allow for the addition of a northbound left turn lane on Bridge Street as part of a possible future project. It is also recommended that a left turn phase from Bridge Street be included in the programming of the new signals.

Structures: See Section 8.5, Table 14 for specific recommendation for long and short structures.

At all structures where a Level and Overlay treatment is being considered, the shorter effective height of the bridge railing, due to the added pavement thickness, must be checked for conformance with the standard guardrail height requirements. A Mill and Fill treatment or adjustment of the railing (if possible) may be necessary to maintain required height.

At all long structures, general cleaning and debris removal should be done on all joints, scuppers, and downspouts.

All long and short structures should be reviewed in the field as described in Section 8.0.

Culverts: All (123) small culverts should be reviewed in the field as described in Section 8.0. Special attention, including cleaning out, and potentially video inspecting, should be paid to the (54) shallow culverts and (13) deep culverts with deficiencies noted in Section 8.6 and to the (23) culverts for which most of the inspection information is not available. A general culvert implementation plan as described in Section 8.0 should also be developed.

Drop Inlets / Catch Basins: All (44) drop inlets within the project limits should be reviewed in the field as described in Section 8.0. Special attention should be paid to the (9) drop inlets with deficiencies noted in Section 8.7. Any drop inlet or catch basin that is considered a roadside obstacle of safety issue

should be addressed. The elevations of affected drop inlets should be evaluated for adjustment if the scope of this project includes changing grades or banking.

Guardrails: All (50) guardrail runs within the project limits should be reviewed in the field as described in Section 8.0. Special attention should be paid to the (7) guardrail runs with deficiencies noted in Section 8.8. All new and replacement guardrail should be designed per current Agency policies and engineering instructions. The District's preference is for all replacement guardrail to be W beam guardrail.

Retaining Walls: All retaining walls should be reviewed in the field as described in Section 8.0.

RW0029 - Conduct routine maintenance and clear away brush.

NOTE: See District comments and recommendations regarding this retaining wall in Section 7.2.

RW0031 – Structure should be removed and replaced, or the structure should be removed and the bank sloped back to eliminate the need for the retaining wall.

NOTE: See District comments regarding this retaining wall in Section 7.2.

Rock Cuts: All rock cuts should be reviewed in the field as described in Section 8.0.

Section 6.2 (above) includes recommendations that ledge outcroppings be removed along the inside of horizontal curves at 3 locations. Significant amounts of ledge removal may be required at 2 of these locations to achieve the recommended safety improvements.

Sections 7.1 and 7.2 (above) include details of 4 areas where the District recommends that ledge outcroppings immediately adjacent to the roadway be removed.

It is also recommended that the one rock cut with a B ranking noted above be considered as noted below.

It is recommended that, early in this project's design phases, each of the areas noted above be explored further and/or considered for inclusion in the project.

Slopes: Sections 7.1 and 7.2 of this NPS include descriptions of (8) areas within the project limits where the District has indicated there appears to be a slope stability issue. It is recommended that, early in this project's design phases, each of these areas be explored further and/or considered for inclusion in the project.

12 Appendix

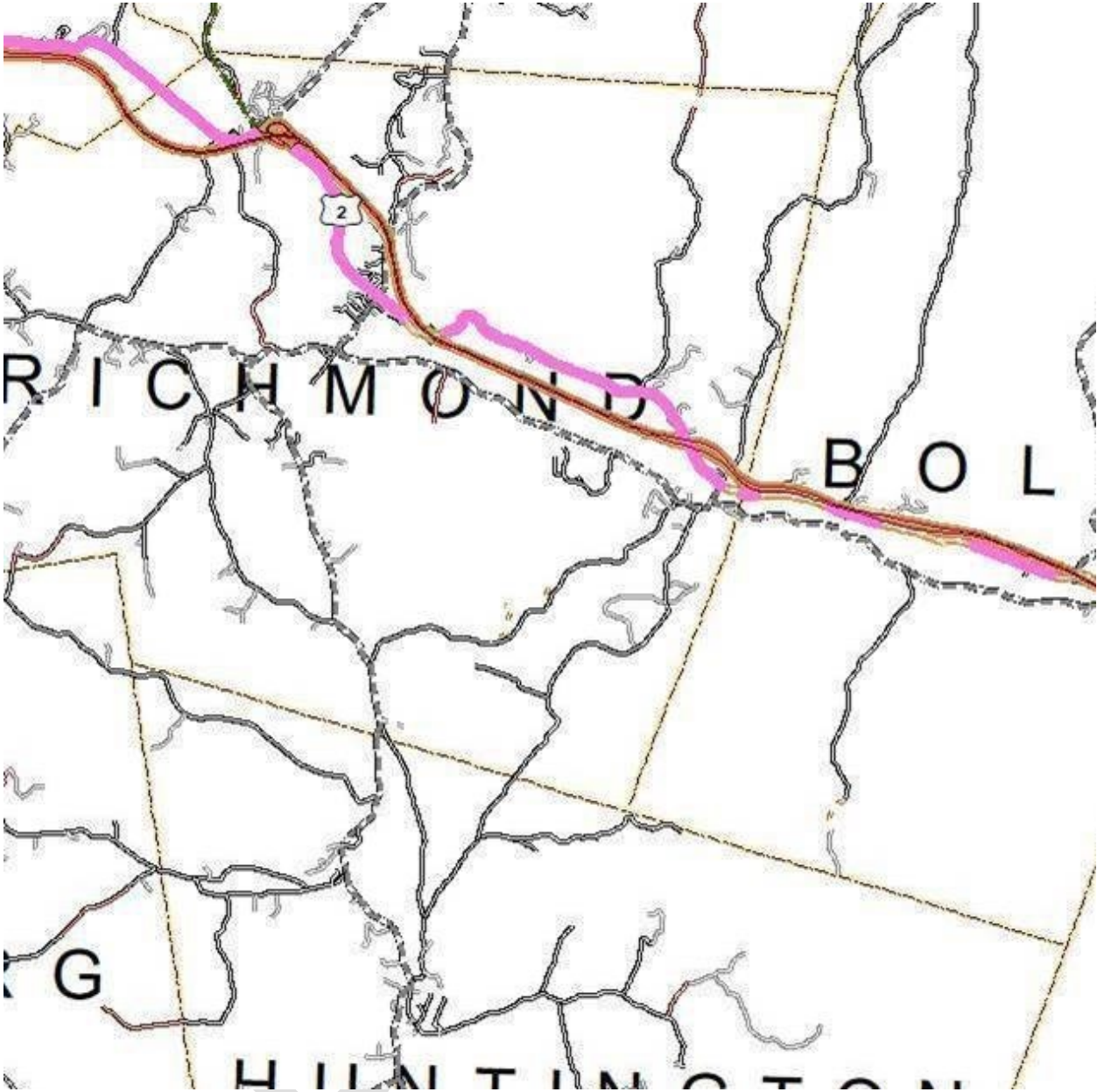


Figure 2 Extents of Buried Concrete Slabs on US2 (Areas where slabs are believed to still exist are indicated in pink)



Figure 3 Richmond Parking - West of Intersection – Westbound Side



Figure 4 Richmond Parking - East of Intersection – Westbound Side



Figure 5 Richmond Parking - East of Intersection - Eastbound



Figure 6 Richmond Parking - East Side of Intersection - Eastbound



Figure 7 Stormwater Infrastructure near Bridge #24



Figure 8 Stormwater Infrastructure Near Park & Ride

COLLISION DIAGRAM

Key Number = 1

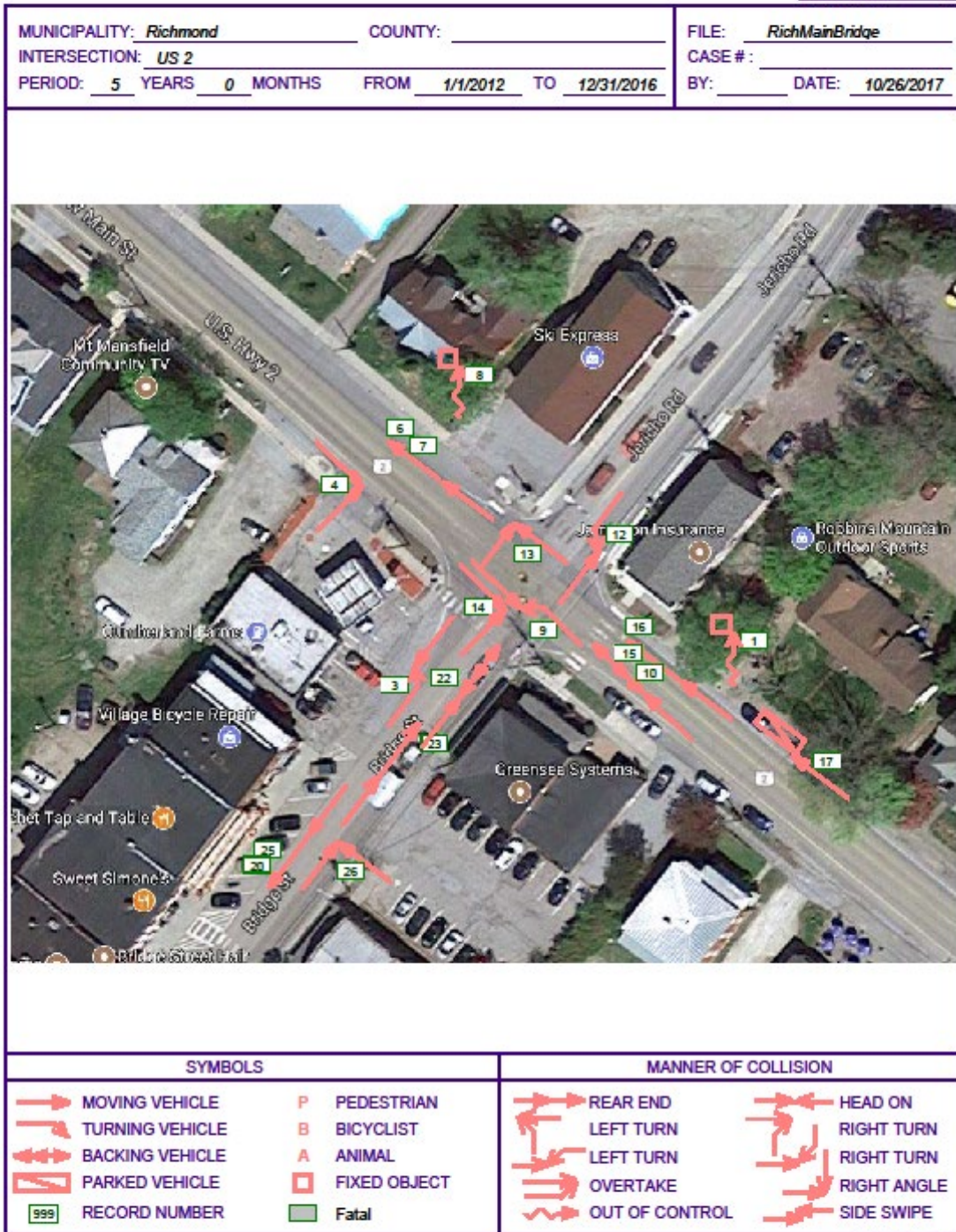


Figure 9 2017 Intersection Collision Diagram

COLLISION DIAGRAM

Key Number = 2



Figure 10 2017 Parking Collision Diagram