COMPLETE STREETS COMMITTEE
MEETING AGENDA

TUESDAY, SEPTEMBER 3, 2019, 7:30 A.M.
TOWN HALL, COUNCIL CHAMBERS

1. Accept minutes of the July 2, 2019 meeting (5 minutes).
2. Committee Vacancy (5 minutes).
3. Discuss HNTB I-295 Crossing Study (30 minutes).
4. Exit 22 Signal Warrant Analysis (15 minutes).
5. Cousin's River Bridge Multi-Use Path (30 minutes)
6. Adjournment. Next scheduled meeting: Tuesday, October 1, 2019.

TRAFFIC AND PARKING COMMITTEE
MEETING MINUTES
July 2, 2019

ATTENDANCE:	Doug Leland, Chair	Rodney Regier
	Police Chief Susan Nourse, Vice Chair	Geralyn Campanelli (absent)
	Doug Reighley, Town Councilor	David Lockman
	Chester Goggin	Catrina Milliman (absent)
	Adam Bliss, Town Engineer	Greg Mishes (absent)

Meeting started at 7:33 am and adjourned at 9:00 am.

I. Accept Minutes of the June 4, 2019 Meeting.

Mr. Goggins motioned to accept the minutes as written; Councilor Reighley seconded; motion passed 6 in favor with none opposed.

II. South Freeport Road Speed Zone Evaluation.

Mr. Leland introduced Mrs. Joyce from 113 South Freeport Road who requested the 25 mph speed limit sign to be relocated approximately 400 feet to the south on the south side of South Freeport Road. Mr. Bliss introduced the project which was outlined in the materials provided. A map was displayed of the existing signage including the proposed relocation of the speed limit sign. Mr. Bliss explained that the Maine DOT has jurisdiction over the establishment of speed limit signs. He has reached out to the Maine DOT for their opinion and is waiting to receive a response. The current speed limit zones were reviewed in 2012 and are appropriately signed per the Maine DOT evaluations. An administrative zone change up to 500 feet may be allowed by the Maine DOT without an involved, formal study. The speed sign relocation would qualify as an administrative zone change.

Traffic monitoring (speed and vehicle counts) locations were also discussed. A semi-permanent monitoring location has been collecting ongoing data on South Freeport Road near Hayboat Point, but this location is where the speed limit changes from 40 mph to 35 mph. A portable data collection system was placed near the dip in the road facing northbound traffic between Cheehaak Road and Smelt Brook Road. The portable system data for the two-week monitoring period showed an average speed of 37 mph and an 85th percentile of 41 mph. The speed limit in this area is 35 mph suggesting the area is appropriately signed. Councilor Reighley requested the portable system be moved to the 25 mph speed limit area. Additional monitoring will be conducted if requested by the Maine DOT.

Mrs. Joyce introduced herself and expressed concerns for vehicular speeds with respect to children and pedestrian and bicyclist safety. Mrs. Joyce's letter was shared with the Committee. Her viewpoint is supported by South Freeport Road geometry (e.g. hill and straightaways) and the speed tables in the Village.

Councilor Reighley motioned to relocate the 25 mph speed limit sign up to 500 feet to the south. Mr. Regier seconded; motion passed 6 in favor with none opposed.

III. Follow-up: Chapter 2, Administrative Code: Section 614, Traffic and Parking Committee.

The Town Council requested a definition of Complete Streets be added to the proposed Complete Streets Committee. The following definition was added based upon nationally accepted terminology and characteristics.

"Complete Streets" (for purpose of general definition within this ordinance) is a transportation policy, which encourages street planning, design, operation, and maintenance that enables safe access for all members of our community, to include pedestrians, bicyclists, motorists, and transit riders, regardless of age and abilities. A 'complete street' safely accommodates all users. An 'incomplete street' does not.

The procedure for acceptance of the proposed changes is an Ordinance Committee meeting followed by the Town Council setting of Public Hearing date and concluding with the Public Hearing.
Councilor Reighley motioned to accept the added definition of Complete Streets to the Administrative Code. Mr. Lockman seconded; motion passed 6 in favor with zero opposed.

Mr. Leland commented that the Appointments Committee would receive guidance from the Traffic and Parking Committee on an annual basis of desired qualifications from potential committee member applicants.

IV. Other.

Mr. Regier requested vegetation removal where line-of-sight issues exist at road intersections. He asked that the line-of-sight be evaluated from small passenger cars rather than taller vehicles such as trucks. Mr. Goggins specifically mentioned the intersection of South Street and Cove Road. Councilor Reighley mentioned the intersection of South Freeport Road and Church Road.

V. Adjournment: Next scheduled meeting: September 3, 2019.

Councilor Reighley motioned to adjourn; Mr. Lockman seconded; motion passed unanimously.

DRAFT

CONCEPTUAL EVALUATION REPORT

BIKE/PEDESTRIAN ACCOMMODATIONS ACROSS INTERSTATE 295 IN FREEPORT, ME

PREPARED FOR:

PORTLAND AREA COMPREHENSIVE TRANSPORTATION SYSTEM (PACTS)

July 8, 2019

Prepared by:

HNTB

CONCEPTUAL EVALUATION REPORT

BIKE/PEDESTRIAN ACCOMMODATIONS ACROSS INTERSTATE 295 IN FREEPORT, ME

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I. DEVELOPMENT AND EVALUATION OF ALTERNATIVES

A. General Considerations

The project goal and one of many goals of Freeport's 2014 Active Living Plan is to provide bicycle and pedestrian connectivity between points east and west of I-295 in Freeport, in a safe and cost-effective manner. The schools and the downtown/shopping district are on the east side of I-295 and many recreational fields and trails are on the west side of Freeport. Safe access across I-295 doesn't currently exist for bicyclists and pedestrians. The Exit 20 bridge has no sidewalks, and bicycles must ride in the travel lanes. The Exit 22 bridge requires bicycles to ride in the travel lanes, but the bridge itself does have a sidewalk, but no approach sidewalks leading up to the bridge.

Based on this goal, the project team evaluated the following three general areas for possible bicycle/pedestrian crossings:

- I-295 corridor between Exits 20 and 22 via a new multi-use trail bridge or tunnel.
- Exit 20 (Desert Road)
- Exit 22 (Mallett Drive)

B. I-295 CORRIDOR BETWEEN EXITS 20 AND 22 VIA A BRIDGE/TUNNEL

The I-295 corridor between Exits 20 and 22 was evaluated at a conceptual level for possible multi-use trail bridge or tunnel crossing locations. Two-foot contours from the Maine Office of GIS, wetland areas from the National Wetlands Inventory (NWI) and right-of-way lines from the Town of Freeport, were downloaded and overlaid on aerial imagery. Contours east and west of I-295 were evaluated for high points that may indicate possible bridge crossing locations or low points that may indicate possible tunnel crossing locations. Six bridge locations and seven tunnel locations were initially identified based on contours alone. These locations are identified in **Figure 1**. The six bridge and seven tunnel locations were further evaluated in plan view to determine if existing buildings, roads or other significant conflicts may exist. Upon further review, three bridge locations and six tunnel locations were dismissed after this analysis for the reasons noted. **Table 1** summarizes the location evaluation.

Table 1: Location Evaluations

Location	Crossing Type	Resolution	Primary Reason of Dismissal
A	Bridge	Dismissed	Large I-295 Median Results in Long Span Length
B	Bridge	Dismissed	Multiple Crossings Required Due to Ramps
C	Tunnel	Dismissed	Hunter Road Proximity to I-295 Results in Steeper then Allow able Path Grades
D	Bridge	**Evaluated Further**	**N/A**
E	Tunnel	**Evaluated Further**	**N/A**
F	Tunnel	Dismissed	Maintenance of Traffic Costs
G	Tunnel	Dismissed	Large R.O.W. Impacts
H	Bridge	**Evaluated Further**	**N/A**
I	Tunnel	Dismissed	Large R.O.W. Impacts
J	Tunnel	Dismissed	Large R.O.W. Impacts
K	Bridge	Dismissed	Large R.O.W. Impacts
L	Tunnel	**Evaluated Further**	**N/A**
M	Bridge	**Evaluated Further**	**N/A**
N	Bridge	Dismissed	Large R.O.W. Impacts

The remaining three bridge crossings and one tunnel crossing are shown in **Figure 2** and described as follows:

- Bridge: Hunter Road to Meetinghouse Road
- Bridge: Undeveloped land to Freeport High School
- Bridge: True Street to Kendall Lane
- Tunnel: Farmview Lane to Somerset, adjacent to railroad

Horizontal and vertical alignments were developed at each of the above locations and a typical section template of a 10-ft wide paved trail with 2-ft grass shoulders was evaluated along the profile to determine approximate slope impacts. Each location was reviewed at a conceptual level to determine extent of environmental, right-of-way, and utility impacts.

Conceptual cost estimates were developed for each crossing using $325/SF for bridges, $3,200/LF for the tunnel and $170/LF for the multi-use trail. Unit costs were developed utilizing the most recent MaineDOT projects with relevant items and inflated to 2019 prices. Prices do not include right of way acquisition, utility relocation, or environmental permitting. **Table 2** is a summary of costs and impacts of each potential crossing location.

Table 2: Evaluation Matrix

Evaluation Criteria		Potential Bridge Location #1: Hunter Road to Meetinghouse Road	Potential Bridge Location #2: Undeveloped Land to Freeport High School	Potential Bridge Location #3: True Street to Kendall Lane	Potential Tunnel Location #1: Farmview Lane to Somerset, adjacent to railroad	Potential Tunnel Location #2: Mallett Drive
Crossing Type		Bridge	Bridge	Bridge	Tunnel	Tunnel
Construction Cost (Bridge & Roadway Construction)		$2,100,000	$2,500,000	$1,900,000	$4,800,000	$1,800,000
Path Connectivity		Roads with no Sidewalks	Requires Additional Path	Roads with no Sidewalk	One Approach has existing sidewalk	Roads with no Sidewalk
Structure Length (ft.)		175 feet	200 feet	165 feet	220 feet	200 feet
Path Approach Length		500 feet	620 feet	515 feet	2050 feet	800 feet
Maintenance of Traffic Costs		Lower Cost	Lower Cost	Lower Cost	Higher Cost	Lower Cost
Utility Impacts	Overhead	Relocations Required	Not Anticipated	Relocations Required	Not Anticipated	Not Anticipated
	Underground	Not Anticipated	Not Anticipated	Not Anticipated	Not Anticipated	Not Anticipated
Right-of-Way Impacts		Intermediate Impacts to 3 Parcels	Major Impacts to 2 Parcels	Minor Impacts to 2 Parcels	Major Impacts to 4 Parcels	Intermediate Impacts to 3 Parcels
Environmental Impacts		Limited/Min. Impacts	Limited/Min. Impacts	Limited/Min. Impacts	Limited/Min. Impacts	Limited/Min. Impacts
Color Code Legend:		More Desirable	→			Less Desirable

A brief description of each crossing follows:

i. Bridge: Hunter Road to Meetinghouse Road

A multi-use trail bridge over I-295 with an approximate 7-degree skew is proposed to tie into Hunter Road on the west and Meetinghouse Road on the east. Due to the topography on the west, a 7.8% grade is anticipated to match into the existing grades on Hunter Road. Even with this steep grade, property impacts and possible impacts to buildings are expected without the construction of retaining walls. The existing typical section of Hunter Road is not wide enough for the proposed facility to match into, therefore improvements to Hunter Road would likely be necessary. Minor property impacts on the east side are likely. The conceptual alignments and impacts are shown in **Figure 3**.
2019 Estimated Construction Cost: $2,100,000

ii. Bridge: Undeveloped Land to Freeport High School

A multi-use trail bridge over I-295 with an approximate 6-degree skew is proposed to begin in an undeveloped area on the west and Freeport High School on the east. Due to the topography on the east, a 8.33% grade is anticipated to match into the existing grades near a parking lot at the High School. On the west side, there are no roads or trails to match into at this point, however this option wasn't dismissed understanding the town may be aware of future opportunities west of I-295 near this crossing. The undeveloped land is currently zoned for residential use. The conceptual alignments and impacts are shown in **Figure 4**.
2019 Estimated Construction Cost: $2,500,000

iii. Bridge: True Street to Kendall Lane

A multi-use trail bridge over I-295 with an approximate 13-degree skew is proposed to tie into True Street on the west and Kendall Lane on the east. Due to the topography on the east, an 8.33% grade is anticipated to match into the existing grades on Kendall Lane. Even with this steep grade, property impacts are likely, however no buildings are expected to be impacted. The current gravel parking area associated with the middle school softball field will be eliminated due to the bridge embankment. Impacts to private properties on the west side are not anticipated. The conceptual alignments and impacts are shown in **Figure 5**.
2019 Estimated Construction Cost: $1,900,000

iv. Tunnel: Farmview Lane to Somerset, adjacent to Maine Central Railroad

A multi-use trail tunnel under I-295, parallel to the existing railroad tunnel (32-degree skew from I-295) is proposed utilizing the existing highway embankments for cover. The connections to the tunnel are anticipated to be from Farmview Lane west of I-295 to Somerset east of I-295. Most of this multi-use trail is outside of the Maine DOT's I-295 right of way and therefore will require acquiring rights for approximately 2,000 linear feet of trail. Maintaining traffic while constructing the tunnel is also very costly with this option since two lanes of traffic in each direction of I-295 would be required. A long term consideration could be to wait until the railroad bridge needs to be replaced so the maintenance of traffic costs would be part of the railroad bridge project rather than the trail project. The railroad bridge rehabilitation is not part of the MaineDOT's current work plan and is rated fair so replacement is not imminent. The conceptual alignments and impacts are shown in **Figure 6**.
2019 Estimated Construction Cost: $4,800,000

C. EXIT 20 (DESERT ROAD)

MaineDOT is studying the Exit 20 interchange to evaluate improvements to traffic operations and safety. Improvements may include a complete redesign of the interchange and ramps or possible signalization of the existing intersections of the I-295 ramps and Desert Road. The results of this study are not available at this time, therefore bicycle/pedestrian improvements in this area have not been evaluated other than the understanding that the community desires sidewalks and bicycle lanes on the bridge.

D. EXIT 22 (MALLET DRIVE)

MaineDOT is studying the Exit 22 interchange to evaluate signal warrants, turn lane locations and possible ramp improvements. The existing bridge over I-295 has a sidewalk on the north side, but there are no sidewalks on the approach roadways. The results of this study are not available at this time, therefore bicycle/pedestrian improvements in this area have not been evaluated other than the understanding that the community desires sidewalks and bicycle lanes on the bridge.

E. MALLET DRIVE – POSSIBLE TUNNEL

During the April 2, 2019 site walk, the group discussed the desire for a safe bicycle/pedestrian cross on Mallet Drive. There is a well-worn path between Freeport Middle School and Maple Avenue that middle schoolers use as direct access to a convenience store on Mallet Drive. Crossing Mallet Drive as a pedestrian or bicyclist can be very challenging due to the posted speed of 35 mph as well as the many turn movements into and out of the businesses and I-295 ramps at the Exit 22 Interchange. A tunnel under Mallet Drive for bicyclists and pedestrians was mentioned as a possible solution to this concern.

A conceptual review of a tunnel at this location was reviewed, although it will not provide the connectivity across I-295 which was the original scope of this evaluation. The conceptual alignments and impacts are shown in **Figure 7** and are summarized in **Table 2**.
2019 Estimated Construction Cost: $1,800,000

II. CONCLUSIONS AND RECOMMENDATIONS

As stated in the General Considerations at the beginning of this document, the project goal is to provide bicycle and pedestrian connectivity between points east and west of I-295 in Freeport, in a safe and cost-effective manner. The three bridge crossings and one tunnel crossing locations have the potential to provide that connectivity, but at a very high cost. A cost benefit analysis was not completed, but all bridge options are on the order of $2 million and the tunnel is nearly $5 million as shown in **Table 2**. These values may be cost prohibitive for a community to fund even as a long term goal. Our recommendation is to continue discussions with, PACTS, Town of Freeport, and MaineDOT, with the goal of possibly adding bicycle lanes and sidewalk(s) at the Exit 20 and/or Exit 22 bridge(s). The MaineDOT will likely require cost sharing from the town.

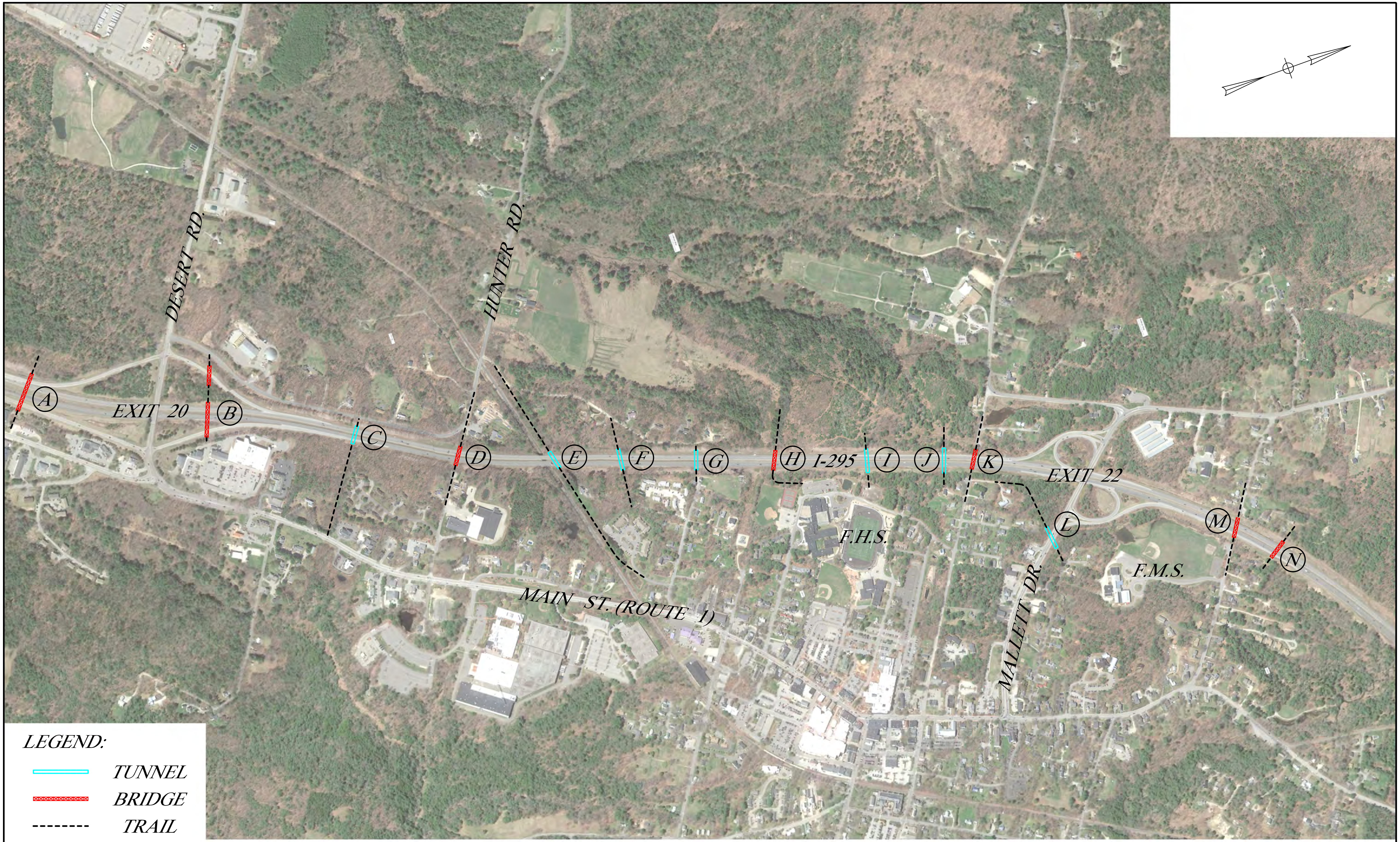

FIGURE 1: EVALUATED CROSSINGS

CONCEPT LAYOUTS
JULY 8, 2019

HNTB

FIGURE 2: PROJECT OVERVIEW

CONCEPT LAYOUTS
JULY 8, 2019

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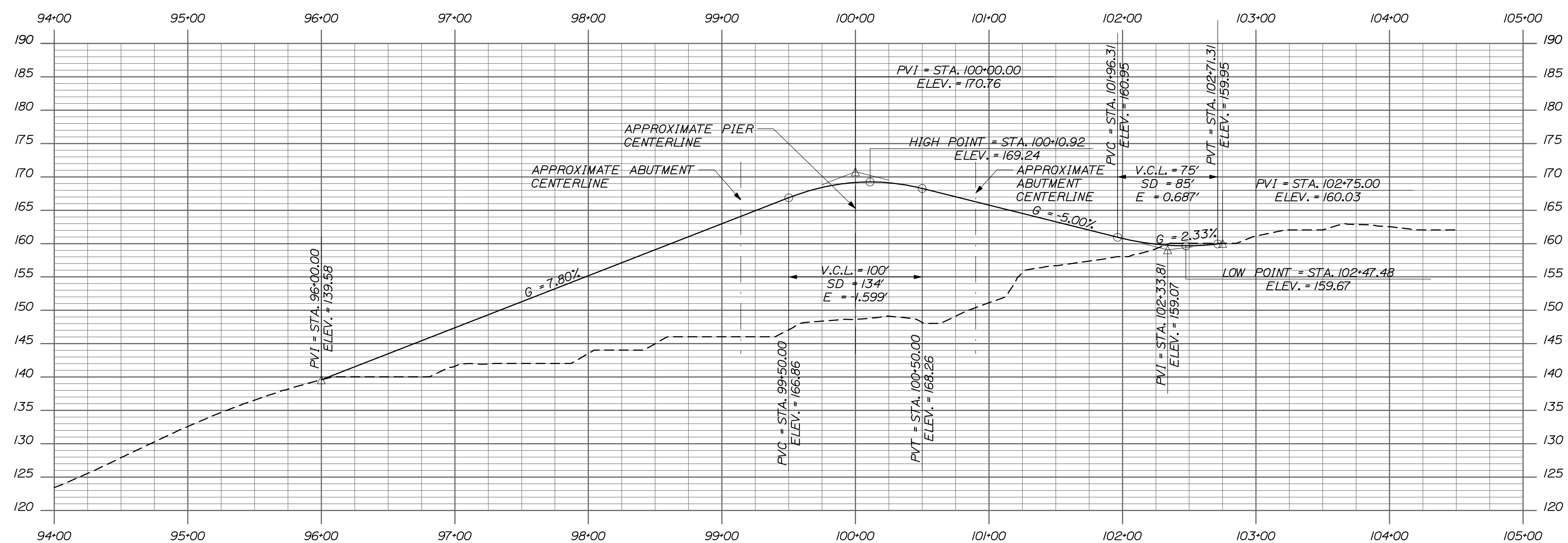
NOTES:
1. ROW INFORMATION PROVIDED BY TOWN OF FREEPORT
2. PLANS DEVELOPED ARE CONCEPTUAL AND DEPICT POTENTIAL PROPERTY IMPACTS. PLANS ARE SHOWN FOR INFORMATION ONLY AS PROPERTY OWNERS HAVE NOT BEEN NOTIFIED REGARDING THIS STUDY.



PROFILE

Horiz. 50 0 50 100
Vert. 10 0 10 20
Scale of Feet

FIGURE 3: POTENTIAL BRIDGE LOCATION #1

CONCEPT LAYOUTS
JULY 8, 2019

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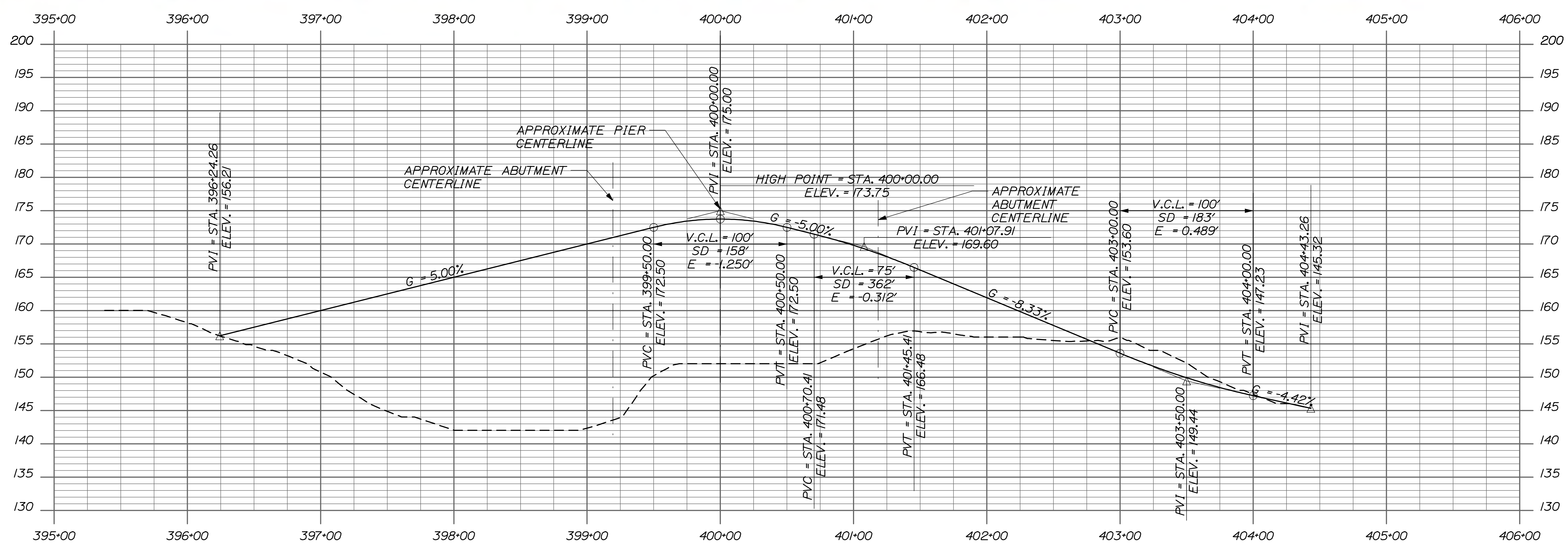

PROFILE

Horiz. 50 0 50 100
Vert. 10 0 10 20
Scale of Feet

FIGURE 4: POTENTIAL BRIDGE LOCATION #2

CONCEPT LAYOUTS
JULY 8, 2019

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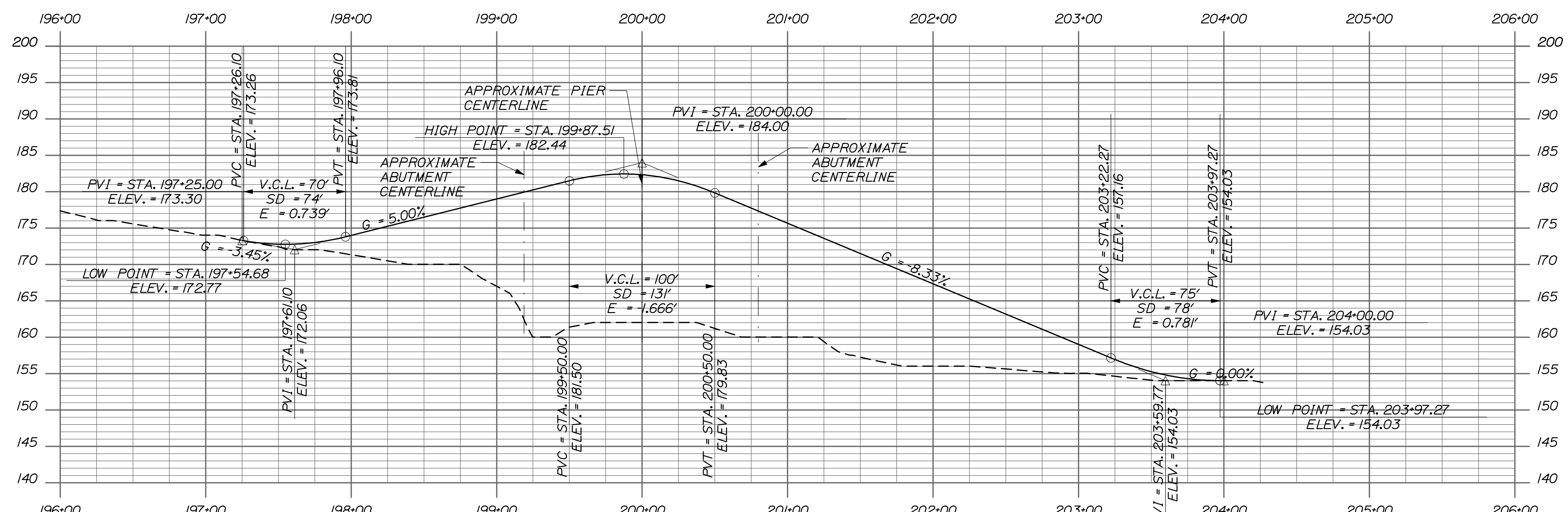

PROFILE

Horiz. 50 0 50 100
Vert. 10 0 10 20
Scale of Feet

FIGURE 5: POTENTIAL BRIDGE LOCATION #3

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JULY 8, 2019

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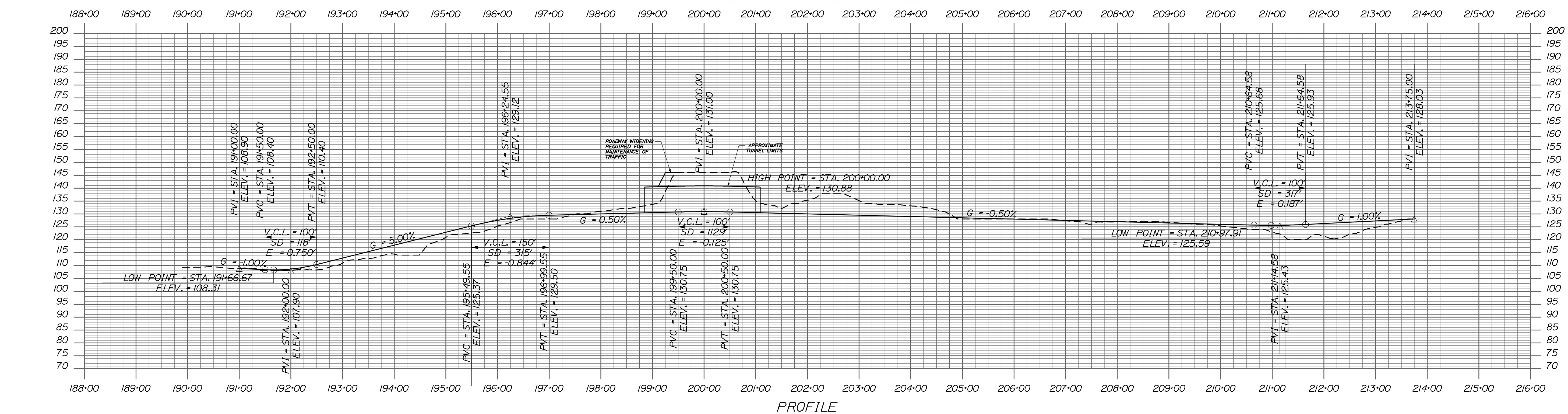

Horiz. 100 0 100 200
Vert. 20 0 20 40
Scale of Feet

FIGURE 6: POTENTIAL TUNNEL LOCATION #1

CONCEPT LAYOUTS
JULY 8, 2019

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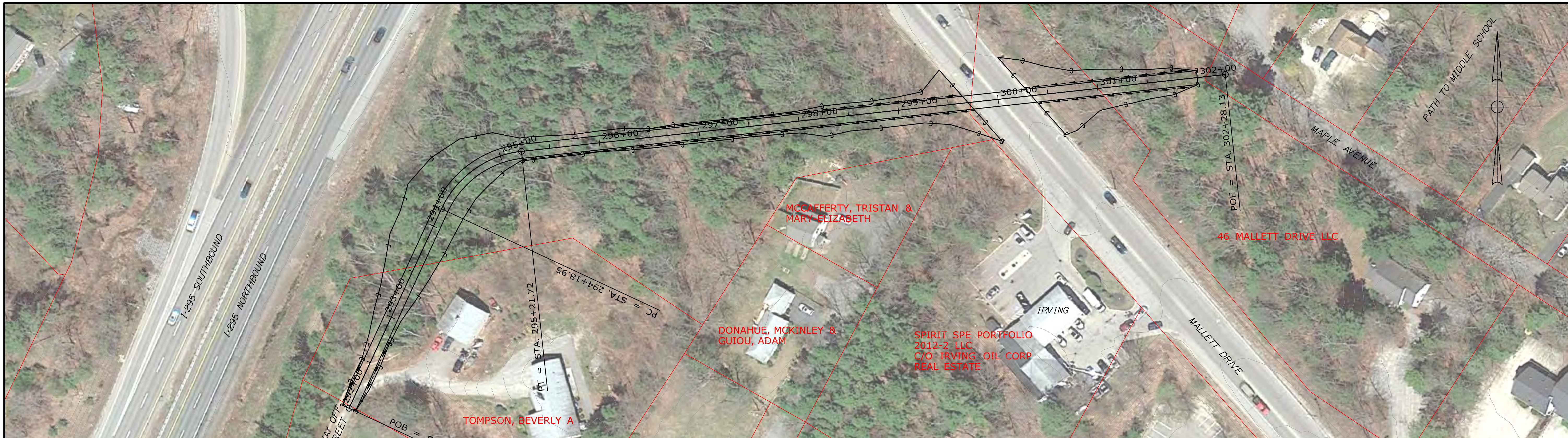

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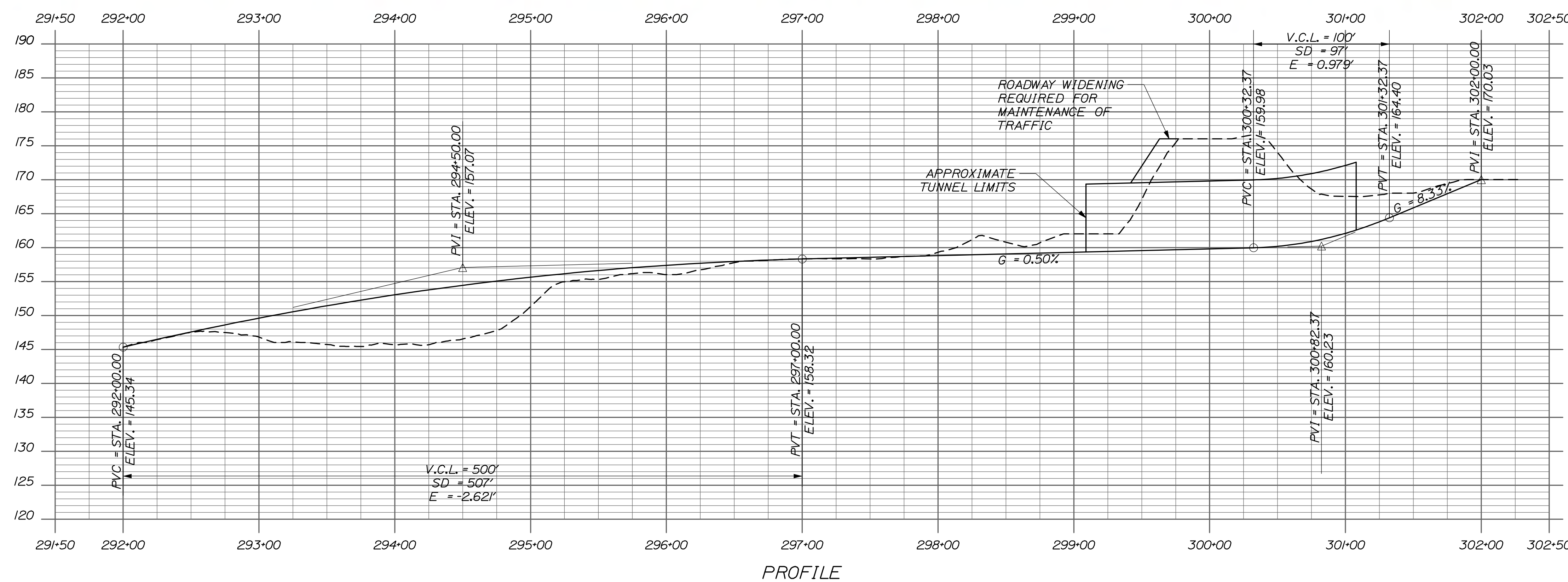


Horiz. 50 0 50 100

Vert. 10 0 10 20

Scale of Feet

FIGURE 7: POTENTIAL TUNNEL LOCATION #2

CONCEPT LAYOUTS
JULY 8, 2019

HNTB

MEMORANDUM

TO: Complete Streets Committee

FROM: Adam S. Bliss, P.E., Town Engineer

DATE: August 28, 2019

SUBJECT: Executive Summary
Exit 22 Signalization Warrant Analysis

This memorandum summarizes the results of a Signal Warrant Analysis for the Exit 22, Mallett Drive Bridge Rehabilitation project. The Maine DOT Transportation Analysis Section evaluated potential intersection improvements associated with the future bridge rehabilitation. Three intersections were evaluated for traffic volumes, vehicle delays (wait times), and crash history, among several other characteristics. These intersections are listed below and are shown on Figure 1 in the report.

A. Durham Road / Mallett Drive (Route 125) Intersection

B. I-295 Southbound On-Off Ramp / Mallett Drive (Route 125) Intersection

C. I-295 Northbound On-Off Ramp / Mallett Drive (Route 125) Intersection

The bridge rehabilitation project is currently in the conceptual design stage and is expected to proceed to preliminary design over the next year. The project is planned to go out to bid next winter but delays could occur because funding mechanisms have not yet been established.

Vehicle traffic simulations were analyzed during the evening commute time because vehicle counts and delays are greater than the morning commute. The average daily traffic on the bridge is 17,000 vehicles per day. The three intersections function at a service level of A, B, and E in the order listed above. Service level A is favorable while E is considered unsatisfactory. Signalization would improve the intersections to satisfactory service levels.

Signalization is warranted at the I-295 Northbound intersection with Mallett Drive (C) in the near term. Future growth scenarios indicate signalization is warranted at the I-295 Southbound intersection with Mallett Drive (B). No signalization is warranted at the Durham Road / Mallett Drive intersection (A). No timetable was provided for the southbound ramp signal but intersection improvements should occur to accommodate a future signal. No formal recommendations have been made about what intersection improvements might occur, but dedicated turn lanes are expected. Benefit / Cost ratios further support the signalization recommendations.

FREEPORT

Exit 22

Maine DOT - Transportation Analysis Section

April 2019

Introduction

Exit 22 in Freeport has historically experienced significant delays, particularly on the northbound off-ramp during the PM Peak Hour. MaineDOT anticipates that the bridge over I-295 will need to be replaced in the near future, so Transportation Analysis has identified possible intersection improvements that could be constructed alongside the bridge replacement. The study area, shown below in Figure 1, is comprised of three intersections: the intersections of SR 125 (Mallett Dr) & Durham Rd (A), SR 125 & the southbound (SB) on/off-ramp (B), and SR 125 & the northbound (NB) on/off-ramp (C).

Figure 1 - Aerial view of the existing location.

Existing Conditions

Currently, the segment on the bridge between the two ramps is one lane in each direction. The bridge deck is 49 feet wide, with narrow sidewalks on both sides, bringing the total roadway width down to 40 feet, including shoulders. Just northwest of the bridge, there is an approximately 50-foot left turn pocket for turning from SR 125 onto the SB on-ramp.

The AADT on SR 125 on the bridge is approximately 17,000 vehicles per day (vpd). To the west of the intersections, the AADT is 10,700 vpd and to the east, the AADT is 13,400 vpd. Durham Rd has an AADT of 1,100 vpd. The NB on-ramp has an AADT of 3,500 vpd and the off-ramp has an AADT of 5,700 vpd. The SB on-ramp has an AADT of 5,100 vpd and the off-ramp has an AADT of 3,400 vpd. The peak hour at this location occurs between 4:30 and 5:30 PM, and represents 9.0% of the daily traffic.

Heavy truck traffic accounts for approximately 1% of the peak hour vehicular volume and 3% of the total daily vehicular volume in this area. Pedestrian and bicyclist volumes are low, with only 10 pedestrians counted at the crosswalks of the three intersections on the day the turning movements were collected. Although the pedestrian volumes are low, the town has expressed interest in building a sidewalk along Mallett Dr from downtown Freeport (to the east) to this area, across the bridge, to improve pedestrian connectivity in the town.

The posted speed limit on Durham Rd is 30 mph. The posted speed limit on SR 125 is 40 mph north of Durham Rd, and drops to 35 mph between and east of the ramps.

From the beginning of 2016 through the end of 2018, the three intersections experienced a total of 50 crashes – 10 at SR 125 & Durham Rd, 23 at SR 125 & the SB on/off-ramp, and 17 at SR 125 & the NB on/off-ramp.

For the existing conditions during the peak hour, the intersection of SR 125 & Durham Rd operates at a level of service A and the intersection of SR 125 & the SB on/off-ramp operates at a level of service B. The intersection of SR 125 & the NB on/off-ramp operates at an unsatisfactory level of service E. The overall delay per vehicle for the entire network is 80.0 seconds.

Signal warrant analyses were performed for all three intersections for existing volumes. Currently, signalization is warranted at the NB on/off-ramp for existing volumes, but is not warranted at the SB on/off-ramp or the SR 125 & Durham Rd intersection.

At this location, there has been a history of wrong-way driving onto the SB off-ramp. To help address this issue, centerline delineators have been installed.

Future Conditions

The expected future growth for this area is 1% per year, resulting in an increase of 20% over 20 years. This is consistent with our expected future growth models for I-295.

For future volumes and the existing intersection configurations, the intersections of SR 25 & Durham Rd and SR 125 & the SB on/off-ramp would operate at a level of service B and the intersection of SR 125 & the NB on/off-ramp would operate at a level of service F. The overall delay per vehicle for the entire network would be 266.3 seconds.

Signal warrant analyses were performed for all three intersections for future volumes. Signalization is warranted at the NB on/off-ramp and the SB on/off-ramp for future volumes, but is not warranted at the SR 125 & Durham Rd intersection.

Alternatives

The first alternative is the No-build condition. The second alternative, shown below in Figure 2, is the signalization of SR 125 & NB on/off-ramp. The third alternative, shown below in Figure 3, is the signalization of both the NB on/off-ramp and the SB on/off-ramp. For both of the signalized alternatives, the channelization of the right turns at NB on/off-ramp is removed, in order to provide a better potential pedestrian facility. Additionally, a left turn lane is added to the southeastbound approach of the NB on/off-ramp intersection, and the storage length of this lane and the northwestbound left turn lane of the SB on/off-ramp intersection are extended to 250 feet.

Figure 2 - Synchro model of the signalization of the NB on/off-ramp intersection alternative.

Figure 3 - Synchro model of the signalization of the NB and SB on/off-ramp intersections alternative.

Analysis

All three scenarios were analyzed for the PM Peak Hour volumes, for both existing volumes and expected future volumes. The PM Peak Hour was chosen because the volumes are higher than the AM Peak Hour.

A summary of the level of service (LOS) and delay per vehicle (Del/Veh) for each scenario is provided in the following table.

Delay and Level of Service Information for Alternatives								
Node	Direction		Alternative (PM Peak Hr)					
			Baseline	Signalized (NB Ramp)	Signalized (NB & SB Ramps)	Future Baseline	Future Signalized (NB Ramp)	Future Signalized (NB & SB Ramps)
Entire System		Entering Volume	2278	2321	2321	2516	2624	2781
		Vehicles Denied Entry	44	1	1	267	158	1
		Total Denied Delay (hr)	19.3	1.1	1.0	139.5	64.3	1.5
		Total Del/Veh (s)	80.0	26.4	30.6	266.3	197.1	47.5
		Total Delay (hr)	50.6	17.0	19.7	186.1	143.7	36.7
2: SR 125 & Durham Rd Performance by approach		Intersection Type	unsig.	unsig.	unsig.	unsig.	unsig.	unsig.
	EB	Total Del/Veh (s)	30.5	36.7	12.1	91.0	638.0	52.9
	SB	Total Del/Veh (s)	2.2	2.3	2.5	2.6	2.6	3.0
	NW	Total Del/Veh (s)	2.2	2.4	4.0	2.7	3.0	4.5
	EB	Approach LOS	D	E	B	F	F	F
	SB	Approach LOS	A	A	A	A	A	A
	NW	Approach LOS	A	A	A	A	A	A
	All	Total Del/Veh (s)	5.1	5.7	4.4	12.2	55.9	8.9
		Overall Intersection LOS	A	A	A	B	F	A
13: SB Ramp & SR 125 Performance by approach		Intersection Type	unsig.	unsig.	sig.	unsig.	unsig.	sig.
	SE	Total Del/Veh (s)	1.5	1.8	6.1	1.9	2.3	5.4
	NW	Total Del/Veh (s)	17.1	4.2	19.5	18.3	5.1	16.9
	NE	Total Del/Veh (s)	11.5	36.4	8.7	25.2	248.8	15.8
	SE	Approach LOS	A	A	A	A	A	A
	NW	Approach LOS	C	A	B	C	A	B
	NE	Approach LOS	B	E	A	D	F	B
	All	Total Del/Veh (s)	11.5	8.2	13.9	14.1	40.6	13.4
		Overall Intersection LOS	B	A	B	B	E	B
19: SR 125 & NB Ramp Performance by approach		Intersection Type	unsig.	sig.	sig.	unsig.	sig.	sig.
	SE	Total Del/Veh (s)	8.8	13.3	12.7	13.4	16.7	17.9
	NW	Total Del/Veh (s)	1.9	12.0	11.6	2.1	17.2	23.3
	SW	Total Del/Veh (s)	149.9	18.1	21.6	259.3	62.3	56.2
	SE	Approach LOS	A	B	B	B	B	B
	NW	Approach LOS	A	B	B	A	B	C
	SW	Approach LOS	F	B	C	F	E	E
	All	Total Del/Veh (s)	39.8	14.0	14.6	51.0	29.4	30.9
		Overall Intersection LOS	E	B	B	F	C	C

The table shows that, for the existing traffic volumes, both signalization alternatives would operate at acceptable levels of service. Signalization of the NB on/off-ramp intersection would result in a total delay per vehicle of 26.4 seconds. Signalization of both the NB and SB on/off-ramp intersections would result in a total delay per vehicle of 30.6 seconds. These are both improvements over the baseline delay per vehicle of 80.0 seconds.

However, for the expected future volumes, signalization of only the NB on/off-ramp intersection would result in unacceptable levels of service. The Durham Rd intersection would operate at a level of service F, due to a delay per vehicle of 638.0 seconds on the eastbound approach. The SB on/off-ramp intersection would operate at a level of service F, due to a delay per vehicle of 248.8 seconds on the off-ramp. The total delay per vehicle for this alternative would be 197.1 seconds. For the future volumes, signalization of the SB on/off-ramp intersection would be warranted.

For the expected future volumes, signalization of both the NB and SB on/off-ramp intersections would result in a total delay per vehicle of 47.5 seconds. This is an improvement over the future baseline delay of per vehicle of 266.3 seconds.

Safety and mobility benefits were evaluated for the two build alternatives. The annual mobility benefit for each alternative was determined by comparing the user cost of the baseline delay with that of the respective alternative. The Highway Safety Manual (HSM) sheet was used to determine the expected annual crash costs for the baseline and the predicted annual crash costs for each alternative. The difference between the baseline crash costs and the alternative crash costs represent the safety benefit. Annual mobility and safety benefits were then converted into present worth, using 20 years and a discount rate of 6%. They were then combined to give the total present worth of combined benefits.

The three main costs of the alternatives would be removing existing roadway, constructing new roadway, and the installation of signals. The cost of signals used for this analysis is $225,000 per intersection. These project costs do not include the cost of bridge replacement.

A summary of the mobility and safety benefits is provided below. The table includes project cost estimates and Benefit/Cost ratios for each alternative.

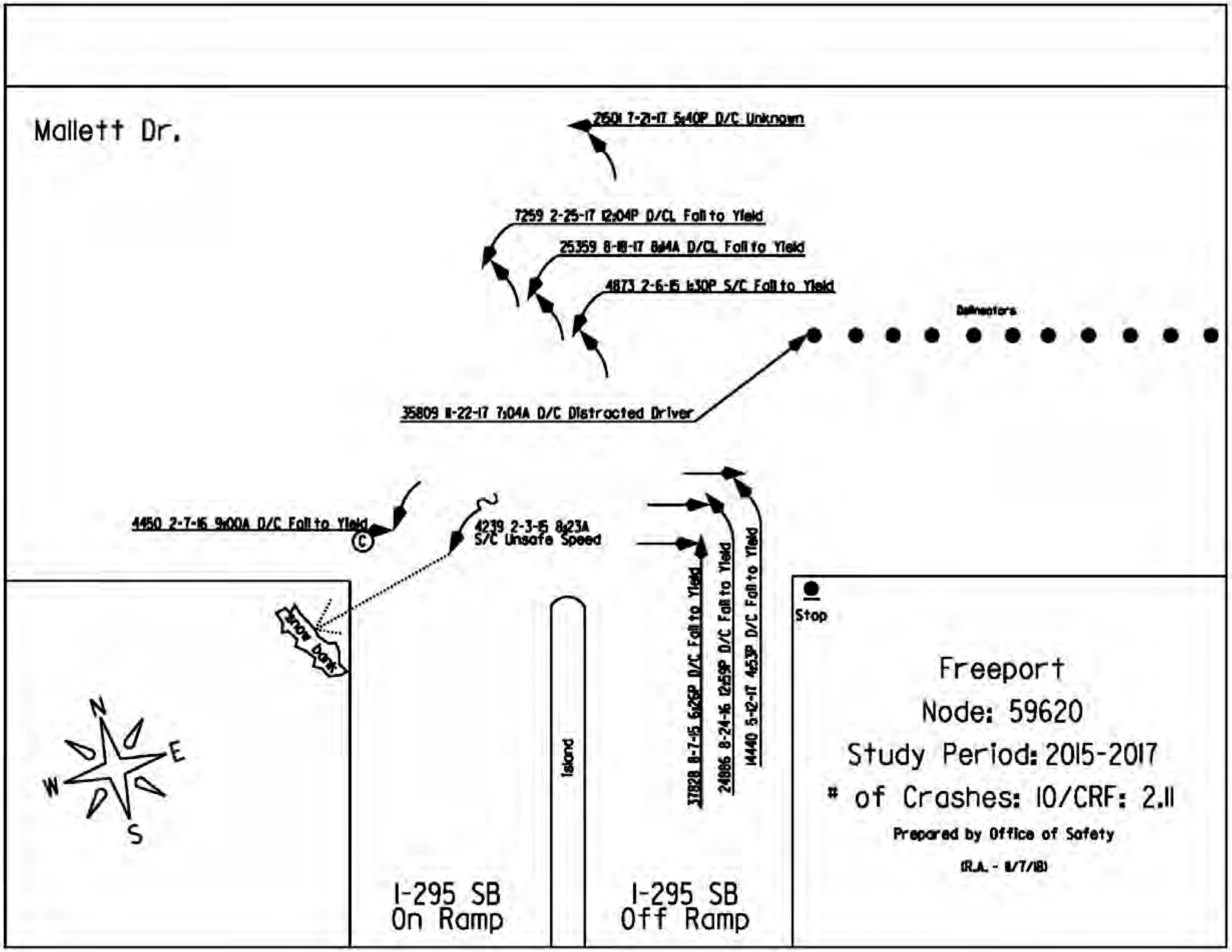
	Present Worth Mobility Benefit	Present Worth Safety Benefit	Present Worth Combined Benefits	Project Cost	Net Present Worth	Benefit / Cost Ratio
Baseline	-	-	$ -	$ -	-	-
Signalized (NB Ramp)	$ 7,456,160	$ 661,516	$ 8,117,676	$ 900,000	$ 7,217,676	9.02
Signalized (NB & SB Ramps)	$ 16,369,374	$ 1,292,683	$ 17,662,057	$ 1,200,000	$16,462,057	14.72

The net present worth is calculated at the present worth of combined benefits minus the project cost. The benefit/cost (B/C) ratio is calculated as the present worth of combined benefits divided by the project cost. Both alternatives have substantial net present worths and favorable B/C ratios.

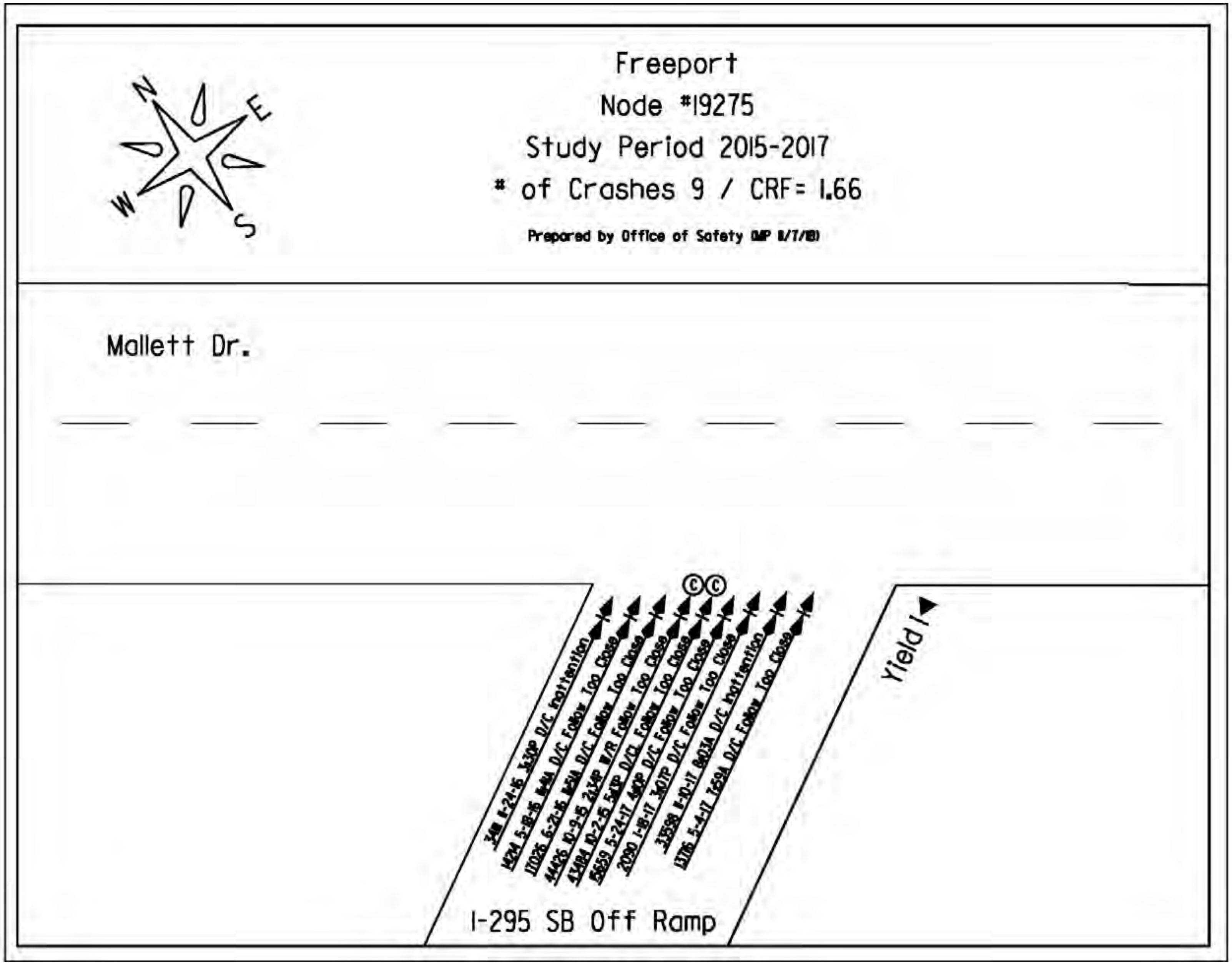
Recommendations

Based on the results of this analysis, it is recommended that the intersection of SR 125 & the NB on/off-ramp be signalized in the near term to accommodate existing volumes. It is also recommended that the intersection of SR 125 & the SB on/off-ramp be prepared for future signalization, to accommodate expected future volumes when signalization is warranted.

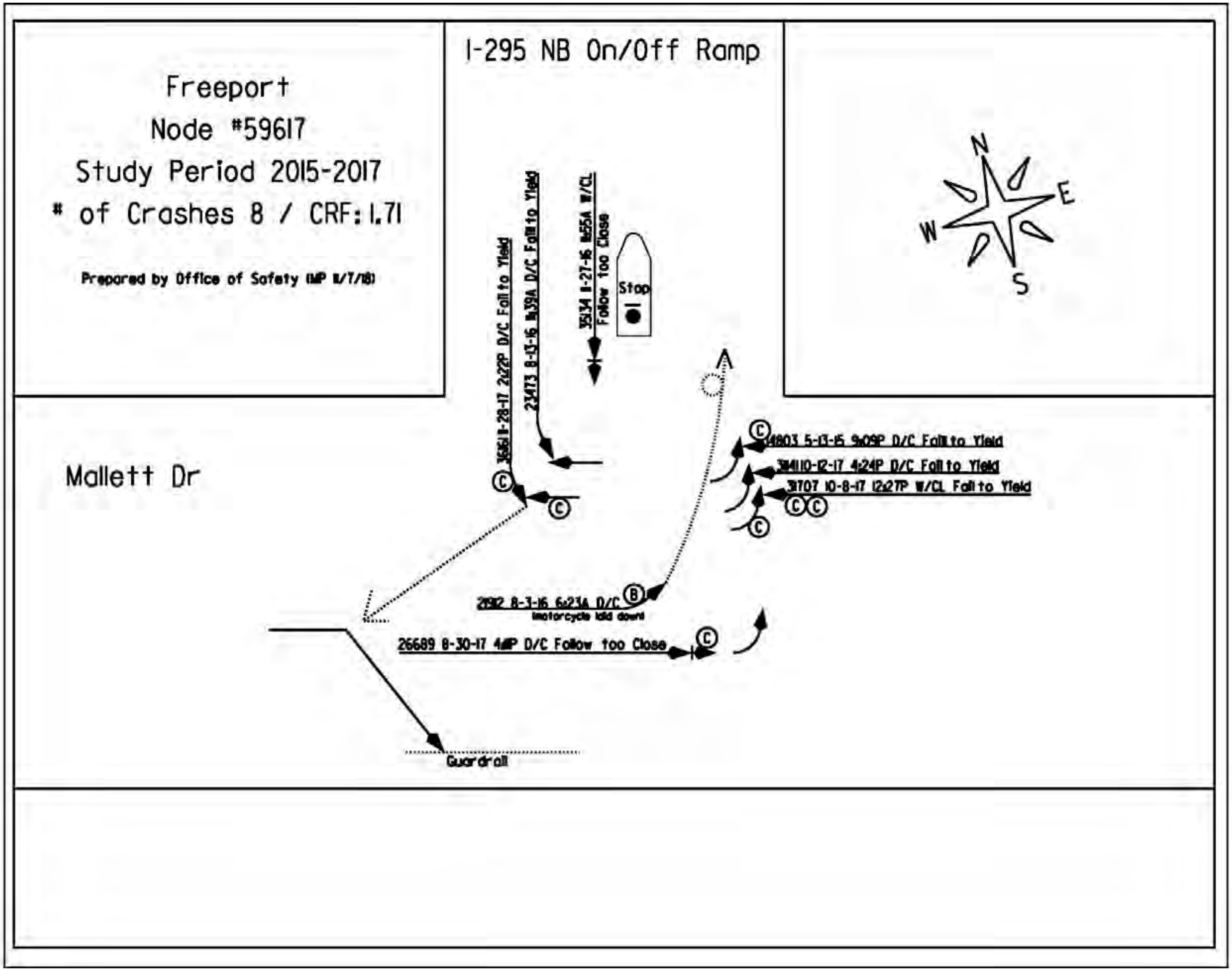
To address the wrong-way ramp issue, consider a narrow, curbed median between the two intersections as part of the bridge replacement project.



Mallett Dr.
25011 7-21-17 5:40P D/C Unknown
7259 2-25-17 12:04P D/CL Fail to Yield
25359 8-18-17 8:14A D/CL Fail to Yield
4873 2-6-15 1:30P S/C Fail to Yield
Delineators
35809 11-22-17 7:04A D/C Distracted Driver
4450 2-7-16 9:00A D/C Fail to Yield
C
4239 2-3-15 8:23A
S/C Unsafe Speed
Snow bank
37828 8-7-15 6:26P D/C Fail to Yield
24886 8-24-16 12:59P D/C Fail to Yield
14440 5-12-17 4:53P D/C Fail to Yield
Stop
N
E
W
S
Island
I-295 SB
On Ramp
I-295 SB
Off Ramp
Freeport
Node: 59620
Study Period: 2015-2017
# of Crashes: 10/CRF: 2.11
Prepared by Office of Safety
(R.A. - 11/7/18)



Freeport
Node #19275
Study Period 2015-2017
# of Crashes 9 / CRF= 1.66
Prepared by Office of Safety
N
E
S
W
Mallett Dr.
Yield
D/C Inattention
5-18-15 D/C Follow Too Close
17026 6-21-16 D/C Follow Too Close
44426 10-9-15 2:34P W/R Follow Too Close
43484 10-2-15 D/CL Follow Too Close
15659 5-24-17 D/C Follow Too Close
2090 1-18-17 3:07P D/C Follow Too Close
33598 11-10-17 8:03A D/C Inattention
1376 5-4-17 7:59A D/C Follow Too Close
I-295 SB Off Ramp



I-295 NB On/Off Ramp
Freeport
Node #59617
Study Period 2015-2017
# of Crashes 8 / CRF: 1.71
Prepared by Office of Safety
N
E
W
S
Stop
Mallett Dr
D/C Fail to Yield
D/C Fail to Yield
Follow too Close
5-13-15 D/C Fail to Yield
10-12-17 4:24P D/C Fail to Yield
10-8-17 W/CL Fail to Yield
C
B
8-3-16 D/C
motorcycle laid down
26689 8-30-17 D/C Follow too Close
Guardrail

Facility Matrices

The following matrices illustrate the range of bicycle facilities applicable to various roadway environments, based on the roadway classification and desired degree of separation. Engineering judgment, traffic studies, previous municipal planning efforts, community input and local context should be used to refine criteria when developing bicycle facility recommendations for a particular street. In some corridors, it may be desirable to construct facilities to a higher level of treatment than those recommended in relevant planning documents in order to enhance user safety and comfort. In other cases, existing and/or future motor vehicle speeds and volumes may not justify the recommended level of separation, and a less intensive treatment may be acceptable. See applicable sections for design details. Narrow shared lanes are less than 14 feet wide. Wide shared lanes are 14 feet or more wide.

Shared Facility → Separated Facility

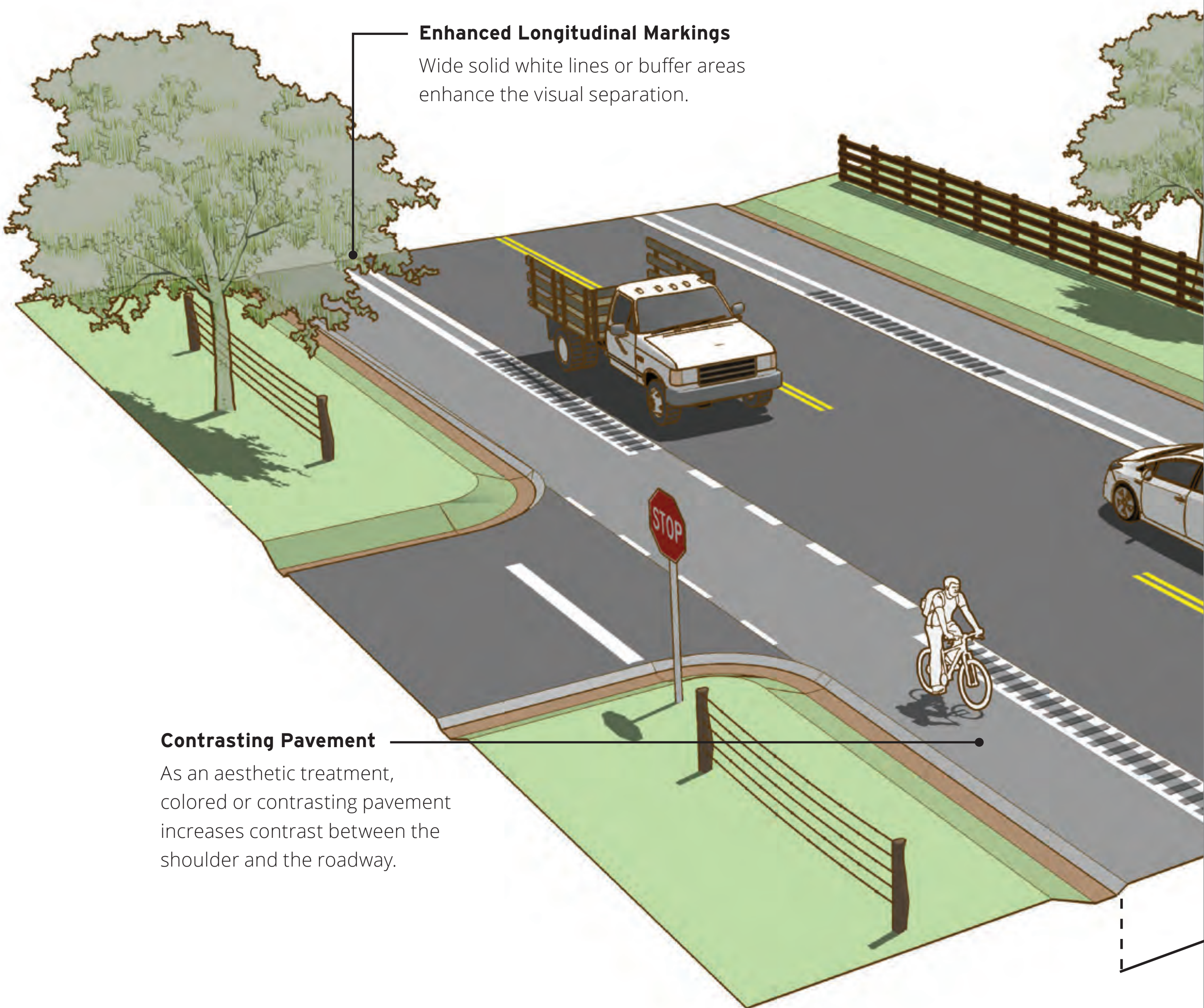
Arterial/Highway Bikeway Matrix (without curb and gutter - rural/suburban context)

Narrow Marked Shared Lane	Wide Marked Shared Lane	Shoulder	Conventional Bicycle Lane	Separated Bicycle Lane: by Barrier*	Shared Use Path

3 Methods for Including Bikeways

Adding a bikeway during a resurfacing project requires reconfiguration of the existing roadway design to “create” the space for the new bicycle facilities. This chapter provides an overview of the flexibility in roadway design that is often necessary to add bicycle facilities to existing roadways.

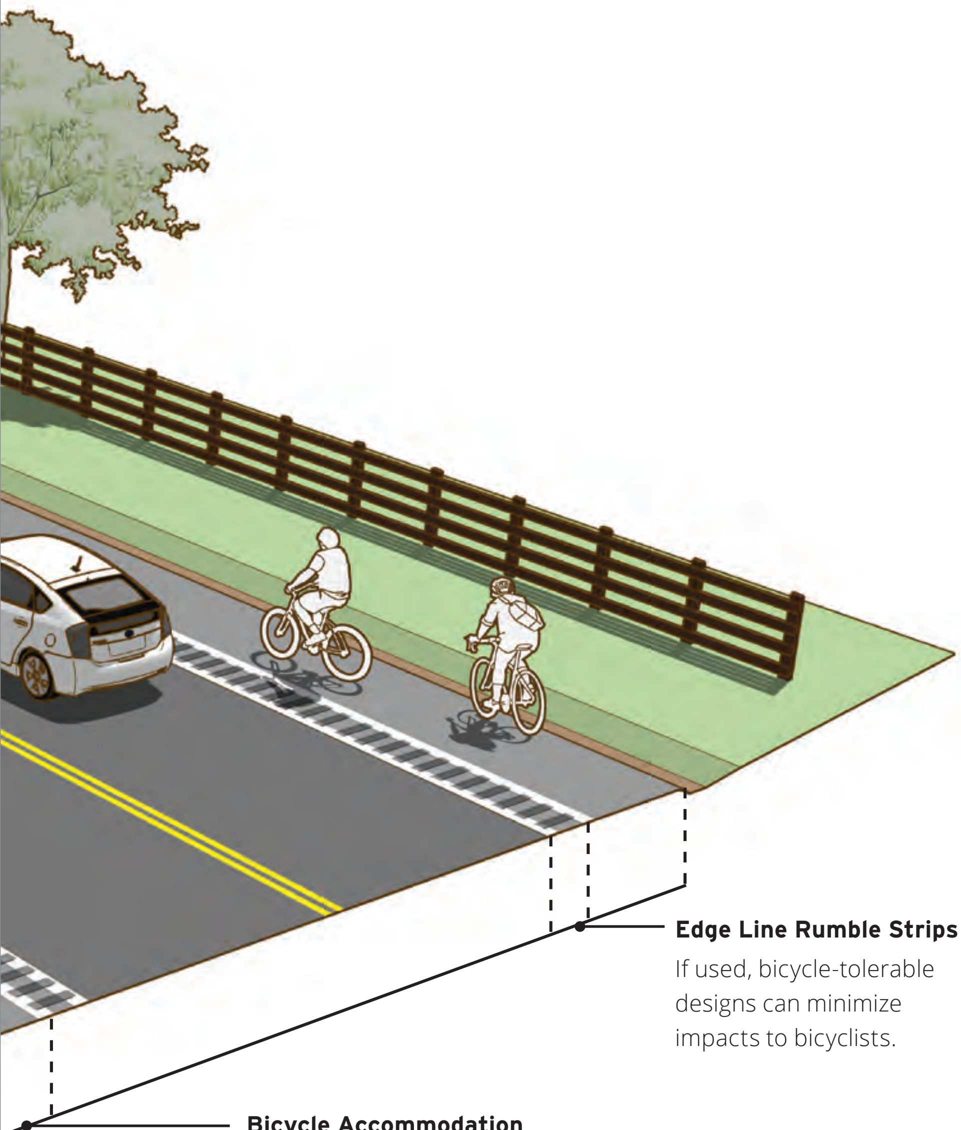
Enhanced Longitudinal Markings
Wide solid white lines or buffer areas enhance the visual separation.



Contrasting Pavement
As an aesthetic treatment, colored or contrasting pavement increases contrast between the shoulder and the roadway.

Paved Shoulder

Paved shoulders on the edge of roadways can be enhanced to serve as a functional space for bicyclists and pedestrians to travel in the absence of other facilities with more separation.



Edge Line Rumble Strips
If used, bicycle-tolerable designs can minimize impacts to bicyclists.

Bicycle Accommodation
Bicyclists travel in the same direction as the adjacent lane.

BENEFITS

- Improves bicyclist experiences on roadways with higher speeds or traffic volumes.
- Provides a stable surface off the roadway for pedestrians and bicyclists to use when sidewalks are not provided.
- Reduces pedestrian "walking along roadway" crashes.
- Can reduce "bicyclist struck from behind" crashes, which represent a significant portion of rural road crashes.
- Provides advantages for all roadway users, by providing space for bicyclists, pedestrians, and motor vehicles.

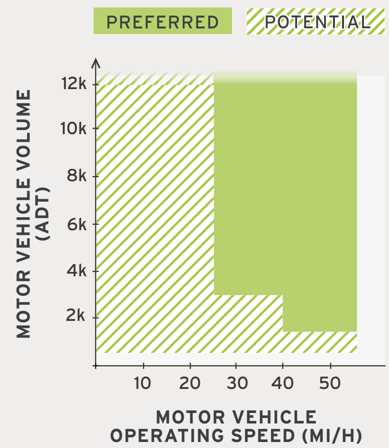
CONSIDERATIONS

- Enhancements with increased levels of striping and signs may interfere with the low-clutter character of a rural environment.
- Requires a wider roadway to provide an accessible shoulder space.

APPLICATION

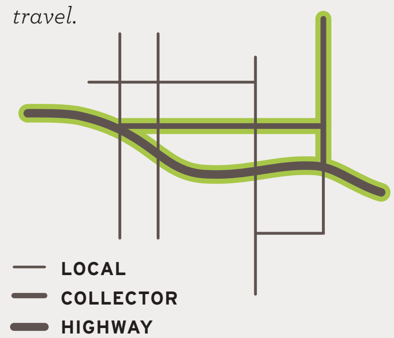
Speed and Volume

Appropriate on roads with moderate to high volumes and speeds and on roadways with a large amount of truck traffic. May function on multilane roads with heavy traffic but fails to provide a low-stress experience in this condition.



Network

Serves long-distance and regional travel.



Land Use

Appropriate outside and within built-up areas, near school zones and transit locations, and where there is expected pedestrian and bicycle activity. Walkable shoulders should be provided along both sides of county roads and highways routinely used by pedestrians.

Sidepath

Sidepaths offer a low-stress experience for bicyclists and pedestrians on network routes otherwise inhospitable to walking and bicycling due to high-speed or high-volume traffic.

Figure 4-8. *Recommended dimensions for sidepath width and unpaved separation distance.*

GEOMETRIC DESIGN

Widths and design details of sidepath elements may vary in response to the desire for increased user comfort and functionality, the available right-of-way, and the need to preserve natural resources.

PATHWAY

Sidepath width impacts user comfort and path capacity. As user volumes or the mix of modes increases, additional path width is necessary to maintain comfort and functionality.

- Minimum recommended pathway width is 10 ft (3.0 m). In low-volume situations and constrained conditions, the absolute minimum sidepath width is 8 ft (2.4 m)
- Provide a minimum of 2 ft (0.6 m) clearance to signposts or vertical elements.

ROADWAY SEPARATION

Separation from the roadway should be informed by the speed and configuration of the adjacent roadway and by available right-of-way as illustrated in Figure 4-9.

- Preferred minimum separation width is 6.5 ft (2.0 m). Minimum separation distance is 5 ft (1.5 m).
- Separation narrower than 5 ft is not recommended, although may be accommodated with the use of a physical barrier between the sidepath and the roadway. The barrier and end treatments should be crashworthy which may introduce additional complexity if there are frequent driveways and intersections. Refer to the AASHTO Roadside Design Guide 2011 for additional information.

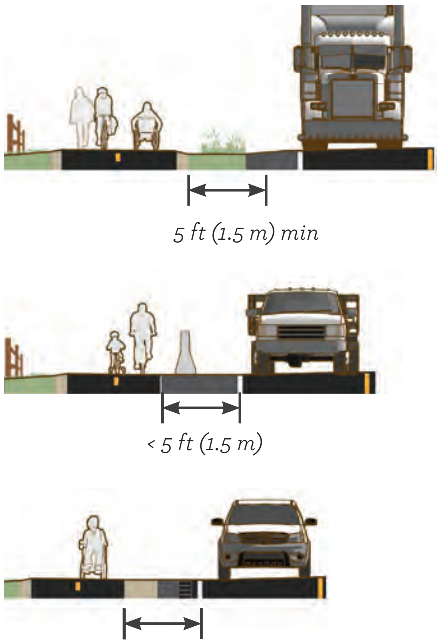


Figure 4-9. *Where a minimum of 5 ft (1.5 m) unpaved separation cannot be provided (top), A physical barrier may be used between the sidepath and the roadway (center). In extremely constrained conditions for short distances, on-roadway rumble strips may be used as a form of separation (bottom).*

- On high-speed roadways, a separation width of 16.5–20 ft (5–6 m) is recommended for proper positioning at crossings and intersections.

Bike Lane

Within built-up areas, increased pedestrian activity and curbside uses degrade the experience of nonexclusive bicycling accommodations such as shoulders. Providing a designated bike lane can provide a consistent area for bicyclists to travel outside the path of motor vehicles. When space is available, add a buffer area, distancing the bike lane from the adjacent motor vehicle travel lane.

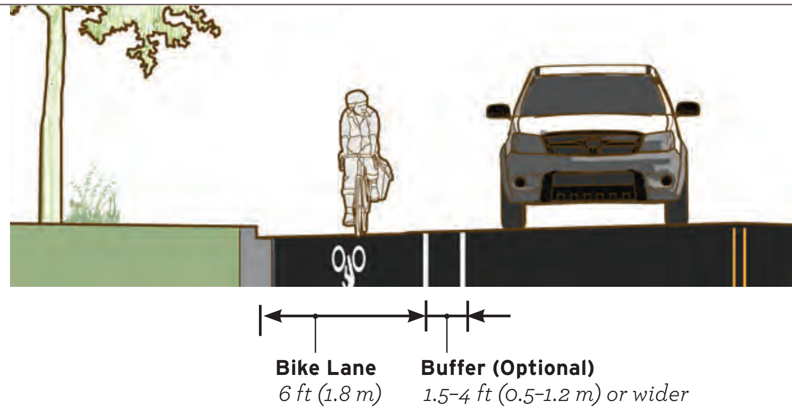


Figure 3-7. *Bike lanes establish an area for exclusive bicycle use outside the path of motor vehicles.*

GEOMETRIC DESIGN

BIKE LANES

Design bike lanes to separate road users and reduce the stress of motor vehicle passing events.

- The preferred minimum width of a bike lane is 6.5 ft (2.0 m) to allow for bicyclists to ride side-by-side or pass each other without leaving the bike lane.
- Absolute minimum bike lane width is 4 ft (1.2 m) when no curb and gutter is present or 5 ft (1.5 m) when adjacent to a curbface, guardrail, other vertical surface or on-street parking stalls (AASHTO Bike Guide 2012).
- Widths 7 ft (2.1 m) or greater may encourage motor vehicle use of bike lane for parking or driving. If extra width is available or desired, configure with a buffer zone to delineate space.

MARKINGS

Mark a bike lane line with a normal solid white line and a standard bike lane symbol marking. Standards and guidance for applying these elements can be found in the MUTCD 2009.

Lane markings should remain solid and not dotted at driveway crossing. The MUTCD does not recognize a driveway as an intersection (MUTCD 2009, AASHTO Bike Guide 2012).

BUFFER ZONE

Bike lanes may be enhanced with a longitudinal marked buffer area for more separation distance. This treatment is appropriate for bike lanes on roadways with high motor vehicle traffic volumes and speed, adjacent to parking lanes, or a high volume of truck or oversized vehicle traffic.[i]

- A minimum width buffer of 1.5 ft (0.5 m) may be bound by two solid lines, without interior markings.

A If the buffer is 4 ft (1.2 m) or wider, mark with diagonal or chevron hatching.

For more information on buffer zone striping and application, refer to NCHRP 766–Recommended Bicycle Lane Widths for Various Roadway Characteristics 2014.

Figure 3-8. *Helmeted bicyclist symbol inside a bike lane with a painted buffer area.*

Sidepath

GEOMETRIC DESIGN

LANDSCAPING

Trees and landscaping can maintain community character and add value to the experience of using a sidepath. They provide shade for users during hot weather and help to absorb stormwater runoff.

- Provide a 3 ft (0.9 m) horizontal clearance between trees and the pathway to minimize pavement cracking and heaving of the paved surface. Consult a local arborist in the selection and placement of trees.
- When trees are desired within the roadway separation area, consider planting small caliper trees with a maximum diameter of 4 inches (100 mm) to alleviate concerns about fixed objects or visual obstructions between the roadway and the pathway.[iv]

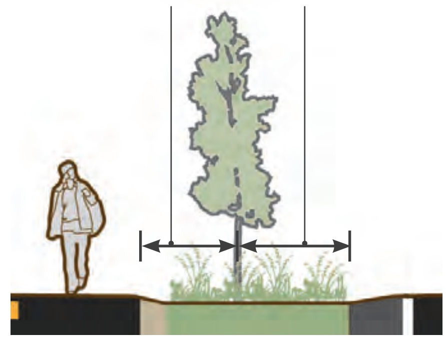


Figure 4-10. *Even small trees can provide an additional feeling of separation between the sidepath and the roadway.*

South Lake Tahoe, CA–Population 21,380

MARKINGS

Sidepaths may include edgelines or centerlines or be unmarked.

- Edge lines should be marked on paths expecting evening use.
- Paths with a high volume of bidirectional traffic should include a centerline. This can help communicate that users should expect traffic in both directions and encourage users to travel on the right and pass on the left (Flink and Searns 1993).

SIGNS

- Shared use paths are bidirectional facilities and signs should be posted for path users traveling in both directions.
- It is important for signs that only apply to the path to not be interpreted as a guidance for roadway travel lanes.

Separated Bike Lane

DESIGN GUIDANCE

Separated bike lanes can offer a similar experience as sidepaths for bicyclists and pedestrians but with increased functionality and safety where increased numbers of pedestrians and potential conflicts with motor vehicles are present. The guidance in this section focuses on one-way separated bike lanes. For two-way separated bike lanes, refer to the FHWA Separated Bike Lane Planning and Design Guide 2015.

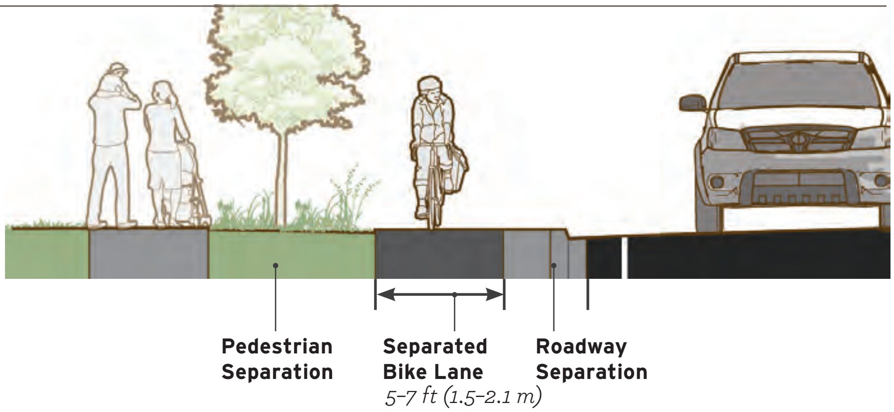


Figure 4-17. *Separated bike lanes are exclusive facilities for bicyclists that are distinct from the sidewalk and physically separated from motor vehicle traffic with a vertical element.*

GEOMETRIC DESIGN

Separated bike lanes are made up of three interrelated zones, illustrated in Figure 4-17.

SEPARATED BIKE LANE

The separated bike lane zone offers a clear operating area for bicyclist travel. Because of the physical separation between the bike lane and the adjacent travel lanes, the design may be more sensitive to debris accumulation, maintenance access, and operating space impacts than conventional on-street bike lanes.

- Preferred minimum width of a one-way separated bike lane is 7 ft (2.1 m). This width allows for side-by-side riding or passing.
- Absolute minimum bike lane width is 5 ft (1.5 m). At this width, bicyclists will not be able to pass slower users until there is a break in the facility and an opportunity to overtake.
- A clear through area of 10 ft (3.0 m) is beneficial for allowing access by snow plows and street sweepers.

Jackson Hole, WY–Population 9,500

Separated Bike Lane

ROADWAY SEPARATION

The roadway separation is the vertical element between the bike lane and the adjacent roadway. Separation width will vary based on separation type.

- A separation width of 3 ft (0.9 m) allows for a variety of separation methods and provides space adjacent to a parking lane to accommodate door swing and passenger unloading.
- A minimum width roadway separation of 1 ft (0.3 m) may be possible with a mountable or vertical curb face.

PEDESTRIAN SEPARATION

Separation from pedestrians is particularly important when a separated bike lane is located immediately adjacent and at the same level as a sidewalk.

- Design and construct separated bike lanes as clearly distinct from the sidewalk. This is accomplished with the use of a curb, separation buffer space, different pavement or other surface treatments, or detectable tactile guidance strips.

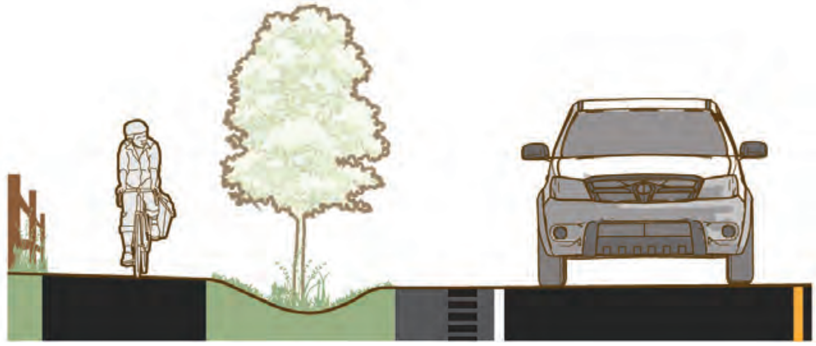


Figure 4-18. *Separated bike lanes may be separated by an unpaved roadway separation, and a vertical element. When configured as directional facilities, separated bike lanes should be provided on both sides of the roadway.*

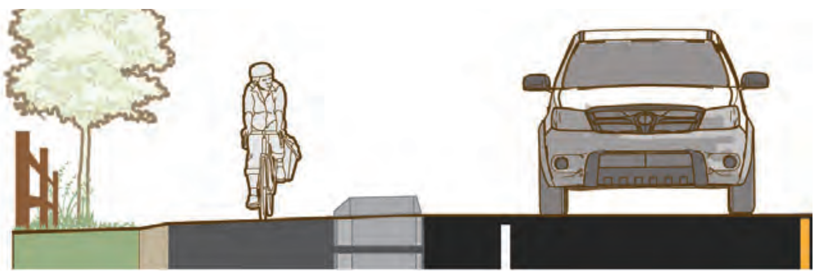


Figure 4-19. *Separated bike lanes may be configured on an existing roadway surface by using a physical barrier such as a curb or median to separate the bikeway from the roadway.*

Figure 4-20. *Separation from the sidewalk is valuable for reducing unwanted pedestrian encroachment into the bike lane. The use of physical separation with vertical elements, unpaved separation, or detectable edges may be more effective than visual delineation.*

MARKING

Separated bike lanes use markings to clarify intended users and travel direction.

- Standard Bike Lane symbol markings clarify that the lanes are for the exclusive use of bicyclists.

SIGNING

An optional Bike Lane (R3-17) sign may be used to supplement the bike lane pavement markings. Standards and guidance can be found in the MUTCD 2009.

Guide signs may be used to indicate which users belong on the separate parts of a separated bike lane corridor, as illustrated in Figure 4-21.

Figure 4-21*. MUTCD signing options for specifying user types and path positioning can be used to indicate which users belong on the separate parts of a separated bike lane corridor (D11-1a, D11-2).*