Development Phase

The results of this study are presented as individual alternatives to the baseline concept. Each alternative consists of a summary of the baseline concept, a description of the suggested change, a listing of its advantages and disadvantages, discussion of schedule and risk impacts (if applicable), and a brief narrative comparing the baseline design with the alternative. Sketches, calculations, and performance attribute comparisons are also presented where applicable.

VE Alternative Cost Estimates

Cost estimates were prepared (see Appendix G. Value Engineering Alternative Estimates) where applicable to compare the net cost difference between the baseline concept and the VE Alternative and are provided to aid decision makers with a sense of the potential relative costs of the VE Alternative. The reader should note that the efforts of the VE team in developing the alternatives in the short time period of the VE study limits their findings to conceptual-level analyses and order-of-magnitude cost estimates only.

Summary of VE Alternatives

The VE Alternatives developed by the VE team during the workshop are provided in the table on the following page. The alternatives are organized by category based upon the project feature/project location or aspect of the project being addressed by them. Each alternative received a unique idea code during the Creative Phase based upon the project function being considered by the idea.

The VE Alternatives identified all consider multiple aspects of total value including assessing the impacts to performance, cost, time, and risk in comparison to the baseline concept. The potential of each VE Alternative is summarized in the table per the following:

- Initial Cost Savings Potential – A quantified indication of the VE Alternative's impacts to the project's initial cost in comparison with the baseline concept. Initial cost savings are conceptual and reflective of the value team's parametric estimation of possible savings and represent orders of magnitude cost impact of the VE Alternative. Because the cost data depicted above represent savings, a red value in parentheses represents a cost increase.
- Performance/Risk – A qualitative summary of the performance impacts of the VE Alternative in comparison with the baseline concept. Performance attributes include the following: MO – Mainline Operations, LO – Local Operations, AT – Active Transportation, ROW – Right of Way/Community Impacts, CI – Temporary Construction Impacts, M – Maintainability, EI – Environmental Impacts

Please refer to the *Project Analysis* section of this report for additional explanation of the performance attributes identified.

Table 11. Summary of VE Alternatives			
Alt No.	**Alternative Title**	**Initial Cost Savings**	**Performance Summary**
Base Case Modifications			
BC-1	Remove NB Joseph Howe to WB Bedford Highway access and convert WB Bedford Highway to SB Joseph Howe to dual lane loop ramp	($200,000)	Improved (MO)
BC-2	Create a direct taper slip ramp from MacKay Bridge to Massachusetts Avenue	($1,100,000)	Improved (MO)
BC-3	Remove traffic from Joseph Howe Drive ramp by providing signalized stop condition at Main Avenue with displaced left/DDI	($600,000)	Improved (MO, LO)
BC-4	Improve turning movement and signal phasing from the Port to MacKay Bridge at Windsor Street Exchange	$0	Improved (MO, LO)
BC-5	Modify Kempt Road operation and access	A. Comment B. $2,400,000 C. $2,800,000	Improved (ROW, AT) Reduced (LO, M)
Bedford At-Grade			
BAG-1	Eliminate grade separation of Bedford Highway at Windsor Intersection	$11,000,000	Improved (CI, ROW, Risk) Reduced (MO, LO, AT)
BAG-2	Relocate grade separation to the east with new local crossing	$10,100,000	Improved (MO, CI, M, ROW) Reduced (AT)
Africville Road Upgrades			
AR-1	Extend MacKintosh Street to Africville Road	$7,400,000	Improved (MO, LO, ROW, M)
Active Transportation			
AT-1	Provide basin-side AT connection to Africville Museum	($1,800,000)	Improved (AT) Reduced (ROW, M)
AT-2	Provide an AT connection to Bedford Highway on the south side	($32,000)	Improved (AT) Reduced (ROW, M)
AT-3	Provide AT connection to Devonshire Avenue along Lady Hammond Road and connect to Africville Museum	Comment	Improved (AT) Reduced (ROW, M)
AT-4	Convert sidewalks into multi-use pathways (MUPs)	($470,000)	Improved (AT) Reduced (ROW, M)
AT-5	Connect MacKintosh Street multi-use pathway to Africville Road over CN Railway	($340,000)	Improved (AT) Reduced (ROW, M)

The cost comparisons reflect a difference or delta between the baseline concept and the VE alternative. As the project progresses, these values can be updated to reflect actual implemented results. Note: Because the cost data depicted above represent savings, a red value in parentheses represents a cost increase.

Performance Attribute Legend: MO – Mainline Operations, LO – Local Operations, AT – Active Transportation, ROW – Right of Way/Community Impacts, CI – Temporary Construction Impacts, M – Maintainability, EI – Environmental Impacts

VE ALTERNATIVE BC-1
Remove NB Joseph Howe Drive to WB Bedford Highway access and convert WB Bedford Highway to SB Joseph Howe Drive to dual lane loop ramp

Description of Baseline Concept:

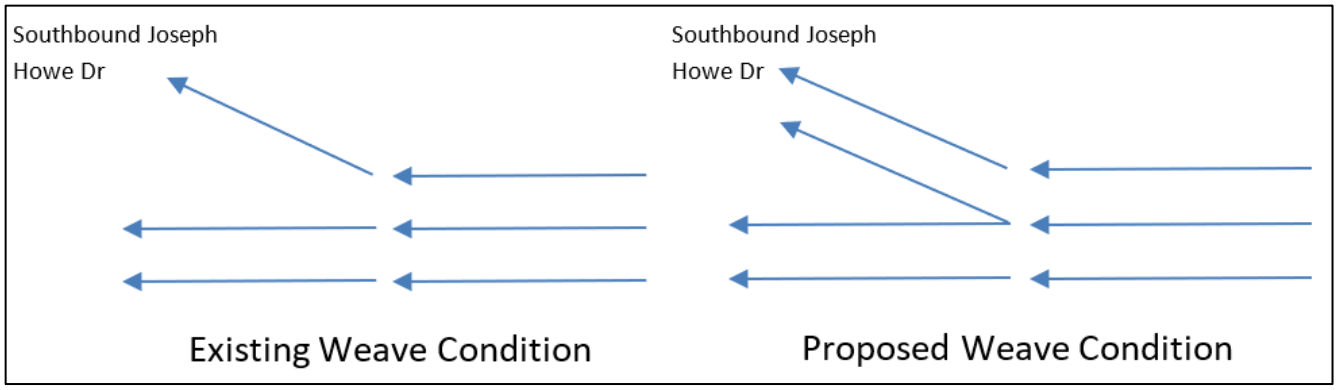
The existing baseline concept makes no changes to the westbound Bedford Highway and Joseph Howe Drive connection. The existing configuration of Joseph Howe Drive is one lane in each direction under the Fairview Bridge. A single lane loop ramp exits from westbound Bedford Highway to form southbound Joseph Howe, while northbound Joseph Howe Drive to westbound Bedford Highway is a yield-controlled entrance with no acceleration lane.

The current loop ramp has an existing inner radius of approximately 10 metres which limits the capacity of this ramp to approximately 600 to 700 vehicle per hour. Upstream of the loop ramp, there is an approximately 360-metre weaving section along Bedford Highway between the loop ramp and the exit from Bayne Street used by trucks leaving the Port. Trucks travelling from the Port to Highway 102 use this loop ramp to access Joseph Howe Drive.

Description of Alternative Concept:

This alternative removes the northbound Joseph Howe Drive access to westbound Bedford Highway in order to increase capacity at the loop ramp and southbound Joseph Howe drive. The rail line to the north of Joseph Howe Drive and Bedford Highway restricts the loop ramp to the existing radius and design without the northbound lane being removed. With the northbound lane removed at the loop ramp, the ramp can be expanded to two lanes therefore increasing the capacity. This will reduce any congestion and queue spillback onto westbound Bedford Highway that the current loop ramp geometry creates.

Additionally, adding a second lane to the loop ramp will improve the weave condition along westbound Bedford Highway from the Port entrance to the Joseph Howe exit. By changing the diverge condition from a 2/1 split to a 2/2 split, vehicles do not have to merge over to exit. Only traffic continuing to westbound Bedford Highway will be required to merge as shown in the graphic below.



Westbound Bedford Highway Weave Condition

The projected 2031 traffic demand during the PM peak hour from northbound Joseph Howe Drive to westbound Bedford Highway is approximately 250 vehicles per hour, with approximately 1400 vehicles per hour travelling from westbound Bedford Highway to southbound Joseph Howe Drive during the same period. With the existing connection removed, the 250 vehicles would likely use Dunbrack Street, Lacewood Drive, or Windsor Street to access westbound Bedford Highway.

VE ALTERNATIVE BC-1
Remove NB Joseph Howe Drive to WB Bedford Highway access and convert WB Bedford Highway to SB Joseph Howe Drive to dual lane loop ramp

Advantages:

- Significantly improves performance of Joseph Howe loop ramp and Bedford Highway
- Improves safety at weaving condition
- Removes safety concern of existing NB Joseph Howe yield controlled entrance

Disadvantages:

- Removes existing NB Joseph Howe Drive to WB Bedford Highway route
- Could increase traffic on smaller local streets with diversion
- Increases speed differential in lane 2

Discussion:

By changing the weave condition, the speed differential in the choice lane would be a concern, especially in the off-peak hours. Vehicles travelling through on Bedford Highway would be driving 60 km/hr while vehicles exiting the loop ramp would be slowing down to the loop ramp speed of 20 km/hr. Utilizing dynamic lane control during peak hours would help control this safety issue. During off peak hours the lanes would revert to the existing 2/1 split and during peak hours the second diverge lane would be used. Based on a Vissim analysis that utilizes the diverging left on Joseph Howe to eastbound Bedford Highway changing Joseph Howe Drive to a two-lane southbound only section from westbound Bedford Highway to the DV-K (Dutch Village-Kempt) ramp would result in approximately a 900 meter reduction in the queue along MacKay Bridge.

Discussion of Schedule Impacts:

No implications to the schedule.

Discussion of Risk Impacts:

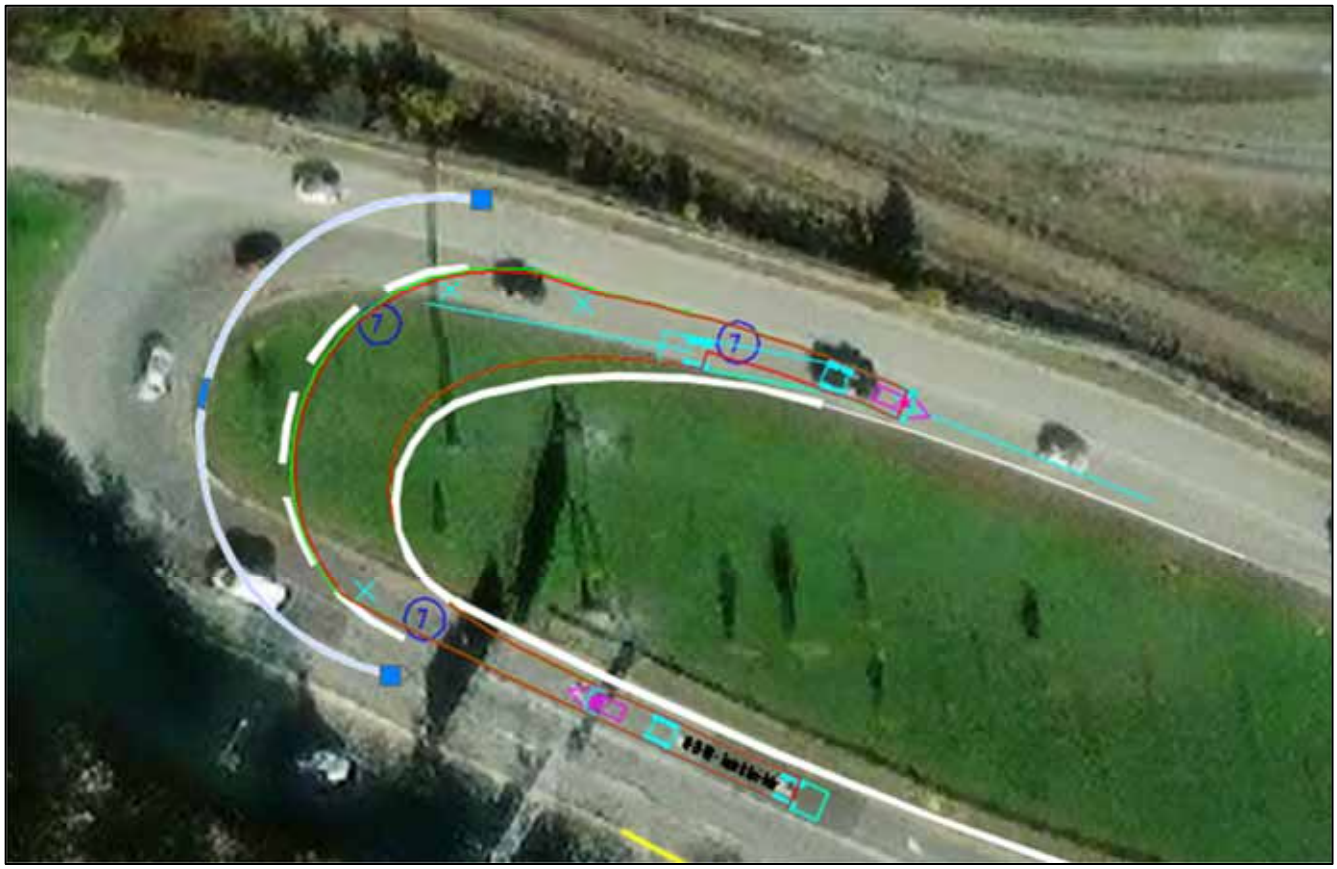
The main risk of this alternative is the public acceptance of the removal of a main origin-destination pair.

VE ALTERNATIVE BC-1

Remove NB Joseph Howe Drive to WB Bedford Highway access and convert WB Bedford Highway to SB Joseph Howe Drive to dual lane loop ramp

Baseline Concept Sketch

VE Alternative Concept Sketch



VE ALTERNATIVE BC-1
Remove NB Joseph Howe Drive to WB Bedford Highway access and convert WB Bedford Highway to SB Joseph Howe Drive to dual lane loop ramp

Performance Assessment:

Performance Attribute		Rationale for Change in Performance
Mainline Traffic Operations	Transit	No degradation to transit priority from Main Avenue.
	Port	Improves weave condition from Bayne Street (Port westbound entrance) onto westbound Bedford Highway
	General Purpose	Reduces congestion caused by slow speed turns along single lane ramp in the PM period. Improves weave from the Bayne Street ramp. Operational improvements in the AM peak period are negligible (alternative heavily favours southbound Joseph Howe Drive, which is heavier in the PM peak period). This alternative was modeled using the displaced left turn at Joseph Howe which was included as part of the modified base Vissim analysis. PM Peak hour results are as follows: • Reduction in delay of 18 percent • Reduction in latent demand of 20 percent • Increase network throughput of 6 percent
Local Traffic Operations		Vehicles travelling from Joseph Howe Drive to Bedford Highway will find a new route. It is expected traffic will disperse between Dunbrack Street, Lacewood Drive via Dutch Village Road, and Windsor Street.
Maintainability		No impact.
Temporary Construction Impacts		Construction impacts would be minimal since the extended turning radius could be constructed outside of the existing curve.
Environmental Impacts		Improved traffic flow builds resiliency of emergency evacuation route from the peninsula. Some increase in impervious surface.
ROW/Footprint Impacts		No significant change.
Active Transportation		No significant change.

Initial Cost Estimate

CONSTRUCTION ELEMENT		*BASELINE CONCEPT*			*ALTERNATIVE CONCEPT*		
Description	**Unit**	**Qty**	**Cost/Unit**	**Total**	**Qty**	**Cost/Unit**	**Total**
2 Lane Urban Ramp - Reconstruct Bedford WB to JH SB Ramp	m	0	$ 4,500	$ -	30	$ 4,500	$ 135,000
				$ -			$ -
SUB-TOTAL				$0			$135,000
PROJECT MARK-UPS	37%			$0			$49,275
TOTAL (Rounded)				$0			$200,000
						ADDED COST	**($200,000)**

VE ALTERNATIVE BC-2
Create a direct taper slip ramp from MacKay Bridge to Massachusetts Avenue

Description of Baseline Concept:

There is a weaving area located between the Windsor Street intersection and MacKay Bridge in the Bedford Highway bound lanes, including ramps from Barrington Street and MacKay Bridge to the Bedford Highway/Massachusetts Avenue/Robie Street/Bayne Street. There is a short 200 metre weave zone that impacts traffic operations (lowers speeds and increases conflicts). The baseline also adds a new off-ramp to Bayne Street that results in two closely spaced successive bullnoses that may worsen weaving conditions from the existing condition since it requires two lane changes for vehicles travelling from MacKay Bridge to Bayne Street.

Description of Alternative Concept:

The alternative concept eliminates the weave zone by creating a new direct taper slip ramp from MacKay Bridge to Massachusetts Avenue/Robie Street/Bayne Street. This concept proposes closing one lane from Barrington Street WB (existing two lanes). The remaining lane becomes an exit-only to Bayne Street resulting in traffic travelling from Barrington Street WB to Bedford Highway via Bayne Street in the future. Lane 1 from MacKay Bridge will continue to Bedford Highway with no change from the baseline concept. Lane 2 from MacKay Bridge will have the option to Bedford Highway or to take the slip ramp to Massachusetts Avenue/Robie Street/Bayne Street.

Advantages:

- Reduces weaving conflicts
- Improves traffic operations
- Improves development of ramp to Bayne Street that avoids successive bullnoses

Disadvantages:

- Eliminates option for traffic from Barrington Street to travel along the mainline to Bedford Highway and turn left to Windsor Street
- Increases cost
- Increases property impacts (HRM owned but unknown condition of capped landfill)

Discussion:

This alternative was initially developed with the objective to improve the Bayne Road off -ramp geometry of the Baseline concept. In the Baseline concept, the Bayne Road off-ramp is added to the existing ramps from MacKay Bridge and Barrington Street with no modifications. Under current conditions the 200m long parallel lanes zone, does not have lane balance (i.e., 2 lanes + 2 lanes coming in and 2 lanes + 2 lanes leaving). This means that two ramp moves – MacKay Bridge to Massachusetts Avenue and Barrington Street to Windsor Street/Bedford Highway, must change lanes and conflict. This results is traffic operations and safety impacts today.

The baseline morning peak hour traffic volumes total throughput on these ramps = 2500 vph, and a corresponding queue of 6.3 km back across MacKay Bridge. This alternative increases this throughput volume to 3170 vph and reduces queue to 1.1km back across the MacKay Bridge.

Halifax Harbour Bridges is planning a major rehab or replacement of the MacKay Bridge in the next 10-15 years; this would likely result in significant changes to the existing ramps to/from the MacKay Bridge. This VE Alternative is required as an amendment to the base case to address operation and weaving concerns; however, consideration should be given to minimize the investment into infrastructure adjustments in this area given its likely short life-span. An additional consideration of the MacKay Bridge maintenance, is that baseline results in significant queues backing up across the

bridge, resulting in high volumes of vehicles sitting on bridge as slower speeds. Any potential durability/maintenance the results in the existing bridge and potential to improve this for the remaining life of the structure should be considered in the implementation of this alternative.

As this alternative involves removal and new construction of asphalt pavement surface for all lanes for 250m, removal and new construction of curb and gutter, storm sewers and light poles for ramp widening – consideration should be given to reviewing current asset conditions and planning upcoming resurfacing needs.

Discussion of Schedule Impacts:

Potential to increase schedule for design and construction. Requires extending study limits further towards MacKay Bridge, additional 30 percent design will have to be completed for this segment and associated additional construction and staging.

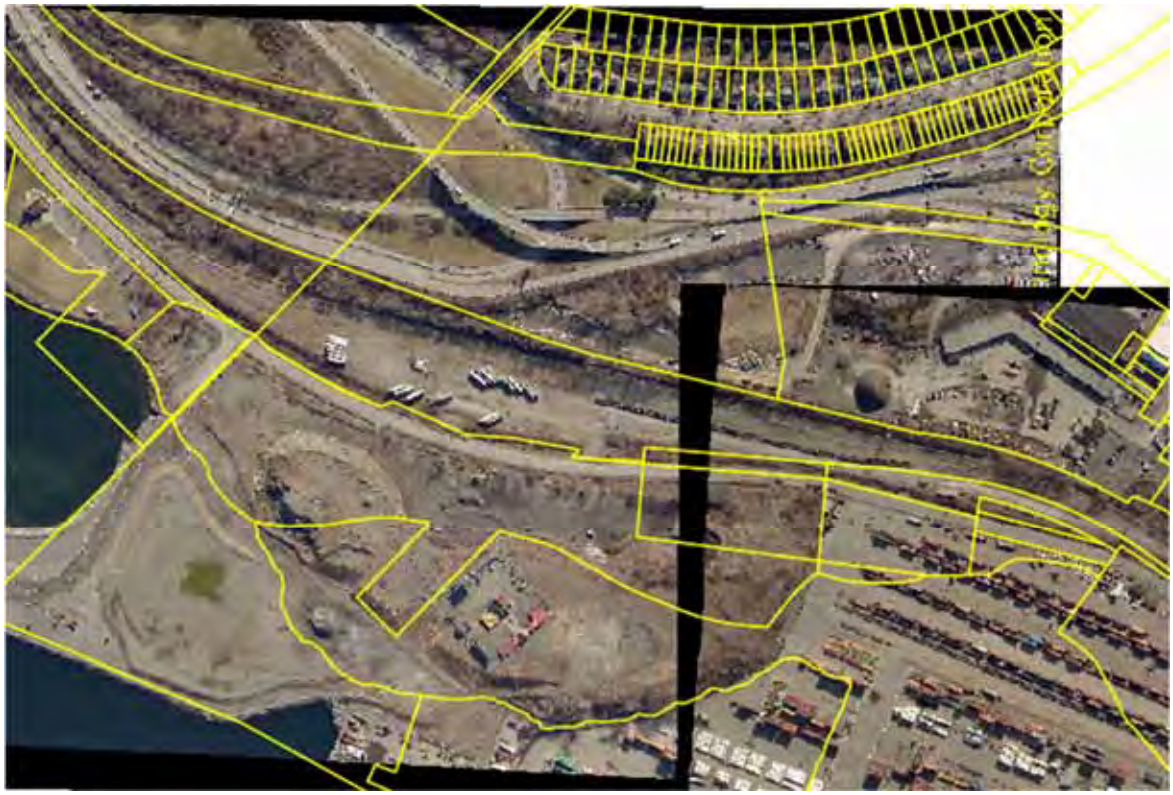
However, depending on staging this works may be designed and constructed in parallel with other works, and may not necessarily extend the overall project schedule.

Discussion of Risk Impacts:

Risks include property acquisition and impacting contaminated materials may delaying the project schedule, and the opportunity that a two-phase implementation plan may be feasible that may allow Windsor Street intersection improvements to proceed ahead of this alternative's implementation.

VE Alternative Concept Sketches

VE ALTERNATIVE BC-2
Create a direct taper slip ramp from MacKay Bridge to Massachusetts Avenue



Performance Assessment:

Performance Attribute		Rationale for Change in Performance
Mainline Traffic Operations	Transit	Improve overall traffic volume throughput in mainline operations for traffic coming from MacKay.
	Port	Improve overall traffic volume throughput in mainline operations for traffic coming from MacKay.
	General Purpose	Improve overall traffic volume throughput in mainline operations for traffic coming from MacKay.
Local Traffic Operations		Ramp from Barrington Street Outbound to Bedford Highway will travel via Bayne Street.
Maintainability		Adds additional lane of pavement. Results in new pavement resurfacing through area.
Temporary Construction Impacts		Results in additional construction to base case. Stage 1 Widen Barrington Street ramp by 1 lane could be constructed at same time a Bayne Street ramp. If construction of gore areas, new curb and gutter and resurfacing occurred after completion of Windsor St Intersection improvements then traffic management would be improved.
Environmental Impacts		Potentially minimal incremental footprint impacts associated with widening. Lands are not environmentally sensitive but might have contamination.

VE ALTERNATIVE BC-2
Create a direct taper slip ramp from MacKay Bridge to Massachusetts Avenue

Performance Attribute	Rationale for Change in Performance
ROW/Footprint Impacts	Potentially minimal incremental footprint impacts associated with widening.
Active Transportation	No change from baseline.

Assumptions and Calculations:

One lane widening to outside of Barrington Street ramp in addition to base case Bayne Street ramp – includes related grading, removal and new storm sewer, gutter, curb, removal and new light poles. It is noted that constructing this widening as part of the baseline project would achieve cost efficiencies. However, constructing as a separate stand alone project would likely increase all costs.

Removal of existing gore areas and weave zone and construction of new slip ramp with two bullnoses, including related curb and gutter.

Resurfacing and new pavement markings of all four lanes for approximately 250m.

Initial Cost Estimate

CONSTRUCTION ELEMENT		*BASELINE CONCEPT*			*ALTERNATIVE CONCEPT*		
Description	**Unit**	**Qty**	**Cost/Unit**	**Total**	**Qty**	**Cost/Unit**	**Total**
1 Lane Urban Ramp - WB Widening between Barrington On-Ramp BN and Robie Off-Ramp	m	0	$ 4,400	$ -	180	$ 4,400	$ 792,000
Barrier - WB Widening between Barrington On-Ramp BN and Robie Off-Ramp BN	m	0	$ 63	$ -	90	$ 63	$ 5,670
				$ -			$ -
SUB-TOTAL				$0			$797,670
PROJECT MARK-UPS	37%			$0			$291,150
TOTAL (Rounded)				$0			$1,100,000
						ADDED COST	**($1,100,000)**

VE ALTERNATIVE BC-3

Remove traffic from Joseph Howe Drive ramp by providing signalized stop condition at Main Avenue with displaced left/DDI

Description of Baseline Concept:

The baseline concept provides an access connection for traffic from Joseph Howe Drive onto the overpass section of the Windsor Street Exchange. This connection removes a significant volume of traffic from the primary intersection of Windsor Street and Lady Hammond Drive. The Joseph Howe Drive (DV-K Ramp) to eastbound Bedford Highway would carry two lanes of traffic, with signals at the end of the ramp and on the Bedford Highway. Vehicles travelling from Joseph Howe Drive to the MacKay Bridge would use the left lane to access to the overpass to the MacKay Bridge. Vehicles travelling to Windsor Street, Lady Hammond Road, and other local connections would use the right lane.

Due to the curvature of the ramp, there is not sufficient width to accommodate vehicles passing trucks. The baseline concept includes the installation of signage restricting passing trucks on the ramp, restricting the ramp to one lane while trucks are present on the ramp. Longer term, operations would be improved by modifying the ramp structure to accommodate two full approach lanes entering the ramp from Joseph Howe Drive.

The existing exit ramp from westbound Bedford Highway to southbound Joseph Howe Drive has a reduced capacity due to its geometric design and small radius which can be especially difficult for trucks to navigate. Additionally, there is a safety concern of traffic backing up onto Bedford Highway from this exit ramp due to both demand and reduced speeds through the curve.

Description of Alternative Concept:

Remove traffic from Joseph Howe Drive ramp by providing a signalized stop condition at Main Avenue with a displaced left/DDI.

Advantages:

- Improves weave condition
- Improves upstream vehicle queues on Joseph Howe Drive/102
- Addresses issue of two lanes on DV-K Ramp
- Wider sidewalk or MUP could be added to DV-K Ramp for connection between Bedford Highway and Joseph Howe Drive
- Increases Bedford Highway to Joseph Howe Drive exit ramp radius and capacity, improving operations along Bedford Highway and improving safety concerns
- Does not require changes to Fairview overpass

Disadvantages:

- Profile considerations
- Complicated signal with addition of transit priority
- Requires additional signal over base condition at Joseph Howe Drive/Bedford Highway connection
- Requires significant signing
- Potential to encourage short-cutting through Main Avenue
- Removes access to westbound Bedford Highway, forcing traffic to take alternate routes

VE ALTERNATIVE BC-3

Remove traffic from Joseph Howe Drive ramp by providing signalized stop condition at Main Avenue with displaced left/DDI

Discussion:

The combination of the high demand volume and the constraints of the existing width of DV-K ramp creates operational challenges. This alternative addresses this operational challenge by decreasing the amount of traffic on the DV-K ramp. Traffic travelling from Joseph Howe Drive to the MacKay Bridge from the DV-K Ramp is diverted through construction of a displaced left intersection on the Joseph Howe Drive to Bedford Highway exit which will access the Bedford Highway via Main Avenue. A two-phase signal on the Bedford Highway at the end of Main Avenue would allow vehicles travelling to the MacKay Bridge to access the overpass section of the Windsor Street Exchange, shown as location B in the graphic below. All EB traffic on the Bedford Highway would be impacted by this signal. Transit priority signals from Main Avenue would be included in the signal phasing. Access to westbound Bedford Highway will be eliminated from Joseph Howe Drive in order to provide two southbound lanes and one left turn lane at the displaced left two phase signal on Joseph Howe Drive, shown as location D in the graphic below. The volume of the Joseph Howe Drive to westbound Bedford Highway movement is expected to be approximately 250 vehicles in the peak hour (PM) in 2031. They would most likely use Dunbrack Street or Windsor Street to access westbound Bedford Highway. Two southbound lanes at the displaced left signal are required because the projected 2031 traffic volumes exceed the capacity of a single lane signal (1400 southbound vehicles opposing 900 left turning vehicles).

Joseph Howe Drive/Bedford Highway Connection

Location A in the graphic above shows that the Joseph Howe Drive connection to Bedford Highway is removed as part of this concept. The existing pavement is restriped to include two lanes southbound from the Bedford Highway exit ramp. The exit ramp radius can be increased to better accommodate trucks and higher turning speeds for vehicles. The DV-K ramp will remain as one lane that is restricted to only Windsor Street Exchange access, as shown at location C in the graphic above. The proposed signals in the baseline scenario are removed at this location. This alternative would not require any changes to the Fairview overpass.

VE ALTERNATIVE BC-3

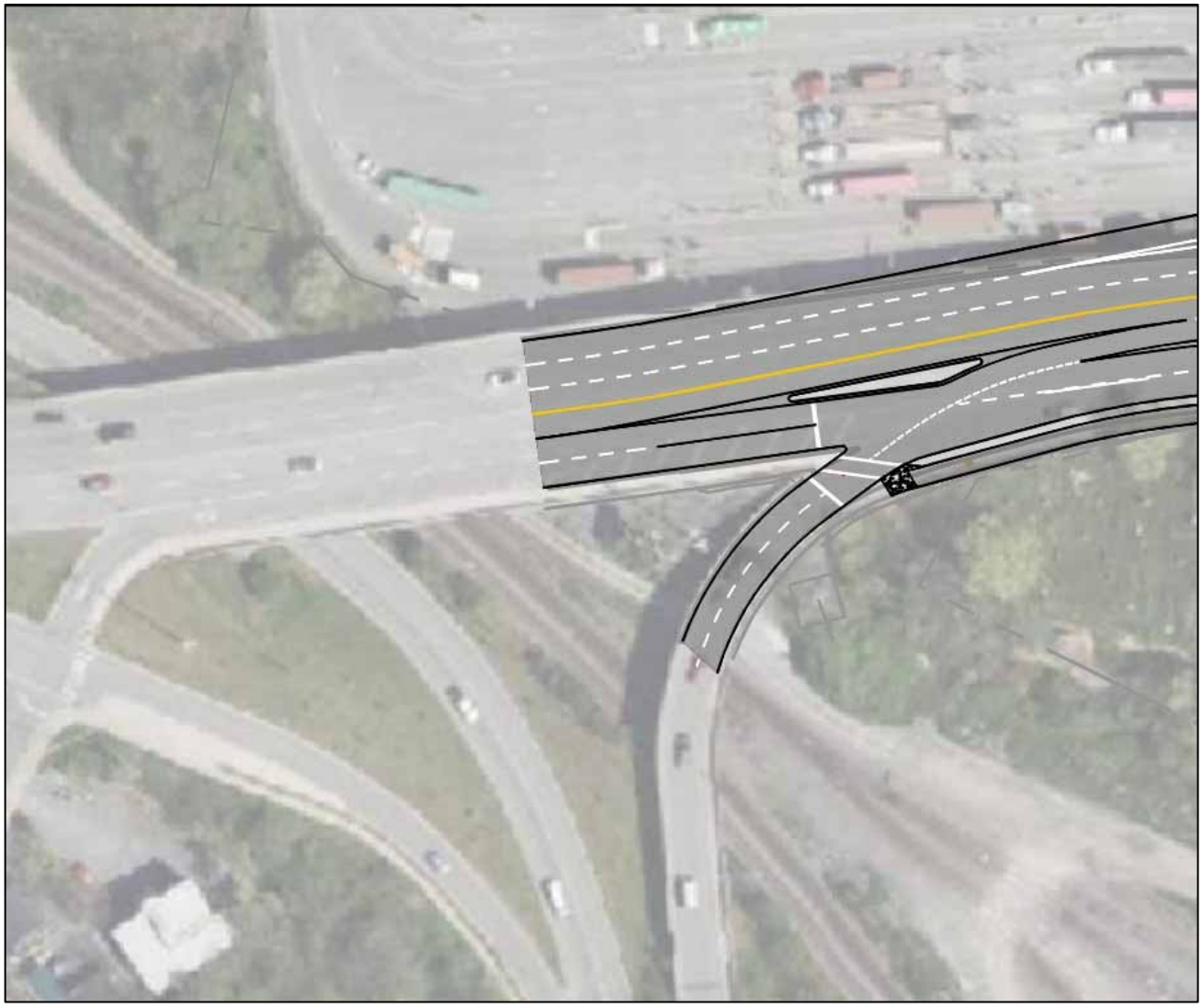
Remove traffic from Joseph Howe Drive ramp by providing signalized stop condition at Main Avenue with displaced left/DDI

Wayfinding signage on Joseph Howe Drive at Dutch Village Road would be required to direct traffic to the proper lane for their desired destination.

Discussion of Risk Impacts:

There is some risk associated with re-grading the Joseph Howe loop ramp to have a wider radius. There is also risk that the grade of the displaced left up the Main Avenue ramp is not feasible. Additionally, improving the Main Avenue ramp might make it more attractive to vehicles. Even though vehicles would be legally prohibited from travelling from Main Avenue to the bridge, they could physically make the maneuver since it is left open for transit which is similar to how it functions today.

Baseline Concept Sketch



VE ALTERNATIVE BC-3

Remove traffic from Joseph Howe Drive ramp by providing signalized stop condition at Main Avenue with displaced left/DDI

VE Alternative Concept Sketch

Performance Assessment:

Performance Attribute		Rationale for Change in Performance
Mainline Traffic Operations	Transit	No degradation to transit priority from Main Avenue
	Port	Reduces traffic volume on DV-K ramp improving travel time from Highway 102 to Port
	General Purpose	Increases vehicle throughput in study area
Local Traffic Operations		Improves Joseph Howe DV-K ramp operations, reduces queue spillback
Maintainability		Increase in pavement and adds a signal over base condition
Temporary Construction Impacts		Negligible
Environmental Impacts		Minor increase in impervious surface
ROW/Footprint Impacts		Likely requires movement of high-mast streetlight at end of Main Avenue
Active Transportation		Provides space on DV-K ramp for increased sidewalk or multi-use path

VE ALTERNATIVE BC-3

Remove traffic from Joseph Howe Drive ramp by providing signalized stop condition at Main Avenue with displaced left/DDI

Initial Cost Estimate

CONSTRUCTION ELEMENT		*BASELINE CONCEPT*			*ALTERNATIVE CONCEPT*		
Description	**Unit**	**Qty**	**Cost/Unit**	**Total**	**Qty**	**Cost/Unit**	**Total**
Traffic Signal - Traffic Signals at: Joseph Howe On-Ramp;	ea	1	$ 400,000	$ 400,000	2	$ 400,000	$ 600,000
1 Lane Urban Ramp - New left Turn on Joseph Howe Ramp	m	0	$ 4,400	$ -	30	$ 4,400	$ 132,000
2 Lane Urban Ramp - Reconstruct Bedford WB to JH SB Ramp	m	0	$ 4,500	$ -	30	$ 4,500	$ 135,000
				$ -			$ -
SUB-TOTAL				$400,000			$867,000
PROJECT MARK-UPS	37%			$146,000			$316,455
TOTAL (Rounded)				$600,000			$1,200,000
						ADDED COST	**($600,000)**

VE ALTERNATIVE BC-4

Improve turning movement and signal phasing from the Port to MacKay Bridge at Windsor Street Exchange

Description of Baseline Concept:

A SB left turn lane is provided for vehicles destined to the mainline in the EB direction. This is the primary route for Port traffic exiting the yard, destined to the MacKay Bridge. The geometry is extremely tight, especially for large vehicles. Hatched area is provided for truck over-tracking.

In addition, the physical island that is proposed may not deter vehicles from making a SB left turn onto Lady Hammond Rd. This is a safety concern as the SB lefts run in the same phase as EB through movements in the base case scenario, potentially creating an unanticipated conflict.

Description of Alternative Concept:

Improve the turning movement and signal phasing from the Port of Halifax to the MacKay Bridge at the Windsor Street Exchange. Improvements include:

- SB left turn stop bar is set back to improve left turning geometry for WB-20 design vehicle
- 40m of storage in SB left turn lane is now available
- Island remains the same
- Alternate signal phasing (split phasing) has been used to modify the base case and eliminate turning conflicts
- Pavement marking guidelines and signage will be required to supplement directional guidance

Advantages:

- Improve SB left turn geometry, specifically for truck turning traffic
    - Positive benefit to Port operations
- Eliminate potential conflict of SB left turning vehicles accessing Lady Hammond Road, conflicting with EB through vehicles

Disadvantages:

- Minor increase in asphalt on NE corner of intersection
- Decrease in available storage length for SB left turn lane; additional queueing through/beyond Bayne Street intersection
- Modification to split phasing increases overall signal cycle time

Discussion:

The design was reviewed by the VE team to make modifications to the SB left turn geometry, while accommodating NB traffic heading to the mainline. Best case scenario presented in image below.

Requires stop bar to be set back, allowing only 40m of queuing storage. Base case scenario requires 71m of storage (critical PM peak). Queuing will spillback through the Bayne St signalized intersection. Consideration should be given to the additional safety benefits outweighing operational impacts on an already failing intersection.

As a result, traffic representatives on the VE team have adjusted the base line model to reflect a 40m storage lane for the SB left turn lane. Overall, no implications to base case as vehicles can't even access the storage lane due to other delays. Needs to be considered in future design modifications.

In addition, modifications to the physical barrier (island) were reviewed to remove the potential conflict of SB left turn traffic accessing Lady Hammond Rd, during the same signal phase as EB through

traffic. Expansion of the existing proposed island is not feasible as this would impede NB traffic from Windsor, destined to the mainline. An additional island location was reviewed to the SW of the existing SB left turn lane; however, this would impede EB left turning traffic and is not feasible.

In conclusion, traffic representatives from the VE team have modified the base line model to include split phasing at this intersection, eliminating the potential conflict. Needs to be considered in future analysis/design.

Discussion of Schedule Impacts:

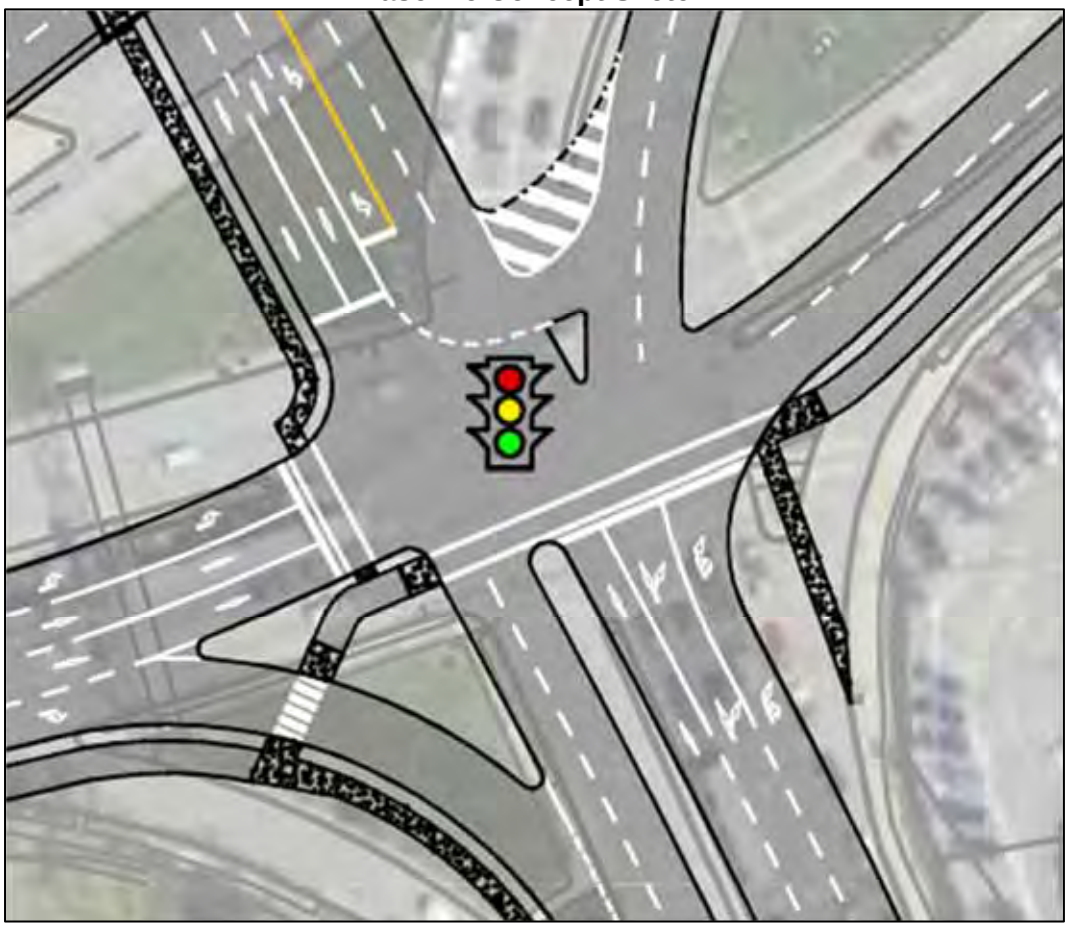
No significant change from baseline.

Discussion of Risk Impacts:

Identified risks are related to traffic conflicts and operational capacity:

- Base case scenario traffic model has been updated to include split phasing and 40m storage lane for SB left turn lane, combined with other adjustments
- Overall reduction in capacity – deemed low risk as the base line model is already failing
- Overall reduces conflicts – risk reduced, positive benefits for all modes

Baseline Concept Sketch



VE ALTERNATIVE BC-4

Improve turning movement and signal phasing from the Port to MacKay Bridge at Windsor Street Exchange

VE Alternative Concept Sketch

Performance Assessment:

Performance Attribute		Rationale for Change in Performance
Mainline Traffic Operations	Transit	No routes identified using SB left. No impact. Improves safety for EB through lines.
	Port	Improves turning geometry for truck traffic heading to the mainline. Improves safety.
	General Purpose	Improves turning geometry for general traffic heading to the mainline. Improves safety.
Local Traffic Operations		Eliminates potential conflict of EB through with SB left to Lady Hammond.
Maintainability		Negligible increase in asphalt.
Temporary Construction Impacts		N/A
Environmental Impacts		N/A
ROW/Footprint Impacts		Negligible impacts. No additional property acquisition required.
Active Transportation		Split phasing may benefit vulnerable road user safety.

VE ALTERNATIVE BC-4

Improve turning movement and signal phasing from the Port to MacKay Bridge at Windsor Street Exchange

Assumptions and Calculations:

WB-20 design vehicle used in AutoTurn simulation.

Costs were not evaluated as the increase in asphalt is negligible in the overall cost estimate.

No costs associated with signal phasing changes.

VE ALTERNATIVE BC-5A

Modify Kempt Road operation and access

Description of Baseline Concept:

The baseline concept includes a ramp from Kempt Road EB towards the MacKay Bridge. The Kempt Road ramp merges at the end of the Windsor Street EB ramp into an EB lane that exits to Massachusetts Avenue. Traffic using these ramps headed towards the MacKay Bridge must change lanes into free-flowing traffic from the Bedford Highway overpass. The length of this weaving area is 118 m and has been identified as a potential high conflict area. The merge of the Kempt Road and Windsor Street EB ramps has also been identified as a potential conflict with poor sightlines.

To accommodate the geometry of the Kempt Road ramp, the existing Lady Hammond Road shifts south, with the addition of a MUP on the south side of the road. The shift of Lady Hammond Road south is expected to impact the Subaru dealership at the corner of Lady Hammond and Kempt Roads. The estimated area of impact is 160 m2 and would require reconstruction of the existing retaining wall. During stakeholder engagement, management and owners of the Subaru dealership indicated that this would have a significant impact to their use of the property for vehicle storage and movement around the site. It is expected that these property impacts would result in injurious affection fees in addition to the land acquisition costs.

Description of Alternative Concept:

This alternative concept displaces the Kempt Rd to MacKay Bridge movements from the proposed ramp directly opposite Kempt Road further west to join the Windsor Street to MacKay Bridge eastbound ramp via a right-turn channel. Lady Hammond Road at the Kempt Road intersection would shift further north closer to the existing alignment, avoiding property impacts to the Subaru dealership.

Advantages:

- Reduces property impacts and business impacts to Subaru dealership
- Improves construction schedule by reducing reconstruction of existing Lady Hammond Road
- Reduces retaining wall costs at Kempt Road intersection
- Addresses safety concerns identified at merge of Windsor Street EB and Kempt Road ramps

Disadvantages:

- Challenging geometry for right turn channel between Lady Hammond Road and Windsor Street EB ramp

Discussion:

Originally this alternative concept considered removing the Kempt Road to MacKay Bridge ramp and shifting Lady Hammond Road further north to avoid property impacts to the Subaru dealership. Based on initial traffic modelling, removing this ramp completely causes an unacceptable impact to traffic operations on MacKintosh Street due to the volume of traffic on Lady Hammond Road.

The alternative concept was then revised to consider relocating the Kempt Road to MacKay Bridge movements further west to accommodate shifting Lady Hammond Road further north to avoid the property impacts to the Subaru dealership. The ramp geometry and placement was determined by truck turning movements.

Discussion of Schedule Impacts:

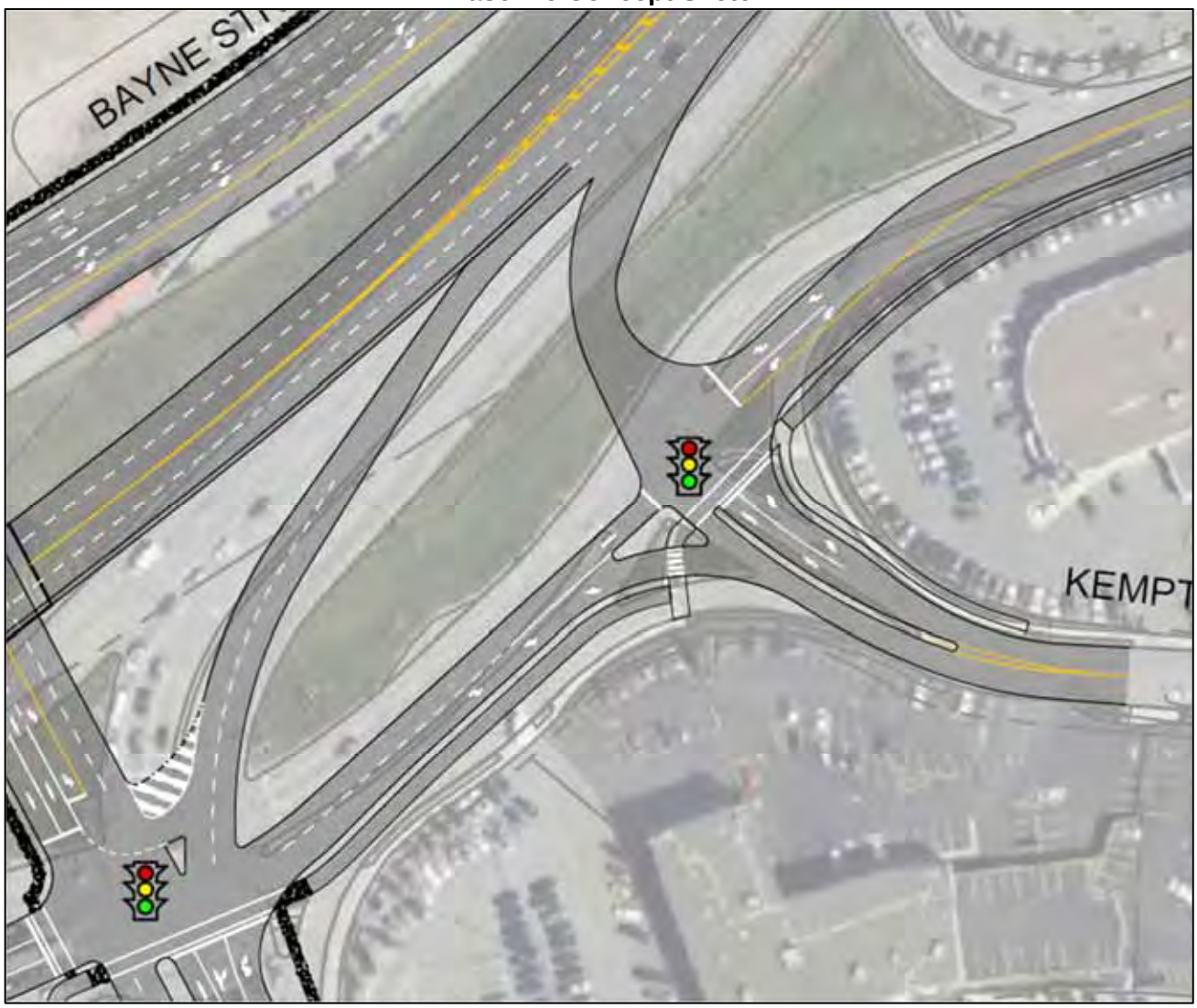
Reducing ROW impacts at the Subaru dealership could shorten the schedule.

VE ALTERNATIVE BC-5A
Modify Kempt Road operation and access

Discussion of Risk Impacts:

Risk is reduced by eliminating ROW impacts to the Subaru dealership.

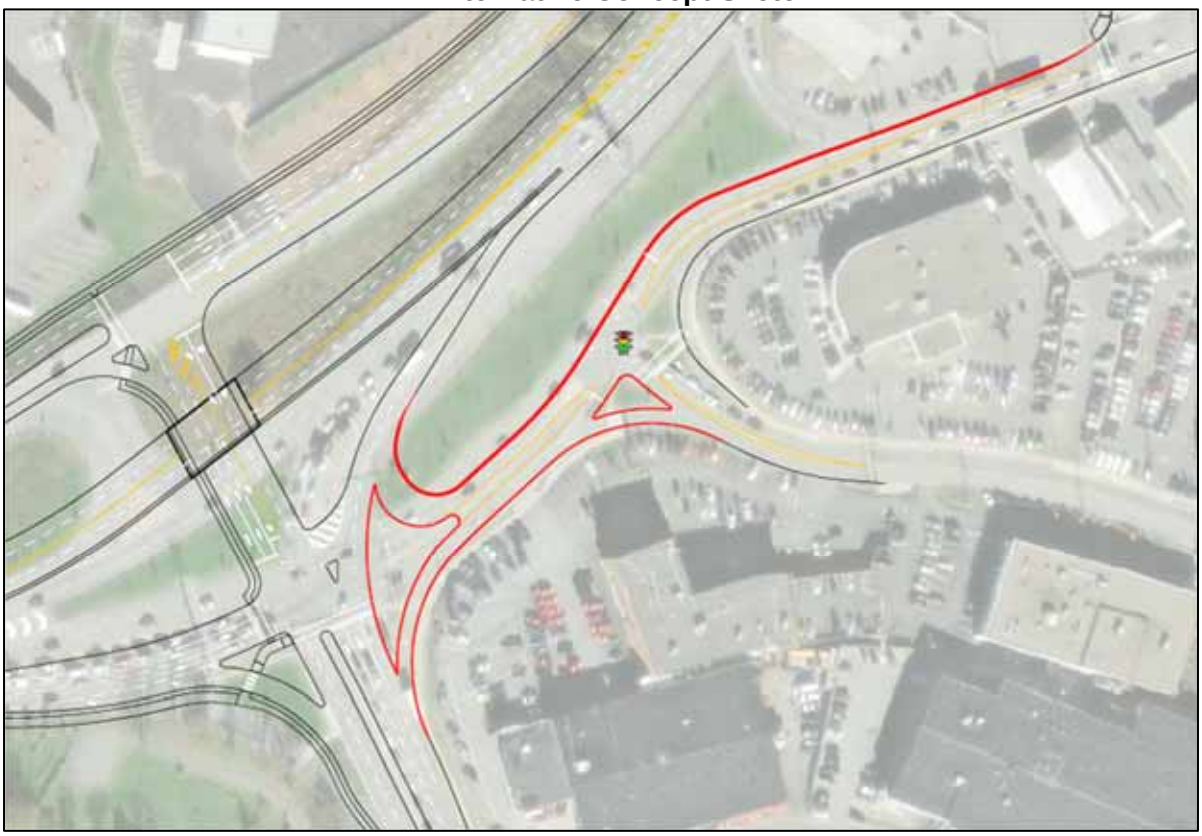
Baseline Concept Sketch



VE ALTERNATIVE BC-5A

Modify Kempt Road operation and access

VE Alternative Concept Sketch



Performance Assessment:

Performance Attribute		Rationale for Change in Performance
Mainline Traffic Operations	Transit	No significant change to transit performance
	Port	No significant change to port traffic operations. Eastbound port traffic would not be affected by this change
	General Purpose	Would lower the truck turning speed at the ramp but would create a safer yield condition at the eastbound Bedford Highway entrance ramp. Would also provide more acceleration distance for trucks utilizing this entrance ramp from Lady Hammond Road.
Local Traffic Operations		No significant change to operations over base condition. Safety of the eastbound Bedford Highway on ramp is improved by removing the yield control entrance onto the highway
Maintainability		No significant change in pavement or structures.
Temporary Construction Impacts		Reduces realignment of Lady Hammond, eliminates need to reconstruct the retaining wall around the Subaru dealership
Environmental Impacts		No significant change from base condition
ROW/Footprint Impacts		Reduces or eliminates the impact to the Subaru dealership by keeping Lady Hammond closer to the existing alignment
Active Transportation		No significant change to AT facilities from base condition

VE ALTERNATIVE BC-5B

Close Kempt Road and redirect traffic

Description of Baseline Concept:

In the baseline concept, Kempt Road connects with Lady Hammond Road at a signalized intersection.

The NB traffic along Kempt Road can go through (ramp connection to the mainline and travel EB to the MacKay Bridge / Massachusetts Avenue or Barrington Street). NB traffic can also turn right on Lady Hammond Road allowing access to WB Bedford Highway, Windsor Street, or the Port area through MacKintosh Street /Bayne Street. Direct access to Windsor Street is not provided as the left turn from Kempt Road is not permitted.

WB traffic on Lady Hammond Road approaches the signal and can access Kempt Road SB or the onramp to the Mainline EB. No movements are allowed through the intersection going WB.

EB traffic on Lady Hammond Road can access SB Kempt Road or continue along Lady Hammond. No access to the ramp is intended for EB Lady Hammond traffic.

Description of Alternative Concept:

Relocate On-Ramp from Lady Hammond Road to MacKay Bridge in line with VE Alternative BC-5A. Close Kempt Road access using a cul-de-sac and reroute Kempt Road traffic to other local roads.

Adjust Lady Hammond Road west of Kempt Road closer to the existing alignment. Maintain existing Lady Hammond Road alignment east of Kempt Road with modifications to the west leg between Windsor and Kempt in line with relocation of On-Ramp to MacKay Bridge in line with Alternative BC-5A. This will adjust the alignment of the west leg northerly to avoid the cul-de-sac and accommodate roadway geometry to tie into the new ramp from Windsor Street.

This option will mitigate ROW impacts to the south side of Lady Hammond Road with tight cul-de-sac design on Kempt Road.

Advantages:

- Removes signalized intersection at Kempt/Lady Hammond
- Opportunity to mitigate ROW impacts on south side of Lady Hammond Road
- Can mitigate retaining wall impacts (SE corner of Kempt/Lady Hammond)
- Could provide safer AT connections by reducing conflicts

Disadvantages:

- Transit rerouting required
- Impacts designated truck route
- Access maintenance for private properties impacted
- Needs stakeholder buy-in. Likely to be received negatively by adjacent commercial properties.
- Will require by-law amendments, upgrades to Commission Street and a new signalized intersection at Commission Street and Lady Hammond Road

Discussion:

Removing the signalized intersection will reroute northbound Kempt Road traffic to Commission Street. An alternate route for traffic is through Young/Windsor Street or Young/Massachusetts Avenue. Projected traffic volume (PM peak, WSP Functional Report) exiting Kempt Road is 385 vph total (80 vph to MacKay Bridge and 305 vph to Lady Hammond Road). This traffic is most likely to reroute to Lady Hammond Road via Commission Street. It's anticipated that most, if not all, of the

redirected Kempt Road traffic would be turning left from Commission Street onto Lady Hammond Road, adding to the existing left turning traffic on Commission Street, for an estimated total of over 500 vehicles per hour. Given the high volume of traffic on Lady Hammond Road, it's likely that a signalized intersection at Commission Street would be warranted. Estimated cost to install new signalized intersection is $400,000.

The truck route by-law would have to be revised to change Commission Street to a full time truck route. To accommodate this change, Commission Street would need to be fully recapitalized within 10 years to an HRM Collector, at an estimated cost of $500,000. Any changes to the truck by-law would need to be authorized by HRM Regional Council.

Street closure of Kempt Road would need to be authorized by HRM Regional Council. Direction from Council could be obtained in approval of the functional plan of the Windsor Street Exchange project, prior to proceeding with preliminary and detailed design.

Halifax Transit confirmed bus re-routing (from Kempt Road to Massachusetts Avenue) is acceptable, there is limited impact to current bus operations.

Discussion of Schedule Impacts:

Positive impact, removes signalized intersection at Kempt Road and reduces reconstruction. Reduces ROW impacts, saving time in property acquisition.

Discussion of Risk Impacts:

Could prompt stakeholder approval requirements (schedule impacts) and requires a by-law change for truck route.

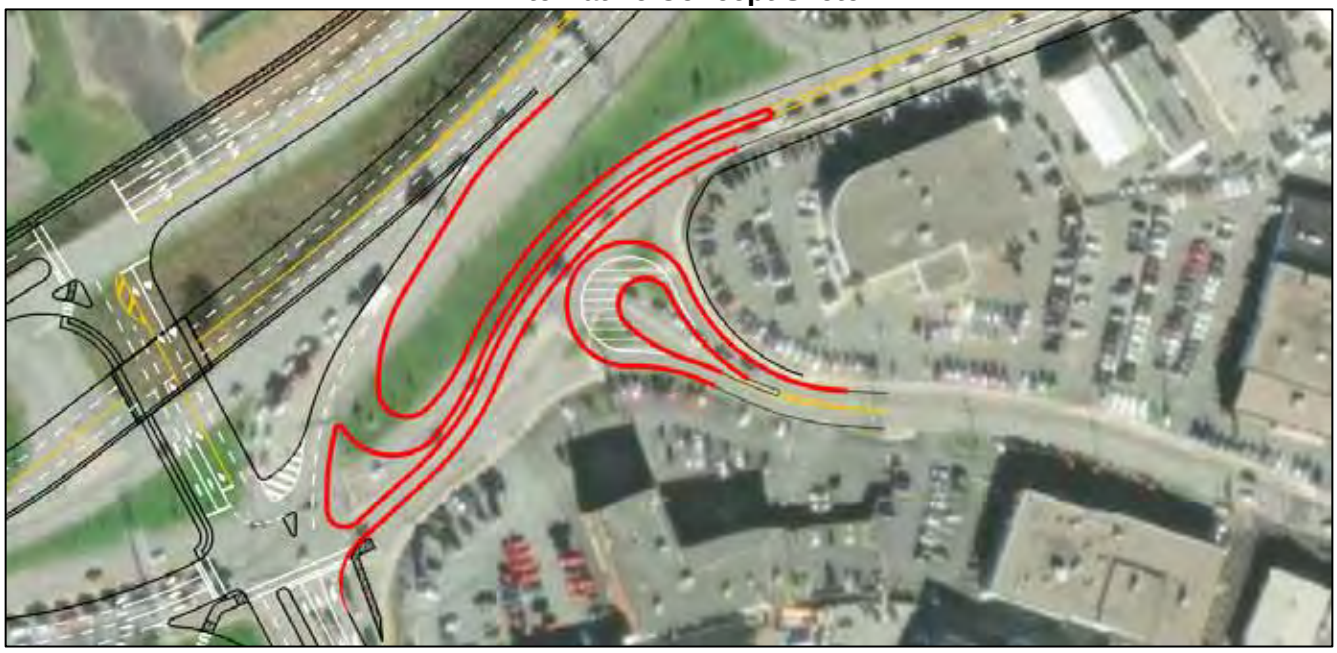
Geometric challenges in realigning entrance ramp to EB Bedford Highway from Lady Hammond.

Baseline Concept Sketch

VE ALTERNATIVE BC-5B

Close Kempt Road and redirect traffic

VE Alternative Concept Sketch



Performance Assessment:

Performance Attribute		Rationale for Change in Performance
Mainline Traffic Operations	Transit	Reroutes express routes 196, 138, 137, 136, and 135 southbound to Young from Kempt Road to Massachusetts Avenue. This was confirmed as acceptable by Halifax Transit.
	Port	No change.
	General Purpose	No change.
Local Traffic Operations		Kempt Road closure limits traffic from Kempt Road onto Lady Hammond Road directly and pushes vehicles to an alternate route. They will likely (going north bound) take Commission Street. An alternate route to the south is Young Street to Massachusetts Avenue or Windsor Street.
Maintainability		Potentially less pavement area; reuse of existing infrastructure. Net zero on new signals (relocated to Commission Street). Additional maintenance at Commission Street to accommodate new truck route in future
Temporary Construction Impacts		No major impacts to traffic, simpler in the sense of no signals, and reuse of existing roadway.
Environmental Impacts		Minor improvements with mitigated reconstruction of Lady Hammond – reduced use of materials and smaller impervious area increase.
ROW/Footprint Impacts		Ability to mitigate impacts at car dealership.
Active Transportation		Removes the need for a crossing at Kempt in the east – west direction.

VE ALTERNATIVE BC-5B

Close Kempt Road and redirect traffic

Assumptions and Calculations:

Geometry for realigned Lady Hammond Road WB to MacKay Bridge ramp connection (Alternative BC-5A) works.

Initial Cost Estimate

CONSTRUCTION ELEMENT		*BASELINE CONCEPT*			*ALTERNATIVE CONCEPT*		
Description	**Unit**	**Qty**	**Cost/Unit**	**Total**	**Qty**	**Cost/Unit**	**Total**
2 Lanes Road Urban - Windsor Street to Kempt Road 1+440 to 1+570 (3.0m MUP)	m	130	$ 4,400	$ 572,000	130	$ 4,400	$ 572,000
2 Lanes Road Urban - Kempt Road to Commission Street 1+570 to 1+840 (3.0 MUP to	m	0	$ 4,400	$ -	60	$ 4,400	$ 264,000
2 Lanes Road Urban - South of Lady Hammond to Start of Tapers 5+000 5+050	m	50	$ 4,400	$ 220,000	0	$ 4,400	$ -
3 Lanes Road Urban - Kempt Road to Commission Street 1+570 to 1+840 (3.0 MUP to	m	270	$ 4,700	$ 1,269,000	0	$ 4,700	$ -
2 Lanes Road Urban - Start of Tapers to Lady Hammond 5+050 5+100	m	0	$ 4,400	$ -	50	$ 4,400	$ 220,000
3 Lanes Road Urban - Start of Tapers to Lady Hammond 5+050 5+100	m	50	$ 4,700	$ 235,000	0	$ 4,700	$ -
1 Lane Urban Ramp - Lady Hammond to Bedford WB On-Ramp 5+100 - 5+160	m	60	$ 4,400	$ 264,000	0	$ 4,400	$ -
MUP (m2) - Windsor Street to Kempt Road 1+440 to 1+570 (3.0m MUP)	m^2	390	$ 63	$ 24,570	390	$ 63	$ 24,570
MUP (m2) - Kempt Road to Commission Street 1+570 to 1+840 (3.0 MUP to MacKintosh)	m^2	450	$ 63	$ 28,350	450	$ 63	$ 28,350
Traffic Signal - Traffic Signals at: Windsor; Kempt; and MacKintosh	ea	3	$ 400,000	$ 1,200,000	3	$ 400,000	$ 1,200,000
				$ -			$ -
SUB-TOTAL				$3,812,920			$2,308,920
PROJECT MARK-UPS	60%			$2,268,687			$1,373,807
TOTAL (Rounded)				$6,100,000			$3,700,000
						SAVINGS	**$2,400,000**

VE ALTERNATIVE BC-5C

Convert Kempt Road to be right-in, right-out only

Description of Baseline Concept:

In the baseline concept Kempt Road connects with Lady Hammond Road at a signalized Intersection.

The NB traffic along Kempt Road can go through (ramp connection to the mainline and travel EB to the MacKay Bridge / Massachusetts Avenue or Barrington Street). NB traffic can also turn right on Lady Hammond Road allowing access to WB Bedford Highway, Windsor Street, or the Port area through MacKintosh Street /Bayne Street. Direct access to Windsor Street is not provided as the left turn from Kempt Road is not permitted.

WB traffic on Lady Hammond Road approaches the signal and can access Kempt Road SB or the onramp to the Mainline EB. No movements are allowed through the intersection going WB.

EB traffic on Lady Hammond can access Kempt Road SB or continue along Lady Hammond. No access to the ramp is intended for EB Lady Hammond traffic.

Description of Alternative Concept:

Relocate On-Ramp from Lady Hammond Road to MacKay Bridge in line with BC-5A

Right-in-right-out access at Kempt Road will effectively remove through movement for the NB Kempt Road traffic (ramp to mainline). This will remove the need for a traffic signal.

This option will allow the project to adjust the Lady Hammond Road alignment northerly providing for grading and property / ROW impacts at the car dealership. It can likely maintain the existing roadway along Lady Hammond Road from Kempt Road easterly thereby minimizing reconstruction needs.

Advantages:

- Removes signalized intersection
- Simplifies traffic movements at Kempt Road
- Minimizes reconstruction on Lady Hammond Road
- Mitigates property / ROW impacts along Lady Hammond Road

Disadvantages:

- Limits movements for NB Kempt Road
- May impact truck route designation
- Impacts to MacKintosh Street / private property access
- Requires by-law amendments, upgrades to Commission Street and potentially a new signalized intersection at Commission Street and Lady Hammond Road

Discussion:

This concept needs to be combined with BC-5A (relocation of proposed Kempt Road Ramp to a channelized right-turn at the Windsor Street intersection) to get the full benefit. Removing that ramp connection from Kempt Road allows the realignment of Kempt Road northerly and reduces ROW impacts.

Removal of the signalized intersection allows for lower construction and maintenance costs as well as lower coordination requirements (with all other signals in the area). This also simplifies movements at Kempt Road minimizing traffic using on-ramp to get to the bridge (i.e. no through movement from Kempt NB).

VE ALTERNATIVE BC-5C

Convert Kempt Road to be right-in, right-out only

Incorporating Alternative BC-5A allows Lady Hammond Road to remain on its exiting alignment. mitigating impacts to private property. In effect, the existing roadway / configuration can be maintained for the most part east of the Kempt intersection thereby reducing construction cost and timelines. Projected traffic volume (PM peak, WSP Functional Report) exiting Kempt Road is 385 vph total (80 vph to MacKay Bridge and 305 vph to Lady Hammond Road). The traffic turning onto Lady Hammond Road could proceed as projected. The traffic heading to the MacKay Bridge is most likely to reroute to Lady Hammond Road via Commission Street. It's anticipated that the redirected 80 vph from Kempt Road traffic would be turning left from Commission Street onto Lady Hammond Road, adding to the existing left turning traffic on Commission Street, for an estimated total of over 200 vehicles per hour. Updated traffic volumes will need to be estimated, along with an associated traffic signal warrant. Based on the warrant projections, deferral of traffic signals could be considered with continued monitoring of the Commission Street and Lady Hammond Road intersection post WSE construction. A Estimated cost to install new signalized intersection is $400,000.

The truck route by-law would have to be revised to change Commission Street to a full time truck route. To accommodate this change, Commission Street would need to be fully recapitalized within 10 years to an HRM Collector, at an estimated cost of $500,000. Any changes to the truck by-law would need to be authorized by HRM Regional Council.

Discussion of Schedule Impacts:

Positive impact, removes signalized intersection at Kempt Road and reduces reconstruction, however, may also shift the need for signals to Commission Street. Reduces ROW impacts, saving time in property acquisition.

Discussion of Risk Impacts:

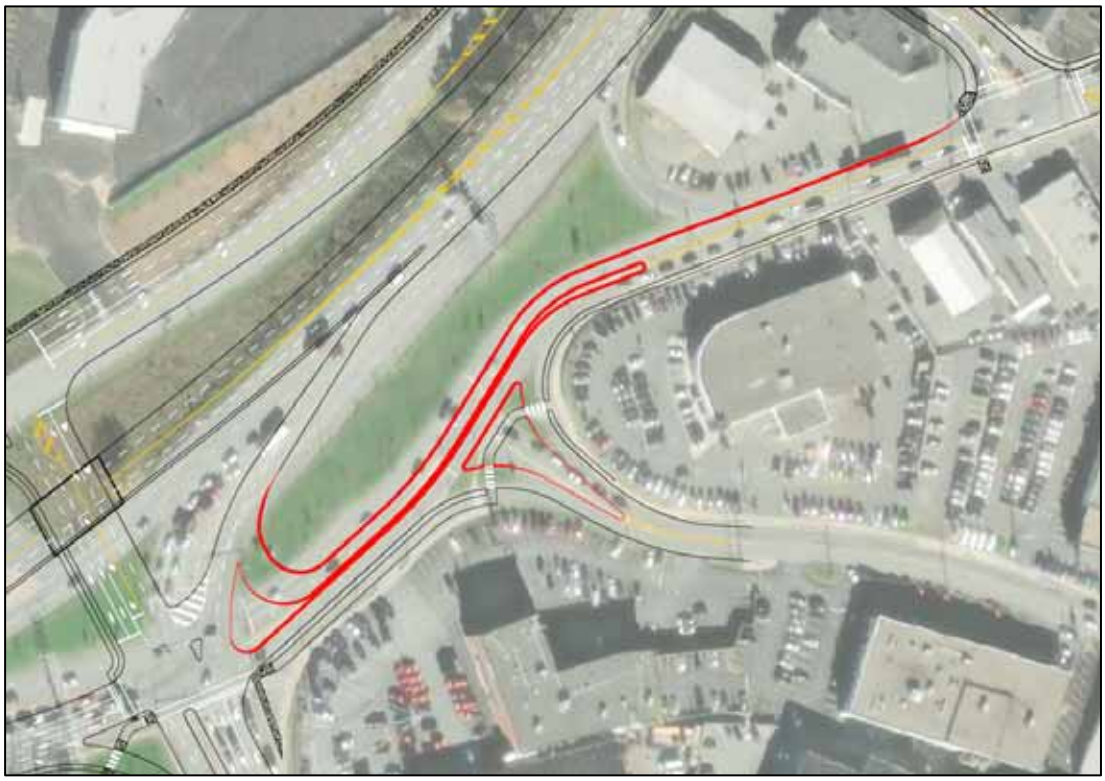
Geometric challenges in realigning entrance ramp to EB Bedford Highway from Lady Hammond.

Baseline Concept Sketch

VE ALTERNATIVE BC-5C

Convert Kempt Road to be right-in, right-out only

VE Alternative Concept Sketch



Performance Assessment:

Performance Attribute		Rationale for Change in Performance
Mainline Traffic Operations	Transit	No change
	Port	No change
	General Purpose	No change
Local Traffic Operations		Right In / Right Out limits traffic from left turning traffic (or MacKay Bridge traffic) from Kempt Road onto Lady Hammond Road and pushes vehicles to an alternate route. They will likely (going north bound) take Commission Street. An alternate route to the south is Young Street to Massachusetts Avenue or Windsor Street.
Maintainability		Potentially less pavement area; reuse of existing infrastructure. Net zero on new signals (relocated to Commission Street). Additional maintenance at Commission Street to accommodate new truck route in future
Temporary Construction Impacts		No major impacts to traffic, simpler in the sense of no signals, and reuse of existing roadway
Environmental Impacts		Minor improvements with mitigated reconstruction of Lady Hammond – reduced use of materials and smaller impervious area increase
ROW/Footprint Impacts		Ability to mitigate impacts at car dealership

VE ALTERNATIVE BC-5C

Convert Kempt Road to be right-in, right-out only

Performance Attribute	Rationale for Change in Performance
Active Transportation	Removes signalized crossing; but maintains directional ramp crossings for RIRO which is effectively the same as base case.

Assumptions and Calculations:

Geometry for realigned Lady Hammond Road WB to MacKay Bridge ramp connection (Alternative BC-5A) works.

Initial Cost Estimate

CONSTRUCTION ELEMENT		*BASELINE CONCEPT*			*ALTERNATIVE CONCEPT*		
Description	**Unit**	**Qty**	**Cost/Unit**	**Total**	**Qty**	**Cost/Unit**	**Total**
2 Lanes Road Urban - Windsor Street to Kempt Road 1+440 to 1+570 (3.0m MUP)	m	130	$ 4,400	$ 572,000	130	$ 4,400	$ 572,000
3 Lanes Road Urban - Kempt Road to Commission Street 1+570 to 1+840 (3.0 MUP to MacKintosh)	m	270	$ 4,700	$ 1,269,000	0	$ 4,700	$ -
2 Lanes Road Urban - South of Lady Hammond to Start of Tapers 5+000 5+050	m	50	$ 4,400	$ 220,000	0	$ 4,400	$ -
3 Lanes Road Urban - Start of Tapers to Lady Hammond 5+050 5+100	m	50	$ 4,700	$ 235,000	0	$ 4,700	$ -
2 Lanes Road Urban - Start of Tapers to Lady Hammond 5+050 5+100	m	0	$ 4,400		50	$ 4,400	$ 220,000
1 Lane Urban Ramp - Lady Hammond to Bedford WB On-Ramp 5+100 - 5+160	m	60	$ 4,400	$ 264,000	0	$ 4,400	$ -
MUP - Windsor Street to Kempt Road 1+440 to 1+570 (3.0m MUP)	m^2	390	$ 63	$ 24,570	390	$ 63	$ 24,570
MUP - Kempt Road to Commission Street 1+570 to 1+840 (3.0 MUP to MacKintosh)	m^2	450	$ 63	$ 28,350	450	$ 63	$ 28,350
Traffic Signal	ea	3	$ 400,000	$ 1,200,000	3	$ 400,000	$ 1,200,000
				$ -			$ -
SUB-TOTAL				$3,812,920			$2,044,920
PROJECT MARK-UPS	60%			$2,268,687			$1,216,727
TOTAL (Rounded)				$6,100,000			$3,300,000
						SAVINGS	**$2,800,000**

VE ALTERNATIVE BAG-1

Eliminate grade separation of Bedford Highway at Windsor Street Exchange

Description of Baseline Concept:

The baseline concept converts the existing at-grade intersection at Windsor Street, Bedford Highway, and Lady Hammond Road into a grade separated interchange. The movement from the Fairview Overpass to MacKay Bridge was an at-grade signalized left turn and is modified into the free-flow movement at the interchange. The at-grade components of the improvement concept provide access to the Fairview Cove Port facility, Africville Road, Windsor Street, Lady Hammond Road, Kempt Road, and Bayne Street.

In the eastbound direction, the exit to Windsor Street uses the existing Windsor Street alignment and the resulting ramp terminal intersection is located roughly in the location of the existing Windsor/Lady Hammond Road/Bedford Highway intersection. The main movements on the Bedford Highway are elevated over the interchange but due to the area's topography, this requires lowering the ramp terminal intersection by at least 2 metres. The eastbound entrance ramps are located at Windsor Street and at Kempt Road.

In the westbound direction, the exit to Windsor Street splits from the Bedford Highway to Massachusetts Avenue and Bayne Street. The exit ramp diverges from the Massachusetts Avenue exit immediately following the painted diverge, before the physical diverge point. Bayne street is converted to on way before MacKintosh Street, with access being provided via a new one-way connection along Forrester Street. Traffic travelling to Windsor Street would continue along Bayne Street to the new Windsor Street connection while traffic travelling to Lady Hammond Road or Kempt Road would utilize MacKintosh Street. Bayne Street would be two-way between Africville Road and MacKintosh Street to provide access for Port traffic eastbound.

Lady Hammond Road is converted to one-way eastbound between Windsor Street and Kempt Road with no access to Lady Hammond Road from the southbound approach on Windsor Street. Traffic from Africville Road or the Port to Lady Hammond Road is routed to MacKintosh Street.

Access to eastbound Bedford Highway from Bayne Street, Africville Road, and Windsor Street is provided by a new ramp leaving the northeast corner of the Windsor Street and Lady Hammond Road intersection. Access to eastbound Bedford Highway from Lady Hammond Road is moved north from the existing ramp to a new single lane ramp at Kempt Road. This ramp yields to traffic entering Bedford Highway from the Windsor Street entrance. In order to accommodate this ramp, Lady Hammond Road is shifted south through this area and significantly impacts the Subaru Dealership at the corner of Kempt Road and Lady Hammond Road.

MacKintosh Street is widened to provide three lanes under the MacKintosh Street bridge with a MUP on the south side. MacKintosh Street will be signalized at both Bayne Street and Lady Hammond Road.

Kempt Road cannot travel west from Lady Hammond Road as that segment of Lady Hammond Road will be converted to one-way eastbound. Access to westbound Bedford Highway from Kempt Road would utilize MacKintosh Street to the Bayne Street on ramp.

The baseline concept significantly impacts utilities due to the significant lowering of the Windsor Street profile. There are numerous overhead and underground utilities that would need to be relocated. Additionally, the baseline concept also impacts ROW along Bayne Street including significant impacts to the Atlantic Coach parking area.

VE ALTERNATIVE BAG-1

Eliminate grade separation of Bedford Highway at Windsor Street Exchange

Description of Alternative Concept:

This alternative provides an interchange option that reduces cost and construction timeline from the baseline. The connection from Windsor Street to Bayne Street is removed, and Windsor Street remains at its existing grade. The free flow Bedford Highway movements remain at grade. Traffic that utilized the Bayne Street and Windsor Street connection to go westbound on Bedford Highway is rerouted through MacKintosh Street.

Advantages:

- Improves constructability
- Reduces costs

Disadvantages:

- Public disapproval
- Eliminates local connections
- May not improve access to Port
- Creates poor operations at MacKintosh Street intersections

Discussion:

This alternative significantly reduces cost and improves constructability over the baseline due to the removal of the Bedford Highway overpass across Windsor Street. If Windsor Street is left at grade, utility impacts are significantly lower. However, Lady Hammond Road must stay on the same alignment as the baseline to provide the ramp to eastbound Bedford Highway which does not eliminate the Subaru Dealership ROW impacts. More traffic is diverted through MacKintosh Street than in the base condition which could cause queue spillback onto the Bayne offramp from Bedford Highway and Lady Hammond Road.

Discussion of Schedule Impacts:

This alternative reduces the construction schedule from the base condition due to the removal of the Windsor Street bridge. Reduction of utility impacts at Windsor Street will also reduce schedule.

Discussion of Risk Impacts:

The main risk is that there will be no operational improvement to the local network. While Bedford Highway is maintained as free flow, local network connections are rerouted through MacKintosh Street. Public acceptance of a project that has limited improvement over existing is also a risk.

VE ALTERNATIVE BAG-1

Eliminate grade separation of Bedford Highway at Windsor Street Exchange

Baseline Concept Sketch

VE Alternative Concept Sketch

VE ALTERNATIVE BAG-1

Eliminate grade separation of Bedford Highway at Windsor Street Exchange

Performance Assessment:

Performance Attribute		Rationale for Change in Performance
Mainline Traffic Operations	Transit	Transit operations would be degraded along with the rest of the vehicular network, which would experience more delay than in the base condition
	Port	Eastbound port traffic must utilize MacKintosh Street to access the Bedford Highway eastbound ramp.
	General Purpose	This alternative performs worse network wide than the base condition due to the removal of the Windsor Street connection. The overall network results for the AM and PM peak hours are as follows, respectively: • Increase in delay of 154 percent and 37 percent • Increase in latent demand of 42 percent and 97 percent • Decrease in network throughput of 14 percent and 18 percent
Local Traffic Operations		Local traffic operations are degraded by removing the Windsor Street/Bayne Street connection.
Maintainability		Reduction of structure and pavement improves maintainability
Temporary Construction Impacts		Improves construction impacts due to structure removal
Environmental Impacts		Reduces impervious surface and structures
ROW/Footprint Impacts		Does not significantly reduce private ROW impacts. Reduces overall footprint under Bedford Highway.
Active Transportation		Reduced; removes north-south connection at Windsor intersection

VE ALTERNATIVE BAG-1

Eliminate grade separation of Bedford Highway at Windsor Street Exchange

Initial Cost Estimate

CONSTRUCTION ELEMENT		*BASELINE CONCEPT*			*ALTERNATIVE CONCEPT*		
Description	**Unit**	**Qty**	**Cost/Unit**	**Total**	**Qty**	**Cost/Unit**	**Total**
5 Lanes Road Urban - Lady Hammond to Bayne 3+120 to 3+228	m	108	$ 5,700	$ 615,600	0	$ 5,700	$ -
Borrow	m	40,000	$ 40	$ 1,600,000	0	$ 40	$ -
Retaining Walls at Bridge (East Approach)	m^2	60	$ 2,000	$ 120,000	0	$ 2,000	$ -
Retaining Walls at Bridge (West Approach)	m^2	120	$ 2,000	$ 240,000	0	$ 2,000	$ -
Retaining Walls - MacKintosh to Windsor 2+658 to 2+410	m^2	124	$ 2,000	$ 248,000	0	$ 2,000	$ -
Retaining Walls - Windsor to Africville 2+410 to 2+290	m^2	60	$ 2,000	$ 120,000	0	$ 2,000	$ -
Bridge over Windsor Street	m^2	445	$ 9,000	$ 4,005,000	0	$ 9,000	$ -
				$ -			$ -
SUB-TOTAL				$6,948,600			$0
PROJECT MARK-UPS	57%			$3,960,702			$0
TOTAL (Rounded)				$11,000,000			$0
						SAVINGS	**$11,000,000**

VE ALTERNATIVE BAG-2

Relocate grade separation to the east with new local crossing

Description of Baseline Concept:

The baseline concept converts the existing at-grade intersection at Windsor Street, Bedford Highway, and Lady Hammond Road into a grade separated interchange. The movement from the Fairview Overpass to MacKay Bridge was an at-grade signalized left turn and is modified into the free-flow movement at the interchange. The at-grade components of the improvement concept provide access to the Fairview Cove Port facility, Africville Road, Windsor Street, Lady Hammond Road, Kempt Road, and Bayne Street.

In the eastbound direction, the exit to Windsor Street uses the existing Windsor Street alignment and the resulting ramp terminal intersection is located roughly in the location of the existing Windsor/Lady Hammond Road/Bedford Highway intersection. The main movements on the Bedford Highway are elevated over the interchange but due to the area's topography, this requires lowering the ramp terminal intersection by at least 2 metres. The eastbound entrance ramps are located at Windsor Street and at Kempt Road.

In the westbound direction, the exit to Windsor Street splits from the Bedford Highway to Massachusetts Avenue and Bayne Street. The exit ramp diverges from the Massachusetts Avenue exit immediately following the painted diverge, before the physical diverge point. Bayne street is converted to on way before MacKintosh Street, with access being provided via a new one-way connection along Forrester Street. Traffic travelling to Windsor Street would continue along Bayne Street to the new Windsor Street connection while traffic travelling to Lady Hammond Road or Kempt Road would utilize MacKintosh Street. Bayne Street would be two-way between Africville Road and MacKintosh Street to provide access for Port traffic eastbound.

Lady Hammond Road is converted to one-way eastbound between Windsor Street and Kempt Road with no access to Lady Hammond Road from the southbound approach on Windsor Street. Traffic from Africville Road or the Port to Lady Hammond Road is routed to MacKintosh Street.

Access to eastbound Bedford Highway from Bayne Street, Africville Road, and Windsor Street is provided by a new ramp leaving the northeast corner of the Windsor Street and Lady Hammond Road intersection. Access to eastbound Bedford Highway from Lady Hammond Road is moved north from the existing ramp to a new single lane ramp at Kempt Road. This ramp yields to traffic entering Bedford Highway from the Windsor Street entrance. In order to accommodate this ramp, Lady Hammond Road is shifted south through this area and significantly impacts the Subaru Dealership at the corner of Kempt Road and Lady Hammond Road.

MacKintosh Street is widened to provide three lanes under the MacKintosh Street bridge with a MUP on the south side. MacKintosh Street will be signalized at both Bayne Street and Lady Hammond Road.

Kempt Road cannot travel west from Lady Hammond Road as that segment of Lady Hammond Road will be converted to one-way eastbound. Access to westbound Bedford Highway from Kempt Road would utilize MacKintosh Street to the Bayne Street on ramp.

The baseline concept significantly impacts utilities due to the significant lowering of the Windsor Street profile. There are numerous overhead and underground utilities that would need to be relocated. Additionally, the baseline concept also impacts ROW along Bayne Street including significant impacts to the Atlantic Coach parking area.

VE ALTERNATIVE BAG-2

Relocate grade separation to the east with new local crossing

Description of Alternative Concept:

This alternative eliminates the need to lower the existing Lady Hammond/Bedford/Windsor intersection area and thus avoids the related utility impacts. The tradeoff is a raising of the Bedford Highway profile east of Windsor Street to provide vertical clearance over the new underpass just east of Kempt Road.

Advantages:

- Reduces utility impacts
- Reduces ROW impacts, particularly at the HRM, Subaru Dealership, and Port properties
- Limits the impact to the Port's marshalling area
- Provides operational improvements over base condition
- Reduces retaining wall required along Bayne Street
- Improves the turning radius of eastbound Bedford Highway traffic bound for the Port at the intersection of Lady Hammond Road and MacKintosh Street
- Provides increased acceleration distance for trucks travelling eastbound and westbound on Bedford Highway
- Moves the grade separation crossing to a more favorable location (away from existing waterline, with better depths to bedrock).
- North-south connection for AT users by means of a multi-use pathway in the new underpass east of Kempt Road
- Improves drainage across Bedford Highway, reducing propensity for ponding on Lady Hamond Road and Kempt Road intersection

Disadvantages:

- Does not improve truck access to the Port to and from eastbound Bedford Highway
- Halifax Water coordination and considerations
- Possible drainage concerns at underpass
- Removes left turn access at Kempt Road

Discussion:

This alternative maintains the Windsor Street and Lady Hammond Road intersection at-grade, which will significantly reduce utility impacts in this area. It also realigns the existing Bedford Highway connection to allow free flow between the Bedford Highway and MacKay Bridge through the Windsor intersection area at existing grade. It maintains the existing alignment of Lady Hammond Road, Kempt Road, and Bayne Street which minimizes ROW impacts and retaining wall across the study area.

The Windsor Street and Lady Hammond intersection is maintained at grade, with a on ramp to eastbound Bedford Highway forming the north leg of the intersection. This is the eastbound access for both Windsor Street and Lady Hammond Road. Kempt Road is converted to right-in-right-out which reduces the number of signals and conflicts along the corridor and also mitigates the baseline impact to the Subaru Dealership.

A new underpass will be constructed under Bedford Highway east of Kempt Road close to where the existing on ramp is located. Lady Hammond Road is converted to one way eastbound which together with the new underpass, MacKintosh Street, and Bayne Street forms a counterclockwise rotary. This allows MacKintosh Street to handle the Lady Hammond Road to westbound Bedford Highway volume

(~1100 vehicles per hour in the PM peak) by utilizing all three lanes without requiring expansion of the MacKintosh Street bridge.

A new two-phase signal will control the eastbound port traffic versus the westbound Bedford Highway traffic. Access to Windsor is provided via a loop ramp from westbound Bedford Highway to eastbound Bayne Street. Windsor traffic would utilize the new underpass to turn westbound on Lady Hammond and then left onto Windsor at the signal.

The northbound Joseph Howe Drive access to westbound Bedford Highway is removed, and the existing loop ramp is expanded to two lanes utilizing the northbound John Howe Drive roadbed. Additionally, adding a second lane to the loop ramp will improve the weave condition along westbound Bedford Highway from the Port entrance to the Joseph Howe exit. By changing the diverge condition from a 2/1 split to a 2/2 split, vehicles do not have to merge over to exit. Only traffic continuing to westbound Bedford Highway will be required to merge. The Joseph Howe ramp to MacKay Bridge at Main Avenue will be converted to two lanes. This will be controlled at a signal at the existing transit only ramp upstream of the Fairview Bridge. Transit priority will be provided at this signal.

For the active transportation component, the alternative concept takes into account the proposal for a new multi-use pathway to the west of the base case project limits (as shown in the alternative describing a new multi-use pathway on the south side of the Bedford Highway). At the Windsor Street intersection, the east-west crossing for the multi-use pathway is essentially equivalent to the base case. Compared to the base case, there would not be a north-south connection for AT users at this location. Where Lady Hammond Drive meets Kempt Road, AT users would need to cross two free flow ramps but otherwise the multi-use pathway crossing would be simplified as compared with the base case. It is intended that the design would include continuing the multi-use pathway on the south side of Lady Hammond Drive to the east beyond the MacKintosh Street intersection. In terms of north-south travel for AT users, the proposed underpass east of Kempt Road would be designed to include a multi-use pathway connection to Bayne Road including the appropriate intersection treatments to provide protected crossings for the pathway users A multi-use pathway would also be included on the north side of Bayne Street. In this overall scenario, the AT connection to Africville Museum could be directed to Lady Hammond Drive and Devonshire Avenue (refer to the discussion in the Alternative AT-3).

Structural Considerations:

- To accommodate the roadway and MUP below, the structure clear distance would be in the order of 22m (between MSE walls). If MSE walls are used in front of the structure, a span length in the order of 26m (2m allowance from face of MSE to c/l bearings) is expected, which is similar to the base case. (This assumes MSE walls are used, which would help to minimize the span, and structure depth).
- As such, the depth of the superstructure will be similar to the structure in the Base case (with an opportunity to consider a higher number of shallower girders (1000 in lieu of 1200 deep) to reduce grade height changes.
- The structure will carry the Bedford Highway, which will be in the order of 30m wide. This large width may make using a single integral abutment bridge challenging. (Bridge would be wider than it is long). As such, consideration can be given to providing two adjacent structures (with a small gap) to separate the EB and WB lanes into independent, but immediately adjacent structures. Other than considerations for width, the structure could readily have integral abutments.

VE ALTERNATIVE BAG-2

Relocate grade separation to the east with new local crossing

- Clearance under the bridge would be 5m for traffic. However, because the roadway above is very wide, there will be significant height requirements due to cross slope on the Bedford Highway.
- The depth of bedrock is favorable to integral-abutment piles.
- Structure is ~40 m northward laterally from watermain tunnel below Lady Hammond. Relative to the base case, this reduces risks and considerations related to driving piles above or near the watermain. As such, the VE team considers that either driven or drilled piles could be considered.
- Historic Halifax Water geotechnical borehole (Maritime Testing, 1974) at Lady Hammond Road/Kempt Roadshows bedrock at 4 m depth. This would require additional BH's along between Bayne Street/Bedford Highway and Lady Hammond Road/Bedford Highway
- If the structure is constructed as two separate adjacent structures, this may assist with construction phasing and detours. Detouring will still be a challenge.
- Some utilities are still impacted (quite a bit lower than others).

Schedule Discussion:

The avoidance of the significant underground utility impacts at the existing Lady Hammond/Bedford/Windsor intersection area presents an opportunity to greatly reduce cost and schedule risk to the project.

Risk Discussion:

The avoidance of the significant underground utility impacts at the existing Lady Hammond/Bedford/Windsor intersection area presents an opportunity to greatly reduce cost and schedule risk to the project.

Baseline Concept Sketch

VE ALTERNATIVE BAG-2

Relocate grade separation to the east with new local crossing

VE Alternative Concept Sketches

VE ALTERNATIVE BAG-2

Relocate grade separation to the east with new local crossing

Performance Assessment:

Performance Attribute		Rationale for Change in Performance
Mainline Traffic Operations	Transit	Improvement due to significant improvement in overall network performance. Reduction in delay of 11 percent and 68 percent (AM and PM, respectively). Reduction in latent demand.
	Port	Improvement due to significant improvement in overall network performance.
	General Purpose	Improvement due to significant improvement in overall network performance. Changes to performance are AM and PM, respectively. • Reduction in delay of 11 percent and 68 percent • Percent (AM and PM, respectively); reduction in latent demand of 51 percent and 98 percent • Increase network throughput of 9 percent and 26 percent
Local Traffic Operations		Improvement due to significant improvement in overall network performance.
Maintainability		Less structure. Bridge not precluded from having integral abutments. Eliminates retaining wall along north side of Bayne Street
Temporary Construction Impacts		Does not require significant regrading and utility relocations at the existing Bedford/Lady Hammond/Windsor intersection.
Environmental Impacts		Increases impervious surface. Greatly reduces emissions from idling vehicles.
ROW/Footprint Impacts		Less impact to marshalling yard, north side of Bayne, Subaru dealership.
Active Transportation		Improved AT operation and connectivity.

VE ALTERNATIVE BAG-2

Relocate grade separation to the east with new local crossing

Initial Cost Estimate

CONSTRUCTION ELEMENT		*BASELINE CONCEPT*			*ALTERNATIVE CONCEPT*		
Description	**Unit**	**Qty**	**Cost/Unit**	**Total**	**Qty**	**Cost/Unit**	**Total**
2 Lanes Road Urban - Start of Turn Lane Tapers to Windsor Street	m	0	$ 4,400	$ -	140	$ 4,400	$ 616,000
2 Lanes Road Urban - Windsor Street to Kempt Road 1+440 to 1+570 (3.0m MUP)	m	130	$ 4,400	$ -	0	$ 4,400	$ -
2 Lanes Road Urban - MacKintosh to Commission 1+750 to 1+840	m	0	$ 4,400	$ -	90	$ 4,400	$ 396,000
2 Lanes Road Urban - Windsor to Bedford WB On-Ramp	m	0	$ 4,400	$ -	120	$ 4,400	$ 528,000
2 Lanes Road Urban - Start of Tapers to Lady Hammond 5+050 5+100	m	0	$ 4,400	$ -	50	$ 4,400	$ 220,000
2 Lanes Road Urban - Bayne to Lower Coach Atlantic Entrance	m	100	$ 4,400	$ 440,000	200	$ 4,400	$ 880,000
2 Lanes Road Urban - Lady Hammond to Bayne	m	0	$ 4,400	$ -	100	$ 4,400	$ 440,000
3 Lanes Road Urban - New Street to MacKintosh 1+650 to 1+750 (3.0 MUP to MacKintosh)	m	0	$ 4,700	$ -	100	$ 4,700	$ 470,000
3 Lanes Road Urban - Kempt Road to Commission Street 1+570 to 1+840 (3.0 MUP to MacKintosh)	m	270	$ 4,700	$ 1,269,000	0	$ 4,700	$ -
3 Lanes Road Urban - Windsor to Africville 2+410 to 2+290	m	120	$ 4,700	$ 564,000	0	$ 4,700	$ -
3 Lanes Road Urban - MacKintosh to Windsor 2+658 to 2+410	m	0	$ 4,700		248	$ 4,700	$ 1,165,600
3 Lanes Road Urban - Start of Tapers to Lady Hammond 5+050 5+100	m	50	$ 4,700	$ 235,000	0	$ 4,700	$ -

VE ALTERNATIVE BAG-2

Relocate grade separation to the east with new local crossing

CONSTRUCTION ELEMENT		*BASELINE CONCEPT*			*ALTERNATIVE CONCEPT*		
Description	**Unit**	**Qty**	**Cost/Unit**	**Total**	**Qty**	**Cost/Unit**	**Total**
4 Lanes Road Urban - Start of Turn Lane Tapers to Windsor Street 1+300 to 1+440 (3.5m MUP)	m	140	$ 5,200	$ 728,000	0	$ 5,200	$ -
4 Lanes Road Urban - Windsor Street to New Street 1+440 to 1+650 (3.0m MUP)	m	0	$ 5,200	$ -	210	$ 5,200	$ 1,092,000
4 Lanes Road Urban - Strawberry Hill to Start of Turn Lanes 3+000 to 3+060	m	60	$ 5,200	$ 312,000	130	$ 5,200	$ 676,000
5 Lanes Road Urban - MacKintosh to Windsor 2+658 to 2+410	m	248	$ 5,700	$ 1,413,600	0	$ 5,700	$ -
5 Lanes Road Urban - Lady Hammond to Bayne 3+120 to 3+228	m	108	$ 5,700	$ 615,600	0	$ 5,700	$ -
6 Lanes Road Urban - Start of Turn Lanes to Lady Hammond 3+060 to 3+120	m	60	$ 6,200	$ 372,000	0	$ 6,200	$ -
1 Lane Urban Ramp - New left Turn on Joseph Howe Ramp	m	0	$ 4,400	$ -	30	$ 4,400	$ 132,000
1 Lane Urban Ramp - Start of taper to single lane to Bedford WB 2+200 to 2+000	m	200	$ 4,400	$ 880,000	0	$ 4,400	$ -
1 Lane Urban Ramp - Lady Hammond to Bedford WB On-Ramp 5+100 - 5+160	m	60	$ 4,400	$ 264,000	0	$ 4,400	$ -
2 Lane Urban Ramp - Africville to Start of taper to single lane 2+290 to 2+200	m	90	$ 4,500	$ 405,000	0	$ 4,500	$ -
2 Lane Urban Ramp - Reconstruct Bedford WB to JH SB Ramp	m	0	$ 4,500	$ -	30	$ 4,500	$ 135,000
MUP (m2) - Windsor Street to Kempt Road 1+440 to 1+570 (3.0m MUP)	m^2	390	$ 63	$ 24,570	0	$ 63	$ -
MUP (m2) - Windsor Street to New Street 1+440 to 1+650 (3.0m MUP)	m^2	0	$ 63	$ -	630	$ 63	$ 39,690
MUP (m2) - MacKintosh to Windsor 2+658 to 2+410	m^2	0	$ 63	$ -	868	$ 63	$ 54,684
MUP (m2) - Lady Hammond to Bayne 3.85m MUP	m^2	578	$ 63	$ 36,383	0	$ 63	$ -
MUP (m2) - Bayne to Forrester 3.85m MUP	m^2	289	$ 63	$ 18,191	0	$ 63	$ -

VE ALTERNATIVE BAG-2

Relocate grade separation to the east with new local crossing

CONSTRUCTION ELEMENT		*BASELINE CONCEPT*			*ALTERNATIVE CONCEPT*		
Description	**Unit**	**Qty**	**Cost/Unit**	**Total**	**Qty**	**Cost/Unit**	**Total**
Retaining Walls at Bridge (East Approach)	m^2	640	$ 2,000	$ 1,280,000	0	$ 2,000	$ -
Retaining Walls at Bridge (West Approach)	m^2	120	$ 2,000	$ 240,000	0	$ 2,000	$ -
Retaining Wall WB Approach to Fairview Bridge	m^2	1,953	$ 2,000	$ 3,906,000	0	$ 2,000	$ -
Retaining Walls at Bridge (North Side)	m^2	0	$ 2,000	$ -	288	$ 2,000	$ 576,000
Retaining Wall WB Approach to Fairview Bridge	m^2	0	$ 2,000	$ -	230	$ 2,000	$ 460,000
Retaining Walls - MacKintosh to Windsor 2+658 to 2+410	m^2	124	$ 2,000	$ 248,000	0	$ 2,000	$ -
Retaining Walls - Windsor to Africville 2+410 to 2+290	m^2	60	$ 2,000	$ 120,000	0	$ 2,000	$ -
Traffic Signals at: Joseph Howe On-Ramp; Windsor; Kempt; and MacKintosh	ea	4	$ 400,000	$ 1,600,000	0	$ 400,000	$ -
1/2 Traffic Signals on Joseph Howe Ramp; Traffic Signal at Main Street	ea	0	$ 400,000	$ -	2	$ 400,000	$ 600,000
Traffic Signals at: MacKintosh; Windsor; Africville	ea	3	$ 400,000	$ 1,200,000	2	$ 400,000	$ 800,000
Traffic Signals at: Windsor; New Street; and MacKintosh	ea	0	$ 400,000	$ -	3	$ 400,000	$ 1,200,000
Bridge over Windsor Street	m^2	445	$ 9,000	$ 4,005,000	0	$ 9,000	$ -
Bridge over New Street	m^2	0	$ 9,000	$ -	500	$ 9,000	$ 4,500,000
Retaining Wall Removal - WB Approach to Fairview Bridge	m^2	1,953	$ 1,000	$ 1,953,000	230	$ 1,000	$ 230,000
				$ -			$ -
SUB-TOTAL				$22,129,344			$15,210,974
PROJECT MARK-UPS	46%			$10,068,851			$6,920,993
TOTAL (Rounded)				$32,200,000			$22,100,000
						SAVINGS	**$10,100,000**

VE ALTERNATIVE AR-1
Extend MacKintosh Street to Africville Road

Description of Baseline Concept:

The project widens Bayne Street to provide two through lanes and then two left turn lanes west of the MacKintosh Street intersection to the Windsor Street intersection. Access to the Port is provided via Africville Road at the base (west end) of Bayne Street. A signalized intersection is provided at the Africville Road and Bayne Street intersection with a two-lane, two-way road west of the Windsor intersection to accommodate movements of trucks exiting the Port. A retaining wall is required along Bayne Street and Africville Road to accommodate the widening/improvements.

The Port of Halifax intends to construct a second truck gate off Africville Road near their new container examination facility at the north of the Port property. The intent is to run trucks on Africville Road from the new access to the new intersection of Bayne Street and Africville Road, where trucks can use the Windsor Street Exchange to access the MacKay Bridge or Highway 102.

Description of Alternative Concept:

Extend MacKintosh Street from its current terminus south of the Canadian National (CN) Railway tracks downhill and through to Africville Road. Trucks would utilize the extension of MacKintosh Street and Africville Road to access the Port truck gates.

Eliminate the intersection of Bayne Street and Africville Road.

Reduce Bayne Street west of the MacKintosh Street intersection to a two-lane lane ramp to Bedford Highway with a single left turn lane at Windsor intersection. Bayne Street will be one-way west-bound which will require the flow for operations vehicles travelling to/from the new MacKintosh Street Depot to be rerouted.

Advantages:

- Reduces impacts to properties along Bayne Street, including Port-owned land that may require a Federal Impact Assessment before construction
- Reduces retaining wall requirements along Bayne Street and Africville
- Reduces conflicts with trucks to and from the Port with general purpose vehicles
- Reduces or eliminates impacts to existing retaining wall and existing WB Bedford Highway

Disadvantages:

- Requires ~9 percent grade on MacKintosh Street to CN tracks
- Potential CN coordination and crossing constraints
- Reroutes Coach Atlantic buses and HRM Maintenance vehicle along Africville Road to MacKintosh Street
- Requires operation vehicles flow on-site at new MacKintosh Street Depot to be reconsidered
- Due to grade, AAA AT facility could not be accommodated on the MacKintosh Street extension; review by HRM's Variance Committee will be required

Discussion:

In the development of the Base Case, due to the high volumes of westbound through movements to the Bedford Highway, the Africville Road at Bayne Street Intersection was modified to become a signalized intersection to mitigate identified delays and provide an opportunity for vehicles exiting the port from Africville Road. Additionally, the southbound approach to the Bayne Street and Africville Road Intersection was adjusted to allow for a southbound channelized right turn lane to the

westbound Bedford Highway entrance ramp. This was to provide right turning vehicles the opportunity to proceed without being delayed by left turning vehicles.

The VE Alternative converts Bayne Street to a one-way street westbound and diverts all truck traffic to and from the Port to the MacKintosh Street extension. Bayne Street thus provides access to Windsor Street intersection and WB entrance ramp only. This reduced demand on Bayne Street allows it to be reduced to a one-way, two-lane road with a left turn lane at Windsor Street. The signal at Windsor Street and Bayne Street becomes a two-phase signal with approaching traffic from the south and east legs only.

The VE Alternative assumes that the Port's proposed improvements for the second truck gate to the north will have been completed.

Schedule Discussion:

Given the alternative should reduce the impacts to the properties along Bayne Street and reduced retaining wall impacts, the project schedule should be reduced. However, VE team is unable to determine or quantify the degree of schedule reduction.

Risk Discussion:

The risks relating to coordination with the Port's improvements to their truck gate is increased as this alternative requires those improvements to be completed. It also increases risks relative to coordinate with CN as the MacKintosh Street extension will need to tie directly to their tracks. The risk of property acquisition along Bayne Street is reduced, along with the risk of needing to complete a Federal Impact Assessment prior to construction on the Port-owned property.

VE ALTERNATIVE AR-1
Extend MacKintosh Street to Africville Road

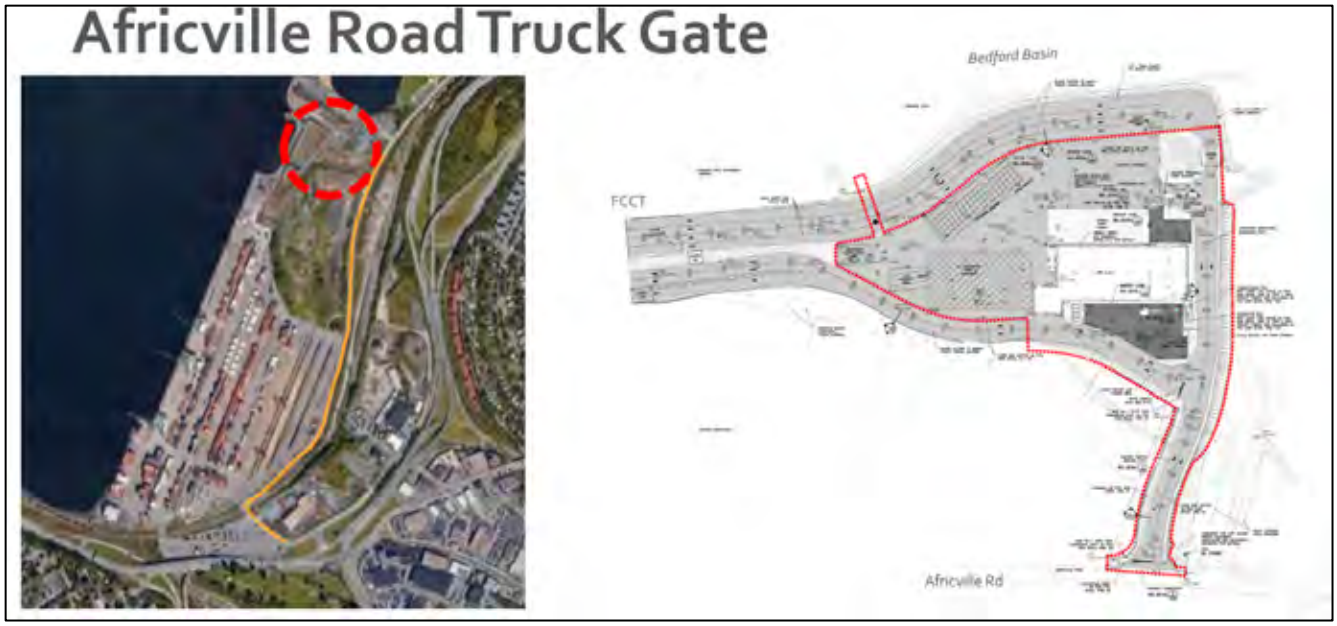
Baseline Concept Sketches

Baseline Concept of Bayne Street from MacKintosh Street to Africville Road

Bayne Street at Windsor Street (left) and Bayne Street at Africville Road (right)

VE ALTERNATIVE AR-1

Extend MacKintosh Street to Africville Road

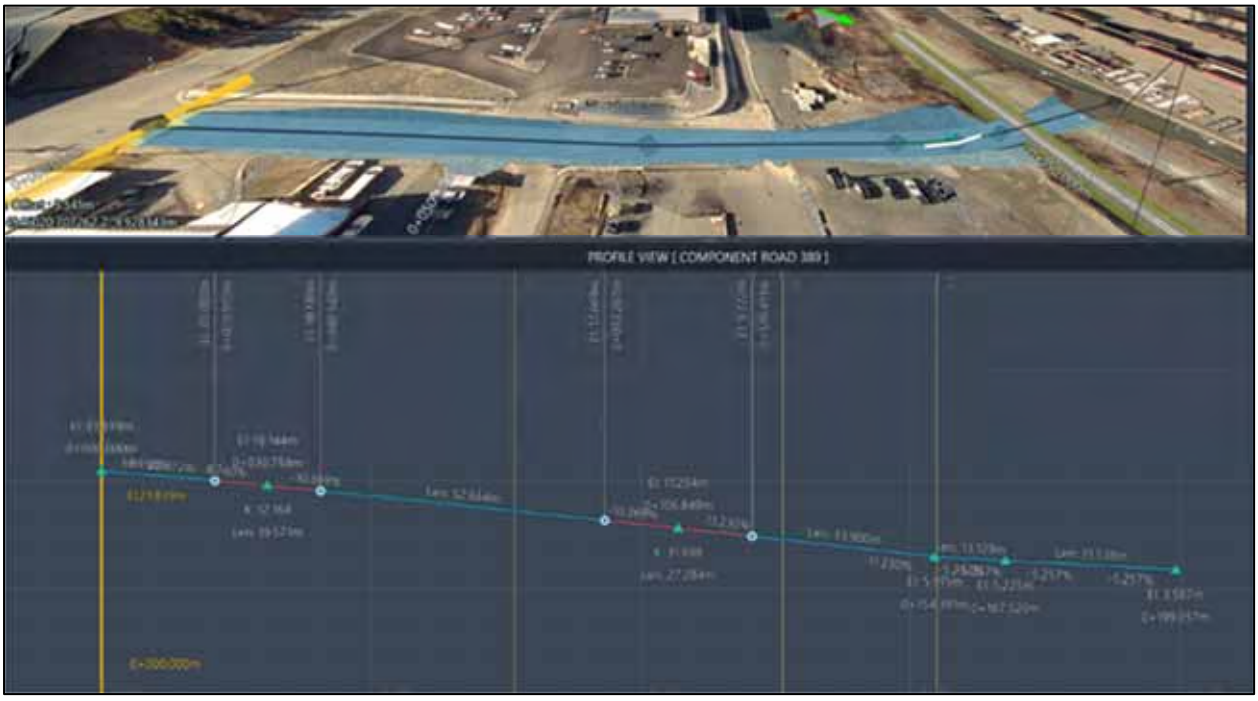


Port of Halifax's proposed second Africville Road truck gate

VE Alternative Concept Sketches

VE ALTERNATIVE AR-1

Extend MacKintosh Street to Africville Road



VE ALTERNATIVE AR-1
Extend MacKintosh Street to Africville Road

Performance Assessment:

Performance Attribute		Rationale for Change in Performance
Mainline Traffic Operations	Transit	No significant change from baseline.
	Port	Truck access to and from the Port is improved with direct access from MacKintosh Street to the two truck gates. Increases the acceleration distance of trucks entering WB Bedford Highway.
	General Purpose	No significant change from baseline.
Local Traffic Operations		Improves operations and signal phasing of the intersection of Windsor and Bayne. Does require rerouting of Coach Atlantic buses and HRM maintenance vehicles along Africville Road to MacKintosh Street intersection.
Maintainability		Improves maintainability by reducing or eliminating the retaining wall along Bayne Street and Africville. Adds a railroad crossing and crossing equipment. Additional signalization at Bayne and Mac.
Temporary Construction Impacts		Allows the use of Africville Road as detour route during construction.
Environmental Impacts		Should reduce the potential environmental impacts of contaminated soils that could be encountered for retaining wall foundations.
ROW/Footprint Impacts		Significant reduction of ROW impacts along Bayne Street. Improves Bayne Street onramp to WB Bedford Highway, thus reducing impacts to existing Bedford Highway and existing retaining wall. Requires coordination with CN to create at-grade crossing. Extending ROW on HRM-owned land between MacKintosh Street and Africville Road.
Active Transportation		AT access along MacKintosh Street to Africville Road will be possible with the extension, however, the 9 percent grade may be an issue. AAA facility could not be constructed and the is insufficient space for switchbacks; will require review by HRM's Variance Committee. Conflicts between AT and vehicles at the intersection of Windsor and Bayne is improved.

Assumptions and Calculations:

Assume that the bridge on a tangent has a 10 percent lower cost/square metre compared to the curved bridge. Assume that the bridge on a tangent has a similar but slightly smaller deck area compared to the curved bridge.

VE ALTERNATIVE AR-1

Extend MacKintosh Street to Africville Road

Initial Cost Estimate

CONSTRUCTION ELEMENT		*BASELINE CONCEPT*			*ALTERNATIVE CONCEPT*		
Description	**Unit**	**Qty**	**Cost/Unit**	**Total**	**Qty**	**Cost/Unit**	**Total**
2 Lanes Road Urban - Bayne to Lower Coach Atlantic Entrance	m	100	$ 4,400	$ 440,000	0	$ 4,400	$ -
2 Lanes Road Urban - Windsor to Africville 2+410 to 2+290	m	0	$ 4,400	$ -	120	$ 4,400	$ 528,000
2 Lanes Road Urban - Africville to Start of taper to single lane 2+290 to 2+200	m	0	$ 4,400	$ -	90	$ 4,400	$ 396,000
2 Lanes Road Urban - Forrester to Affricville	m	0	$ 4,400	$ -	140	$ 4,400	$ 616,000
3 Lanes Road Urban - Windsor to Africville 2+410 to 2+290	m	120	$ 4,700	$ 564,000	0	$ 4,700	$ -
2 Lane Urban Ramp - Africville to Start of taper to single lane 2+290 to 2+200	m	90	$ 4,500	$ 405,000	0	$ 4,500	$ -
Retaining Wall WB Approach to Fairview Bridge	m^2	1,953	$ 2,000	$ 3,906,000	230	$ 2,000	$ 460,000
Traffic Signals at: MacKintosh; Windsor; Africville	ea	3	$ 400,000	$ 1,200,000	2	$ 400,000	$ 800,000
Retaining Wall Removal - Retaining Wall WB Approach to Fairview Bridge	m	1,953	$ 1,000	$ 1,953,000	230	$ 1,000	$ 230,000
				$ -			$ -
SUB-TOTAL				$8,468,000			$3,030,000
PROJECT MARK-UPS	35%			$2,963,800			$1,060,500
TOTAL (Rounded)				$11,500,000			$4,100,000
						SAVINGS	**$7,400,000**

VE ALTERNATIVE AT-1

Provide basin-side AT connection to Africville Museum

Description of Baseline Concept:

The base case provides multi-use pathway (MUP) connections across the south side of the project area and does not connect to other planned facilities in the adjacent network. There is no connection for active transportation (walking/rolling and cycling) through the Windsor Street Exchange to connect to the Africville Museum to the north of the project area.

Description of Alternative Concept:

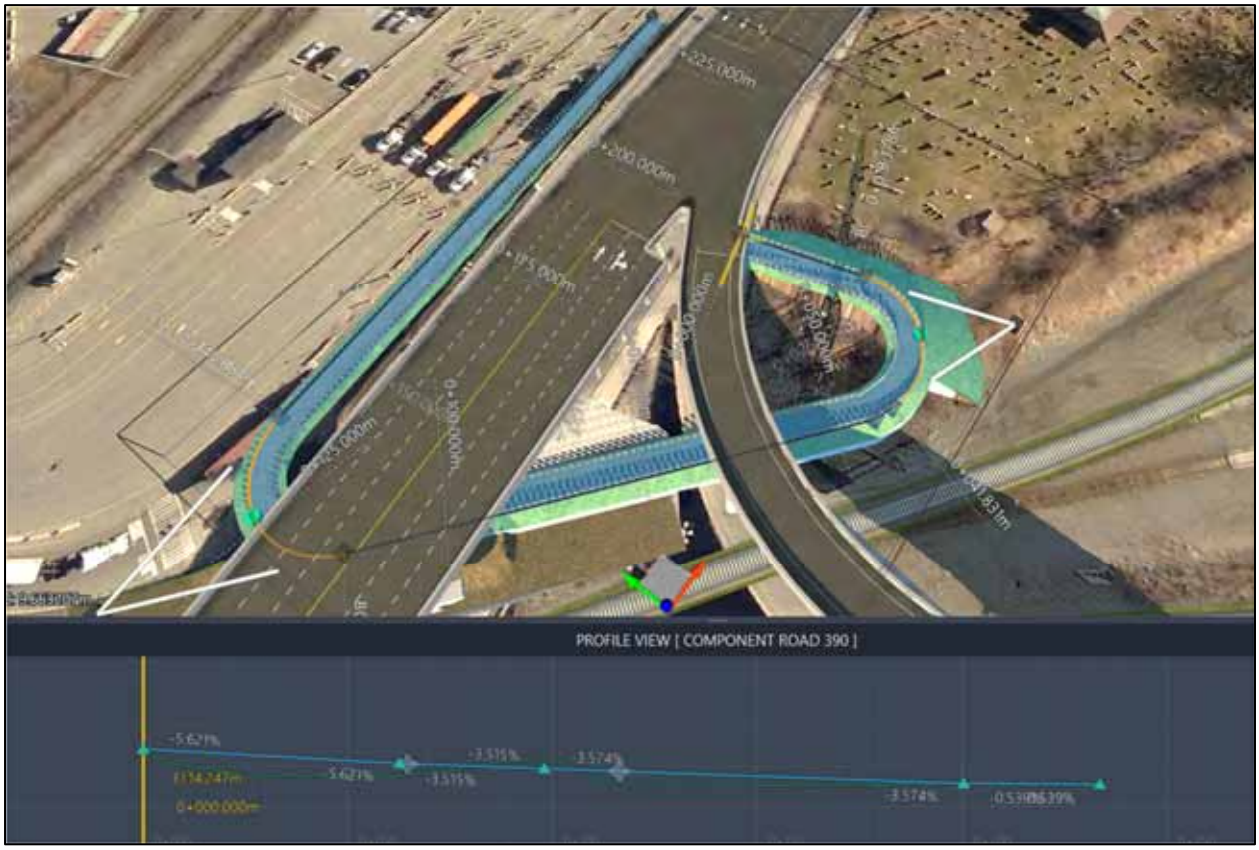
There are multiple potential routes to connect between the future MUP along the basin side of the Bedford Highway through the study area to make a connection to the east. The goal is the creation of a continuous safe walking/rolling and cycling connection that stretches from Bedford Highway to the south end of the Halifax Peninsula and connects to the larger walking/rolling and cycling networks.

The options can be summarized as follows:

- **Option A – Adjacent to Rail through FCCT –** This connection would begin as a continuation of the MUP on the basin side of the Bedford Highway and run adjacent to the CN rail corridor through the Fairview Cove Container Terminal (FCCT) to create the most direct connection to Africville Road. It would continue from there along the southeast side of Africville Road as a MUP to connect to the museum.
- **Option B – Adjacent to Roadway / Connect to Bayne Street –** This connection would begin on the basin side of the Bedford Highway and run directly adjacent to the roadway on the north side via use of the Fairview Overpass (utilizing an existing lane or via a new structure to the north). A MUP on the east side of the port access route between the marshalling yard and the Ambassatours land and right turn onto Africville Road.
- **Option C – Adjacent to Roadway / Connect to MacKintosh Street –** This variation would continue the MUP further east along the north side of the Bedford Highway/MacKay Bridge roadway to connect to a MUP on MacKintosh Street. A connection would be required to be created between MacKintosh Street and Africville Road either via a road connection or solely as continuation of the MUP.
- **Option D – Southern Alignment / Spiral to North Side –** This connection would begin as a continuation of the MUP on the south side of the Bedford Highway and proceed along the south side of the project area. After crossing the Fairview Overpass, the connection would spiral down to pass under the overpass and proceed north adjacent to the CN rail where it would connect to Option A and turn right to continue east.

VE ALTERNATIVE AT-1

Provide basin-side AT connection to Africville Museum



The discussion section examines the feasibility of Options A to D and addresses why Option D was chosen as the preferred alternative.

VE ALTERNATIVE AT-1

Provide basin-side AT connection to Africville Museum

Advantages:

- This approach would encroach on Port property in the current marshalling yard which is planned to be reconfigured anyway as part of the truck gate work.
- Uses the existing sidewalk on the Fairview Overpass.
- Connects to the MUP at the Bedford Highway project limits.
- Provides an option for a Fairview Overpass AT crossing.
- Could add a North-side AT facility to a future replacement structure when Fairview Overpass needs to be replaced

Disadvantages:

- Property acquisition required from the Port for all feasible options (B, C, D)
- Property Acquisition required from CN/ St. John's Anglican Church for loop (Option D).
- Basin-side connection may be redundant if an AT connection is possible on the south side of the project area along Bedford Highway to Lady Hammond and along MacKintosh Street.
- Interface with Truck traffic at grade (Option A).
- Addition of barriers to separate the MUP/traffic may take some space from the lanes on the Fairview Overpass.
- Requires moving a billboard south of the Joe Howe Ramp to allow for the loop (Option D).

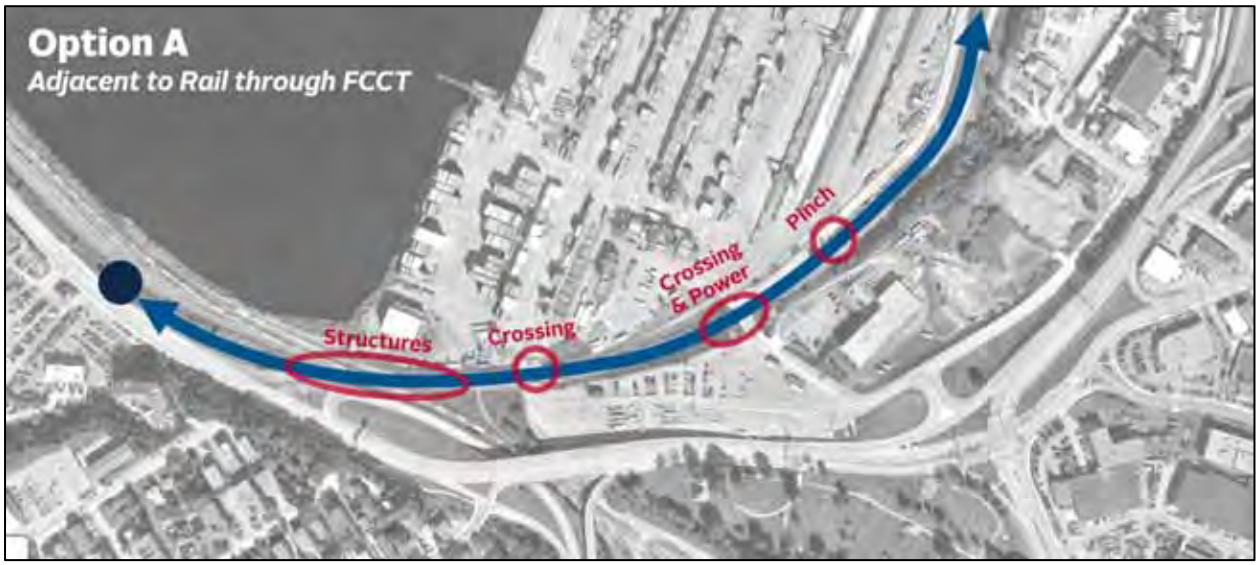
Discussion:

This section provides discussion of the various routing options for making safe walking/rolling and cycling connections through the project area. The discussion focuses on challenges that will largely be common to all proposed reconfigurations of road connections in the area. Note that there could be additional opportunities or challenges presented to active transportation connections dependent on the preferred roadway condition. The preferred roadway option will require detailed examination of the issues presented below and any new elements introduced to ensure that safe, continuous, and comfortable infrastructure can be provided for walking/rolling and cycling through the area.

VE ALTERNATIVE AT-1

Provide basin-side AT connection to Africville Museum

Option A – Adjacent to Rail through FCCT



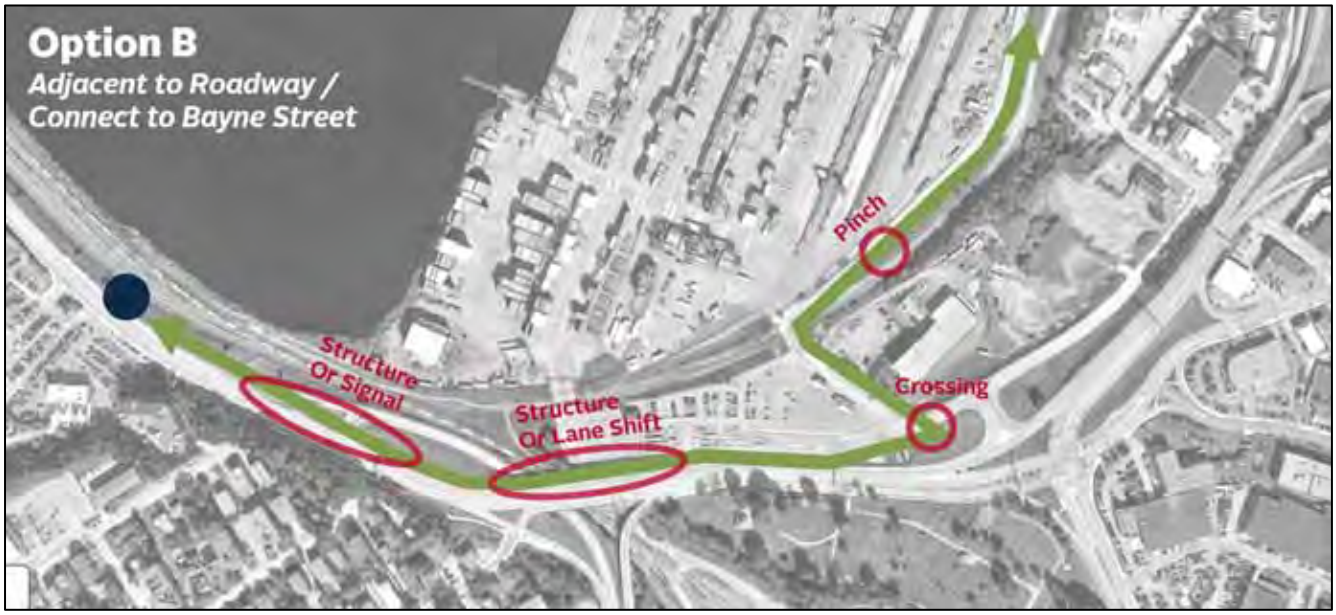
Option A provides conceptually the most direct connection between the Bedford Highway and Africville Road. However, this option is not feasible due to the crossings required along the port property. The following challenges were noted along the alignment:

- Users of the MUP would be required to make two at-grade crossings of active truck corridors on Port property (Truck gate and at Africville Road). Having an AT crossing at the truck gate would negatively impact port operations and introduces a significant safety concern for the AT users.
- To avoid the at-grade crossing at the truck gate, a long AT elevated structure would be required. The structure would need to ramp up from the Bedford Highway, cross over the CN rail tracks and ramp back down at the west side of Bayne Street. However, a power transmission tower occupies the space between the rail and employee parking at the Bayne Street crossing. MUP users would be required to pass directly under the structure, the MUP would need to be routed around the tower, or the structure would need to be relocated. The cost and complications of creating this structure through the area preclude this option from consideration.

- Along Africville Road to the north of Bayne Street there is a significant narrowing of the corridor due the placement of a power transmission tower base to the south and a utility cabinet, light pole, and rail line on the port property to the north. At this pinch point, the road width is approximately 9m. Widening and realigning the corridor to the north to avoid impacting the power transmission tower would impact port property and require the relocation of the light pole and a utility cabinet. The space required to add the MUP may not provide sufficient horizontal clearance to the rail line.

Due to the cost and complications related to constructing a structure through the area to remove dangerous crossing points for pedestrians and cyclists, this option is dismissed.

Option B – Adjacent to Roadway / Connect to Bayne Street



VE ALTERNATIVE AT-1

Provide basin-side AT connection to Africville Museum

Option B provides a connection directly adjacent to the Bedford Highway along its north side. The MUP would cross over the Fairview overpass, return the MUP to grade, and make a right turn to proceed along the east side of Bayne Street adjacent to the Ambassatours property. This option ***may be feasible***, but contains several challenging elements:

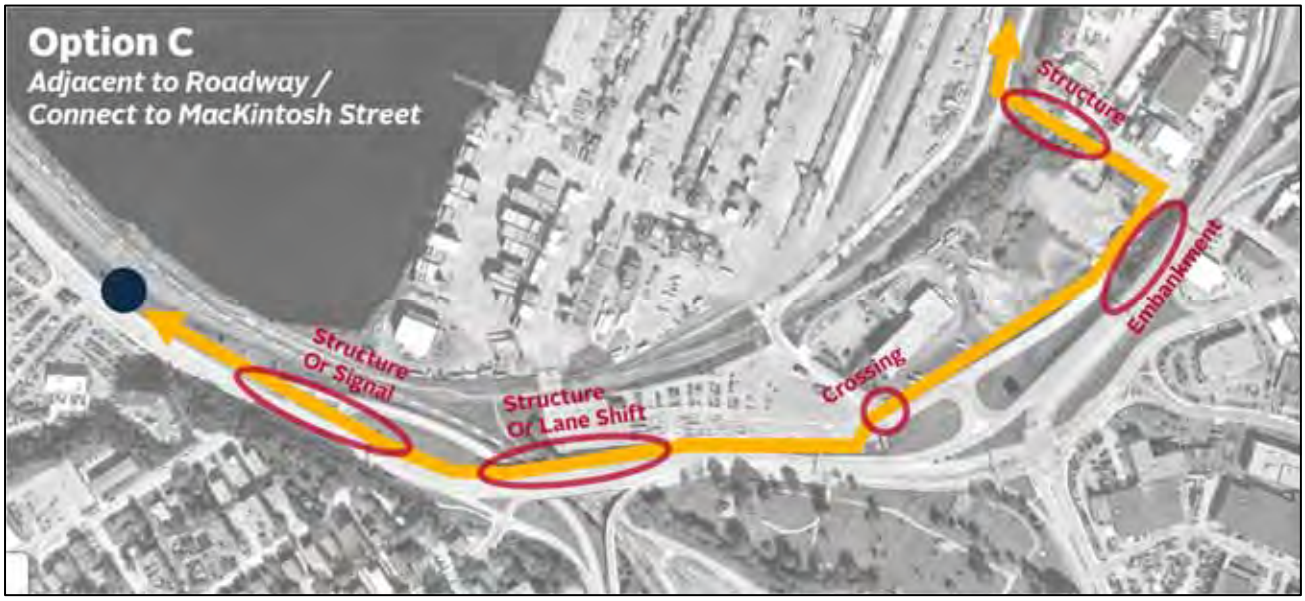
- On the western end of the connection, there would be a requirement to safely cross people walking/rolling and cycling over the two legs of the Joseph Howe ramp that intersect with the Bedford Highway. This will require one of two solutions:
    - Signalized crossing of the ramps. As this would be a significant change for traffic flow and would introduce a two potentially unsafe interruptions to the MUP, this option has been dismissed.
    - A pedestrian bridge crossing over the ramps is the preferred option. The path would begin to ramp up from Manor Drive and be supported by piers over the Joe Howe Exit/entrance ramps. This structure would be approximately 200 m long and 5 m wide to allow for combined use by cyclists in both directions as well as pedestrians. The grade of the ramps and bridge would be around 5 percent; therefore, a 6 m wide structure may be more user friendly as the grades are over 3 percent. The pathway would ramp down but remain supported on retaining walls on the approach to Fairview Overpass.
- There are two options for crossing the MUP over the Fairview Overpass:
    - Reassign space on the structure for the MUP along the North side. There is currently no sidewalk on the North side of the bridge. Therefore, the 3 m south side sidewalk would likely need to be removed to allow for this MUP. The current bridge barrier would need to be upgraded for pedestrian and cyclist use. In addition, a barrier to separate the MUP and traffic should be added for comfort and safety of the users on the MUP. The addition of this barrier would not impact the lane widths as long as the barrier is not wider than the existing North Barrier. Branching the MUP from the traffic after the bridge would be difficult as there is a large retaining wall that would need to be altered to provide a ramp through Port property down to Bayne Street. As one of the constraints is to avoid alterations to the Fairview Overpass, this option has been dismissed.
    - Construct a new active transportation structure to the north of the Fairview Overpass. Once across the rail corridor, the facility would ramp down to grade adjacent to the retaining wall. There is a possibility of combining this structure with the crossing needed by Halifax Water however their design options include many alternatives that cross underground.
- Where the MUP crosses Bayne Street, MUP users would need to cross at-grade through an area of significant truck activity (currently approximately 250 trucks access the Port a day, with a projected increase to 735 per day by 2050). Safe operation would require signalization.
- Similar to Option A, where the MUP joins Africville Road, there is a significant pinch point to the north of Bayne Street created by the power transmission tower, rail line, light pole, and utility cabinet. The widening of the road to include the MUP would need to address these challenges to provide an appropriate facility through this point.

VE ALTERNATIVE AT-1

Provide basin-side AT connection to Africville Museum

For this option to be feasible, the route includes a 775 m elevated AT pathway from Manor Drive to Bayne Street and a safe, at-grade crossing at Bayne Street. The cost of the structure would be approximately $20,000,000.

Option C – Adjacent to Roadway / Connect to MacKintosh Street



This option is a variation of Option B that depends on the outcome of Alternative 19 and Alternative 6. Instead of turning to connect at Bayne Street, the MUP would extend from the Bedford Highway between Bayne Street and Bedford Highway to turn at MacKintosh Street to connect to Africville Road. This option ***may be feasible***, but contains several challenges:

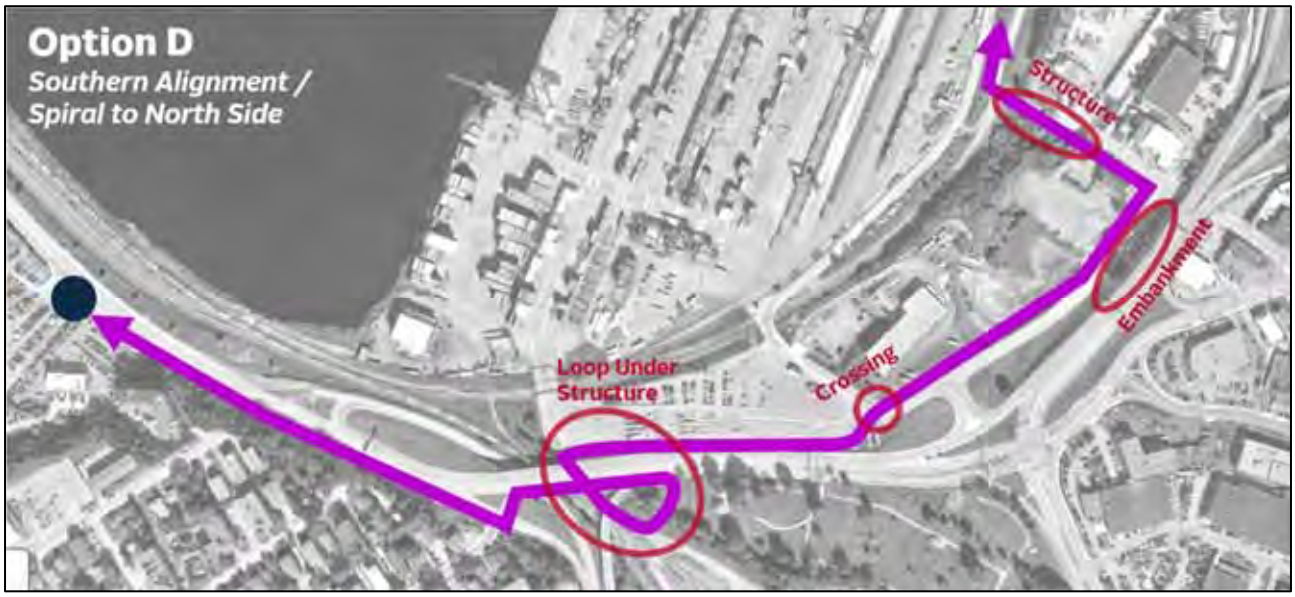
- Common to Option B
  - Safe crossing of Joseph Howe ramps
  - Reassignment of space on the Fairview Overpass OR construction of a new active transportation structure
  - Safe Crossing at Bayne Street.
- Pedestrians and cyclists will be required to cross the roadway between the port marshalling yard and the Ambassatours property at a signalized intersection, which will need to be considered in the intersection design and signal phasing.
- At the northwestern end of MacKintosh Street, a new connection to Africville Road would be required. There is an approximate 10m elevation change between MacKintosh Street and Africville Road which results in a road at approximately 9 percent grade. The connection could take two forms:
  - A full roadway connection with MUP (See Alternative AR-1 – Extending MacKintosh Street to Africville Road). As part of this alternative, the public CN crossing on Africville Road along the route in Option B may be abandoned. This

means that Option B would no longer be available, and would be replaced by Option C.

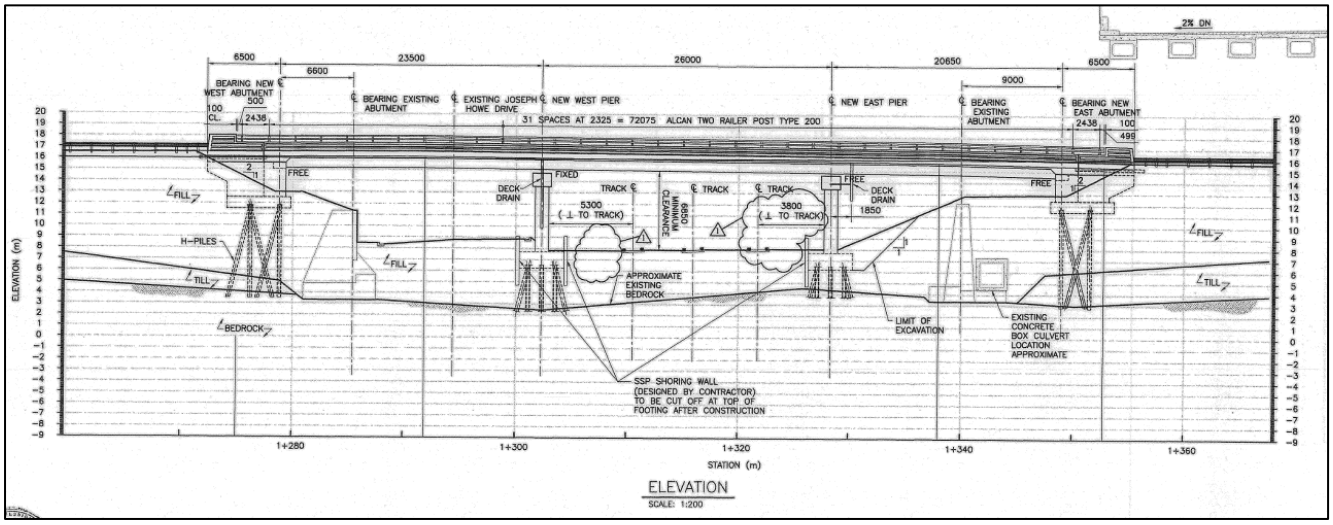
- An active transportation-only connection. However, this option may not be feasible as CN would be required to have two public crossings in close proximity.

As in Option B, for this option to be feasible, the route includes a 775 m elevated AT pathway from Manor Drive to Bayne Street and a safe, at-grade crossing at Bayne Street. The cost of the structure would be approximately $20,000,000.

Option D: Southern Alignment / Loop to North Side



Option D is a variation on the 775 m AT structure required in Options B and C. At the west end, this option ties into the Bedford Highway MUP on the south side of the Bedford Highway and proceeds east across the south side of the Fairview Overpass. Once across the Joseph Howe northbound to eastbound ramp, the MUP would spiral down the grade to proceed underneath the Fairview Overpass. There is an open bay that would require excavation to provide space for the MUP and separation between MUP users and rail traffic, as shown in the cross section below:



Once on the north side of the overpass, it would turn right to proceed to the east at-grade adjacent to the existing retaining wall. From this point it would be identical to Option B or C. This option ***may be feasible***, but presents challenges:

- The spiral movement to move up and down between the structure and the rail line would provide a condition very similar to the existing condition on the Macdonald Bridge

bikeway with steep grades and a tight radius that will make the movement challenging for many users.

- The elevation change from top of structure to the rail line is approximately 5m. Given an approximate distance of 70m to create a feasible facility connecting the two elevations, the grade of the facility would be approximately 8 percent, which is the maximum desirable grade for an active transportation facility. Further design and consideration of adjacent property concerns will be required to confirm the alignment and resulting grades.
- The ramp would be located on property currently owned by CN Rail and St. John's Anglican Church, which may preclude or prolong acquisition of adequate space to provide the connection.
- Construction of the spiral movement and beneath the Fairview Overpass would be in close proximity to the CN Rail, requiring coordination with CN and use of flaggers. This could introduce significant additional costs and delays to construction.

Preferred Alternative:

Option B and C are similar and depend on the connection to Africville Road chosen for the overall project. The major disadvantage of these options is the cost to build the 775 m elevated structure. Therefore, if the land acquisition is feasible, Option D is preferred.

Schedule Discussion:

Could be done as an independent project

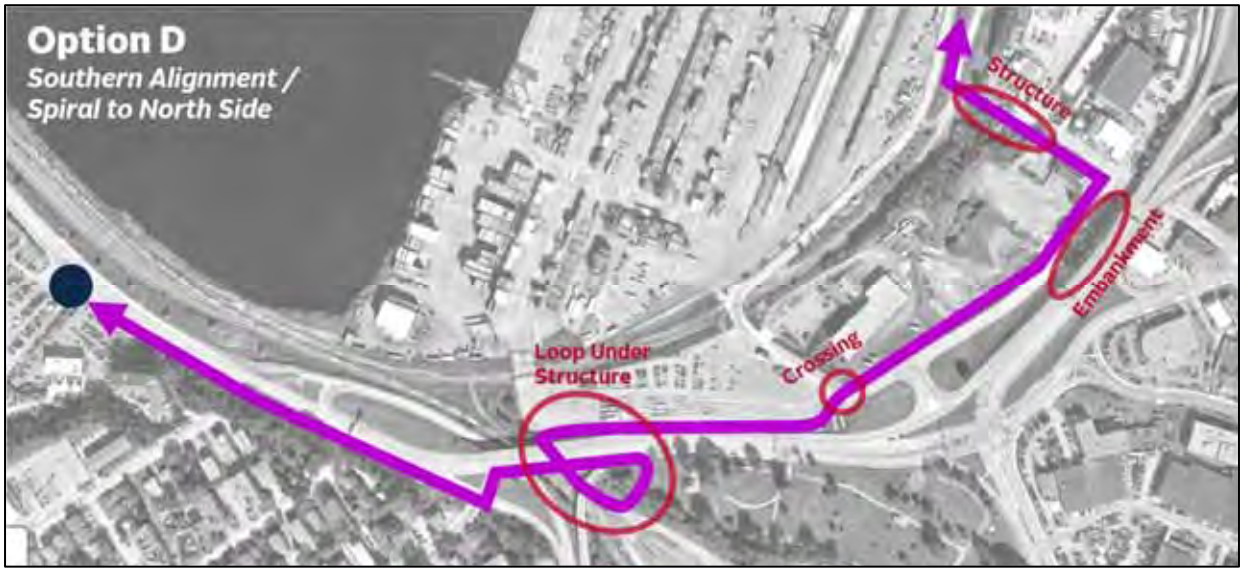
Risk Discussion:

Property is a risk. Public perception of the loop.

VE ALTERNATIVE AT-1

Provide basin-side AT connection to Africville Museum

VE Alternative Concept Sketch



Performance Assessment

Performance Attribute		Rationale for Change in Performance
Mainline Traffic Operations	Transit	No Impact
	Port	At grade AT crossing at Bayne will interface with truck traffic.
	General Purpose	No Impact
Local Traffic Operations		No Impact
Maintainability		Adds new MUP, retaining wall, fencing, and handrail.
Temporary Construction Impacts		No Impact – could be completed at a later date.
Environmental Impacts		Additional tree removal to provide ramp.
ROW/Footprint Impacts		Will require AT path on current port property. Requires property acquisition from St. John's cemetery and CN, as well as removal of up to two billboards.
Active Transportation		Create a continuous connection for walking/rolling and cycling through the Windsor Street Exchange that connects from Bedford Highway to the Africville Museum and further active transportation facilities.

VE ALTERNATIVE AT-1

Provide basin-side AT connection to Africville Museum

Assumptions and Calculations:

Initial Cost Estimate

CONSTRUCTION ELEMENT		*BASELINE CONCEPT*			*ALTERNATIVE CONCEPT*		
Description	**Unit**	**Qty**	**Cost/Unit**	**Total**	**Qty**	**Cost/Unit**	**Total**
Sidewalk (m2) - MacKintosh to Windsor 2+658 to 2+410	m^2	372	$ 150	$ 55,800	0	$ 150	$ -
Sidewalk (m2) - Windsor to Africville 2+410 to 2+290	m^2	180	$ 150	$ 27,000	0	$ 150	$ -
Sidewalk (m2) - Bayne to Lower Caoch Atlantic Entrance	m^2	150	$ 150	$ 22,500	0	$ 150	$ -
Borrow - MUP Fill for Loop	m	0		$ -	2,900	$ 40	$ 116,000
MUP (m2) - 3.5m Wide MUP (1km)	m^2	0		$ -	3,500	$ 63	$ 220,500
Retaining Wall along Loop	m^2	0		$ -	450	$ 2,000	$ 900,000
				$ -			$ -
SUB-TOTAL				$105,300			$1,236,500
PROJECT MARK-UPS	60%			$63,180			$741,900
TOTAL (Rounded)				$200,000			$2,000,000
						ADDED COST	**($1,800,000)**

VE ALTERNATIVE AT-2

Provide an AT connection to Bedford Highway on the south side

Description of Baseline Concept:

- A multi-use pathway is proposed on the south side between the Joseph Howe Drive on-ramp and the Windsor Street intersection
- It is assumed that the multi-use pathway is shown at the minimum width of 3.0 m from the red book. The recommended width in the red book is 3.5 m
- It is assumed that the multi-use pathway is separated from the curb by a boulevard space. The typical boulevard width in HRM is 1.5 m
- The property line of the cemetery creates a physical constraint to the south

Additional Context

- Project limits and relationship to Bedford Highway Functional Study (dated July 2022)
    - The western project limit for the base case is the eastern limit of the Fairview overpass
    - The results of the Bedford Highway Functional Study were available at the time of the base case (Bedford Highway Functional Plan was complete before WSE started)
    - The project limit of the Bedford Highway Functional Study originally included the Windsor Street Exchange. When the Windsor Street Exchange project was approved in 2019, the limit of the Bedford Highway Functional Study was changed to the Fairview Overpass. When the Bedford Highway study moved to Preliminary Design, it was determined that coordination between the 2 projects would occur at the Fairview Overpass. Given the timing of both designs, HRM directed both consultants to design to the Fairview Overpass with design coordination to occur at a future date. The Preliminary Design including high level information between Manor Drive and east of the Joseph Howe Drive on-ramp was provided to the VE team.
    - In the Bedford Highway Functional Study a multi-use pathway is shown on the south side of the road connecting down the Joseph Howe Drive off-ramp to the intersection with Dutch Village Road.
        - In the study, a crossing is included on the east side of the Main Avenue intersection with a multi-use pathway on the Main Avenue ramp (east side) and on the Fairview Overpass heading east to the Joseph Howe Drive on-ramp
- The Fairview Overpass is a bridge that is cost-shared between HRM and the Province
    - The current concrete sidewalk is:
        - 3.0 m wide from face of curb to the existing railing (1.45 m high, including barrier and railing according to bridge drawing) on the Fairview Overpass
        - 2.2 m wide from face of curb to the existing railing on the Joseph Howe Drive on-ramp (DV-K Ramp)
            - Note: it is assumed that the railing height is similar to that on the Fairview Overpass (in the range of 1.45 m high)
    - Modifications are limited to asphalt surface and above
    - Addition of signals was in the base case and is assumed to be acceptable in the alternatives
    - It is assumed that it is acceptable to modify existing sidewalk to a multi-use pathway.

        - Note: any changes and additional loading would need to be approved by the Province. Modifying the existing railing (if required) would be considered a major structural change
        - Note: It is assumed that HRM would be the approval authority for any new crossing treatment for the Joseph Howe Drive on-ramp

Description of Alternative Concept:

- Addition of multi-use pathways to base case as follows:
    - South side of Joseph Howe Drive off-ramp (FVO-B-JH Ramp) connecting to the intersection of Dutch Village Road
    - Multi-use pathway on the east side of Main Avenue on-ramp and on south side of Fairview Overpass
    - Multi-use pathway on the east side of the Joseph Howe Drive on-ramp between the Dutch Village intersection and the Fairview Overpass
        - The addition of this facility is possible should changes to the Joseph Howe Drive on-ramp be undertaken (Alternative BC-3)
- The minimum width for a multi-use pathway in the red book is 3.0 m. The recommended width is 3.5 m.
    - Note: In TAC, the practical lower limit for a shared multi-use pathway is 2.7 m. The recommended lower limit is 3.0 m with a recommended upper limit of 6.0 m (also the practical upper limit)
- The minimum boulevard width between the curb and the multi-use pathway is 1.0 m in the red book
    - Note: with higher speed roadways some municipalities are adding vertical element between curb and facility in addition to the curb
- It is assumed that the existing railings on Fairview Overpass and on Joseph Howe Drive on-ramp would not need to be modified to accommodate cyclists on a multi-use pathway as the existing railing height is sufficient
    - Standard: Where used adjacent to cycling and multi-use facilities, fences, railing and barriers should be a minimum height of 1.37 m to prevent people riding bikes from falling over the railing
        - Note: Where a designated bike route is identified on a bridge or culvert, a minimum 1.37 m high barrier fence or parapet wall / railing combination should be provided on the outside of the bridge, consistent with the Canadian Highway Bridge Design Codev(CAN/CSA-S6-06). Various types of railing can be used such as metal or concrete post and rails, concrete safety shapes or combination of metal and concrete
- Crossing treatments
    - Crossing treatment for multi-use pathway across Joseph Howe Drive on-ramp connecting to multi-use pathway on the east side of the on-ramp
        - Note: the representative crossing treatment in the graphic to be modified should this option be selected
    - Intersection crossing for the multi-use pathway on the east side of the intersection of Main Avenue and the Joseph Howe Drive off-ramp
        - The pavement markings are based on recent installation of intersection treatments for multi-use pathways at a signalized intersection in HRM
        - Note: this signalized intersection will also need to accommodate transit movements as well as motor vehicles (which are currently not permitted on Main Avenue accessing the Fairview Overpass)

VE ALTERNATIVE AT-2

Provide an AT connection to Bedford Highway on the south side

Advantages:

- Continuous AT connection from Bedford Highway to the Windsor Street intersection
- Connection between the Chain of Lakes Trail (currently ending near Dutch Village intersection) and: (1) Bedford Highway; and (2) Windsor Street intersection

Disadvantages:

- The approval and design challenges associated with the cost-sharing arrangement between HRM and the province for the Fairview Overpass
- Spatial limitations associated with the Fairview Overpass limits the option to a multi-use pathway with constrained widths for additional separation treatments (as compared with separate two-way bikeway and sidewalk space)
- The design requires the uncontrolled crossing of the multi-use pathway at the Joseph Howe Drive on-ramp

Discussion:

- The focus is AT connectivity between the Bedford Highway and the Windsor Street intersection. On this basis, the multi-use pathway in the following sections is of primary importance:
    - Joseph Howe Drive off-ramp between Bedford Highway and Main Avenue
    - Main Avenue between Joseph Howe Drive off-ramp and the Fairview Overpass
    - The base case section (east of the Joseph Howe Drive on-ramp)
- The section of secondary importance would be the multi-use pathway between the Joseph Howe Drive off-ramp and the Dutch Village intersection
    - Note: the existing multi-use pathway south of the Dutch Village intersection is on the west side
- The third section is the multi-use pathway on the Joseph Howe Drive on-ramp
- The configuration of the general-purpose lanes on the Fairview Overpass has an impact on the design of the multi-use pathway in this section (i.e., need for a vertical element beyond that of a curb as a buffer between the curb lane and the multi-use pathway)
- The design of the crossing of the proposed multi-use pathway at Main Avenue and the short segment on the east side of Main Avenue would be impacted by any design changes to the Joseph Howe Drive on and off-ramps
- The Bedford Highway Functional Study includes a stated preference for a multi-use pathway on the basin side of the Bedford Highway. The discussion of options on the south side is independent based on the need to connect to the Chain of Lakes trail system (near the Dutch Village intersection)

Schedule Discussion:

Any changes and additional loading would need to be approved by the province.

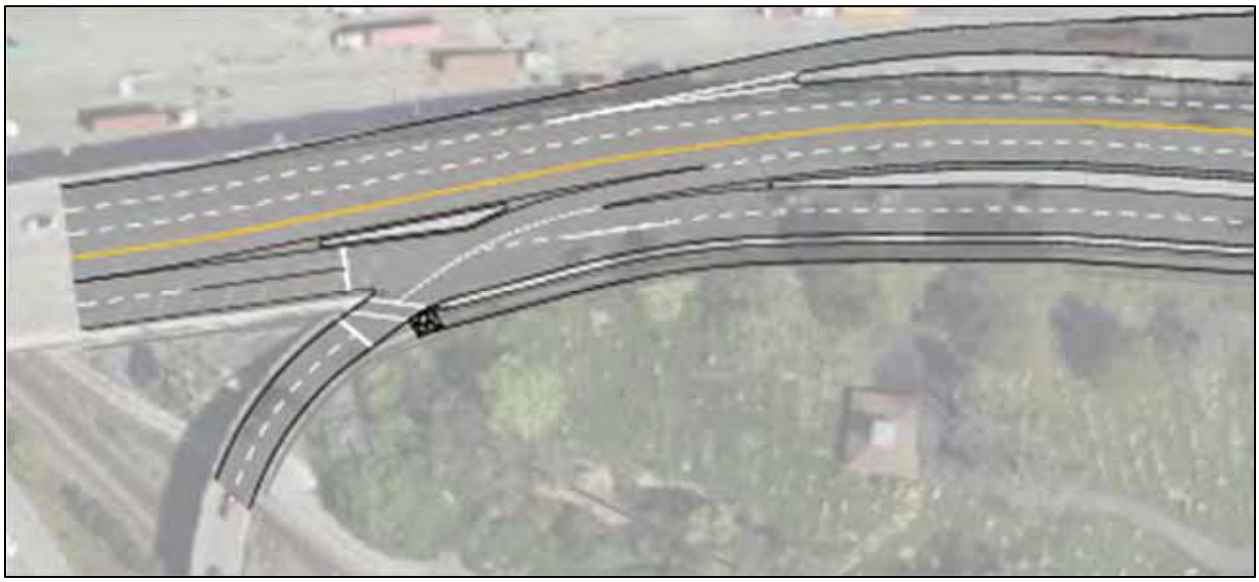
Risk Discussion:

Any changes and additional loading would need to be approved by the province.

VE ALTERNATIVE AT-2

Provide an AT connection to Bedford Highway on the south side

Baseline Concept Sketch



VE Alternative Concept Sketch

Shading Legend: Blue – new MUP to replace SW from Bedford Highway study; Green – new MUP on Main Avenue Ramp (different than existing sidewalk as part of Alternative BC-3); Orange – replacing existing sidewalk with MUP on Fairview crossing; Thin Green – new MUP in place of sidewalk on JW on-ramp; Yellow – base case MUP

VE ALTERNATIVE AT-2

Provide an AT connection to Bedford Highway on the south side

Performance Assessment

Performance Attribute		Rationale for Change in Performance
Mainline Traffic Operations	Transit	Change required to Main Avenue access to Fairview Overpass
	Port	No change
	General Purpose	No significant change from baseline – Alternative BC-3 changes the lane configurations on Fairview Overpass
Local Traffic Operations		Change to configuration of Joseph Howe Drive on and off-ramps as well as Main Avenue intersection
Maintainability		Increased infrastructure
Temporary Construction Impacts		Changes to configuration would have temporary access implications
Environmental Impacts		No change
ROW/Footprint Impacts		Introduction of multi-use pathway on south side of Joseph House Drive off-ramp connecting to Dutch Village intersection would impact private property frontages. This has been accounted for in by the Bedford Highway project team.
Active Transportation		Improved AT connectivity and operations

Assumptions and Calculations:

- It is assumed that the cost estimate for the base case includes 3.0 m multi-use pathways. On this basis, the same width is used in the cost estimate for the alternatives
- New multi-use pathway on south side of Joseph Howe off-ramp
    - Includes stubs on both sides at 160 m of new MUP in location of existing sidewalk
        - Note: assuming implementation of Bedford Highway Functional Study would include the extension of the multi-use pathway to Manor Street and to the Dutch Village intersection
- Intersection improvements to Main Avenue includes a multi-use pathway crossing on two legs
    - Note: already signalized and other changes associated with other alternatives
- Converting existing sidewalk on Main Avenue on-ramp and on Fairview crossing to multi-use pathway
    - Approximately 20 m on the east side of the Main Avenue on-ramp
        - Note: in sketch the new multi-use pathway associated with the Main Avenue on-ramp is not in the same position of the existing sidewalk. This is to reflect another alternative associated with the roadway. If that option does not proceed then the new multi-pathway could potentially be in the same position as the existing sidewalk
    - Approximately 105 m on the Fairview Overpass
- Crossing treatment at the Joseph Howe Drive on-ramp (not signalized)
- Cost Estimate does not include the proposed multi-use pathway on the east side of the Joseph Howe Drive on-ramp (connecting to the Dutch Village intersection)

VE ALTERNATIVE AT-2

Provide an AT connection to Bedford Highway on the south side

Initial Cost Estimate

CONSTRUCTION ELEMENT		*BASELINE CONCEPT*			*ALTERNATIVE CONCEPT*		
Description	**Unit**	**Qty**	**Cost/Unit**	**Total**	**Qty**	**Cost/Unit**	**Total**
MUP (m2) - 3.5m Wide MUP across Fairview Bridge (105m)	m^2	0	$ 63	$ -	368	$ 63	$ 23,184
				$ -			$ -
SUB-TOTAL				$0			$23,184
PROJECT MARK-UPS	36%			$0			$8,346
TOTAL (Rounded)				$0			$32,000
						ADDED COST	**($32,000)**

VE ALTERNATIVE AT-3

Provide AT connection to Devonshire Avenue along Lady Hammond Road and connect to Africville Museum

Description of Baseline Concept: The baseline concept does not provide a similar connection, as this lies outside of the project area. Within the project area, there is a MUP that terminates at the project's eastern edge on the western side of the existing Lady Hammond Road and MacKintosh Street intersection.

Description of Alternative Concept: This alternative concept would extend the cycling facility east from the project area along Lady Hammond Road and Duffus Street to connect to existing and planned cycling infrastructure along Isleville Street and Devonshire Avenue. This would provide access to/from the north to the Africville Museum and MUP as an alternate route with a basin-side AT solution. This will require planning and design work for HRM staff outside of this project.

There are also additional opportunities to connect to existing and planned cycling facilities in the area that are not currently planned to connect through the Windsor Street Exchange area that would provide significant additional value to the project and the regional safe cycling network, as below:

- Connection to the north from Lady Hammond Road over Massachusetts Avenue via the use of an abandoned rail bridge
- Extension of existing bike lanes on Windsor Street to connect to the MUP in the project area
- Extension of existing MUP on Joseph Howe Drive to connect to the MUP in the project area

Advantages:

- Connects the active transportation facilities for the project to the regional network to provide continuous safe connections for walking/rolling and cycling
- Improves the value of the active transportation facilities in the project area

Disadvantages:

- None noted

Discussion: From an active transportation network planning perspective, provision of an improved east-west connection through the Windsor Street Exchange for walking/rolling and cycling points to significant advantages to continuing that east-west connection along Lady Hammond Road and Duffus Street to connect to existing and planned cycling facilities along Isleville Street and Devonshire Avenue, as shown in the graphic on the following page.

Making this connection would significantly increase the value of the MUP through the study area by creating a safe, continuous connection between Bedford Highway and the south end of the Halifax Peninsula. The connection to the Isleville Local Street Bike Lane would also provide access to the north to the future Africville Road MUP, as an alternate route to a potential basin-side AT solution.

For cyclists destined to/from points south on the Halifax Peninsula, extending safe cycling facilities along Lady Hammond Road and Duffus Street to connect to Devonshire Avenue would provide a direct route to connect with north-south facilities on Isleville Street and Barrington Street. A potential basin-side solution that connects to the northern portion of the Africville Road

VE ALTERNATIVE AT-3

Provide AT connection to Devonshire Avenue along Lady Hammond Road and connect to Africville Museum

MUP would provide similar access via a more circuitous route, but with less challenging grades (dependent on the feasibility and design of the connection).

Connections to existing facilities on Windsor Street and Joseph Howe Drive will also serve to amplify the value of the MUP through the project area by closing short gaps in the cycling network. Completion of these connections would provide safe connections to/from the Regional Centre All Ages and Abilities (AAA) cycling network, as well as significant residential and commercial uses along Joseph Howe Drive and a connection to the Chain of Lakes Trail to provide regional safe cycling access.

There is also an opportunity to create a new connection across Massachusetts Avenue to provide additional north-south access using an abandoned rail bridge and corridor, as highlighted in the graphic on the following page. This would connect to the existing Memorial Drive Trail – a short informal trail that connects to the adjacent homes. This would provide north-south walking/rolling and cycling access for residents in the area to Lady Hammond Road across a significant barrier. Inspection of the structure will be required to determine its state of repair and longevity before this could be undertaken. HRM staff have programmed the inspection for spring of 2024.

VE ALTERNATIVE AT-3

Provide AT connection to Devonshire Avenue along Lady Hammond Road and connect to Africville Museum

Functional planning will be required for the proposed connections to determine the appropriate facility type, crossings, etc. as a MUP is not a preferred facility type. Separate infrastructure for walking/rolling and cycling is preferred wherever possible. However, the existing and planned facilities may guide the most likely facility type selection:

- Lady Hammond Road
  - The MUP begins/terminates at the eastern end of the project area as a MUP along the south side of Lady Hammond Road. To the east of the project area, it may be possible to provide separated walking/rolling and cycling infrastructure dependent on roadway width. The connection would be approximately 1.1km to Devonshire Avenue.
- Joseph Howe Drive
  - There is a MUP along the west side of the corridor that currently terminates at Dutch Village Road approximately 340m to the south. Continuing the MUP connection from the project area to complete this connection would be the most logical option.
  - There will also be value in providing a MUP on the east side of Joseph Howe Drive, at a minimum from Dutch Village Road, to connect to the project area to the north via the DVK Ramp. There is currently a sidewalk on the east side of the ramp. This will provide options for pedestrians and cyclists moving between the project area and Joseph Howe Drive and allow them to avoid crossing the Fairview overpass depending on their destination. This MUP connection would be approximately 300m.
- Windsor Street
  - The current painted bike lanes on Windsor Street will soon be reconstructed as a unidirectional curb-protected facility that begins/terminates on the south side of the intersection with Connaught Street. The connection to the Windsor Street Exchange MUP could alternately be made via extension of the unidirectional

cycling facilities or a transition to a MUP on one side of the street to match the facility type in the interchange. This connection will be approximately 350m.
    - The baseline condition does not provide an extension of cycling facilities along Windsor Street. There will be some advantage to the project and the municipality to consider this extension in the design exercise to ensure that adequate space will be available to complete the connection in the future.
- Rail Structure / Memorial Drive Trail
    - Formalisation of the connection across the abandoned rail structure would create a trail connection that would take the form of a MUP. This connection would be approximately 600m.

Schedule Discussion:

The connections discussed in this alternative lie outside of the project area so will not impact the project schedule.

HRM staff will need to program the necessary projects to complete the connections. Coordination of reconstruction of the Windsor Street Exchange with completion of these connections to minimize the time between completion of both will provide the most immediate value to residents.

Risk Discussion:

There is no direct project risk related to this alternative.

If these connections are not completed in the future, there is some risk to the municipality that its goals for mode shift to sustainable modes (walking/rolling, cycling, transit) will not be achieved, GHG reduction targets are not met, and other considerations.

Baseline Concept Sketch

VE ALTERNATIVE AT-3

Provide AT connection to Devonshire Avenue along Lady Hammond Road and connect to Africville Museum

VE Alternative Concept Sketch

Performance Assessment

Performance Attribute		Rationale for Change in Performance
Mainline Traffic Operations	Transit	No change from baseline.
	Port	No change from baseline.
	General Purpose	No change from baseline.
Local Traffic Operations		No change from baseline.
Maintainability		No change from baseline.
Temporary Construction Impacts		No change from baseline.
Environmental Impacts		No change from baseline.
ROW/Footprint Impacts		No change from baseline.
Active Transportation		Maximize value of active transportation facilities in the project area by completing network gaps

VE ALTERNATIVE AT-4

Convert sidewalks into multi-use pathways (MUPs)

Description of Baseline Concept:

- New sidewalk is proposed in the following locations: (1) both sides of Windsor Street south of the Windsor intersection; (2) west side of Windsor Street north of the Windsor intersection; (3) east side of MacKintosh Street between Bayne Street to the north and Lady Hammond Road to the south, continuing along the north side of Lady Hammond Road; (4) the north side of Bayne Street between MacKintosh Street and Africville Road
- It is assumed that the sidewalk is shown at the recommended width of 1.8 m from the red book; the minimum width is 1.5 m
- The current intersection treatment is a typical crosswalk

Description of Alternative Concept:

- Include a multi-use pathway in the following locations (where sidewalk is shown in the base case)
    - On the west side of Windsor Street between Bayne Street and the Windsor Street intersection
    - On the north side of Bayne Street
    - On the west side of Windsor Street south of the Windsor Street intersection
- The intersection treatments in those locations would be changed to strip and signals appropriate for a multi-use pathway crossing
- New section of multi-use pathway on the south side of Lady Hammond Road east of the MacKintosh Street /Lady Hammond Road intersection (refer to other alternatives for additional information)

Advantages:

- Improved AT connectivity and operation for both cyclists and pedestrians north of the Windsor Street intersection
    - Provides redundancy in the network for options travelling north
    - May provide an alternative for an AT connection for both pedestrians and cyclists on MacKintosh Street
    - With the number of potential lanes on Bayne Street there is an opportunity offer an option for cyclists through the inclusion of a multi-use pathway separated from general traffic
- Improved AT connectivity and operation for both cyclists and pedestrians south of the Windsor Street intersection
    - With the volume and speed of the roadway, a separated facility would provide an improved alternative to painted bike lanes on Windsor Street south of the intersection
- Improved AT connectivity and operation for both cyclists and pedestrians east of Lady Hammond Road
    - A new section of multi-use pathway on the south side of Lady Hammond Road east of the MacKintosh Street /Lady Hammond Road intersection would provide options for connectivity to the bikeway network to the downtown (i.e., Agricola)
        - A benefit would also include moving through the T-intersection without having to cross vehicle traffic on the other legs of the intersection

VE ALTERNATIVE AT-4

Convert sidewalks into multi-use pathways (MUPs)

Disadvantages:

- A sidewalk has a width of 1.5-1.8 m. A multi-use pathway would require a minimum width of 3.0 m according to the red book (recommended width of 3.5 m) plus the boulevard width between the pathway and the curb
- Potential for conflict between pedestrian and cyclists in a shared space
- More complex intersection crossing treatment for a multi-use pathway as compared with a sidewalk

Discussion:

- With the potential demands for multiple modes through MacKintosh Street additional options for connectivity are important
- A multi-use pathway in the location of the proposed sidewalk between the Windsor Street intersection and the Windsor/Bayne intersection would require a separate phase for the multi-use pathway crossing at this intersection because of the dual left (depending on the configurations in the various alternatives)
- Refer to the alternative discussion specific to providing a two-way bikeway adjacent to a sidewalk

Schedule Discussion:

No impact to schedule.

Risk Discussion:

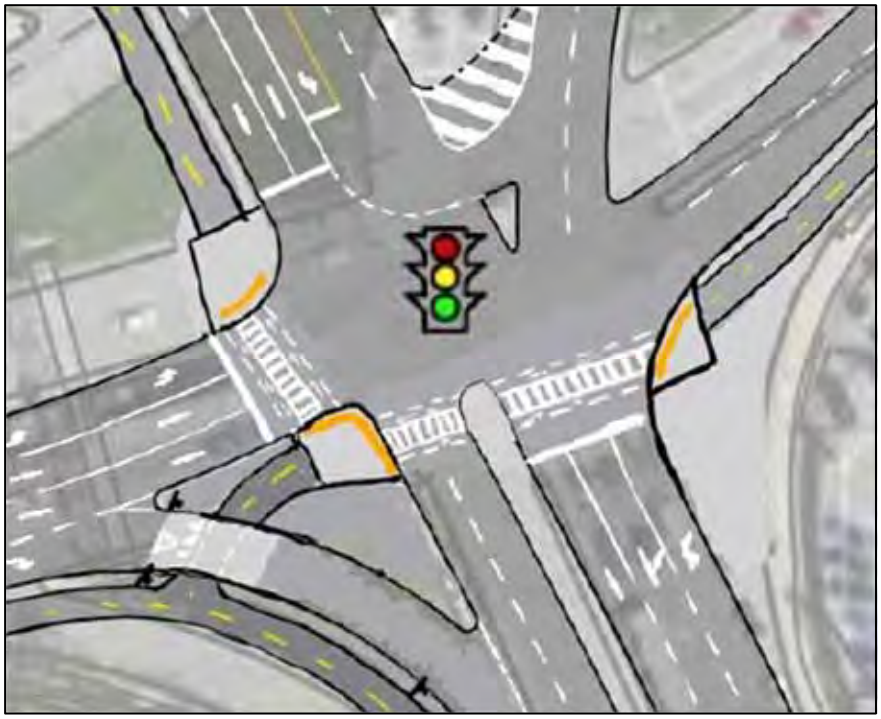
No specific risk assuming no significant change to ROW requirements.

Baseline Concept Sketch

VE ALTERNATIVE AT-4

Convert sidewalks into multi-use pathways (MUPs)

VE Alternative Concept Sketches



Example showing multi-use pathway in place of new sidewalk on west side of Windsor Street

Example sketch of new multi-use pathway on south side of Lady Hammond Road heading in both directions from MacKintosh Street/Lady Hammond Road intersection

VE ALTERNATIVE AT-4

Convert sidewalks into multi-use pathways (MUPs)

Performance Assessment

Performance Attribute		Rationale for Change in Performance
Mainline Traffic Operations	Transit	No specific impact compared to baseline.
	Port	No specific impact compared to baseline.
	General Purpose	No specific impact compared to baseline.
Local Traffic Operations		No specific impact compared to baseline.
Maintainability		Different type of infrastructure (asphalt pathway in place of concrete sidewalk) but minimal change.
Temporary Construction Impacts		No specific impact compared to baseline.
Environmental Impacts		No specific impact compared to baseline.
ROW/Footprint Impacts		Space requirements for multi-use pathway is greater than sidewalks but impact to ROW depends on alternative.
Active Transportation		Improved connectivity for all AT users.

Assumptions and Calculations:

The following are the lengths where the new sidewalk in the base case would be changed to a multi-use pathway:

- Windsor Street south of intersection on west side: 100 m
- Windsor Street north of intersection on north side: 100 m
- Bayne Street from MacKintosh Street to Africville Road (including bend): 465 m

Note: The estimate does not include any associated changes to signals and physical infrastructure at intersections should a multi-use pathway be included (i.e., Windsor/Bayne)

It is assumed that new multi-use pathway in the cost estimate for the base case is 3.0 m wide. On this basis, the same width is used in the cost estimate for the alternatives.

The length of new multi-use pathway on Lady Hammond Road between the MacKintosh Street /Lady Hammond Road intersection and the Commission Street/Lady Hammond Road intersection is approximately 120m.

- The intersection at Commission Street is also signalized (and changes to the intersection are not included in the cost estimate)

VE ALTERNATIVE AT-4

Convert sidewalks into multi-use pathways (MUPs)

Initial Cost Estimate

CONSTRUCTION ELEMENT		*BASELINE CONCEPT*			*ALTERNATIVE CONCEPT*		
Description	**Unit**	**Qty**	**Cost/Unit**	**Total**	**Qty**	**Cost/Unit**	**Total**
Sidewalk (m2) - MacKintosh to Windsor 2+658 to 2+410	m^2	372	$ 150	$ 55,800	868	$ 63	$ 54,684
Sidewalk (m2) - Windsor to Africville 2+410 to 2+290	m^2	180	$ 150	$ 27,000	420	$ 63	$ 26,460
Sidewalk (m2) - Strawberry Hill to Start of Turn Lanes 3+000 to 3+060	m^2	90	$ 150	$ 13,500	210	$ 63	$ 13,230
Sidewalk (m2) - Start of Turn Lanes to Lady Hammond 3+060 to 3+120	m	90	$ 150	$ 13,500	210	$ 63	$ 13,230
Sidewalk (m2) - Lady Hammond to Bayne 3+120 to 3+228	m^2	162	$ 150	$ 24,300	378	$ 63	$ 23,814
Sidewalk (m2) - Lady Hammond to Bayne 3.85m MUP	m^2	225	$ 150	$ 33,750	525	$ 63	$ 33,075
Sidewalk (m2) - Bayne to Lower Coach Atlantic Entrance	m^2	150	$ 150	$ 22,500	350	$ 63	$ 22,050
Retaining Wall along Bayne	m^2	0	$ 2,000	$ -	150	$ 2,000	$ 300,000
				$ -			$ -
SUB-TOTAL				$190,350			$486,543
PROJECT MARK-UPS	58%			$109,451			$279,762
TOTAL (Rounded)				$300,000			$770,000
						ADDED COST	**($470,000)**

VE ALTERNATIVE AT-5

Connect MacKintosh Street multi-use pathway to Africville Road over CN Railway

Description of Baseline Concept:

The baseline concept did not include multi-use pathway (MUP) connection to Africville Road.

Description of Alternative Concept:

Extend the proposed MUP approx. 165 m from the end of MacKintosh Street at Civic 3800 (HRM Depot) to Africville Rd. This would be tied into Alternative 19 (Road Connection) or be an independent AT Crossing.

Advantages:

- Completes an active transportation (AT) connection to Africville Road from Bedford Highway via Lady Hammond Road – MacKintosh Street to Africville Road
- Provides AT crossing at CN tracks

Disadvantages:

- Outside of original project limits – Added scope, costs, and land requirements
- May require utility relocation
- Requires works across CN tracks and land

Discussion:

The current base case does not connect an AT facility directly to Africville Road. A MUP from the end of MacKintosh Street to Africville Road will complete a connection from Bedford Highway to Africville Road as it relates to Modified Option B, and would facilitate future connections along Africville Road to the Museum, National Historic Site, Park and future Africville Road AT connection from Barrington Street.

Schedule Discussion:

This will require planning time and resources to engage CN for design approval and permitting. A crossing agreement or land acquisition may be required prior to tendering which may impact WSE project delivery by 2027. Design can be accommodated during detail design phase without significant schedule impact. It may slightly add to the construction duration however it is a localized area with minimal construction impact (except to CN) and could easily coincide with other works. It may aid in the overall construction schedule by providing an additional access to stage construction phases.

Risk Discussion:

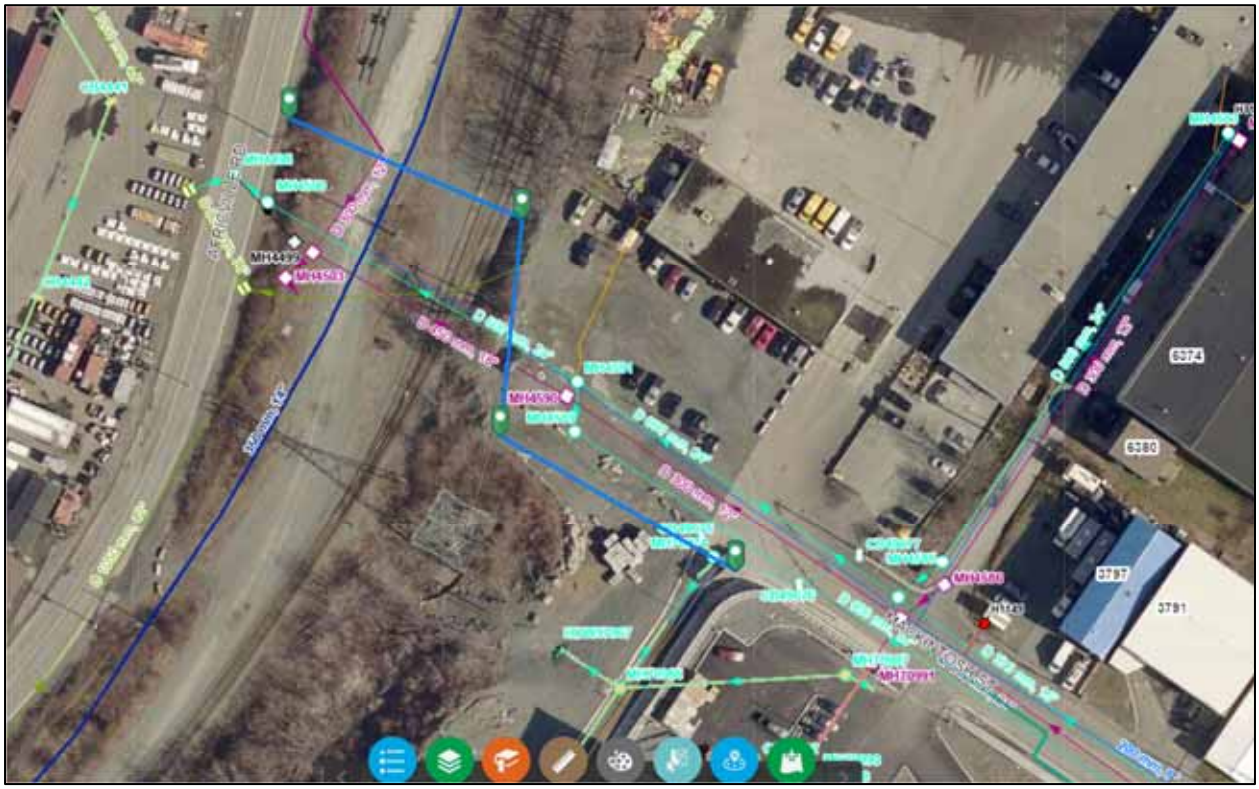
CN approval is required related to the proposed trail crossing at the rail track. They may not permit a new crossing at this location as there is another in close proximity.

Potential for utility impacts related to NSP/Aliant/Halifax Water infrastructure. Excavation is required for regrading slope to accommodate 8 percent max. profile grade (Alternative AR-1 shows a road at 9 percent). CN rail tracks are fixed elevation, and a switch back is required to accommodate max. grades due to the existing topography. Note that the existing MacKintosh Street is approximately 11 percent existing grade.

VE ALTERNATIVE AT-5

Connect MacKintosh Street multi-use pathway to Africville Road over CN Railway

VE Alternative Concept Sketch



Performance Assessment

Performance Attribute		Rationale for Change in Performance
Mainline Traffic Operations	Transit	N/A
	Port	N/A
	General Purpose	N/A
Local Traffic Operations		N/A
Maintainability		N/A
Temporary Construction Impacts		Improves temporary construction access.
Environmental Impacts		Provides greenway through industrial area.
ROW/Footprint Impacts		N/A
Active Transportation		Improves Integrated Mobility & Connecting Communities supporting Council's Key Priorities.

VE ALTERNATIVE AT-5

Connect MacKintosh Street multi-use pathway to Africville Road over CN Railway

Assumptions and Calculations:

CN approval can be obtained.

The existing gravel parking lot behind the old MacKintosh Street Depot can be regraded and portion used for MUP alignment and switch back.

Potential utility conflicts can be avoided and/or accommodated.

Initial Cost Estimate

$10,000 - Clearing and grubbing

$10,000 - Common excavation and removal of surplus material

$5,000 - Rock breaking

$40,000 - Storm sewer; collection or diversion at end of MacKintosh Street, infilling ditch at CN track, infilling ditch at Africville Road

$80,000 - 40 sq.m. of retaining wall for switchback

$25,000 - 250 mm thick type 2 sub-base for walkway limits

$15,000 - 165 m length of 3.5 m asphalt walkway

$10,000 - 3 pedestrian gates and signage

$10,000 - 40 sq.m. of concrete sidewalk, twsi plates & curb for pedestrian ramps

$10,000 - Reinstatement of gravel parking lot & CN access road

Total $215,000

Excluding land related costs, $1500 per day CN flagging cost, traffic control, utility relocations, contingencies, engineering & construction admin.

CONSTRUCTION ELEMENT		*BASELINE CONCEPT*			*ALTERNATIVE CONCEPT*		
Description	**Unit**	**Qty**	**Cost/Unit**	**Total**	**Qty**	**Cost/Unit**	**Total**
MUP from Forester to Africville (Refer to Cost Breaksown in Write-up)	LS	0	$ 215,000	$ -	1	$ 215,000	$ 215,000
				$ -			$ -
SUB-TOTAL				$0			$215,000
PROJECT MARK-UPS	56%			$0			$120,400
TOTAL (Rounded)				$0			$340,000
						ADDED COST	**($340,000)**

VE Study Results

Introduction
The following describes the completion of the Value Metrics process that began in the *Project Analysis* section of this report.

Define VE Strategies
VE studies result in the development of a number of alternatives. While each alternative is developed as an independent concept, typically the cumulative impact of select alternatives provides the best value solution for the project. This is due to the fact that some alternatives may be competing ideas or different ways to address the same issue. Some alternatives are developed to answer a question raised by a decision maker or to resolve an open issue and found not to be beneficial to the ultimate project.

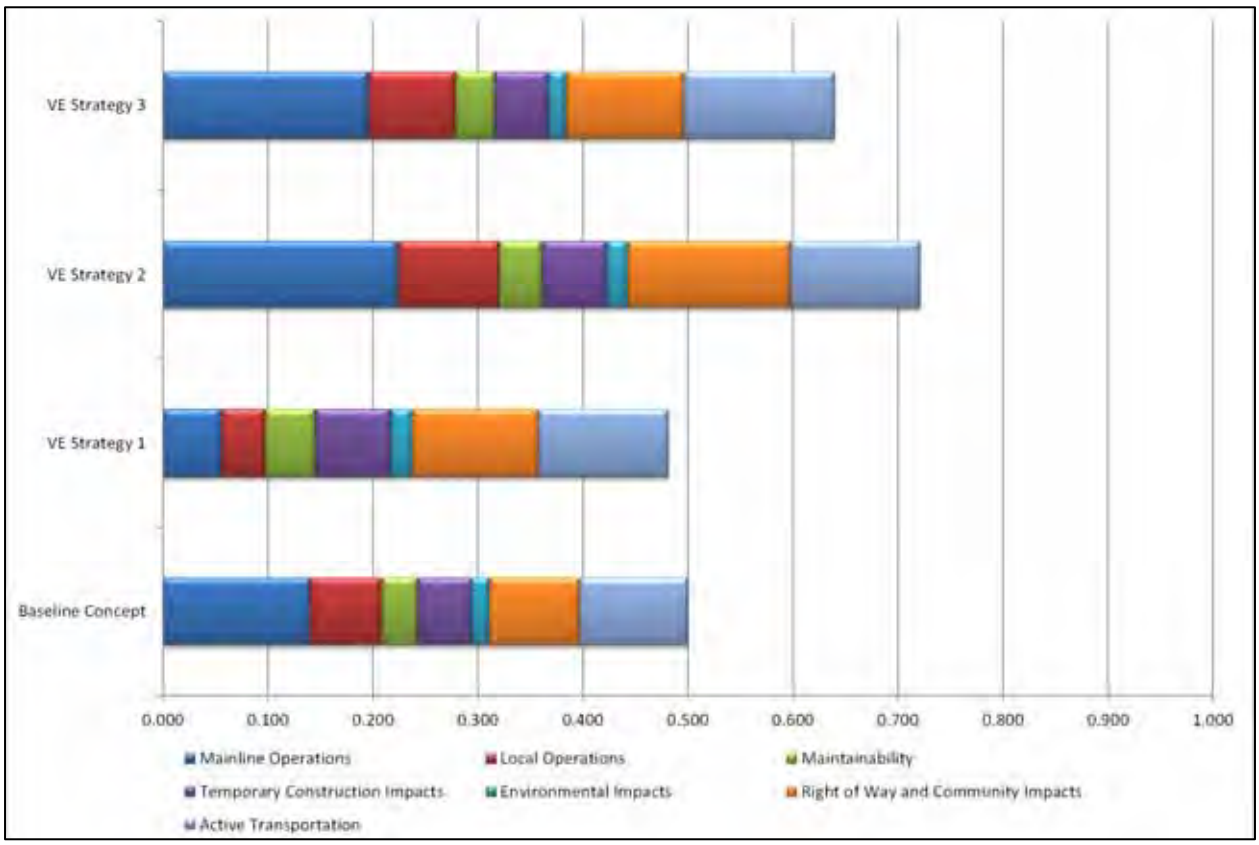
As a result of these factors, the VE team developed VE Strategies that represent possible combinations of alternatives to assist the decision makers in their evaluation of the VE alternatives. The VE Strategies are based on factors that include improved performance, likelihood of implementation, cost savings, or any combination of project's performance attributes. This information is a guide and is not intended to reject the other alternatives from stakeholder consideration.

Table 12. Summary of VE Alternatives

Strategy Description	Initial Cost Savings	Performance Change	Value Index	Value Change
VE Strategy 1 – BC-1, BC-2, BC-3, BC-5 (Option C), BAG-1, AR-1, AT-2, AT-3, AT-4, AT-5	$18,490,000	-6.5%	2.375	+43%
VE Strategy 2 – BC-1, BC-2, BC-3, BC-5 (Option C), BAG-2, AT-2, AT-3, AT-4, AT-5	$10,190,000	+44.3%	2.961	+78%
VE Strategy 3 – BC-1, BC-2, BC-3, BC-5 (Option C), AR-1, AT-2, AT-3, AT-4, AT-5	$7,490,000	+28.0%	2.473	+49%

Compare Performance – Baseline Concept and VE Strategies
The VE team considered the combined effect of all VE Alternatives for each VE Strategy. The total performance scores reflect the performance rating for each attribute multiplied by its overall priority (weight) expressed using a ratio scale. The chart below compares the total performance scores for the baseline concept and the VE Strategies.

Figure 10. Performance Profile of VE Strategies



Rating Rationale for Value Scenarios

The rating rationale for the performance of the baseline concept was presented previously in this section. The rating rationale for the VE Strategies developed by the VE team is provided below.

Table 13. VE Strategy 1			
Performance Measures	**Performance Scoring**		
Attributes and Rating Rationale	***Performance***	***Baseline***	***VE Strategy***
Mainline Operations Provides free flow from Bedford Highway to MacKay Bridge. Removes Windsor crossing which requires Port traffic to use MacKintosh Street for connection to Bedford Highway. Improves Port access to new truck gate with connection at MacKintosh Street. Total travel time for throughput movements is reduced. Improves weaving from MacKay Bridge to Massachusetts Avenue. Improves weaving WB Bedford Highway and Joseph Howe Drive Ramp Increases capacity of Joseph Howe Drive exit ramp. Provides signal protected queue jump for transit at Main Avenue. Increases travel distance for transit busses for Routes 90 and 4. Improves ramp connection at Kempt Road and speed change distance.	***Rating***	**5**	**2**
	Weight	**28.0**	
	Contribution	**140**	**56**
Local Operations Requires local traffic to use MacKintosh Street for access to Bedford Highway (increase out of direction travel) Restricts Kempt Road to right in, right out. Improves queuing on Joseph Howe and DV-K ramps Increases delays to local traffic (network-wide)	***Rating***	**5**	**2**
	Weight	**13.7**	
	Contribution	**68.5**	**27.4**
Maintainability Eliminates new structure over Windsor. Reduces impacts to existing retaining walls. Reduces new retaining walls along Bayne Street. Requires upgrades to Commission Street in the future. Reduces number of traffic signals (2).	***Rating***	**5**	**7**
	Weight	**6.8**	
	Contribution	**34**	**47.6**

Table 13. VE Strategy 1			
Performance Measures	**Performance Scoring**		
Attributes and Rating Rationale	***Performance***	***Baseline***	***VE Strategy***
Temporary Construction Impacts At-grade construction simplifies detouring and maintenance of traffic. Requires less temporary closures and access issues. Less disruptions to private properties during construction. Less rock breaking.	***Rating***	**5**	**7**
	Weight	**10.3**	
	Contribution	**51.5**	**72.1**
Environmental Impacts Reduced impervious area Reduced retaining walls may create more space for green infrastructure and landscaping.	***Rating***	**5**	**6**
	Weight	**3.4**	
	Contribution	**17**	**20.4**
ROW / Footprint Impacts Reduces impacts to Subaru dealership at Kempt Road. Reduces impacts to properties along Bayne Street. Significant reduction in impacts to existing utilities. No impact to existing HW feeder main from new structure foundations. Requires an additional CN crossing at MacKintosh Street. Reduces impacts to Port marshalling yard / Port properties.	***Rating***	**5**	**7**
	Weight	**17.2**	
	Contribution	**86**	**120.4**
Active Transportation Provides multi-use connection to Bedford Highway multi-use pathway through project area to Lady Hammond and Africville. Removes N-S connection at Windsor intersection. Improved functionality with multi-use paths in lieu of sidewalks.	***Rating***	**5**	**6**
	Weight	**20.6**	
	Contribution	**103**	**123.6**
	Total Performance	**500**	**467.5**
	Net Change in Performance		**-6%**

Table 14. VE Strategy 2			
Performance Measures	**Performance Scoring**		
Attributes and Rating Rationale	***Performance***	***Baseline***	***VE Strategy***
Mainline Operations Provides free flow from Bedford Highway to MacKay Bridge Total travel time for throughput movements is improved. Improves weaving from MacKay Bridge to Massachusetts Avenue. Improves weaving WB Bedford Highway and Joseph Howe Drive Ramp. Increases capacity of Joseph Howe Drive exit ramp. Provides signal protected queue jump for transit at Main Avenue. Increases travel distance for transit busses for Routes 90 and 4. Improves ramp connection at Kempt Road and speed change distance. Reduces spill back of traffic from ramps.	***Rating***	**5**	**8**
	Weight	**28.0**	
	Contribution	**140**	**224**
Local Operations Requires local traffic to use MacKintosh Street for access to Bedford Highway (increase out of direction travel) Restricts Kempt Road to right in, right out. Improves queuing on Joseph Howe and DV-K ramps Decreases delays to local traffic and connectivity to mainline.	***Rating***	**5**	**7**
	Weight	**13.7**	
	Contribution	**68.5**	**95.9**
Maintainability Slightly larger new structure, but provides opportunity for more durable structure. Reduces impacts to existing retaining walls. Reduces new retaining walls along Bayne Street. Requires upgrades to Commission Street in the future. May increase number of traffic signals.	***Rating***	**5**	**6**
	Weight	**6.8**	
	Contribution	**34**	**40.8**

Table 14. VE Strategy 2			
Performance Measures	**Performance Scoring**		
Attributes and Rating Rationale	***Performance***	***Baseline***	***VE Strategy***
Temporary Construction Impacts New structure location will require additional traffic detours. Reduced profile changes will result in reduced material handling and impacts to existing.	***Rating***	**5**	**6**
	Weight	**10.3**	
	Contribution	**51.5**	**61.8**
Environmental Impacts Reduced impervious area Reduced retaining walls may create more space for green infrastructure and landscaping.	***Rating***	**5**	**6**
	Weight	**3.4**	
	Contribution	**17**	**20.4**
ROW / Footprint Impacts Reduces impacts to Subaru dealership at Kempt Road. Reduces impacts to properties along Bayne Street. Significant reduction in impacts to existing utilities. No impact to existing HW feeder main from new structure foundations. Reduces impacts to Port marshalling yard / Port properties.	***Rating***	**5**	**9**
	Weight	**17.2**	
	Contribution	**86**	**154.8**
Active Transportation Provides multi-use connection to Bedford Highway multi-use pathway through project area to Lady Hammond and Africville. Removes N-S connection at Windsor intersection. Improved functionality with multi-use paths in lieu of sidewalks.	***Rating***	**5**	**6**
	Weight	**20.6**	
	Contribution	**103**	**123.6**
	Total Performance	**500**	**721.3**
	Net Change in Performance		**+44%**

Table 15. VE Strategy 3			
Performance Measures	**Performance Scoring**		
Attributes and Rating Rationale	***Performance***	***Baseline***	***VE Strategy***
Mainline Operations Provides free flow from Bedford Highway to MacKay Bridge Total travel time for throughput movements is reduced. Improves weaving from MacKay Bridge to Massachusetts Avenue. Improves weaving WB Bedford Highway and Joseph Howe Drive Ramp. Increases capacity of Joseph Howe Drive exit ramp. Provides signal protected queue jump for transit at Main Avenue. Improves ramp connection at Kempt Road and speed change distance.	***Rating***	**5**	**7**
	Weight	**28.0**	
	Contribution	**140**	**196**
Local Operations Provides two entrance ramps to EB Bedford Highway from Kempt Road and Windsor Street. Restricts Kempt Road to right in, right out. Improves queuing on Joseph Howe Drive and DV-K ramps.	***Rating***	**5**	**6**
	Weight	**13.7**	
	Contribution	**68.5**	**82.2**
Maintainability Reduces new retaining walls along Bayne Street. Reduces impacts to Fairview Overpass retaining walls.	***Rating***	**5**	**5.5**
	Weight	**6.8**	
	Contribution	**34**	**37.4**
Temporary Construction Impacts No significant changes from baseline.	***Rating***	**5**	**5**
	Weight	**10.3**	
	Contribution	**51.5**	**51.5**

Table 15. VE Strategy 3			
Performance Measures	**Performance Scoring**		
Attributes and Rating Rationale	***Performance***	***Baseline***	***VE Strategy***
Environmental Impacts No significant changes from baseline.	***Rating***	**5**	**5**
	Weight	**3.4**	
	Contribution	**17**	**17**
ROW / Footprint Impacts Reduces impacts to Subaru dealership. Reduced impacts to properties along Bayne Street and Port marshalling yard. Utility impacts similar to baseline.	***Rating***	**5**	**6.5**
	Weight	**17.2**	
	Contribution	**86**	**111.8**
Active Transportation Provides multi-use connection to Bedford Highway multi-use pathway through project area to Lady Hammond and Africville. Provides N-S connection at Windsor intersection. Improved functionality with multi-use paths in lieu of sidewalks.	***Rating***	**5**	**7**
	Weight	**20.6**	
	Contribution	**103**	**144.2**
	Total Performance	**500**	**640.1**
	Net Change in Performance		**+28%**

Compare Value

The cost and elements were compared and normalised for the baseline concept and the VE Strategy using the following tables. These tables illustrate how cost scores were derived. In this comparison, a lower score is desirable as the project will benefit from lower costs.

Note that given this study was conducted at the planning/feasibility level of project development, the time factor was assumed to be the same for the baseline concept and all VE Strategies, thus was not calculated in deriving the value index.

Table 16. Comparison of Cost Values

Strategy	Total Cost	Score
Baseline Concept	$53,400,000	0.301
VE Strategy 1 – BC-1, BC-2, BC-3, BC-5 (Option C), BAG-1, AR-1, AT-2, AT-3, AT-4, AT-5	$34,942,000	0.197
VE Strategy 2 – BC-1, BC-2, BC-3, BC-5 (Option C), BAG-2, AT-2, AT-3, AT-4, AT-5	$43,242,000	0.244
VE Strategy 3 – BC-1, BC-2, BC-3, BC-5 (Option C), AR-1, AT-2, AT-3, AT-4, AT-5	$45,942,000	0.259
TOTAL	$177,526,000	1.000

Once relative scores for performance and cost have been derived, the next step is to synthesize a value index for the baseline concept and the VE Strategy. A Value Matrix was prepared which facilitated the comparison of the baseline and the VE Strategy by organizing and summarizing this data into a tabular format. The performance scores for the Strategy were divided by the total cost scores for the Strategy to derive a value index. The value indices for the VE Strategy were then compared against the value index of the baseline concept and the difference is expressed as a percent (± %) deviation.

Table 17. Value Matrix – Baseline Concept and VE Strategy

Strategy	Performance Score	Change in Performance	Cost Score	Value Index	Change in Value
Baseline Concept	500.0	N/A	0.301	1.662	N/A
VE Strategy 1	467.5	-6.5%	0.197	2.375	+43%
VE Strategy 2	721.3	+44.3%	0.244	2.961	+78%
VE Strategy 3	640.1	+28.0%	0.259	2.473	+49%

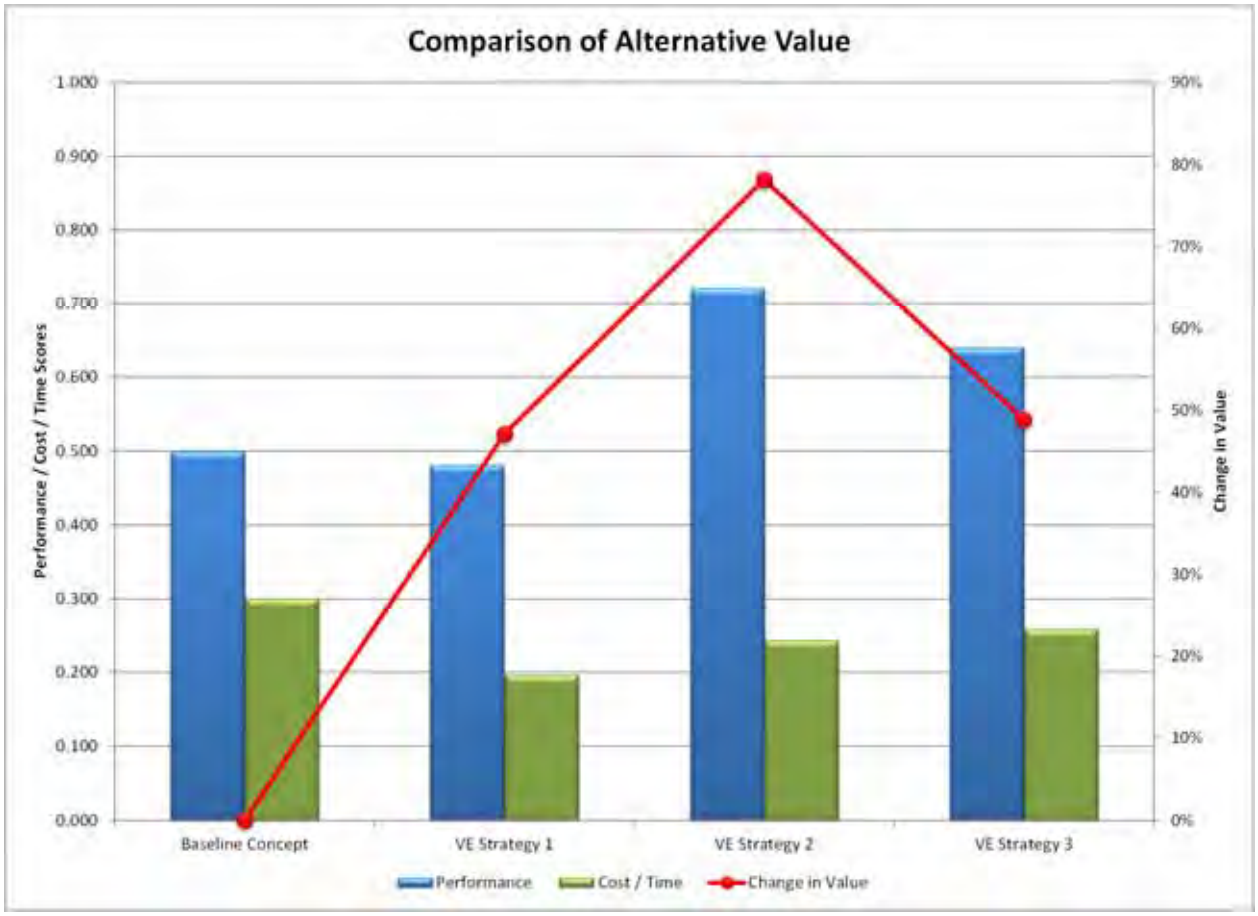


Figure 11. Comparison of Value - Baseline Concept and VE Strategies

Implementation Action

Introduction

The results of the VE study are presented for review and implementation to HRM Project Team and Management. The following VE Recommendation Approval Form sheet is designed to help the decision-makers record their implementation decisions. A compilation of the implementation decisions will be included in the Final VE Study Report.

Implementation Action Recommendation

Reviewers are asked to provide their disposition of each VE alternative denoting their recommendation to implement or not, based on current information, in the given project development phase. It is recognized that future conditions may change this disposition. Comments will be discussed at the Implementation Meeting where final disposition and savings validation will be determined.

Disposition Recommendation Options:

- Agree
- Agree with Modifications
- Further Study Needed
- Mutually Exclusive
- Disagree/Reject

The Qualitative Performance Measures used in the table are as follows:

- E – Reduced Environmental Impact
- O – Enhanced Operational Performance
- C – Reduced Construction Impacts
- D – Expedited Project Delivery

Summary and Disposition of VE Alternatives

Alt No.	Alternative	Qualitative Performance Measures				Cost Savings (or Added Cost)	Approval	Comments
		E	O	C	D			
BC-1	Remove NB Joseph Howe to WB Bedford Highway access and convert WB Bedford Highway to SB Joseph Howe Drive to dual lane loop ramp		X			($200,000)	Further Study Needed	Further study needed: • Consider where displaced traffic will go • Expand traffic model to Bayview Drive • Critically important to improve traffic flows through the project area • Public feedback is necessary • Improves truck connection to Highway 102 • Improves flow from MacKay Bridge • Evaluate speed differential/lane imbalance outside peak hours • Confirm truck turning movements • Potentially consider as a future phase/part of the Bedford Highway project Disagree: • Transit routes 8 & 91 would need to be rerouted; would impact large area of Joseph Howe Drive • Displaced traffic likely to use streets through Fairview that are at capacity • Risk of underutilized lane as many drivers will be hesitant to drive beside large vehicles on tight turn; may apply to general traffic as well

Alt No.	Alternative	Qualitative Performance Measures				Cost Savings (or Added Cost)	Approval	Comments
		E	O	C	D			
								• Cannot be implemented without BC-3
BC-2	Create a direct taper slip ramp from MacKay Bridge to Massachusetts Avenue		X			($1,100,000)	Agree with Modifications	• Will need to assess whether an interim measure can be implemented given timeline of the MacKay Bridge project
BC-3	Remove traffic from Joseph Howe Drive ramp by providing signalized stop condition at Main Avenue with displaced left/DDI		X			($600,000)	Further Study Needed	• Traffic model to be expanded further upstream on Joseph Howe Drive • Critical to provide transit priority queue jump inbound; BRT routing could be adjusted to take advantage as well • Modifications to DV-K Ramp are outside our current agreement with NS; could be considered as part of future project • Will need to consider truck turning radii; risk of truck overtracking • Movement to MacKay Bridge will have additional signals and will be challenging to sign
BC-4	Improve turning movement and signal phasing from the Port to MacKay Bridge at Windsor Street Exchange		X			$0	Agree	• Evaluate risks with reduced queue space for trucks coming out of Port

Alt No.	Alternative	Qualitative Performance Measures				Cost Savings (or Added Cost)	Approval	Comments
		E	O	C	D			
BC-5	Modify Kempt Road operation and access	X			X	$2,800,000	Further Study Needed (Option C)	• HRM Traffic does not anticipate the need for signals at Commodore Street.
BAG-1	Eliminate grade separation of Bedford Highway at Windsor Street Intersection	X		X	X	$11,000,000	Disagree	• Would need to be compared to existing condition to determine if improvement would meet Transport Canada requirements • Option only makes sense as an interim measure or if we have funding concerns • Appears to negatively impact transit routes in both directions • Truck traffic from the Port towards the MacKay would be negatively impacted
BAG-2	Relocate grade separation to the east with new local crossing	X	X	X	X	$10,100,000	Further Study Needed	• Should investigate all movements to determine if connections have been removed • Should be compared to improved Base Case for evaluation
AR-1	Extend MacKintosh Street to Africville Road	X	X	X	X	$7,400,000	Further Study Needed	• Highly dependent on discussion with CN Rail • Could open potential transit opportunities to Africville • Will need to consider trucks climbing approx. 9% grade

Alt No.	Alternative	Qualitative Performance Measures				Cost Savings (or Added Cost)	Approval	Comments
		E	O	C	D			
								• Will need to consider CN activity and potential short-term closures for train activity
AT-1	Provide basin-side AT connection to Africville Museum		X			($1,800,000)	Further Study Needed (outside project scope)	• Will likely be considered separate to WSE project; final design of WSE should not preclude this from happening • Highly dependent on discussion with CN Rail • Safety concerns with Port traffic will need to be addressed
AT-2	Provide an AT connection to Bedford Highway on the south side		X			($32,000)	Agree	• Makes AT connection between Bedford Highway and WSE projects
AT-3	Provide AT connection to Devonshire Avenue along Lady Hammond Road and connect to Africville Museum		X			Comment	Further Study Needed (outside project scope)	• Outside of WSE project area • Should be assessed by Transportation Planning and AT Planning staff to coordinate programming to coincide with WSE construction
AT-4	Convert sidewalks into multi-use pathways (MUPs)		X			($470,000)	Further Study Needed	• Adds significant cost; may have land and utility impacts • Some connections may be preferable over others

Alt No.	Alternative	Qualitative Performance Measures				Cost Savings (or Added Cost)	Approval	Comments
		E	O	C	D			
AT-5	Connect MacKintosh Street multi-use pathway to Africville Road over CN Railway	X	X			($340,000)	Further Study Needed	• Highly dependent on discussion with CN Rail • If AR-1 does not go ahead, this is a critical AT connection to Africville

Summary of VE Strategies	VE Strategy 1: (BC-1, BC-2, BC-3, BC-5 (Option C), BAG-1, AR-1, AT-2, AT-3, AT-4, AT-5): $18,490,000 VE Strategy 2: (BC-1, BC-2, BC-3, BC-5 (Option C), BAG-2, AT-2, AT-3, AT-4, AT-5): $10,190,000 VE Strategy 3: (BC-1, BC-2, BC-3, BC-5 (Option C), AR-1, AT-2, AT-3, AT-4, AT-5): $7,490,000