Route 333 Transportation Study

Transportation Study
Final Report

CBCL

Project 241105.00 • September 2025

4	Transportation Study Report – Final	Emanuel Nicolescu	September 19, 2025	Hasan Hadi and Utkarsh Patel
3	Transportation Study Report – Draft Final	Emanuel Nicolescu	July 17, 2025	Hasan Hadi and Utkarsh Patel
2	Transportation Study Report – V2	Emanuel Nicolescu	11-Apr-2025	Hasan Hadi and Utkarsh Patel
1	Transportation Study Report – V1	Emanuel Nicolescu	14-Mar-2025	Hasan Hadi and Utkarsh Patel
0	Transportation Study Report –Draft	Emanuel Nicolescu	20-Dec-2024	Hasan Hadi and Utkarsh Patel
Rev.	Issue	Reviewed By:	Date	Issued By:

Project No. 241105.00

September 19, 2025

Mark Brace, P.Eng.

Project Engineer

Nova Scotia Department of Public Works

Email: Mark.Brace@novascotia.ca

Dear Mr. Brace:

RE: Route 333 Transportation Study – Transportation Study Report – Draft Final

CBCL is pleased to submit this Draft Final of the Route 333 Transportation Study. This version of the report includes updates to address the provided feedback on the draft report, additional tests and analysis, and response to Stakeholder comments. Furthermore, additional analysis scenarios and recommendations have been added for your consideration, along with discussion of proposed corridor improvement concepts and associated costs estimates.

We believe that the analysis presented herein provides a strong basis for future planning in the context of known major developments and anticipated regional growth.

We kindly invite you to review this Draft Final Report and to provide us of your feedback for consideration within the final version of the report. Please contact us at your convenience to discuss any concerns or questions that arise following your review.

Yours very truly,

CBCL Limited

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Appendices

1 Introduction

CBCL Limited (CBCL) has been contracted by Nova Scotia Department of Public Works (DPW) to conduct a Transportation Study for Route 333, herein referred to as Prospect Rd. This Transportation Study Report has been prepared in line with the proposed study approach and in view of several discussions with DPW and other stakeholders.

1.1 Project Description

Prospect Rd. is the main access point to the Halifax peninsula and the 100-series highway system for several communities on the South Shore. Population along the route has been steadily increasing over the years, and now Halifax Regional Municipality (HRM) is reviewing the possibility of larger-scale residential and commercial developments in the area. New developments will lead to higher travel demand through the area, with impacts expected on the operation of existing intersections and road sections. The last study of the corridor was conducted almost 10 years ago, without consideration for the scale of these major developments.

Considering these points, the need for a new transportation study of the area, and the requirement to upgrade several key connection points, have been identified by DPW. This study reflects the most up-to-date information in the planning process and accounts for clear steps so that the Prospect Rd. corridor and additional connection recommendations are sufficient to accommodate the mobility needs of both the existing and planned future development.

1.2 Study Area

The project study area mainly focuses on Prospect Rd. as shown in Figure 1-1, but also extends to cover the following:

- Prospect Road, from St. Margaret's Bay Road (SMB Rd.) to Shad Bay
- SMR Rd. and its intersection with Exit 2 ramps on Hwy 103
- Potential connections from Prospect Rd. to the Hwy 103 Exit 3 interchange
- Potential connection from Prospect Rd. to Route 306
- Potential connections between Horseshoe Lake Drive and Ragged Lake Boulevard.

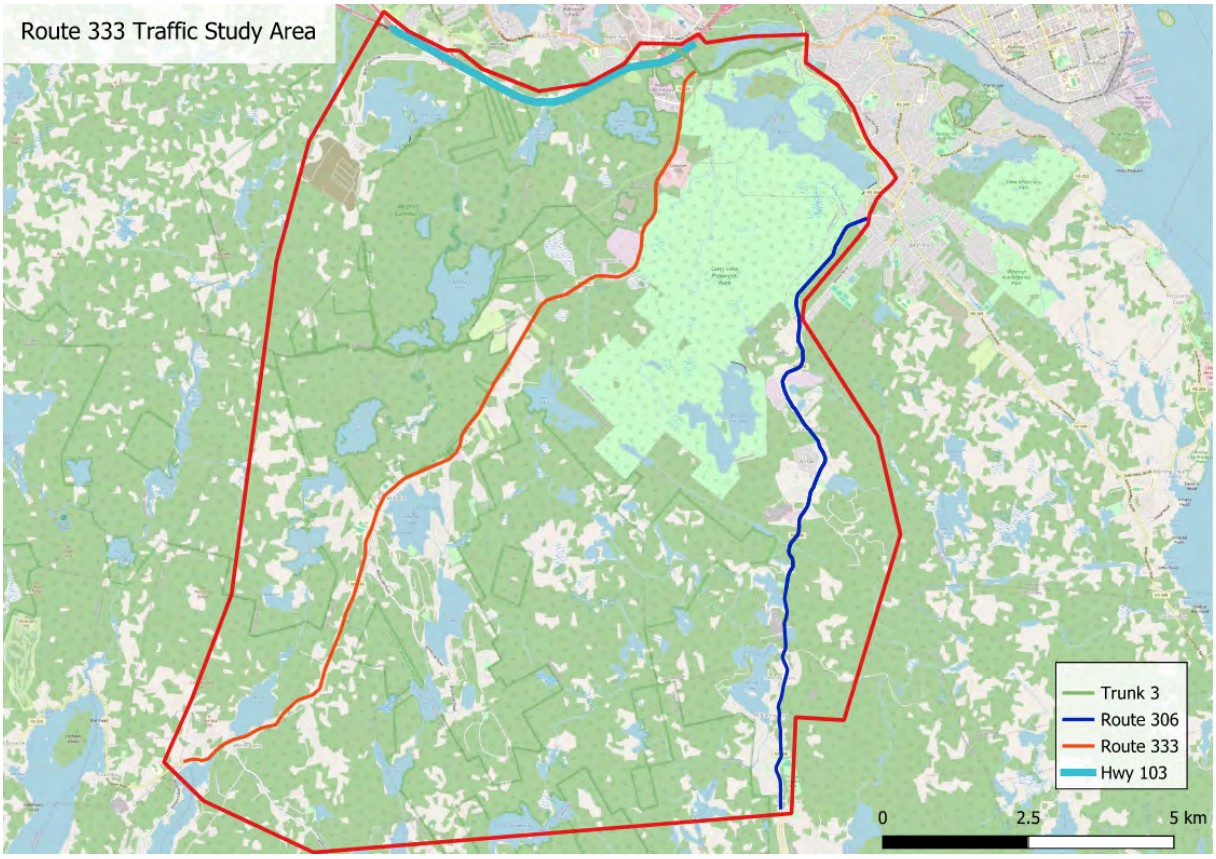


Figure 1-1: Study Area

1.3 Study Purpose and Objectives

The main objective of this Study is to provide DPW and partners with evidence-based analyses and recommendations considering the existing (Baseline) and future travel demand and traffic patterns on Prospect Rd., incorporating the existing and planned developments within the study area, as well as exploring new corridor connections from Prospect Rd. to Highway 103 (Hwy 103) and Route 306.

Besides improving the overall traffic operational conditions, a key objective of this study is to identify new major corridor connections to the study area, to serve as complementary

and alternative gateways to Prospect Rd. Such alternative connections have considerable value to the transportation and mobility system as it offers additional capacity, disperse the traffic, and most importantly provides new egress routes in case of emergencies.

The study was prepared according to the following additional objectives:

- Identify existing roadway deficiencies, as well as anticipated deficiencies over the 10 and 20-year horizons and assess mitigation measures.
- Utilize outputs from the new Link Nova Scotia (Link NS, formerly the Joint Regional Transportation Agency) JESS Activity-Based Travel Demand Model (ABM) co-owned by HRM to inform the modelling work and traffic analysis of this project within regional planning considerations. Link NS indicated that the 2031 and 2045 horizon years would be the closest scenarios matching the project's 10 & 20-year horizon timelines. These years were therefore adopted for this study.
- Conduct sensitivity analysis so that the modelling work and analysis are robust and easily adjusted should any of the key factors change.
- Assess the benefits of the new connections for vehicular traffic and sustainable transportation on Prospect Rd.
- Develop corridor improvement plans using recommended mitigation measures and potential connection points at Exit 3 and Route 306.

2 Data and Information Sources

The following data, information and documents have been considered as part of the transportation study:

- Traffic Counts Data for the Study Area, CBCL 2024.
- Collision History for Prospect Rd. for 2015-2024, DPW 2024.
- Collision Database for Study Area, HRM Open Data 2024.
- Exhibition Park Growth Area Initiation Report, Fathom 2023.
- Ragged Lake Concept Plan, Design Point 2020.
- Ragged Lake Long Term Traffic Planning Study, GRIFFIN Transportation Group 2015.
- Ragged Lake Industrial Lands Reserve Land Suitability Analysis, CBCL 2021.
- JESS ABM Subarea Model Extracts, Link NS 2024.
- Highway Design Guidelines, Nova Scotia Transportation and Infrastructure Renewal 2015.
- Institute of Transportation Engineers (ITE) Trip Generation Manual, 10th Edition.

2.1 Traffic Data Collection

With the aim to establish baseline traffic conditions within the study area, new Turning Movement Counts (TMCs) were collected by CBCL at 15 key intersections within the study area which are shown in Figure 2-1 and listed in Table 2-1. A higher resolution map is provided in Appendix A.

At each survey location, MioVision Scout automatic video traffic counter units were installed to collect video for a total of 10 hours covering the weekly AM, Midday and PM peak traffic periods.

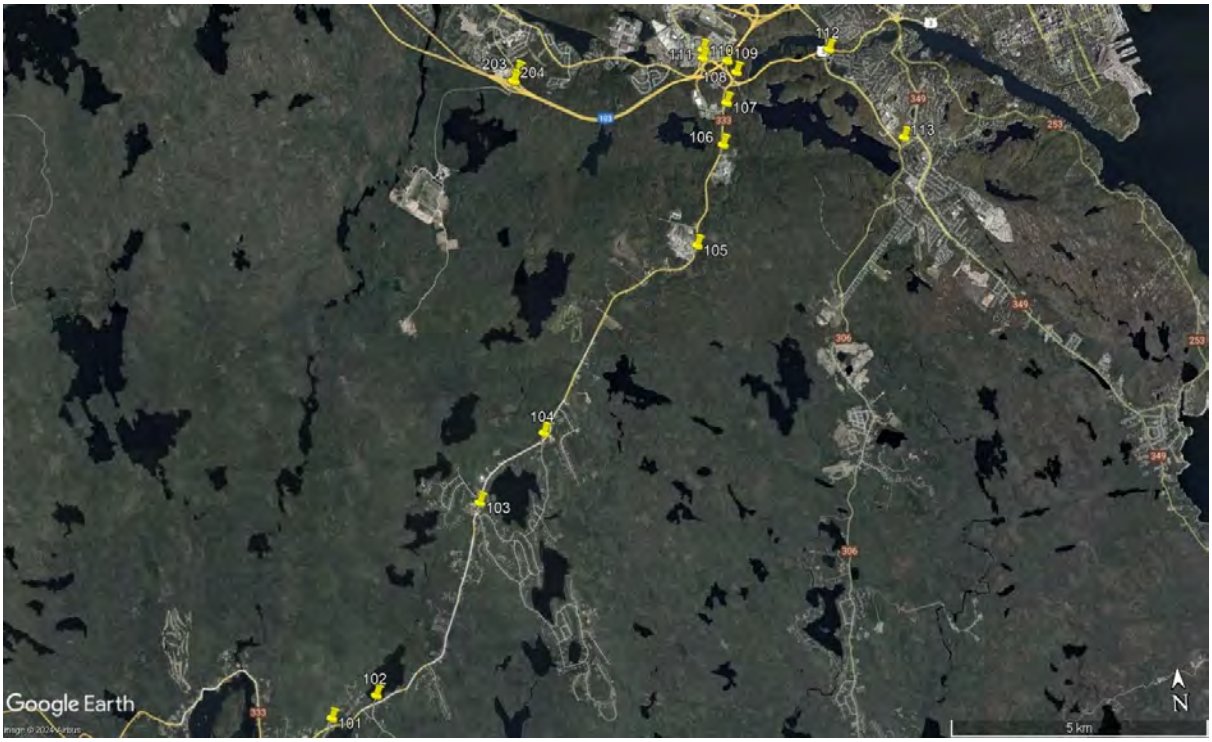


Figure 2-1: Traffic Counts Surveys Locations (Map)

The TMC data was summarized as turn diagrams representing the baseline traffic flows through the study area.

Table 2-1: Traffic Counts Surveys Locations (List)

ID	Analysis Location	Traffic Control	Survey Date
101	Prospect Rd. & Prospect Bay Road	Unsignalized	June 12, 2024
102	Prospect Rd. & Terence Bay Road	Unsignalized	June 12, 2024
103	Prospect Rd. & Brookside Road	Unsignalized	June 13, 2024
104	Prospect Rd. & Clube Road	Unsignalized	June 13, 2024
105	Prospect Rd. & Mills Drive	Unsignalized	June 13, 2024
106	Prospect Rd. & Exhibition Park Driveway	Unsignalized	June 13, 2024
107	Prospect Rd. & Ragged Lake Boulevard	Unsignalized	June 18, 2024
108	Prospect Rd. & Trunk 3	Signalized	June 19, 2024
109	SMB Rd. & Hwy 103 Off-ramp/On-ramp	Signalized	June 19, 2024
110	Lakelands Boulevard. & SMB Rd.	Signalized	June 19, 2024
111	Lakelands Boulevard. & Steele/Tim Hortons access	Unsignalized	June 20, 2024
112	Dunbrack St. & Albert Walker Drive & Walter Havill Drive	Signalized	June 20, 2024
113	Route 306 & Dunbrack St.	Signalized	June 20, 2024
203	Highway 103 Timberlea Village Pkwy WB Ramp	Unsignalized	September 26, 2024

204	Highway 103 Timberlea Village Pkwy WB Ramp	Unsignalized	September 26, 2024

Figure 2-2 and Figure 2-3 illustrate intersection turn diagrams for the AM and PM peak hours, respectively (included in Appendix B). We note that the traffic flows along Prospect Rd.'s southern sections are generally low, while more activity can be observed along the central and northern sections of the corridor where the traffic flows reach 924 veh/hr in the northbound direction during the AM peak hour, and over 1,040 veh/hr in the southbound direction during the PM peak hour. This increase occurs in the vicinity of the Halifax Exhibition Centre and the Ragged Lake Business Park, which is to be expected, as the confluence of regional commuter routes. Considerable conflicting movements can also be observed at the Intersections of Prospect Rd., Trunk 3, SMB Rd., Hwy 103 and Lakelands Boulevard. Traffic flows along Dunbrack St. are in range of 900 – 1,000 veh/hr in both directions during the AM peak hour with increased traffic observed during the PM peak hour up to 1,694 veh/hr in the southbound direction.

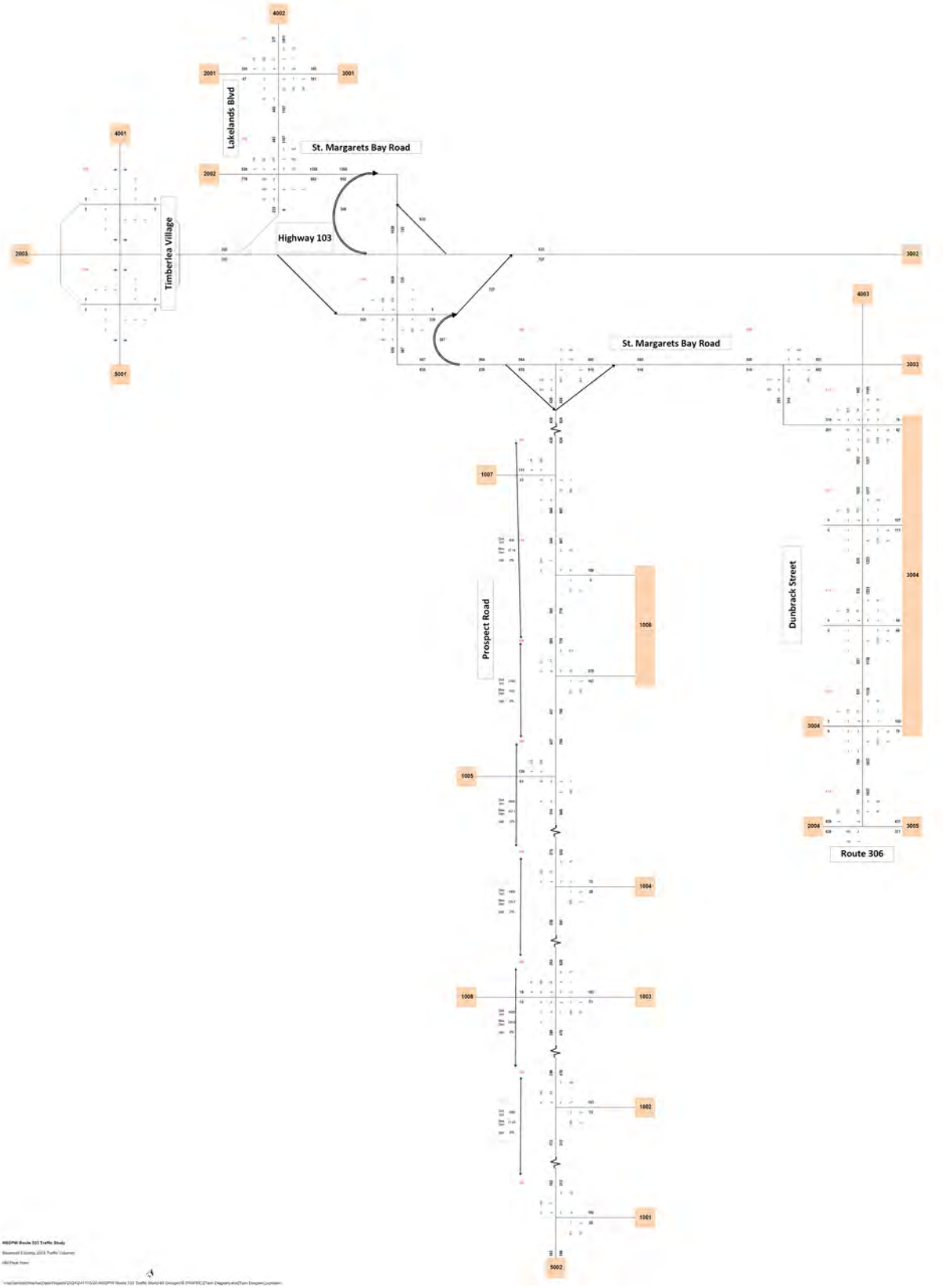


Figure 2-2: Intersection Turn Diagram – AM Peak Hour

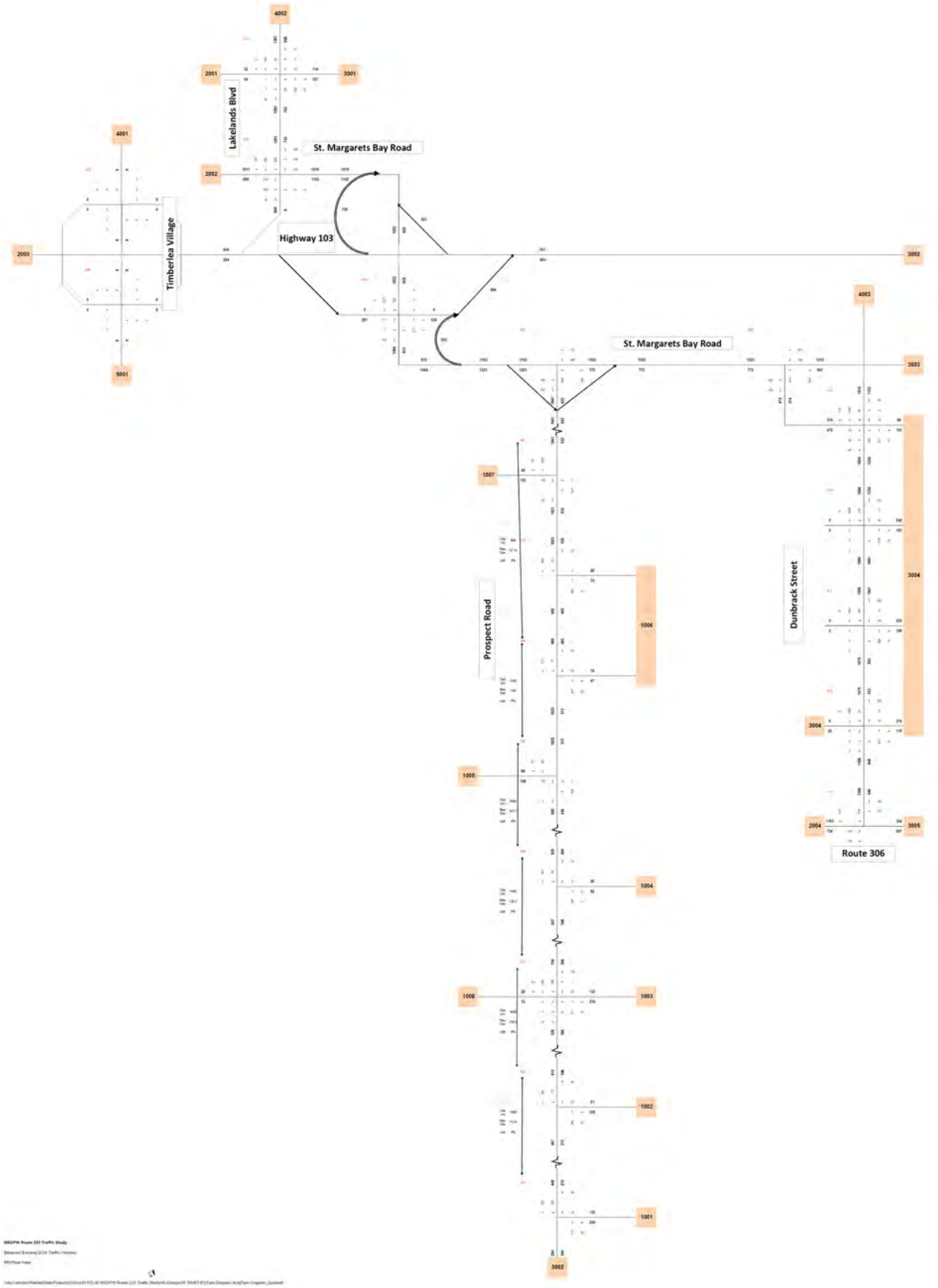


Figure 2-3: Intersection Turn Diagram – PM Peak Hour

2.2 JESS ABM Travel Demand

In addition to the traffic counts surreys, baseline subarea traversal matrices of the JESS ABM were procured from Link NS. The extracts were provided to the project team in the form of PTV VISUM version files representing the JESS ABM 2022 baseline conditions within the study area, shown in Figure 2-4 and Figure 2-5 for the AM and PM peak hours, respectively.

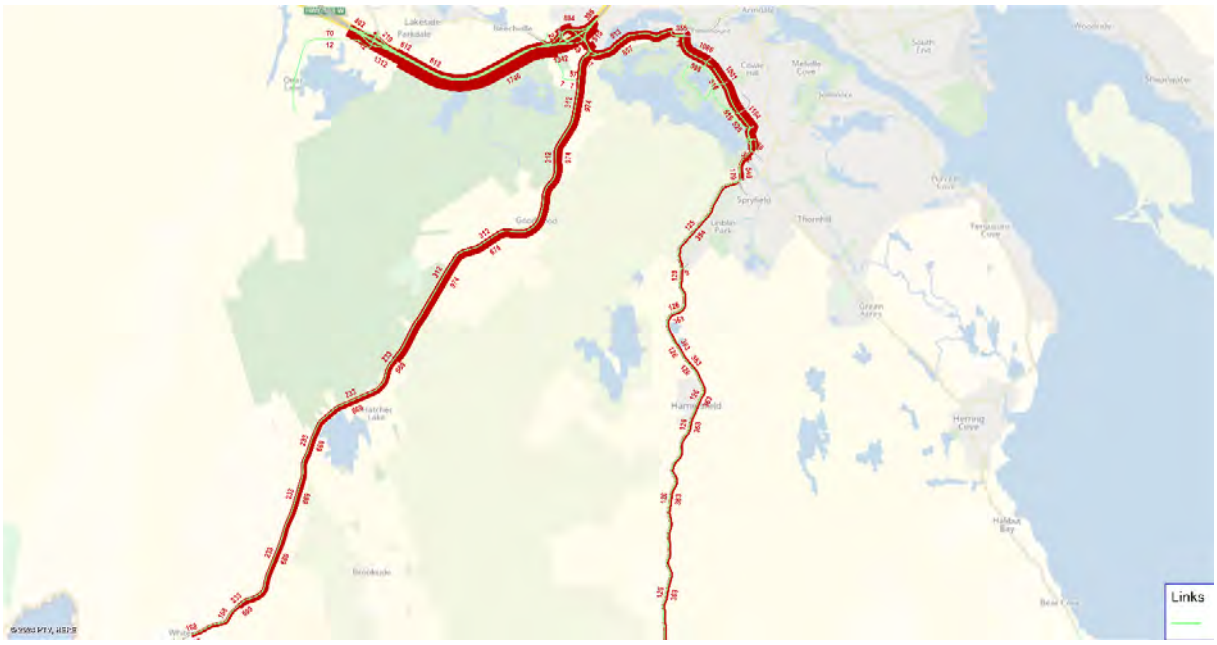


Figure 2-4: JESS ABM Subarea Baseline Traffic Flows – AM Peak Hour

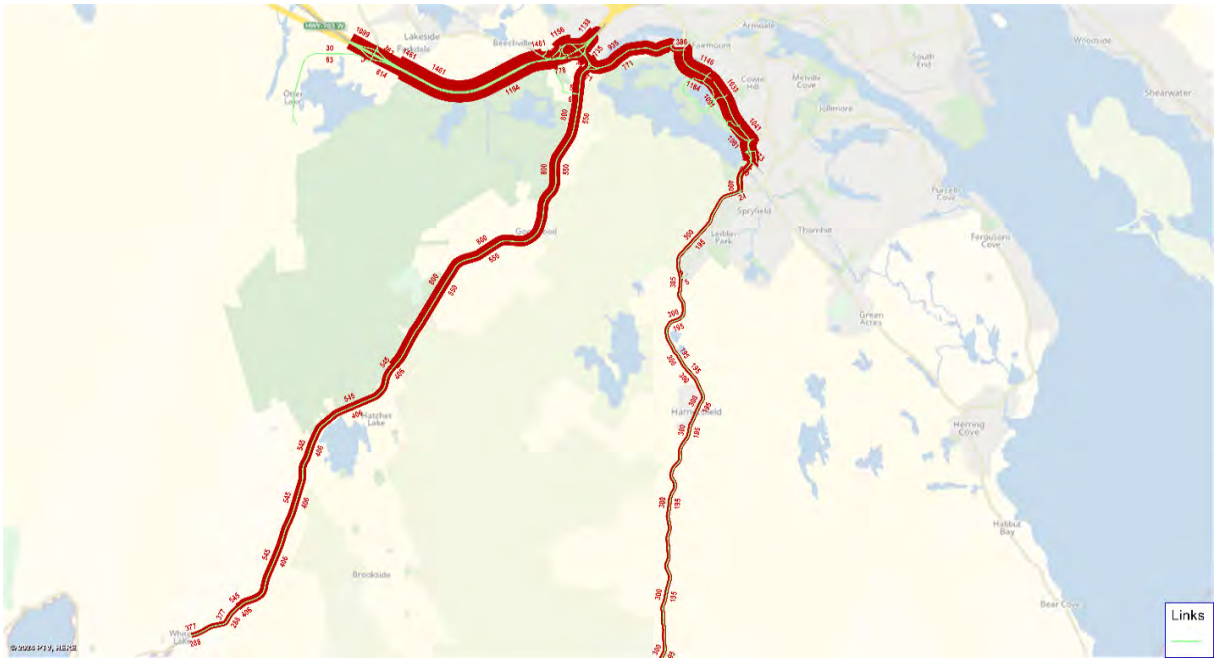


Figure 2-5: JESS ABM Subarea Baseline Traffic Flows – PM Peak Hour

The JESS ABM traffic flows were compared to the traffic counts at the screenline level on the north and south edges of the study area. As summarized on Table 2-2, the traffic flows are comparable, with the exception that the south screenline overestimates flows in the northbound direction. This is partly due to this area being represented by large and coarse Traffic Analysis Zones, with few connectors to the road network. As such, the JESS model loads volumes farther south along the Prospect Road corridor. Overall, we find this acceptable, as the JESS ABM extracts were subsequently adjusted to the actual traffic counts to prepare the baseline travel demand matrices.

Table 2-2: Traffic Flow Comparison (JESS ABM Model vs Traffic Counts)

Dir.	AM Peak Hour			PM Peak Hour		
	Model Flows	Counts Flows	Counts / Model	Model Flows	Counts Flows	Counts / Model
North Screenline						
NB	1,690	1,818	1.08	2,070	2,548	1.23
SB	1,670	1,904	1.14	1,906	2,446	1.28
Avg.	1,680	1,861	1.11	1,988	2,497	1.26
South Screenline						
NB	1,480	1,035	0.70	1,218	930	0.76
SB	659	802	1.22	1,448	1,487	1.03
Avg.	1,070	919	0.86	1,333	1,209	0.91

3 Baseline Conditions

3.1 Existing Roadways and Intersections

This section describes the existing roadways at all the existing key intersections within the study area. **Figure 3-1** illustrates the intersection numbering used throughout this report.

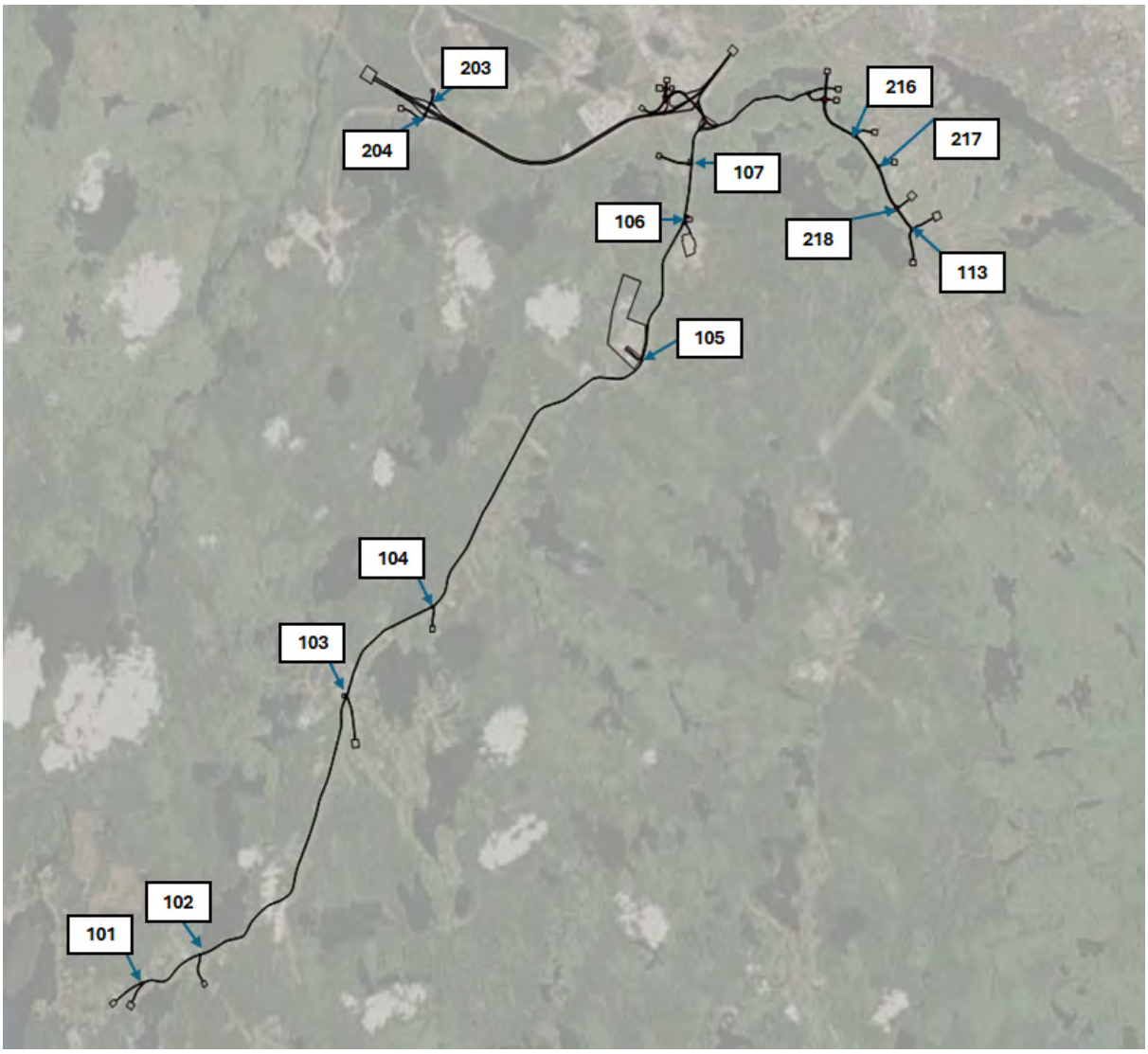


Figure 3-1: Intersection Numbering (Study Area View)

3.1.1 Intersection 101 (Prospect Road & Prospect Bay Road)

Figure 3-2: Prospect Rd. & Prospect Bay Road Intersection

Prospect Bay Road is a two-lane collector road (Type F) providing access to residential areas around Prospect Bay and extends to connect with Prospect Village at the end.

There is a small angle between the intersection approaches which results in a wide throat area. The Prospect Bay Road centerline has a small radius on the approach to bring left turning drivers to the stop bar at close to 90 degrees to optimize the view of oncoming traffic in both directions along Prospect Road. There is a yield-controlled slip lane (with 2 yield signs) for right turning traffic onto Prospect Road, but the skewed approach angle limits the view of oncoming traffic from the left.

The existing intersection arrangement may sometimes lead to elevated speeds for left turns to Prospect Bay Road, and in low traffic conditions, aggressive drivers may use the slip lane in the wrong direction for the same turning movement.

The intersection is under two-way stop control with a stop sign on the Prospect Bay Road approach. There is no left turn lane for vehicles turning onto Prospect Bay Road and this may cause some friction and delays for through traffic, but we suspect the gravel shoulder

and Legion driveway are often used to pass vehicles queued to turn left. A left-turn warrant analysis was undertaken to determine whether the proportion of left turn volumes vs opposing volumes would operationally justify the need for a left turn. While Baseline volumes do not currently meet the threshold, we note that future travel demands described in Section 5 suggest the need for a left turn by the 2045 horizon.

Intersection - Prospect Road and Prospect Bay Road (#101)

Scenario - SQ 2045 Mitigation

	AM Peak Hour	PM Peak Hour
Advancing Volume (V_a)	325	426
Opposing Volume (V_o)	209	190
Left Turns in V_a	180	244
% Left Turns in V_a	55.38%	57.28%

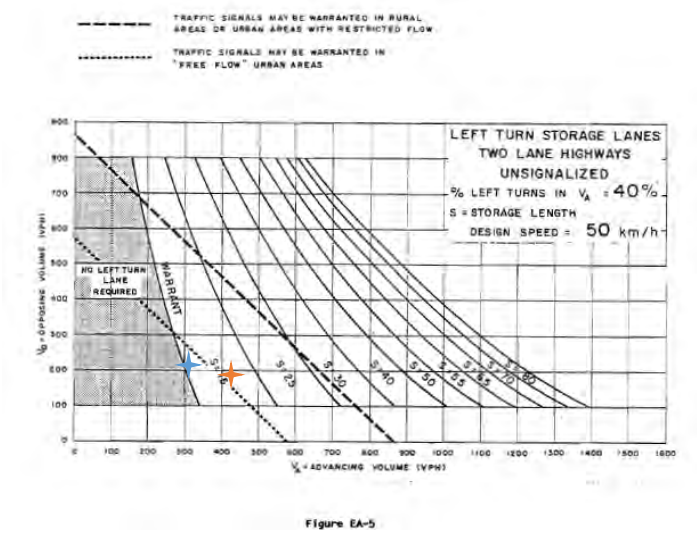


Figure 3-3 Left Turn Warrant - Prospect Road & Prospect Bay

Intersection reconfiguration should be considered to remove or realign the right turn slip lane to improve speed compliance and safety. Depending on property ownership, topography, and available sight distance, there may also be an opportunity to realign Prospect Bay Road to relocate the T-intersection 30-50m westward to improve the overall geometry.

A signal warrant was also prepared for this intersection, summarized in Appendix F, finding that signalization would be not justified based on the current and estimated future vehicular volumes.

3.1.2 Intersection 102 (Prospect Road & Terence Bay Road)

Figure 3-4: Prospect Rd. & Terence Bay Road Intersection

This T-intersection is under two-way stop control with a stop sign on the Terence Bay Road approach. Both roads have two lanes and Prospect Road was recently widened through the intersection to add a westbound left turn lane. All approaches have paved shoulders, and the westbound approach has guiderails on both sides.

We are not aware of any operational or safety concerns, so no improvements are recommended at this time.

3.1.3 Intersection 103 (Prospect Road & Brookside Road)

Figure 3-5: Prospect Rd. & Brookside Road Intersection

This is a non-standard T-intersection under two-way stop control. The following characteristics were noted.

- The driveway to the adjacent Guardian Drugs and Medical Center forms a fourth intersection leg opposite the Brookside Road approach; both are stop-controlled.
- Brookside Road intersects Prospect Road at a significant angle; there is a short curve on the intersection approach alleviates this skew somewhat.
- Both Prospect Road approaches have left turn lanes. The Brookside Road approach has a dedicated right turn lane, the geometry of which permits higher than desired speeds. The driveway approach has a shared egress lane.
- There is a Prospect Road pedestrian crossing on the south leg of the intersection. It is marked with signs and pavement markings, and it has RA-5 pedestrian-activated overhead flashing beacons. There are no sidewalks or pedestrian routes on either side of the road, other than a gravel path that connects to the Guardian Drugs parking lot.

- There is poor access management for the Holt's General Store property which also includes a large bank of Canada Post mailboxes. It abuts the south and east legs of the intersection and the store's paved parking areas extend to the asphalt roadways along most of the property frontage on both Prospect Road and Brookside Road. This represents a significant shortcutting opportunity and a safety concern for legitimate users of the parking lot (i.e. store customers and people picking up their mail). The shortcut route would be especially attractive for northbound right turning drivers.

There are several intersection changes/improvements that could be considered to alleviate the concerns mentioned above.

- Proper pedestrian connections to both ends of the sidewalk.
- Reconfiguration of the General Store site to incorporate appropriately sized driveways , designated parking for the store and mailboxes, a parking layout that discourages shortcutting, and improved pedestrian access.
- A signal warrant analysis (attached in Appendix F) suggests that this intersection will warrant signalization by the 2045 horizon. Signalization could, however, be considered on a more accelerated timeline to address some of the operational and safety concerns outlined herein and improve conditions for outbound movements from Brookside Road.
- Realignment of Brookside Road southward, to meet Prospect Road at a less acute angle is hampered by the following conditions and is not recommended:
    - Realignment would incur significant property impacts on the Holt's General Store and would create an offset intersection relative to the Hatchet Lake Medical Centre driveway.
    - Several power and telecommunications pole on the south-east corner of the intersection, adjacent the Canada Post boxes hampers realignment.
    - The Medical Centre property on the west side of Prospect Road, and the Toybox Automotive property on the east side of Brookside Road are at a higher elevation relative to a realigned intersection – realignment would result in steep driveway grades and sub-optimal site circulation.

3.1.4 Intersection 104 (Prospect Road & Club Road)

Figure 3-6: Prospect Rd. & Club Road Intersection

This T-intersection operates under two-way stop control with a stop sign on the minor road for left and right turns. There is a dedicated westbound left-turn lane provided on Prospect Rd. featuring turn arrow paint markings. On the west side, a painted median is included at the intersection to align the through traffic movements with the receiving lane. Several driveways connect to the main road before and after this intersection.

Club Road intersects Prospect Rd. on a horizontal curve. It seems that the primary configuration of this intersection has changed, as there is a slip lane blocked by a guardrail before connecting to Prospect Rd., now serving as an access road for two houses. No sign is detected before the division of this slip lane from Club Road, which could be confusing for unfamiliar drivers.

3.1.5 Intersection 105 (Prospect Road & Mills Drive)

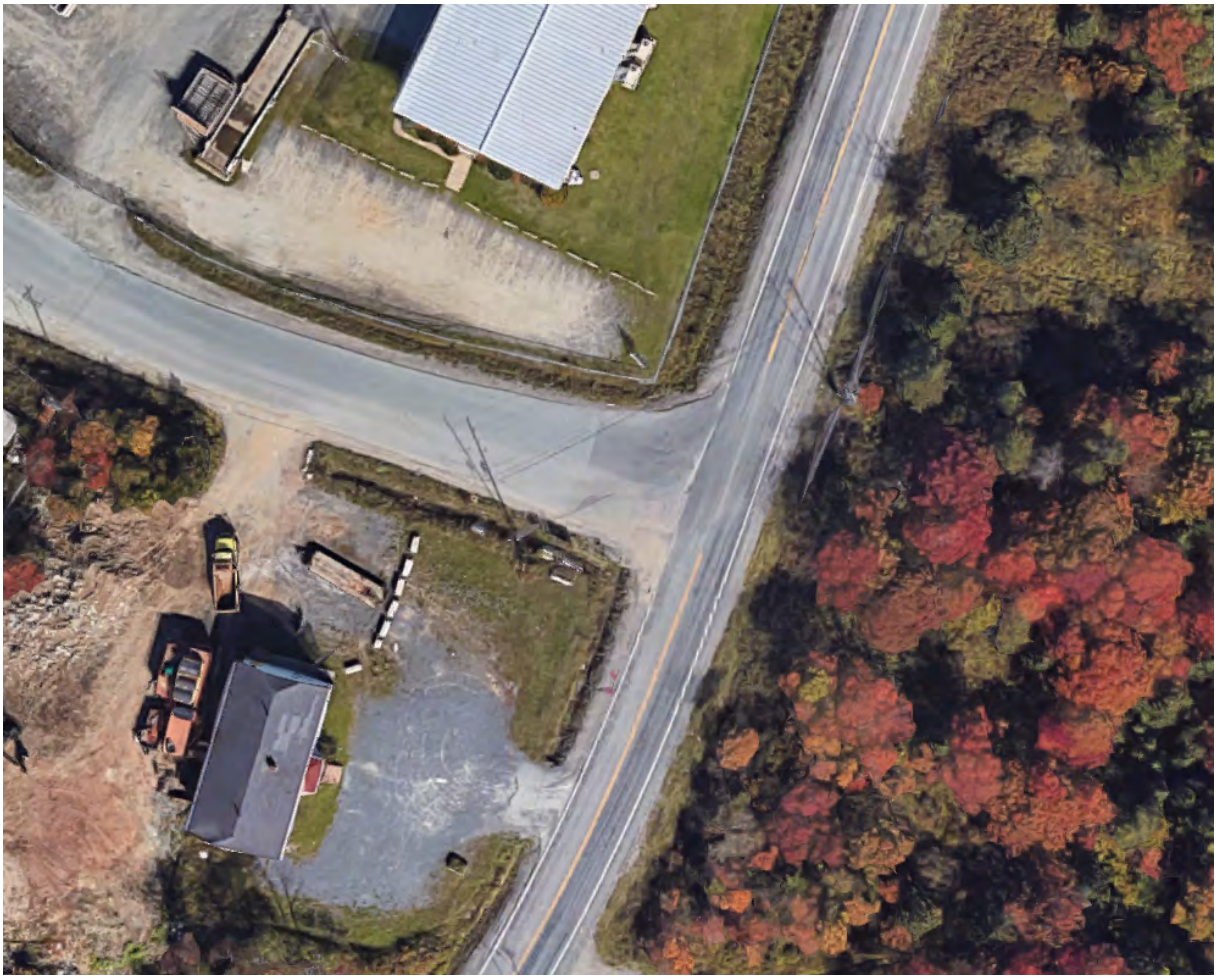


Figure 3-7: Prospect Rd. & Mills Drive Intersection

This T-intersection operates under two-way stop control, with a stop sign on the Mills Dr. approach. Mills Dr. is a two-way and two-lane road providing access to a variety of industrial businesses and intersects Prospect Rd. just north of a horizontal curve, limiting sightlines to the south. Mills Dr. has a very large asphalt width of approximately 9m, which is likely to accommodate the large heavy vehicles that service the businesses.

In general, the intersection configuration could be improved to provide a dedicated southbound right turn lane, which would reduce the delays for southbound through movements. Adding pavement markings to include a center line and stop bar on Mills Dr. would also help delineate the traffic movements. Removal of vegetation at the southern corner of the property at Civic 739 would help to improve the sight distance to the south along the horizontal curve.

There is anecdotal concern about heavy trucks slowly executing outbound-left movements against higher and faster flows on Prospect Road. The horizontal and vertical curves north and south of Mills Drive shorten sight distances and present a hazard.

A signal warrant analysis, included in Appendix F, indicates that signalization is not supported by current vehicular volumes, but would be justified by the 2045 horizon year analyzed in Section 5. We note that such a signal could be semi-actuated, such that the minor Mills Drive approach would only receive a green phase upon the presence of approaching vehicles. The intersection upgrade would include the installation of loop detectors on the Mills Drive approach.

3.1.6 Intersection 107 (Prospect Road & Ragged Lake Boulevard)

Figure 3-8: Prospect Rd. & Ragged Lake Boulevard Intersection

The is a two-way stop-controlled T-intersection with a stop sign on the westbound approach. Ragged Lake Boulevard has a two-lane configuration, featuring a vegetated median and lanes in excess of 7m wide. There is a dedicated left-turn lane on the northbound approach of Prospect Rd., as well as a right-turn slip lane on the southbound

approach. Painted directional arrows are provided on the northbound and southbound turn lanes on Prospect Rd.

Although the intersection is located on a horizontal tangent, it is also located at the crest of a vertical curve in Prospect Rd. to the north. This reduces the sight distance for vehicles on Ragged Lake Boulevard. Although there is no painted stop bar, the stop sign on Ragged Lake Boulevard is set back very far from the edge of Prospect Rd. This causes driver sightlines to be partially obscured by the Business Park sign to the north, as well as vegetation to the south. Vehicles are required to roll forward past the stop sign to achieve suitable visibility to the north and south. An improvement at this intersection would be to relocate the stop sign closer to Prospect Rd. and provide a painted stop bar.

Another consideration would be to assess traffic volumes for providing a dedicated eastbound left turn lane. With the very wide lane widths, there is an opportunity to divide the space into two lanes without changes to the curb lines. Vehicle turning movements would need to be confirmed prior to implementing any new lane paint markings.

3.1.7 Intersection 108 (Prospect Road & Trunk 3)

Figure 3-9: Prospect Rd. & Trunk 3 Intersection

This is a signalized T-intersection is located on the outside of a horizontal curve in SMD Rd. Prospect Rd. has two eastbound left-turn lanes at the intersection, as well as a long right turn slip lane onto SMB Rd.

SMB Rd. includes two northbound through lanes, and a northbound left-turn lane at the intersection. The southbound approach has a single through lane, and right turn slip lane onto Prospect Rd. The southbound approach also includes a painted median to align the through movements with the receiving lane.

The intersection is equipped with side-mounted and overhead traffic signals for all approaches. The intersection also has pedestrian crossings located on the south and west legs, complete with dedicated signal heads and pedestrian push buttons. Despite the pedestrian crossings, there does not appear to be any formal pedestrian facilities adjacent to this location, meaning pedestrians must use the shoulder of the roadway to reach these crossings. New trails or sidewalks around this intersection would provide a safer pathway for pedestrians. Any links could connect into an AT network of some kind to avoid any “dead end” pedestrian routes.

3.1.8 Intersection 109 (St. Margarets Bay Road & Highway 103 Off-ramp/On-ramp)

Figure 3-10: SMB Rd. & Hwy 103 Off-ramp/On-ramp Intersection

This four-leg signalized intersection is created by SMB Rd. and the Highway 103 eastbound on and off ramps. The southbound approach includes two through lanes, and a dedicated left-turn lane. The northbound approach has two through lanes, and a right turn slip lane that merges on the Highway 103 on-ramp. This leg also includes a painted median to help align traffic lanes through the intersection. The eastbound approach (Highway 103 off-ramp) includes a left/through lane, and a dedicated right turn lane at the intersection. There was previously an eastbound right turn slip lane onto SMB Rd., but it has been blocked off to traffic. The east leg of the intersection acts as a receiving lane only for vehicles entering the Highway 103 on-ramp. The intersection has pedestrian crossings located on the east and south legs, complete with pedestrian signal heads and push buttons. The east and west legs of the intersection are slightly offset from one another, meaning the path of travel for eastbound through movements is not straight through the intersection. This intersection could be improved by realigning the east leg (Highway 103 on-ramp) sightly to the south to remove the offset and improve vehicle movements from the west. Another improvement would be to develop formal pedestrian facilities that connect into a greater AT network, which would improve the access to the crosswalks at this intersection.

3.1.9 Intersection 110 (Lakelands Boulevard & St. Margarets Bay Road)

Figure 3-11: Lakelands Boulevard & SMB Rd. Intersection

This is a four-arm signal controlled intersection.

SMB Rd.is a two-way street with two lanes in each direction, with added left-turn and right-turn lanes at the intersection, making it four lanes for approaching and two lanes for leaving in both sides at the intersection. Lakelands Boulevard is a two-way divided boulevard with two lanes in each direction, with slip lanes at the intersection from southbound Lakelands Boulevard to westbound SMB Rd. and from westbound SMB Rd. to northbound Lakelands Boulevard.

The south side of the intersection connects to the on-ramp for Hwy 103 and a slip lane that connects eastbound SMB Rd. to the on-ramp. The ramp is a one-way double lane that merges into a single lane approaching the highway.

There are stop lines and right-turn and left-turn marks for the southbound Lakelands Boulevard arm. There is a right-turn mark on the slip lane connecting southbound Lakelands Boulevard to westbound SMB Rd.

Left-turn, right-turn, and stop line marks are also present on the left-turn and right-turn lanes of SMB Rd.

The intersection is equipped with side-mounted and overhead traffic signals with direction signs on top for all arms. This is a controlled-access interchange, with no allowances for pedestrian circulation.

3.1.10 Intersection 111 (Lakelands Boulevard. & Steele/Tim Hortons Access)

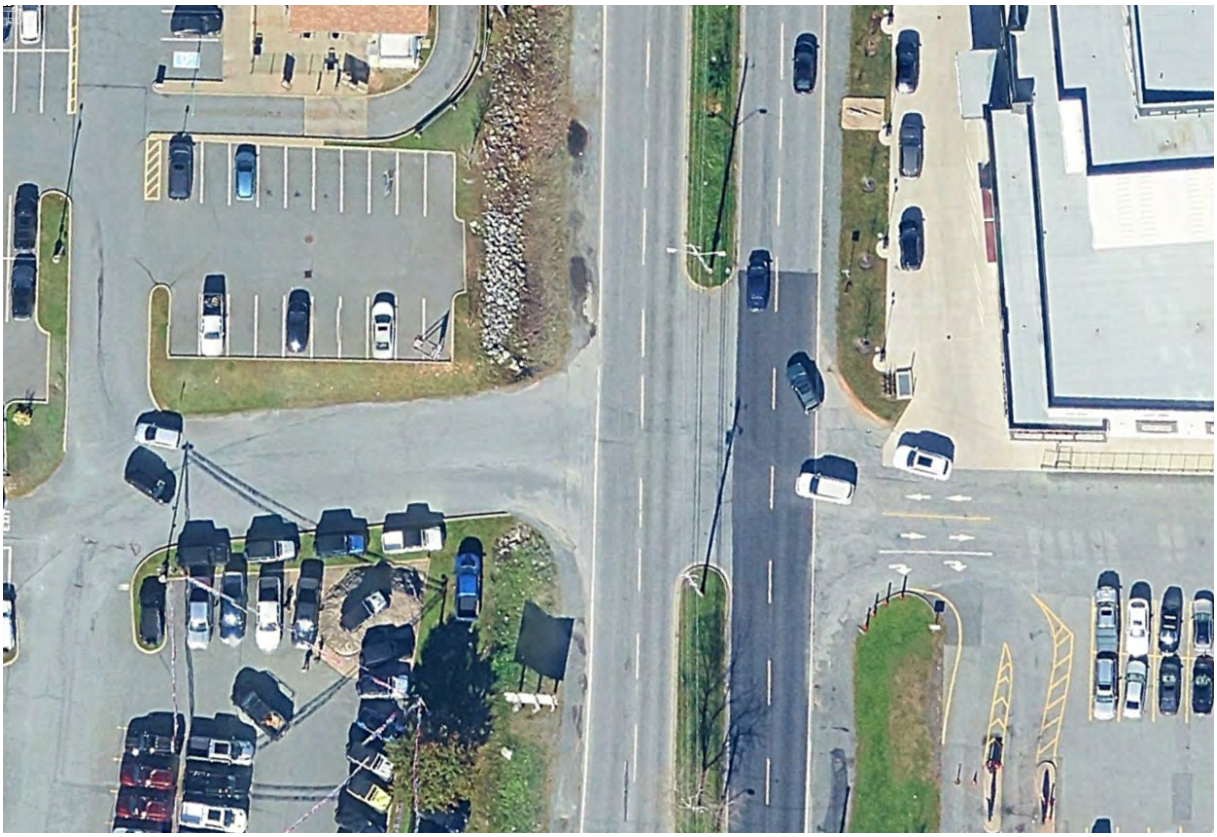


Figure 3-12: Lakelands Boulevard & Steele/Tim Hortons Access Intersection

This is an uncontrolled four-leg intersection. Lakelands Boulevard, a two-lane boulevard, is the major flow, with the minor flows on commercial driveways

The driveways do not have stop signs or stop lines. The east driveway has pavement markings and arrows identifying the circulation directions and guiding entering vehicles to the Tim Hortons drive-though lanes. The outbound-right (WBR) exit lane is complicated by the driveway access to the adjacent hotel and restaurant. Similarly, the east side of Lakelands Boulevards has a sub-optimal bus layby and gravel shoulder that leads to a poorly defined northbound-right movement into the Tim Hortons site.

We note that this intersection could benefit from several geometric improvements:

- Formalize the layby on the east side of Lakelands Boulevard with a curb, terminating well ahead of the Tim Hortons driveway.
- Reconfigure the dealership driveway on the west side of Lakelands Boulevard to align with the Tim Hortons driveway.
- Add stop bars on both driveways.
- Formalize the north leg of the intersection with a painted southbound-left pocket lane.

Figure 3-13 Intersection 111 Conceptual Reconfiguration

3.1.11 Intersection 112 (Dunbrack St. & Albert Walker Drive & Walter Havill Drive)

Figure 3-14: Dunbrack St. & Albert Walker Drive & Walter Havill Drive Intersection

This is a four-leg signalized intersection. Dunbrack St. is a two-way divided road with two lanes in each direction, with an added left-turn lane at the intersection (three approaching lanes and two receiving lanes on each side of the intersection). Albert Walker Dr is a two-way road with a single lane westbound and two lanes eastbound. Walter Havill Dr is a two-way road with two lanes in each direction. There are four right turn slip lanes on each approach.

There are pedestrian crossings on all four approaches and all slip lanes. Left-turn arrows are included on the left-turn lanes approaching the intersection. Yield signs are present at the slip lanes where they connect to the main lanes.

The intersection is equipped with side-mounted and overhead traffic signals with direction signs on top for all arms. Pedestrian signals and signs are provided for pedestrian crossings.

3.1.12 Intersection 113 (Route 306 & Dunbrack St.)

Figure 3-15: Route 306 & Dunbrack St. Intersection

Dunbrack St. is a divided two-way street with two lanes in each direction and intersects Old Sambro Road on a horizontal curve. Old Sambro Road is a two-way street; the northbound approach has two lanes in each direction, and the southbound approach has a single lane in each direction. This signalized T-intersection includes pedestrian crossings and stop lines for all directions. There is a westbound slip lane with a raised island for right turn movements from Dunbrack St.- onto the Old Sambro Road.

Directional signs at the intersection guide drivers to choose the correct path. There are side and top road signals for each arm and pedestrian signals for each pedestrian crossing. Chevron signs are present at the slip lane connecting to Old Sambro Road. Left-turn markings are present on the left lanes of the south and west arms.

3.1.13 Intersection 200 (St. Margarets Bay Road & Albert Walker Drive)

Figure 3-16: SMB Rd. & Albert Walker Drive Intersection

This signalized T-intersection is located on a tangent section of SMB Rd. To the west, the profile of SMB Rd. lowers into a vertical curve, reducing the sight distance in that direction for the northbound right movements. SMB Rd. eastbound includes one through lane and a right turn slip lane, while the westbound approach has a dedicated left-turn lane and one through lane. SMB Rd. also includes bike lanes in both directions. Albert Walker Dr has a left-turn lane, and a slip lane for right turn movements onto SMB Rd. There are pedestrian crossings provided on all intersection legs and on the slip lanes.

3.1.14 Intersections 203 & 204 (Timberlea Village Parkway & Otter Lake Drive & Highway 103)

Figure 3-17: Timberlea Village Parkway & Otter Lake Drive & Highway 103 Intersection

The Timberlea Village Parkway overpasses the Fishermen's Memorial Highway via a bridge. The highway bounds are connected to this road by two ramps, with ramp-road intersections located on both sides of the bridge. The ramps are single-lane, one-way roads. Timberlea Village Parkway is a two-way street with a single lane in each direction.

At the southern intersection, the off-ramp has a stop line, and Timberlea Village Parkway has a left-turn lane on the southbound arm and a wider marked median on the northbound arm. Since the ramps are one-way, left turns from Timberlea Village Parkway (northbound) and right turns from Timberlea Village Parkway (southbound) are not possible; other maneuvers are permitted. There are stop signs at the ramp-off entrance and "Do Not Enter" signs on both sides of the ramp-off at the intersection.

At the northern intersection, the off-ramp connects via a slip lane to Timberlea Village Parkway (northbound) and also with a stop line to the intersection. The northbound Timberlea Village Parkway has a left-turn lane with marked arrows, and the southbound Timberlea Village Parkway has a wider marked median. There are stop signs at the ramp-off entrance and "Do Not Enter" signs on both sides of this ramp at the intersection. A chevron and divided road signs are located on the ramp-off slip lane's triangular island.

3.1.15 Intersection 216 (Dunbrack St. & Osborne Street)

Figure 3-18: Dunbrack St. & Osborne Street Intersection

This is a signalized T-intersection with two slip lanes facilitating northbound and westbound right turns between Dunbrack St. and Osborne.

Dunbrack St. is a two-way divided road with two lanes in each direction. The southbound approach has a left-turn lane at the intersection. The intersection is equipped with side-mounted and overhead traffic signals, as well as pedestrian crossings with dedicated signals on all legs. There are yield signs for the slip lanes before they enter the main road. Stop lines for entering lanes and left-turn arrows on the left-turn lane of southbound Dunbrack St. can be seen on the pavement. Raised islands guide the traffic flow into slip lanes at the intersection. "Keep right" traffic signs and chevron signs are located at the start of the median. Overall, the intersection configuration appears to be reasonable, and the right-turn slip lanes facilitate faster traffic flow.

3.1.16 Intersection 217 (Dunbrack St. & Peter Saulnier Driveive)

Figure 3-19: Dunbrack St. & Peter Saulnier Drive Intersection

This is a signalized T-intersection includes pedestrian crossings on all approaches. Dunbrack St. is a divided, two-way road with two lanes in each direction. The southbound Dunbrack St. is equipped with a left-turn lane at the intersection. Peter Saulnier Drive is also a two-way road with two lanes in each direction. There are stop lines are provided at the intersection and left-turn arrows on the left-turn lane of Dunbrack St.

Additionally, right-turn and left-turn arrows are present on Peter Saulnier Drive (westbound) on the pavement. The intersection is equipped with side-mounted and overhead traffic signals, as well as pedestrian signals for all legs. "Keep right" traffic signs and chevron signs are located at the start of the median at the intersection. The general configuration of the intersection is acceptable, and removing some trees on the southeast corner could improve the visibility of stopped cars behind the stop line on Peter Saulnier Drive, thereby increasing the safety level.

3.1.17 Intersection 218 (Dunbrack St. & Cowie Hill Road)

Figure 3-20: Dunbrack St. & Cowie Hill Road Intersection

This is a signalized four-leg intersection with pedestrian crossings for all approaches. Dunbrack St. is a divided two-way street with two lanes in each direction. Left-turn lanes are added to the north and south legs entering the intersection.

Cowie Hill Road is a two-way street with a single lane in each direction. Two slip lanes connect Cowie Hill Road-west to Dunbrack St.-north and Dunbrack St.-south to Cowie Hill Road-west, facilitating right turns in these directions without stopping.

The intersection is equipped with side and top traffic signals and pedestrian signals for all approaches. The left-turn lanes on northbound and southbound approaches are marked on the pavement. Pedestrian crossing markings are present for all legs and slip lanes, excluding the southbound right turn slip lane connecting Dunbrack St. to Cowie Hill Road. The west leg lacks any pavement markings.

3.2 Existing Land Use

Review of the existing land use and known development plans reveal the potential for significant activity generation along the Prospect Road corridor, with major growth over the next few decades. As illustrated on Figure 3-21, we note the potential of the following consolidated areas generating significant travel demand in the future:

- Halifax Exhibition Centre (HEC).
- Ragged Lake Industrial Park.
- Mills Drive Industries.

The Study future analysis scenarios incorporate these developments to capture their impacts on the existing mobility networks and to inform the requirement for infrastructure improvements. The future analysis also incorporates the future regional population and employment growth included in the JESS model.

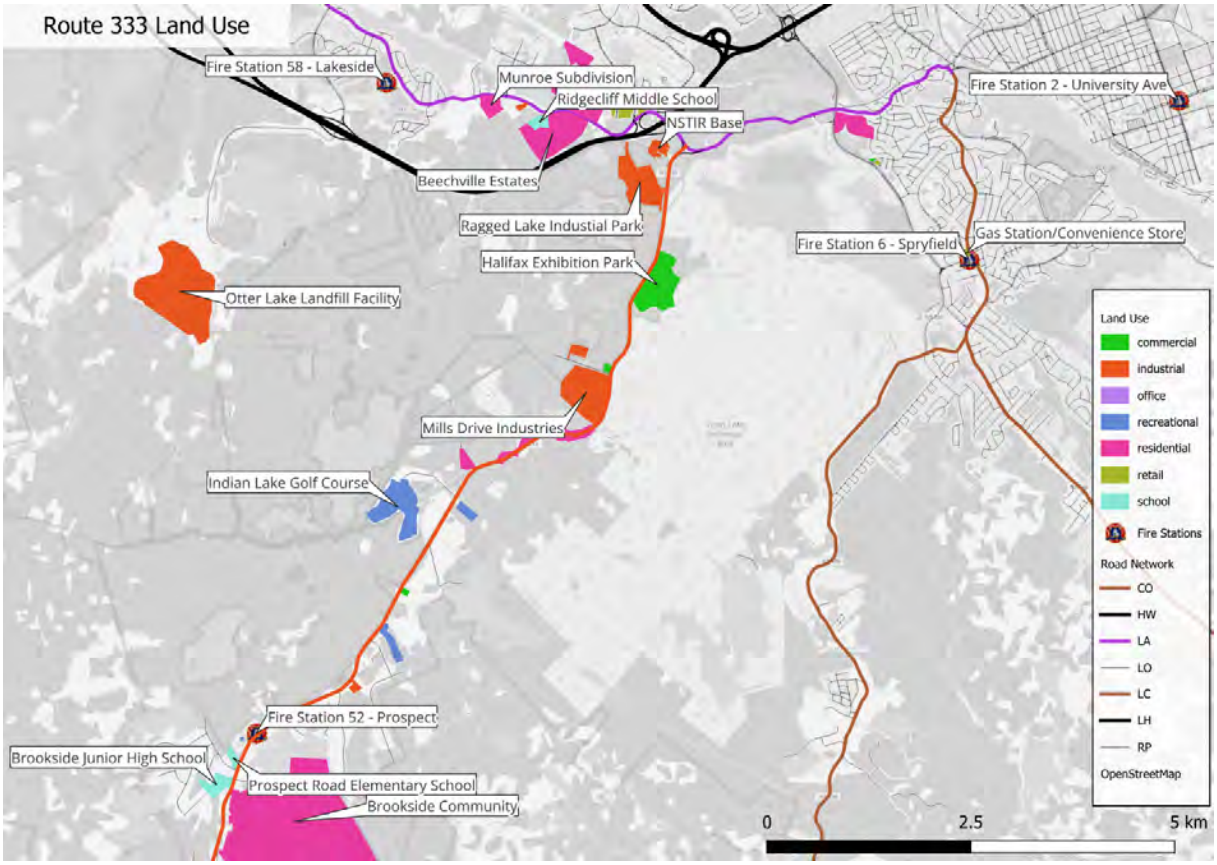


Figure 3-21: Existing Developments Along Prospect Rd.

3.2.1 Ragged Lake Industrial Park Expansion

The RLIP lands cover the area bound by Otter Lake, Prospect Road and Highway 103, generally north of Evergreen Place (illustrated on Figure 3-22). The entire Park covers a gross total area of approximately 1,364 acres (550 Hectares). CBCL's 2021 Land Suitability Analysis of the area noted numerous wetlands, watercourses and ecologically sensitive areas in addition to the lake system, which would reduce the actual developable area. The 2015 concept layout illustrated below provided the basis for the road network evaluated in Section 5, with the understanding that future work will refine the block structure, while the alignments investigated for an Exit 3 connection could modify the logic of the internal road network. HRM is embarking on a comprehensive study of the Ragged Lake area that will refine the development scenarios and internal mobility and circulation networks, and build upon the major corridor analysis presented herein.

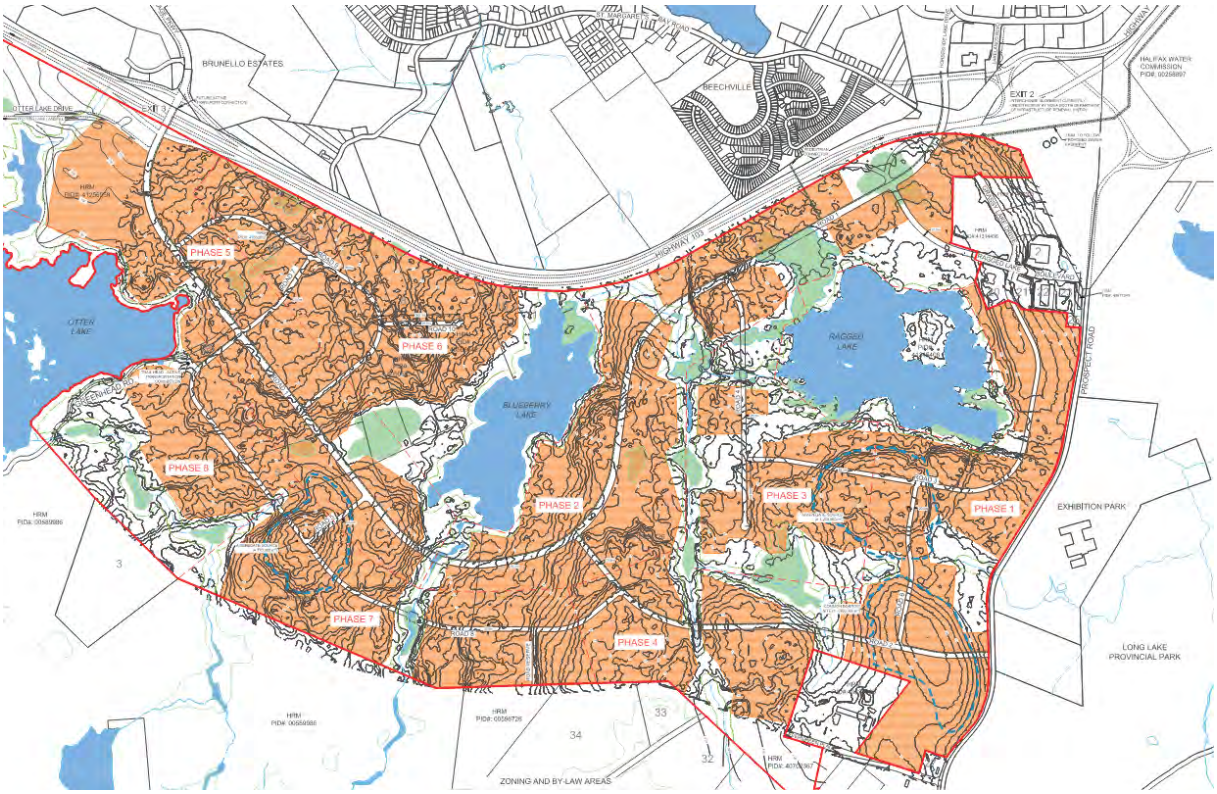


Figure 3-22 Ragged Lake Industrial Park Concept

3.2.2 Halifax Exhibition Centre Redevelopment

The HEC proposes a full redevelopment of the site with up to 5,867 residential units and 4,000 square metres of ground floor commercial (the development plan is illustrated on Figure 3-23). This concept was incorporated into the traffic analysis presented in Section 5, although we note the potential for future changes to the overall development concept, development statistics, and resulting future travel demands.

Figure 3-23 HEC Development Concept

3.3 Collision Analysis

3.3.1 Collision Data

HRM traffic collision data from the past five years (2019-2024) was used to conduct this collision analysis, as it contains a robust level of attributes associated with collision records, including the following factors:

- Date.
- Location/Address.
- Road Configuration.
- Collision Configuration.
- Intersection vs Non-Intersection.
- Natural and Artificial Lighting Conditions.
- Weather Conditions.
- Road Surface Conditions (weather and material).
- Road Geometry.

811 collisions were identified in the study area over the analysis period. Figure 3-24 and Figure 3-25 display the discrete collision location points in red as well as an aggregated heat map of high-collision locations. Although the count of collisions appears high, it should be noted that the study area consists of long stretches of roadway, including Prospect Rd. (16 km) and Route 306 (15.5 km) which extend south into more rural environments. With a large, expanded region containing both urban and rural areas, a higher count of collisions throughout the network is reasonable over the study period.

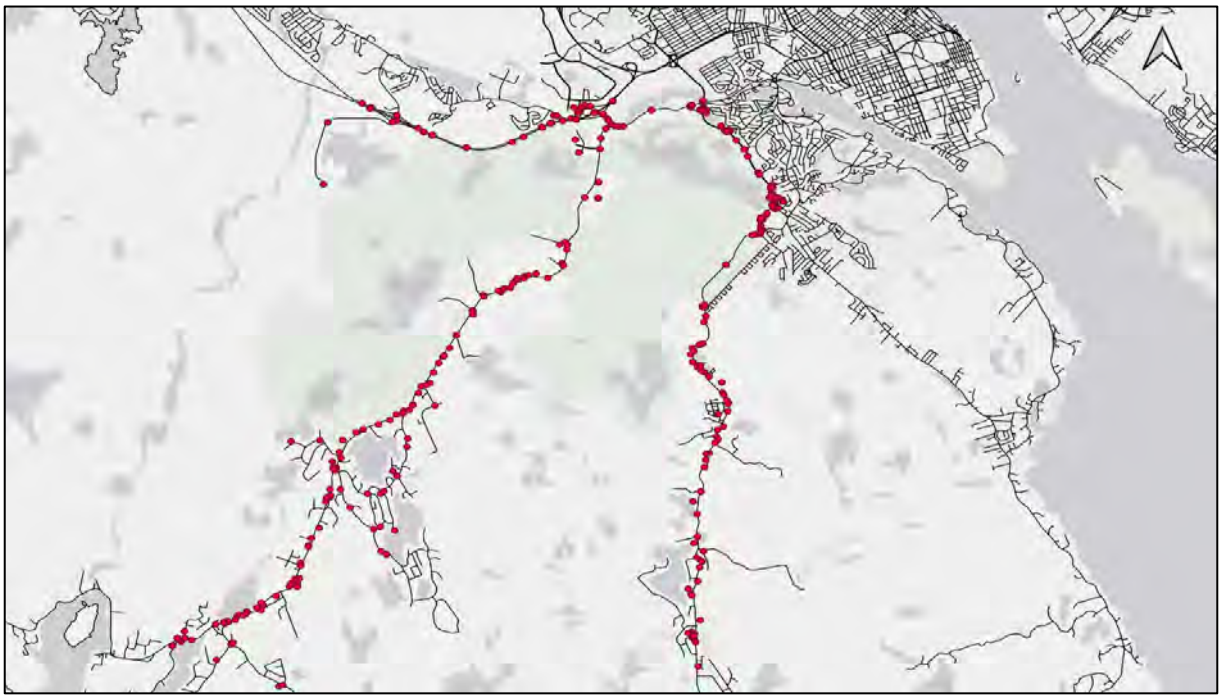


Figure 3-24 Collision Data

Figure 3-25 Collision Data Heat Map

As indicated by the heat map, most collision clusters are located near the higher volume intersections in the study area.

3.3.2 Collision Frequency

Historical collision data for the study area, collected between January 2019 and June 2024, identified a total of 811 collisions over the period, with an average of 145 collisions per year, with a generally stable trend. Approximately 60% of collisions occurred at non-intersection locations throughout the study area. The breakdown of collision by year shows a relatively consistent count ranging between 137 and 154 collisions annually over the study period.

Table 3-1: Annual Collision Summary

Road Configuration	2019	2020	2021	2022	2023	2024	Total
Non-intersection	83	84	75	87	100	57	486
Intersection - two or more public roads	57	56	62	67	53	30	325
Total	**140**	**140**	**137**	**154**	**153**	**87**	**811**

This analysis seeks to identify collision trends through the study area by identifying potential contributing factors like road geometry, weather conditions, light conditions, etc.

3.3.3 Collision Configuration

Analysis of collision by type and movement show that 59% (477) of collisions involved multiple vehicles, with most in rear-end collision configuration. Of the remaining sing-vehicle collisions, most vehicles went off the road to the right, implying a curve in the road horizontal alignment to the left or swerve. Table 3-2 contains a summary of collision configuration data.

Table 3-2: Collision Configuration Summary

Row Labels	Count of COLLISION
Multiple vehicle - approaching sideswipe	12
Multiple vehicle - head on	19
Multiple vehicle - hit parked vehicle	22
Multiple vehicle - left turn across opposing traffic	20
Multiple vehicle - left turn against traffic	10
Multiple vehicle - left turn into traffic	8
Multiple vehicle - one crossing path of other to the left	68
Multiple vehicle - one crossing path of other to the right	20
Multiple vehicle - rear end	228
Multiple vehicle - right angle	23
Multiple vehicle - right turn, including turning conflicts	2
Multiple vehicle - same direction sideswipe	45
Single vehicle - hit a moving or stationary object on road surface	59
Single vehicle - off road to the left	84
Single vehicle - off road to the right	160
Single vehicle - rollover	8
(blank)	23
Total	**811**

Many of these collision configurations are associated with movements at or near intersection locations, or as vehicles make movements at residential driveway locations.

3.3.4 Environmental Conditions

Further review of the collision records suggests that environmental factors did not play significant roles during most collisions, as most (345) were recorded during both clear weather and daylight hours. Of the poor-weather related collisions, the majority still occurred during daylight hours as well. Figure 3-26 illustrates the light conditions in the study area, and Figure 3-27 displays the data distribution between the various weather conditions.

Figure 3-26 Lighting Conditions at Time of Collision

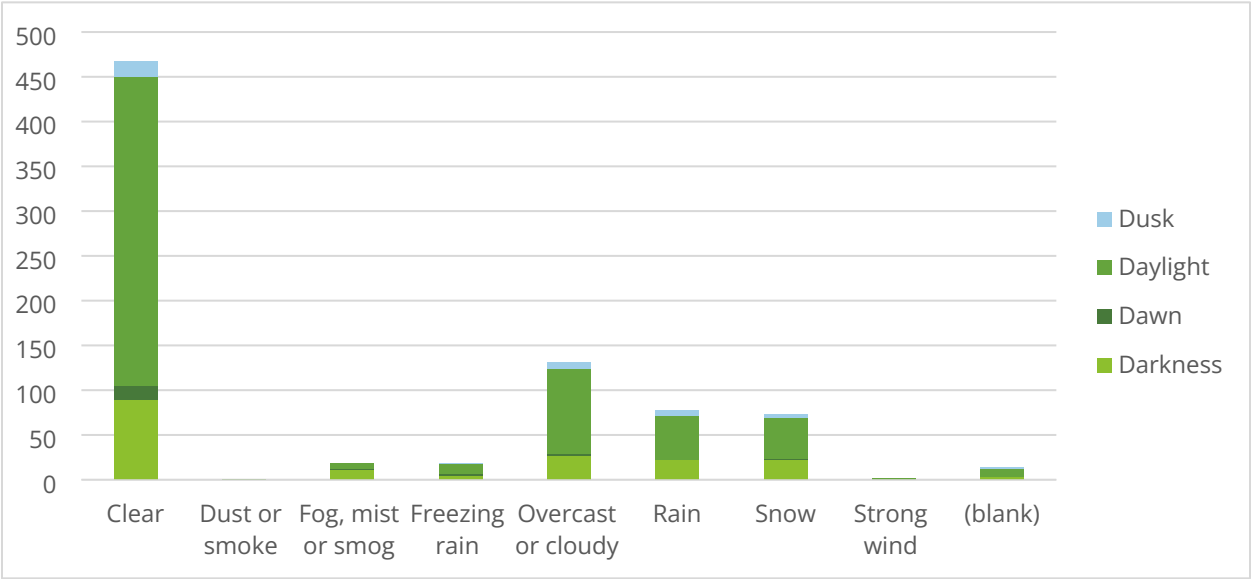


Figure 3-27 Collision Environmental Factors

3.3.5 Geometric Collisions Factors

Review of the collision data included the geometric design, including the road alignment and road grade to identify potential contribution to the collisions. The majority (73%) of collisions occurred on straight road segments, and the road grade was also identified as level in 72% of recorded collisions. Nearly 25% of collisions occurred on a sloping section of roadway, nearly half of which also coincided with a horizontal curve in the roadway. Figure 3-28 displays the breakdown of collisions and their vertical and horizontal geometry attributes. Figure 3-29 and Figure 3-30 display the locations of these characteristics throughout the network.

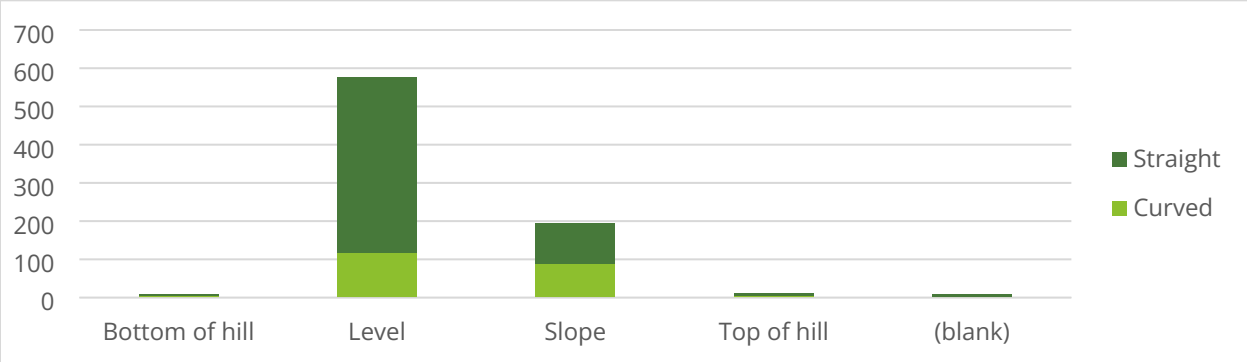


Figure 3-28 Collision Road Geometry Factors

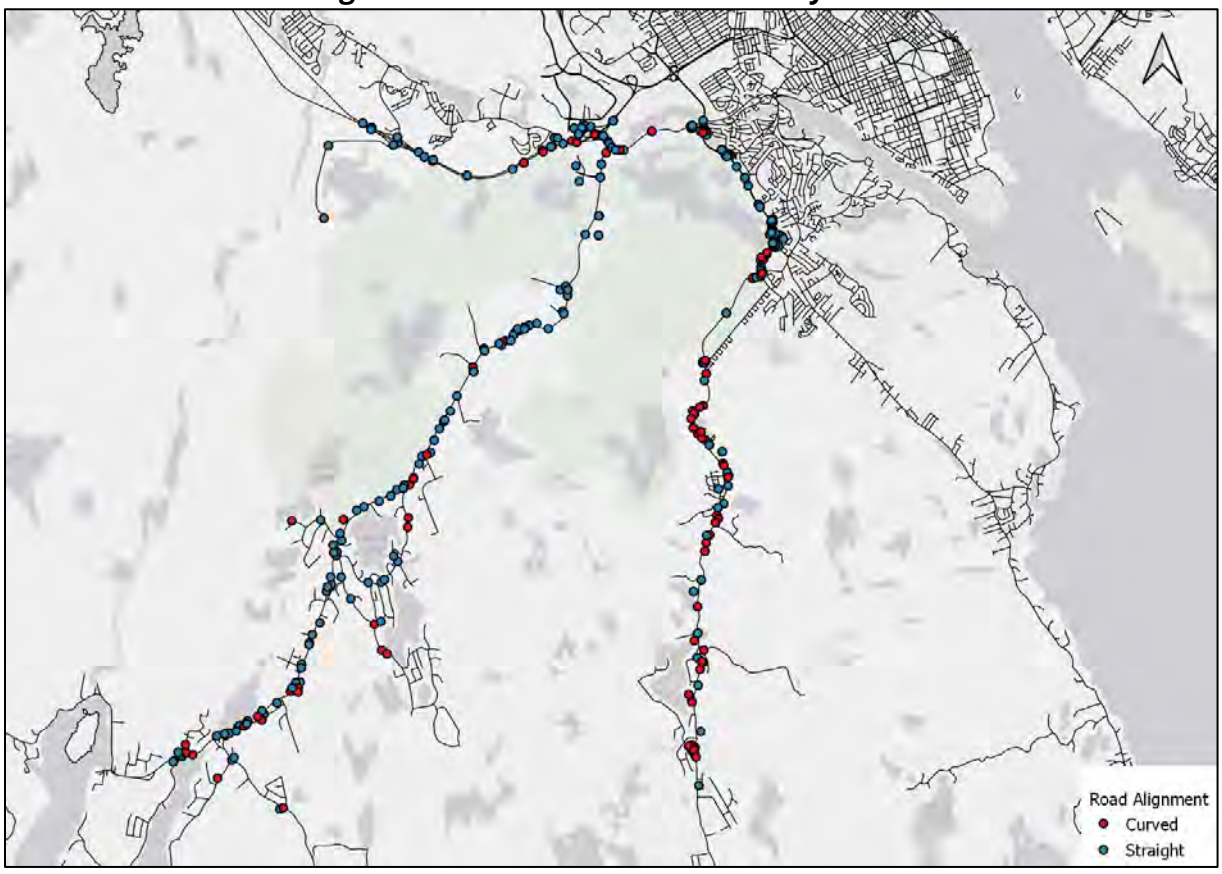


Figure 3-29 Collision Road Alignment

Figure 3-30 Collision Road Grade

In general, collisions located on curves appear to be more concentrated near the south of the study area away from the Halifax Peninsula as the road network takes on a more rural character. One particular area of note with respect to road geometry is Route 306 between Civic #653 and Civic #733. Through this section there is a large cluster of recorded collisions located through an existing horizontal curve with a sloping vertical alignment. Many of these collisions are rear-end configurations, suggesting traffic may be speeding through the section resulting in reduced stopping sight distances through the curves.

3.3.6 Conclusion

From this analysis, it appears that factors like weather, lighting and road geometry did not have major contributions to collision rates in the study area. Collision hot spots were identified primarily around the larger volume intersections/interchanges, with configurations that are generally associated with typical movements through the intersection, namely rear-ends and sideswipes during left turns. These are to be expected in urban regions, primarily resulting from human errors rather than roadway geometry or environmental characteristics. The overall collision rates at these intersections, reporting the yearly number of collisions per million vehicles entered, is low and consistent with

typical trend. Although the overall collision rates are relatively low, any collision that closes Route 333 results in a long detour of approximately 80 km, and a closure of Route 305 causes in a 40 km detour. These closures significantly impact drivers in terms of travel time and associated costs. With an average of 145 collisions/year over the past five years in the study area, and an expected increase in traffic volumes, the frequency of road closures and long detours is anticipated to rise as well. This underlines the study's focus on building more resilience into the transportation network through more connections and parallel corridors.

4 Traffic Impact Methodology

4.1 Analysis Approach

Our analysis approach includes establishing traffic flows for the baseline conditions based on new JESS ABM matrices and traffic counts data, forecasting future traffic flows, and conducting analysis for a combination of status quo and mitigation scenarios to establish anticipated impacts.

To best understand the impacts to traffic in the study area, a microsimulation model was built using the PTV VISSIM software. The model breaks down all traffic generated in a study area into smaller, more manageable Traffic Analysis Zones (TAZ), representative of key developments, communities and activity clusters. All traffic generated by these TAZ's enters and exits a digital representation of the study area's road network via representative access points. Trips between TAZ's are loaded onto the road network via Origin-Destination (O-D) matrices, that aggregate individual trips over a given analysis period. Through an iterative process, the model seeks optimal paths over the road network between each O-D pair based on initial travel times, assigns a portion of the total volume on the road network, simulates the movement of each vehicle and road user between TAZ of Origin and TAZ of Destination, and re-iterates the process with updated travel times. The process is repeated until the assignment process converges on an optimal solution; at this point the model is said to have achieved Dynamic User Equilibrium, whereby the optimal paths between each TAZ have been found. The simulation provided a visual representation of complex multi-modal circulation onto an aerial map, which illustrates the dynamics of traffic patterns, circulation, wayfinding, conflict points and obstacles.

We have developed a comprehensive modelling framework that includes various modelling and analysis tools at macro- and microscopic levels, which allows an examination of the impacts on the wider traffic circulation as well as on the operational performance of intersections. Figure 4-1 illustrates the modelling farmwork adopted for this study which mainly includes the following.

- Obtain updated JESS ABM outputs from Link NS in the form of subarea traversal matrices focused on the project study area. Model runs were completed by Link NS consultants in coordination with the project team.
- Build a high-fidelity VISSIM model of the Prospect Rd. study area; calibrate the model to intersection turning movement count data. Since the baseline road network does not include parallel routes, calibration efforts focused on the reproduction of correct Origin-Destination pairing.
- With the calibrated VISSIM model, evaluate Baseline conditions and report results.
- Develop input conditions for 2031 and 2045 Status Quo scenarios. Receive updated JESS ABM outputs from future models for the two horizon years.
- Extract 2031 and 2045 Status Quo subarea traversal OD matrices and add to the calibrated Baseline conditions VISSIM OD Matrices to derive future VISSIM matrices.

- Run VISSIM model under future Status Quo scenarios.
- Develop Mitigation Measures and Corridor Improvements, obtain updated JESS ABM outputs for 2031 and 2045 scenarios, that include full buildout of HRM's planned and approved density targets.
- Extract subarea traversal OD matrices under both future years for the Mitigation and Corridor Improvements scenarios.
- Update VISSIM model with new Mitigation and Corridor Improvements demand matrices.

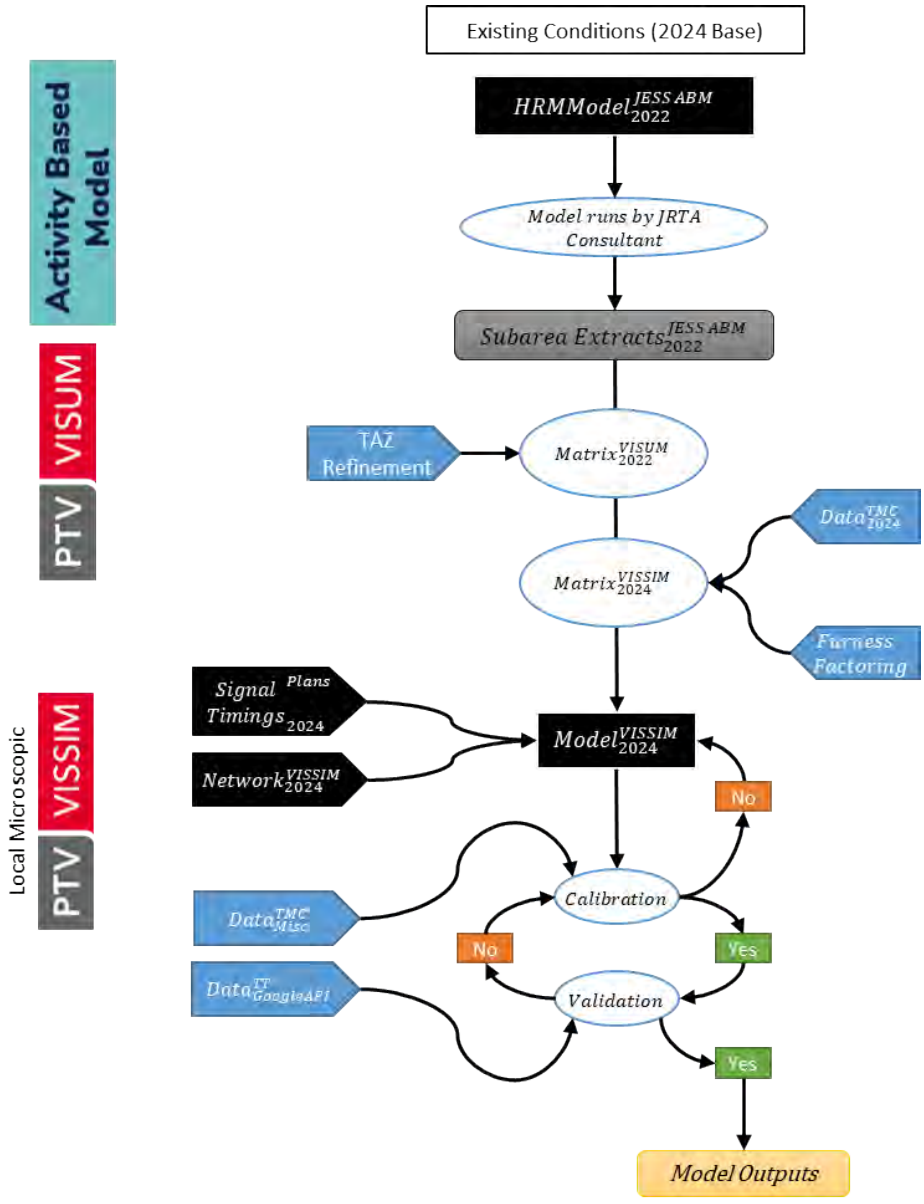


Figure 4-1: Traffic Modelling Framework - Baseline

4.2 Analysis Scenarios and Peak Hours

The transportation study covers the analysis years, scenarios and peak hours as summarized in Table 4-1. As shown, the proposed scenarios cover the Baseline year as well as an intermediate (2031) and ultimate (2045) future years. For each future scenario, two variants have been tested to allow impact assessment: a Status Quo scenario representing the future conditions considering the growth of the Baseline traffic; and Mitigation scenario reflecting the proposed interventions to improve the network. Furthermore, Corridor Improvements scenarios have also been tested to reflect the impacts of new connections between Prospect Rd., Hwy 103 Exit 3 and Route 306. Two peak hours were investigated, reflecting traffic during the weekday morning and evening typical conditions.

Table 4-1: Analysis Scenarios

Road Network	Travel Demand		
	Baseline	2031	2045
Baseline	AM / PM Peak Hour		
Status Quo (development roads)		AM / PM Peak Hour	AM / PM Peak Hour
Prospect Rd. Proposed Mitigations		AM / PM Peak Hour	AM / PM Peak Hour
Prospect Rd. Proposed Mitigations and Corridor Improvement Plans			AM / PM Peak Hour

4.3 Baseline Model Preparations

4.3.1 Baseline Network

As noted above, a microsimulation model was developed for the study area using the PTV VISSIM. The road network symbolizes the supply side of the transportation system, which is a representation of the roadways and road intersections as shown in Figure 4-2 and Figure 4-3. The end of each gateway road represents an origin or destination TAZ where the traffic flows are loaded to the transportation network.

The baseline model network is detailed and representative of the on-ground roadway network including the number of lanes, speed, allowed movements and conflict points. A sample of the detailed the model network representation is illustrated in Figure 4-4. It is to be noted that the current model includes provided signal timing plans from DPW and HRM.

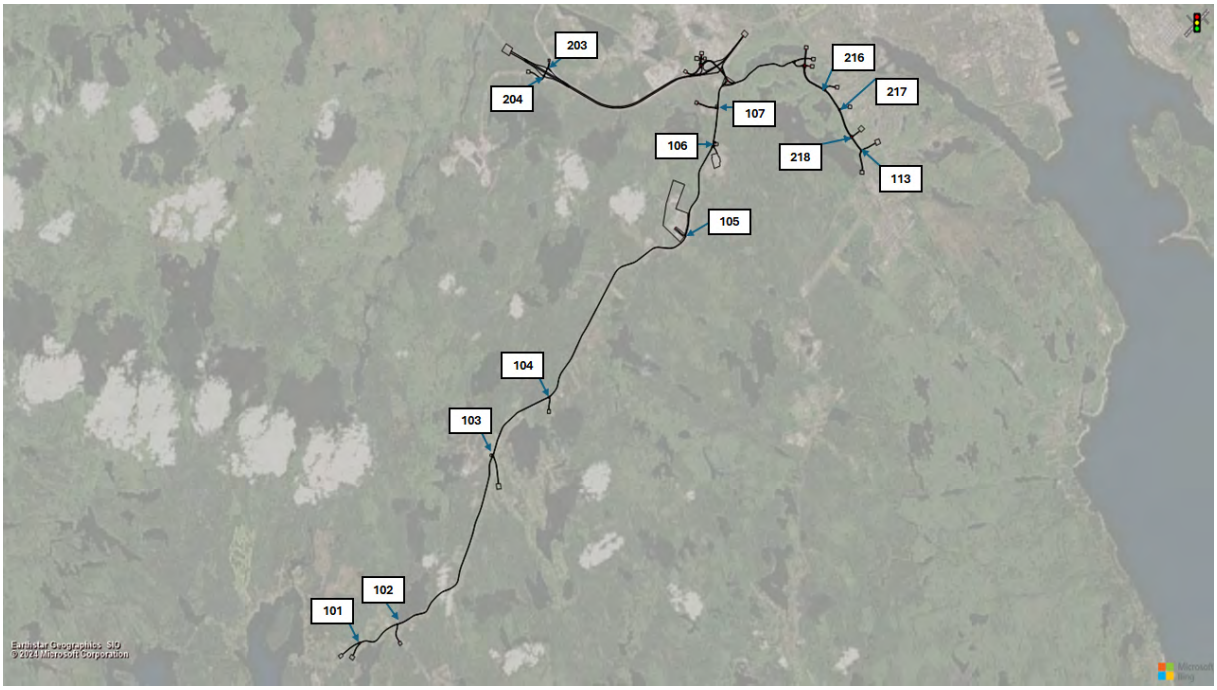


Figure 4-2: Model Network Overview

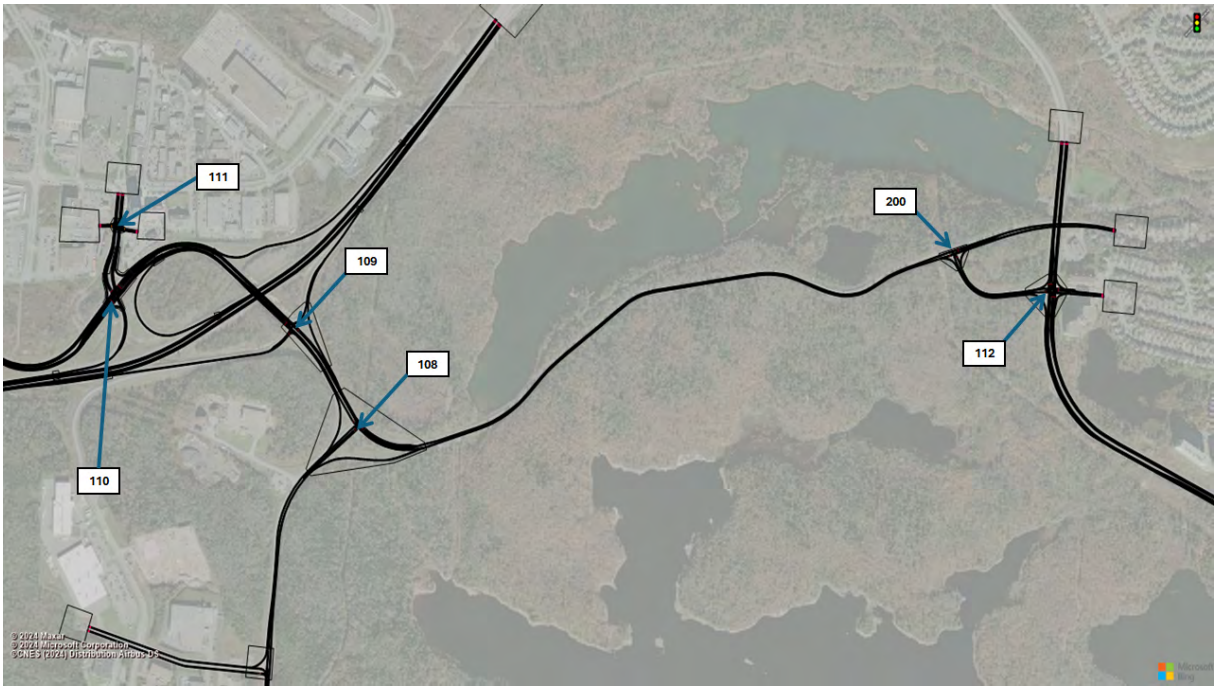


Figure 4-3: Model Network Key Intersections

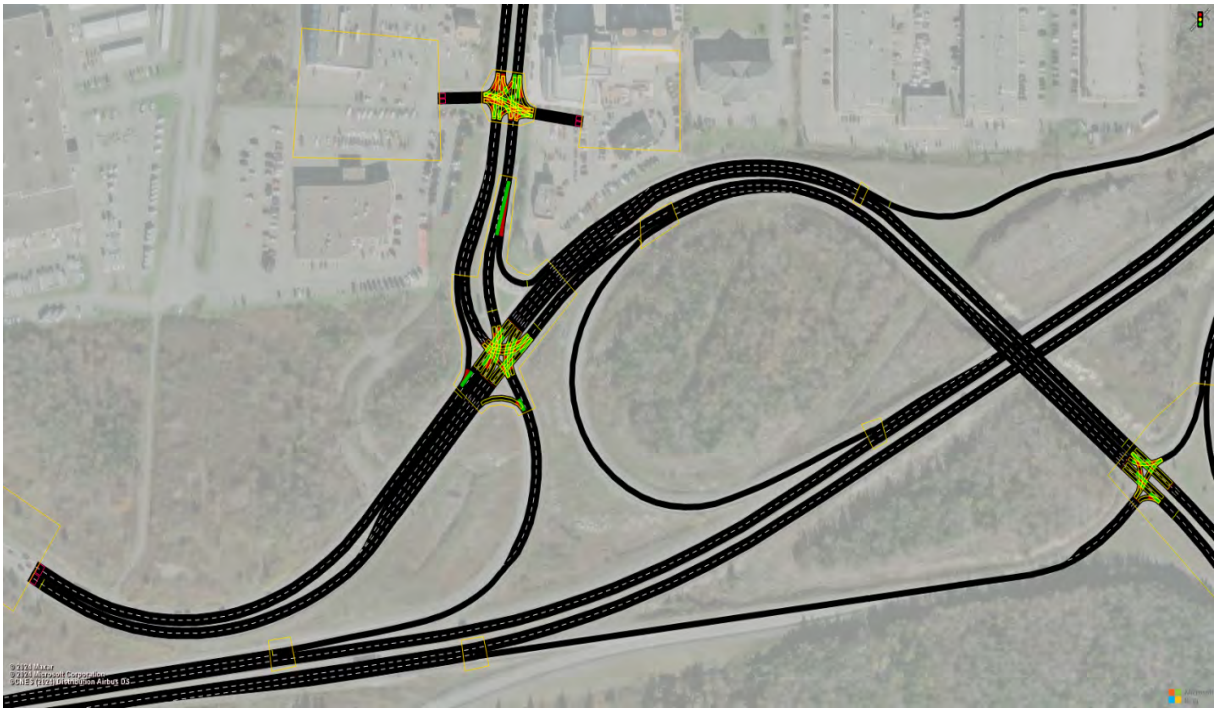


Figure 4-4: Model Network Sample of Detailed Representation

4.3.2 Public Transit

The Study Area is currently serviced by two bus routes, the #22 Armdale, and #123 Timberlea, as illustrated on Figure 4-5. Route #22 runs a terminal loop with a stop on Ragged Lake road, and a stop on SMB Rd. and operates on a 30-minute frequency. Route 123 has a stop on SMB Rd. within the study area and also operates on a 30-minute frequency.

At the time of this writing, HRM was in discussion with Halifax Transit on future transit servicing to the area, particularly in response to the proposed Exhibition Centre redevelopment. Considering the current low service frequency the uncertainty of future service, and the Ragged Lake Study expected to be initiated by HRM, bus routes were not coded in this model. While the scale of residential and employment development incorporated into this study lends itself to supporting significant transit service improvements, the HRM study is expected to be better suited to its exploration.

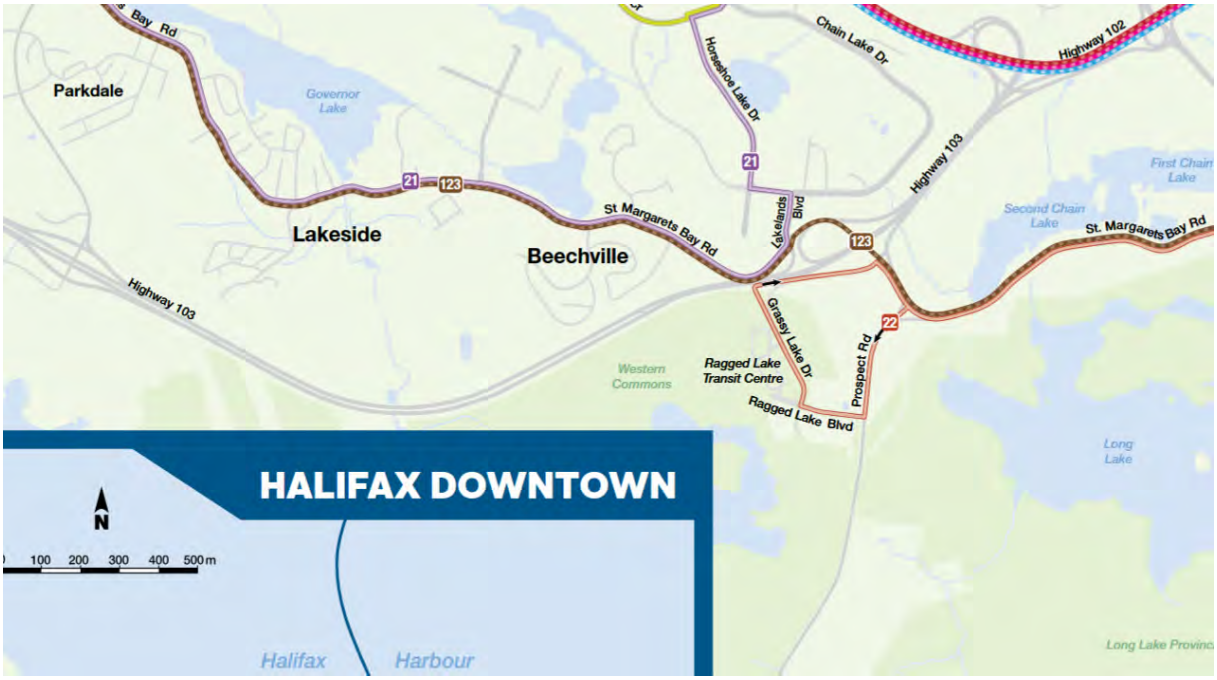


Figure 4-5 Halifax Transit Route Map

4.3.3 Baseline Demand

The Baseline Matrices from JESS ABM Model Subarea were disaggregated to a finer level appropriate for micro-simulation-based analysis and to reflect this project VISSIM TAZ system. Testing model runs were completed, and initial calibration exercise was completed. The results based on the JESS ABM matrices were found to be somewhat underrepresenting the traffic flows along Prospect Rd. and hence, the demand matrices were then calibrated to new traffic counts data. Further details on the calibration process are provided within the next section.

Under the baseline conditions, the modelled transportation network experiences a total traffic demand of about 9,200 vehicles during the weekday AM peak hour and 10,500 vehicles during the PM peak hour as shown in Table 4-2.

Table 4-2: Total Baseline Travel Demand

Time Period	Total Volume
AM Peak Hour	9,182
PM Peak Hour	10,500

4.3.4 Model Calibration

Once the network was reviewed for connectivity, consistency and correct intersection and link operations, the calibration effort focused on reproducing actual travel patterns as observed through the traffic counts data at key intersections within the study area.

A set of model calibration criteria were followed for this assignment, consistent with industry modelling standards. These criteria, illustrated below, follow two target sets:

1. Ensuring that linear regression between observed and modelled volumes at intersections and on links is at least 90%.
2. Ensuring that the relative difference between observed and modelled volumes for intersection turning movements falls within a GEH measure of 5-10 for most intersections. The GEH "Statistic" is an assessment formula named after its creator, Geoffrey E. Havers. It allows comparison of the relative differences between observed and modelled results, and it is defined in Equation 4.1.

Equation 4.1: GEH "Statistic"

$$GEH = \sqrt{\frac{2(M-C)^2}{(M+C)}}$$

Where:

M = modelled hourly volume

C = observed volume

The model was run using the Dynamic Traffic Assignment module (DTA). This entailed running the DTA path finding procedure, which searches for the quickest paths between each origin-destination pair. The procedure short-lists the 5 best paths, avoiding long detour options. Up to 50 iterations of the path finding procedure were run; the procedure searches for new paths each time, assigning the travel demand in small increments, repeating the process until the path finding convergences on a stable, optimal solution to assign the complete travel demand. With paths at equilibrium, 10 iterations of the model were run to extract turning movement volumes at key intersections. This process entailed comparing modelled volumes to the count data.

Under existing baseline conditions, the modelled road network does not present any parallel or alternative routing between any two points of origin and destination. As such, the calibration process was focused on the reproduction of correct OD-pairings, speeding, and points of friction on the road network, as revealed by direct observation and intersection turning movement counts.

The model was found to produce assignment results closely matching on-ground conditions during the AM peak hour. As illustrated in Figure 4-6, the model assignment produced an R^2 of over 95% for turn volumes, with limited deviations at a few intersections.

The model is generally balanced in that modelled volumes follow the regression line closely on both sides with few outliers; demands are consistent, not systemically over-estimated or underestimated. The AM model tends to over-estimate the higher volumes slightly, meaning that some of the major movements may be over-loaded in some cases compared to observed volumes. This may be an artefact of the balancing of the turning movement counts, which were not undertaken on the same day at all intersections.

The GEH analysis of the AM peak hour is shown in Table 4-3. The analysis confirms that about 83% of turns have a GEH less than 5 aligning the criteria threshold of 85%; approximately 99% of turns have a GEH less than 10, exceeding the threshold of 95%. This was achieved equally well across the entire road network, demonstrating that the model produced reliable travel patterns across the entire study area.

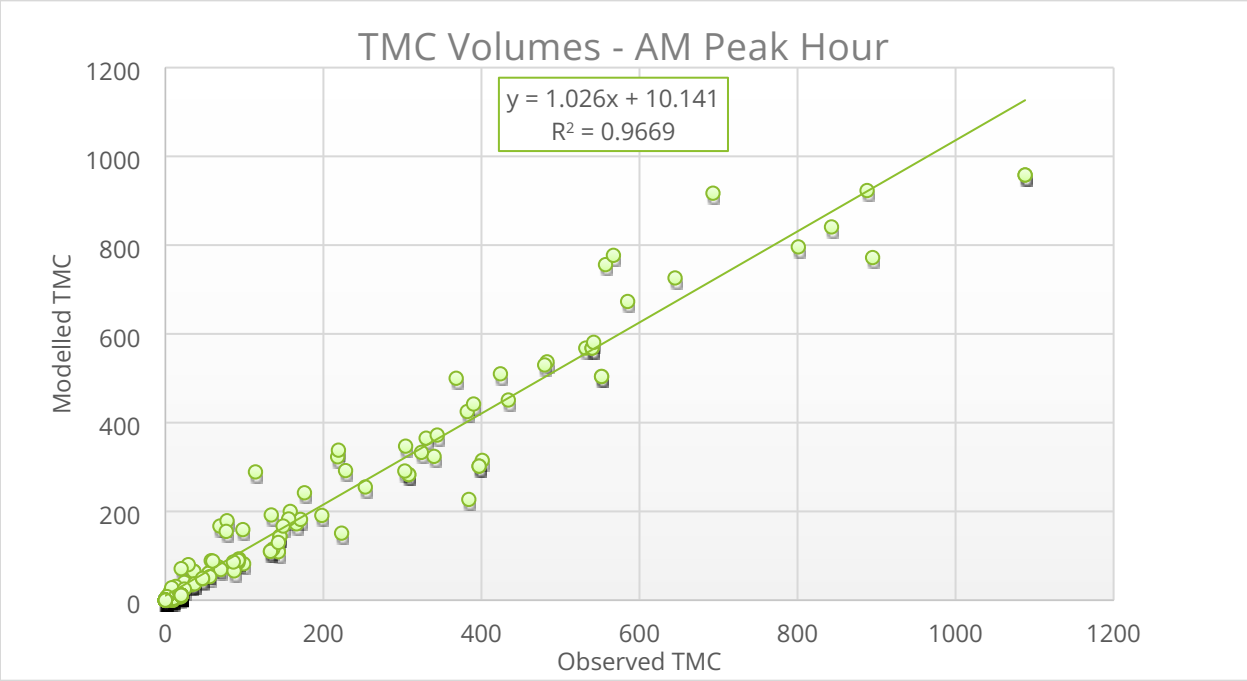


Figure 4-6: Model Calibration R^2 – AM Peak Hour

Table 4-3: Model Calibration GEH – AM Peak Hour

AM Peak Hour	Modelled	Total	Modelled	Target	Check
Turns with GEH <= 5	85	102	83%	85%	CLOSE
Turns with GEH <= 10	101	102	99%	95%	OK

Within the PM peak hour, the model Linear Regression R^2 still exceeds 97%, and modelled volumes are well positioned along the regression line as shown in Figure 4-7. Conversely to the AM peak hour, the PM model slightly underestimates some major movements; this may again be a result of the turning movement count balancing. Similar to the AM peak hour, the model meets the GEH calibration criteria during the PM peak hour for most of the intersection turns in the study area as shown in Table 4-4.

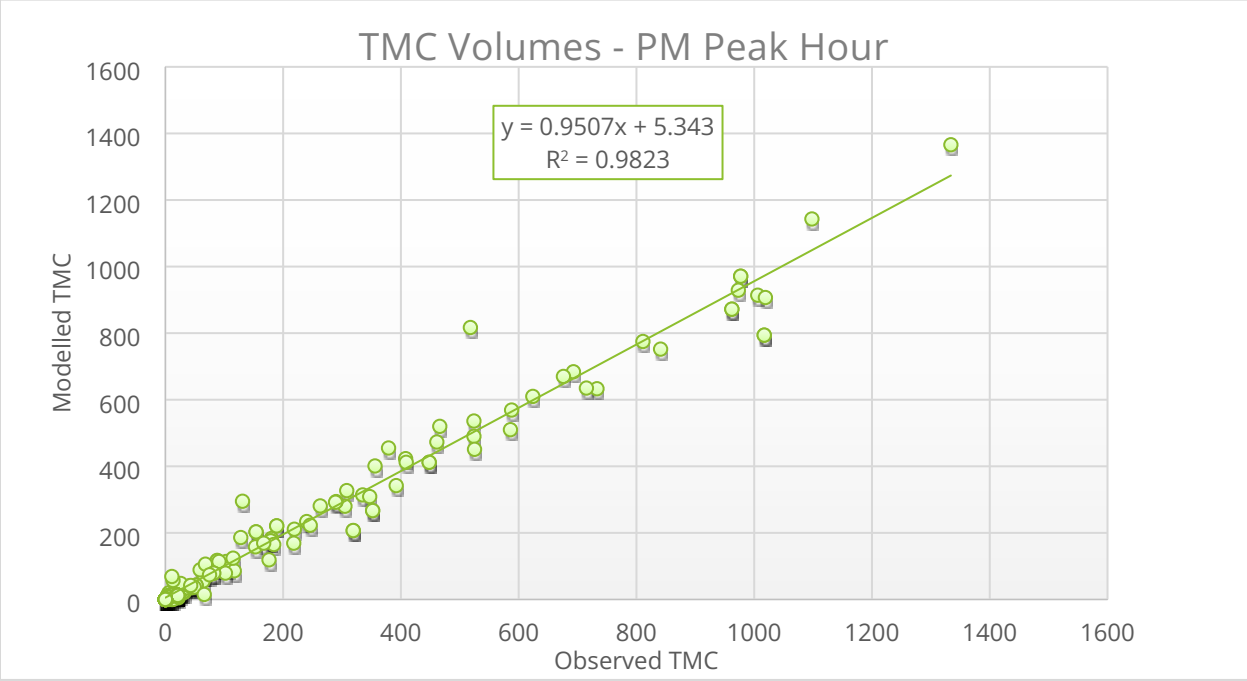


Figure 4-7: Model Calibration R^2 – PM Peak Hour

Table 4-4: Model Calibration GEH – PM Peak Hour

AM Peak Hour	Modelled	Total	Modelled	Target	Check
Turns with GEH <= 5	97	104	93%	85%	OK
Turns with GEH <= 10	102	104	98%	95%	OK

4.4 Travel Demand Forecasting

With the aim to prepare representative future travel demand matrices for 2031 and 2045 scenarios, new model runs were completed using the JESS ABM in line with the established modelling framework. According to Link NS's latest growth scenarios, the 2031 horizon would be expected to accommodate a 55% increase in the number of people living in HRM, along with a 73% increase in employment. By 2045, this growth is planned to amplify further, effectively doubling the population of HRM and tripling the number of jobs. A significant portion of this growth would occur within the study area.

The JESS ABM planning assumptions were verified and / or revised to reflect the latest development plans for the key identified major developments within the study area. The HEC latest planning assumptions within the JESS ABM were verified and found to be representative, while the assumptions for the Ragged Lake Development were revised as following:

- 12% of developable land by 2031 (~154 acres, 1,360 employees)
- 66% of developable land by 2045 (~848 acres, 7,480 employees)

JESS ABM runs were completed by Link NS consultant and made available to the project team to inform the analysis. Upon receipt, the JESS ABM future matrices were compared to the baseline matrices to establish the growth levels and patterns in the form of Delta matrices representing the net growth in travel demand between the scenarios, and expressed as:

$$[Matrix_{Delta}] = [Matrix_{Scenario}] - [Matrix_{Baseline}]$$

The origin and destination sums of the Delta matrices were then added to the sums of the calibrated VISSIM baseline matrices, and run through a Furness factoring process to produce new scenario-specific travel demand matrices in a usable format for use within this study VISSIM models.

It is to be noted that although the planning assumptions for the Ragged Lake Development were considered within the JESS ABM, the resultant trip generation of this development was found to be significantly lower than the anticipated development trip generation estimates based on ITE rates. While such differences are understood given the strategic nature and purpose of the JESS ABM, the trip estimates of this development were further uplifted to match the ITE trip generation estimates, which are considered to be conservative and more in line with the objectives of the study area VISSIM model. Table 4-5 includes the trip generation estimates for the Ragged Lake Development based on the applicable ITE trip rates[1].

[1] ITE trip rates are based on land use class 130.

Thus, the framework outlined in Section 4.1 is expanded as follows:

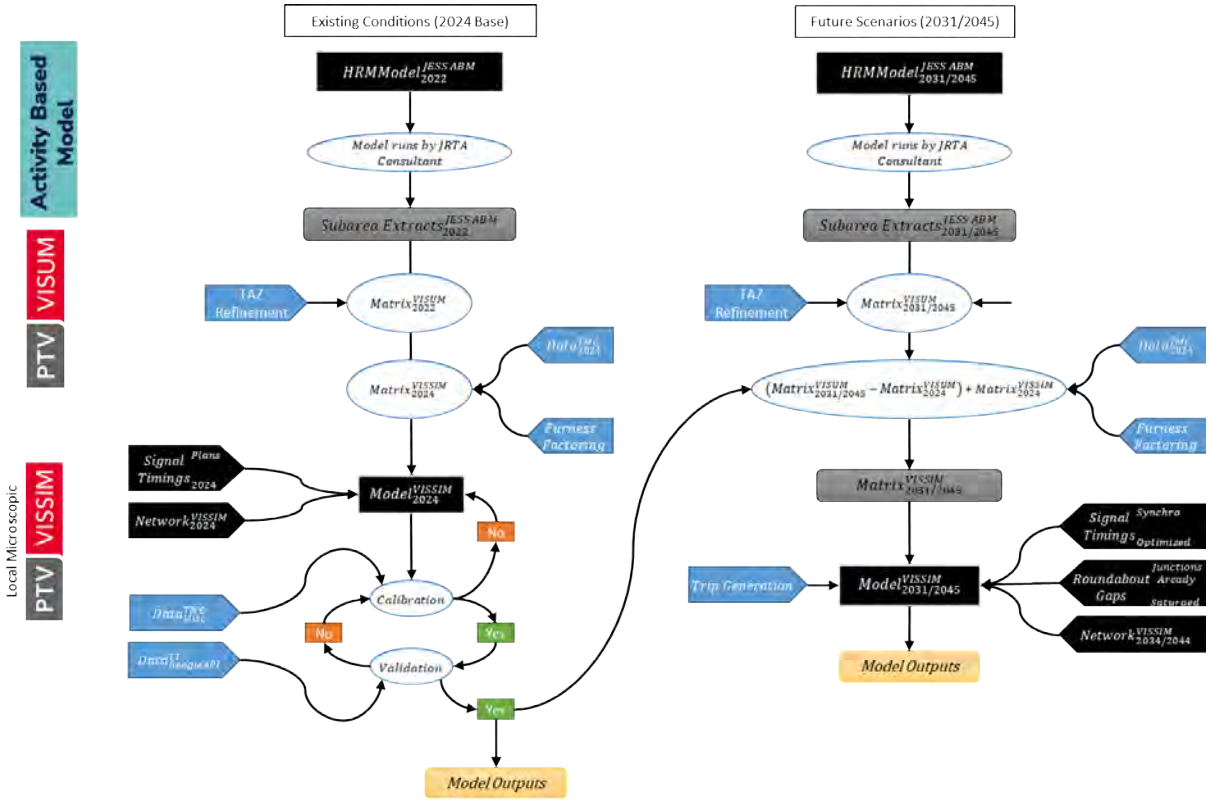


Figure 4-8 Traffic Modelling Framework - Future

Table 4-5: Ragged Lake Development ITE Trip Generation

Scenario / Horizon	% of Total Area[2]	Approx. Acreage	# Employees	AM In	AM Out	AM Total	PM In	PM Out	PM Total
Status Quo 2031	12%	154	1,360	497	74	**571**	120	451	**571**
Status Quo 2045[3]	30%	385	3,400	1,242	186	**1,428**	300	1,128	**1,428**
Corridor Improvements 2045	66%	848	7,480	2,968	444	**3,412**	717	2,695	**3,412**

The following **Table 4-6** includes a summary of the travel demand matrices under the various scenarios, as well as a comparison between the final demand levels used within this study VISSIM model versus the JESS ABM VISUM model. As it can be seen, the VISSIM model demand matrices are consistently higher that the JESS ABM matrices due to the

[2] Total developable area of Ragged Lake Development estimated at 520 hectares, ~1,285 acres.
[3] For status quo scenarios, i.e., without new corridor connection to Hwy 103, a lower percentage for the Ragged Lake Development potential progress is estimated at 30% only by 2045. This assumption seems reasonable given that the development accessibility will be restricted to Prospect Rd. only.

baseline demand calibration explained earlier as well as the uplifting of the Ragged Lake Development demand for the future years.

Overall, the travel demand within the study area is anticipated to grow by about 35% in 2031 and almost double by 2045, compared to the current baseline travel demand. Such growth levels would require appropriate interventions to ensure that the transportation network and infrastructure is capable of catering to this demand.

Table 4-6: Travel Demand Matrices Summary and Comparison

Scenario	Horizon	This Study VISSIM Model	VISSIM Growth from Baseline	JESS ABM VISUM	Diff % VISSIM to VISUM
AM Peak Hour					
Baseline	2024	9,182		6,671	38%
Status Quo	2031	12,356	35%	10,200	21%
	2045	16,612	81%	13,353	24%
Corridor Improvements	2045	18,002	96%	13,353	37%
PM Peak Hour					
Baseline	2024	10,500		8,450	24%
Status Quo	2031	14,428	37%	12,932	12%
	2045	18,936	80%	16,101	18%
Corridor Improvements	2045	20,399	94%	16,101	29%

5 Traffic Impact Analysis

Model runs were completed for all the scenarios and horizons and results were extracted to perform traffic analysis and quantify the impacts of each scenario.

The scenarios are evaluated for the morning (AM) and afternoon (PM) peak hours. A total of 5 simulation iterations were completed with consideration of "seed" conditions to account for demand levels prior to the start of peak hours.

5.1 Key Performance Indicators

The principal local performance measures considered within this study include vehicular volumes and average speeds on road links, as well as average and maximum queues, and average vehicle delay, expressed in terms of Level of Service (LOS) at intersections.

LOS is the key indicator of intersection performance with respect to traffic movement and is defined by the average amount of delay experienced by drivers at each of the intersection movements. Higher delays result in increased driver discomfort, fuel consumption, and travel time. LOS gives a summary of conditions, expressing the combined impacts of speed, travel time, traffic interruptions, traffic flow, comfort, and convenience, in a scalar metric from 'A' to 'F'. LOS 'A' represents conditions approaching free-flow and LOS 'F' represents a level of delay generally unacceptable to drivers and where peak hour traffic volumes usually exceed the peak hourly capacity. At some locations where the minor flow is significantly lower than the major flow, the modelling framework results show conservative levels of service. While some of these movements may be reported to experience higher delays, this does not necessarily translate to an operational issue. Real life driver behaviour in such circumstances is more cooperative than is represented in the model.

The criteria associated with each LOS are summarized in Table 5-1. As shown in the table, the delays listed for signalized intersections are higher than for the same level of service at unsignalized intersections; this is because drivers are typically more tolerant of extended delays at signalized intersections.

Table 5-1: Level of Service (LOS) Criteria

Level of Service (LOS)	Average Delay per Vehicle (seconds)	
	Signalized	Unsignalized
A	<10	<10
B	>10 and <20	>10 and <15
C	>20 and <35	>15 and <25
D	>35 and <55	>25 and <35
E	>55 and <80	>35 and <50
F	>80	>50

The following naming convention is used while discussing the results:

Movement Direction:

- NB – Northbound
- SB – Southbound
- WB – Westbound
- EB – Eastbound

Turn Type:

- R – Right
- T – Through
- L – Left
- U – U-turn

5.2 Roadways Link Analysis

This section summarizes the roadways performance analysis at link level for the baseline and status quo scenarios. While this section is focused on providing an overview summary of the results, additional and complete model outputs are available within the appendices for reference.

5.2.1 AM Peak Hour

Figure 5-1 through Figure 5-3 show the average road speeds across the entire study area during the AM peak hour under the conditions of baseline, status quo 2031 and status quo 2045, respectively.

Under the baseline conditions, the study area generally operates with reasonable average speed around 50km/hr or better. Nevertheless, some exceptions can be observed such as bottleneck along SMB Rd. in the EB direction towards Halifax peninsula, where the capacity constraints around the Armdale roundabout results in extended queues during the AM peak hour.

For the status quo 2031 scenario, operational conditions are similar to the baseline conditions. This is to be expected given the moderate anticipated growth in travel demand under this scenario which is mainly relevant to the further development of the HEC and Ragged Lake developments. It is to be noted that some delays are observed at the HEC accesses which implies that the development can benefit from additional access point in 2031, in addition to the existing accesses.

The status quo 2045 scenario results show substantial congestion along Prospect Rd. southern and central sections. These conditions are mainly due to the relatively considerable increase of the Ragged Lake development travel demand under this year in which inbound traffic towards the development accesses (NBL movement) blocks the through movements along Prospect Rd. It should be noted that as traffic is being held back on Prospect Rd., lower number of vehicles appear on SMB Rd. hence, the model shows

shorter queues in the EB direction compared to the baseline and status quo 2031 scenarios.

Queues and reduced speeds are also to be anticipated along Dunbrack St. and Old Sambro Road (Route 306). Although reduced performance along these roads is expected given the growth in travel demand, it can also be referred to the fact that this area is around the study area boundaries, where route choice is restricted by the model extent. For example, some of the traffic demand along Old Sambro Road (Route 306) could in reality be dispersed to Herring Cove Road (Route 349) in the future.

Figure 5-1: Road Speed – Baseline AM Peak Hour (Study Area)

Figure 5-2: Road Speed – Status Quo 2031 AM Peak Hour (Study Area)

Figure 5-3: Road Speed – Status Quo 2045 AM Peak Hour (Study Area)

5.2.2 PM Peak Hour

Figure 5-4 through Figure 5-6 show the average road speeds across the entire study area during the PM peak hour under the conditions of baseline, status quo 2031 and status quo 2045, respectively.

The study area operates with acceptable average speed around 50km/hr or better with no noticeable bottlenecks under the baseline conditions.

Within the status quo 2031 scenario, Prospect Rd. continue to operate with acceptable levels including the HEC and Ragged Lake development accesses. Reduced average speeds in range of 10km/hr are observed along Dunbrack St. SB direction.

During the PM peak hour of the status quo 2045 scenario, heavy congestion is to be expected along SMB Rd. EB direction. This is mainly due to restricted capacity of the WBL movement at the intersection with Prospect Rd., resulting in extended queues and blocking other movements at the intersection. Also, worsen conditions occurs along Dunbrack St. SB direction as mentioned earlier.

The roadways link analysis completed confirm that while the status quo network could cater for the 2031 demand with minor interventions (additional access point for HEC), the network is not sufficient to cater for the anticipated demand levels during 2045. More comprehensive mitigation measures are to be considered in the long term.

Figure 5-4: Road Speed – Baseline PM Peak Hour (Study Area)

Figure 5-5: Road Speed – Status Quo 2031 PM Peak Hour (Study Area)

Figure 5-6: Road Speed – Status Quo 2045 PM Peak Hour (Study Area)

5.3 Intersections Performance

This section summarizes the intersections performance using the LOS parameter for the baseline and status quo scenarios. While this section is focused on providing an overview summary of the results, additional and complete model outputs are available within the appendices for reference. Figure 5-7 shows a key map and node IDs for the intersections discussed in this section. We note that under baseline conditions, Grassy Lane Drive terminates in a bus-only on-ramp to Hwy103 EB. Starting with the future Status Quo, this analysis has assumed that this ramp would be open to general-purpose vehicular traffic, matching the earlier Ragged Lake concept plan. The upcoming HRM Ragged Lake study is expected to resolve whether this ramp will remain transit-only to service the bus depot, or be open to general traffic.

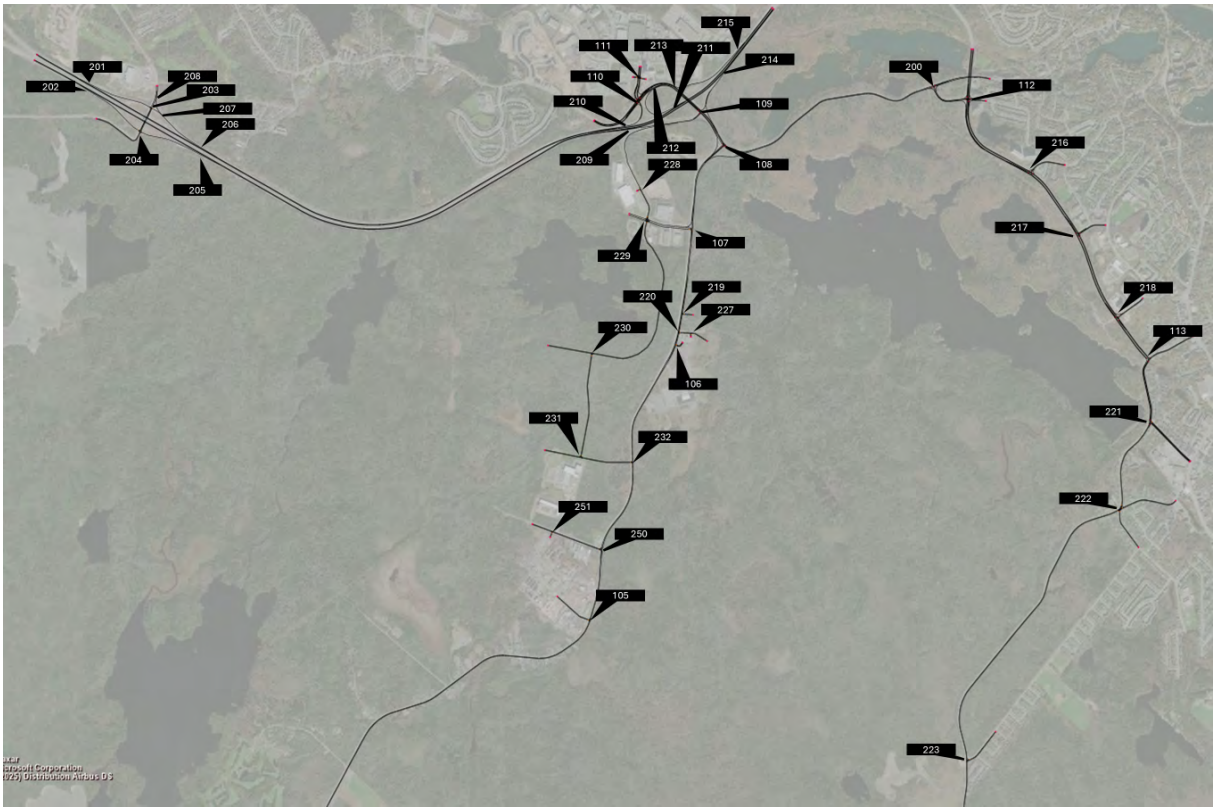


Figure 5-7: Key Map for Intersection Numbering

5.3.1 AM Peak Hour

Table 6.2 summarizes the intersection evaluation results at the key identified intersections in terms of the operational LOS during the AM peak hour.

As it can be seen, all key intersections are anticipated to operate with LOS D or better during the AM peak hour of the baseline conditions.

Within the status quo 2031 scenario, some impacts can be noted on the SMB Rd. intersections with Prospect Rd. and Hwy 103 ramps, where LOS D is to be expected. Other

impacts include the HEC access point as well as the intersection between Dunbrack St. and Route 306. These impacts are considered somewhat moderate and operational conditions could be improved with minor mitigation measures including considering an additional access point for HEC and optimization of traffic signals along SMB Rd. Figure 5-8 illustrate some of the key turn movements that experience congestions and queues include the WBL and NBR at the intersection between Prospect Rd. and SMB Rd. (Node 108).

Significant reduction in the LOS can be seen during the status quo 2045 AM peak hour. Majority of intersections experience additional delays congestions. Along Prospect Rd., the intersections at the Ragged Lake and HEC development accesses generally operate with LOS E and F, which has significant impact on the overall traffic movement along the road, as explained within the roadways analysis section. On SMB Rd. intersection, and similar to the status quo 2031 scenario, several movements operate with LOS F as shown in Figure 5-9.

Table 5-2: Intersection Level of Service – AM Peak Hour (Baseline and Status Quo)

Node ID	Intersection Name	Baseline	Status Quo 2031	Status Quo 2045
106	Prospect Rd. & Exhibition Park Driveway	A	B	E
107	Prospect Rd. & Ragged Lake Boulevard	A	B	A
108	Prospect Rd. & SMB Road	C	D	E
109	St.Margarets Bay Rd & Hwy 103 Off-ramp/On-ramp	C	D	D
110	SMB Road & Lakelands Blvd	B	C	D
112	Dunbrack Street & Albert Walker Drive/Walter Havill Drive	C	C	E
113	Dunbrack Street & Route 306	C	E	F
200	St.Margarets Bay Rd & Albert Walker Drive	D	C	E
203	Hwy 103 Timberlea Village Pkwy WB Ramp	A	A	A
204	Hwy 103 Timberlea Village Pkwy EB Ramp	A	A	A
219	Prospect Rd. & HEC Future Access 01	A	B	B
220	Prospect Rd. & HEC Future Access 02	A	D	E
232	Prospect Rd. & Ragged Lake Future Access	#N/A	A	E
233	Prospect Rd. & HEC Future Access 03	#N/A	#N/A	F
234	Prospect Rd. & HEC/RL Future Access	#N/A	#N/A	E
250	Prospect Rd. & Evergreen Place	A	A	E

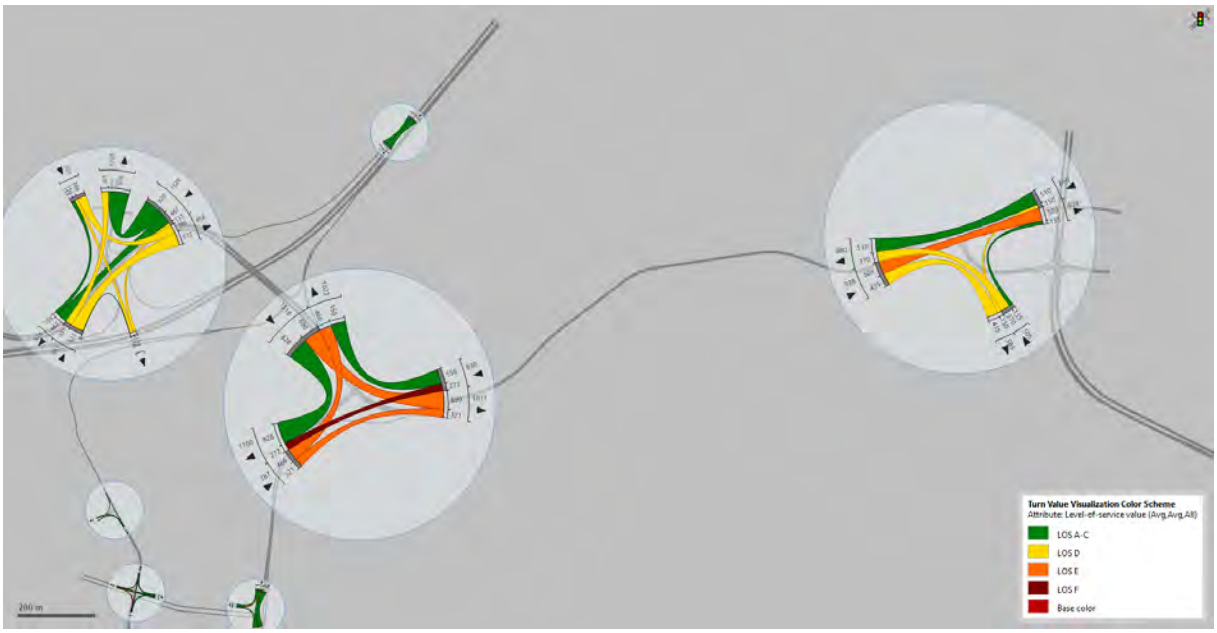


Figure 5-8: LOS – Status Quo 2031 AM Peak Hour (Hwy 103 & Prospect Rd.)

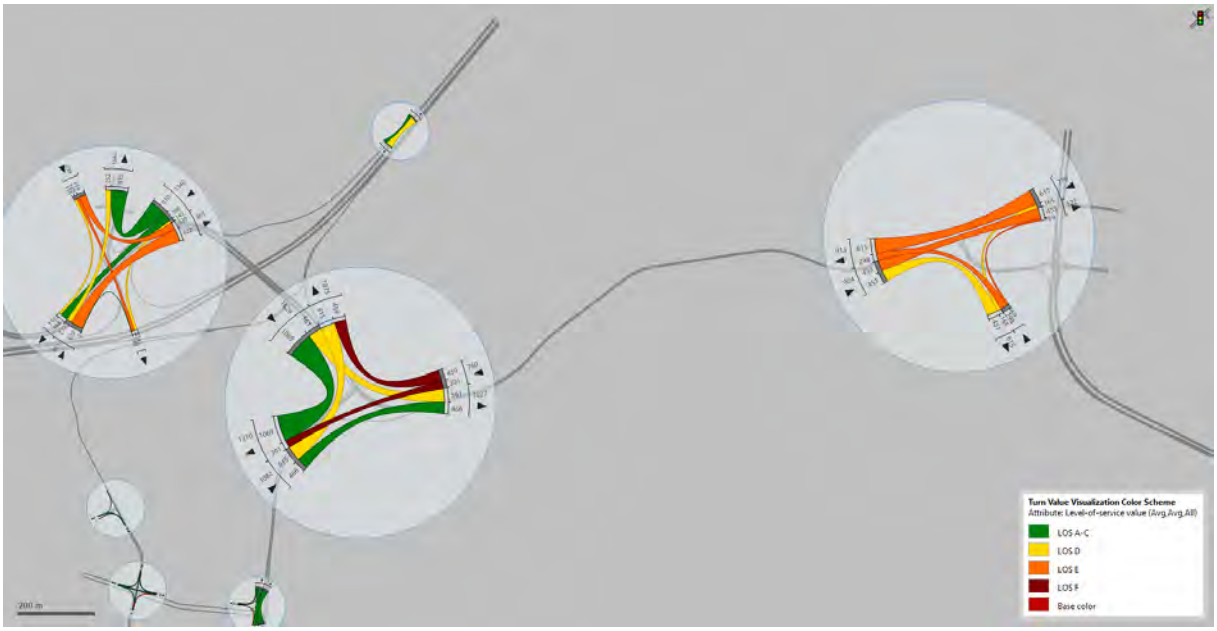


Figure 5-9: LOS – Status Quo 2045 AM Peak Hour (Hwy 103 & Prospect Rd.)

5.3.2 PM Peak Hour

Table 5-3 summarizes the intersection evaluation results at the key identified intersections in terms of the operational LOS during the PM peak hour.

Generally, all intersections operate with similar levels to the AM peak hour under the baseline and status quo 2031 conditions with some localized capacity constrains at the HEC accesses and the Dunbrack St. / Route 306 intersection. Besides the latter, all intersections have LOS D or better. The critical movements at the node 108 continue to be critical during the PM peak as shown in Figure 5-10.

Much worse conditions are to be expected within the status quo 2045 scenarios where majority of intersections experience LOS E and F. Extensive delays and queues occur at the intersection between SMB Rd. and Prospect Rd (Figure 5-11) where the intersection capacity is not enough to cater for the WBL movement towards Prospect Rd. with ~400 veh/hr, and the NB movements towards SMB Rd. with a total hourly demand in range of 1,000 veh/hr. The congestion at this gateway intersection as well as the other access intersection on Prospect Rd., results in bottlenecks and reduced operational speed as demonstrated within the previous section.

The intersections performance analysis completed confirm that the status quo network is not sufficient to cater for the anticipated demand levels during 2045. More comprehensive mitigation measures are to be considered in the long-term including the type and configuration of intersections especially along Prospect Rd.

Table 5-3: Intersection Level of Service – PM Peak Hour (Baseline and Status Quo)

Node ID	Intersection Name	Baseline	Status Quo 2031	Status Quo 2045
106	Prospect Rd. & Exhibition Park Driveway	A	A	D
107	Prospect Rd. & Ragged Lake Boulevard	A	B	F
108	Prospect Rd. & SMB Road	C	E	F
109	St.Margarets Bay Rd & Hwy 103 Off-ramp/On-ramp	B	D	F
110	SMB Road & Lakelands Blvd	C	D	F
112	Dunbrack Street & Albert Walker Drive/Walter Havill Drive	C	E	F
113	Dunbrack Street & Route 306	D	D	E
200	St.Margarets Bay Rd & Albert Walker Drive	B	B	E
203	Hwy 103 Timberlea Village Pkwy WB Ramp	A	A	A
204	Hwy 103 Timberlea Village Pkwy EB Ramp	A	A	A
219	Prospect Rd. & HEC Future Access 01	A	B	F
220	Prospect Rd. & HEC Future Access 02	A	D	F
232	Prospect Rd. & Ragged Lake Future Access	#N/A	B	D
233	Prospect Rd. & HEC Future Access 03	#N/A	#N/A	F
234	Prospect Rd. & HEC/RL Future Access	#N/A	#N/A	E
250	Prospect Rd. & Evergreen Place	A	A	C

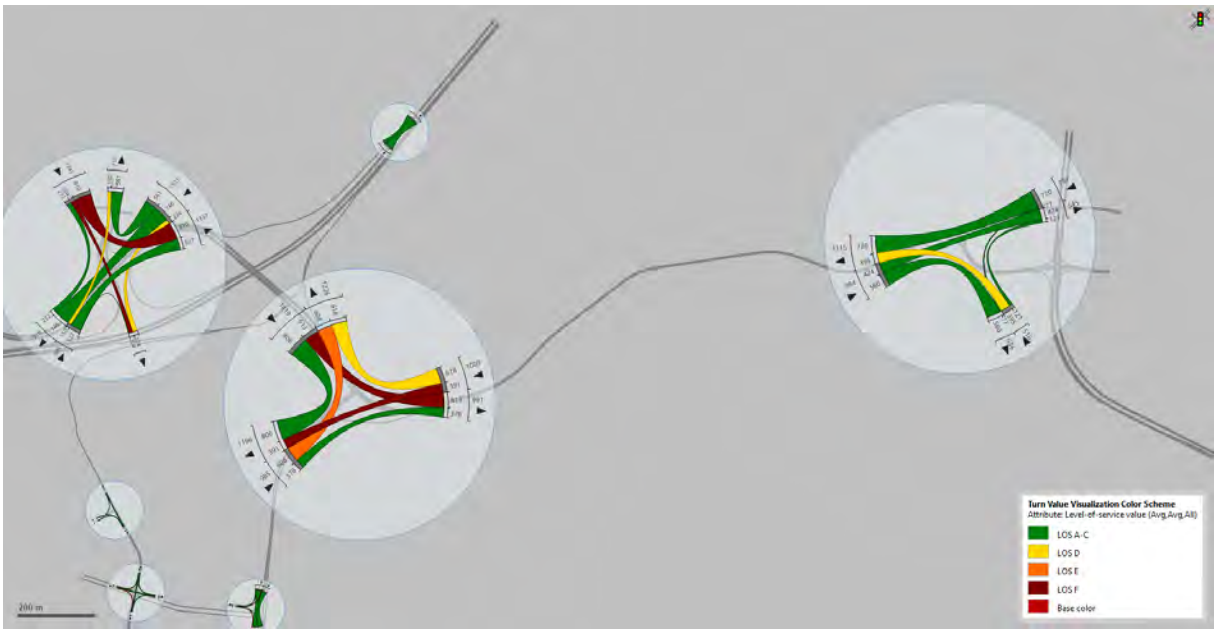


Figure 5-10: LOS – Status Quo 2031 PM Peak Hour (Hwy 103 & Prospect Rd.)

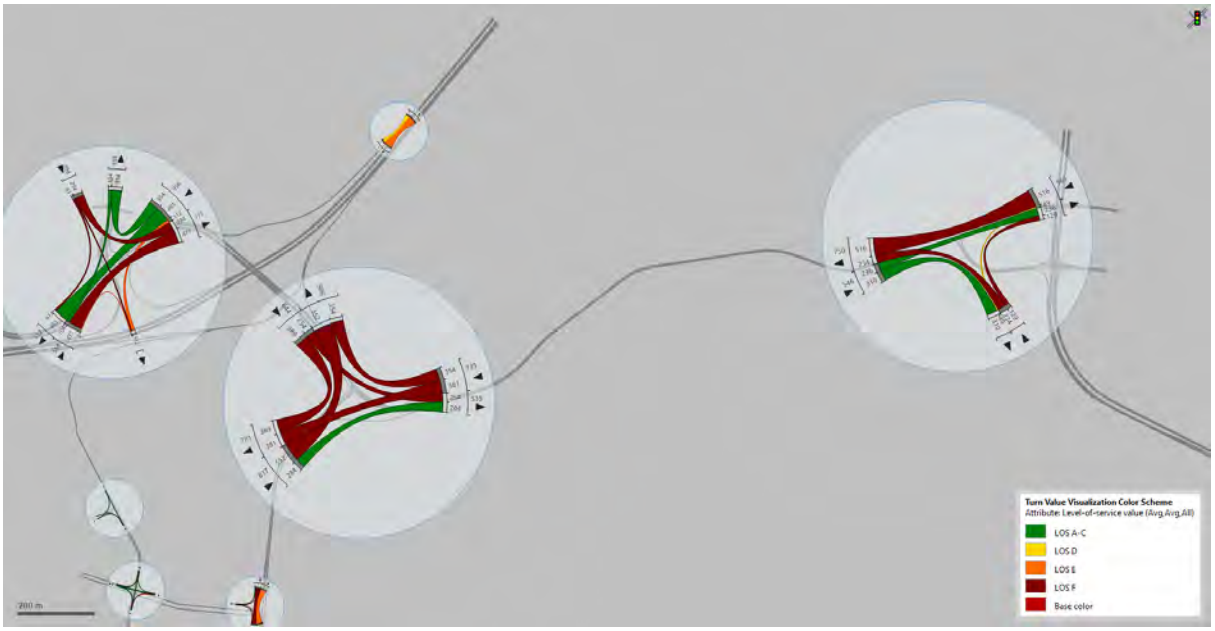


Figure 5-11: LOS – Status Quo 2045 PM Peak Hour (Hwy 103 & Prospect Rd.)

5.4 Mitigation

Within this section, the team has explored and described "soft" mitigation measures that are aimed at enhancing the operational conditions in the future, compared to the status quo scenarios, without consideration of the Corridor Improvements scenario.

5.4.1 2031 Mitigation Measure

To address the operational issues identified within the status quo 2031 scenario, the following mitigation measures were tested:

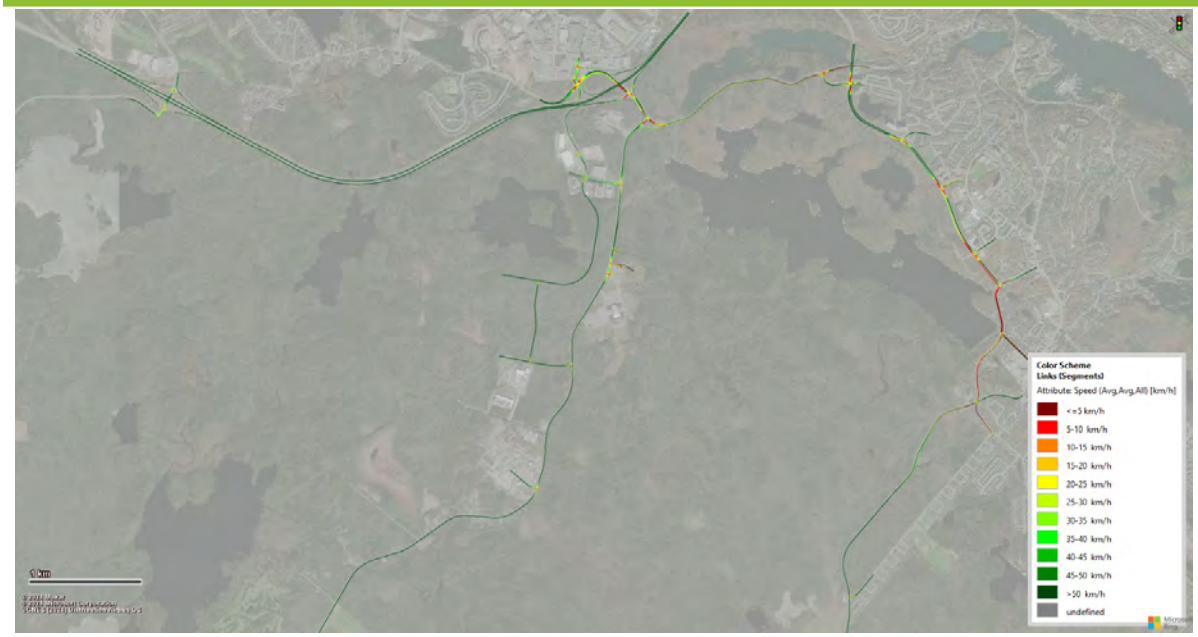
- New central access point along Prospect Rd. for HEC as per the development plan (Node 234)
- New traffic signal (3-leg) at the intersection of Prospect Rd. and the HEC central access point
- New traffic signal at the intersection of Prospect Rd. and Evergreen Pl.
- Optimization of SMB Rd. intersections signal timing

Model runs have been completed for the mitigation 2031 AM and PM peak hour scenarios. An overview summary of the main results is provided within this section while additional and complete model outputs are available within the appendices for reference.

Figure 5-12 and Figure 5-13 show a road speed comparison between the status quo and mitigation 2031 scenarios, while Table 5-4 and Table 5-5 include a comparison of the intersection LOS for the same scenarios.

As it can be seen, **the soft mitigation measures suggested result in generally enhanced operational conditions at the network level**, during both peak hours. Nevertheless, it is to be noted that the HEC development could benefit from expediting the development of all the planned access points and internal networks by 2031, rather than phasing those according to the land use development.

Status Quo 2031



Mitigation 2031

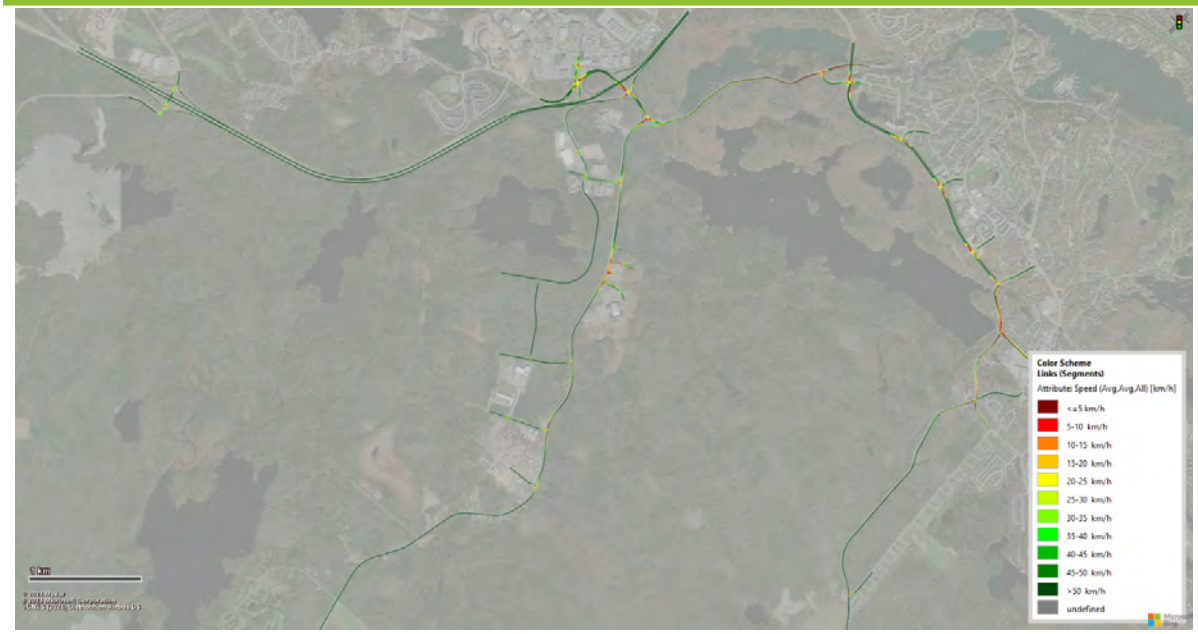
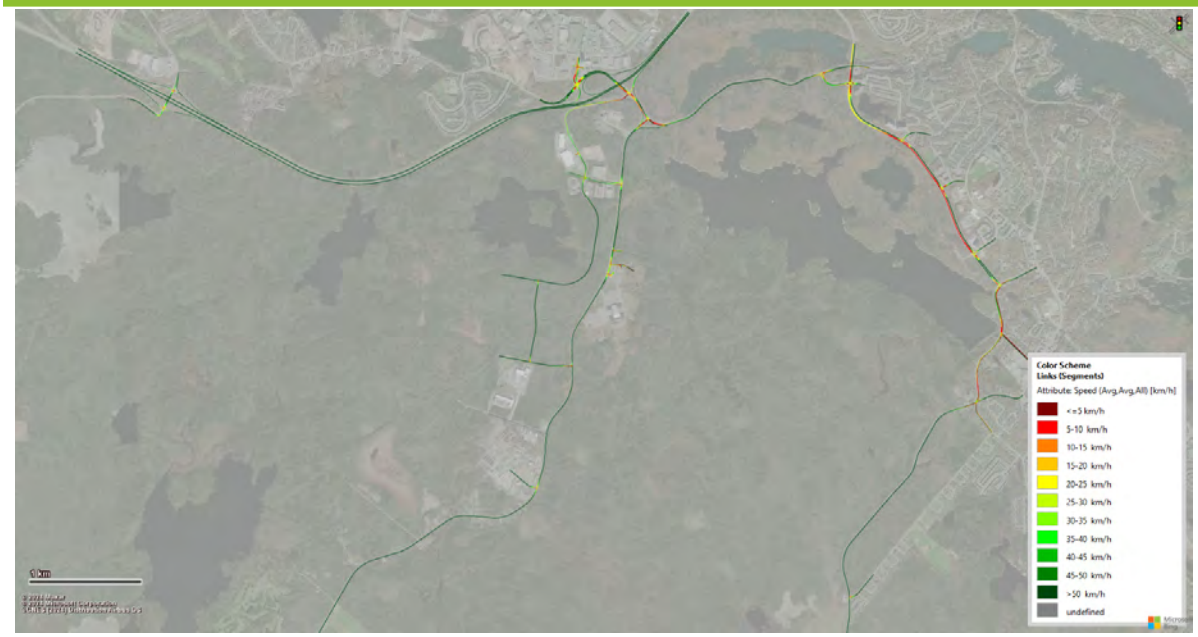


Figure 5-12: Road Speed Comparison – Status Quo vs Mitigation 2031 AM Peak Hour

Status Quo 2031



Mitigation 2031

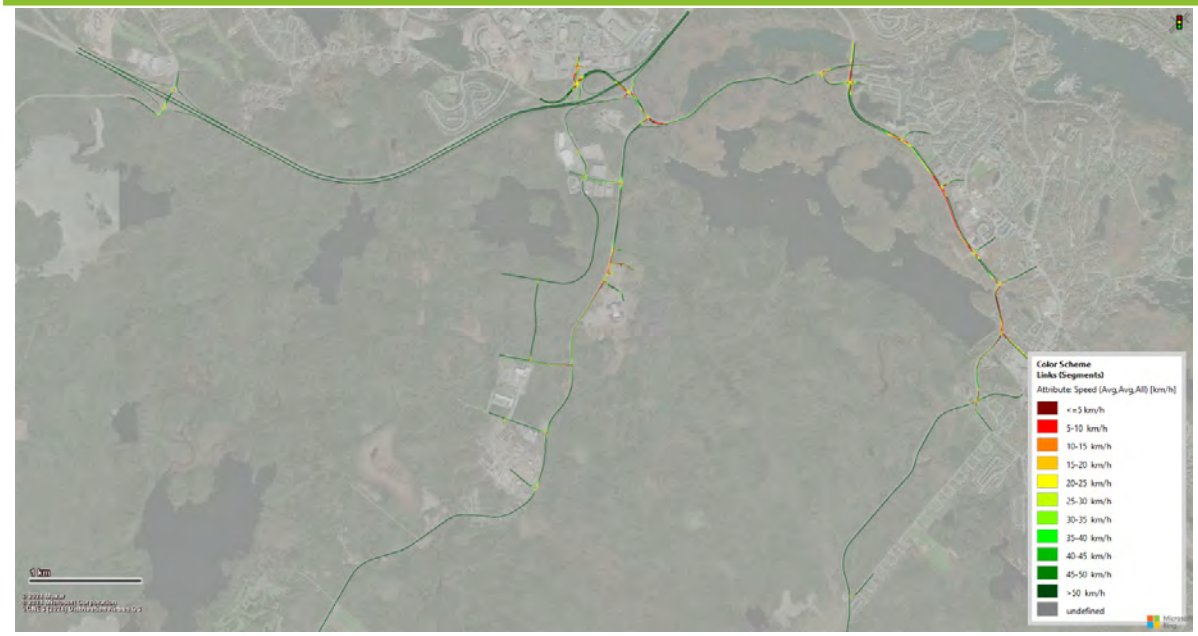


Figure 5-13: Road Speed Comparison – Status Quo vs Mitigation 2031 PM Peak Hour

Table 5-4: Intersection LOS Comparison – AM Peak Hour (Status Quo vs Mitigation 2031)

Node ID	Intersection Name	Status Quo 2031	Mitigation 2031
106	Prospect Rd. & Exhibition Park Driveway	B	C
107	Prospect Rd. & Ragged Lake Boulevard	B	B
108	Prospect Rd. & SMB Road	D	D
109	St.Margarets Bay Rd & Hwy 103 Off-ramp/On-ramp	D	D
110	SMB Road & Lakelands Blvd	C	C
112	Dunbrack Street & Albert Walker Drive/Walter Havill Drive	C	D
113	Dunbrack Street & Route 306	E	C
200	St.Margarets Bay Rd & Albert Walker Drive	C	D
203	Hwy 103 Timberlea Village Pkwy WB Ramp	A	A
204	Hwy 103 Timberlea Village Pkwy EB Ramp	A	A
219	Prospect Rd. & HEC Future Access 01	B	C
220	Prospect Rd. & HEC Future Access 02	D	D
232	Prospect Rd. & Ragged Lake Future Access	A	B
233	Prospect Rd. & HEC Future Access 03	#N/A	#N/A
234	Prospect Rd. & HEC/RL Future Access	#N/A	C
250	Prospect Rd. & Evergreen Place	A	C

Table 5-5: Intersection LOS Comparison – PM Peak Hour (Status Quo vs Mitigation 2031)

Node ID	Intersection Name	Status Quo 2031	Mitigation 2031
106	Prospect Rd. & Exhibition Park Driveway	A	B
107	Prospect Rd. & Ragged Lake Boulevard	B	B
108	Prospect Rd. & SMB Road	E	D
109	St.Margarets Bay Rd & Hwy 103 Off-ramp/On-ramp	D	C
110	SMB Road & Lakelands Blvd	D	D
112	Dunbrack Street & Albert Walker Drive/Walter Havill Drive	E	D
113	Dunbrack Street & Route 306	D	C
200	St.Margarets Bay Rd & Albert Walker Drive	B	C
203	Hwy 103 Timberlea Village Pkwy WB Ramp	A	A
204	Hwy 103 Timberlea Village Pkwy EB Ramp	A	A
219	Prospect Rd. & HEC Future Access 01	B	B
220	Prospect Rd. & HEC Future Access 02	D	E
232	Prospect Rd. & Ragged Lake Future Access	B	C
233	Prospect Rd. & HEC Future Access 03	#N/A	#N/A
234	Prospect Rd. & HEC/RL Future Access	#N/A	C
250	Prospect Rd. & Evergreen Place	A	A

Within the Mitigation 2031 scenario, the intersection of Prospect Rd. with HEC Future Access 02 (Node 220) is anticipated to operate with overall LOS E. This is mainly driven by the WBL movement out of out of HEC towards Prospect Rd. SB direction, and the WBR outbound movement. Both are relatively low-volume movements with limited overall impact. In reality, this issue can be avoided by providing connectivity of the HEC internal network so that outbound traffic can be dispersed over the multiple available accesses.

Figure 5-14: LOS – Mitigation 2031 PM Peak (Node 220 - Prospect Rd. & HEC Future Access 02)

5.4.2 2045 Mitigation Measures

Given that the scale of the negative impacts anticipated within the status quo 2045 scenario, additional mitigation measures have been explored which are in addition to those considered in 2031. The following list includes the mitigation measure tested for 2045:

- Widening of Prospect Rd. to 4-lanes between SMB Rd. and Ragged Lake development southern access point
- Realignment of Ragged Lake access point opposite of HEC to create a 4-leg signalized intersection with the HEC central access point (Node 234)
- New traffic signal (3-leg) at the intersection of Prospect Rd. and the HEC southern access point
- Extension of Evergreen Pl. to connect with Ragged Lake internal network
- New traffic signal (3-leg) at the intersection of Prospect Rd. and Brookside Rd.

Model runs have been completed for the mitigation 2045 AM and PM peak hour scenarios. An overview summary of the main results is provided within this section while additional and complete model outputs are available within the appendices for reference.

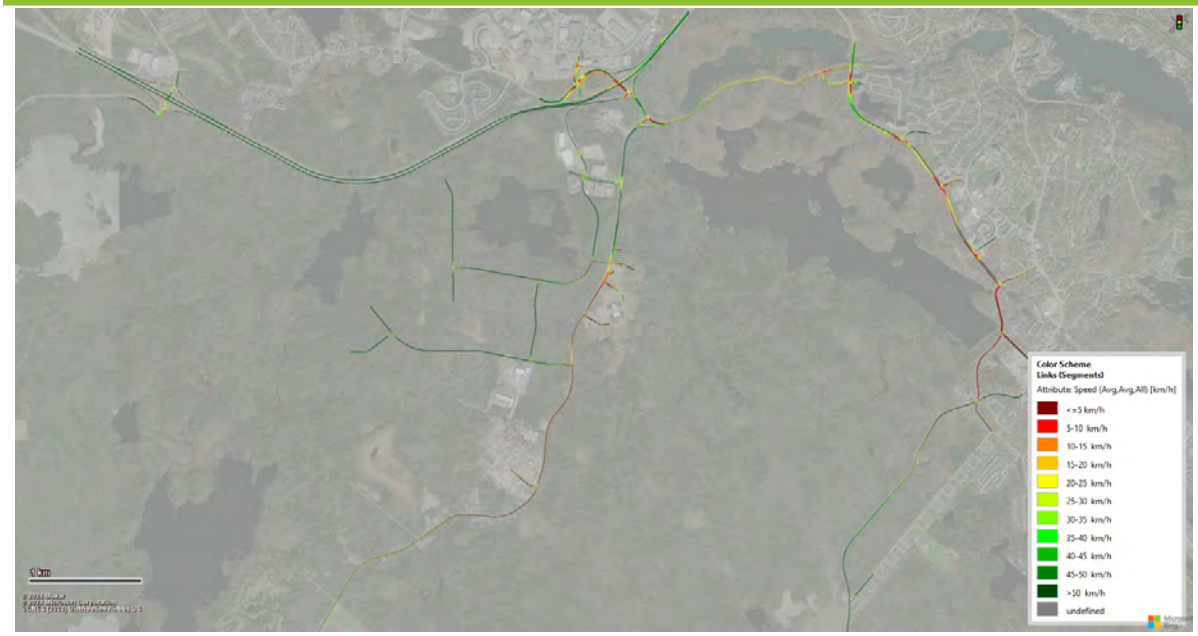
Figure 5-15 and Figure 5-16 show a road speed comparison between the status quo and mitigation 2045 scenarios, while Table 5-6 and Table 5-7 include a comparison of the intersection LOS for the same scenarios.

The results suggests that the considered mitigation measures would change the dynamics along Prospect Rd., For example, the introduction of new traffic signals along with the widening of the Prospect Rd. both relieve the NB congestion along the southern and central sections of Prospect Rd. during the AM peak hour, which was initially held back at the Ragged Lake development accesses under the status quo 2045 conditions. Nevertheless, this traffic is now accumulating at the northern sections of Prospect Rd. towards SMB Rd. Within the same peak, improved but less than ideal conditions can be expected at HEC and Ragged Lake access points. Improved conditions can also be seen at the Dunbrack St. and Route 306 intersection.

Within the PM peak hour, significant improvement of operational conditions can be seen along the SMB Rd. WB direction. Such improvement is expected as the widening of Prospect Rd. allows for more efficient traffic movement in the SB direction. Worsen conditions along Prospect Rd. northern section are also to be expected, similar to the AM peak hour.

The completed analysis confirms that the proposed mitigation measures for 2045 although relatively improve the overall operational conditions within the study, especially along SMB Rd. and southern / central sections of Prospect Rd., they don't resolve the anticipated congestion along the northern section of Prospect Rd. nor ease the access to / from Ragged Lake development. This is mainly due to the scale of the future anticipated travel demand which is beyond the capacity of Prospect Rd. For this reason, corridor improvements would be required with a new connection between Prospect Rd. and Hwy 103 Exit 3.

Status Quo 2045



Mitigation 2045

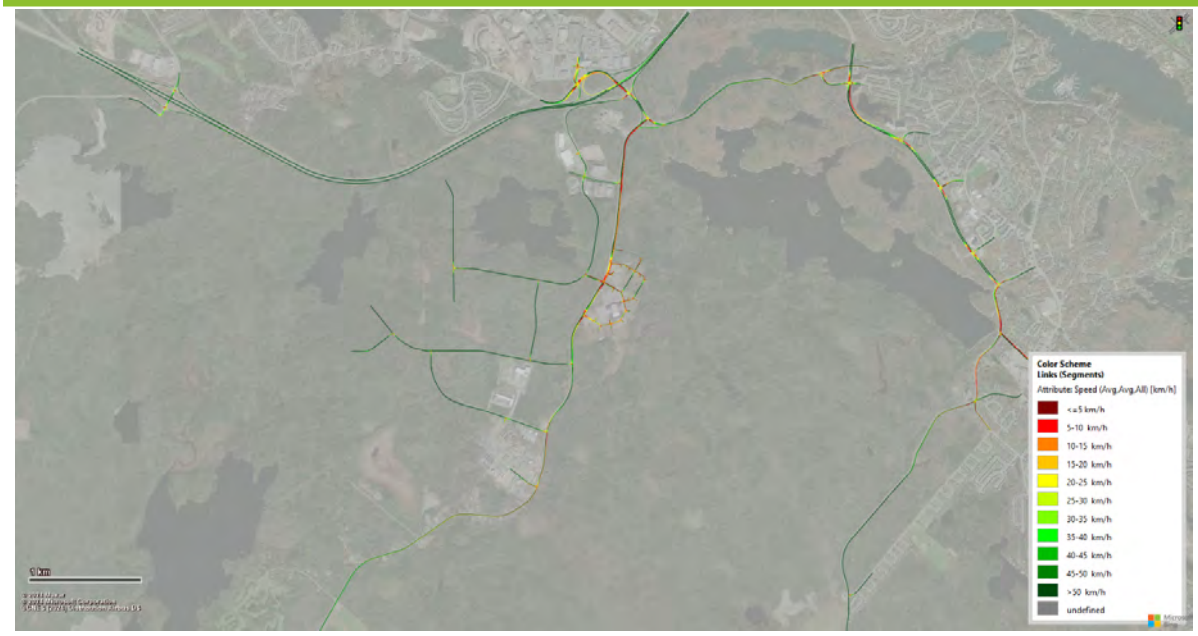
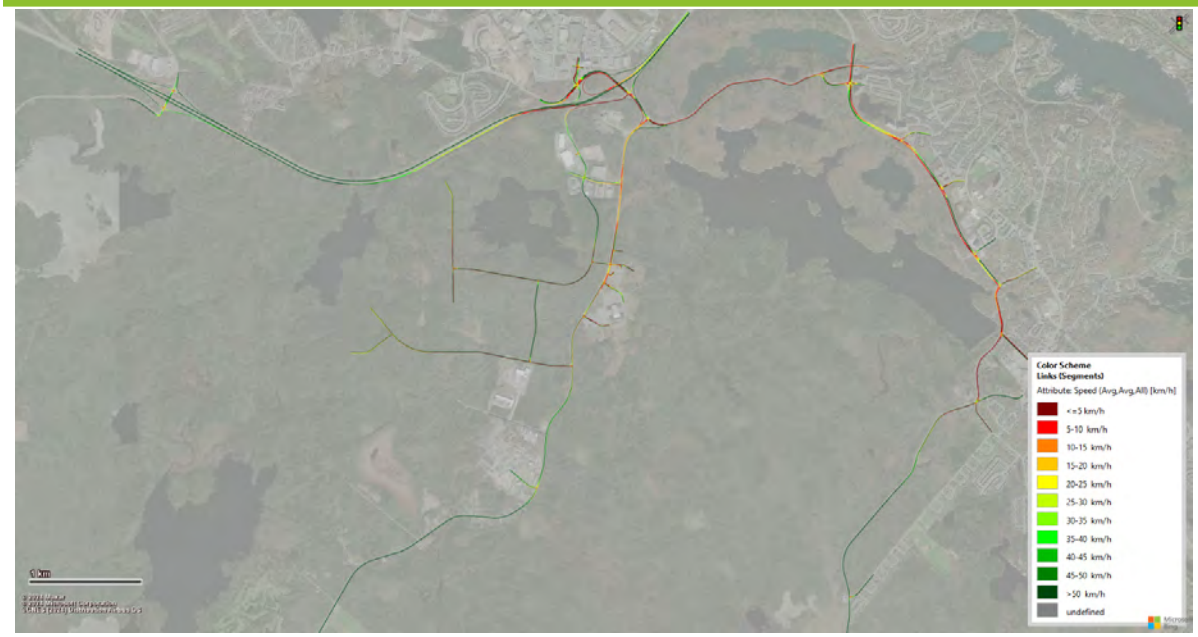


Figure 5-15: Road Speed Comparison – Status Quo vs Mitigation 2045 AM Peak Hour

Status Quo 2045



Mitigation 2045

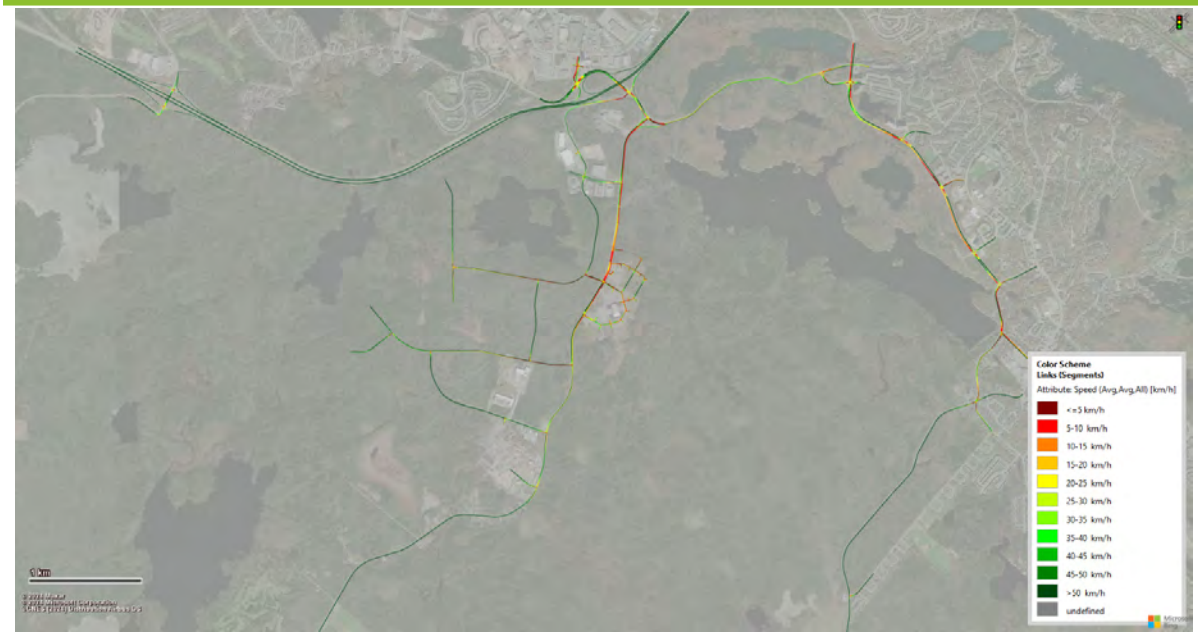


Figure 5-16: Road Speed Comparison – Status Quo vs Mitigation 2045 PM Peak Hour

Table 5-6: Intersection LOS Comparison – AM Peak Hour (Status Quo vs Mitigation 2045)

Node ID	Intersection Name	Status Quo 2045	Mitigation 2045
106	Prospect Rd. & Exhibition Park Driveway	E	C
107	Prospect Rd. & Ragged Lake Boulevard	A	D
108	Prospect Rd. & SMB Road	E	E
109	St.Margarets Bay Rd & Hwy 103 Off-ramp/On-ramp	D	D
110	SMB Road & Lakelands Blvd	D	D
112	Dunbrack Street & Albert Walker Drive/Walter Havill Drive	E	E
113	Dunbrack Street & Route 306	F	D
200	St.Margarets Bay Rd & Albert Walker Drive	E	C
203	Hwy 103 Timberlea Village Pkwy WB Ramp	A	A
204	Hwy 103 Timberlea Village Pkwy EB Ramp	A	A
219	Prospect Rd. & HEC Future Access 01	B	C
220	Prospect Rd. & HEC Future Access 02	E	D
232	Prospect Rd. & Ragged Lake Future Access	E	B
233	Prospect Rd. & HEC Future Access 03	F	D
234	Prospect Rd. & HEC/RL Future Access	E	E
250	Prospect Rd. & Evergreen Place	E	D

Table 5-7: Intersection LOS Comparison – PM Peak Hour (Status Quo vs Mitigation 2045)

Node ID	Intersection Name	Status Quo 2045	Mitigation 2045
106	Prospect Rd. & Exhibition Park Driveway	D	C
107	Prospect Rd. & Ragged Lake Boulevard	F	E
108	Prospect Rd. & SMB Road	F	F
109	St.Margarets Bay Rd & Hwy 103 Off-ramp/On-ramp	F	D
110	SMB Road & Lakelands Blvd	F	D
112	Dunbrack Street & Albert Walker Drive/Walter Havill Drive	F	E
113	Dunbrack Street & Route 306	E	D
200	St.Margarets Bay Rd & Albert Walker Drive	E	C
203	Hwy 103 Timberlea Village Pkwy WB Ramp	A	A
204	Hwy 103 Timberlea Village Pkwy EB Ramp	A	A
219	Prospect Rd. & HEC Future Access 01	F	E
220	Prospect Rd. & HEC Future Access 02	F	F
232	Prospect Rd. & Ragged Lake Future Access	D	D
233	Prospect Rd. & HEC Future Access 03	F	D
234	Prospect Rd. & HEC/RL Future Access	E	E
250	Prospect Rd. & Evergreen Place	C	B

Within the Mitigation 2045 scenario, 6 intersections continue to operate with LOS E and F. The following paragraphs and figures aim at explaining the issues behind these less-than-ideal operational conditions.

The intersection of Prospect Rd. and Ragged Lake Boulevard (Node 107) is anticipated to operate with overall LOS E. This is mainly due to extended queues along Prospect Rd. NB direction backing up from the intersection with SMB Rd.

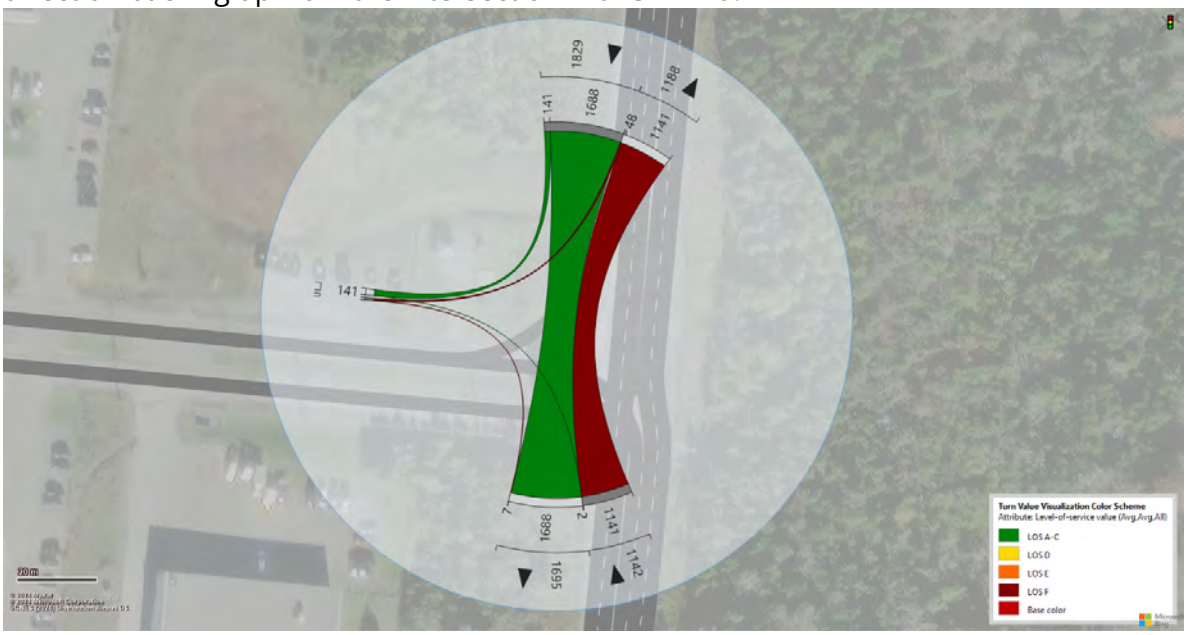


Figure 5-17: LOS – Mitigation 2045 PM Peak (Node 107 - Prospect Rd. & Ragged Lake Boulevard)

The intersection of Prospect Rd. and SMB Rd. (Node 108) is anticipated to continue to operate with overall LOS F. This is mainly due conflicting and high traffic flows in the NB and EB direction, beyond the intersection capacity.

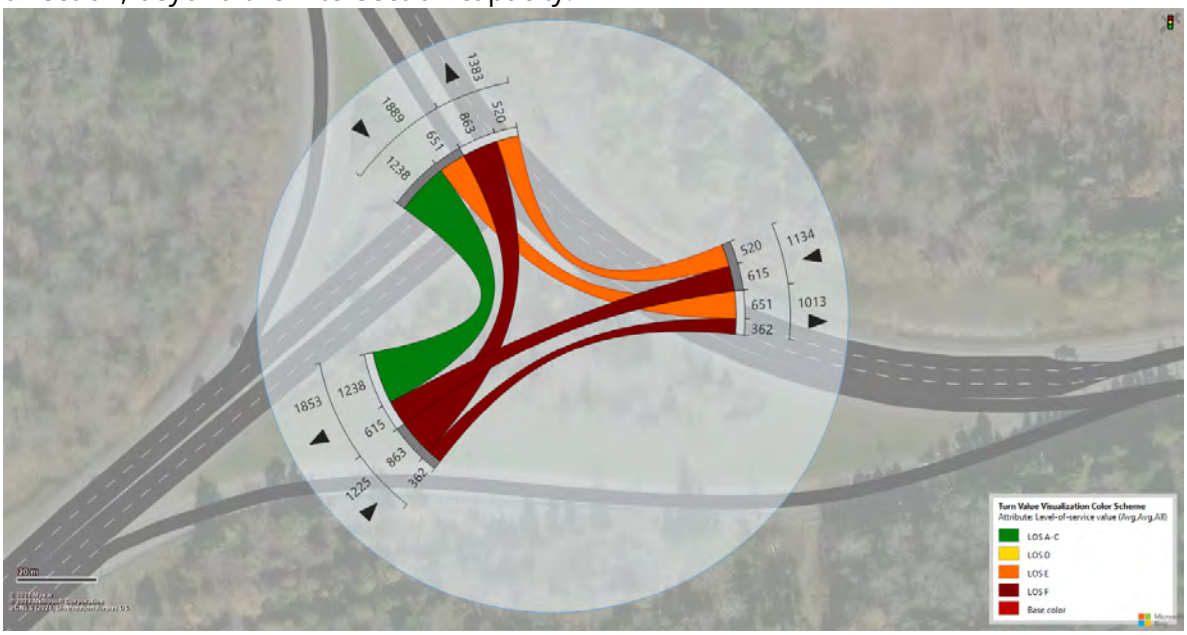


Figure 5-18: LOS – Mitigation 2045 PM Peak (Node 108 - Prospect Rd. & SMB Rd.)

The intersection of Dunbrack St. and Albert Walker Drive (Node 112) is anticipated to operate with overall LOS E. This is mainly due to NBL movement conflicting with the dominant SBT traffic of about 1,400 vehicles.

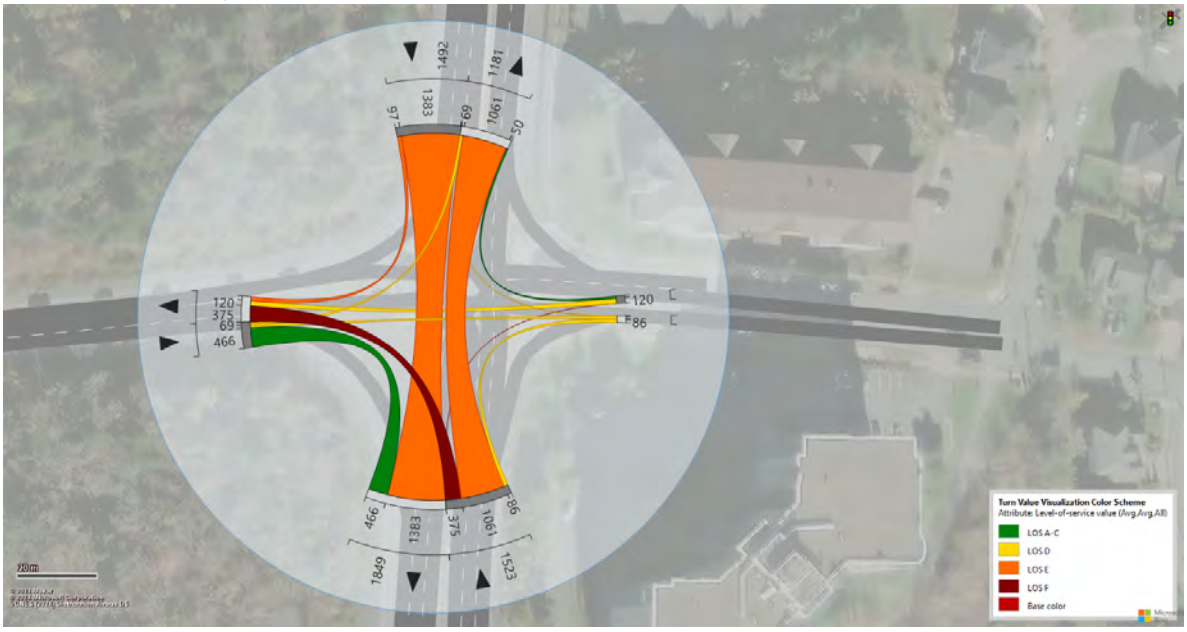


Figure 5-19: LOS – Mitigation 2045 PM Peak (Node 112 – Dunbrack St. & Albert Walker Drive)

The intersection of Prospect Rd. & HEC Future northern Access 01 (Node 219) is anticipated to operate with overall LOS E. This is mainly due delays at along Prospect Rd. SBT (1,591 vehicles) and SBL (32 vehicles) movements resulting from extended queues at the next signalized intersection at the central access point of HEC and Ragged Lake developments.

Figure 5-20: LOS – Mitigation 2045 PM Peak (Node 219 – Prospect Rd. & HEC Future Access 01)

It is understood that the developer is revising the site plan to provide better internal connectivity between the site access roads, which is expected to produce more optimal loading between the roads and likely resolve this constraint.

The intersection of Prospect Rd. & HEC Future Access 02 (Node 220) is anticipated to operate with overall LOS F. This is a more centralized access to the HEC in which the SBL movement (194 vehicles) experience significant delays due to the conflict with the dominant NBT movement (1,060 vehicles) along Prospect Rd. The intersection was modelled as stop-controlled, with a dedicated SBL turn lane. In reality, the relatively heavy volumes may result in loading to the other intersections, as the internal road network of the development is inter-conencted.

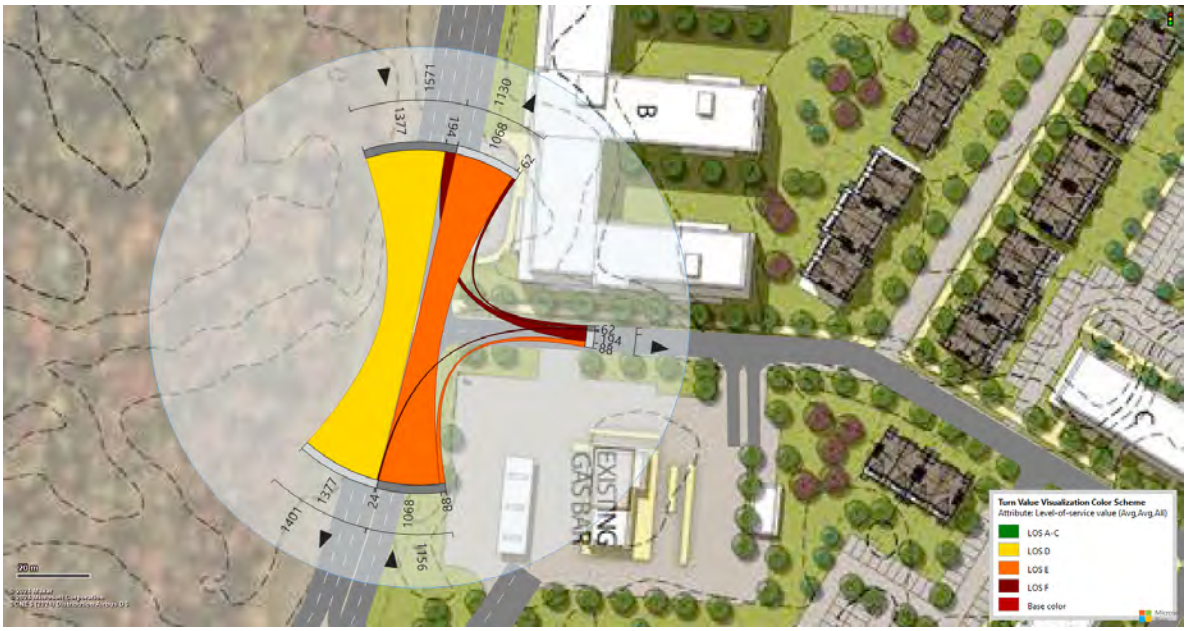


Figure 5-21: LOS – Mitigation 2045 PM Peak (Node 220 – Prospect Rd. & HEC Future Access 02)

The intersection of Prospect Rd. & HEC/RL Future Access (Node 234) is anticipated to operate with overall LOS E. This is the main access to both HEC and Ragged Lake development with conflicting in / out movements, beyond the intersection capacity.

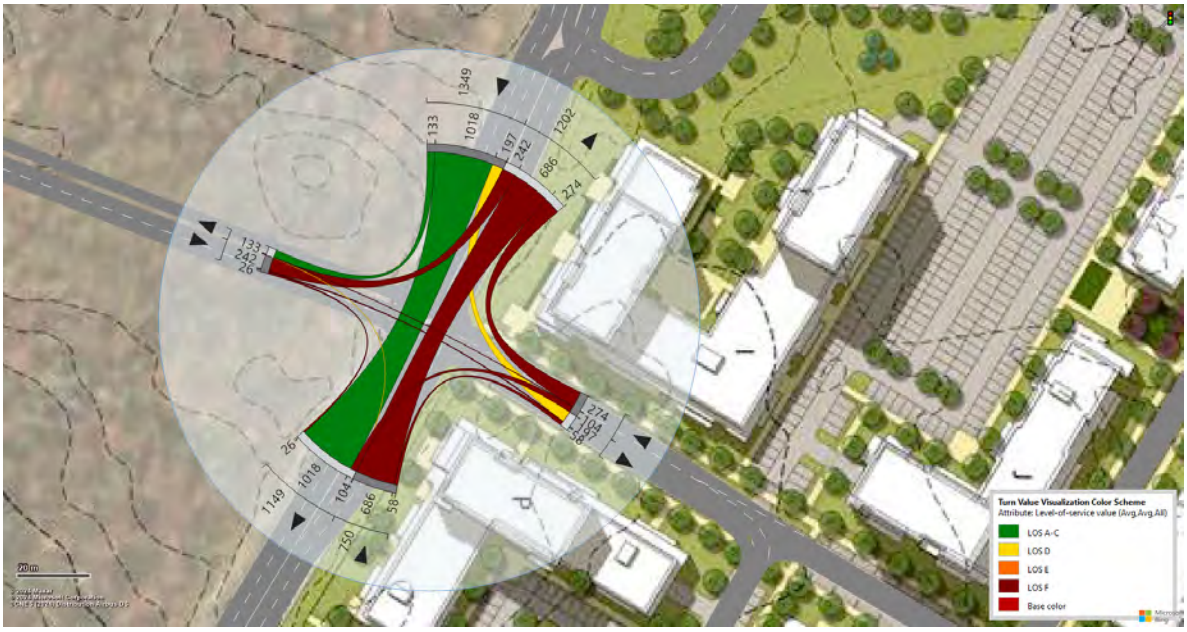


Figure 5-22: LOS – Mitigation 2045 PM Peak (Node 234 – Prospect Rd. & HEC/RL Future Access)

5.5 Corridor Improvements 2045

In line with the project objectives, and with the aim to address the Prospect Rd. capacity constraints demonstrated through preceding analysis results, corridor improvement scenarios have been developed which include all the preceding mitigation measures plus new corridor connections by 2045 as follows:

- **Connection to Hwy 103:**
  - **Option 1** – new connection between Prospect Rd. and Hwy 103 **Exit 3**
  - **Option 2** – new connection between Prospect Rd. and Hwy 103 **between Exit 2 and Exit 3**
- **Connection to Route 306**
  - New emergency connection between Prospect Rd. and Route 306

5.5.1 Option 1

In this option, the new connection **would start from the Prospect Rd. & Evergreen Pl. intersection and ending at Hwy 103 Exit 3, as illustrated on** Figure 5-23. It is to be noted that the purpose of modelling this connection is to capture its functionality and additional route choices offered, and that the exact variations in the alignment options would not have noticeable impacts on the traffic analysis.

Figure 5-23: Corridor Improvements 2045 Option 1 Modelled Network

Model runs have been completed for the Corridor Improvements 2045 Option 1 AM and PM peak hour scenarios. An overview summary of the main results is provided within this section, while additional and complete model outputs are available in the appendices.

The new connection to Exit 3 will serve as an additional gateway for the developments along Prospect Rd., providing access to Hwy 103 and the wider transportation networks, as well as enabling additional development of Ragged Lake towards. For this reason, and to understand the benefits of this new connection, it is important to quantify the potential increase in the amount of traffic being serviced under the two scenarios, the corridor improvements and the mitigation 2045 (without the new connection). Table 5-8 shows such comparison and suggests that **the introduction of the new connection will allow to serve an additional traffic in range 57% to 74% for the peak directions**, compared to the Mitigation scenario excluding a connection to Exit 3.

During the AM peak hour, the new Exit 3 connection will enable in increase of 18% in NB circulation and 74% in SB circulation. While the new connection will take much of this volume, particularly int eh SB direction, we note that the increased Ragged Lake development will also trigger an increase in the SB inbound volumes on Prospect Rd. This dynamic is not entirely reversed in the PM peak hour, As summarized below, the southbound inbound direction is more distributed across the corridors, since the additional Ragged Lake development does not produce a significant increase in inbound PM trips. Further investigation at Exit 3 found that the ramp terminals would draw even more vehicular travel demand off Prospect Rd. if they were signalized.

Table 5-8: Traffic Flows Comparison at Gateways (Mitigation 2045 vs Corridor Improvements 2045 Option 1)

Peak Hour	Road	Direction	Mitigation 2045	Corridor Improvements 2045 Option 1	% Difference
AM Peak Hour	Prospect Rd.	NB	1063	1038	**-2%**
		SB	1644	2079	**+26%**
	New Connection to Hwy 103-**Exit 3**	NB	0	215	
		SB	0	788	
	Total	**NB**	**1063**	**1253**	**+18%**
		SB	**1644**	**2867**	**+74%**
PM Peak Hour	Prospect Rd.	NB	1225	1223	**0%**
		SB	1853	1541	**-17%**
	New Connection to Hwy 103-**Exit 3**	NB	0	699	
		SB	0	284	
	Total	**NB**	**1225**	**1922**	**+57%**
		SB	**1853**	**1825**	**-2%**

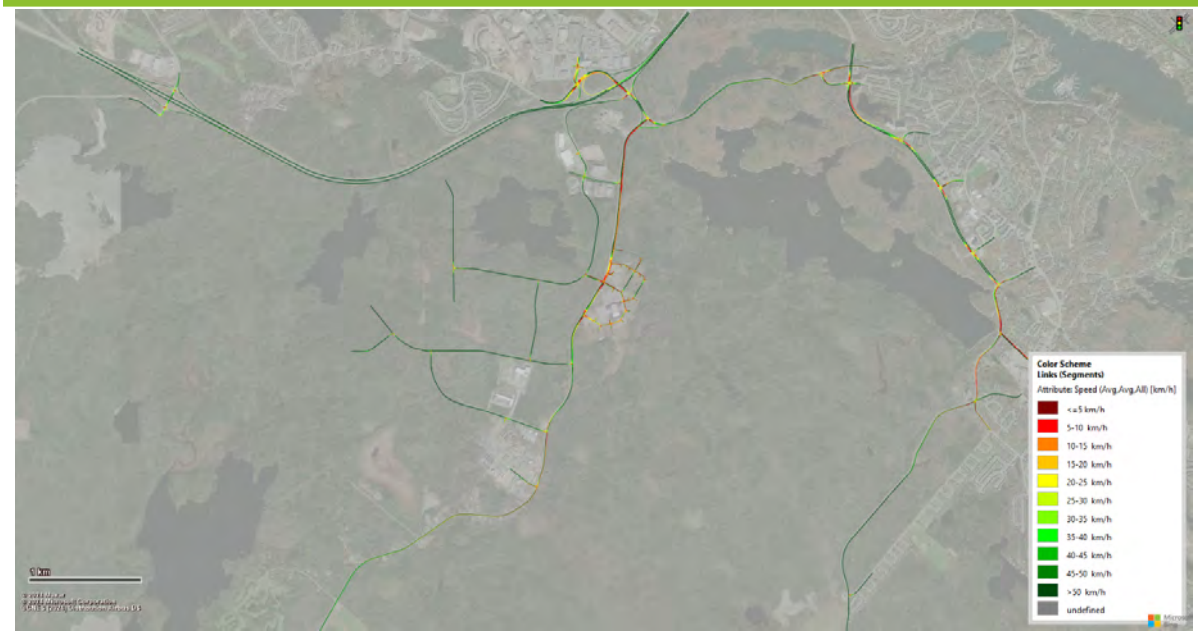
Figure 5-24 and Figure 5-25 show a road speed comparison between mitigation 2045 and corridor improvements 2045 Option 1 scenarios, while Table 5-9 and Table 5-10 include a comparison of the intersection LOS for the same scenarios.

From operational analysis perspective, majority of road segments and intersection continue to operate with similar levels to the previous scenario without the new connection. This suggests that Prospect Rd. would still be at capacity, but the entire system is capable of moving considerably higher traffic flows, which are utilizing the new connection to Exit 3. Without such connection, all these flows will not have the opportunity to enter / exit the various developments due to the bottlenecks along Prospect Rd.

The completed analysis confirms the need for an additional connection between Prospect Rd. and Hwy 103. The connection to Exit 3 would relieve operational pressure on the Prospect Rd. and Exit 2 and would also provide alternative route to connect the Prospect Rd. communities with the wider transportation network.

The analysis also suggests that additional mitigation measures are to be explored to further enhance the operational conditions along Prospect Rd. and to support the planned residential and employment developments. Such additional measures could include introducing alternative and / or additional connection between Prospect Rd. and Hwy 103, as well as the signalization of Exit 3 intersections.

Mitigation 2045



Corridor Improvements 2045 Option 1

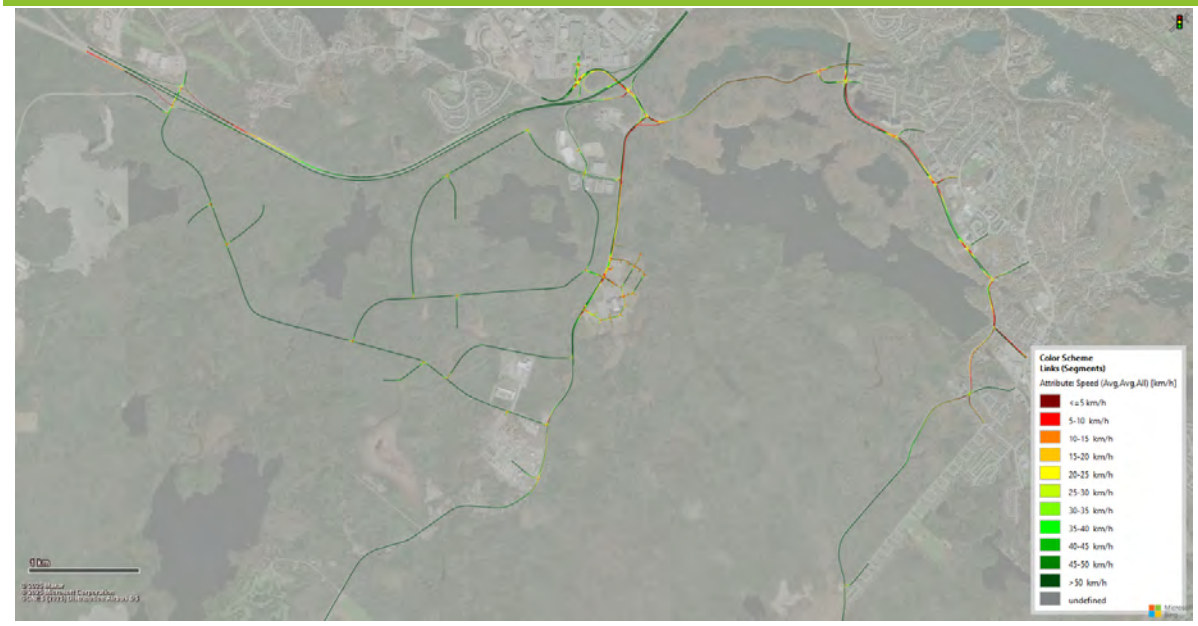
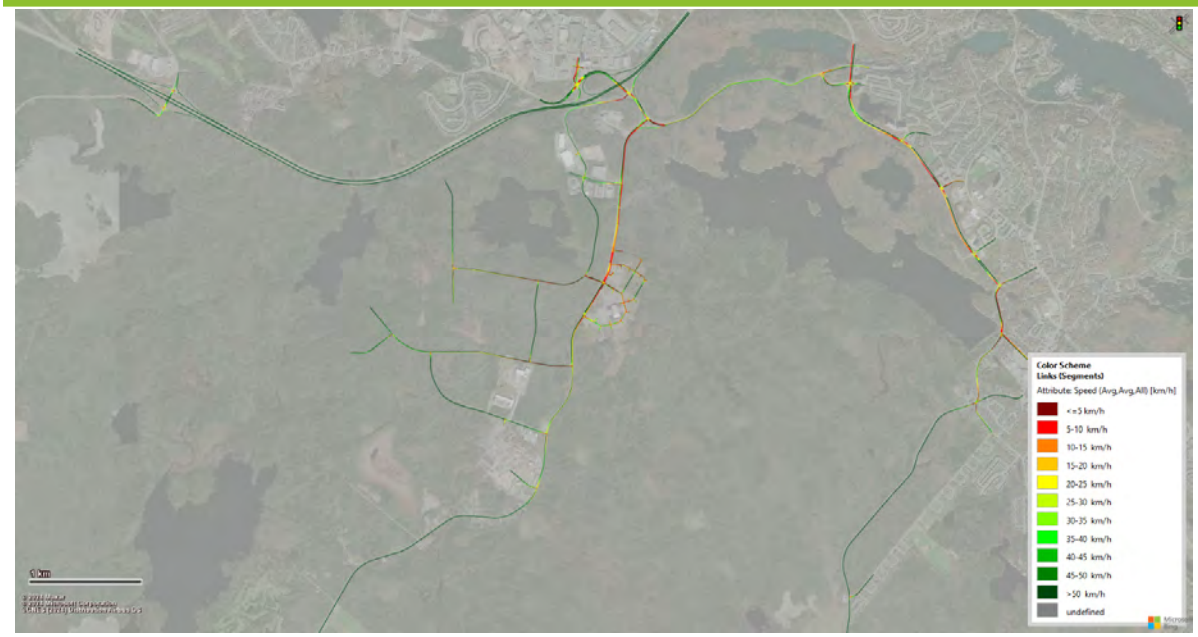


Figure 5-24: Road Speed Comparison – Mitigation vs Corridor Improvements 2045 Option 1 AM Peak Hour

Mitigation 2045



Corridor Improvements 2045 Option 1

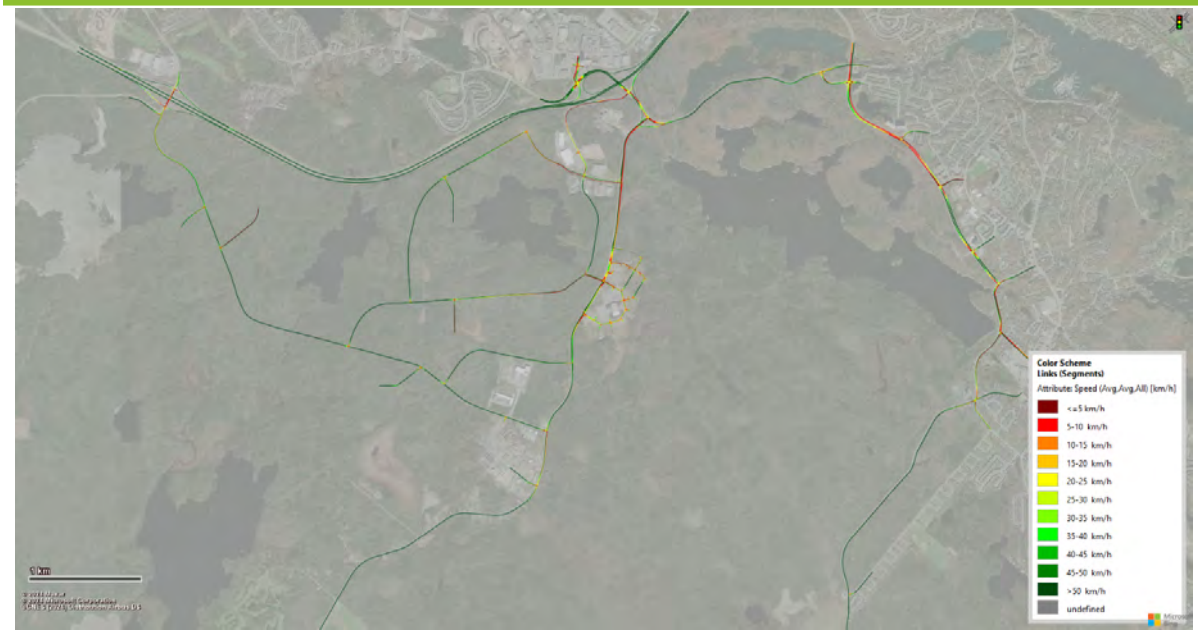


Figure 5-25: Road Speed Comparison – Mitigation vs Corridor Improvements 2045 Option 1 PM Peak Hour

Table 5-9: Intersection LOS Comparison – AM Peak Hour (Mitigation vs Corridor Improvements 2045 Option 1)

Node ID	Intersection Name	Mitigation 2045	Corridor Improvement 2045 - Option1
106	Prospect Rd. & Exhibition Park Driveway	C	C
107	Prospect Rd. & Ragged Lake Boulevard	D	C
108	Prospect Rd. & SMB Road	E	F
109	St.Margarets Bay Rd & Hwy 103 Off-ramp/On-ramp	D	D
110	SMB Road & Lakelands Blvd	D	C
112	Dunbrack Street & Albert Walker Drive/Walter Havill Drive	E	E
113	Dunbrack Street & Route 306	D	D
200	St.Margarets Bay Rd & Albert Walker Drive	C	C
203	Hwy 103 Timberlea Village Pkwy WB Ramp	A	C
204	Hwy 103 Timberlea Village Pkwy EB Ramp	A	D
219	Prospect Rd. & HEC Future Access 01	C	C
220	Prospect Rd. & HEC Future Access 02	D	D
232	Prospect Rd. & Ragged Lake Future Access	B	A
233	Prospect Rd. & HEC Future Access 03	D	C
234	Prospect Rd. & HEC/RL Future Access	E	D
250	Prospect Rd. & Evergreen Place	D	C
271	Prospect Road/RL Roundabout	#N/A	#N/A
272	New Interchange North Intersection	#N/A	#N/A
273	New Interchange South Intersection	#N/A	#N/A

Table 5-10: Intersection LOS Comparison – PM Peak Hour (Mitigation vs Corridor Improvements 2045 Option 1)

Node ID	Intersection Name	Mitigation 2045	Corridor Improvement 2045 - Option1
106	Prospect Rd. & Exhibition Park Driveway	C	C
107	Prospect Rd. & Ragged Lake Boulevard	E	F
108	Prospect Rd. & SMB Road	F	E
109	St.Margarets Bay Rd & Hwy 103 Off-ramp/On-ramp	D	D
110	SMB Road & Lakelands Blvd	D	D
112	Dunbrack Street & Albert Walker Drive/Walter Havill Drive	E	E
113	Dunbrack Street & Route 306	D	D
200	St.Margarets Bay Rd & Albert Walker Drive	C	C
203	Hwy 103 Timberlea Village Pkwy WB Ramp	A	F
204	Hwy 103 Timberlea Village Pkwy EB Ramp	A	F
219	Prospect Rd. & HEC Future Access 01	E	C
220	Prospect Rd. & HEC Future Access 02	F	E
232	Prospect Rd. & Ragged Lake Future Access	D	B
233	Prospect Rd. & HEC Future Access 03	D	C
234	Prospect Rd. & HEC/RL Future Access	E	E
250	Prospect Rd. & Evergreen Place	B	C
271	Prospect Road/RL Roundabout	#N/A	#N/A
272	New Interchange North Intersection	#N/A	#N/A
273	New Interchange South Intersection	#N/A	#N/A

Within the Corridor Improvement 2045 Option 1 scenario, operational conditions at the intersections are similar to the previous mitigation 2045 scenario, as mentioned earlier. Nevertheless, the 2 intersections at Exit 3 experience worsen conditions and are anticipated to operate with LOS F during the PM peak hour. This is mainly driven by the induced traffic at these intersections as a result of the new connection to Prospect Rd. These issues have been further investigated, and it was confirmed that they can be resolved by introducing traffic signals as demonstrated within the Ultimate Beyond 2045 scenario in the following sections.

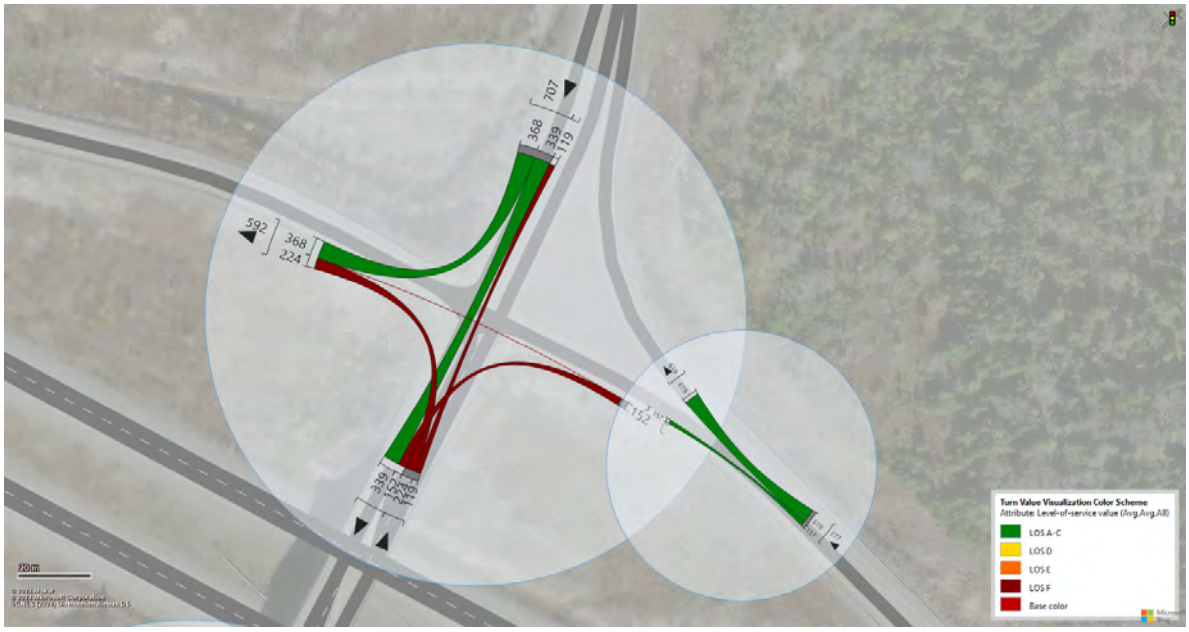


Figure 5-26: LOS – Corridor Improvements 2045 PM Peak (Node 203 – Hwy 103 & Timberlea Village Pkwy WB Ramp)

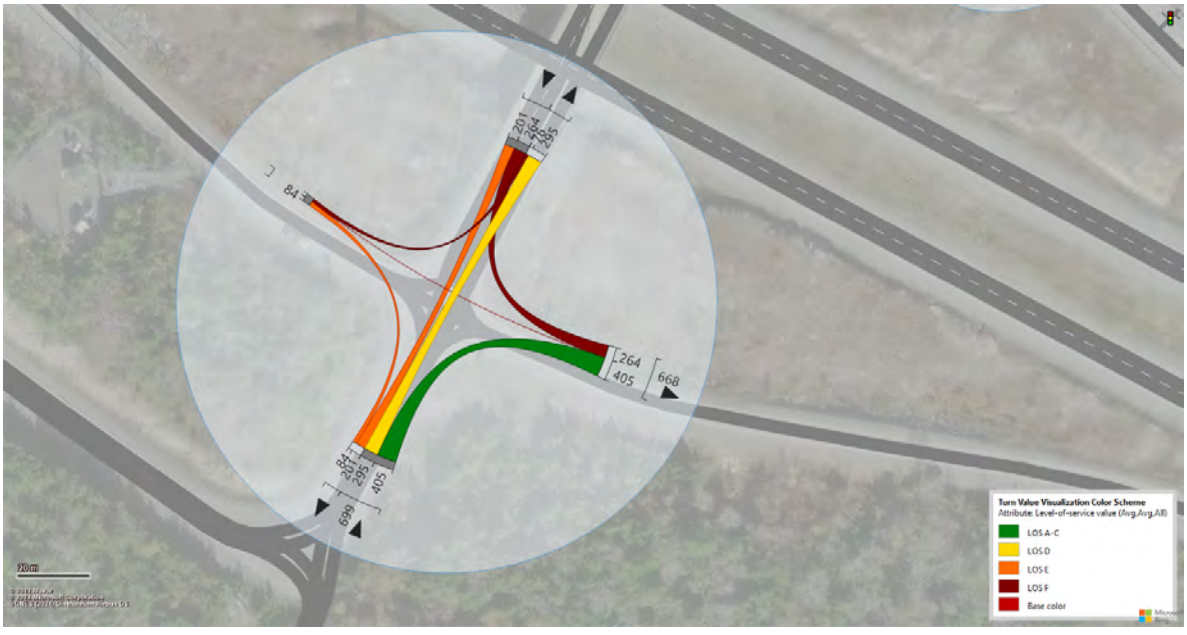


Figure 5-27: LOS – Corridor Improvements 2045 PM Peak (Node 204 – Hwy 103 & Timberlea Village Pkwy EB Ramp)

5.5.2 Option 2

Under Option 2, a more direct connection between Prospect Rd. and Hwy 103 has been investigated which **starts from an upgraded roundabout at Prospect Rd. intersection with Big Indian Rd. and ends at a new interchange on Hwy 103 between Exits 2 and 3**. Figure 5-28 illustrates the modelled network for this scenario.

For the purposes of completing the traffic analysis, the shown configuration of directional ramps has been modelled and analysed. It is be noted that this test aims are exploring the potential operational improvements on the road network, rather that recommending a specific location or configuration of such new interchange or directional ramps. The latter, if deemed necessary, is to be covered by a dedicated study focused on the Ragged Lake development needs.

Figure 5-28: Corridor Improvements 2045 Option 2 Modelled Network

Model runs have been completed for the Corridor Improvements 2045 Option 2 AM and PM peak hour scenarios. An overview summary of the main results is provided within this section. while additional and complete model outputs are available within the appendices.

The connection to the new interchange between Exits 2 and 3 also serve as an additional gateway for the developments along Prospect Rd., providing access to Hwy 103 and the wider transportation networks.

Looking at the gateways traffic flows, and in comparison to Option 1 connecting to Exit 3, **Option 2 has the potential to be considerably more utilized in both the NB and the SB directions**, as shown in Table 5-11. At the same time, this more-direct connection to Hwy 103 would help by reducing the traffic flows along Prospect Rd. in range of 20% to 30% as it offers a parallel route to Prospect Rd. towards the wider network.

Table 5-11: Traffic Flows Comparison at Gateways (Corridor Improvements 2045 Option 1 vs Option 2)

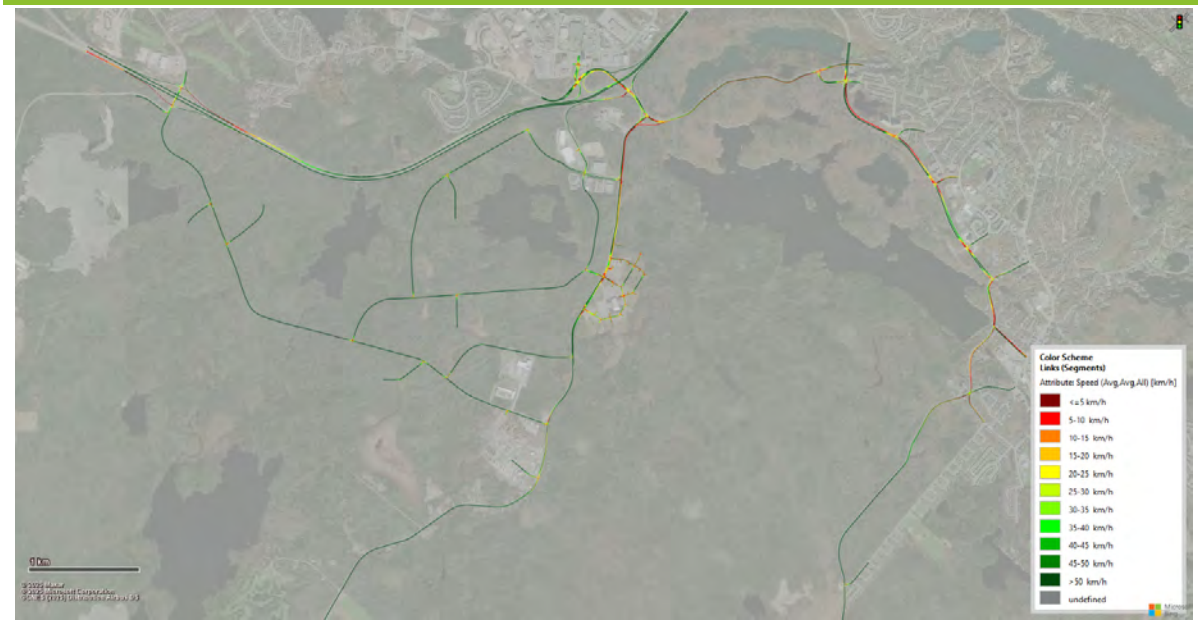
Peak Hour	Road	Direction	Corridor Improvements 2045 Option 1	Corridor Improvements 2045 Option 2	% Difference
AM Peak Hour	Prospect Rd.	NB	1038	809	**-22%**
		SB	2079	1655	**-20%**
	New Connection to Hwy 103-**Exit 3**	NB	215	0	
		SB	788	0	
	New Interchange on Hwy 103-**Between Exits 2&3**	NB	0	488	
		SB	0	1719	
	Total	**NB**	**1253**	**1297**	**+4%**
		SB	**2867**	**3374**	**+18%**
PM Peak Hour	Prospect Rd.	NB	1223	1172	**-4%**
		SB	1541	1090	**-29%**
	New Connection to Hwy 103-**Exit 3**	NB	699	0	
		SB	284	0	
	New Interchange on Hwy 103-**Between Exits 2&3**	NB	0	1347	
		SB	0	702	
	Total	**NB**	**1922**	**2519**	**+31%**
		SB	**1825**	**1792**	**-2%**

Figure 5-29 and Figure 5-30 show a road speed comparison between the corridor improvements 2045 Option 1 and Option 2 scenarios, while Table 5-12 and Table 5-13 include a comparison of the intersection LOS for the same scenarios.

In terms of operation performance, the further reduction in traffic flows along Prospect Rd. would result in slightly improved average speed on the road, while the LOS assessment shows that majority of intersections within the study area would continue to operate with similar levels to the previous Option 1 scenario. Nevertheless, **this Option remains a viable and useful alternative given the ability to serve additional traffic at the study**

area level, the lower traffic flows along Prospect Rd., as well as offering a secondary connection to Hwy 103.

Corridor Improvements 2045 Option 1



Corridor Improvements 2045 Option 2

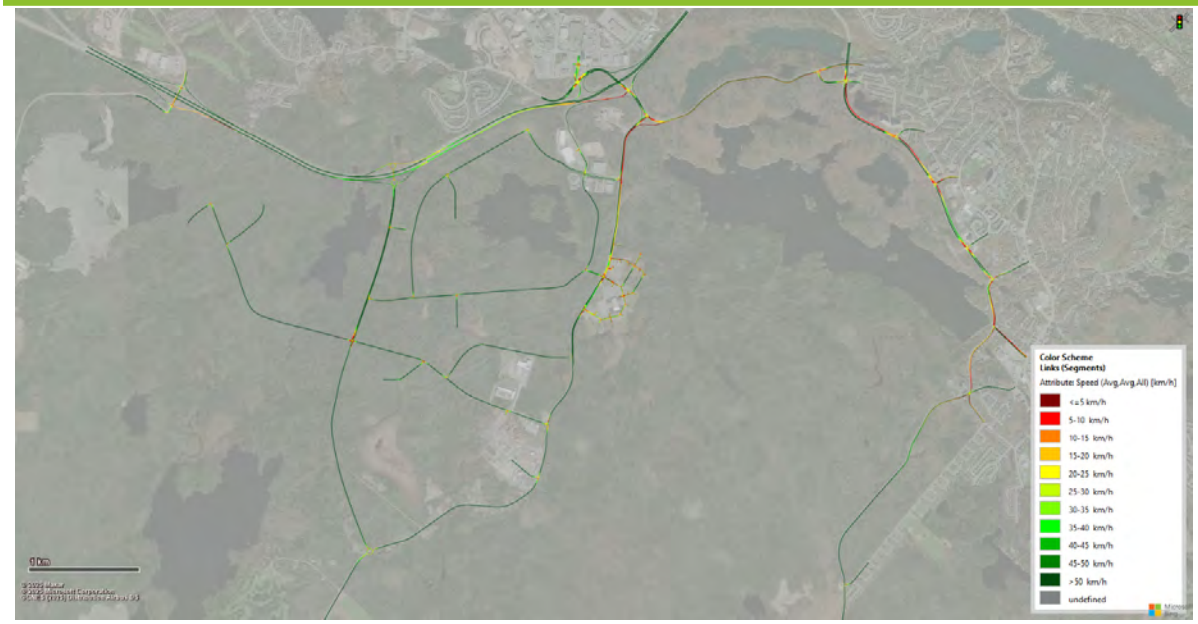
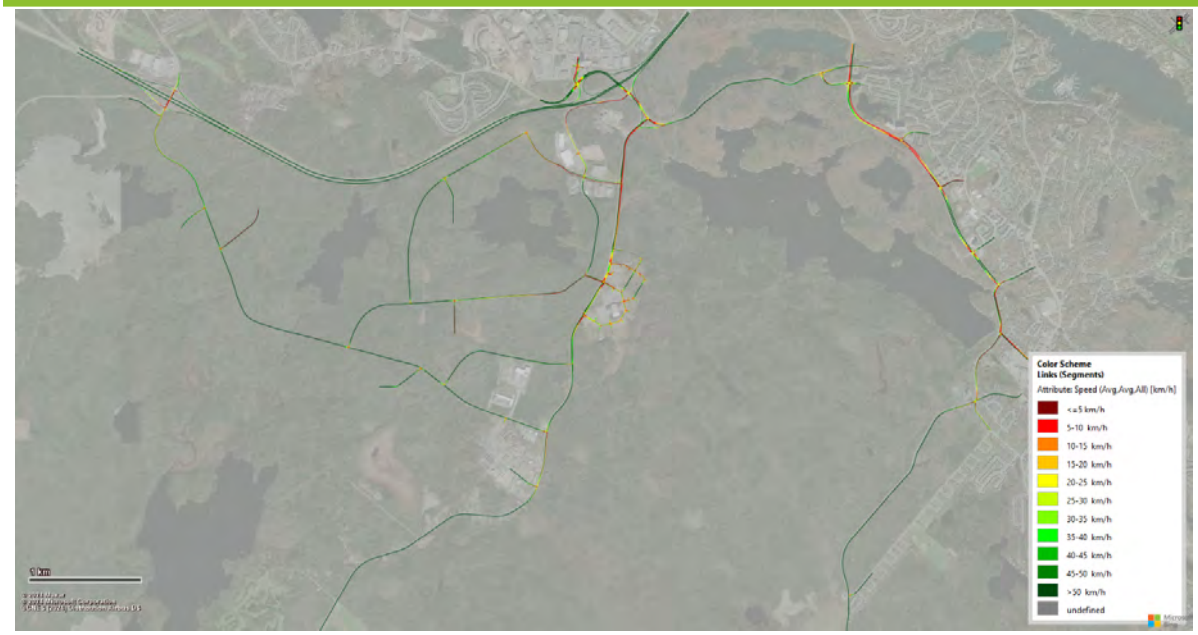


Figure 5-29: Road Speed Comparison – Corridor Improvements 2045 Option 1 vs Option 2 AM Peak Hour

Corridor Improvements 2045 Option 1



Corridor Improvements 2045 Option 2

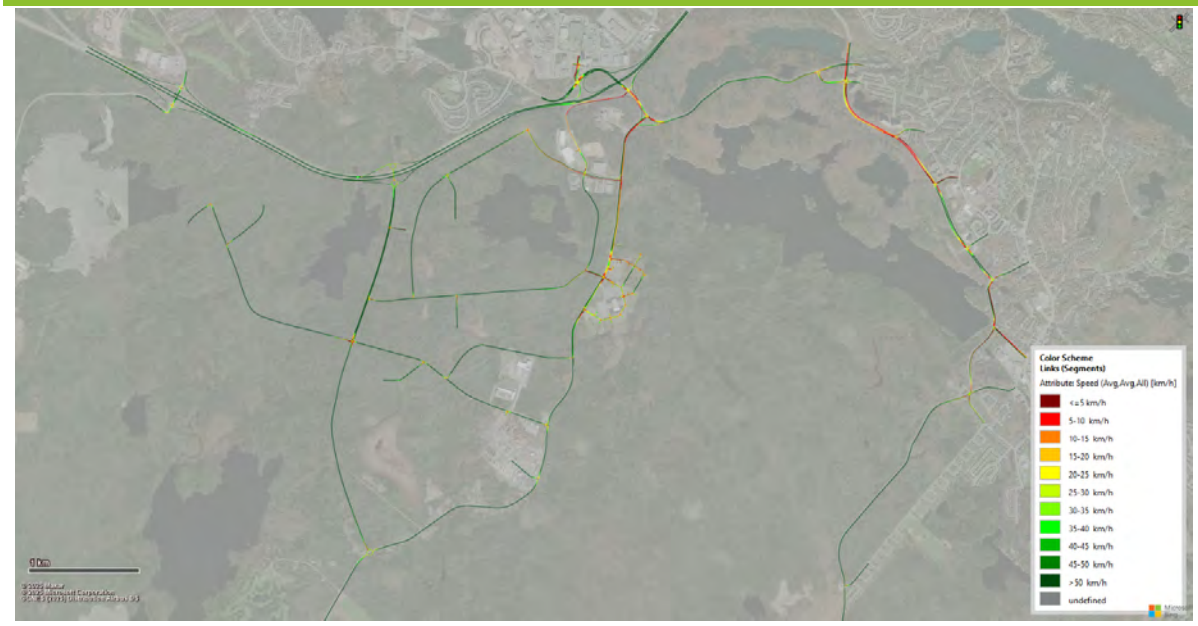


Figure 5-30: Road Speed Comparison – Corridor Improvements 2045 Option 1 vs Option 2 PM Peak Hour

Table 5-12: Intersection LOS Comparison – AM Peak Hour (Corridor Improvements 2045 Option 1 vs Option 2)

Node ID	Intersection Name	Corridor Improvement 2045 - Option1	Corridor Improvement 2045 - Option2
106	Prospect Rd. & Exhibition Park Driveway	C	C
107	Prospect Rd. & Ragged Lake Boulevard	C	D
108	Prospect Rd. & SMB Road	F	F
109	St.Margarets Bay Rd & Hwy 103 Off-ramp/On-ramp	D	C
110	SMB Road & Lakelands Blvd	C	C
112	Dunbrack Street & Albert Walker Drive/Walter Havill Drive	E	E
113	Dunbrack Street & Route 306	D	D
200	St.Margarets Bay Rd & Albert Walker Drive	C	C
203	Hwy 103 Timberlea Village Pkwy WB Ramp	C	C
204	Hwy 103 Timberlea Village Pkwy EB Ramp	D	D
219	Prospect Rd. & HEC Future Access 01	C	D
220	Prospect Rd. & HEC Future Access 02	D	D
232	Prospect Rd. & Ragged Lake Future Access	A	A
233	Prospect Rd. & HEC Future Access 03	C	C
234	Prospect Rd. & HEC/RL Future Access	D	E
250	Prospect Rd. & Evergreen Place	C	B
271	Prospect Road/RL Roundabout	#N/A	A
272	New Interchange North Intersection	#N/A	D
273	New Interchange South Intersection	#N/A	A

Table 5-13: Intersection LOS Comparison – PM Peak Hour (Corridor Improvements 2045 Option 1 vs Option 2)

Node ID	Intersection Name	Corridor Improvement 2045 - Option1	Corridor Improvement 2045 - Option2
106	Prospect Rd. & Exhibition Park Driveway	C	C
107	Prospect Rd. & Ragged Lake Boulevard	F	F
108	Prospect Rd. & SMB Road	E	F
109	St.Margarets Bay Rd & Hwy 103 Off-ramp/On-ramp	D	D
110	SMB Road & Lakelands Blvd	D	D
112	Dunbrack Street & Albert Walker Drive/Walter Havill Drive	E	E
113	Dunbrack Street & Route 306	D	D
200	St.Margarets Bay Rd & Albert Walker Drive	C	C
203	Hwy 103 Timberlea Village Pkwy WB Ramp	F	A
204	Hwy 103 Timberlea Village Pkwy EB Ramp	F	A
219	Prospect Rd. & HEC Future Access 01	C	D
220	Prospect Rd. & HEC Future Access 02	E	E
232	Prospect Rd. & Ragged Lake Future Access	B	B
233	Prospect Rd. & HEC Future Access 03	C	C
234	Prospect Rd. & HEC/RL Future Access	E	E
250	Prospect Rd. & Evergreen Place	C	A
271	Prospect Road/RL Roundabout	#N/A	B
272	New Interchange North Intersection	#N/A	A
273	New Interchange South Intersection	#N/A	A

5.6 Ultimate Beyond 2045

This section explores additional and more comprehensive intervention options that could serve the study area beyond 2045.

5.6.1 Option 3A

This option essentially includes both of the new connections considered within Option 1 and 2, i.e., new connection between Prospect Rd. and Hwy 103 Exit 3, and another connection between Prospect Rd. and a new partial interchange along Hwy 103 between Exits 2 and 3, at a central location to the future Ragged Lake development, as illustrated in Figure 5-31. In addition to the new connections to Hwy 103, this scenario includes all the previously mentioned mitigation measures.

While the Option 2 network was shown to result in somewhat better results, this option aims at capitalizing on the existing interchange at Exit 3, which could be naturally connected to the future Ragged Lake development internal network and strengthen the connectivity of the wider network.

Figure 5-31: Ultimate Beyond 2045 Option 3A Modelled Network

Model runs have been completed for the Ultimate Beyond 2045 Option 3A AM and PM peak hour scenarios. An overview summary of the main results is provided within this section. while additional and complete model outputs are available within the appendices.

Traffic flow comparison at the study area gateways is provided within Table 5-14 which shows that in comparison to Option 1, the availability of two connections towards Hwy 103 would help by reducing traffic flows on Prospect Rd. by 25%-30%, compared to Option 1, while still processing 11% to 23% more vehicular demand.

Table 5-14: Traffic Flows Comparison at Gateways (Corridor Improvements 2045 Option 1 vs Ultimate Beyond 2045 Option 3A)

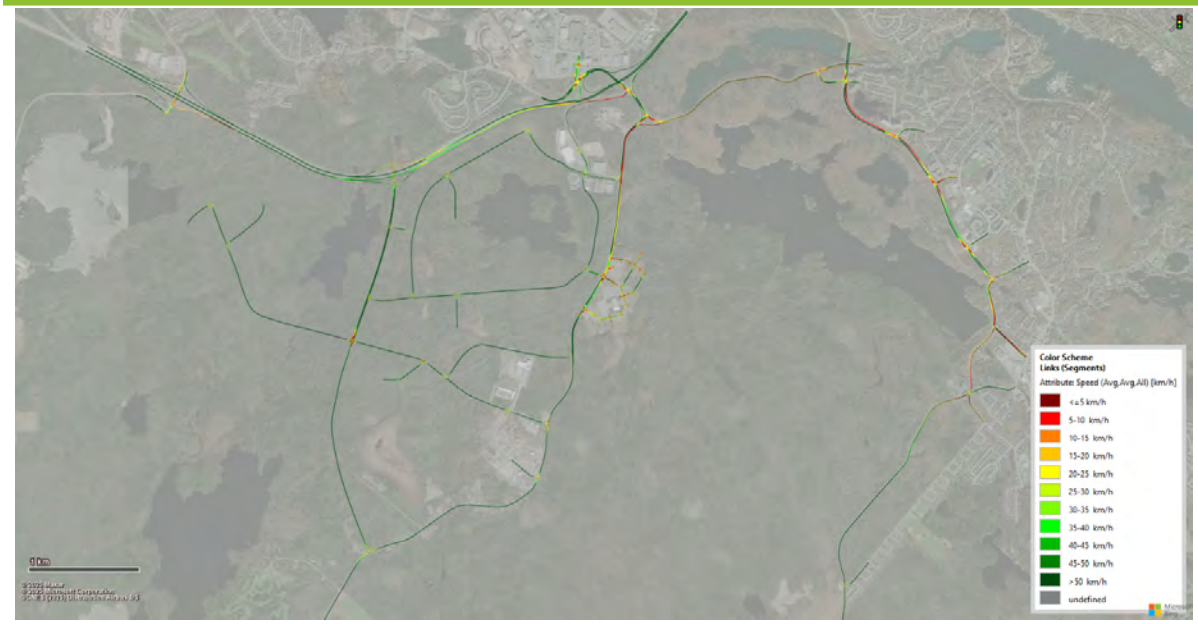
Peak Hour	Road	Direction	Corridor Improvements 2045 Option 1	Ultimate Beyond 2045 Option 3A	% Difference
AM Peak Hour	Prospect Rd.	NB	1038	774	-25%
		SB	2079	1510	-27%
	New Connection to Hwy 103-**Exit 3**	NB	215	135	
		SB	788	900	
	New Interchange on Hwy 103-**Between Exits 2&3**	NB	0	357	
		SB	0	1103	
	Total	**NB**	**1253**	**1266**	**1%**
		SB	**2867**	**3513**	**23%**
PM Peak Hour	Prospect Rd.	NB	1223	876	-28%
		SB	1541	1075	-30%
	New Connection to Hwy 103-**Exit 3**	NB	699	589	
		SB	284	272	
	New Interchange on Hwy 103-**Between Exits 2&3**	NB	0	659	
		SB	0	481	
	Total	**NB**	**1922**	**2124**	**11%**
		SB	**1825**	**1828**	**0%**

Figure 5-32 and Figure 5-33 show a road speed comparison between Corridor Improvements 2045 Option 2 and Ultimate Beyond 2045 Option 3A scenarios, while Table 5-15 and Table 5-16 include a comparison of the intersection LOS for the same scenarios.

In terms of average road speed along Prospect Rd., both scenarios show somewhat similar results in both peak hours. Similarly, operational conditions appear to be in line with the Option 2 scenario.

Keeping in mind the ability to server additional traffic at the study area level, and the lower traffic flows along Prospect Rd., **this option could be considered for beyond 2045 to capitalize on both of the existing interchange at Exit 3, as well as the envisioned comprehensive network on the future Ragged Lake development, to provide a total of 2 new connections between Prospect Rd. communities and Hwy 103.**

Corridor Improvements 2045 Option 2



Ultimate Beyond 2045 Option 3A

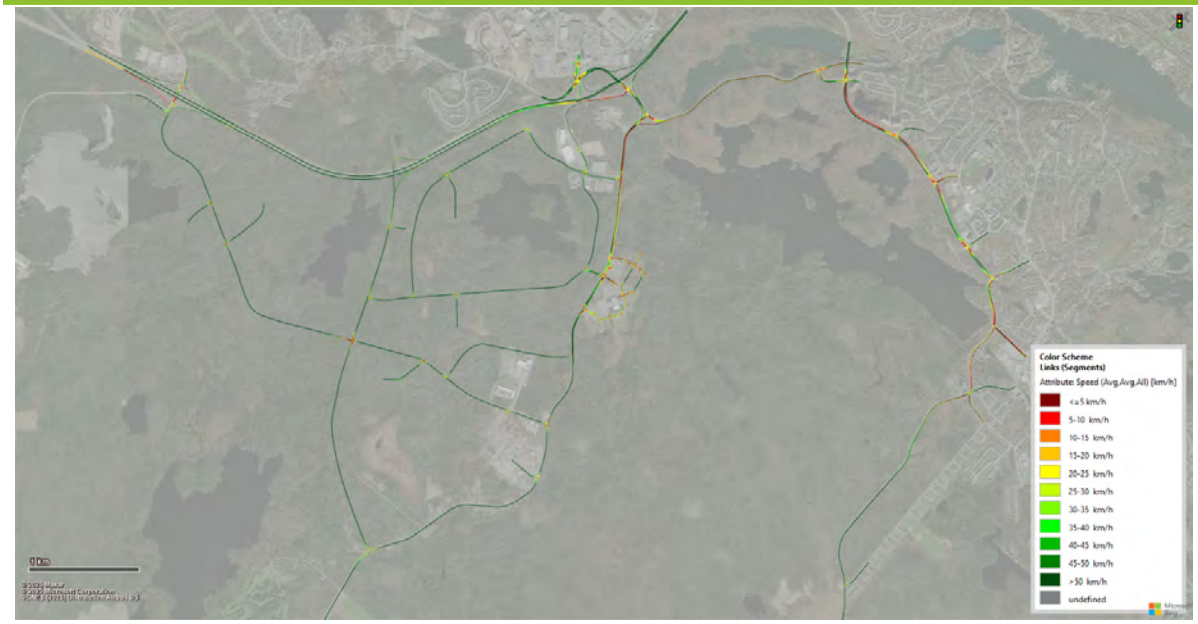
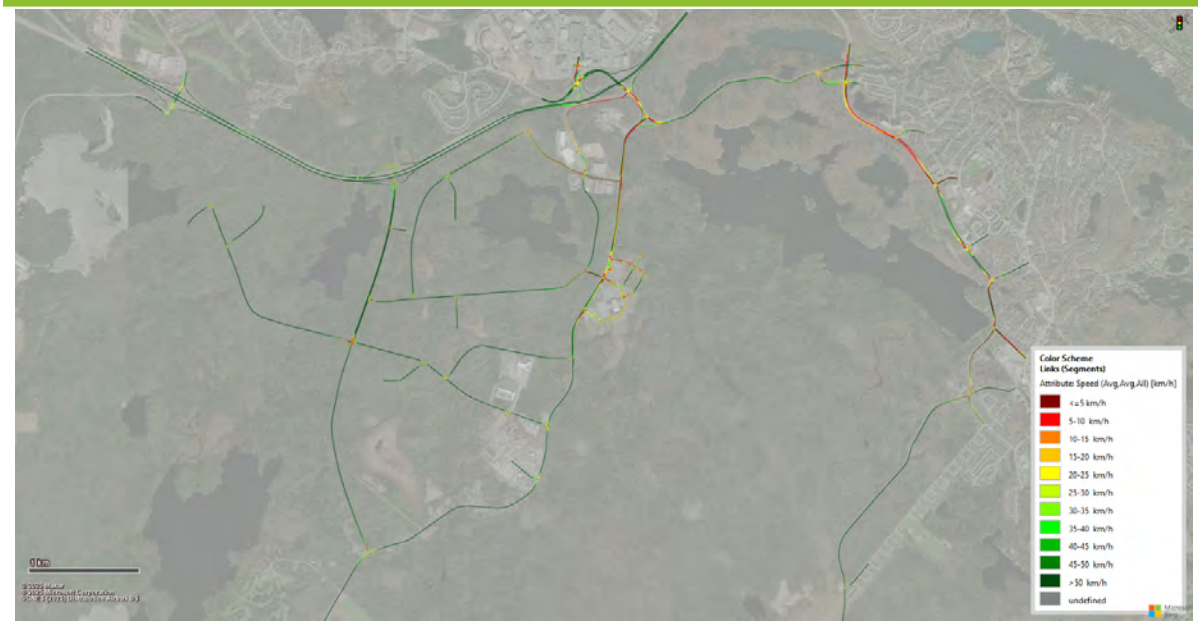


Figure 5-32: Road Speed Comparison – Corridor Improvements 2045 Option 2 vs Ultimate Beyond 2045 Option 3A AM Peak Hour

Corridor Improvements 2045 Option 2



Ultimate Beyond 2045 Option 3A

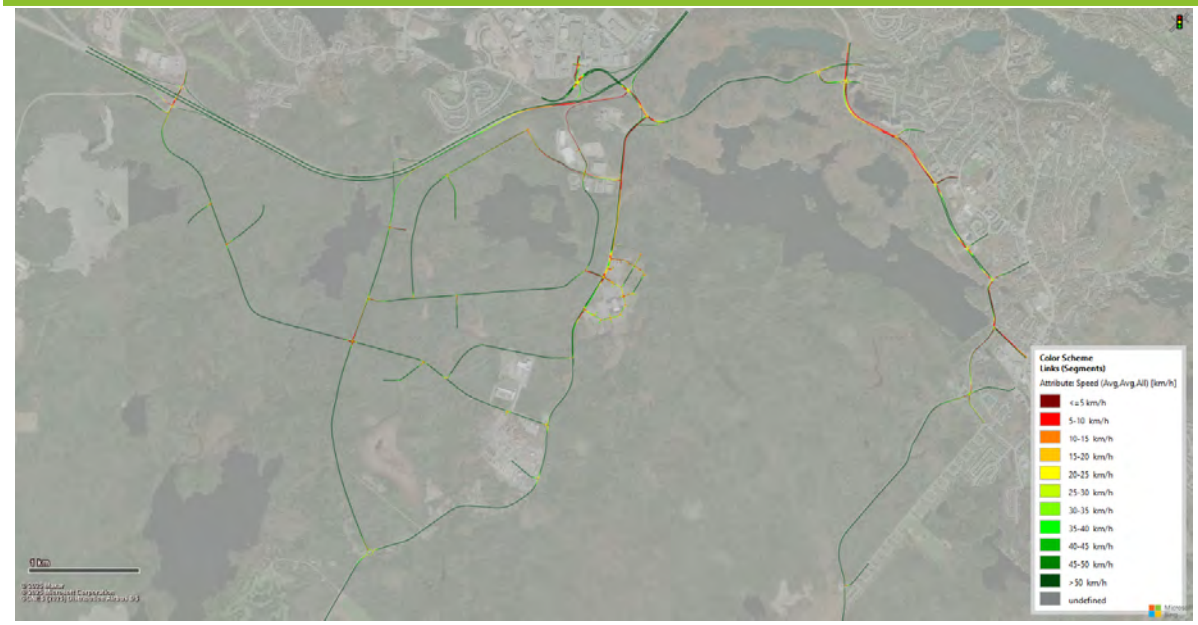


Figure 5-33: Road Speed Comparison – Corridor Improvements 2045 Option 2 vs Ultimate Beyond 2045 Option 3A PM Peak Hour

We note that despite the significant capacity added to the study area road network, the Prospect Road & St. Margaret's Bay Road intersection is expected to remain constrained, due to the high travel demand incurred by development along Prospect Road, including the Exhibition Centre redevelopment. Given the heavy volumes in all major conflicting movements, there is limited opportunity to alleviate constraints at this intersection, further supporting a strategy that seeks to distribute demand over multiple corridors.

Table 5-15: Intersection LOS Comparison – AM Peak Hour (Corridor Improvements Option 2 2045 vs Ultimate Beyond Option 3A 2045)

Node ID	Intersection Name	Corridor Improvement 2045 - Option2	Ultimate Beyond 2045 - Option 3A
106	Prospect Rd. & Exhibition Park Driveway	C	C
107	Prospect Rd. & Ragged Lake Boulevard	D	D
108	Prospect Rd. & SMB Road	F	F
109	St.Margarets Bay Rd & Hwy 103 Off-ramp/On-ramp	C	C
110	SMB Road & Lakelands Blvd	C	C
112	Dunbrack Street & Albert Walker Drive/Walter Havill Drive	E	E
113	Dunbrack Street & Route 306	D	D
200	St.Margarets Bay Rd & Albert Walker Drive	C	C
203	Hwy 103 Timberlea Village Pkwy WB Ramp	C	C
204	Hwy 103 Timberlea Village Pkwy EB Ramp	D	D
219	Prospect Rd. & HEC Future Access 01	D	D
220	Prospect Rd. & HEC Future Access 02	D	E
232	Prospect Rd. & Ragged Lake Future Access	A	A
233	Prospect Rd. & HEC Future Access 03	C	C
234	Prospect Rd. & HEC/RL Future Access	E	D
250	Prospect Rd. & Evergreen Place	B	B
271	Prospect Road/RL Roundabout	A	A
272	New Interchange North Intersection	D	#N/A
273	New Interchange South Intersection	A	#N/A

Table 5-16: Intersection LOS Comparison – PM Peak Hour (Corridor Improvements Option 2 2045 vs Ultimate Beyond Option 3A 2045)

Node ID	Intersection Name	Corridor Improvement 2045 - Option2	Ultimate Beyond 2045 - Option 3A
106	Prospect Rd. & Exhibition Park Driveway	C	C
107	Prospect Rd. & Ragged Lake Boulevard	F	E
108	Prospect Rd. & SMB Road	F	F
109	St.Margarets Bay Rd & Hwy 103 Off-ramp/On-ramp	D	E
110	SMB Road & Lakelands Blvd	D	D
112	Dunbrack Street & Albert Walker Drive/Walter Havill Drive	E	E
113	Dunbrack Street & Route 306	D	D
200	St.Margarets Bay Rd & Albert Walker Drive	C	C
203	Hwy 103 Timberlea Village Pkwy WB Ramp	A	E
204	Hwy 103 Timberlea Village Pkwy EB Ramp	A	D
219	Prospect Rd. & HEC Future Access 01	D	C
220	Prospect Rd. & HEC Future Access 02	E	E
232	Prospect Rd. & Ragged Lake Future Access	B	B
233	Prospect Rd. & HEC Future Access 03	C	C
234	Prospect Rd. & HEC/RL Future Access	E	E
250	Prospect Rd. & Evergreen Place	A	A
271	Prospect Road/RL Roundabout	B	B
272	New Interchange North Intersection	A	#N/A
273	New Interchange South Intersection	A	#N/A

5.6.2 Option 3B

For completeness, Option 3B has also been included in the analysis which includes all the transportation network components as Option 3A, with the exception of the new interchange at Hwy 103 between Exits 2 and 3, where this scenario assumes full interchange configuration while the previous scenario assumed partial interchange with directional ramps only.

The modelled network part of this option is illustrated in Figure 5-34.

Figure 5-34: Ultimate Beyond 2045 Option 3B Modelled Network

Model runs have been completed for the Ultimate Beyond 2045 Option 3B AM and PM peak hour scenarios. An overview summary of the main results is provided within this section. while additional and complete model outputs are available within the appendices.

Traffic flow comparison at the study area gateways is provided within Table 5-17 which shows that the key benefit of the full interchange configuration would be evident during the PM peak hour, where the transportation network would be able to serve additional traffic within the study area by about up to 70%, compared to the Option 1 scenario, while lowering vehicular volumes on Prospect Road by up to 37%.

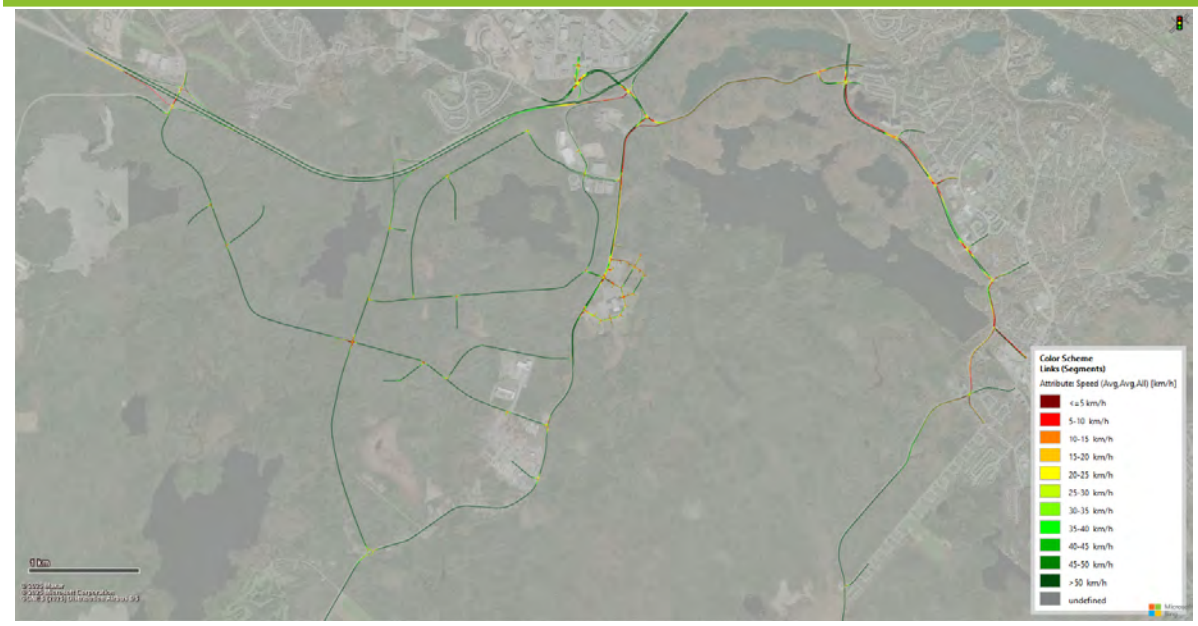
Table 5-17: Traffic Flows Comparison at Gateways (Ultimate Beyond 2045 Option 1 vs Option 3B)

Peak Hour	Road	Direction	Ultimate Beyond 2045 Option 1	Ultimate Beyond 2045 Option 3B	% Difference
AM Peak Hour	Prospect Rd.	NB	1038	706	-32%
		SB	2079	1510	-27%
	New Connection to Hwy 103-**Exit 3**	NB	215	114	
		SB	788	702	
	New Interchange on Hwy 103-**Between Exits 2&3**	NB	0	479	
		SB	0	1460	
	Total	**NB**	**1253**	**1299**	**4%**
		SB	**2867**	**3672**	**28%**
PM Peak Hour	Prospect Rd.	NB	1223	1100	-10%
		SB	1541	976	-37%
	New Connection to Hwy 103-**Exit 3**	NB	699	968	
		SB	284	550	
	New Interchange on Hwy 103-**Between Exits 2&3**	NB	0	1198	
		SB	0	1094	
	Total	**NB**	**1922**	**3266**	**70%**
		SB	**1825**	**2620**	**44%**

Figure 5-35 and Figure 5-36 show a road speed comparison between the ultimate beyond 2045 Option 3A and Option 3B scenarios, while Table 5-18 and Table 5-19 include a comparison of the intersection LOS for the same scenarios.

The results are generally similar to the Option 3A scenario with the partial interchange configuration; however, the availability of additional movements part of the full interchange configuration would relieve some traffic from Exit 3 as well as from Prospect Rd. northern section. **Given the relatively limited cost implications of considering a full interchange rather than a partial interchange, this Option 3B would be recommended for beyond 2045 conditions, subject to the HEC and Ragge Lake development progress within the study area.**

Ultimate Beyond 2045 Option 3A



Ultimate Beyond 2045 Option 3B

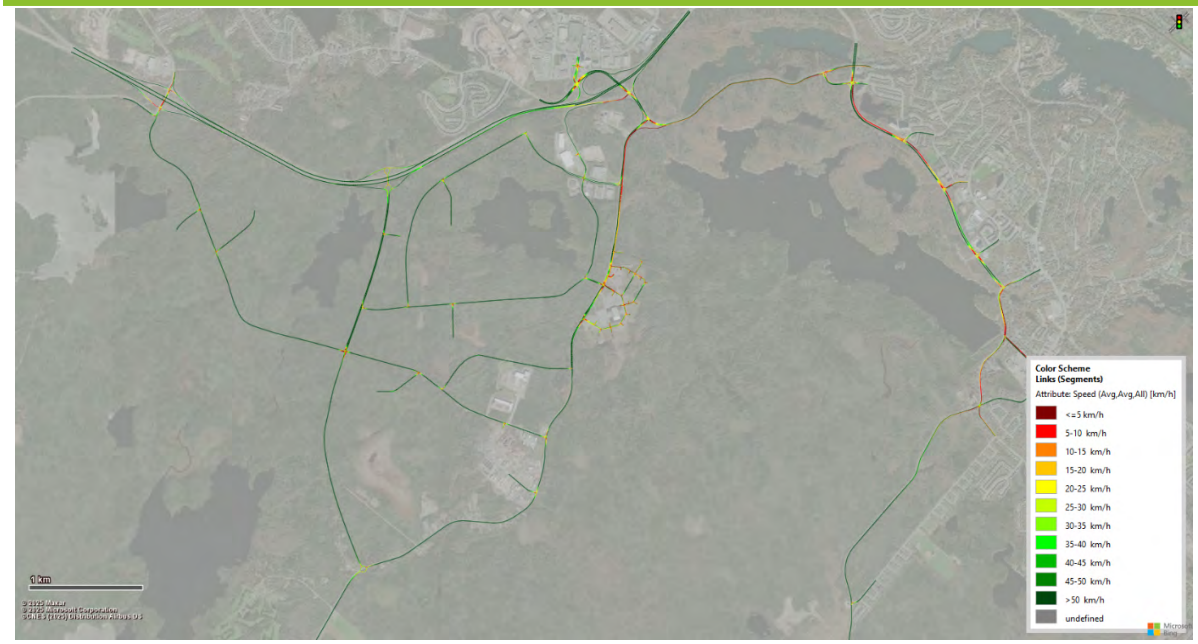
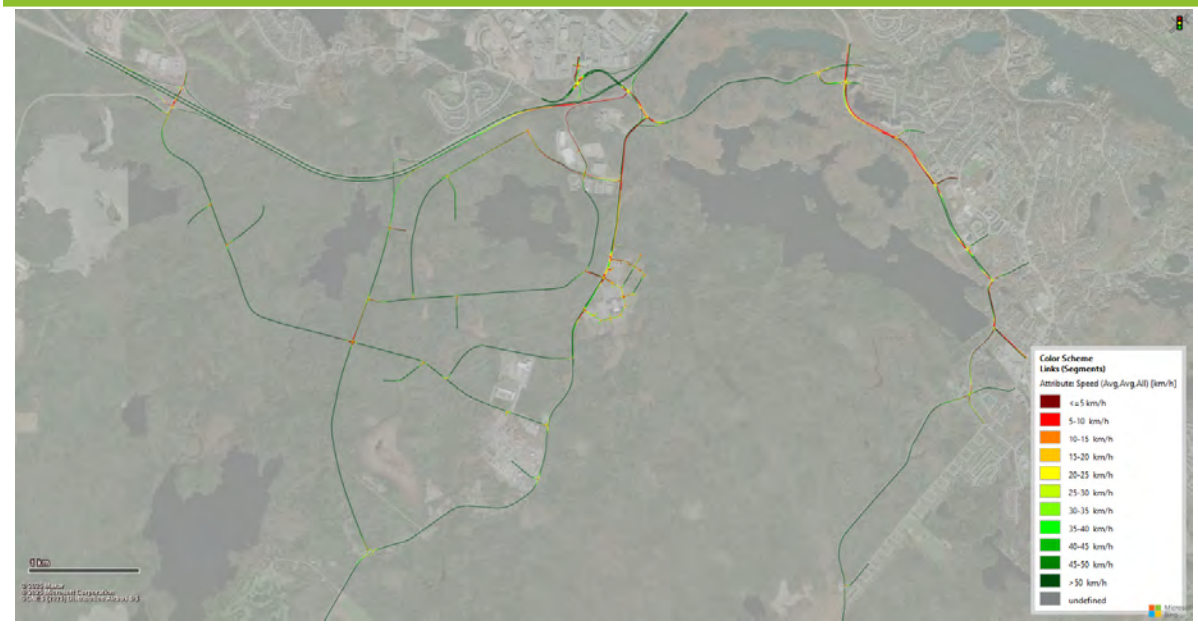


Figure 5-35: Road Speed Comparison – Ultimate Beyond 2045 Option 3A vs Option 3B AM Peak Hour

Ultimate Beyond 2045 Option 3A



Ultimate Beyond 2045 Option 3B

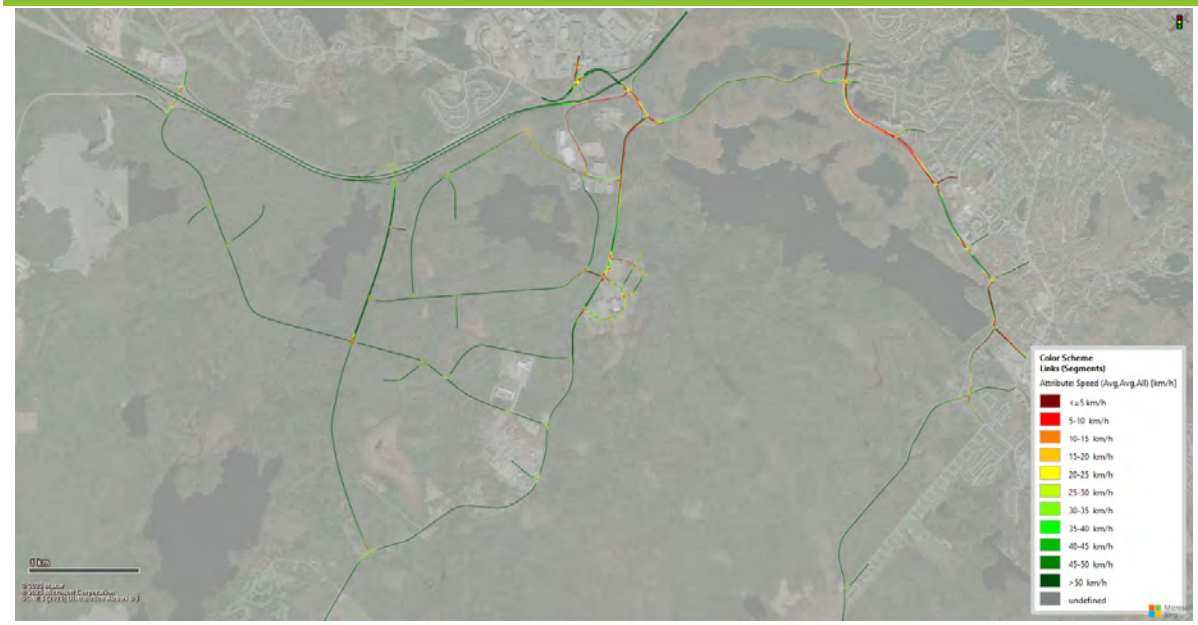


Figure 5-36: Road Speed Comparison – Ultimate Beyond 2045 Option 3A vs Option 3B PM Peak Hour

Table 5-18: Intersection LOS Comparison – AM Peak Hour (Ultimate Beyond Option 3A vs Ultimate Beyond Option 3B 2045)

Node ID	Intersection Name	Ultimate Beyond 2045 - Option 3A	Ultimate Beyond 2045 - Option 3B
106	Prospect Rd. & Exhibition Park Driveway	C	D
107	Prospect Rd. & Ragged Lake Boulevard	D	D
108	Prospect Rd. & SMB Road	F	F
109	St.Margarets Bay Rd & Hwy 103 Off-ramp/On-ramp	C	C
110	SMB Road & Lakelands Blvd	C	C
112	Dunbrack Street & Albert Walker Drive/Walter Havill Drive	E	E
113	Dunbrack Street & Route 306	D	D
200	St.Margarets Bay Rd & Albert Walker Drive	C	C
203	Hwy 103 Timberlea Village Pkwy WB Ramp	C	C
204	Hwy 103 Timberlea Village Pkwy EB Ramp	D	D
219	Prospect Rd. & HEC Future Access 01	D	D
220	Prospect Rd. & HEC Future Access 02	E	E
232	Prospect Rd. & Ragged Lake Future Access	A	A
233	Prospect Rd. & HEC Future Access 03	C	C
234	Prospect Rd. & HEC/RL Future Access	D	E
250	Prospect Rd. & Evergreen Place	B	B
271	Prospect Road/RL Roundabout	A	A
272	New Interchange North Intersection	#N/A	C
273	New Interchange South Intersection	#N/A	A

Table 5-19: Intersection LOS Comparison – PM Peak Hour (Ultimate Beyond Option 3A vs Ultimate Beyond Option 3B 2045)

Node ID	Intersection Name	Ultimate Beyond 2045 - Option 3A	Ultimate Beyond 2045 - Option 3B
106	Prospect Rd. & Exhibition Park Driveway	C	B
107	Prospect Rd. & Ragged Lake Boulevard	E	D
108	Prospect Rd. & SMB Road	F	F
109	St.Margarets Bay Rd & Hwy 103 Off-ramp/On-ramp	E	E
110	SMB Road & Lakelands Blvd	D	D
112	Dunbrack Street & Albert Walker Drive/Walter Havill Drive	E	E
113	Dunbrack Street & Route 306	D	D
200	St.Margarets Bay Rd & Albert Walker Drive	C	C
203	Hwy 103 Timberlea Village Pkwy WB Ramp	E	B
204	Hwy 103 Timberlea Village Pkwy EB Ramp	D	A
219	Prospect Rd. & HEC Future Access 01	C	B
220	Prospect Rd. & HEC Future Access 02	E	D
232	Prospect Rd. & Ragged Lake Future Access	B	A
233	Prospect Rd. & HEC Future Access 03	C	C
234	Prospect Rd. & HEC/RL Future Access	E	E
250	Prospect Rd. & Evergreen Place	A	A
271	Prospect Road/RL Roundabout	B	B
272	New Interchange North Intersection	#N/A	A
273	New Interchange South Intersection	#N/A	A

5.7 Overall Network Performance

To provide an overview of the overall network performance under the various scenarios completed, Figure 5-37 and Figure 5-38 summarize the average speed and average delay across the network, respectively. These represent the averages across all vehicles, locations and times in the traffic model and during the peak hours of analysis. The average speeds include all stops and slowdowns, and are therefore lower than the posted speed limits at any given location.

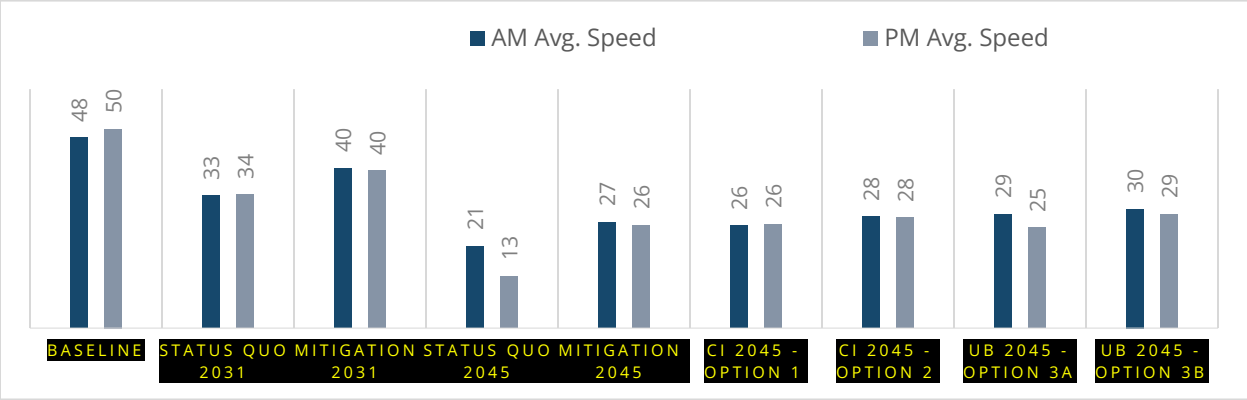


Figure 5-37: Network Performance – Average Speed (km/hr)

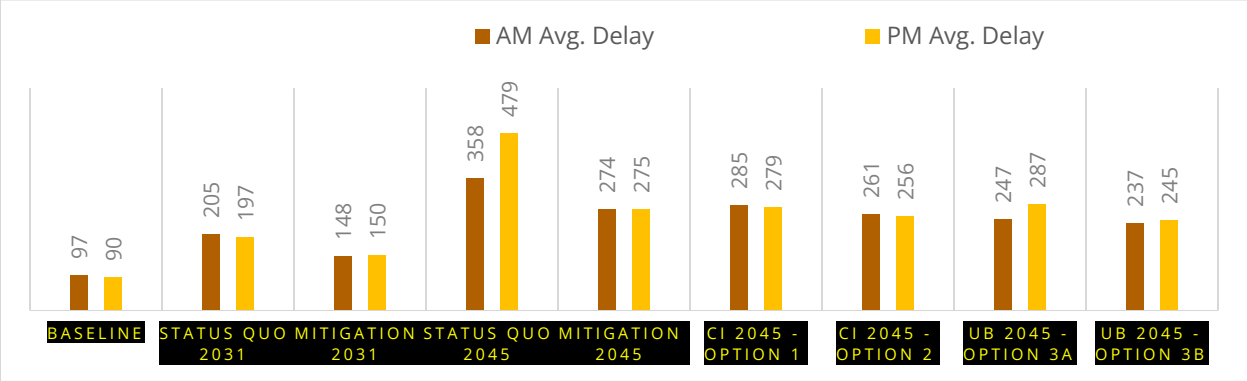


Figure 5-38: Network Performance – Average Delay (seconds)

Compared to the baseline conditions, lower speeds are anticipated under the future status quo conditions, in range of 30km/hr and below 20km/hr, during 2031 and 2045, respectively. The lower speeds are localized at the existing major intersections that will experience a significant increase in vehicular demand and drive the lower averages. The mitigation scenarios show improved speeds, compared to the status quo, which confirm the benefits of considering the tested mitigation measures. The corridor improvements 2045 and ultimate beyond 2045 scenarios results are comparable to the mitigation scenarios as highlighted earlier, but they **service a higher number of vehicular trips with the new connections, with lower traffic flows along Prospect Road, which is beneficial**.

In terms of the average delays, similar conclusions can be drawn on the benefits of the mitigation and the corridor improvements 2045 and ultimate beyond 2045 scenarios, resulting in **reduced delays when compared to the status quo scenarios**.

5.8 Traffic Impact Analysis Summary

Upon completion of the traffic impact analysis work, Table 5-20 has been prepared to provide a complete summary of all the scenarios in terms of the considered road network components, the underlaying demand source and approach, the key findings from the AM and PM peak hour impact analysis, as well as key takeaways and conclusions of each scenario.

Table 5-20: Traffic Impact Analysis Summary Table

Item / Scenario	Baseline	Status Quo 2031	Mitigation 2031	Status Quo 2045	Mitigation 2045	Corridor Improvements 2045 Option 1	Corridor Improvements 2045 Option 2	Ultimate Beyond 2045 Option 3A	Ultimate Beyond 2045 Option 3B
Scenario Description									
Road Network	Baseline road network.	Same as baseline **plus** • New access point along Prospect Rd. for Ragged Lake development, north of Evergreen Pl.	Same as status quo 2031 **plus** • New central access point along Prospect Rd. for HEC as per the development plan • New traffic signal (3-leg) at the intersection of Prospect Rd. and the HEC central access point • New traffic signal at the intersection of Prospect Rd. and Evergreen Pl. • Optimization of SMB Rd. intersections signal timing	Same as status quo 2031 **plus** • Two new access points along Prospect Rd. for HEC as per development plan • New additional access point along Prospect Rd. for Ragged Lake development, opposite of HEC	Same as mitigation 2031 **plus** • Widening of Prospect Rd. to 4-lanes between SMB Rd. and Ragged Lake development southern access point • Realignment of Ragged Lake access point opposite of HEC to create a 4-leg signalized intersection with the HEC central access point • New traffic signal (3-leg) at the intersection of Prospect Rd. and the HEC southern access point • Extension of Evergreen Pl. to connect with Ragged Lake internal network • New traffic signal (3-leg) at the intersection of Prospect Rd. and Brookside Rd.	Same as mitigation 2045 **plus** • New corridor connection between Prospect Rd. and Hwy 103 at Exit 3 • New corridor connection between Prospect Rd. and Route 306 for emergency traffic only	Same as mitigation 2045 **plus** • New corridor connection between Prospect Rd. and Hwy 103 between Exits 2 and 3 • New interchange along Hwy 103 at a central location to the Ragged Lake development, between Exits 2 and 3 • New roundabout along Prospect Rd. at the intersection with Big Indian Rd. • New corridor connection between Prospect Rd. and Route 306 for emergency traffic only	Same as mitigation 2045 **plus** • New corridor connection between Prospect Rd. and Hwy 103 at Exit 3 • New corridor connection between Prospect Rd. and Hwy 103 between Exits 2 and 3 • New partial interchange along Hwy 103 at a central location to the Ragged Lake development, between Exits 2 and 3 • New roundabout along Prospect Rd. at the intersection with Big Indian Rd. • Signalization of the intersections at Hwy 103 Exit 3 • New corridor connection between Prospect Rd. and Route 306 for emergency traffic only	Same as Ultimate Beyond 2045 Option 3A plus • New full interchange along Hwy 103 at a central location to the Ragged Lake development, between Exits 2 and 3
Demand	Baseline traffic demand based on JESS ABM outputs calibrated to recent traffic counts.	Baseline demand **plus** • Future growth as per JESS ABM • Uplifted demand to match ITE trip generation for 12% of Ragged Lake development	Same as status quo 2031 **plus** • Partial dispersion of Route 306 demand to Route 349	Baseline demand **plus** • Future growth as per JESS ABM • Uplifted demand to match ITE trip generation for 30% of Ragged Lake development	Same as status quo 2045 **plus** • Partial dispersion of Route 306 demand to Route 349	Same as Mitigation 2045 **plus** • Uplift demand to match ITE trip generation for 66% of Ragged Lake development	Same as corridor improvements 2045 Option 1	Same as corridor improvements 2045 Option 1	Same as corridor improvements 2045 Option 1

Item / Scenario	Baseline	Status Quo 2031	Mitigation 2031	Status Quo 2045	Mitigation 2045	Corridor Improvements 2045 Option 1	Corridor Improvements 2045 Option 2	Ultimate Beyond 2045 Option 3A	Ultimate Beyond 2045 Option 3B
Traffic Impacts									
AM Peak Hour	• Generally, the study area operates with reasonable average speed • Critical locations are the intersections between Hwy 103, Prospect Rd. and SMB Rd. • Bottleneck observed along SMB Rd. eastbound towards Halifax peninsula, caused by capacity constraints around the Armdale roundabout • Standing queues may extend along SMB Rd. and Dunbrack St. intersection • LOS F on the EBT movement at the intersection of SMB Rd. and Dunbrack St. (Albert Walker Drive) during the AM peak hour.	• Somewhat similar results to the baseline conditions • Worsen conditions at the HEC access points due to the anticipated future demand • Standing queues along Dunbrack St. southbound and Route 306 northbound	• Improved operational conditions at the HEC access points • Improved operational conditions along Dunbrack St. and Route 306	• Heavy congestion along Prospect Rd. southern / central sections due to increased demand of Ragged Lake and HEC • NBL movement on a single lane approaching Ragged Lake blocking through movement along Prospect Rd • Worsened conditions at the Dunbrack St. and Route 306 intersection	• Improved conditions along Prospect Rd. southern section • Improved but less than ideal conditions at HEC and Ragged Lake access points • Worsen conditions along Prospect Rd. northern section as the mitigation measures allow more traffic to approach SMB Rd., compared to the status quo scenario where the traffic was blocked at the southern / central sections of Prospect Rd. • Improved conditions at the Dunbrack St. and Route 306 intersection	• The new connection to Exit 3 allows to serve additional 74% of traffic flows from the wider network towards the developments along Prospect Rd. • Operational conditions are generally similar to the previous mitigation 2045 scenario • Prospect Rd. northern section remains at capacity	• Compared to the option 1 scenario, the connection to the new interchange between Exits 2 and 3 allows to serve additional 18% of traffic flows from the wider network towards the developments along Prospect Rd. • Operational conditions are generally similar to the previous Option 1 scenario • Prospect Rd. northern section remains at capacity	• The new directional ramps from Hwy 103 allow servicing additional traffic, with about 9% less traffic on Prospect Rd. in the peak direction, compared to the Option 2 scenario. • Operational conditions are generally similar to the previous Option 2 scenario	• Operational conditions are generally similar to the previous Option 3A scenario
PM Peak Hour	• Generally, the study area operates with reasonable average speed • Critical locations are the intersections between Hwy 103, Prospect Rd. and SMB Rd. • LOS F on the SBL movement at the intersection of Dunbrack St. and Route 306	• Similar to the AM peak hour	• Similar to the AM peak hour	• Heavy congestion along Prospect Rd. northern section and at HEC and Ragged Lake access points • LOS F at majority of Prospect Rd. northern segment intersections, and the intersections between Hwy 103, Prospect Rd. and SMB Rd. • Heavy congestion along SMB Rd. westbound direction	• Significantly improved conditions along SMB Rd. westbound direction as the widening of Prospect Rd. allows for more efficient traffic movement in the southbound direction • Worsen conditions along Prospect Rd. northern section as the mitigation measures allow more traffic to approach SMB Rd.	• The new connection to Exit 3 allows to serve additional 57% of traffic flows from the developments along Prospect Rd. towards the wider network • Operational conditions are similar to the AM peak hour	• Compared to the option 1 scenario, the connection to the new interchange between Exits 2 and 3 allows to serve additional 31% of traffic flows from the wider network towards the developments along Prospect Rd. • Operational conditions are similar to the AM peak hour	• The new directional ramps from Hwy 103 allow servicing the area with about 25% less traffic on Prospect Rd. in the peak direction, compared to the Option 2 scenario. • Improved operational conditions at Prospect Rd. intersections as a result of the lower traffic flows.	• The full interchange helps in reducing the traffic flows at Prospect Rd. by additional 26% in the peak direction, compared to the Option 3A scenario. • Operational conditions are generally similar to the previous Option 3A scenario

Item / Scenario	Baseline	Status Quo 2031	Mitigation 2031	Status Quo 2045	Mitigation 2045	Corridor Improvements 2045 Option 1	Corridor Improvements 2045 Option 2	Ultimate Beyond 2045 Option 3A	Ultimate Beyond 2045 Option 3B
Conclusions									
		The status quo road network is generally sufficient to cater for the anticipated 2031 future demand. Minor mitigation to the HEC access points could benefit the development.	The proposed mitigation measures for 2031 are anticipated to improve the operational conditions within the study area and are sufficient to cater for the anticipated 2031 future demand along Prospect Rd. HEC could also benefit from expediting the development of all the planned access points and internal networks by 2031, rather than phasing those according to the land use development.	The status quo road network is not sufficient to cater for the anticipated 2045 future demand and several mitigation measures would be required to ease congestion and improve operational conditions.	The proposed mitigation measures for 2045 although relatively improve the overall operational conditions within the study, especially along SMB Rd. and southern / central sections of Prospect Rd., they don't resolve the anticipated congestion along the northern section of Prospect Rd. nor ease the access to / from Ragged Lake development. Corridor improvements would be required with a new connection between Prospect Rd. and Hwy 103 Exit 3.	The completed analysis confirms the need for the new connection between Prospect Rd. and Hwy 103 Exit 3, and also suggests that additional mitigation measures are to be explored to further relief the operational conditions along Prospect Rd.	The completed analysis confirms that the introduction of a new interchange or directional ramps from Hwy 103 to the Ragged Lake development could be beneficial in the long term, to serve the planned Ragged Lake development, in addition to relieving the stress on Prospect Rd. accesses.	The completed analysis confirms that having two connections to Hwy 103, at Exit 3 as well as the new partial interchange between Exits 2 and 3, would be beneficial as it would reduce the traffic flows along Prospect Rd. while serving additional traffic at the overall study area level.	The completed analysis confirms that upgrading the new interchange at Hwy 103 between Exits 2 and 3, from a partial to full interchange configuration would help in reducing the traffic flows along Prospect Rd. during the PM peak hour.

6 Corridor Improvement Concepts

The initial RFP required that the Study explore the feasibility and impacts of improving the study area's connectivity and emergency preparedness with the addition of new connectors between the Prospect Road corridor and Exit 3, as well as emergency access routes between Prospect Road and Route 306. CBCL prepared concept alignments for these connections using the Autodesk Infraworks design package, discussed in detail below, and summarized on Figure 6-1. This exercise also included a high-level evaluation of the corridor improvements identified in Section 5.

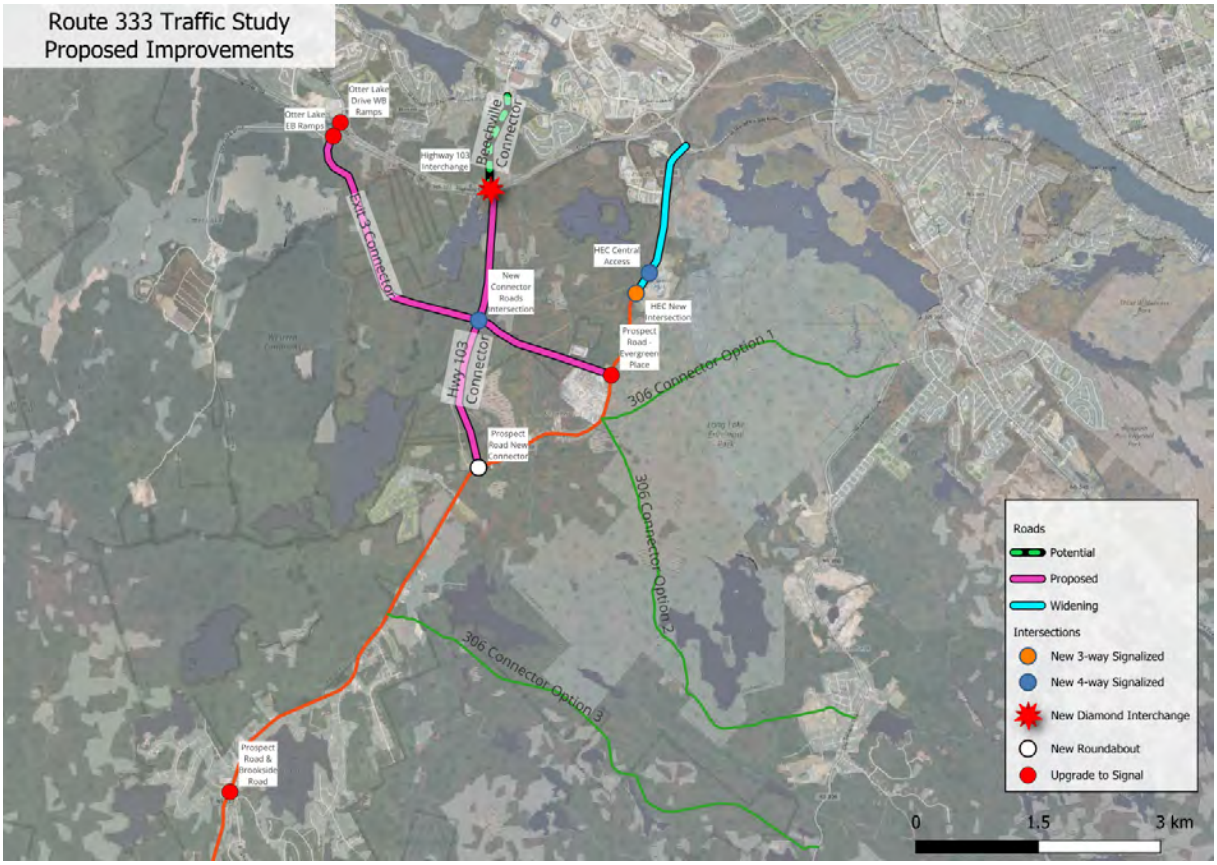


Figure 6-1 Proposed Corridors and Improvements

6.1 Prospect Road

6.1.1 Prospect Road Widening

The traffic analysis presented above suggested that Prospect Road would require widening at a future date to accommodate the additional vehicular travel demand associated with background regional growth, the HEC development, and the Ragged Lake Industrial Park expansion. The traffic analysis found that this would be most beneficial between SMB Rd. and Evergreen Place (as illustrated conceptually on Figure 6-2. This would coincide with the proposed Exit 3 Connector, discussed below, and the southern access road to the Ragged Lake industrial park.

Figure 6-2 Conceptual Prospect Road Widening

This widening would formalize Prospect Road to 4 through lanes (2 per direction), with ancillary turning lanes at major intersections, as proposed through the Traffic Analysis summarized in Section 5. A 3m multi-use path would be introduced, providing full connectivity for active transportation users, between the Ragged lake Industrial Park, the HEC, St. Margarets Bay Road, and Exit 2.

The Prospect Rd. right-of-way is wider on the left side of the road. The entire corridor has an electrical transmission line on the east side, and a partial parallel transmission line for approximately 675m on the west side, south of the NS Public Works depot (as illustrated on Figure 6-3). In the interest of minimizing reconfiguration of the road and the existing pavement, this discussion proposes widening on the left side of the road to minimize impacts on the transmission line. Some property impacts would be expected on the west side, almost entirely to HRM property, as suggested on Figure 6-4. The car pool lot at 2353 Prospect Rd. may also be affected with the loss of a few parking spaces, as illustrated on Figure 6-5. We note, however, that the proposed redevelopment of the Halifax Exhibition Centre into a major residential node, would benefit more from a multi-use path on the east

side, which would keep active transportation users off the road and entirely on one side of the corridor, without the need for additional road crossings. This would come at the cost of a fuller reconstruction of Prospect Road, with a shifting of the road centreline further west to minimize impacts on the power transmission corridor.

While Prospect Road is currently serviced with ditches on both sides, the widening proposed herein provides the opportunity to upgrade drainage with curb and catch basins, to be confirmed at a future design stage.

Figure 6-3 Prospect Road NS Power Corridor Impacts

Figure 6-4 Prospect Road Property Ownership

Figure 6-5 Impacts on Carpool Parking Lot

6.1.2 Intersection Control Improvements

The operational improvements resulting from the Traffic Analysis summarize din Section 5 suggested the following intersection improvements to Prospect Rd. in addition to the widening presented above.

- Alignment of the proposed Ragged Lake access road opposite of HEC to create a 4-leg signalized intersection with the HEC main road
- New 3-leg signalized intersection of the HEC southern access road
- Signalization of the 3-leg intersection of Prospect Rd. and Evergreen Pl.
- Signalization of the 3-leg intersection of Prospect Rd. and Mills Dr. to be coordinated with the Evergreen Pl. intersection, and with actuation on the Mills Dr. approach
- Signalization of the Prospect Rd. and Brookside Rd. intersection
- New roundabout along Prospect Rd. at the intersection with Big Indian Rd.

6.2 Exit 3 Connector

The conceptual connector to Exit 3 was developed through review of the proposed Raged Lake Development, and the Ragged Lake Land Suitability Study (CBCL 2022). As illustrated on **Figure 6-6**, alignments generally avoid wetlands ad waterbodies, while seeking to minimize the number of watercourse crossings. While all connector options started at Otter Lake Drive in the west, they connected to Prospect Road anywhere between the Halifax Exhibition Park in the north, and Big Indian Road in the south.

Figure 6-6 Conceptual Exit 3 Connector Alignments

6.2.1 Alignment 1

Approximately 5km long, alignment 1 would extend south from Timberlea Village Parkway at Exit 3, and connect to Prospect Road north of Big Indian Road (see **Figure 6-7**). This alignment would provide the closest and most direct connection between the Prospect Rd. communities and Exit 3, bypassing the most congested and friction-prone segment of Prospect Rd. and requiring relatively few horizontal curves. This alignment would cross multiple watercourses and overland drainage channels, requiring a dozen major culverts and potentially a bridge structure for the creek between Blueberry Lake and Big Indian Lake.

This alignment option would diverge significantly from the 2015 Ragged Lake Industrial Park expansion concept, and would require the introduction of another east-west major road through the development to connect further north on Prospect Road.

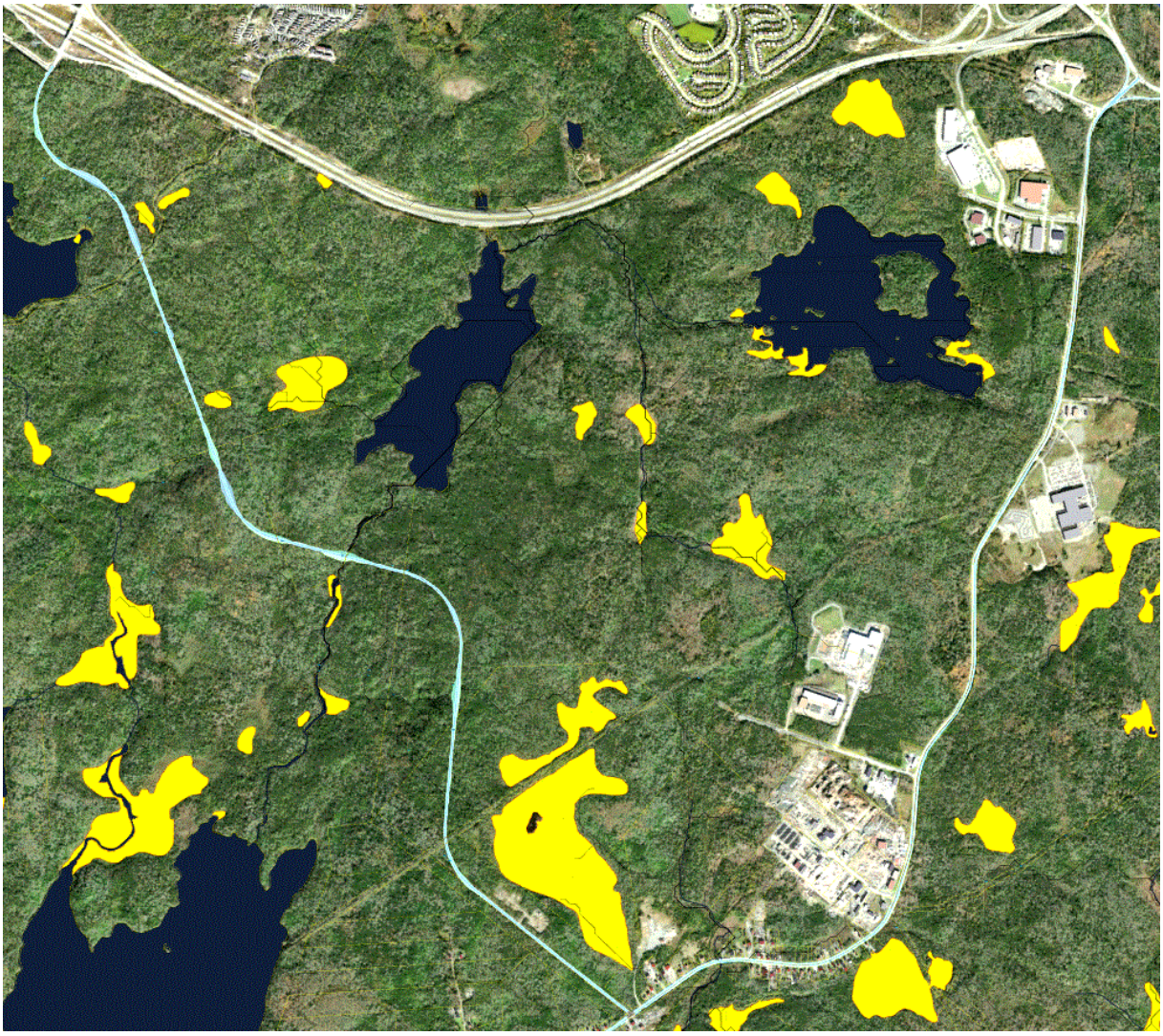


Figure 6-7 Conceptual Exit 3 Connector Alignment 1

6.2.2 Alignment 2

Similar to Alignment 1, Alignment 2 would extend Timberlea Village Parkway southward before turning east. Upon traversing the creek between Blueberry Lake and Big Indian Lake, this alignment would turn straight east, connecting to Prospect Lake across from the HEC (see **Figure 6-8**). This option would provide a new corridor roughly parallel to Hwy103, and would traverse the centre of the proposed Ragged Lake Industrial Park. Considering its proximity to Exit 3, it would not be as attractive to trips originating or destined along Prospect Road. Covering approximately 5.2km, it would also be a less direct and longer connection to Exist 3 for the Prospect Road communities. This alignment would traverse fewer major watercourses, requiring 8 major culverts.

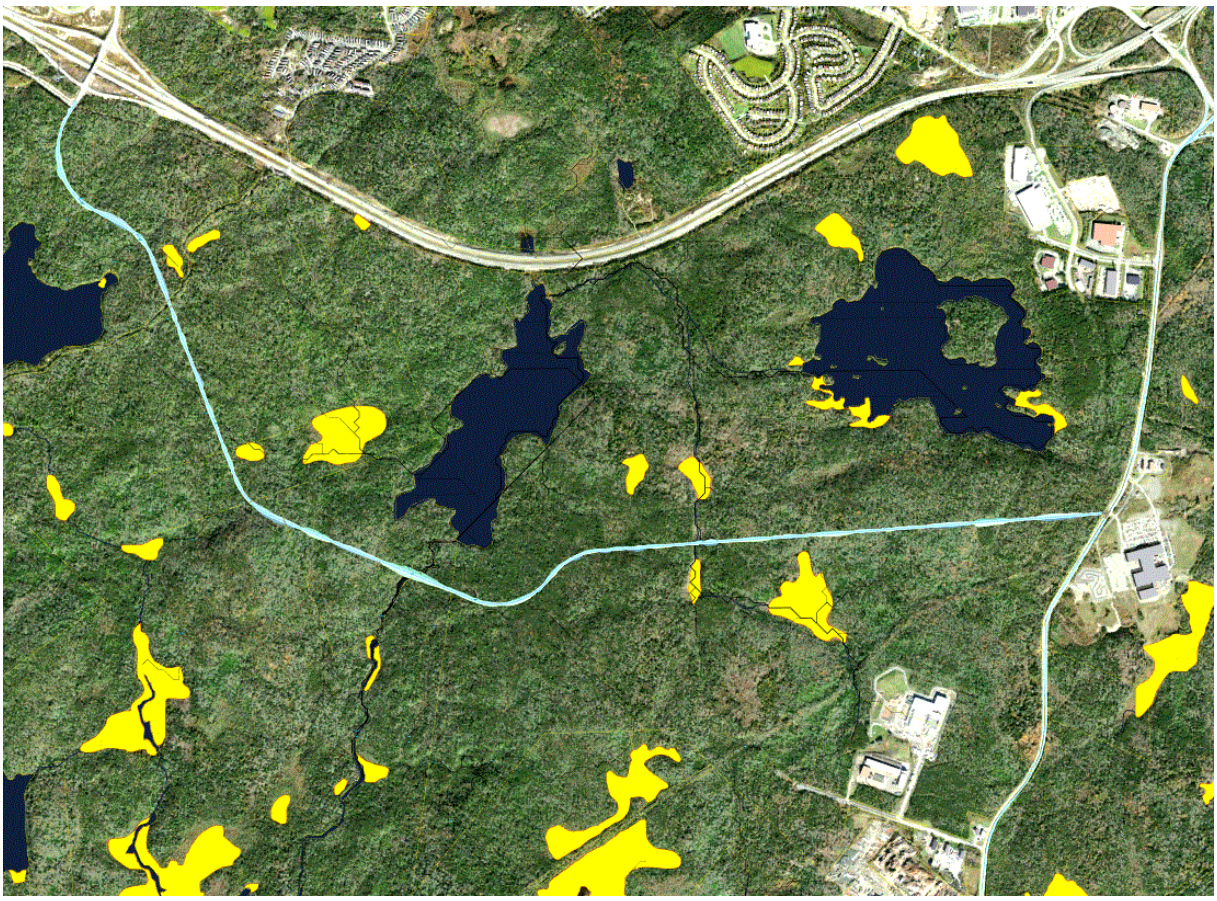


Figure 6-8 Conceptual Exit 3 Connector Alignment 2

6.2.3 Alignment 3

This 5km alignment would be similar to Alignment 2, but would turn further south to connect to Evergreen Pl. as illustrated on **Figure 6-9**. It would align closely with the Ragged Lake Industrial Park, while also servicing the Prospect Rd. communities. It would generally follow the topography, achieve a balance between the requirements for cuts and fills, and minimize watercourse crossings. Preliminary analysis suggests the requirement for only 8 small diameter circular culverts, and one large box culvert, minimizing the overall cost of the road.

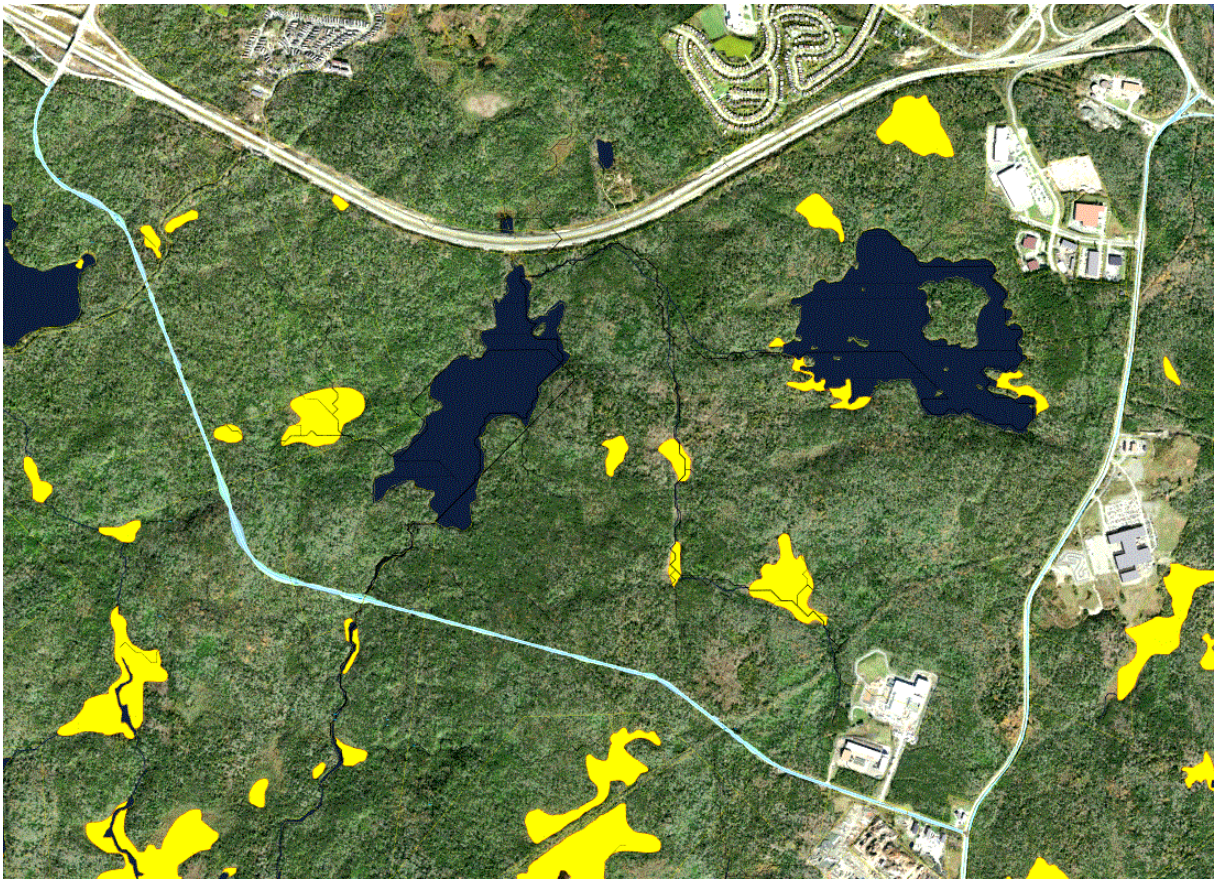


Figure 6-9 Conceptual Exit 3 Connector Alignment 3 (Preferred)

For the purposes of this assignment, it was found that this alignment would provide a good compromise between the provision of an alternate route from Prospect to Hwy103, servicing future development along the corridor, and optimizing geometrics. This alignment reflects the road network carried through the Traffic Impact Analysis above.

6.3 Route 306 Connector

In response to community concerns about the few options for emergency access and egress, the Department of Public Works requested that an additional emergency connector be investigated between Prospect Road and Route 306. The Department owns two rights of way east of Prospect Road, which may accommodate gravel emergency roads, as conceptualized under Option 1 and Option 2, below.

Three alignments were considered, as illustrated on **Figure 6-10**.

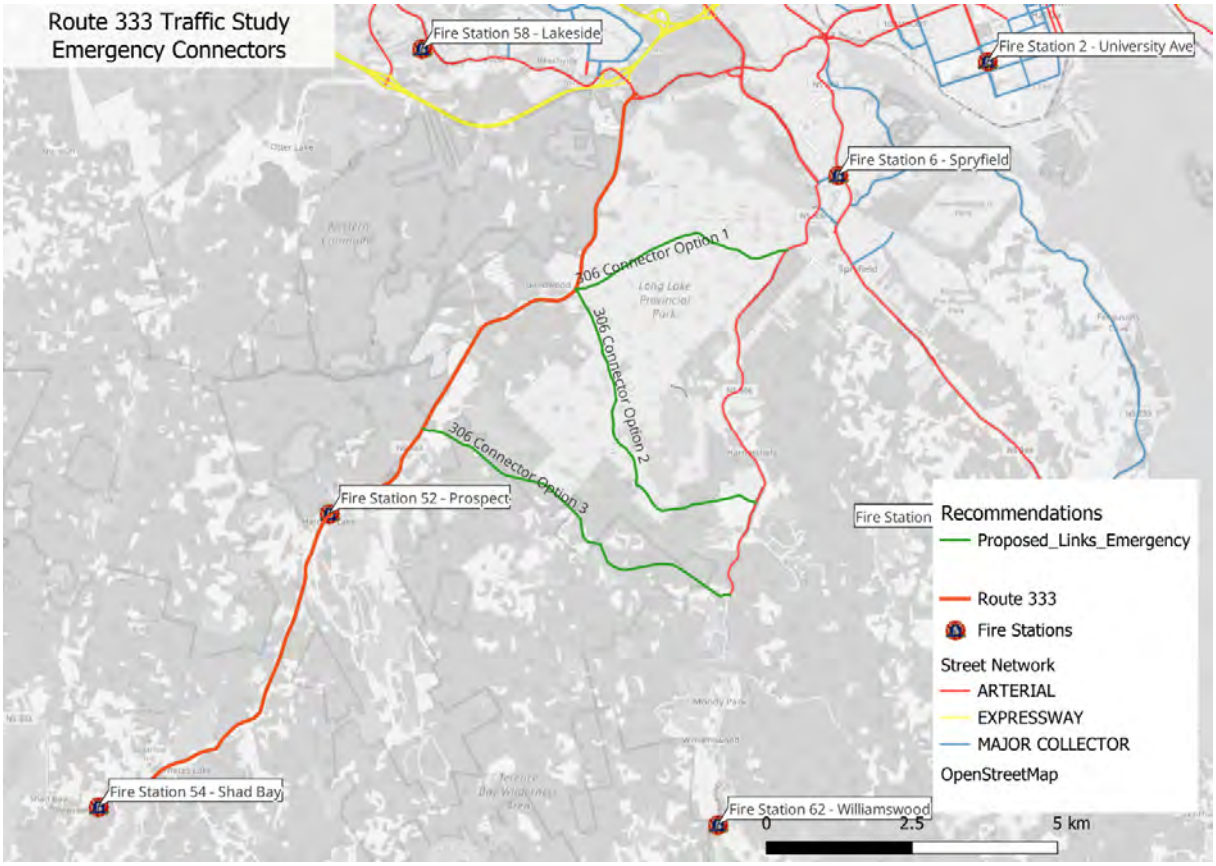


Figure 6-10 Route 306 Connector Options

6.3.1 Option 1

The northernmost alignment, illustrated on **Figure 6-11**, would traverse approximately 4km along the existing DPW right-of-way, from a starting point roughly at the Prospect Road & Mills Drive intersection, to approximately 350m west of the Old Sambro Road & Sussex Street intersection.

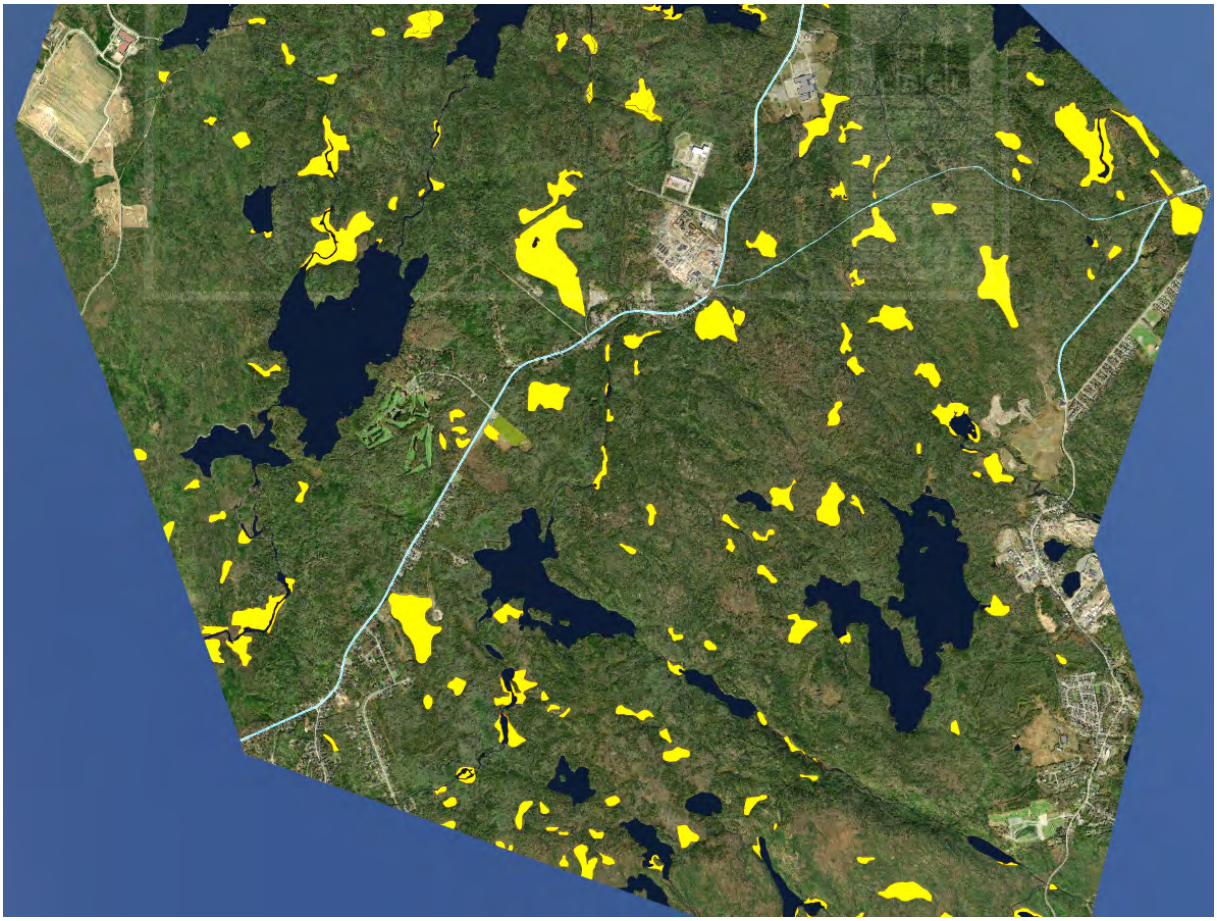


Figure 6-11 Conceptual Route 306 Connector – Option 1

This route provides the shortest access to Route 306, is conveniently close to the Exhibition Grounds and Ragged Lake, and provides egress from Prospect Road towards the north, closer to the peninsula emergency/health services, and close to Fire Station 6 at the intersection of Old Sambro and Herring Cove Road.

6.3.2 Option 2

The middle alignment, known as Foss Hill Road, similarly follows an existing DPW right-of-way, and would connect to Brunt Road on Route 306, turning around Spruce Hill Lake (see **Figure 6-11**).

This alignment option, approximately 5.6km long, would provide egress for Harrietsfield on Route 306 towards Prospect Road, so the focus is different than Option 1. Mutual Assistance response times on Prospect Rd. from Fire Station Station 62 Williamswood would be reduced, but access times towards peninsula services would be longer.

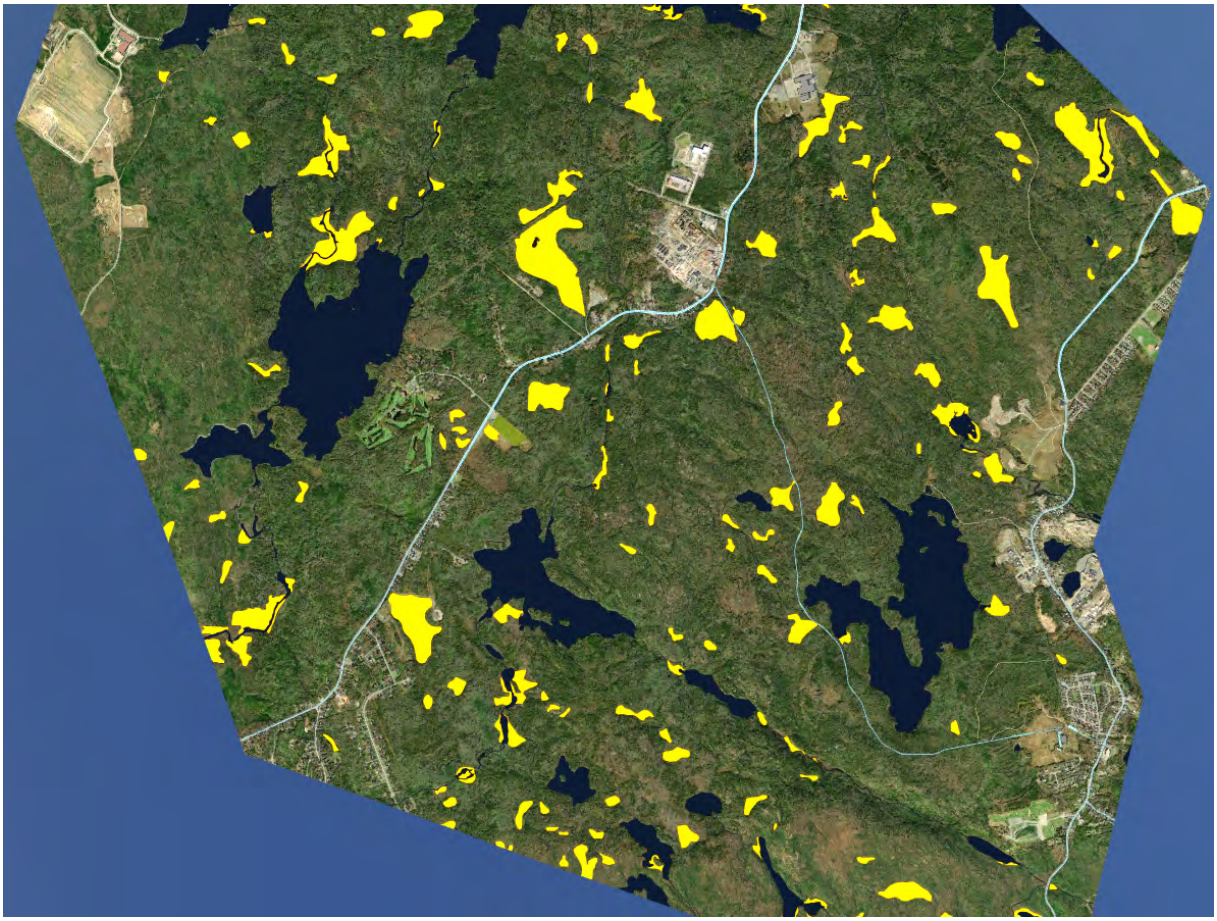


Figure 6-12 Conceptual Route 306 Connector – Option 2

6.3.3 Option 3

Option 3 would propose a new 6.5km right-of-way roughly connecting Hatchet Lake and Harrietsfield, south of Peters Lake and Narrow Lake, as illustrated conceptually on Figure 6-13. It would reduce response time from Station 52 Prospect to Harrietsfield. Its focus would be on the southern end of Prospect Road and would provide lateral connectivity between 333 and 306. This alignment would provide direct connectivity between Sambro/306 communities, and Prospect Bay/Brookside/Hatchet Lake, and could be considered as a full road access, not just for emergency services. Cost estimates were therefore developed for both road classes.

Figure 6-13 Conceptual Route 306 Connector – Option 3

6.4 Hwy 103 Interchange

The Study was initially required to examine a potential new overpass between Ragged Lake and Horseshoe Lake Road, as conceived in previous analysis, and as illustrated on **Figure 6-14**.

Figure 6-14 Conceptual Horseshoe Lake Road Overpass - DWP

Through discussion with DPW staff, and early examination of existing conditions at Exit 2, it was considered that the addition of another overpass structure so close to Exit 2 would complicate circulation and way-finding across the tight area, and would not alleviate the conditions incurred by regional travel to Ragged Lake and the Prospect Road corridor. Considering the need to distribute the travel demand associated with the future Ragged Lake Industrial Park and the Halifax Exhibition District development, away from Prospect Road, the project team evaluated the alternative option of establishing a new interchange on Hwy 103, approximately halfway between Exit 3 and Exit 2.

The introduction of an additional interchange would be phased according to the development timelines of Ragged Lake and the Exhibition grounds. For the purposes of this Study, and as part of the Traffic Analysis discussed above, a partial diamond interchange was conceived to illustrate the concept (see **Figure 6-15** and **Figure 6-16**).

Figure 6-15 Conceptual Partial Interchange - View east towards Exit 2

Figure 6-16 Conceptual Partial Interchange - View west towards Exit 3

As development of the Ragged Lake Industrial Park would progress, the partial interchange could be upgraded to a full roundabout diamond intersection, as illustrated conceptually on **Figure 6-17** and **Figure 6-18**.

Figure 6-17 Conceptual Full Diamond Interchange - View east towards Exit 2

Figure 6-18 Conceptual Full Diamond Interchange - View west towards Exit 3

6.5 Beechville Connector

Noting that the area north of Hwy 103 is designated for Urban Residential (as illustrated on **Figure 6-19**), the partial interchange could be expanded into a full diamond interchange serving a potential extension of Beechville Park Drive from St. Margaret's Bay Road (as shown on Figure 6-20 and Figure 6-21).

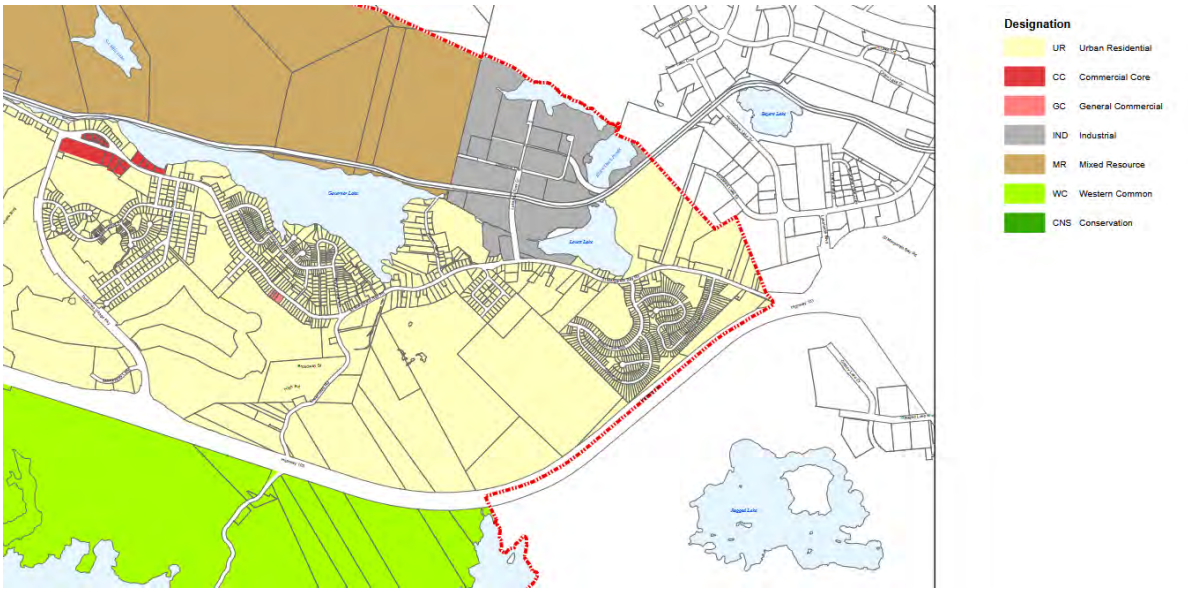


Figure 6-19 HRM Generalized Future Land Use

The 1.1km road would extend the existing Beechville Park Drive south to the full diamond interchange described above.

Figure 6-20 Conceptual Beechville Connector - Looking North-East Towards Exit 2

Figure 6-21 Conceptual Beechville Connector - Looking North-West Towards Exit

This connector would provide a second access/egress point for Beechville and Timberlea Village, bypassing the complexity of Exit 3. As described below, this conceptual connector would extending further south towards Goodwood, thereby forming a new north-south corridor for the Beechville-Ragged Lake-Prospect axis

6.6 Goodwood Connector

The conceptual Hwy 103 interchange and Beechville Connector described above could be extended south across the Ragged Lake Industrial Park expansion, to connect to Prospect Road just north of Big Indian Lake, as illustrated on Figure 6-22.

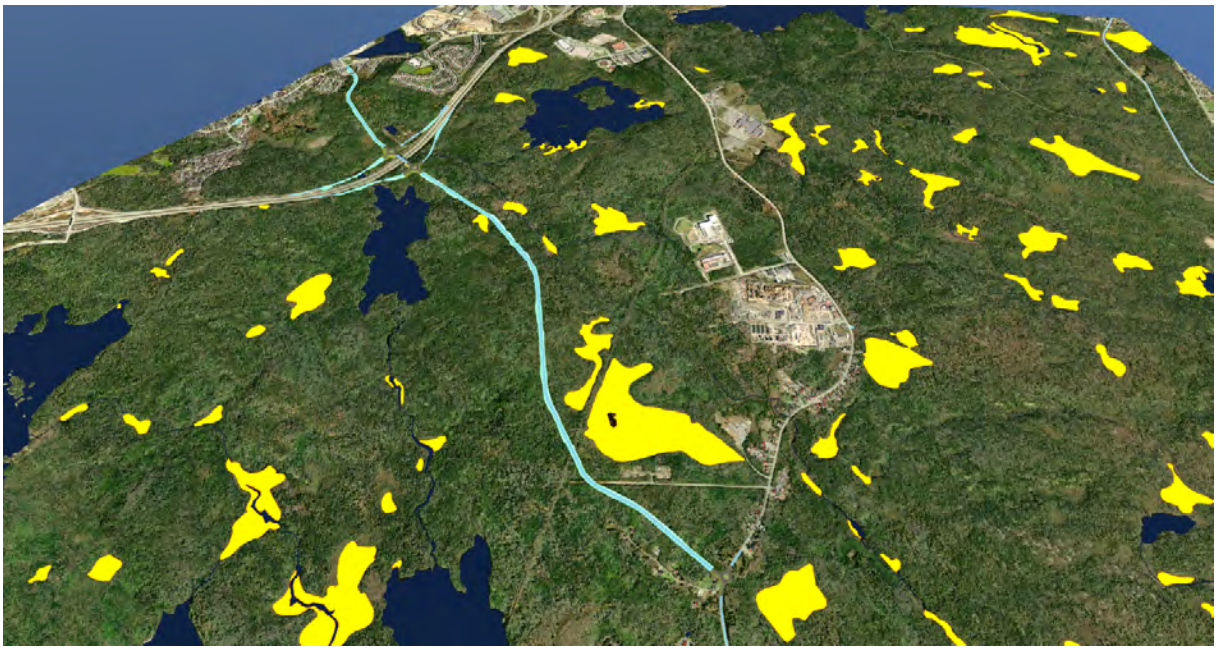


Figure 6-22 Conceptual Goodwood Connector

This 3.5km connector would extend south from the new interchange to the east of Blueberry Lake, and around the major wetlands. This alignment would traverse few watercourses and require minor culverts, and would roughly align with Prospect Road's north-south orientation. This road would meet Prospect Rd. north of Big Indian Road, possibly at a roundabout, and would function as a direct bypass for the Prospect Rd. communities around the most congested portions of Prospect Rd.

The Traffic Analysis has considered the construction of this connector beyond 2045, intersecting the proposed Exit3-Evergreen Pl. Connector at a major intersection in the middle of the Ragged Lake Industrial Park. We note, however, that this Connector's direct access to the Hwy103 corridor makes it attractive for emergency access and detours; its construction could therefore be considered earlier than the timelines proposed through the Traffic Analysis.

6.7 Class D Opinion of Probable Costs

The Corridor Improvement Concepts outlined above were developed using the Autodesk Infraworks software to a level of detail sufficient for extraction of earthwork quantities, linear road lengths, and culvert sizing. This has allowed the development of a Class D OPC, summarized in **Table 6-1**, and provided in more detail in Appendix G.

Table 6-1 Class D OPC - Corridor Improvement Concepts

No.	Name	Lanes	Class D OPC* (design & construction)
1	Prospect Road Improvements - Widening over 3km to 4 through lanes with turning lanes at intersection, from St. Margaret's Bay Road to Evergreen Place, including a 3m multi-use path on the west side of the road. - New 3-leg signalized intersection - New 4-leg signalized intersection - Signalize Evergreen Place intersection - Signalize Brookfield Road intersection - Signalize Mills Drive intersection (semi-actuated)	4	$21,750,000
2	Connector Exit 3 to Evergreen Place (Exit 3 Connector) - 5km, 4-lane road - signalize Exit 3 ramp intersections	4	$60,500,000
3	Connector Hwy 103 to Big Indian Lake (Goodwood Connector) - 3.5km 4-lane road - new 4-leg signalized intersection with Exit 3 Connector	4	$46,500,000
4	Connector Hwy 102 to Beechville Park Drive (Beechville Connector) - 1.1km 4-lane road	4	$11,250,000
5	Hwy 103 Interchange		$59,500,000
6	306 Connector Option 1 - 4.15km emergency 2-lane access	2	$12,250,000
7	306 Connector Option 2 - 5.6km emergency 2-lane access	2	$13,000,000
8	306 Connector Option 3A - 6.45km emergency 2-lane access	2	$22,750,000
9	306 Connector Option 3B - 6.45km 2-lane public road	2	$25,000,000

** Rounded to nearest $250,000*

7 Summary and Conclusions

CBCL Limited (CBCL) has been appointed by Nova Scotia Department of Public Works (DPW) to conduct a Transportation Study for Prospect Rd. (Prospect Rd.). This document constitutes the draft Transportation Study Report and has been prepared in line with the proposed study approach and in view of several discussions with DPW and other stakeholders.

Baseline conditions have been reviewed and analysed including the Baseline roadways and intersections, the current and envisioned land use plans as well as collisions historic data.

A simulation-based traffic model has been developed in PTV VISSIM software platform to support the traffic analysis within this study. Model networks were constructed for various scenarios including the baseline network, mitigation measures as well as new corridor connections to Prospect Rd. The travel demand side of the model was developed based on recent output extracted from Regional Transportation Agency (Link NS) JESS Activity-Based Travel Demand Model (ABM), which were further calibrated to newly collected traffic counts data. As a conservative approach, further refinements to the travel demand were applied to account for potential future demand of key new developments, based on first principles and published trip generation rate. Model runs have been completed for the AM and PM peak hours of five distinct scenarios. Traffic impact analysis was conducted which confirmed the need for mitigation measures and corridor improvements to better serve the anticipated future demand levels within the study area.

The following list of interventions were tested and are recommended. **The interventions recommended by a given year are in addition to those recommended for the previous year.**

- **By 2031 Horizon**
  - **The Mitigation 2031 Scenario is recommended with the following interventions:**
    1. New central access point along Prospect Rd. for HEC as per the development plan
    2. New traffic signal (3-leg) at the intersection of Prospect Rd. and the HEC central access point
    3. New traffic signal at the intersection of Prospect Rd. and Evergreen Pl.
    4. Optimization of SMB Rd. intersections signal timing

- **By 2045 Horizon**
  - **The Corridor Improvements 2045 Option 1 Scenario is recommended with the following interventions:**
    5. Widening of Prospect Rd. to 4-lanes between SMB Rd. and Evergreen Pl.
    6. Realignment of Ragged Lake access point opposite of HEC to create a 4-leg signalized intersection with the HEC central access point
    7. New traffic signal (3-leg) at the intersection of Prospect Rd. and the HEC southern access point
    8. Extension of Evergreen Pl. to connect with Ragged Lake internal network
    9. New traffic signal (3-leg) at the intersection of Prospect Rd. and Brookside Rd.
    10. New connection between Prospect Rd. and Hwy 103 Exit 3
    11. New connection between Prospect Rd. and Route 306 for emergency vehicles and emergency evacuation.

- **Beyond 2045**
  - **The Ultimate Beyond 2045 Option 3B Scenario is recommended with the following interventions:**
    12. Signalization of the intersections at Hwy 103 Exit 3
    13. New roundabout along Prospect Rd. at the intersection with Big Indian Rd.
    14. New Full interchange along Hwy 103 at a central location to the Ragged Lake development, between Exits 2 and 3
    15. New Beechville Connector
    16. New Goodwood Connector

Potential concepts for the key interventions have been provided within Section 6. In addition, **Table 7-1** provides a summary matrix that illustrates the components of the main scenarios considered, as well as the takeaways from the operational analysis and the recommended scenarios.

By virtue of being the only direct connection to several developments, Prospect Rd.'s northern section is expected to operate in congested conditions on some segments in the future given the significant growth in the anticipated travel demand in the area, despite major proposed network and corridor capacity improvements.

Nevertheless, **the proposed mitigation and corridor improvements are anticipated to enhance operational conditions of the study area as a whole, allowing the transportation system to serve significantly higher levels of vehicular travel demand, and accommodate the new residential and employment developments with acceptable impacts.**

The alternative connections presented herein add considerable value to the transportation system as they offer additional capacity, disperse the traffic, and most importantly provides new egress routes in case of emergencies for the Prospect Rd. communities and developments.

Table 7-1: Summary of Scenarios and Recommendations

		Improvement / Measure	Mitigation 2031	Status Quo 2045	Mitigation 2045	Corridor Improvements 2045 Option 1	Corridor Improvements 2045 Option 2	Ultimate Beyond 2045 Option 3A	Ultimate Beyond 2045 Option 3B
Improvements	Prospect Rd.	Planned accesses for HEC and RL	✓	✓	✓	✓	✓	✓	✓
		New traffic signal (3-leg) at the intersection of Prospect Rd. and the HEC central access point	✓						
		New traffic signal at the intersection of Prospect Rd. and Evergreen Pl.	✓		✓	✓	✓	✓	✓
		Widening of Prospect Rd. to 4-lanes between SMB Rd. and Ragged Lake development southern access point			✓	✓	✓	✓	✓
		Realignment of Ragged Lake access point opposite of HEC to create a 4-leg signalized intersection with the HEC central access point			✓	✓	✓	✓	✓
		New traffic signal (3-leg) at the intersection of Prospect Rd. and the HEC southern access point			✓	✓	✓	✓	✓
		Extension of Evergreen Pl. to connect with Ragged Lake internal network			✓	✓	✓	✓	✓
		New traffic signal (3-leg) at the intersection of Prospect Rd. and Brookside Rd.			✓	✓	✓	✓	✓
		New roundabout along Prospect Rd. at the intersection with Big Indian Rd.					✓	✓	✓
	New Corridors	New corridor connection between Prospect Rd. and Route 306 for emergency traffic only				✓	✓	✓	✓
		New corridor connection between Prospect Rd. and Hwy 103 at Exit 3				✓		✓	✓
		New corridor connection between Prospect Rd. and Hwy 103 between Exits 2 and 3					✓	✓	✓
	Hwy 103 Interchanges	New Partial interchange along Hwy 103 at a central location to the Ragged Lake development, between Exits 2 and 3					✓	✓	
		New Full interchange along Hwy 103 at a central location to the Ragged Lake development, between Exits 2 and 3							✓
		Signalization of the intersections at Hwy 103 Exit 3						✓	✓
Operational Measures		**Operational Conditions** along Prospect Rd.	Limited Improvement	No Improvement	Limited Improvement	Improved	Significantly Improved	Significantly Improved	Significantly Improved
		Total Traffic Served from the wider network towards the developments along Prospect Rd.	Moderate	Moderate	Moderate	High	Higher	Significantly Higher	Significantly Higher
		Local Traffic Flows along Prospect Rd.	High	High	High	Lower	Lower	Significantly Lower	Significantly Lower
Cost		**High-Level Construction Cost**	Low	Low	Moderate	Moderate	High	Higher	Significantly Higher
Community		**Community Connectivity**	No Improvement	Limited Improvement	Limited Improvement	Improved	Improved	Significantly Improved	Significantly Improved
Recoomendation		**Recommendation**	**By 2031**			**By 2045**			**Beyond 2045**

APPENDIX A

High Resolution Maps

APPENDIX B

Intersection Turn Diagrams

APPENDIX C

Detailed Model Outputs

APPENDIX D

Overall Intersection Analysis Results

APPENDIX E

Detailed Intersection Analysis Results

APPENDIX F

Warrant Analysis Results

APPENDIX G

Class D Opinion of Probably Costs

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