Bayers Road/Highway 102 Corridor Study
Component 2 - Highway 102 Upgrades, Final Report
March 2010

Department of Transportation and Infrastructure Renewal and The Halifax Regional Municipality

Completed By:

Stantec Consulting Ltd.

in association with

delphiMRC

Stantec #: 20639

Final Report

Executive Summary

E-1 INTRODUCTION

The Nova Scotia Department of Transportation and Infrastructure Renewal (NSTIR) and Halifax Regional Municipality (HRM) have contracted the Stantec, Delphi-MRC team to undertake a study of the Bayers Road / Highway 102 Corridor and the proposed extension of Highway 107 to Highway 102. The team has undertaken transportation planning, traffic analysis, functional design and overall project management for the corridor study.

The purpose of the study is to determine the ultimate capacity and best use of the Highway 102 corridor and to study the alignment and connection options for the future Highway 107. The primary objectives of the Project are to determine:

- Traffic Projections (Component 1)
- Highway 102 Upgrades (Component 2)
- Highway 107 Extension (Component 3)

This report (the second of three) provides an overview of the **Component 2** process and summarizes key findings from the analysis. The following is a description of the study objectives for Component 2.

- Review of Expansion Potential (additional lanes) of Highway 102 – to establish constraints and potential for the physical expansion.
- Infrastructure Needs Assessment – to apply the Component 1 traffic volume forecasts and establish ramp lanes and intersection needs for the horizon years.
- HOV Lane Strategic Review – to assess the feasibility and benefits of HOV (High Occupancy Vehicles) lanes on Highway 102
- Establish a Design Criteria – to set the parameters for the physical expansion of Highway 102 and associated ramps and crossing roads.
- Preparation of Conceptual Plans – to apply the recommendations from the Infrastructure Needs Assessment.
- VE Session for 107 Connection – to establish / review the options for the Highway 107 connection with Highway 102
- Conduct a Public Information Session – to present the results of the study and obtain feedback on the conceptual plans.
- Costing and Implementation – to determine approximate costs for the work and a concept schedule for implementation.

- Comparative Review and Ultimate Capacity Forecast – to re-examine the model results and to estimate a point in time when the capacity of the corridor would be reached.

E-2 REVIEW OF EXPANSION POTENTIAL

The existing conditions in the corridor were evaluated to determine the potential and constraints within the corridor. The purpose of the task was to identify and document factors that would influence the design.

The design team conducted site visits and reviewed aerial photography, right-of-way plans, property mapping and construction plans and profiles for Highway 102. Plans summarizing these constraints are included in ***Appendix B.***

Some of the key items include:

- Property Constraints: The current transportation corridor and right-of-way limits shown highlighted in yellow on the plans. Adjacent property owned by HRM or NSTIR is identified which may present an opportunity for expansion. Adjacent property that is currently developed is identified and represents a constraint to expansion.
- Environmental and Natural Features are noted as potential constraints to expansion such as water bodies and water courses that present environmental concerns. Significant water bodies within the study area include: The Sackville River which crosses Highway 102 in Bedford (Highway 102 / 101), Kearney Run, just south of the proposed Highway 113 interchange location, Lake Thomas in the Fall River area, The wetland at the Highway 102/113 junction which has been identified in the Environmental Assessment of the Highway 113. At this point in the process, these are only identified as significant. No specific work has been done to measure the impacts. With the exception of those noted above, water crossings of the Highway 102 are limited to minor culverts.
- Horizontal and vertical road geometry which may need to be up-graded to provide a safe facility.
- Bridge structures. Age and size were documented to determine potential for additional lanes. There are a total of 29 existing bridge structures within the study area. The minimum design life requirement for new bridges for TIR is specified at a minimum of 75 years, without major rehabilitation. A number of bridges on Highway 102 were constructed in the early 1960's and will reach the estimated design life of 75 years in the horizon year of 2036 for this study. This is based on the assumption that the initial design of these structures was also 75 years. Other bridges located within the study area will reach their estimated design life within 10 to 15 years past the horizon year of this study. Therefore, many of these bridges will be in need of major repair or replacement by the horizon year of this study. Careful consideration will be required on the decision to widen or upgrade existing structures for which the design life may be exceeded within the next 20 to 30 years as compared to the replacement of existing bridges by new bridges with the required number of lanes both on Highway 102 or the crossing roads.

- Other built infrastructure and natural features: Existing power transmission lines and trunk municipal infrastructure (watermain and trunk sewers) may complicate the widening of the highway at specific locations. Rock outcrops were noted to be considered in the overall cost of an expanded facility.
- Active Transportation Paths / Bikeways were added to the plans based on the HRM Active Transportation Plan. This includes bikeways within the arterial roadways that cross the 102 as well as a few suggested locations for pedestrian over or underpasses.

The objectives for the development of the concept plans were established as follows:

- to provide sufficient capacity for horizon traffic
- to maximize safety features (correction of sub-standard features)
- to minimize environmental impact
- to avoid impact to developed properties
- to minimize property acquisition
- to minimize impact to other municipal and power infrastructure

E-3 INFRASTRUCTURE NEEDS ASSESSMENT

This infrastructure needs analysis for the components of the corridor forms the crucial link between the planning and design tasks. The forecast demand volumes developed in Component 1 - were used as input to the infrastructure needs assessment task. In this task, the major corridor intersections were evaluated – using Highway Capacity Manual methodologies – to determine the number of lanes and auxiliary lanes required to accommodate the forecast demand.

The study area intersections (19 in total) were analyzed during the AM and PM peak hour for each of the 2016, 2026 and 2036 planning horizons and each of the three road network scenarios. Likewise, each ramp (approximately 50 in total) in the study area was evaluated.

The ramp volume forecasts are contained in ***Appendix E*** for each of the planning horizons. The findings of the intersection infrastructure needs and staging are illustrated in ***Appendix F***.

The following points should be considered when applying the findings of the Infrastructure Needs Assessment in any future work.

- The application of traditional 4-step transportation demand models - like the model used in this study – are intended to provide roadway link-level information for long-term strategic decisions. The use of detailed turning movement volumes from any model should consider their course level of findings.
- It is expected that the HRM Regional Plan will change and evolve over time. However, the transportation demand model is based on the current knowledge of land use and demographic information. Any future changes to the land use and demographic information will impact the transportation demand forecasts in the region.

- It must be noted that the intersection infrastructure needs analysis was carried out for individual intersections and did not review the upstream/downstream impacts of adjacent signals. Consideration of the impacts associated with adjacent intersections was discussed with the Project Steering Committee; however, the decision was made to move forward with the original workplan and only focus on individual intersections.

E-4 TRAVEL DEMAND MANAGEMENT REVIEW

As part of Component 2, a strategic level review of HOV (High Occupancy Vehicle) lanes was undertaken. The objective of this analysis was to determine the feasibility of HOV lanes in the context of the Highway 102 Bayers Road corridor and determine the impact of the initial implementation at specific points in time within this study's future planning horizon. In examining the potential impacts of HOV lanes on the Highway 102 corridor, we applied the analysis technique outlined in NCHRP Report 365.

Some of the benefits typically associated with HOV lanes include:

- A travel time savings relative to general purpose lanes;
- An improved operational reliability relative to general purpose lanes;
- Move more people (not cars) relative to general purpose lanes;
- Increase the use of ride-sharing and public transit;
- Reduce the number of single-occupant vehicles;
- The potential to reduce overall vehicle emissions due to fewer single occupant cars on the road.

The strategic-level review of HOV lanes on Highway 102 was carried out using two specific and distinct concepts of HOV lane implementation – and their subsequent impact – in order to provide a range of findings. The first concept is an early implementation of HOV lanes that would occur at the time of widening the Highway 102 corridor to a 6-lane cross section – this is termed the add-a-lane scenario. The second concept examines the impact of implementing HOV lanes some period of time after the Highway 102 corridor has been widened to a 6-lane cross-section – this is termed the take-a-lane scenario.

The general findings of the review indicate that:

- The Highway 102 corridor is well suited to HOV lanes if implemented properly;
- Bayers Road is a potential candidate site and would complete an HOV corridor from Highway 102 onto the peninsula;
- If managed effectively, additional infrastructure in the corridor could be deferred - such as the need to widen to 8 lanes on Highway 102 between Joe Howe and Hwy 103;
- The success of HOV lanes would require constant management, enforcement, and performance monitoring and really requires a detailed region-wide, long-term vision for HOV lanes.

E-5 DESIGN CRITERIA AND CONCEPTUAL PLANS

The primary objective of the study is to establish, at a conceptual level, the infrastructure required in the horizon year (year 2036). To this end, drawings were developed using

- the number of core lanes (determined in Component 1),
- the intersection and ramp requirements as well as
- Standard design criteria based on TIR and HRM have design guidelines as well as National Standards set by the Transportation Association of Canada

The drawings, encompassing over 30 kilometers of roadway, are included in ***Appendix I.*** The plans show a design of Bayers Road / Highway 102 with 6 core lanes from the peninsula to Exit 4, the Bedford interchange. From Exit 4 to Exit 5, the current 4-lane core lane design is maintained.

The Highway 102 right-of-way varies in width from approximately 90 to 100 meters. As observed from the mapping, Highway 102 has been constructed offset from the centerline of the right-of-way allowing more room on the inbound side for widening of the highway.

The typical cross-sections ***(Sheets 40-42, Appendix I)*** illustrate how the roadway would typically be widened. At locations where more than 6 lanes are required – for ramp approach lanes for example, most of the widening will need to occur on the inbound side to make use of the existing right-of-way.

Bayers Road Concept Plans

The corridor between Windsor Street to Joseph Howe Drive in Fairview is generally divided into four (4) distinct areas and each one has specific features and restrictions to widening. These four areas include:

- Section 1: Bayers Road from Windsor Street to Connaught Avenue which is an existing three lane street. From Windsor to Oxford, there may be potential to widen on the DND side, avoiding numerous properties on the south side. Between Oxford and Connaught any effects of widening would be felt on both sides of the roadway.
- Section 2: Bayers Road from Connaught Avenue to Romans Avenue. Widening would occur primarily on the inbound side. But retaining walls would be required to minimize property impacts.
- Section 3: Bayers Road from Romans Avenue to Ashburn Avenue is where the arterial street transitions to an access controlled highway and where access to adjacent properties is very awkward and difficult as it exists now. This is a challenging area and two potential re-construction alternatives have been presented on ***Sheets 05a and 05b in Appendix I***. The second alternative is a suggestion that was made by residents who attended the information sessions to bring the inbound lanes adjacent to the outbound lanes, which would cause less disruption to properties and improve access to the Ralston, Wellington Row properties by re-joining these streets to the larger residential neighbourhood.

- Section 4: Bayers Road from Ashburn Avenue to Joseph Howe Drive to Fairview. School Avenue in Fairview is tight up against the Highway on a steep grade. There is considered to be no potential for expansion along this side of the Highway. Widening is proposed for the opposite side of the highway (the Ashburn Golf Course side)

The Access Controlled Highway within the study area; from Joseph Howe Drive to Exit 5 is approximately 24 km in total length with a total of nine (9) existing interchanges with arterial roadways or other 100 series Highways. The following is a list of the existing and proposed interchanges within the study area. A detailed description of the changes at each interchange is included in ***Chapter 6***:

- Exit 0 -Highway 102/Joseph Howe Drive
- Exit 1A -Highway 102/Northwest Arm Drive
- Exit 1 - Highway 102/Highway 103
- Exit 2A - Highway 102/Lacewood Drive
- Exit 2 - Highway 102/Kearney Lake Road
- New Exit - Highway 102/Larry Uteck Drive
- New Exit - Highway 102/Highway 113
- Exit 3 - Highway 102/Hammonds Plains Road
- Exit 4 - Highway 102/Highway 1 (Bedford Highway) and Hwy 101
- New Exit - Highway 102/Highway 107
- Exit 4C - Highway 102/Glendale and Duke Street
- Exit 5 - Highway 102/Lake Thomas Drive

E-6 HIGHWAY 107 CONNECTION TO HIGHWAY 102

It was recognized at the outset that a connection at Exit 4 would be challenging given the existing network and terrain in the area. A four-day working session (the Value Engineer (VE) session) was held with NSTIR and HRM staff to capitalize on the experience and knowledge of the full Project Team. Various draft conceptual design options were developed through this session where recognized value engineering concepts were applied to the task.

The full report for the VE session was submitted to NSTIR following the VE process. It is identified as ***Appendix J*** and bound separately. The following is a summary of the session and results. The Value Engineering (VE) session was facilitated by Delphi-MRC and Lewis & Zimmerman Associates, Inc on behalf of Stantec for NSTIR and HRM.

The goal of this VE workshop, was to develop and evaluate a series of potential interchange configurations to identify candidates to carry forward to a functional design stage. At the start of the workshop, the VE team was presented with three interchange alternatives prepared by MRC. These alternatives were prepared to provide the VE team with a practical starting point upon which modifications could be made and alternate configurations could be explored.

Using the performance evaluation criteria and construction cost estimates developed during the VE workshop, the independent specialists of the VE Panel conducted a performance measurement review and prepared a detailed risk-based safety evaluation for each of the six scenarios developed during the VE workshop. The results of this evaluation are summarized in ***Exhibit E.1.***

Exhibit E.1: Final Performance Evaluation Matrix

	Scenario Description	Total Performance	% Performance Improvement	Initial Cost ($ millions)	Value Index (Perf/Cost)	% Value Improvement
1	Initial Design Concept A - Base Case	495	~	44.4	11	~
2	Initial Design Concept B	464	-6%	45.9	10	-9%
3	Initial Design Concept C	481	-3%	44.7	11	-3%
4	Scenario 1: Alt DCB-22 Cloverstack/Roundabout	227	-54%	90	3	-77%
5	Scenario 2: Alt DCB-1A, Alt DCB-1B, and Alt DCB-7	339	-32%	60.8	6	-50%
6	Scenario 3: Alt DCB-13 Cloverstack	239	-52%	89.7	3	-76%
7	Scenario 4: Alt DCC-8A Larger Ramp W of Hwy 102	582	18%	65.2	9	-20%
8	Scenario 5: Alt DCC-8B Variant of Scenario 6	465	-6%	77.1	6	-46%
9	Scenario 6: Alt DCB-14 Collector Distributor & Loop ramps	322	-35%	65.2	5	-56%

The performance criteria for each of the chosen VE design scenarios were compared to the original project performance rating to arrive at a total score. The difference between the score for each of the interchange design scenarios developed during the workshop (highlighted in green) and the score of the selected baseline concept (Alternative A) was expressed as a percentage. A positive value for the percent difference value indicates an improvement over the base case.

According to the criteria selection, weightings and the ratings established by the VE team, the project values are best achieved by the initial design Concept A (the base case). Of the design scenarios developed as part of the workshop, Scenario 4 provided improved performance with slightly degraded value due to a higher cost of implementation.

E-7 PUBLIC INFORMATION SESSIONS

Public Information Sessions were held to explain the study and obtain information and feedback from local residents, businesses, and landowners. The public sessions were advertised in local newspapers. Elected officials were invited by letter or e-mail. Based on the concept plans, a number of property owners were identified who might be directly impacted by the work and were invited to the sessions by letter. As well, meeting notices were delivered door to door for residents in the Bayers Road area.

Prior to the sessions, the study team discussed the format of the sessions and considered separate sessions with only specific information for the Bayers Road area, and then other sessions specific to the Highway 102 and Highway 107 areas. However, it was decided to present the study as it was conducted – as a single corridor where changes to specific sections may have an influence on the whole. The intent was to relay to the public how the corridor areas were linked. The full study scope was presented in different geographic areas with the understanding that concerns expressed would be more local to the attendees at particular sessions. There was considerable criticism of this approach especially from the Bayers Road residents who generally felt that the Highway 102 and Highway 107 work was irrelevant to their concerns. This was considered in the review of comments received.

The following sessions were held:

February Sessions

- Wednesday, February 11, 2009 at the St. Andrew's Centre, 6955 Bayer's Road, Halifax, from 6pm to 9pm with a presentation at 6:30pm
- Thursday, February 12, 2009 at the LeBrun Community Centre, 36 Holland Avenue, Bedford, from 6pm to 9pm with a presentation at 6:30pm.

Following the February sessions, two additional sessions were conducted in response to requests for better coverage of the Sackville and Burnside areas.

March Sessions

- Wednesday, March 25, 2009 at the Sackville High School, 1 Kingfisher Way, Lower Sackville, from 6pm to 9pm with a presentation at 6:30pm
- Thursday, March 26, 2009 at the Park Plaza Hotel and Conference Centre, Ramada Plaza, 240 Brownlow Avenue, Dartmouth, from 4pm to 6pm.

From the questionnaires and comments received, it may be inferred that the public are generally commenting on opposite ends of the project (i) Bayers Road and (ii) Highway 107. As a result the questionnaires were collated to reflect this division. In effect the Bayers Road comments are collated as one unit (***Appendix K, Table K-1***) and the Highway 102 / 107 comments are collated as a separate unit (***Appendix K, Table K-2***)

The tables are a color-coded compilation of the responses to visually display the level of agreement or disagreement with the project. The pink color represents agreement and gray tone represents disagreement. The following observations are made:

- ***Table K-1*** shows responses 1-41, which were received at the February 11, 2009 meeting or shortly following the meeting. They are primarily residents of the Bayers Road area (including adjacent streets or peninsula residents)
  - Property impacts and Community Life are clearly the main concerns (76% and 52% respectively indicated this as their primary concern).
  - The majority of those who provided comments at the February 11th session disagreed with the project. It is assumed that this disagreement applies primarily to the Bayers Road component.
- ***Table K-2*** shows responses 42-63 which were received at the February 12, 2009 and the March 25, 2009 sessions are primarily Bedford and Sackville residents.
  - Health and Safety was indicated most often as the number one priority (47%)
  - The majority of those who provided comments at the February 12, 2009 and March 25, 2009 sessions agree with the project.

As a result of the public input received and subsequent discussions with the steering committee, the following changes to the plans are considered appropriate:

- Revise the "transition area" of Bayers Road to bring the inbound lanes adjacent to the outbound lanes, which would cause less disruption to properties and improve access to the neighbourhood.
- Revise the Bayers Road design in the area of the Halifax Shopping Centre to provide for all widening on the outbound side of the road.

In addition to the above, careful consideration of the Highway 107 phase 1 is required. This phase would direct traffic directly to Glendale from the new Highway 107 and this has been identified as a primary concern.

E-8 COSTING AND IMPLEMENTATION

Property Impacts

Property impacts at various areas in the corridor are discussed in **Chapter 6.0**, as a primary factor in the development of the concept design. The concept plans in ***Appendix I*** show the properties which may be impacted by construction. The approximate area of impact is shown on the drawings. As well, individual properties are numbered. This information along with HRM GIS data base information was used to notify these property owners of the public information session as described in **Chapter 8.0**. An estimated 90 properties along the Bayers Road Corridor would be directly impacted by the construction. A further 42 properties along the Highway 102 corridor would be directly impacted.

Timelines

The ***Appendix I*** concept drawings are based on the full build-out of the facility to the 2036 horizon. A conceptual timeline for the expansions has been determined and shown in ***Exhibit E.2***. This approximate timeline shows the roadway components as noted in ***Exhibit E.2***. In addition to comments provided in the table, the following is noted:

- The interchanges will have to be upgraded before any Hwy 102 widening can occur given that the old structures are tight to the roadway.
- An approximate 2 year time frame is assumed for each component of the work.
- The timing for the Bayers Road widening is adjusted to correspond with the proposed widening on Hwy 102.
- Highway 102 from Joseph Howe to NW Arm widening may be required to 8 lanes in 2035/2036. This has not been shown in the timeline or accounted for in the costing.

Exhibit E-2 Timelines

		Horizon Year 2016							Horizon Year 2026										Horizon Year 2036									
No.	Location	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
	BAYERS ROAD																											
1.0	Windsor St. to Connaught Ave.							■	■	Timing not an issue as there is no new capacity added																		
2.0	Connaught Ave.to Roman's Ave.					■	■	Timing dependent on Hwy 102 upgrades (Sections 4 and 5)																				
3.0	Roman's To Ashburn					■	■																					
	SECTION 4																											
4.1	Interchange: Joe Howe					■	■																					
4.2	102 from Joe Howe to NW Arm					■	■																					
4.3	Interchange: NW Arm				■	■		Upgrade interchange with Hwy 103 interchange																				
	SECTION 5																											
5.1	102 from NW Arm to 103					■	■		Upgrade Hwy 102 with Hwy 103 interchange																			
5.2	Interchange: Highway 103				■	■		Key interchange in corridor, needs ramp widening																				
	SECTION 6																											
6.1	102 from 103 to Lacewood								■	■																		
6.2	Interchange: Lacewood								■	■	Ramps									Regency Int.					■	■		
	SECTION 7																											
7.1	102 - Lacewood to Kearney Lake									■	■																	
7.2	Interchange: Kearney Lake						■	■		Intersection widening requires structure upgrade																		
	SECTION 8																											
8.1	102 - Kearney Lake to Larry Uteck												■	■														
8.2	Interchange: Larry Uteck	■	■																									
	SECTION 9																											
9.1	102 from Larry Uteck to 113	Deferred due to demand between 113 and 101																		■	■							
9.2	Interchange: Highway 113								■	■		Upgrades carried out after HPR upgrades																
	SECTION 10																											
10.1	102 from 113 to H. Plains Road								■	■		Upgrades carried out after HPR upgrades																
10.2	Interchange: H Plains Road						■	■		Intersection widening requires structure upgrade																		
	SECTION 11																											
11.1	102 from H Plains to Bed. Hwy											■	■	Timing will depend on completion of Hwy 107														
11.2	Bedford Exit 4 Interchange										■	■		Exit 4 ramps require upgrading first														
	SECTION 12																											
12.1	102 from Bed. Hwy to Glendale											■	■	Exit 4 to Exit 4C occurs at same time														
12.2	Interchange: Glendale / Duke											■	■															
12.3	Interchange: 107 at Exit 4C											■	■															
	SECTION 13																											
13.1	102 from Glendale to Trunk 2	No new capacity added, minor work														■	■											
13.2	Interchange: Tr. 2 at Fall River	2 separate intersection upgrades required														■	■									■	■	

Approximate Costs

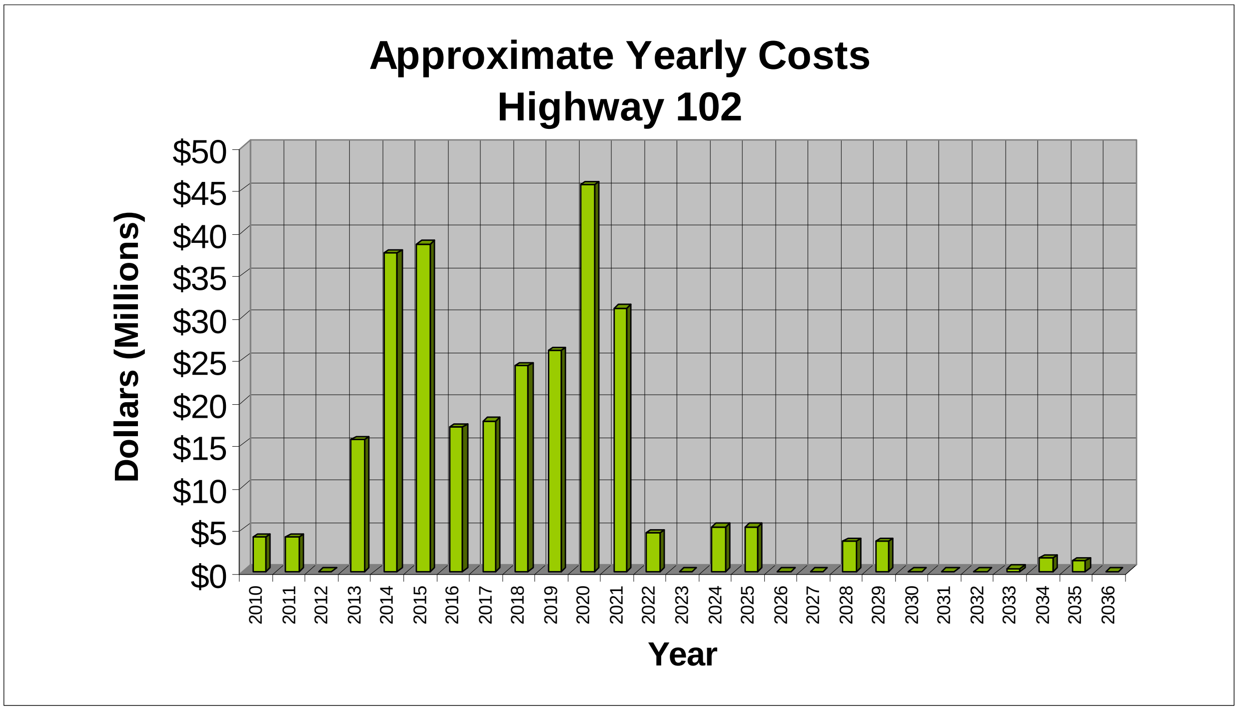
Based on the functional designs that have been completed, the design team prepared an opinion of capital costs for the major components of construction. Costs are identified for each phase of the project, and identified in present day (2009) dollars. These are 'order of magnitude' conceptual level costs.

Exhibit E.3 - Cost Summary Table

Section	Location	Approximate Cost
	BAYERS ROAD	
1.0	Bayers Road - Windsor Street to Connaught Avenue	$ 2,000,000
2.0	Bayers Road - Connaught Avenue to Roman's Avenue	$ 4,000,000
3.0	Bayers Road - Roman's Avenue To Ashburn Avenue (Transition Section)	$10,000,000
	SECTION 4	
4.1	Interchange: Joseph Howe Drive	$23,000,000
4.2	Highway 102 from Joseph Howe Drive to Northwest Arm Drive	$ 5,000,000
4.3	Interchange: Northwest Arm Drive	$11,000,000
	SECTION 5	
5.1	Highway 102 from Northwest Arm Drive to Highway 103	$ 3,000,000
5.2	Interchange: Highway 103	$20,000,000
	SECTION 6	
6.1	Highway 102 from Highway 103 to Lacewood Drive	$13,000,000
6.2	Interchange: Lacewood Drive	$ 3,000,000
	SECTION 7	
7.1	Highway 102 from Lacewood Drive to Kearney Lake Road	$14,000,000
7.2	Interchange: Kearney Lake	$12,000,000
	SECTION 8	
8.1	Highway 102 from Kearney Lake Road to Larry Uteck Drive	$10,000,000
8.2	Interchange: Larry Uteck Drive	$ 9,000,000
	SECTION 9	
9.1	Highway 102 from Larry Uteck Drive to Highway 113	$ 7,000,000
9.2	Interchange: Highway 113	$11,000,000
	SECTION 10	
10.1	Highway 102 from Highway 113 to Hammonds Plains Road	$ 7,000,000
10.2	Interchange: Hammonds Plains Road	$21,000,000
	SECTION 11	
11.1	Highway 102 from Hammonds Plains Road to Bedford Highway	$34,000,000
11.2	Bedford Exit 4 Interchange (Option 1 Costing)	$38,000,000
	SECTION 12	
12.1	Highway 102 from Bedford Highway to Glendale Drive	$ 7,000,000
12.2	Interchange: Glendale / Duke	$0
12.3	Interchange: Highway 107 at Exit 4C (Option 1 Costing)	$14,000,000
	SECTION 13	
13.1	Highway 102 from Glendale to Trunk 2	$ 8,000,000
13.2	Interchange: Trunk 2 at Fall River	$ 6,000,000
	Approximate Total Cost	$292,000,000

Based on the approximate costs for each component of the project and the projected timeline, the following ***Exhibit E.4*** shows the resulting yearly costs.

Exhibit E.4 Approximate Yearly Costs – Highway 102



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APPENDICES

1.0 Introduction

The Nova Scotia Department of Transportation and Infrastructure Renewal (NSTIR) formerly called the Department of Transportation and Public Works (TPW) has contracted the Stantec, Delphi-MRC team for the Bayers Road/Highway 102 Corridor Transportation Study – A study of Highway 102 (Bicentennial Highway) and the proposed extension of Highway 107 to Highway 102. The Terms of Reference for the project are provided in ***Appendix A***.

The team has undertaken transportation planning, traffic analysis, highway engineering, benefit/ cost analysis and overall Project Management for the corridor study. The study commenced in March of 2007.

The purpose of the study is to determine the ultimate capacity and best use of the Highway 102 corridor and to study the alignment and connection options for Highway 107. The primary objectives of the Project are to:

- Complete Traffic Projections for Highway 102 and 107 (Component 1)
- Identify Highway 102 Upgrades Requirements based on Component 1 (Component 2)
- Review the Highway 107 Extension to Highway 102 (Component 3)

The project is divided into three main components and specific objectives are discussed in Section 1.2. All three components are inter-related and portions of each component occurred concurrently. Component 1, the traffic projection component of the project provides the data required to complete Component 2 and 3 respectively. Traffic Projections have been determined using the QRSII model to the horizon years 2016, 2026, and 2036. The results of this work are summarized in "***Component 1 – Traffic Projections Final Report***", February 20, 2008.

The following report presents the results of ***Component 2*** of the project – to identify a plan for the upgrading of Highway 102. The key objective of the plan will be to provide an acceptable level of safety and capacity for the corridor for the next 30 years (the study horizon - 2006-2036).

1.1 BACKGROUND INFORMATION

The main purpose of the 100 series highway network in Nova Scotia is the safe and efficient movement of large volumes of people and goods at high speeds possibly over long distances while minimizing negative economic, social and environmental impacts.

Highway 102 is an important primary highway link for northern and eastern part of the province, linking HRM to the Trans Canada Highway 104 in Truro. Highway 102 within the study area serves HRM as an urban commuter highway. Route 102 includes the full length of Bayers Road from Windsor Street on the Halifax peninsula to the start of the access controlled Highway 102 at Joseph Howe Drive a distance of approximately 2.5 kilometres.

The length of arterial street (Bayers Road) includes six (6) signalized intersections and a number of local intersecting streets at un-signalized crossings. In the area of Joseph Howe Drive, the facility transitions to an Access Controlled Highway.

The Access Controlled Highway within the study area; from Joseph Howe Drive to Exit 5 is approximately 24 km in total length with a total of nine (9) existing interchanges with arterial roadways or other 100 series Highways. Highway 102 has four (4) core lanes – two lanes in each direction with a median. From the Joseph Howe Drive interchange to just north of the Highway 1/101 Interchange, the opposing traffic is divided by a narrow median and concrete jersey barrier. From the Highway 101 crossing, easterly the median widens to a rural freeway, wide grassed median. The Component 2 project study area is shown on ***Figure 1.1.***

The following is a list of the existing and proposed interchanges within the study area. A detailed description of each interchange is included in Chapter 6:

- Exit 0 -Highway 102/Joseph Howe Drive
- Exit 1A -Highway 102/Northwest Arm Drive
- Exit 1 - Highway 102/Highway 103
- Exit 2A - Highway 102/Lacewood Drive
- Exit 2 - Highway 102/Kearney Lake Road
- New Exit - Highway 102/Larry Uteck Drive
- New Exit - Highway 102/Highway 113
- Exit 3 - Highway 102/Hammonds Plains Road
- Exit 4 - Highway 102/Highway 1 (Bedford Highway) and Hwy 101
- New Exit - Highway 102/Highway 107
- Exit 4C - Highway 102/Glendale and Duke Street
- Exit 5 - Highway 102/Lake Thomas Drive

1.2 OBJECTIVES FOR COMPONENT 2 – HIGHWAY 102 UPGRADES

As noted above, the results of Component 1 are used to determine the ultimate required capacity of the Highway 102 Corridor and the ultimate interchange configurations required to support the capacity. Component 2 of the study focuses on the Highway 102 corridor including existing and proposed intersections and interchanges. Included in the above noted existing interchanges, future interchanges include (1) the Larry Uteck Interchange and (2) the Highway 113 connection. Both of these connection points have been evaluated in previous studies, location points have been established and plans have been developed. Work from these previous studies has been reviewed and incorporated into the overall corridor plan of this study.

The third new connection with Highway 102 is the Highway 107 interchange located between Exit 4 and Exit 4C. Previous planning exercises for this connection were based on an extension of Highway 107 known as the Second Lake Connector which would have been located further west, but this option is no longer feasible. Over recent years various plans have been developed at the conceptual level only for the road authority as well as for private land owners. However, a consensus on the ultimate recommended location had not been achieved between the stakeholders. A significant challenge for this component of the study involves determining a preferred location and configuration of a connection point for the new Highway 107 with Highway 102.

The following locations have been considered for the 107 connection to the Highway 102:

- Connection to the Duke Street Interchange (Exit 4C): NSTIR have developed detailed plans for this connection point which have been incorporated into this study.
- Connection to the Highway 101/Highway 102 Interchange (Exit 4): Direct flow of traffic from Highway 107 to this interchange would allow efficient access to both Highway 101 and Highway 102, provided an acceptable connection can be achieved. The potential for this connection was explored through a Value Engineering (VE) session as discussed in Chapter 7.0

1.3 STUDY METHODOLOGY

The following is a brief description of the Study Methodology for Component 2.

- Review of Expansion Potential (additional lanes) of Highway 102 – to establish constraints and potential for the physical expansion.
- Infrastructure Needs Assessment – to apply the Component 1 (traffic volume forecasts and establish ramp lanes and intersection needs for the horizon years.
- HOV Lane Strategic Review – to assess the feasibility and benefits of HOV (High Occupancy Vehicles) lanes on Highway 102
- Establishing a Design Criteria – to set the parameters for the physical expansion of Highway 102 and associated ramps and crossing roads.
- Preparation of Conceptual Plans – to apply the recommendations from the Infrastructure Needs Assessment.
- VE Session for 107 Connection – to establish/review the options for the Highway 107 connection with Highway 102

- Conduct a Public Information Session – to present the results of the study and obtain feedback on the conceptual plans.
- Costing and Implementation – to determine approximate costs for the work and a concept schedule for implementation.

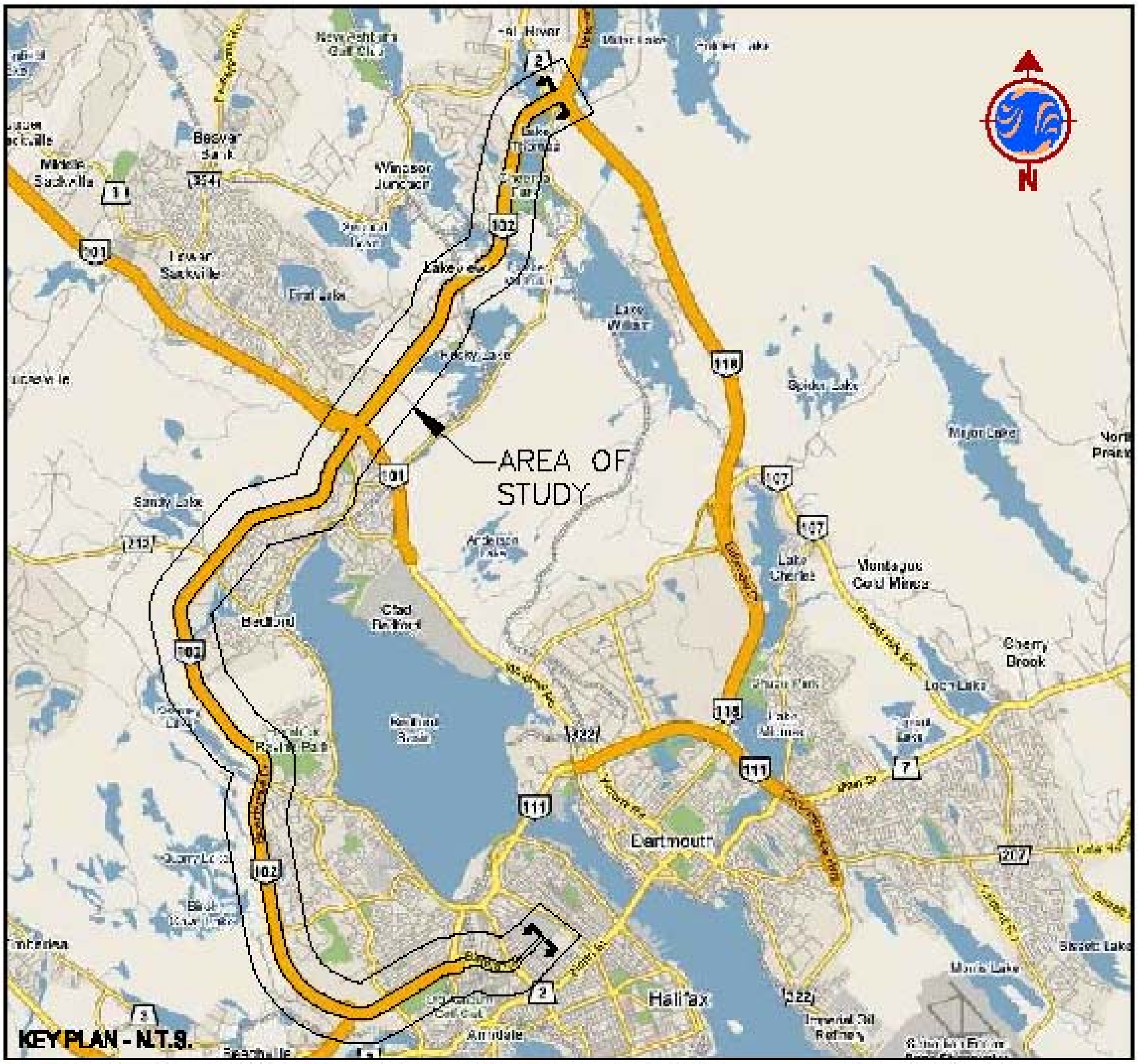


FIGURE 1.1
AREA OF STUDY

2.0 Ultimate Physical Expansion Potential

The purpose of this task is to evaluate the potential to expand Highway 102 within the existing corridor. The design team has conducted multiple site visits and a detailed review of background material in order to characterize the site and identify key constraints to expansion of the highway. Background material reviewed included aerial photography, right-of-way plans, property mapping and construction plans and profiles for Highway 102. This material was obtained from HRM as well as from the Department of Transportation and Infrastructure Renewal.

An overall site plan and profile (in ***Appendix B***) has been prepared showing:

- The current transportation corridor and right-of-way limits
- Adjacent property owned by HRM
- Adjacent property that is currently developed
- Water bodies and water courses
- Power Transmission lines
- Trunk municipal infrastructure
- Horizontal and vertical road geometry
- Bridge structures
- Rock outcrops
- Active Transportation paths / bikeways

In addition typical cross-sections are presented in the following figures to illustrate how the highway would typically be widened within the existing right of way. These cross-sections identify the lane and shoulder widths, as well as the type of median available within the existing corridor. From this information a summary of potential to expand and key constraints are identified.

This task was carried out prior to the completion of Corridor Demand Analysis and the Capacity Constraints Analysis. The completion of these tasks identifies the ultimate number of core lanes (through lanes) recommended for the corridor. Auxiliary lanes which are lanes required for ramps would be required in addition to the core lanes. This allows for a more specific analysis of the physical constraints to expansion as discussed in subsequent chapters. The following section is an overview of the existing infrastructure, constraints and potential for expansion.

2.1 BAYERS ROAD EXPANSION

Bayers Road is a 3-lane street from Windsor Street to Connaught Avenue with widening for turning lanes at the Oxford Street and Windsor Street intersections. From Connaught Avenue to Joseph Howe Drive, Bayers Road is a four-lane street, primarily divided by a median island with concrete curb.

The Bayers Road/Windsor Street intersection has recently been re-constructed, with a re-alignment of Bayers Road to allow continuous flow of traffic from Bayers Road to the four-lane Young Street. As well, significant improvements have been done in past years at the Connaught Avenue/Halifax Shopping Centre intersections to add turning lanes and additional signalization. Two functional plans have been previously developed for the expansion of Bayers Road and considered in this study. As part of this task, the two options were reviewed with respect to expansion constraints of this area. This, together with the traffic evaluation results in a recommended conceptual plan for the re-construction of Bayers Road.

HRM has developed functional plans to widen Bayers Road to 4 lanes from Windsor Street to Connaught Avenue and six (6) lanes from Connaught Avenue to Highway 102. In addition to this scenario, a more recent functional design provides for five (5) lanes from Connaught Avenue to Highway 102, with a reversible bus lane. For both scenarios, it is assumed that the section from Windsor Street to Connaught Avenue will be expanded to 4 lanes. The two plans are provided in ***Appendix B***.

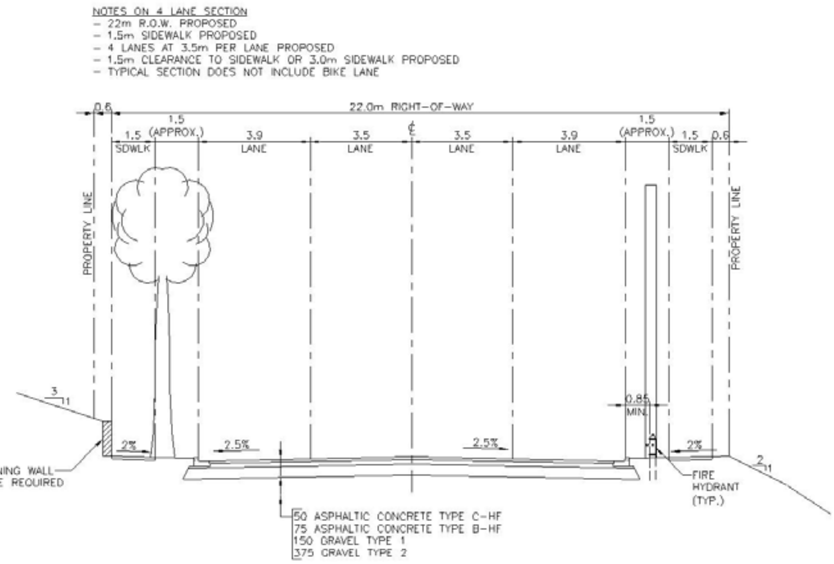
Typical sections for Bayers Road have been developed and shown in ***Figure 2.1***.

The corridor between Windsor Street to Joseph Howe Drive in Fairview has been divided into four (4) distinct areas as each one has specific features and restrictions to widening / upgrading. These four areas include:

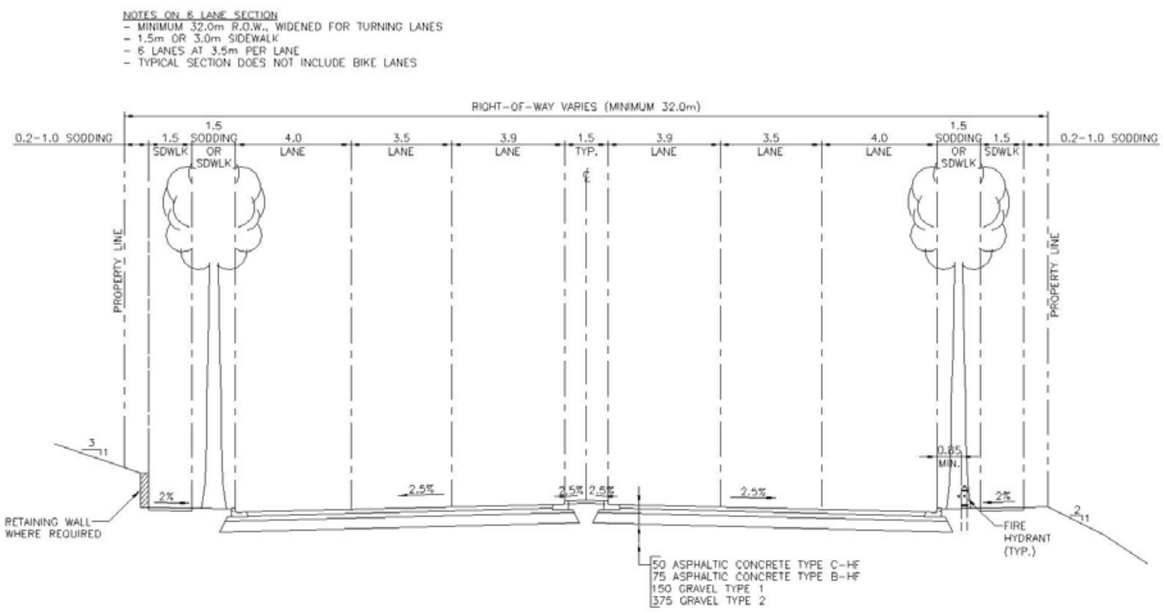
- Section 1: Bayers Road from Windsor Street to Connaught Avenue
- Section 2: Bayers Road from Connaught Avenue to Romans Avenue
- Section 3: Bayers Road from Romans Avenue to Ashburn Avenue ("Transition Section")
- Section 4: Bayers Road from Ashburn Avenue to Joseph Howe Drive to Fairview

2.1.1 Section 1: Bayers Road from Windsor Street to Connaught Avenue

Section 1 which covers Bayers Road from Windsor Street to Connaught Avenue has numerous residential properties and driveways accessing Bayers Road, and the existing right-of-way width is limited at only 18 m along the main corridor. Widening from 3 lanes to four lanes requires a minimum right of way width of 22 meters as shown on the typical section in ***Figure 2.1***. From Bayers Road to Oxford Street, widening on the north side of the street will impact DND property but will avoid impact to approximately 15-16 residential properties.



TYPICAL SECTION BAYERS ROAD FOUR LANES
WINDSOR STREET TO CONNAUGHT AVENUE (URBAN MAJOR COLLECTOR – MODIFIED)
SCALE: N.T.S.



TYPICAL SECTION BAYERS ROAD SIX LANES
CONNAUGHT AVENUE TO ROMANS AVENUE (URBAN ARTERIAL – MODIFIED)
SCALE: N.T.S.

FIGURE 2.1
BAYERS ROAD TYPICAL SECTIONS

Through the Oxford Street intersection, it is suggested that the widening be maintained on the north side to just west of Oxford Street to minimize the impact to the commercial properties located on the south side of the street. From this point, it is expected that shifting the roadway widening to the south side will have advantages as well as reduce the impact on properties. However, one house located to the west of Connolly has minimal lateral clearance to the existing traveled way and will be further impacted by widening, likely requiring buy-out or relocation within the existing property.

Photo No. 1: Bayers Road Looking Inbound from Connaught Avenue

Photo No. 2: Bayers Road, Commercial properties at Oxford Street

The four intersections from Windsor Street to Connaught Avenue include the following:

1. <u>Bayers Road/Windsor Street</u> – Existing four-way signalized intersection: This intersection has recently been reconstructed to allow continuous flow from Bayers Road to Young Street and to provide left turn lanes.

2. <u>Bayers Road/Dublin Street</u>: Dublin is a local road with an unsignalized "T" intersection at Bayers Road. Currently, there are no turn restrictions or dedicated turning lanes.

3. Bayers Road/Oxford Street – Existing four-way signalized Intersection. Currently, there are no turn restrictions or dedicated turning lanes. Recently installed signals would require modifications to accommodate widening.

4. Bayers Road/Connolly – Connolly is a local road with a four-way unsignalized intersection at Bayers Road. It is located approximately midway between two signalized intersections, Oxford Street and Connaught Avenue, with 240 and 220 m spacing respectively. Currently, there are no turn restrictions or dedicated turning lanes.

2.1.2 Section 2: Bayers Road from Connaught Avenue to Romans Avenue

The second section of Bayers Road is from Connaught Avenue to Romans Avenue. Connaught Avenue is a four-lane arterial street with left and right turning lanes at Bayers Road. In the original plans (in ***Appendix B***), the proposed widening of Bayers Road whether to five lanes or six lanes involves widening on the south side of Bayers Road (on the Halifax Shopping Centre side). Subsequent to this review, further widening options were explored and are discussed in Section 6.2. The proposed six-lane design is a traditional roadway design with additional turning lanes where required. The five-lane design includes a centre, reversible bus transit lane which warrants detailed analyses to assess the operational characteristics of the design.

Since Bayers Road in this section is divided by a median, the local roads and driveways are right-in-right-out accesses only for either the five or six lane design scenario. As shown on the plans in ***Appendix B***, the widening would require the removal of four (4) residential buildings on the south side of the street. On the north side of the street, in the vicinity of Micmac Street, between 9-10 properties have direct access to Bayers Road. An access management plan for all these entrances should be considered to remove or consolidate entrances.

The following is a summary of the seven intersections located on Bayers Road from Connaught Avenue to Romans Avenue.

1. Bayers Road/Connaught Avenue: Connaught Avenue is a major arterial with a signalized four way intersection at Bayers Road and turning lanes. The expansion of Bayers Road on the south side results in minor re-alignment of the channelized right (southbound).

2. Bayers Road/George Dauphinee: George Dauphinee is a local road with an unsignalized "T" intersection at Bayers Road and no dedicated turning lanes. The right-in-right-out access is expected to remain.

3. Bayers Road/HSC Entrance: Signalized Intersection. Significant improvements have been done over past years at the Halifax Shopping Centre intersections to add turning lanes and additional signalization. The widening of Bayers Road would result in modifications to the signalization. The intersection encompasses two driveways from

the shopping centre with one driveway allowing right turns from the HSC to Bayers Road and the second driveway allowing left turns to Bayers Road.

4. Bayers Road / MicMac: Micmac Street is a local road with an unsignalized "T" intersection at Bayers Road and no dedicated turning lanes. The right-in-right-out access is expected to remain.

5. Bayers Road/Coleman: Coleman Street is a local road with an unsignalized "T" intersection at Bayers Road and no dedicated turning lanes. The right-in-right-out access is expected to remain.

6. Bayers Road/Vaughan Avenue: Vaughan Avenue is a local road with an unsignalized "T" intersection at Bayers Road and no dedicated turning lanes. The right-in-right-out access is expected to remain.

7. Bayers Road /Romans Avenue: – Romans Avenue at Bayers Road is currently a signalized intersection with left turn restrictions, but allowing straight through movements. With the exception of the right turn from Romans Avenue to Bayers Road, there are no dedicated turning lanes at the intersection. The five-lane versus the six-lane designs for Bayers Road result in significantly different configurations for the Romans Avenue intersection. The operational characteristics are discussed here.

    - For a six-lane Bayers Road design, both sides of the intersection are converted to right-in-right-out access points. Traffic signals would be removed to improve flow along Bayers Road. A pedestrian overpass would be constructed to link the north and south neighborhoods. At the intersection, a fourth outbound lane is developed. Two of the four lanes would exit to Joseph Howe Drive.

    - For a five-lane Bayers Road design a signalized intersection at Romans Avenue is maintained. The centre reversible bus lane at the intersection requires special consideration with respect to the loading and unloading of passengers.

2.1.3 Section 3: Bayers Road from Romans Avenue to Ashburn Avenue

This section of the Bayers Road/Highway 102 corridor from Romans Avenue to Ashburn Avenue represents a major challenge to re-design given the existing constraints. When examining the corridor as a whole for the horizon year and the ultimate design configuration, it is important to keep an open mind to the possibilities for re-construction. Decisions will be based on the surrounding existing and possible future land use (re-development). In some cases, the willingness to adjust the adjacent land use to accommodate the expansion of the transportation facilities will be key.

Some of the key constraints will include:

- The Existing Residential Neighborhood between Pennington Street and Ralston Avenue has 13 homes and is situated between two major transportation facilities. The neighborhood has limited access and, over past years, has experienced significant increases in traffic that will continue to increase and pressure the neighborhood. The neighborhood, in turn, limits the expansion of the transportation facilities.

- The Existing Bayers Road Shopping Centre. Similar to the residential neighborhood, the shopping centre has suffered from awkward access. To remain viable, access to this traffic generator needs to be maintained and possibly improved.

The six-lane cross section design for Bayers Road essentially maintains the current configuration of this "transition section" and does not address the potential expansion of Highway 102. The design only allows for the current two lanes inbound with the additional third lanes being developed from Joseph Howe area inbound. As noted previously, only two of the four outbound lanes at Romans Avenue exit to Highway 102. To modify the six-lane design to allow for expansion of Highway 102 would further impact the residential neighborhood.

The 5-lane design significantly alters this existing "transition" section of Bayers Road/Highway 102. The inbound and outbound lanes are designed adjacent to each other as opposed to the current situation as well as the six-lane design which splits inbound and outbound movements to go around the residential neighborhood. A new parallel roadway between Romans Avenue and the original Bayers Road is proposed. A new connector road would be constructed between Highway 102 and the original Bayers Road with full movements signalized intersections at both ends. It appears that this design option improves access to the Bayers Road Shopping Centre. While 2-3 homes in the residential neighborhood are impacted, the overall access to that area is also considered to be improved.

This section also includes two existing CN rail crossings over the main line into HRM which would require re-construction or expansion as highlighted on the plans in ***Appendix B***.


Photo No. 3: Bayers Road Outbound over CN Rail

2.1.4 Section 4: Bayers Road from Ashburn Avenue to Fairview

Perhaps more challenging than the previous section, the portion of the Highway 102 from Ashburn Avenue to Joseph Howe Drive to Fairview includes a number of large infrastructure components including transmission towers and bridges.

Exit 0, Highway 102/Joseph Howe Drive is a partial diamond interchange with only partial movements with a signalized intersection at the ramp terminals and Joseph Howe Drive. Beyond the Joseph Howe interchange (northbound/outbound), the existing Highway 102 right-of-way is approximately 60-65m wide.

The key features and constraints to expansion are described here:

- Transmission Main: A major power transmission main runs parallel to Highway 102/Bayers Road on the south side of the road within this section and crosses Bayers Road just east of Pennington Street (west of the CN rail crossing).

Photo No. 4: Power Transmission Tower next to Joseph Howe Drive and Ashburn Golf Course

- Ashburn/Joseph Howe Structure: This structure is approximately 240 m long which spans over Ashburn Avenue to Joseph Howe Drive. This bridge structure was constructed in 1962. Homes on Elliot Avenue and Abbot Drive are in close proximity of the structure. Any expansion of the existing structure would be a significant and costly undertaking. It is anticipated at this time that expansion of lanes would be achieved by twinning the existing bridge structure. As shown on the plan in ***Appendix B***, construction of a twin/ parallel, 3-lane bridge structure would encroach on the backyards of the Abbot Drive properties. At this time, only partial acquisition of these properties is anticipated, however, full buy-out of properties may be required.

Photo No. 5: Ashburn/Joseph Howe Structure

- Exit 0 Ramp Structure: Currently the inbound exit ramp crosses under the Highway 102. The bridge structure would require lengthening to allow for expansion of the Highway 102 above and a realignment of the inbound ramp

- Ramp/102 Retaining Walls: The inbound and outbound ramps at the Joseph Howe interchange have been constructed with extensive retaining walls in order to maintain the ramp within the existing right of way.

- Ashburn Golf Course: The golf course is located on the south side of the highway between Exit 1(Northwest Arm Drive) and Exit 0 (Joseph Howe Drive). The clubhouse access road also runs parallel to the highway and appears to encroach on the Highway 102 right-of-way. However, the closest building is set back from the right of way limit by approximately 15 meters.

- Fairview Homes on School Avenue: School Avenue runs parallel to Highway 102 from Exit 0 (Joseph Howe Drive) to Exit 1(Northwest Arm Drive). School Avenue provides access to approximately 52 homes which front on School Avenue. Since these properties back onto other developed lots, there is no opportunity to provide an alternate access to these properties.

Based on the above constraints, it is considered that School Avenue and the homes located along the street negate the possibility of any widening of Highway 102 or ramp reconstruction on the north side of the Highway. This is a constraint that does not have a workable solution; therefore, widening and reconstruction will need to occur on the south side of the highway (the golf course side). Given this, any twinning of the Joe Howe bridge structure will also need to occur on the south side of the existing structure. This constraint results in a significant impact to built infrastructure on the south side of the Highway including impact to the power transmission line towers as well as potential impact to the homes on Abbot Drive.

The 1:2000 Scale Bayers Road plans presented in ***Appendix B*** do not reflect a proposed expansion of Highway 102 and the area is further developed and discussed in Chapter 6.0.

2.2 HIGHWAY 102 HORIZONTAL AND VERTICAL GEOMETRY

An overall review of the vertical and horizontal geometry of Highway 102 was undertaken by the Study team. ***Tables C1 to C6 in Appendix C*** provide a summary of this detailed analysis. Based on a general design speed of 110 km/hr for Highway 102 corridor, substandard horizontal and vertical curves which did not meet TIR or TAC standards were identified in these tables. Other lower design speeds were used for specific locations as noted below. The design criteria used for this evaluation is discussed in Chapter 5.

The following items are noted:

- ***Tables C1 and C2*** show a summary of longitudinal grades on the northbound and southbound lanes. The design standards of 6% maximum slope and 0.5% minimum slope are considered appropriate for the facility. Generally the percent grade is within acceptable standards. A short length of Highway 102 between North West Arm Drive and Joseph Howe Drive is at 7.2% slope. The posted speed at this location is 70 km/hr. Therefore the steeper grade is considered acceptable. In the area of the Sackville River, the Highway 101/102 interchange the maximum slope of 6% is slightly exceeded.

- There are various sections of Highway 102 where the minimum grade of 0.5% is not met. A grade of less than 0.5%, is acceptable for an open ditch, rural section where drainage is achieved by the crossfall of the highway section and the ditch slope. However, if a re-development was to include a curbed section or drainage along the central median barrier, the flat longitudinal grades will pose a problem.

- ***Tables C3 and C4*** show a summary of existing horizontal curves. The assumed design speed for this analysis was based on 110 km/hr. It is also assumed that the curves would, in the future, be superelevated to a maximum of 6%. Five horizontal curves out of total of 28 horizontal curves are identified as substandard: i.e less than 600 meters in radius. The design criteria applied here is further discussed in Chapter 5.

- ***Tables C5 and C6*** show a summary of existing vertical curves. Based on a design speed of 110 km/hr, the minimum sag curve K value is 62 and the minimum crest K is 110. A total of 26 vertical curves out of 40 curves along this corridor exceed this criterion.

2.3 HIGHWAY 102 CORE LANES EXPANSION (NARROW MEDIAN SECTION)

Figure 2.2 shows typical cross sections for Highway 102. The existing section (Typical Section No. 1) shows a narrow median, four-lane section which applies for the Highway 102 from Joseph Howe Drive to just past the Highway 101 interchange as previously described, covering most of the corridor study area. The median section (from inside of outbound lane to inside of inbound lane), based on the digitized mapping and aerial photos varies from approximately 1.6

to 4.6 meters. The design median section (5.6 m) is based on NSTIR standards. Widening of the highway will incorporate the design standard for the median. The right-of-way width varies from approximately 90 to 100 meters. As shown on the cross section and observed from the mapping, most of Highway 102 has been constructed offset from the centerline of the right-of-way. The existing Highway 102 centerline is approximately 11 to 13 m offset to the right of the right-of-way centerline (looking outbound).

2.3.1 Six Core Lanes

Typical Section No. 2 shows the proposed methodology to widen the existing 4-lane narrow median cross section to a 6-lane narrow median cross section. The section shows that it is possible to add one lane on each side of the existing highway section. However, grading within the property limits on the right side of the section (looking outbound) will depend on the surrounding topography. Grading limits will be developed at the conceptual level to determine property impacts however, the accuracy of the DTM (Digital Terrain Model) is limited (accuracy to less than 2.5 meters or more vertically) and therefore horizontal accuracy of the grading extents will also be very limited. For questionable areas (very narrow right-of-way) it may be necessary to increase the 6:1 design side slope and add guard rail to the section to avoid property impacts. The exact requirements will be determined in the preliminary and detailed design and is not included as part of this study.

2.3.2 Eight Lanes (Six core lanes with two auxiliary lanes)

While two lanes may be added on either side of the existing cross section, it is acknowledged that in many areas an eight lane section will need to be applied and will include six core lanes and two auxiliary lanes. Typical Cross Section No. 3 shows widening of the Highway 102 corridor to eight lanes. Given the offset of the centerline of Highway 102 from the centerline of the right-of-way, widening to eight lanes will require that most of the widening occur to the left of the centerline (looking outbound) to take advantage of this additional right-of-way.

Three of the additional lanes would be added to the left side of the centerline and one lane added to the right side of the centerline. This configuration has a few implications in the design and costing of the reconstruction as follows:

- Eight lane section requires a shift in the Highway centerline along with a shift in the crown.
- Asphalt padding will be required to achieve the crown shift.
- Re-construction of the median Jersey barrier is required.

To establish the design section for the re-construction of Highway 102, a typical pavement structure has been assumed and shown on the typical section. The pavement structure would be confirmed by geotechnical analyses during preliminary and detailed design. Also assumed for the purpose of conceptual design and costing:

- An asphalt overlay on the existing highway lanes, while shown on the typical sections is not accounted for in the costing. Typically the overlay would occur at the same time as the expansion, but would be considered as maintenance.
- Any vertical clearances issues at bridge structures would be assessed during preliminary and detailed design.
- Widening at full depth re-construction would occur at the limit of the existing traveled lanes (i.e., no salvage of the existing shoulder pavement).

2.3.3 Ten Lanes (Eight core lanes with two auxiliary lanes)

As discussed above, widening beyond six lanes will require that the widening be done on inbound side (ie. left side) of Highway 102. A conceptual widening to 10 lanes is shown on ***Figure 2.3***. The section indicates that 10 lanes could be accommodated only for areas with moderate side slopes (adjacent terrain). Large fills or cuts or superelevated sections would require additional right-of-way or roadside measures such as new guide rail with steeper slopes, rock slopes, and / or retaining walls.

2.4 HIGHWAY 102 CORE LANES EXPANSION (WIDE MEDIAN SECTION)

From Exit 4 (Bedford Bypass area) to approximately Exit 5 (Lake Thomas area), the highway cross section is noted as “rural freeway”. The median width is typically 22.6m from the edge of traveled way (in-bound) to edge of traveled way (out-bound) with slopes from the shoulders to a central drainage ditch, allowing drainage of the sub-base. Widening to provide additional lanes would occur within the median by filling in this area with gravels. Typical sections for widening are shown on ***Figure 2.4***.

Some design considerations for this work include:

- The median is currently at a minimum width for a freeway section without a median barrier. Therefore any widening will result in the installation of a new median barrier.
- The existing median provides open ditch highway drainage. If a depressed median is maintained in a widened section, catchbasins and piped storm systems would be required.
- Alternately the cross fall of the inside lanes could be reversed to re-direct drainage to the outer ditch system.
- Widening as shown in the typical sections would result in an increased vertical grade. Vertical clearances to structure would need to be confirmed.
- Widening to a six lane structure may be done while maintaining an open ditch with two parallel steel beam guide rails or with construction of a wide gravel median (that would accommodate a future 8-lane section) with a central jersey barrier. The benefit of the latter is that the design allows for the ultimate median and barrier, with less “throw away” costs. However, the wide gravel median may be undesirable in the long term for an expansion to eight lanes that may never occur.

- The design sections show normal crown design only. It is acknowledged that there are existing superelevated sections that have separate profile alignments. Special design treatments would be required at these areas which may include:

    - Full reconstruction to adjust the vertical alignments to allow widening in the centre median
    - Design and construction of retaining walls in the centre median to allow for separate vertical alignments.

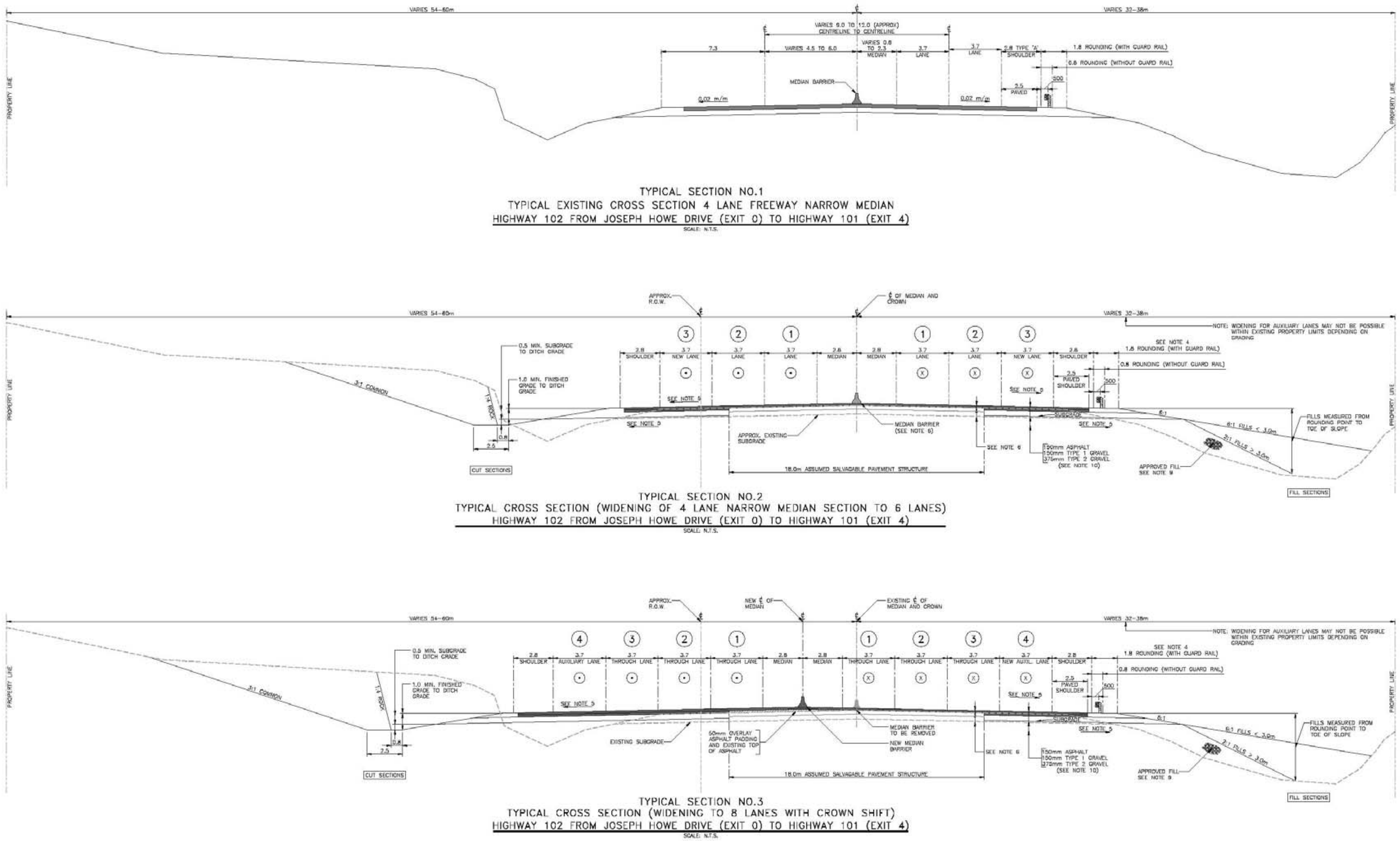


FIGURE 2.2
HIGHWAY 102 NARROW MEDIAN TYPICAL SECTIONS

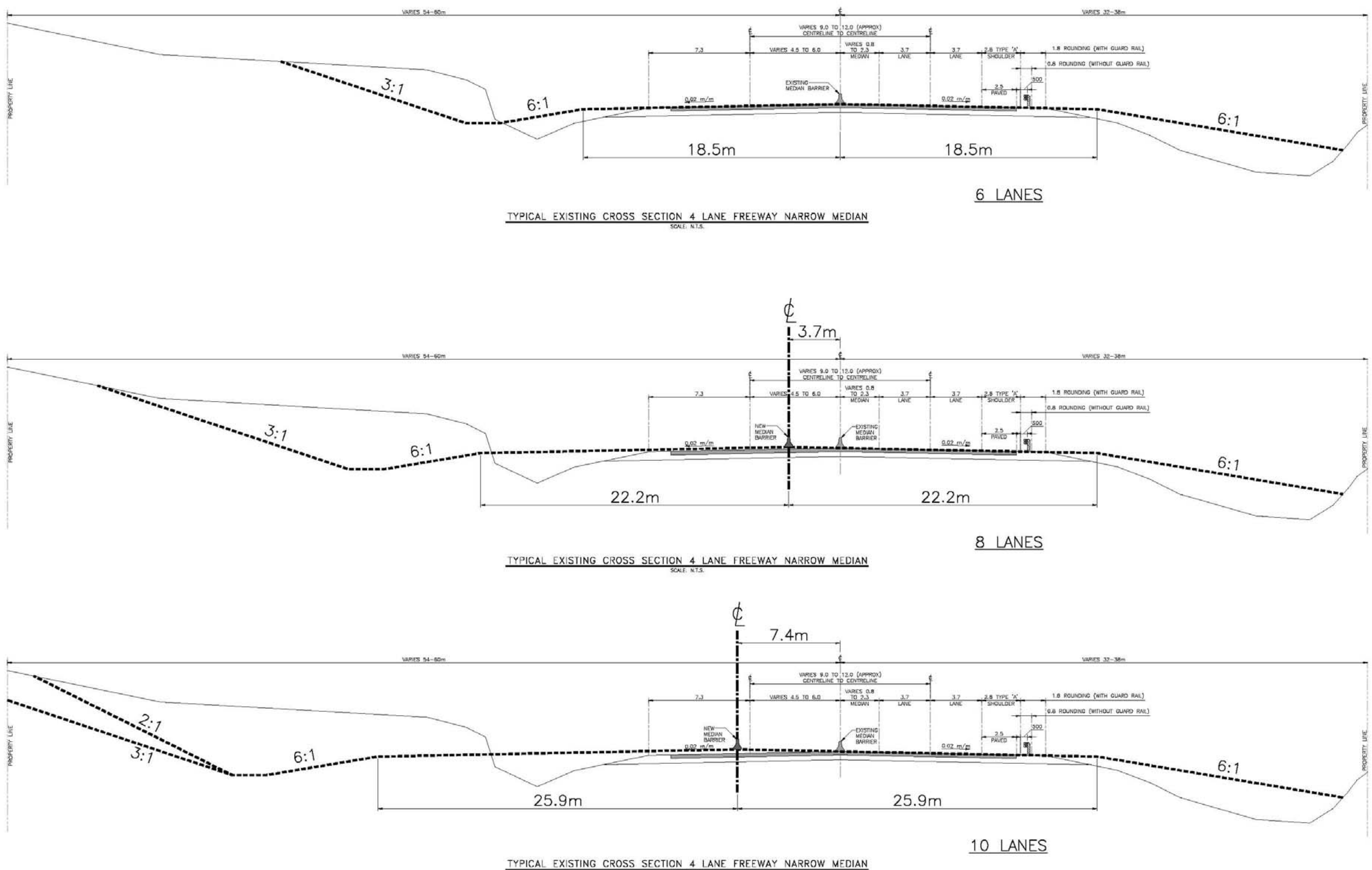


FIGURE 2.3
GRADING IMPACTS AND CENTERLINE
SHIFT REQUIRED FOR WIDENING

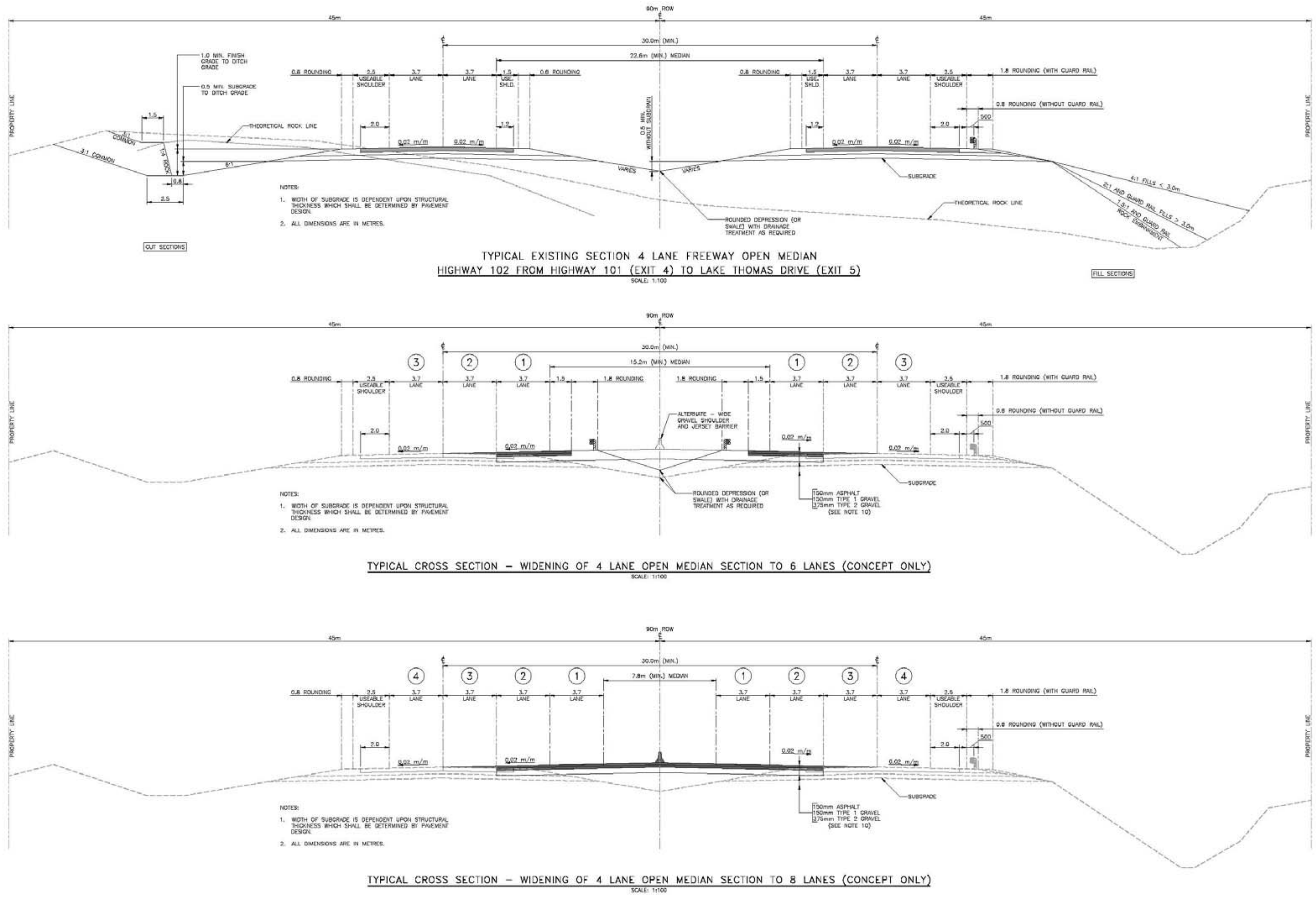


FIGURE 2.4
HIGHWAY 102 WIDE MEDIAN TYPICAL SECTIONS

2.5 STRUCTURAL REPORT

2.5.1 Summary of Existing Structures

There are a total of 29 existing bridge structures within the study area. Data sheets are which are included in ***Appendix D*** for each structure were assembled from site visits and plans provided by NSTIR. The following table is a summary of the 29 bridge structures. Locations are noted on the Constraints Plans in ***Appendix B***.

The minimum design life requirement for new bridges for TIR is specified at a minimum of 75 years, without major rehabilitation. A number of bridges on Highway 102 were constructed in the early 1960's and will reach the estimated design life of 75 years in the horizon year of 2036 for this study. This is based on the assumption that the initial design of these structures was also 75 years. Other bridges located within the study area will reach their estimated design life within 10 to 15 years past the horizon year of this study. Therefore, many of these bridges will be in need of major repair or replacement by the horizon year of this study.

Careful consideration will be required on the decision to widen or upgrade existing structures for which the design life may be exceeded within the next 20 to 30 years as compared to the replacement of existing bridges by new bridges with the required number of lanes both on Highway 102 or the crossing roads.

Table 2.1: Summary of Bridge Structures

No	Location	Drawings Available	Initial Date of Construction	Age of structure in horizon year (2036)	Spare capacity on Highway 102 lanes
1	Bayers Road over CN (1)	-	-	-	No
2	Bayers Road over CN (2)	-	-	-	No
3	Highway 102 overpass at Desmond		1962	74 yrs	No
4	Highway 102 overpass at Joseph Howe Drive	yes	1962	74 yrs	No
5	Highway 102 overpass at Exit 0 Ramp	-	1962	74 yrs	No
6	Highway 102 underpass at NW Arm Drive	yes	1976	60 yrs	No
7	Highway 102 underpass at Highway 103	yes	1963	73 yrs	No
8	Highway 102 overpass at Lacewood	yes	1989	47 yrs	Yes 6 lanes
9	Highway 102 overpass at Kearney Lake Road	yes	1979 (widening)	57 + yrs	Yes 6 lanes with narrow median/ sh
10	Highway 102 Box Culvert	-	-	-	TBD
11	Highway 102 overpass at Hammonds Plains	yes	1979 (widening)	57 + yrs	Yes – 8 lanes
12	Highway 102 over Sackville River	yes	1979 (widening)	57 + yrs	Yes 7-8 lanes

No	Location	Drawings Available	Initial Date of Construction	Age of structure in horizon year (2036)	Spare capacity on Highway 102 lanes
13	Highway 102 underpass at Bedford Highway	-	-	-	No
14	Highway 102 underpass at Bedford Bypass	yes	1976	60 yrs	No
15	Highway 101 to Bedford Bypass Inbound	yes	1977	59 yrs	No
16	Ramp from Sackville Drive over Bedford Highway to Bedford Bypass	-	-	-	-
17	Bedford Bypass Outbound to Hwy 101 (over Memory Lane and Sackville Drive)	-	-	-	-
18	Highway 102 underpass at Glendale/Duke	yes	1995	41 yrs	Yes
19	Duke Street overpass (over future 107 ramp)	-	1995	41 yrs	-
20	Highway 102 over Lakeview Road - SB	yes	1971 / 1981	56-65 yrs	No
21	Highway 102 over Lakeview Road – NB	-	-	-	No
22	Highway 102 over CNR - SB	-	-	-	No
23	Highway 102 over CNR - NB	-	-	-	No
24	Highway 102 overpass at Cobequid Road – SB	yes	1980	56 yrs	No
25	Highway 102 overpass at Cobequid Road - NB	-	-	-	No
26	Highway 102 over CNR - SB	yes	1980	56 yrs	No
27	Highway 102 over CNR - NB	-	-	-	No
28	Highway 102 over Lake Thomas watercourse	yes	1961	75 yrs	No
29	Highway 102 overpass at Lake Thomas Drive	-	-	-	-

2.5.2 Expansion Potential – Bridge Structures

The data collected as part of this study show that 5 of the total 29 structures have capacity to accommodate additional lanes on Highway 102. The structures as noted in ***Table 2-1*** include Lacewood overpass, Kearney Lake underpass, Hammonds Plains underpass, Sackville River crossing, and Glendale/Duke Street underpass.

The expansion of the intersecting roadways was not evaluated as part of this review. From our observations, it appears that the majority of the structures could be widened if required. However, the total replacement of older bridge structures may be more cost effective than a major rehabilitation and widening. As well, twinning of existing structures may be more desirable to limit the disruption to surrounding areas and existing infrastructure during construction.

2.6 ENVIRONMENTAL/NATURAL CONSTRAINTS

At this point in the study, environmental and natural features are noted as potential constraints to expansion. Water course and water body features are identified on the mapping shown in ***Appendix B*****.** Significant water bodies within the Highway 102 study area include:

- The Sackville River
- Kearney Run
- Wetland at Highway 113
- Lake Thomas

The Sackville River will represent a constraint to the re-development of the Highway 102/101 interchange as well as the expansion of the Highway 102 core lanes. In addition to the Sackville River, one additional large culvert structure has been identified at Kearney Run, just south of the proposed Highway 113 interchange location. The wetland at the Highway 102/113 junction has been identified in the Environmental Assessment of the Highway 113.

With the exception of those noted above, water crossings of the Highway 102 are limited to minor culverts. It is expected that an environmental assessment of the corridor would be undertaken prior to or in conjunction to the preliminary and detailed design of the highway expansion. From initial observations it is anticipated that any environmental impact of extension of the minor culverts can be mitigated, except at locations where total replacement may be necessary. However, it is also expected that any direct impact to the Sackville River or the Lakes will represent a challenge.

Exit 5 at 102/Lake Thomas Drive represents the limit of the study area. Highway 102 at this location has a narrow median and crosses the lake system with what appears to be a constructed / man-made causeway and bridge system. Should the highway or interchange configuration in this area require expansion, the Lake will pose significant construction and environmental constraint.

Photo No. 6: Lake Thomas to the west of Highway 102

The other predominant natural features along the highway corridor are rock outcrops which are noted on the presentation plans. While not considered a constraint to expansion of the highway, surrounding rock formations will significantly impact the cost of expansion both in terms of mass excavation costs and property acquisition or special design treatments.

Photo No. 7: Typical Rock Slopes

2.7 OTHER DESIGN CONSIDERATIONS

2.7.1 HRM Active Transportation Plan

The HRM Active Transportation Plan outlines a number of facilities required along the Highway 102 corridor from Exit 1 to near Exit 5, and these include pedestrian, cyclists and multi-use trails.

The following table, ***Table 2.2*****,** identifies the location of these crossings according to their proposed location and crossing road, and the type of facility proposed at each location. The locations at the noted chainage are shown on the Constraints Plans in ***Appendix B***.

From our review of the Active Transportation Plan it does not appear that specific site conditions were evaluated at each and every proposed location identified in the report. Therefore the location of this infrastructure would appear to be flexible for the locations that are not located at existing crossings along Highway 102.

For the design and upgrading of existing structure, Section 4.3 of the Technical Appendix: Facility Planning and Design Guidelines should be referred to. The Technical Appendix does not make reference to pedestrian tunnels. Our past experience with HRM indicates that the minimum requirement for a pedestrian tunnel is a 4 metre wide by 4 metre wide cross section. Because of the length of the pedestrian tunnels under Highway 102, larger structures may be required. It is anticipated that illumination will also be required on a 24-hour basis. Should pedestrian overpass structures be identified, each site would be dealt with on an individual basis taking into consideration site conditions and lane requirements on Highway 102.

Table 2.2 - Highway 102 Corridor
Pedestrian and Cyclist Facilities Proposed in HRM Active Transportation Plan

Site	Location	Corridor Chainage Location	Type of Facility Proposed	Comment
A	Exit 1 – Northwest Arm Drive	Station 102+200	Bicycle Facility	Use existing street network with required modifications to street infrastructure. Located on structure over Highway 102.
B	Located between Exit 1A and Exit 2A	Station 104+350 – Connects with Greenpark Close on east side of Highway 102 and with Washmill Lake Court on west side of Highway 102 – Bayers Lake Business Park	Bicycle Facility	Two crossings identified on concept plan are intended to be one crossing at Washmill Lake Court. Extends from Greenpark Court and Main Avenue to the east to Washmill Lake Court in Bayers Lake Business Park to the west of Highway 102.
C	Exit 2A – Lacewood Drive and Chain Lake Drive	Station 105+450	Bicycle Facility	Use existing street network with required modifications to street infrastructure. The lateral distance and lanes under the bridge are to be confirmed.
D	Located between Exit 2A and Exit 2	Station 107+250	Bicycle Facility	Located under Highway 102 – consider location of watercourse in determining location. Trail would connect Parkland Drive to the east to the Birch Cove area to the west of Highway 102.
E	Exit 2 – Kearney Lake Road	Station 108+400	Bicycle Facility plus Paved Shoulder	Use existing street network with required modifications to street infrastructure. Lateral clearances under bridge structure to be confirmed with detailed bridge plans.
F	Located approximately 2.0 km north of Exit 2 at future Larry Uteck Interchange	Station 110+300		Located under Highway 102 on Larry Uteck Drive and would connect to the bicycle trail along the shoulder of Kearney Lake Road on the west side of Highway 102, and the upper part of the Kent Park area to the east. HRM ATP shows as Regional MPS Transit Hub.
G	Exit 3 – Hammonds Plains Road	Station 113+500	Bicycle Facility plus Paved Shoulder	Use existing street network with required modifications to street infrastructure – Restricted area under bridge structure due to required through and turning lanes.

Site	Location	Corridor Chainage Location	Type of Facility Proposed	Comment
H	Located 1.0 km north of Exit 3 - Basinview Drive	Station 114+700	Off-Road Route with Soft surface	Located under Highway 102 and would connect the Bedford/Glen Moir area on the east side to HRM property on the west side of Highway 102.
I	Near Exit 4A	Station 117+050 – just south of Exit 4	Paved off-road	Located under Highway 102 and connects to other off-road routes and bicycle facilities. Also located adjacent to Sackville River. Trail would connect Department of National Defense on the west side of Highway 102, and Bedford Range Ball Park on the east side.
J	Exit 4C – Glendale Avenue and Duke Street	Station 118+808	Bicycle Facility	Located at an existing crossing over Highway 102 – Lateral clearances on bridge structure may be affected by bicycle lanes requirements.
K	Cobequid Road – 4.0 km North of Exit 4C	Station 122+600	Bicycle Facility	Located at an existing crossing under Highway 102 - Use existing street network with required modifications to street infrastructure

2.7.2 Other Built Infrastructure

The constraints plan shows key municipal infrastructure as well as power transmission lines. Watermains have been located on the plan based on HRM GIS data as well as input from HRWC. Water transmission mains parallel and cross Highway 102 at various locations. Similarly, power infrastructure is noted within the vicinity of Highway 102. Significant impact most likely will occur at interchange areas, where relocation of water lines or power lines will be required.

Photo No. 8: Location of water transmission main crossing in Bedford

2.8 SUMMARY OF EXPANSION POTENTIAL AND CONSTRAINTS

Based on investigations to-date, the following expansion potential is noted:

- The existing Highway 102 corridor will likely accommodate six (6) core lanes and two (2) auxiliary lanes at most locations.
- A centerline shift is required for widening to the eight lane width requiring careful coordination with six (6) lane sections aligned over the structures.
- Localized property acquisition or design treatments will be required at areas of large cuts and fills.
- Expansion to 8 core lanes (10 lanes with auxiliary lanes) would likely have significant property impacts

Key constraints to expansion of Highway 102 include:

- School Avenue and adjacent homes
- Sackville River
- Lake Thomas

The objectives for the expansion design will be developed in conjunction with the results of the traffic analysis. The following key objectives are noted:

- Maximize safety features (correction of sub-standard features)
- Minimize environmental impact
- Provide sufficient capacity for horizon traffic
- Avoid impact to developed properties
- Minimize property acquisition
- Minimize impact to other municipal and power infrastructure

3.0 Infrastructure Needs Assessment

As part of Objective 2 of the Highway 102/Bayers Road Corridor Study we have carried out a roadway infrastructure needs assessment of the study area intersections and interchange ramp terminals. This particular task forms the crucial link between the planning and design components of this project by identifying future potential right-of-way needs.

3.1 METHODOLOGY

The forecast demand volumes developed using the calibrated transportation demand model – as discussed in the Component 1 report - were used as input to the infrastructure needs assessment task. In this task, the major corridor intersections were evaluated – using Highway Capacity Manual[1] methodologies – to determine the number of lanes and auxiliary lanes required to accommodate the forecast demand. The process is illustrated in ***Figure 3.1***.

The following assessment refers to the three future road network scenarios which were analyzed at each planning horizon year during both the AM and PM peak hours. The scenarios were defined in the Component 1 report and descriptions are summarized here.

- **Scenario A** – Existing road infrastructure + planned network upgrades (traffic signals, lane widening, new roads) + the Highway 102/Larry Uteck Drive interchange
- **Scenario B** – All the upgrades in Scenario A + Highway 113 + Highway 107 extension connecting with the Highway 102 immediately north of Exit 4C (Duke Street).
- **Scenario C** – All the upgrades in Scenario A + Highway 113 + Highway 107 extension connecting directly with Highway 101.

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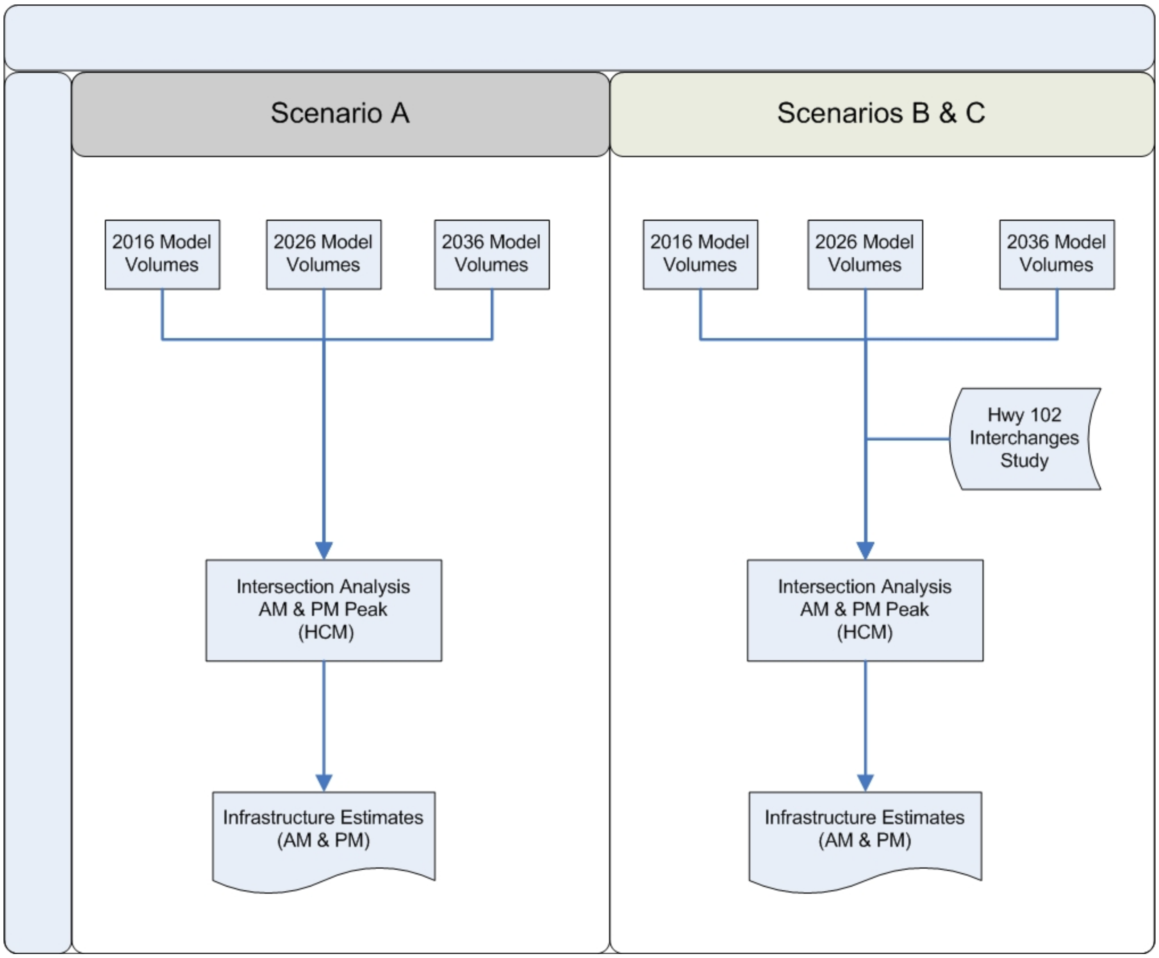
[1] Highway Capacity Manual, Transportation Research Board. 2000.

Figure 3.1: Infrastructure Needs Assessment Process



All three road network scenarios were modeled for each planning horizon and peak hour; however, the required infrastructure at the study area intersections was the same for Scenarios B and C[2]. As a result, and as illustrated in ***Figure 3.1***, the infrastructure needs assessment findings have been reported using two categories - Scenario A and Scenarios B & C.

The specific intersections evaluated in this task were limited by the level of detail in the transportation demand model (only those intersections coded in the model could be evaluated). The following are the major corridor intersections analyzed as part of the infrastructure needs assessment task:

[2] This is an expected result given that the Scenario B and C road networks only differ by the specific connection location of the Highway 107 extension to Highway 102.

- Bayers Road/Windsor Street
- Bayers Road/Connaught Avenue
- Bayers Road/Joseph Howe Drive
- Joseph Howe Drive/Highway 102 Ramps
- Northwest Arm Drive/Highway 102 Northbound ramps
- Northwest Arm Drive/Highway 102 Southbound ramps
- Lacewood Drive/Highway 102 Northbound ramps
- Lacewood Drive/Highway 102 Southbound ramps
- Lacewood Drive/Regency Park Drive
- Kearney Lake Road/Highway 102 Northbound ramps
- Kearney Lake Road/Highway 102 Southbound ramps
- Larry Uteck Drive/Highway 102 Northbound ramps
- Larry Uteck Drive/Highway 102 Southbound ramps
- Hammonds Plains Road/Highway 102 Northbound ramps
- Hammonds Plains Road/Highway 102 Northbound ramps
- Hammonds Plains Road/Papermill Lake-Brookshire Ct
- Glendale Avenue/Highway 102 Northbound ramps
- Glendale Avenue/Highway 102 Southbound ramps
- Trunk 2 (Fall River)/Highway 102 Northbound ramps
- Trunk 2 (Fall River)/Highway 102 Southbound ramps

The volumes have been displayed on the existing interchange and intersection configurations to highlight the potential constraints. The ramp volumes are contained in ***Appendix E***.

3.2 SUPPLEMENTAL REVIEW – PLANNED BEDFORD DEVELOPMENTS

A review of the HRM Highway 102 Interchanges Study[3] was carried out in consideration of the forecast traffic volumes (for the 2026 horizon) at the Kearney Lake Road, Larry Uteck Drive and Hammonds Plains Road interchanges. Given that the HRM study volumes were developed by combining data from several Master Plan Area transportation studies, the level of detail of the assignment results are expected to be more refined than any transportation model calibrated at the traffic analysis zone level.

The review of the two data sets – the HRM forecasts and the modeling forecasts for the Highway 102 corridor study – indicated that both volume forecasts were developed using two independent techniques. As discussed in the Component 1 report, the transportation demand model was developed using long-term population and employment growth that amounted to approximately 1% per year[4] - a low estimate of volume. Conversely, the volumes reported in the HRM study were developed using a general historical traffic growth rate (an approximate average growth in the range of 2-3% per year) <u>in addition</u> to the planned developments (such as Bedford South, Papermill Lake and Bedford West) resulting in aggressive traffic growth – a high estimate of volume.

In summary, there are two sets of forecast demand for the Kearney Lake Road, Larry Uteck Drive and Hammonds Plains Road interchanges that provide us with a reasonable range of demand that can be expected for the planning horizons under study. It would then be prudent to use the higher forecast demand to provide a conservative estimate of infrastructure needs at the interchange ramp terminals, as the intent of this task is to determine right-of-way needs for the future. For the purposes of this analysis, the upper range of demand forecasts taken from the HRM study were selected[5].

In the course of the study, the Steering Committee questioned whether the application of a 2-3% growth rate over the full study area would be appropriate. In terms of the transportation model used for the Highway 102 corridor study, the land use/demographic inputs generally followed the HRM Regional Plan forecasts and assumed a general traffic growth of about 1% per year – a typical and appropriate 30-year growth rate. The methodology that was applied to develop the forecast volumes is an established process that has been used in transportation planning for over 40 years. It links the demographic forecasts to the traffic that is expected on the roads.

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[3] Highway 102 Interchanges Study, Prepared for the Halifax Regional Municipality, June 2007.

[4] As developed with the Project Steering Committee for the Highway 102/Bayers Road Corridor study.

[5] The HRM Study forecast volumes for the 2026 horizon. In order to obtain 2016 and 2036 horizon estimates we used the transportation demand model growth to backcast and forecast, respectively.

If additional growth factors (say 2-3% per year) were applied to all the link volumes, the purpose of using a transportation model is defeated. To put this into context, it would be saying that population and employment will grow by 2-3% over the next 30 years. This is approximately three times the demographic estimates for HRM and is considered extremely optimistic. Furthermore, the "blind" application of growth at individual links does not take into account adjacent network capacity constraints that may or may not influence route choice and travel behavior.

In summary, the application of a general growth rate to the modeled or observed volumes is not recommended. The methodology used provides a range of volumes at the Hammonds Plains, Larry Uteck and Kearney Lake Road to specifically address the potential growth that is expected in this area. The average volume growth (over the next 30 years) at the other study area links is expected to be in line with the forecast regional growth rate of about 1% per year.

3.3 THE FORECAST INFRASTRUCTURE NEEDS

The study area intersections were analyzed during the AM and PM peak hour for each of the 2016, 2026 and 2036 planning horizons. Further, the forecast volumes for two road network scenarios were evaluated – Scenario A and Scenarios B/C. As discussed earlier, the findings of the Scenario B and C evaluation were the same and thus were reported as one scenario.

The intersections located at the Hammonds Plains Road, Larry Uteck Drive and Kearney Lake Road interchanges were evaluated using volumes taken from the HRM study. As discussed earlier, these higher volumes were used given the need to estimate ultimate right-of-way limits for the future planning horizons.

The ramp volume forecasts are contained in ***Appendix E*** for each of the planning horizons. The findings of the intersection infrastructure needs and staging are illustrated in ***Appendix F***.

3.4 ADDITIONAL CONSIDERATIONS

The following points should be considered when applying the findings of the Infrastructure Needs Assessment in any future work.

- The application of traditional 4-step transportation demand models - like the model used in this study – are intended to provide roadway link-level information for long-term strategic decisions. The use of detailed turning movement volumes from any model should consider their course level of findings.
- It is expected that the HRM Regional Plan will change and evolve over time. However, the transportation demand model is based on the current knowledge of land use and demographic information. Any future changes to the land use and demographic information will impact the transportation demand forecasts in the region.

- It must be noted that the intersection infrastructure needs analysis was carried out for individual intersections and did not review the upstream/downstream impacts of adjacent signals. Consideration of the impacts associated with adjacent intersections was discussed with the Project Steering Committee; however, the decision was made to move forward with the original workplan and only focus on individual intersections.

3.5 INTERPRETATION OF RESULTS FOR CONCEPTUAL PLANNING

As previously noted, the infrastructure needs analysis forms the crucial link between the planning and design components of the project. With the above noted considerations in mind, the results of the ramp volume forecasts and intersection needs analysis need to be interpreted and judgment applied to arrive at a conceptual plan that can eventually be carried forward to preliminary and detailed design. It is important to note that the volumes generated by the model are not design volumes, but represent planning level information. Just as detailed design would not proceed without a current, detailed topographic survey, the design of lanes, storage, and turning movements at particular locations should not proceed without up-to-date traffic data and detailed analysis of the location as well as upstream and downstream impacts.

As part of a checking and comparison exercise, the Steering Committee requested that ramp volumes be produced by “back-casting” the available 2006 volumes to 2001. The volumes were produced and submitted to the Steering Committee in summary tables. However, it was clearly advised and cautioned that valid comparisons cannot be made between 2001 model results and actual traffic counts conducted in 2006. The 2006 planning horizon was not identified in the original scope of work for this study. Nevertheless, the exercise was completed and the results summarized in tables for the interest of the Steering Committee. These tables are included in ***Appendix E.***

Additional tables summarizing the forecast ramp volumes for each planning horizon were prepared and are included in ***Appendix E***. The data is the same as provided in the Forecast Corridor Ramp Volumes figures but presented in a different format to compare all data for each ramp and assume a peak hour volume for planning purposes. Also a numbering system for the ramps was identified which is carried forward to the conceptual plans. Included in the table is the 2001 model volume as well as the 2001 comparison volume as reported in tables noted above. Sketches are included showing each interchange. A summary of the ultimate planning horizon volume forecasts for each ramp is provided in ***Table 3.1*** and these values were used to determine the required number of lanes.

Table 3.1 Summary of Ramp Volumes for Planning Year 2036

Ramp No.	Ramp Name	Peak Volume (vph) Planning year 2036	Lanes Required
Interchange: Joseph Howe Drive			
1	Joseph Howe Dr. / Hwy 102 SB Off-Ramp	1000	1
2	Joseph Howe Dr. / Hwy 102 NB On-Ramp	1100	1

Ramp No.	Ramp Name	Peak Volume (vph) Planning year 2036	Lanes Required
Interchange: Northwest Arm Drive			
1	Northwest Arm Drive / Hwy 102 EB to SB On-Ramp	600	1
2	Northwest Arm Drive / Hwy 102 NB Off-Ramp	400	1
3	Northwest Arm Drive / Hwy 102 EB to NB On-Ramp	400	1
4	Northwest Arm Drive / Hwy 102 SB Off-Ramp	700	1
5	Northwest Arm Drive / Hwy 102 WB to SB On-Ramp	300	1
6	Northwest Arm Drive / Hwy 102 WB to NB On-Ramp	300	1
Interchange: Hwy 103			
1	Hwy 103 / Hwy 102 EB to SB On-Ramp	2100	2
2	Hwy 103 / Hwy 102 SB to WB OFF-Ramp	500	1
3	Hwy 103 / Hwy 102 NB to WB OFF-Ramp	1600	2
4	Hwy 103 / Hwy 102 EB to NB On-Ramp	600	1
Interchange: Lacewood Drive			
1	Lacewood Drive / Hwy 102 SB On-Ramp	700	1
2	Lacewood Drive / Hwy 102 NB Off-Ramp	600	1
3	Lacewood Drive / Hwy 102 SB Off-Ramp	900	1
4	Lacewood Drive / Hwy 102 NB On-Ramp	900	1
Interchange: Kearney Lake Road			
1	Kearney Lake / Hwy 102 SB On-Ramp	900	1
2	Kearney Lake / Hwy 102 NB Off-Ramp	800	1
3	Kearney Lake / Hwy 102 SB Off-Ramp	1100	1
4	Kearney Lake / Hwy 102 NB On-Ramp	800	1
Interchange: Larry Uteck Drive			
1	Larry Uteck Drive / Hwy 102 SB On-Ramp	1900	2
2	Larry Uteck Drive / Hwy 102 NB Off-Ramp	1800	2
3	Larry Uteck Drive / Hwy 102 SB Off-Ramp	1400	2
4	Larry Uteck Drive / Hwy 102 NB On-Ramp	1500	2
Interchange: Highway 113			
1	Hwy 113 / Hwy 102 SB Off-Ramp	1800	2
2	Hwy 113 / Hwy 102 NB On-Ramp	900	2
Interchange: Hammonds Plains Road			
1	Hammonds Plains / Hwy 102 NB to EB Off-Ramp	1200	1
2	Hammonds Plains / Hwy 102 SB Off-Ramp	1100	1
3	Hammonds Plains / Hwy 102 SB On-Ramp	1200	1
4	Hammonds Plains / Hwy 102 NB to WB Off-Ramp	1000	1
5	Hammonds Plains / Hwy 102 NB On-Ramp	1900	2
Interchange: Highway 101			
1	Hwy 101 / Hwy 102 SB to EB Off-Ramp	600	1
2	Hwy 101 / Hwy 102 EB to SB On-Ramp	1100	1
3	Hwy 101 / Hwy 102 NB to EB Off-Ramp	500	1
4	Hwy 101 / Hwy 102 EB to NB On-Ramp	800	1

Ramp No.	Ramp Name	Peak Volume (vph) Planning year 2036	Lanes Required
5	Hwy 101 / Hwy 102 SB to WB Off-Ramp	900	1
6	Hwy 101 / Hwy 102 WB to SB On-Ramp	500	1
7	Hwy 101 / Hwy 102 NB to WB Off-Ramp	1300	2
8	Hwy 101 / Hwy 102 WB to NB On-Ramp	400	1
Interchange: Glendale / Duke Street			
1	Glendale / Duke Street / Hwy 102 SB On-Ramp	600	1
2	Glendale / Duke Street / Hwy 102 NB Off-Ramp	1000	1
3	Glendale / Duke Street / Hwy 102 SB Off-Ramp	400	1
4	Glendale / Duke Street / Hwy 102 NB On-Ramp	300	1
Interchange: Trunk 2 / Lake Thomas Road			
1	Trunk 2 / Hwy 102 SB Off-Ramp	400	1
2	Trunk 2 / Hwy 102 SB On-Ramp	800	1
3	Trunk 2 / Hwy 102 NB Off-Ramp	500	1
4	Trunk 2 / Hwy 102 NB On-Ramp	500	1

Data in the ***Appendix E*** tables was reviewed for anomalies that may impact the conceptual plan and the following items noted:

- There are a few locations where the projected volume is less than the 2001 volume. It is concluded that for most locations the difference is minor and the model is essentially telling us that the volume will remain the same. In the case of the Kearney Lake Road interchange, it is our interpretation that the decrease demonstrates that traffic will be diverted to the new Larry Uteck interchange.

- At Highway 113 the Ramp 2 (NB on-ramp) AM volumes seem low compared to the opposite PM movement. This phenomenon was confirmed using another regional model. For planning purposes it is suggested that an equal number of lanes be provided for both the NB on-ramp and SB off-ramp based on the more significant planning volume forecasts.

- At Hammonds Plains the model volume for Ramp 5 – NB on ramp volume is higher compared to the HRM generated numbers resulting in a recommendation of two lanes instead of a single lane. The analysis carried out in the HRM study for Bedford South and West did not contemplate the Highway 107 extension being in place. It was assumed to be in place in the transportation demand model. The model appears to have assigned a larger number of trips around the head of the harbor (the Highway 107 extension is forecast to be a very desirable route) and this is likely why the modeled northbound on-ramp volumes are larger relative to the HRM study volumes.

- There are three locations where the actual or back-casted volume represents the maximum volume for the ramp. The differences between the calculated ramp volume and the modeled estimate (at Joseph Howe, NW Arm, and

Lacewood) are relatively low and do not impact the required infrastructure. However, the future queue lengths may be lengthened and their extent will depend on how TPW wants to manage the queues using traffic signal timing. To determine this, a more detailed traffic analysis is required to review the interaction of vehicle movements and queue lengths with adjacent intersections. This is beyond the scope of the study.

3.6 NETWORK IMPROVEMENTS BEYOND THE STUDY AREA

In ***Appendix E***, the Intersection Needs and Staging figures showing required lanes at the modeled signalized intersections suggest some improvements are required beyond the study area. In peninsular Halifax, specifically for the Bayers Road area, the results of the Windsor Street intersection analysis suggest a required 6 lanes on Young Street and 4 lanes required for Windsor Street. As well, the Connaught Avenue intersection analysis suggests that three lanes in each direction will be required in the future. These areas are beyond the study area and the results reinforce that other network improvements will be required in conjunction with the Bayers Road/Highway 102 corridor improvements to provide for a reasonable level of operation within the corridor. How the traffic is disseminated/channeled from/to the 102 within the peninsula has not been addressed within this study.

At the time of this study, there are several transportation planning and operational studies being carried out for the HRM. These include regional planning work, study of the harbour crossings, traffic demand management studies, upgrades to the Armdale Rotary and the expansion of Chebucto Road. Other examples beyond the peninsula include Highway 103, Kearney Lake Road and Hammonds Plains Road. Each of these individual studies may adequately address their respective context, but it is imperative that these findings – and the findings from the Highway 102 corridor study – are comprehensively evaluated in a regional transportation plan review in the near future.

In addition to the above noted, farther reaching impacts of the projected traffic flows, the suggested changes within the corridor may be considered too severe to be implemented and conscious decisions to *not* implement the recommendations may be required. For example, severe property impacts or environmental impacts may result in downscaling of the reconstruction plan. Likewise, the results of the traffic analysis may be impractical from a functional point of view to implement. For example, while there are triple left turns suggested in the figures in ***Appendix E***, the functional design of this is impractical. Where there is not a workable solution to this (provision of additional ramps, etc.), the conceptual drawings show a double left turn lane, recognizing that as traffic volumes approach horizon year levels, the length of queues will increase, again suggesting that other network improvements would be required.

In summary it is recognized that the conceptual plan resulting from this study will require strengthening of the HRM network elsewhere in order to account for some of the projected deficiencies in the study corridor.

4.0 Travel Demand Management Review

4.1 BACKGROUND

Implementing managed lanes in a corridor is aimed at increasing the person-moving capacity of a facility rather than the vehicle-moving capacity[6]. This offers the potential to contribute to a more efficient use of the existing infrastructure, a reduction of person-hours of travel, and a reduction in vehicle emissions. Managed lane strategies can include combinations of occupancy requirements (high occupancy vehicle or HOV lanes), value pricing, time-of-day restrictions or vehicle type restrictions. This review will focus on the strategic implementation of HOV lanes.

The objective of this analysis was to determine the feasibility of HOV lanes in the context of the Highway 102 Bayers Road corridor and determine the impact of the initial implementation at specific points in time within this study's future planning horizon. In examining the potential impacts of HOV lanes on the Highway 102 corridor, we applied the analysis technique outlined in NCHRP Report 365[7]. This technique uses an incremental mode-choice model concept to perform a strategic-level review aimed at determining the potential effectiveness of HOV lanes. This technique is further discussed in Section 4.3 of this chapter.

In order to carry out a more detailed HOV lane evaluation, a calibrated transit and mode choice demand model is required. As a regional transit model is not available from the HRM, we have focused our review at the strategic-level.

4.2 BENEFITS OF HOV LANES

There are a number of benefits associated with HOV facilities. In North America, these benefits have been studied and researched since the first HOV facility was introduced in 1969[8]. Some of the benefits typically associated with HOV lanes include[9]:

- Offer a travel time savings relative to general purpose lanes;
- Have an improved operational reliability relative to general purpose lanes;
- Move more people relative to general purpose lanes;
- Increase the mode share of ride-sharing and public transit;

[6] Freeway Management and Operations Handbook. FHWA. 2006.
[7] National Cooperative Highway Research Program (NCHRP) Report 365: Travel Estimation Techniques for Urban Planning. National Research Council, Transportation Research Board, Washington, D.C. 1998.
[8] The first HOV facility in the United States was a bus-only lane on I-395 in Northern Virginia/Washington D.C. in 1969.
[9] Freeway Management and Operations Handbook. FHWA. 2006.

- Reduce the number of single-occupant vehicles;
- Have the potential to reduce overall vehicle emissions.

4.3 THE ANALYSIS METHODOLOGY

As discussed in NCHRP Report 365 the most common mode choice model formulations used in the travel demand process are based on the logit function. The logit model is a mathematical process that estimates the probability of choosing one mode over another (*i.e.* drive a car or carpool). The three common mode choice methodologies include:

- Simple multinomial logit model
- Nested logit model
- Incremental logit model

The multinomial and nested logit models are well suited to estimating mode share probabilities of various transit strategies (*i.e.* bus and/or light rail service). Both of these models would obviously require large amounts of data specific to the study area. However, the incremental logit model is well suited to evaluating TDM strategies at a high level. We have, therefore, applied the incremental logit model process to our strategic review of HOV lanes. The analysis process is illustrated in ***Figure 4.1***.

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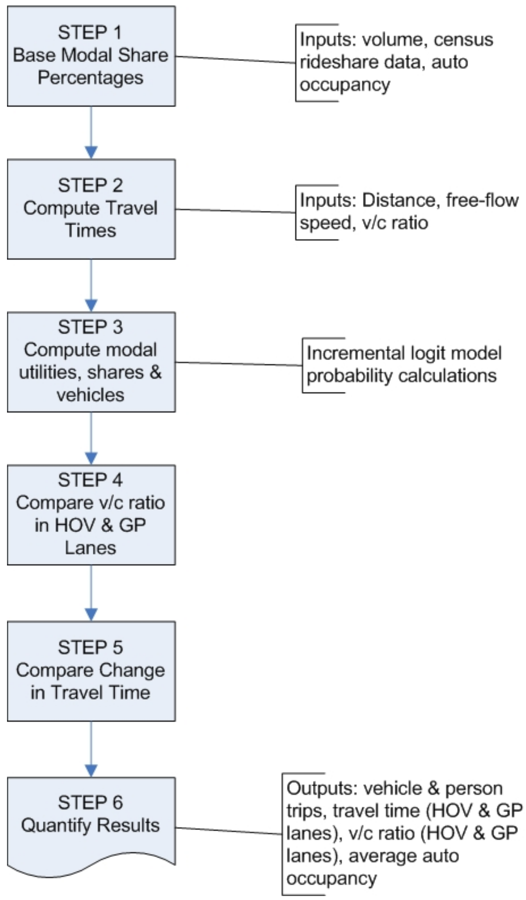
Figure 4.1: Mode Choice Model Process



The input data used in the mode choice modeling process is summarized in ***Table 4.1.***

Table 4.1: Mode Choice Model Input Data

Input	Source	Value
Volume	QRS II forecast results	Scenario specific
Rideshare percentage	2001 Census data (Statistics Canada)	10%
Auto occupancy	Average peak hour value[A]	1.14
Distance	Study area (Hwy 101-Joseph Howe Dr)	16.5 km
Free-flow speed	Estimated operating speed in corridor under free-flow conditions	100 km/h
Volume/Capacity ratio	Forecast volumes & capacities defined in this study[B]	Scenario specific

A – value taken from HRM Regional Plan transportation demand model
B – volumes taken from corridor modeling results for each horizon year and capacities based on 1,600 vphpl, the same value used in previous tasks in this study.

The detailed calculation worksheets from this analysis are contained in ***Appendix G*** of this report.

4.4 PARTICULAR HOV LANE CONCEPTS

The strategic-level review of HOV lanes on Highway 102 was carried out using two specific and distinct concepts of HOV lane implementation – and their subsequent impact – in order to provide a range of findings. The first concept is an early implementation of HOV lanes that would occur at the time of widening the Highway 102 corridor to a 6-lane cross section – this is termed the add-a-lane scenario. The second concept examines the impact of implementing HOV lanes some period of time after the Highway 102 corridor has been widened to a 6-lane cross-section – this is termed the take-a-lane scenario. Intuitively, we would expect greater public acceptance of HOV lanes if the HOV lanes were implemented as part of a corridor widening strategy (*i.e.* the add-a-lane concept) rather than taking away single occupant vehicle capacity and converting it to HOV capacity (*i.e.* the take-a-lane concept). Each scenario is described in the following Sections.

4.4.1 HOV Add-a-lane Concept

The HOV add-a-lane concept was selected as one scenario to be evaluated given that the Highway 102 and Bayers Road corridor currently has a basic 4-lane cross-section. As forecasted in previous tasks of this study, the future demand is expected to increase and require a basic 6-lane cross-section for a significant portion of the corridor by the 2036 horizon. The add-a-lane concept represents early and immediate implementation of HOV lanes and examines the general propensity to use these lanes in this context. ***Figure 4.2*** illustrates the add-a-lane concept starting with two lanes per direction and converting to a 2+1 configuration.

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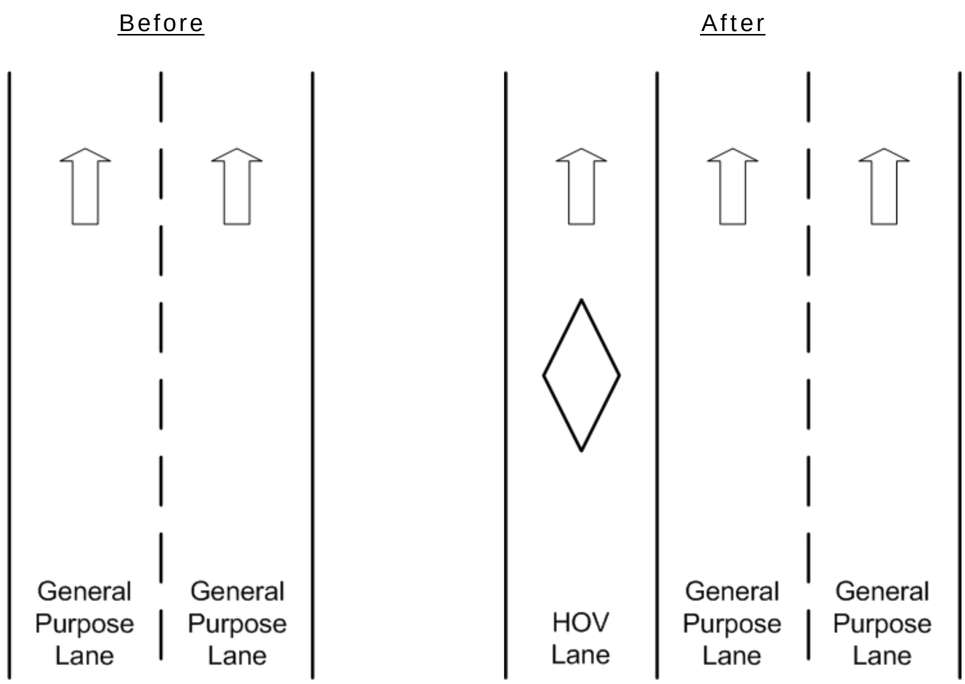
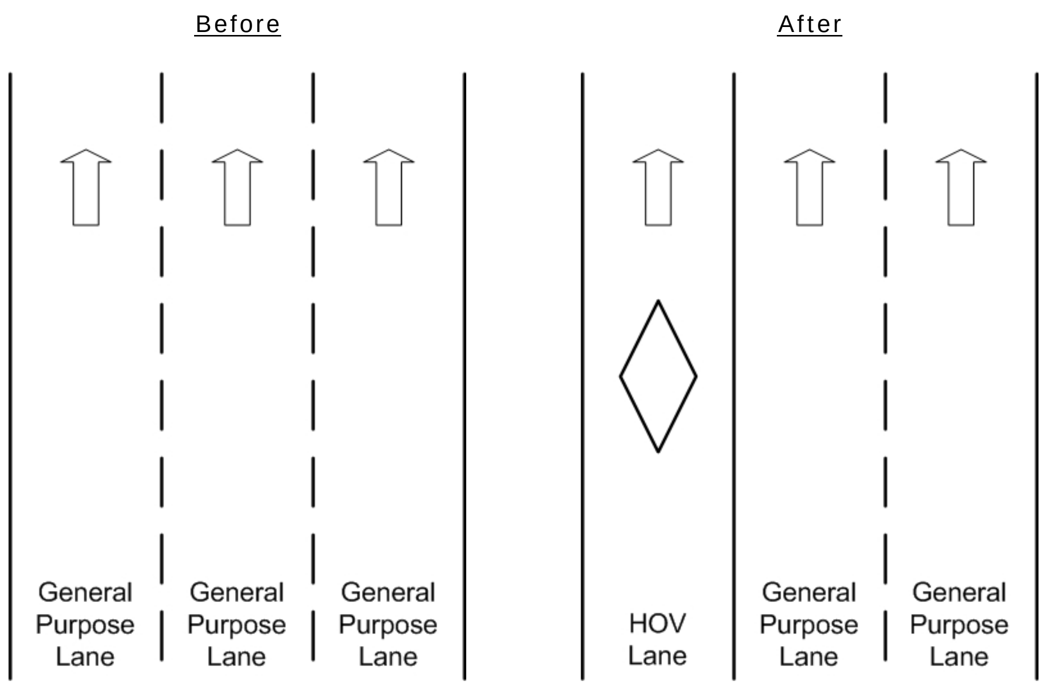
Figure 4.2: HOV Lane Add-a-lane concept for an existing 4-lane facility



4.4.2 HOV Take-a-lane Concept

Conversely, the HOV take-a-lane concept reduces the number of general purpose lanes (*i.e.* single occupant vehicle capacity) to allow for the implementation of an HOV lane – without widening the existing facility. This scenario was analyzed to illustrate the potential of incorporating HOV lanes as a long term demand management measure, some period of time after the corridor has been expanded to a basic 6-lanes. Although the take-a-lane implementation scenario results in the same lane configuration once HOV has been implemented, single-occupant road users will undoubtedly have become accustomed to using the three general purpose lanes in each direction and may resist a capacity reduction. ***Figure 4.3*** illustrates the take-a-lane concept with the "before" scenario having three lanes per direction and converting to a 2+1 HOV lane configuration in the "after" condition.

Figure 4.3: HOV Lane Take-a-lane concept for an existing 6-lane facility



4.4.3 Highway 102 HOV Lane Analysis Scenarios

The majority of North American drivers are accustomed to using their cars to make single-occupant trips (*i.e.* work trips, shopping trips, recreational trips, etc.). As the literature and NCHRP methodology applied to this analysis suggest, the incentive to change this behavior requires a significant impact on the road user to be effective. The incentive to use a HOV lane is predominantly a time savings for a given trip[10] and will require some level of congestion in the general purpose lanes to be effective.

The results of our analysis are provided in Sections 4.4.3.1 and 4.4.3.2 for the Scenario A and Scenario B/C road networks, respectively.

4.4.3.1 Results and Findings – Scenario A Road Network

The Scenario A road network assumes planned short-term upgrades including the Larry Uteck Drive interchange with no new roadway facilities constructed over the long term (essentially the existing road network with future traffic). The general findings of this analysis are contained in ***Table 4.2***. The values in the table represent the v/c ratios of the general purpose lanes for the peak direction of travel during the weekday peak period. These values also represent a “snap-shot” in time if HOV lanes were to be implemented at each planning horizon[11]. In all cases the v/c ratio in the HOV lane was less than 0.9.

Table 4.2: Strategic Review Results for General Purpose Lane V/C Ratios – Scenario A

HOV Concept		Add-a-lane				Take-a-lane	
HOV Configuration		2+1		3+1		2+1	
		Before	After	Before	After	Before	After
AM Peak	2016	1.16	0.93	0.79	0.70	0.79	1.06
	2026	1.34	0.87	0.90	0.79	0.90	1.18
	2036	1.47	0.68	0.98	0.85	0.98	1.27
PM Peak	2016	1.06	0.89	0.71	0.63	0.71	0.95
	2026	1.25	0.93	0.83	0.74	0.83	1.11
	2036	1.34	0.87	0.90	0.79	0.90	1.18

- *Introduction of HOV lane appears to offer some benefit* (green)
- *GP lane v/c ratio does not appear to promote use of HOV lane* (yellow)
- *GP lane v/c ratio exceeds capacity* (orange)

[10] There is arguably some cost savings through the increase of person-trips per vehicle but this is considered to be an indirect cost, a cost the majority of drivers typically do not perceive or take into account when choosing a mode of travel other than their car.

[11] For example, the 2026 AM peak hour results for the 2+1 add-a-lane concept indicate that if HOV lanes were to be implemented at this point in time the v/c ratios would be 1.34 and 0.87 for the before and after scenarios, respectively.

As expected, under the add-a-lane concept (early implementation of HOV lanes) the general purpose lane V/C ratios drop once the HOV lane is added. Conversely, in the take-a-lane scenario the V/C ratios for the general purpose lanes increase.

Values shaded in green suggest there is some benefit associated with the introduction of HOV lanes as sufficient congestion is encountered in the general purpose lanes after adding the HOV lane to make the HOV lane attractive.

Values shaded in yellow represent concepts in which the general purpose lane V/C ratio resulting from the introduction of an HOV lane is not high enough to make the HOV lane attractive. As a result, its use will be limited.

Values shaded in red indicate HOV lane concepts that result in unacceptable V/C ratios in the general purpose lanes.

A review of these results suggests the following:

- Implementing the add-a-lane 2+1 configuration appears to offer some benefit up to the 2026 horizon year.
- If the implementation of HOV does not occur until after the 2026 horizon, a 3+1 configuration may be more appropriate to accommodate the forecasted demand.
- The take-a-lane configuration appears to result in unacceptable V/C ratios on the general purpose lanes at all horizon years examined with the exception of 2016. This configuration does not appear appropriate.

4.4.3.2 Results and Findings – Scenario B and C Road Network

The Scenario B and C road networks were analyzed as one scenario due to their similar demand forecasts. These two Scenarios have the same road network as Scenario A with the addition of both Highway 113 and the Highway 107 extension. The general findings of the HOV lane strategic-level review are contained in ***Table 4.3***. The values in the table are the v/c ratios of the general purpose lanes for the peak direction of travel during the weekday peak period. These values also represent a “snap-shot” in time if HOV lanes were to be implemented at each planning horizon. In all cases the v/c ratio in the HOV lanes was less than 0.9.

Table 4.3: Strategic Review Results for General Purpose Lane V/C Ratios – Scenarios B&C

HOV Concept		Add-a-lane				Take-a-lane	
HOV Configuration		2+1		3+1		2+1	
		Before	After	Before	After	Before	After
AM Peak	2016	1.06	0.89	0.71	0.63	0.71	0.95
	2026	1.25	0.93	0.83	0.74	0.83	1.11
	2036	1.34	0.87	0.90	0.79	0.90	1.18
PM Peak	2016	0.97	0.84	0.65	0.58	0.65	0.87
	2026	1.16	0.93	0.77	0.69	0.77	1.03
	2036	1.25	0.93	0.83	0.74	0.83	1.11

- Introduction of HOV lane appears to offer some benefit
- GP lane v/c ratio does not appear to promote use of HOV lane
- GP lane v/c ratio exceeds capacity

A review of these results suggests the following:

- Implementing the add-a-lane 2+1 configuration appears to offer some benefit up to the 2036 horizon year.
- If the add-a-lane 3+1 configuration is implemented sometime between the 2016 and 2026 horizons, it appears to offer no incentive for drivers to use the HOV lane due to the fact that there is adequate residual capacity in the 3 general purpose lanes and thus no incentive for drivers to use the HOV lane. This configuration does not appear appropriate for implementation until the 2036 planning horizon.
- The take-a-lane 2+1 configuration appears to result in unacceptable V/C ratios on the general purpose lanes at all horizon years examined with the exception of 2016. This configuration does not appear appropriate.

4.4.4 Bayers Road HOV Lane Review

Two proposed design concepts developed by HRM for Bayers Road between Highway 102 and Windsor Street have been examined as part of the Highway 102 corridor study. These include a 6-lane cross-section with auxiliary turning lanes at the intersections and a 5-lane cross-section with a centre lane dedicated to transit bus traffic.

In earlier phases of this corridor study, it was determined that the Bayers Road corridor will ultimately require a basic 6-lane cross-section to service the forecast demand up to the 2036 horizon. A 6-lane cross-section could allow for the introduction of a future HOV facility under a 2+1 HOV configuration (2 general purpose lanes + one HOV lane in each direction). If implemented in conjunction with an HOV facility on Highway 102, this would provide a continuous HOV network onto the Halifax peninsula.

Accommodating the 2036 forecasted demand by adding a 5th lane on Bayers Road dedicated to transit bus service would require an immediate and significant shift in driving culture to be effective. This is a significant challenge. To put this alternative into perspective, an urban arterial lane throughput is typically assumed to be 800 single occupant vehicles per hour. Based on this assumption, it would require approximately 20 transit buses per hour to move the same number of people. This results in a bus headway of one bus every 3 minutes.

Based on this simple calculation it would appear more appropriate to implement the 6-lane cross-section option for Bayers Road and manage auto occupancy gradually over time (as congestion grows) through the use of HOV lanes.

4.5 SUMMARY

It is difficult to predict the potential success of HOV lanes based on a strategic-level analysis as there are many variables that can impact this success; is there a local propensity to carpool? Does congestion cause a sufficient delay to induce people to use the HOV lane? How will the lanes be managed? However, the findings from this analysis suggest that the corridor may be well suited to the implementation of HOV lanes.

The following points summarize findings from our strategic-level review of implementing HOV lanes on the Highway 102 corridor:

- The add-a-lane 2+1 HOV lane configuration appears feasible to implement up to the 2026 planning horizon under Scenario A network conditions and up to the 2036 planning horizon under Scenario B/C network conditions.
- Under the Scenario A road network, if the implementation of HOV lanes does not occur until after the 2026 horizon, our review suggests that a 3+1 HOV lane configuration may be more appropriate to accommodate the demand.
- The take-a-lane 2+1 configuration does not appear appropriate given the resulting high v/c ratios in the general purpose lanes.
- It would appear that public acceptance of HOV lanes may be greater if implemented early in a corridor widening strategy (i.e the add-a-lane concept). This affords the agency(s) the ability to gradually manage the increase of auto occupancy over-time.
- If HOV lanes are managed effectively, there is a potential for the agency(s) to defer further corridor widening (of the current forecast of 6 lanes) beyond the ultimate planning horizon of this study.

4.6 IMPLEMENTATION CONSIDERATIONS

A common misconception associated with HOV lanes is that they alone extend the life of the capacity of the facility. This is not the case and the literature suggests that their success relies heavily on effective management of the facility to nurture a reduction in the modal share of single occupant vehicles.

The success of the HOV lane experience can vary widely from jurisdiction to jurisdiction based on the conditions of a particular facility, the level of congestion and the desirability for drivers to change their mode of travel (away from the single occupant vehicle). In some cases, the HOV lanes are too successful and are over-utilized and in others, they are under-utilized. The following three items are key to the success of a HOV facility:

- constant management activities
- constant performance monitoring
- constant enforcement activities

This requires a certain level of governance between agencies (*i.e.* TPW, HRM, Metro transit and multiple police jurisdictions). Ultimately, there needs to be a region-wide, long-term vision that deals with managed lanes that require buy-in from these agencies.

5.0 Design Criteria

The primary objective of the study is to establish, at a conceptual level, the infrastructure required in the horizon year (year 2036). The following is a discussion of the design criteria, used to develop the conceptual plans.

5.1 HIGHWAY 102 CORRIDOR DESIGN CRITERIA

The Highway 102 corridor was initially shaped based on rolling terrain characteristic of the Nova Scotia landscape and the accepted design standard in use at that time. As a result, the alignment of the roadway can be described as curvilinear with various limiting geometrical features. Given the terrain, the minimum applicable criterion was applied at some locations in the construction of the existing facility. Based on a review of the existing geometry, it appears that the previous design criterion for the highway was based on:

- Design speed of 100 km/hr
- Maximum superlevation of 8%
- Approximate assumed operating speed of 90-100 km / hr to determine the minimum vertical criteria.

The current posted speed of Highway 102 is 100 km/hr for the most part. As the highway approaches Bayers Road, the design speed is reduced to 90 km/hr, then 70 km/ hr and ultimately 50 km/hr on the HRM arterial. The other exceptions to the posted speed of 100 km / hr occur on horizontal curves located to the north of Hammonds Plains Road and to the south of Exit 5 (Trunk 2 / Lake Thomas Road) where the curves are posted at 90 km/hr and 85 km/hr respectively.

While it is acceptable to apply a design speed that is equivalent to the posted speed of the roadway, as is current NSTIR criteria, it is generally desirable to achieve a design speed that is 10-20 km /hr above the posted speed. As a result, the target design speed for the Highway 102 facility is assumed to be 110 km/hr. The maximum allowable superelevation also impacts the horizontal criterion that shapes the roadway. In previous designs a maximum superelevation of 8% was used for high speed facilities in Canada. As urban areas develop around these high speed facilities, congestion can result in reduced operating speeds in the peak hour. This combined with our climate (snow cover, slippery / icy conditions) can result in reduced lateral friction on the 8% crossfall and increased potential for cars to slide sideways. Current design practices in Canada assume a maximum superelevation of 6% which reduces this potential.

Given the above, the alignment criteria for the upgraded Highway 102, and associated ramp facilities is based on a 110 km/hr design speed and maximum superelevation of 6% for this study. However, following the evaluation of re-construction costs and property impacts, a decision to design for the posted speed only, may be considered. Should this be the case, consideration should be given to reducing the posted speed for the entire facility to 90 km /hr. Highway 102 in the horizon year will have additional and more complex interchanges, additional lanes and increased driver work-load. It is expected that an overall reduction in the posted speed would reflect this complexity and provide a more safe facility. However, prior to design work for the facility, a safety review should be undertaken to establish this criteria.

Regardless of the assumed desirable criteria, it is acknowledged that the upgrades to the highway are a retrofit of an existing facility. As a result compromises will be required that will result in an assumed design criteria that may be less than the desirable. At locations where the desirable criteria is not possible due to costs or property impacts, appropriate mitigation measures will be required such as corridor and ramp lighting or signage to provide a facility that operates at an acceptable level.

The following is a more detailed discussion of the geometric design criteria for Highway 102. ***Appendix H*** includes detailed tables describing the proposed criteria for each section of the facility including cross roads and ramps.

5.2 HIGHWAY 102 HORIZONTAL ALIGNMENT

The Bayers Road/Highway 102 Corridor has been divided into 13 sections, generally defined by intersections and interchanges. As previously noted in Chapter 2, a review of the horizontal alignment was undertaken and summarized in ***Tables C1 to C6, in Appendix C***. Alignments and tables were produced for both the northbound and southbound lanes. To simplify the presentation drawings, only the alignment for the southbound lanes was carried forward. However, if the limiting criterion was located on the northbound lanes, this is identified on the conceptual plans. ***Table H2*** in ***Appendix H*** is a summary table of Highway 102 main lanes showing the horizontal criteria as well as the proposed action to achieve the desirable design speed or the mitigation required. In summary, it is proposed to improve the horizontal alignment where required from Bayers Road to Highway 101 since reconstruction to six lanes has been recommended for this section. Improvements to the north of Highway 101 would depend on the results of a safety review to measure the effectiveness of the current signage.

The critical areas where significant improvements are suggested are indicated on the conceptual plans and include:

- Horizontal curve to the north of Kearney Lake Road to be improved to 110 km/hr design speed with 6% superelevation;
- Horizontal curve at location of future Highway 113 connection to be improved to 110 km/hr design speed with a 6% superelevation;
- Horizontal curves to the south of Exit 4, Bedford Interchange to be improved to 110 km/hr design speed at 6% superelevation.

5.3 HIGHWAY 102 VERTICAL ALIGNMENT

A similar review of the Highway 102 vertical alignment was undertaken and the results are summarized in ***Tables C1 to C6*** in ***Appendix C.*** The vertical alignment was reviewed based on the mapping made available to the study team. It was later confirmed and refined based on a moving vehicle Global Positioning Survey (GPS) survey. A best fit alignment was produced based on the data collected from this survey. The resulting vertical alignment is shown on the 1:15,000 scale expansion constraints plan in ***Appendix B.***

To compare the existing conditions to the design criteria, the TAC guidelines were reviewed as well as NSTIR standards. Vertical curve standards are established based on stopping site distances which in turn are developed based on vehicle height and object height used throughout the industry as assumed standards. The TAC guidelines provide a range of values for the stopping site distance and curve criteria based on a range of operating speeds. For conservative designs, an operating speed equivalent to the design speed is generally assumed. NSTIR standards as provided in **Table H89-022** establish vertical curves based on an assumed operating speed that is less than the design speed. The following table, ***Table 5.1*** is a comparison of the TAC and NSTIR standards for the 100 and 110 km/hr design speeds:

Table 5.1 Comparison of TAC and NSTIR Vertical Design Criteria

Design Speed	TAC Assumed Operating Speed (km / hr)	TAC Stopping Sight Distance m	NSTIR Stopping Sight Distance m	TAC Crest Curve K	NSTIR Crest Curve K	TAC Sag Curve K	NSTIR Sag Curve K
100 km / hr	85 -100	160 - 210	200	45 - 80	70	37 – 50	50
110 km / hr	91 – 110	180 - 250	220	60 - 110	85	43 – 62	55

For the review of the existing facility in this study, an operating speed of 110 km / hr is considered desirable for design purposes. As a result, the upper end of the TAC range (in the above table) is considered desirable. However, the review of existing curves has established that there are a number of curves that do not meet the desirable criteria. The analysis was completed for both the northbound and southbound lanes and the results are reported in ***Tables C5 and C6*** Since there are only slight differences, one alignment was carried forward to ***Table H1,*** showing the existing condition and the estimated operating speed that correlates with the curve. Based on the data presented, the decision to upgrade the curve or to provide mitigating measures can be made.

Table H1 in Appendix H summarizes the suggested action for each area where substandard curves are identified. The critical areas where improvements may be required include:

- A 2.6 km section of roadway between Lacewood and Kearney Lake has a series of substandard curves. Given the length of this section reconstruction is not suggested, but a safety review is recommended to confirm if accident statistics indicate particular areas of concern.

- A substandard crest curve to the north of Kearney Lake Road is suggested to be improved.
- A substandard crest curve at the future Larry Uteck Drive Interchange is suggested to be improved.
- A 900 m section of roadway (series of crests and sags) to the south of the new Highway 113 is suggested to be improved.
- A crest curve to the south of Glendale / Duke Street is suggested to be improved.

5.4 INTERCHANGES DESIGN CRITERIA

5.4.1 Design Speed of Ramps

The proposed design speed of ramps is based on various factors including the mainline and crossing road speeds as well as the surrounding terrain and land use. The TAC design guideline (page 2.4.6.1) recommends a minimum inner loop design speed of 40 km/hr for urban conditions:

> "For an urban freeway, which is usually characterized by a narrow median, high volumes of traffic, short trip lengths, presence of roadway illumination and where property is often a constraint, the minimum inner loop design speed should be 40 km/hr."

Table 2.4.6.1 TAC, Ramp design speed recommends, for a Highway design speed of 110 km/hr, a ramp design speed of 100 – 60 km / hr. For the purpose of the Highway 102 ramps, speeds are established based on the existing conditions, considering that improvements represent a retrofit condition. The following table, ***Table 5.2*** shows desirable and minimum criteria that were applied to the designs:

Table 5.2 Ramp Design Speed

Type of Ramp	Desirable Design Speed	Minimum Design Speed
Inner Loop Ramp	60 km/hr	40 km/hr
Outer loop ramp	70 km/hr	60 km/hr
Directional Ramp	100 km/hr	60 km/hr

5.4.2 Design Speed for Trucks

A problem that has been experienced at the Bedford interchange (Exit 4) is the roll over of large trucks primarily as a result of the truck traveling faster than the design/posted speed limit. The risk of roll-over may occur even when trucks are traveling only marginally over the design speed. Therefore TAC recommends that the design of ramps that carry substantial truck traffic should use the higher range of design speeds.

Percent volume of trucks were not available for this study, but should be reviewed during the preliminary and detailed design phase. Given the terrain at the Bedford interchange and the surrounding land use, it is expected that loop ramps with design speeds less than 60 km/hr will still be required. However, it is anticipated that at this location, the problem of rollover is due mainly to the fact that inadequate deceleration lanes to the loops are provided (in the cloverleaf design) resulting in vehicles traveling the ramps at greater than the design speed. The change in configuration of the interchange and improvements to the speed change lanes may improve this situation, allowing vehicles to adequately reduce their speeds prior to maneuvering the loop ramps. Special advisory speed signing may also be considered where appropriate.

5.4.3 Auxiliary Lanes, Acceleration / Deceleration

The TAC standards for Acceleration/Deceleration are measured to the controlling curve on the ramp and therefore include the spiral as part of the speed change lane. NSTIR do not use spirals as part of their design standards and have developed standards based on the required acceleration / deceleration to the bullnose of the ramp. At this level of design (concept), the curve details are not established; therefore, design lengths are based on the upper end of the range provided in the TAC guideline and applied to Highway 102, measured from the bullnose. While this may be considered as conservative, other factors such as sight distance on crests would need to be considered in detailed design and final acceleration/deceleration lengths would be based on final ramp and highway designs. For example, where ramps are relatively straight and end in a stop condition (as at diamond interchanges), the deceleration length may be measured to the intersection. Acceleration lane lengths may need to be increased based on sight distances to bullnoses on crests which has not been evaluated at this level

5.4.4 Other Conceptual Level Design Criteria for Interchanges

The following criteria are considered in the conceptual design of the improvements to Highway 102. However, additional consideration is required in detailed design since the criteria are "rules of thumb" and generally dependent on more information than is available at the conceptual level:

- Allow a minimum of 300m distance following an exit to drop a core lane as per discussions with NSTIR. This criterion is applicable where other 100 series highways (103, 113, and 107) merge with Highway 102.
- For two lane exits, a speed change length in the order of 400 m to 450m for mainline speeds of 100 km/hr or above is recommended (TAC pg 2.4.6.7)
- Design lengths for weave distances will depend on a traffic analysis which is beyond the conceptual level of this study. A minimum distance of 400m, bullnose to bullnose is assumed for mainline highway weave conditions. This is also applied to weave distances on proposed collector/distributor roadways.

5.4.5 Summary of Ramp Design Criteria

Appendix H provides tables of design criteria for each ramp within the Highway 102 corridor. The tables include the assumed peak hour volume for planning purposes and the assumed design speed. Other design criteria provides include:

- Minimum radius, maximum superelevation at the control curve of the ramp.
- Minimum crest curve K factor
- Minimum sag curve K factor for headlight control and comfort control.
- Minimum stopping sight distance.
- Suggested length of speed change lanes

The tables provide a basis for the conceptual planning of the facilities. The application of specific criteria will need to be confirmed at the preliminary and detailed design phases.

5.5 CROSS SECTION ELEMENTS

Typical design cross sections have previously been presented for Highway 102 widening as well as Bayers Road in Chapter 2. Conceptual plans in ***Appendix I*** also include design sections for the highway widening and design typical sections for single and two lane ramps showing shoulder / boulevard treatments and typical right of way allowances, based on current NSTIR and HRM standards. The typical sections will be used to establish property impacts at the concept level.

6.0 CONCEPTUAL PLANS

6.1 CORRIDOR PLANNING

Appendix I includes 1:2000 scale conceptual design plans for the Highway 102 corridor from Windsor Street to Exit 5 in Fall River. The plans represent the application of the traffic forecasts and analysis presented in the "Component 1 – Traffic Forecasts Final Report", February 13, 2008 as well as the Infrastructure Needs Analysis and design criteria presented in this report. The plans show the conceptual full build out of the facility based on the 2036 horizon year.

6.1.1 Background Mapping

Background mapping of existing conditions has been prepared using available provincial topographic mapping as well as digitized the existing lane work based on 2003 and 2006 aerial photos. There is some distortion and therefore horizontal accuracy is limited. Through the course of the study, HRM had contracted to have LIDAR mapping completed for Halifax including the study area by a specialty contractor and not for this study specifically. However, the processing of the LIDAR data was not complete at the time the base mapping was prepared for this study. As a result the existing ground surface is based on available aerial mapping, which can be, approximately plus or minus 2.5 m in vertical accuracy and is, in some areas, out of date with respect to existing developments. It is important to note that the accuracy of the mapping has a direct impact on the accuracy of determining property impacts and costing of reconstruction. These impacts are key objectives for the study and will be evaluated at a conceptual level consistent with the data used.

6.1.2 Core Lanes Proposed

The plans in ***Appendix I*** show a design of Bayers Road / Highway 102 with 6 core lanes from the peninsula to Exit 4, the Bedford interchange. From Exit 4 to Exit 5, the current 4-lane core lane design is maintained. The need to recommend 3 lanes (peak direction) from Highway 113 to Highway 101 was questioned by the Steering Committee since the graphs presented in "Component 1 – Traffic Projection – Final Report" February 20, 2008 show a borderline need for more than 2 lanes. The Graph for the 2036 am peak hour shows that 2 lanes are acceptable from the Larry Uteck Interchange to Highway 101. However, the 2036 pm peak hour graph shows that the 2 lane capacity would be exceeded. The Steering Committee advised the team to proceed with the six lane design continuous to the Bedford/Highway 101 interchange (Exit 4).

The design of auxiliary lanes for the facility varies based on existing conditions including the spacing of interchanges and the existing terrain. As well, there are a number of two lane entrances and exits which require auxiliary lanes to be extended a longer distance to allow the opportunity for traffic to merge with the through lanes. This is particularly applicable where other 100 series highways (103, 113, and 107) merge with Highway 102.

6.1.3 Timing of New Connections

The timing of Highway 107 Connector and Highway 113 construction is unknown at the time of this study and most likely the Highway 107 Connector will be constructed and operating for some time prior to the construction of Highway 113. As well, the proposed implementation of the Larry Uteck interchange is unknown but assumed to be operational prior to the 2036 horizon year. However, the study is focused on planning for the ultimate condition, which includes having the 100 series facilities in place as well as the Larry Uteck interchange.

The modeling has shown that these three new connections influence the design of the corridor and impact the other interchanges. For example, the Component 1 Final Report suggests that an 8 lane Highway 102 would be required from Joseph Howe to Highway 103 if the Highway 107 and the Highway 113 connections were not provided within the horizon study period. While construction of these facilities is dependant on many factors, it was agreed that Highway 102 would be planned as a six-lane facility based on the assumption that the Highway 107 and the Highway 113 are constructed within the planning horizon.

6.1.4 Storage Lanes for Queues at Intersections

The configuration of the intersections is conceptual only and queue lengths have not been evaluated. Assumptions have been be made to determine the number of lanes across bridges, for cost estimating purposes where required. At this level of design, reasonable judgment needs to be applied to minor road links such as ramps. Where a ramp volume is projected to be relatively high, yet still meets the criteria for a single lane ramp (less than 1,200 vph), queuing at the ramp intersections is expected to be a design consideration. While for these ramps, a single lane exit terminal is designed; additional storage lanes on the ramp are expected to be required and are provided in the conceptual plan. The detailed design will need to confirm that appropriate storage lengths are provided. This together with signal phasing at the detailed design phase will reduce the possibility of queues extending to the highway lanes.

The following sections include a description of the conceptual design of each area and interchange within the corridor.

6.2 BAYERS ROAD

The traffic analysis suggested that Bayers Road be expanded to a full six lanes from Windsor Street to Highway 102. Design sketches for a 6-lane design from Windsor Street to Highway 102 were produced and presented to the Steering Committee to visualize the impact on the surrounding developed area. As expected, the 6-lane design in the area from Windsor Street to Connaught has significant impacts on the developed residential properties. As a result, the Steering Committee have advised that planning for this section of Bayers Road will include a four lane design only, recognizing that further analysis of the network is required to identify appropriate future improvements. The four-lane design is consistent with the existing Young Street cross-section and manages the impacts to the surrounding area.

6.2.1 Connaught Avenue Intersection

Improvements at the Connaught Avenue Bayers Road intersection are shown on Sheet 03. The double right turn movements suggested in the intersection analysis are accommodated by providing exclusive right turn lanes and receiving lanes with channelized right turn lanes. Currently the double southbound right turns from Connaught are signalized at the channelized lane, with phasing that allows them to weave to the Halifax Shopping Center (HSC) entrance (left turn). To provide a more direct access to the HSC, an extension of Roslyn Road is shown as an option which would eliminate this weave. However, the impacts to the Bayers Road through movement at the HSC signals would need to be evaluated (ie. the green time as well as the reduced queue length). If this is not possible, then a reconstruction of the double right as currently exists will be required. The recommendation for a triple left from northbound Connaught to westbound (outbound) Bayers Road is not feasible within the right-of-way and other network improvements outside the study area need to be evaluated to deal with this issue.

The HSC entrance intersection is located on a horizontal curve of radius 110 m. As a result, the alignment of the through lanes on Bayers Road is less than ideal. Detailed design of the intersection should consider a flatter horizontal alignment to better align the through lanes. The design drawings show a curve of approximately 200m with the widening occurring on the outbound side of the roadway. This scheme limits the property impacts to one side of Bayers Road.

The concept shown is intended to show the impacts of constructing the lanes as shown to be required by this study. However, it is recognized that a detailed evaluation of the two closely spaced intersections will be required to determine the most effective treatment for the area. The idea of providing one or two roundabouts at this location has been suggested but is beyond the scope of this study. The property on the north-west corner of Connaught and Bayers Road is owned by HRM and this property may allow for the development of a roundabout.

The detailed design should also consider a re-design of the HSC entrances and perhaps review the impacts of providing a single driveway to the HSC using a more conventional four way intersection. The intersection is currently “split” between two distinct entrance/exit driveways.

6.2.2 Bayers Road Access Management

The level of traffic analysis completed for this project does not include a detailed review of each intersection or entrance within the corridor. However, conceptual design suggestions have been considered to improve traffic operations on Bayers Road.

As noted above, the section of roadway from Windsor to Connaught will be planned as four-lane section to minimize impacts to adjacent properties. The area has numerous private driveways and these are expected to remain. As well, access to Dublin Street, Connelly Street and Oxford Street are not expected to change, however, turn restrictions could be considered in the future.

From Connaught to Highway 102, the following suggestions are proposed as shown on ***Sheets 03 and 04, Appendix I***:

- It is suggested that an effort be made to eliminate most private entrances on Bayers Road from Connaught Avenue to Highway 102. The drawings show alternate suggested access locations.
  - If possible, reconstruct the church entrance at the corner of Connaught and Bayers Road to George Dauphinee, and close the Bayers Road double entrance.
  - Remove the single residential access between George Dauphinee and HSC Access Road and reconstruct to George Dauphinee.
  - Construct a municipal street from Romans Avenue (along existing private lane) and extended to a turning circle near the rear of Bayers Road properties ***(Sheet 04, Appendix I***).
- Consider extension of Roslyn Road from Connaught to HSC Entrance, through HRM property, providing direct access from residential area to the shopping area. As well, this would alleviate the right turn movement at the Connaught Avenue intersection. In particular southbound traffic from Connaught to the HSC would have direct access.
- Consider closing the access from Micmac Street (dead end) and connect to new Rosyln Road Extension.
- Drawing Sheets 05a and 05b, Appendix I show alternate schemes for access to the 13 homes located on Pennington Street and Ralston Avenue, between the Highway 102 inbound and outbound lanes. For Alternative 1, access would be provided at one location via Desmond Street from a new signalized intersection on Bayers Road. The existing one-way Desmond Street would become a two-way access road. For Alternative 2, the neighbourhood would be re-attached to the streets to the south of the Highway 102 inbound lanes. In either alternative, the direct access to the inbound and outbound lanes is removed.

6.3 EXIT 0, JOSEPH HOWE DRIVE

Exit 0 is an existing partial moves diamond interchange with a single signalized intersection at the ramp terminals and Joseph Howe Drive.

6.3.1 Joseph Howe Drive

The traffic analysis has suggested improvements to Joseph Howe Drive with the addition of turning lanes and through lanes which essentially result in the widening of Joseph Howe Drive by one lane through the Bayers Road intersection and the Exit 0 intersection. The existing CN

Rail right-of-way has recently been purchased by HRM. The Joseph Howe Drive bridge structure represent the most significant constraint to the widening of this roadway. In addition to other design considerations for this roadway, Joseph Howe Drive has been identified as a link in the HRM Active Transportation plan and the design reflects a wider pavement design to allow for bike lanes on both sides of the street. ***Sheet 06, Appendix I*** shows a widening plan for Joseph Howe Drive. The street would be widened on the west side encroaching on the former CN property. It is expected that the available width between the bridge piers and the CN tracks will not allow for extra pavement width. As a result, an additional lane is shown to the west of the bridge pier. Driveways and other access points to Joseph Howe Drive including Abbott Drive and the golf course driveway will need to be reconstructed.

6.3.2 Exit 0 Interchange Plan

Changes to the Exit 0, Joseph Howe Drive Interchange reflect improvements at the ramp intersection at Joseph Howe Drive and the widening of Highway 102 to 6 core lanes. As previously discussed, a twin parallel bridge structure is suggested for the crossing of Joseph Howe Drive and Ashburn Avenue. The outbound on-ramp will remain as-is, thereby avoiding impact to the existing retaining wall structures on that side. The inbound off-ramp will be re-aligned to suit the expansion of the ramp structure that crosses under the highway. This is a partial diamond interchange with a single intersection at Joseph Howe Drive.

Possible consideration should be given to re-aligning the inbound off ramp, through the Ashburn golf course property to intersect Joseph Howe Drive approximately opposite Abbot Drive. This would provide a more conventional interchange configuration and to avoid the expansion of the ramp structure, which could be removed. This alternate interchange configuration would require a second signalized ramp intersection at Joseph Howe Drive. The CN rail crossing at this location was the primary impediment to this configuration but this has been removed. There would be further impact to the golf course property and access road.

6.4 EXIT 1, NORTHWEST ARM DRIVE/DUNBRACK STREET INTERCHANGE

Exit 1 is an existing full moves Parclo A Interchange. The ramp terminals are un-signalized intersections. Adjacent land is fully developed in the northeast quadrant (Fairview neighborhood). The separation to the next interchange northbound on Highway 102 (Highway 103) is only about 800 meters. As a result, the design plans for the interchanges were developed jointly as shown on ***Sheets 08 and 09 in Appendix I.*** To avoid impact to the developed land, widening of the highway is proposed for the inbound side. The Northwest Arm Drive ramps have been modified to favor the heavy Highway 103 inbound traffic. This includes a “braided” off ramp to Northwest Arm Drive and the elimination of an on-ramp (Ramp 1). A northbound left turn lane is introduced at on Northwest Arm Drive to direct inbound traffic to the loop ramp (Ramp 5). It is recognized that this concept will reduce the capacity of the North West Arm Drive interchange. However, the modeled volumes at this location are relatively low and the capacity for the horizon year is still achieved with this configuration. The ramp terminal intersection on North West Arm Drive would be signalized.

North West Arm Drive has been identified as a link in the HRM Active Transportation plan. While the bridge structure would require lengthening or replacement for the highway widening, the deck width is sufficient for the crossing road traveled lanes. It may be possible to develop bike lanes within the existing pavement width by reducing the median width, allowing for a wider pavement to allow for bike lanes on both sides of the street.

6.5 EXIT 1A, HIGHWAY 103 INTERCHANGE

Exit 1A is an existing full moves three leg Trumpet Interchange. The Highway 102 cross-section includes continuous ramp lanes between the Northwest Arm Drive interchange and the Highway 103 interchange on both sides of the highway. As previously noted, the two-lane inbound Highway 103 ramp would be braided with the off-ramp to Northwest Arm Drive. While one of the Highway 103 ramp lanes will merge with the through traffic, the second lane is carried as a continuous fourth lane to Joseph Howe Drive.

The outbound 103 ramp (ramp 3) is also required to be expanded to a two-lane ramp. The radius of this ramp is proposed to be expanded to a 100m radius to allow for increased speeds. The bridge structure would be reconstructed off-line from the existing structure. A two-lane exit terminal to the ramp is shown with the fourth lane from North West Arm Drive exiting to Highway 103. From the North West Arm Drive on-ramp (Ramp 6) to the Highway 103 off-ramp (Ramp 3), an approximate weave distance of 670m is available. However, the two-lane exit terminal requires that traffic on the optional exiting lane (third highway core lane) decelerate in the core lane, which is not a desirable condition. An additional lane or collector system may be required at this location, but this should be established based on a detailed weave analysis, which is beyond the level of this design.

6.6 EXIT 2A LACEWOOD INTERCHANGE

Exit 2A at Lacewood Drive is an existing full moves diamond Interchange. Adjacent land is fully developed in three quadrants with commercial developments. From Lacewood Drive to the Highway 103 interchange, there is an existing continuous auxiliary lane, providing a three-lane section on the southbound (in-bound) direction. Both ramp terminal intersections along Lacewood Drive are signalized. While the ramps terminals are single lane entrances and exits, three of the four ramps are widened to two lanes for queue storage at the intersections. The interchange has been constructed to full build-out and the structure will allow for the expansion of Highway 102 to 6 lanes. Proposed work at the interchange involves reconstruction of the entrance and exit terminals to reflect the six-lane design of Highway 102. The proposed interchange design is shown on ***Sheet 12 in Appendix I***

6.7 EXIT 2 KEARNEY LAKE ROAD INTERCHANGE

Exit 2 at Kearney Lake Road is an existing full moves diamond Interchange. Both of the ramp terminal intersections are signalized. Properties to the east of the interchange are developed. Kearney Lake Road is currently a three-lane section at the bridge structure, which is required to be expanded to a minimum of six lanes to allow for turning movements at the ramp intersections. As previously described, the horizontal curvature of the mainline Highway 102 lanes is suggested to be increased as well as adjustment of the vertical crest to the north of the interchange. This as well as the expansion of Kearney Lake Road shapes the proposed interchange and impacts the bridge structure. The traffic forecasts suggest that single lane ramps are required. However, as noted at Lacewood Drive, it is expected that ramp volumes will require storage lanes be provided on the ramps to manage queues. The proposed interchange design is shown on ***Sheet 16 in Appendix I***

Kearney Lake Road has been identified as a link in the HRM Active Transportation plan and the design reflects a wider pavement design to allow for bike lanes on both sides of the street. To the east of the interchange there is a commercial driveway as well as a signalized intersection at Parkland Drive opposite a second commercial driveway. These access points are expected to remain. Any adjustment to the signalized intersection at the easterly ramp terminals would need to be coordinated with the Parkland Drive signals.

6.8 FUTURE LARRY UTECK INTERCHANGE

The design plans for this interchange, as provided by the Steering Committee, have been incorporated into the conceptual design plan and is shown on ***Sheet 18 and 19 in Appendix I.*** The design has been modified to allow for the proposed six-lane design of Highway 102. However, it is acknowledged that the design as presented does not accommodate the projected traffic at the ultimate planning horizon year and further work is required to finalize a plan for this interchange and to incorporate the upstream and downstream impacts.

6.9 FUTURE HIGHWAY 113 AND EXIT 3 HAMMONDS PLAINS INTERCHANGE

Exit 3 is an existing full movement Parclo B Interchange. Freeway traffic exits to loop ramps, and include the westerly ramp terminals which are signalized. Adjacent land is developed in the north-easterly quadrant. Traffic projections at Exit 3 Hammonds Plains Interchange reflect the significant proposed development planned for the surrounding area. As well, the proximity of the proposed Highway 113 requires that the two interchanges be designed as inter-linked interchanges. The following is a summary of the proposed design features resulting from this process as well as a description of design options that were considered. The conceptual plan is shown on ***Sheets 21 through 24 of Appendix I***.

6.9.1 Horizontal Alignment of Highway 102 at 113/Hammonds Plains

As previously described, there is a horizontal curve at the location of the new Highway 113 ramps that is suggested to be improved to suit the desirable design speed of the highway. This was incorporated into the options that were reviewed since the application of the new curve has an impact on the location of new ramp terminals and resulting weave distances. Similarly, it is recommended that the horizontal curve to the north of the Hammonds Plains interchange should be up-graded to the desirable standard.

The northeast quadrant of the Hammonds Plains interchange (Brookshire Court) area is fully developed and new construction is designed to avoid impact to these properties. As a result, an overall shift of the Highway 102 centerline on the west side of the highway is required.

6.9.2 Coordinating Highway 113 with Hammonds Plains and Weave Condition

Northbound off-ramps to Hammonds Plains (Ramps 1 and 4) are proposed to exit the highway prior to the Highway 113 ramps and would then combine with traffic from the Highway 113 bound for Hammonds Plains Road. This eliminates a weave situation on the Highway 102 main lanes and moves it to a lower speed 3-lane section of the combined ramps. An approximate length of 600m (bullnose to bullnose) is provided for this three-lane section which distributes traffic to eastbound and westbound Hammonds Plains Road (Ramp 1 and Ramp 4 respectively).

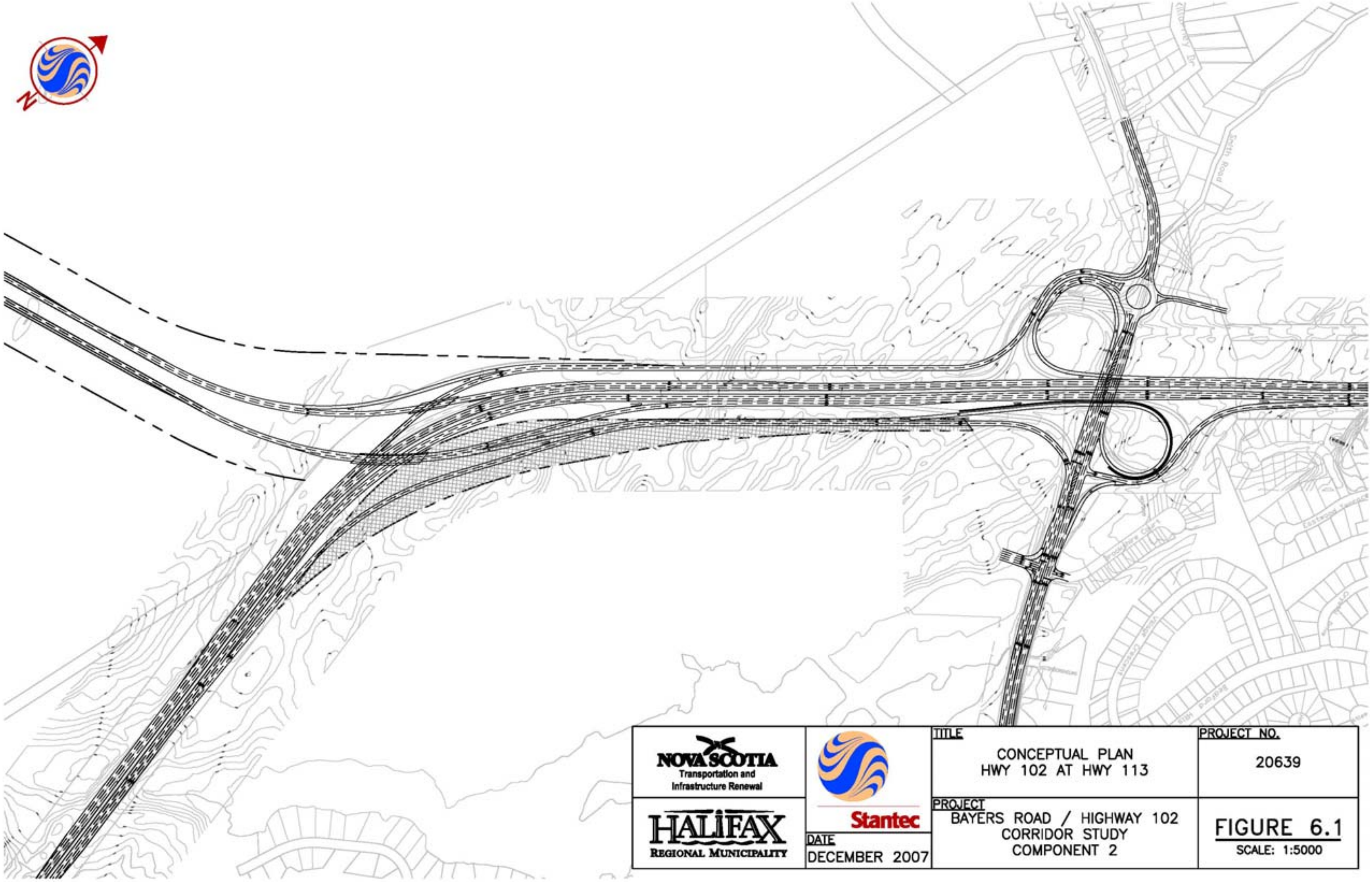
A potential re-alignment of Highway 113 was explored that would move the ramps away (southerly) from the Hammonds Plains interchange and introduce a horizontal curve on the 113 between the 102 and the Kearney Lake Road diamond interchange. The purpose of completing this review was to improve the weave distances between Hammonds Plains Road and Highway 113. However, the re-alignment of the Highway 113 outside of the right-of-way already identified was determined to have a severe impact on properties.

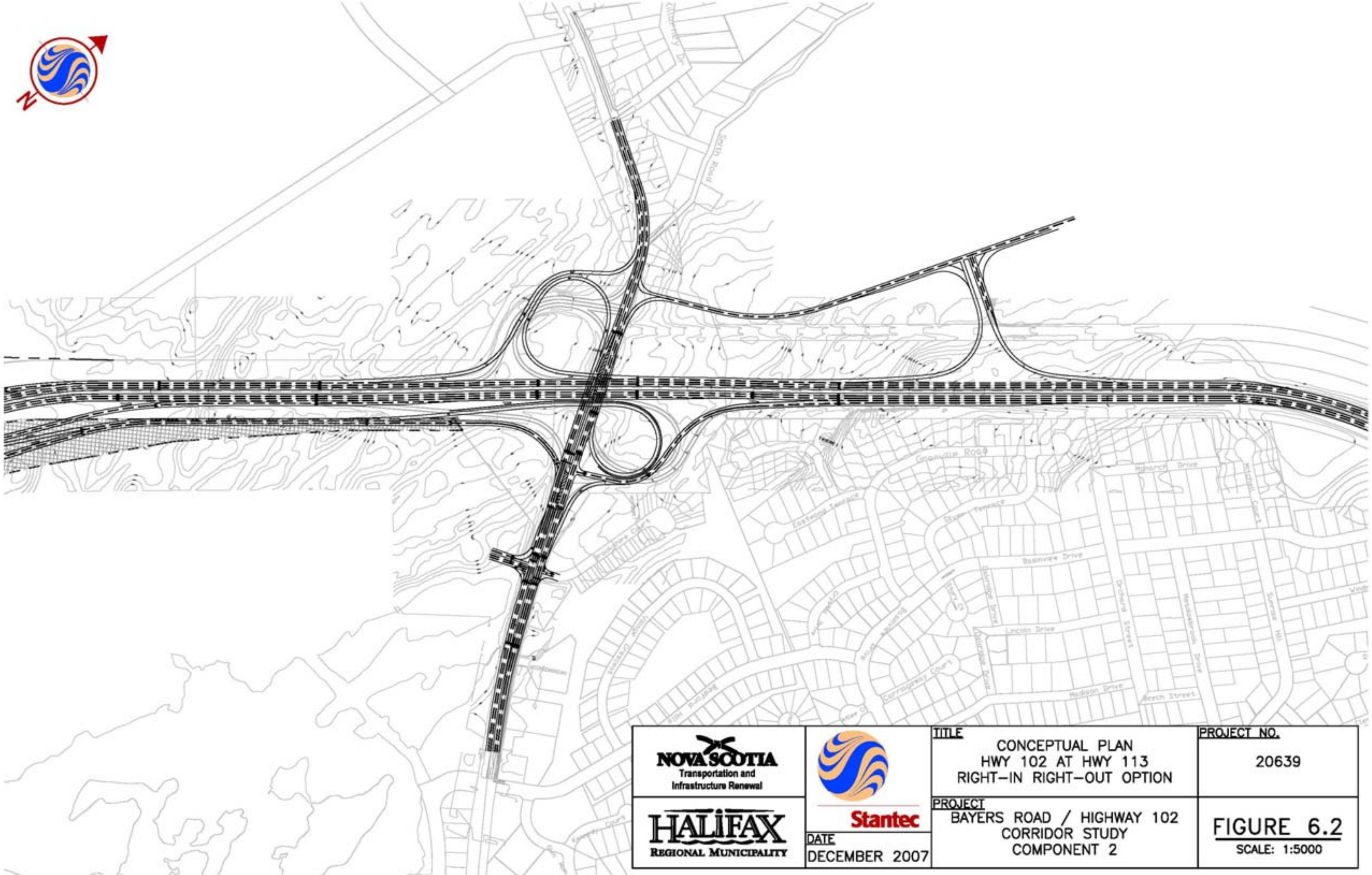
The conceptual plan (***Sheets 22 and 23 in Appendix I***) shows the weave distance on southbound 102 that results based on the fixed location of Highway 113 is approximately 700 m between bullnose locations. A detailed weave analysis will be required to determine if this distance will be acceptable. An alternate configuration has been prepared should the weave distance be unacceptable. ***Figure 6.1*** shows the southbound on-ramp as grade separated ("braided") with the Highway 113 ramps, eliminating the weave condition on the Highway 102 mainline. Similar to the northbound ramps as described above, a lower speed weave would occur on the southbound two-lane ramp section.

6.9.3 Hammonds Plains Road Design

Previous traffic analyses have concluded that turning movements between Hammonds Plains Road and the ramps as well as accesses to new proposed developments present a challenge for conceptual planning of the interchange. In addition, the Steering Committee requires that access to the lands in the northwest quadrant is required. The future Nine Mile Drive will provide access to the southeast quadrant and connect to Hammonds Plans Road opposite the existing Brookshire Court. The traffic analysis indicates a requirement for double and triple left turn movements at various locations.

During the development of the conceptual design, various options were considered. A right-in right-out access from the main line Highway 102 to the northwest quadrant was designed and presented to the steering committee as shown in ***Figure 6.2***. This was developed based on previous work done in the area which projected large volumes of westbound traffic turning left from Hammonds Plains to the southbound on-ramp (Ramp 3). The traffic projections were later confirmed in this study. The alternative allows free-flow movements at the right in right-out as well as the westerly intersection which would not require signalization. However, significant land acquisition would be required and the option was rejected. As a result the study team was tasked with providing a suitable design of a modern roundabout at the westerly intersection.


NOVA SCOTIA
Transportation and Infrastructure Renewal
HALIFAX
REGIONAL MUNICIPALITY
Stantec
DATE
DECEMBER 2007
TITLE
CONCEPTUAL PLAN
HWY 102 AT HWY 113
PROJECT
BAYERS ROAD / HIGHWAY 102
CORRIDOR STUDY
COMPONENT 2
PROJECT NO.
20639
FIGURE 6.1
SCALE: 1:5000


NOVA SCOTIA
Transportation and Infrastructure Renewal
HALIFAX
REGIONAL MUNICIPALITY
Stantec
DATE
DECEMBER 2007
TITLE
CONCEPTUAL PLAN
HWY 102 AT HWY 113
RIGHT-IN RIGHT-OUT OPTION
PROJECT
BAYERS ROAD / HIGHWAY 102
CORRIDOR STUDY
COMPONENT 2
PROJECT NO.
20639
FIGURE 6.2
SCALE: 1:5000

NSTIR conducted an analysis of a roundabout at the westerly intersection location and prepared a roundabout design for the westerly ramp intersection. The roundabout design was provided to the consulting team by NSTIR and added to the conceptual plan. The Steering Committee was advised regarding potential operational problems with the roundabout by the ultimate planning horizon. It is anticipated that by 2036 a three-lane roundabout would be required to accommodate the forecast volumes. As well, concerns were expressed regarding expected unbalanced flows which may result in undesirable queues and poor performance of the roundabout. The Steering Committee advised that the design as prepared by NSTIR would be carried forward in the study, acknowledging that the capacity and operation of the facility may present problems by the ultimate planning horizon and further detailed study would be required.

6.10 EXIT 4, BEDFORD INTERCHANGE HIGHWAY 102 / HIGHWAY 101

6.10.1 Exit 4 Existing Interchange

The Exit 4 area consists of essentially two separate interchanges. There is a full cloverleaf interchange between Highway 102 and the Bedford highway. It is located at the low point of Highway 102 adjacent to the Sackville River. The existing interchange configuration was shaped by the surrounding severe natural terrain and environmental features. The cloverleaf is characterized as having short weave distances.

In addition to the cloverleaf, the Bedford Bypass was constructed to provide direct access to Highway 101 from Windmill Road. This connection is a three level interchange with directional ramps providing access to Sackville Drive and Cobequid Road.

In addition to the safety concerns related to the weave distances within the cloverleaf, the projected traffic for the horizon year will require re-construction of specific ramps for the Exit 4 interchange

6.10.2 Exit 4 Interchange Plan

The proposed design for this interchange addressed in this section assumes a future connection of Highway 107 at the location of Exit 4C the Glendale/Duke Street interchange (Scenario B, as defined in Chapter 1). As previously noted, the design of this interchange for Scenario C (direct connection of the 107 at the Bedford Interchange) was studied in the Functional Design Workshop (Value Engineering Session) and is reviewed in **Chapter 7** of this report.

The following items are key in the re-design of the Bedford interchange for Scenario B:

- Projected traffic volumes for Ramp 7 suggest that a two lane ramp will be required in the horizon year.
- The corridor analysis recommends that six (6) core lanes are required for Highway 102 to the south of the Bedford interchange. From the Bedford interchange to the north, 4 core lanes are required.

- Criteria as provided by NSTIR stipulate that ramps between 100 series highways are to be free-flow ramps. Ramps between 100 series highways and Arterial Streets can incorporate signalized intersections. Highway 101, 102 and the Bedford Bypass require free flow movements to/from. The Bedford Highway is classified as an HRM Arterial roadway and signalized intersections are permitted at the ramp terminals.
- Full movements at all interchanges are desirable.

The interchange configuration as shown on ***Sheet 28 a, Appendix I*** (and in detail on sheets 28b to 29) was developed as a result of the above noted criteria. ***Figures 6.3 and 6.4*** show the ramp numbering system for the existing configuration (6.3) as well as the corresponding movement in the new configuration (6.4). The following is a summary of key features of the new interchange configuration:

- Ramp 7 is improved to a two lane ramp facility.
- Ramp 3 is reconstructed in the same location with improved geometry.
- To eliminate a weave section on the 101/Bedford highway, the existing loop ramp 4 is removed.
- Loop Ramp 6 is removed and a left turn is introduced to combine traffic with Ramp 2 to access Highway 102 southbound.
- Ramp 4, providing access to highway 102 from Highway 101 is replaced by a new ramp at the location of the Bedford Bypass.
- Given the new Ramp 7 on the westbound lanes of Highway 101, the Ramp 5 entrance results in an unacceptable weave to the exit for Sackville Drive. As a result, Ramp 5 is moved to access the extended Bedford Bypass lanes and is “braided” with a new ramp from the Bedford Bypass to Cobequid Road.
- New Structures are required at the Sackville River, the Bedford Highway and the Bedford Bypass. With the exception of the Sackville River crossing, the location of the new structure is “off-line” from the existing structure to facilitate staging of the construction.
- Given the proximity of the adjacent interchanges – Glendale/Duke Street and the superimposed Highway 107 interchange, ramps 4, 5 and 8 as described above will access a collector distributor system and is described in more detail in the next section.

Figure 6.3 – Exit 4 Existing Ramps

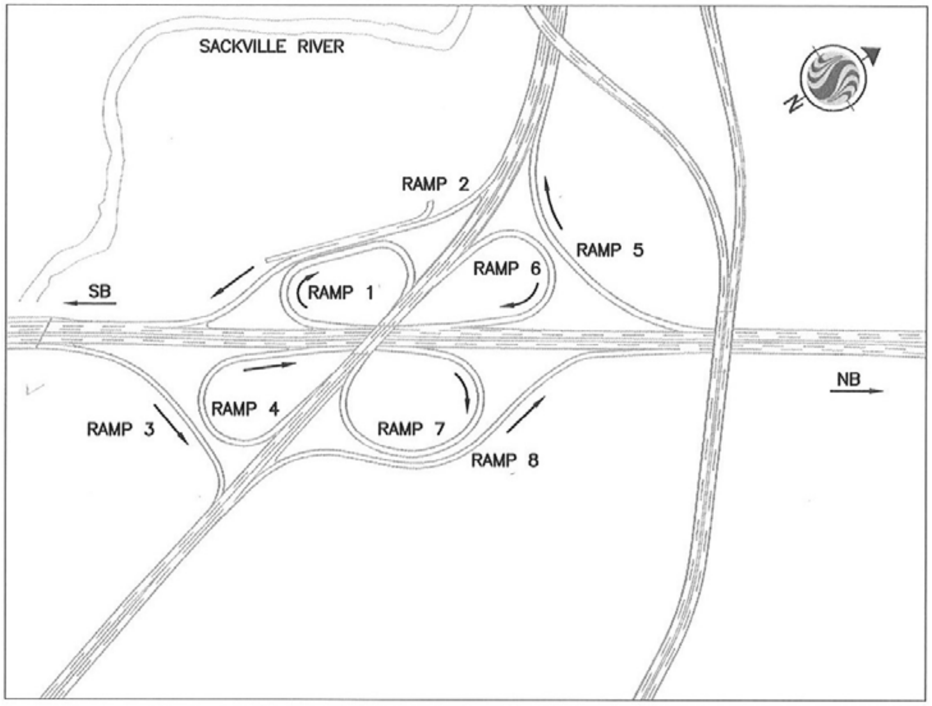
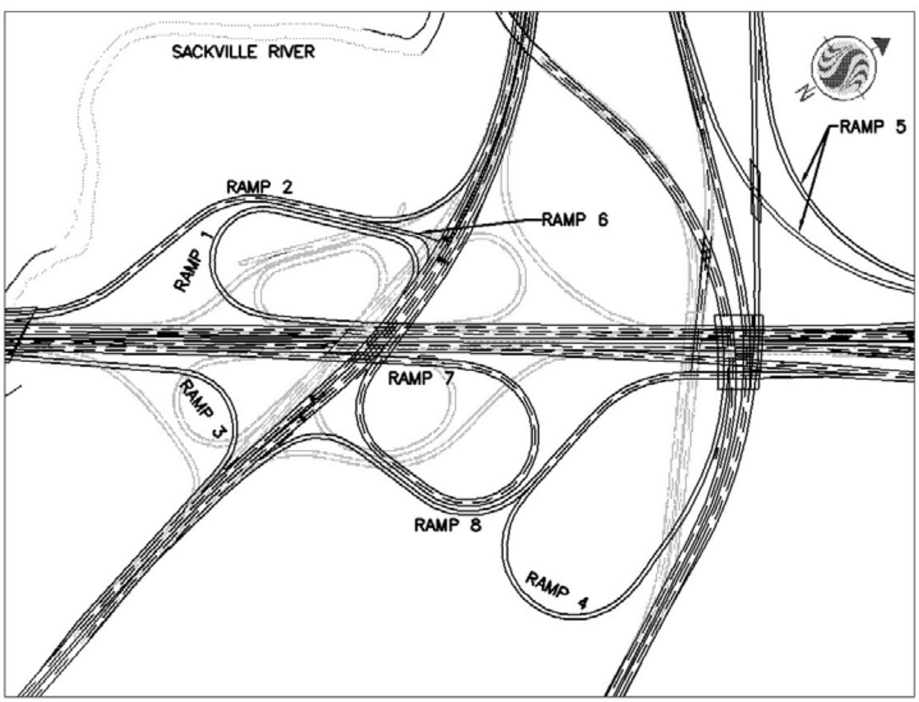


Figure 6.4 – Exit 4 New Ramps



In summary the ramps as labeled in ***Figure 6.3 and 6.4*** have been re-designed as summarized in ***Table 6.1***:

Table 6.1 : Summary of Exit 4 Ramps

Ramp No.	Description	Planning Volume vph	Replaced with
1	Hwy 101 / Hwy 102 SB to EB Off-Ramp	600	1 lane, same location, improved geometry
2+6	Hwy 101/Hwy 102 EB to SB On-Ramp, Hwy 101/Hwy 102 WB to SB On-Ramp	1600	2 lane, Ramp 6 combined with Ramp 2
3	Hwy 101/Hwy 102 NB to EB Off-Ramp	500	1 lane, same location, improved geometry
4	Hwy 101/Hwy 102 EB to NB On-Ramp	800	1 lane, moved to Bedford Bypass
5	Hwy 101/Hwy 102 SB to WB Off-Ramp	900	1 lane, moved to Bedford Bypass
7	Hwy 101/Hwy 102 NB to WB Off-Ramp	1300	2 lane, same location, improved geometry
8	Hwy 101/Hwy 102 WB to NB On-Ramp	400	1 lane, same location, improved geometry

6.11 EXIT 4C GLENDALE AND HIGHWAY 107 INTERCHANGE(S)

Exit 4C is a full movement diamond interchange –The easterly ramp terminal on Duke Street is signalized and currently there is a new development underway at the southeast quadrant. The interchange structure has been constructed to allow for additional auxiliary lanes on the freeway in anticipation of the possible future Highway 107 connection at this location. The addition of the Highway 107 ramps including a directional ramp for westbound to southbound Highway 107 traffic (left turning traffic) would essentially result in a three leg directional interchange between Highway 102 and Highway 107 that lies within the area of the Duke Street diamond interchange. The design for the Highway 107 connection at the 4C location was provided to the study team by NSTIR as it was previously designed in detail to allow the construction of the Glendale / Duke Street Interchange. The plans provided were incorporated into the drawings and shown on ***Sheets 30 and 31, Appendix I.***

6.12 EXIT 5, TRUNK 2 (LAKE THOMAS DRIVE)

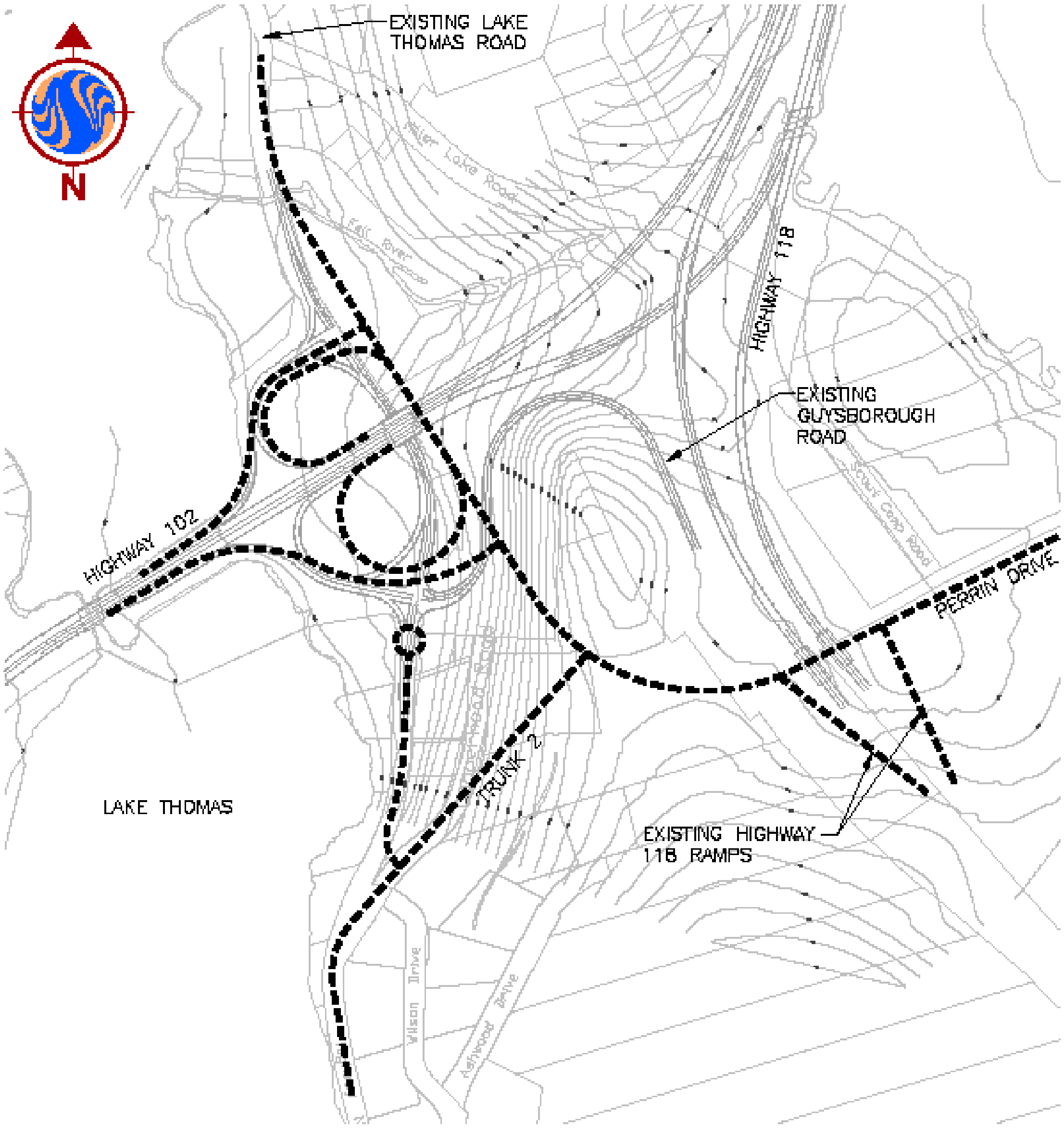
Exit 5 is an existing full movement Parclo AB Interchange. The interchange configuration was established within the constraints of the adjacent Lake Thomas (located to the south) and the Highway 102 merge with Highway 118. Properties adjacent to the interchange are developed, and therefore the potential to re-configure this interchange will be limited.

Trunk 2 is a rural highway linking Bedford and Fall River. To the north of the study area (towards Fall River), Trunk 2 is called Lake Thomas Drive. In addition to providing access to Highway 102, Trunk 2 facilitates access to Highway 118 via Guysborough Road to a partial diamond interchange at Perrin Drive. Trunk 2 is a two lane roadway with turning lanes developed through the interchange area. The northbound ramp terminal (easterly intersection) has recently (2007) been signalized. The existing and proposed changes for this area are shown on ***Sheet 39, Appendix I.***

Based on the traffic analysis, Trunk 2 / Lake Thomas Roads should be widened to a 6 lane section (at the structure) by horizon year 2036. Large volume turning movements at the easterly intersection reflect the traffic flow from Fall River to Highway 118. As a result, a five-lane section for Guysborough Road is required at the intersection. As a result of the natural terrain and land ownership, the existing Guysborough Road has a severe horizontal curve at the intersection. Given the expansion required in the future, an alternate alignment for Guysborough Road from Trunk 2 to Perrin Drive should be considered. It is acknowledged that this would result in significant property impacts and excavation (likely rock). However, an overall re-design of the area should be considered that would re-align Trunk 2/Lake to be continuous with Guysborough Road, consistent with the predominant traffic flow and more direct to Perrin Drive and Highway 118. However, the advantages of re-alignment to suit the traffic will need to be weighed against the loss in route continuity for Trunk 2. ***Figure 6.5*** is a sketch of a possible concept. Development of this concept is beyond the scope of this study.

Since expansion of Highway 102 is not proposed for this area, and relatively low volumes are projected for the Exit 5 ramps improvements to the Trunk 2/Lake Thomas Road ramps are not suggested. However, the deceleration and acceleration lengths for these ramps are identified as less than desirable. Widening of the highway to improve the auxiliary lanes results in impacts to the Lake and the bridge structure at the water crossing. Suggested lengthening of these lanes is shown on ***Sheet 39, Appendix I***. It is acknowledged that there are environmental impacts involved in this improvement. However, should an overall re-design of the area be considered, the ramp alignments could be improved (increased design speed) and longer acceleration/decelerations provided.

Figure 6.5 Alternate Configuration of Exit 5, Lake Thomas Interchange



7.0 Highway 107 Connection to Highway 102

7.1 INTRODUCTION

As noted in Section 1.2 "Objectives" for Component 2 – Highway 102 Upgrades, "a significant challenge for this component involves determining the location of the Highway 107 extension and the functional design of the Highway 107 interchange with Highway 102." The Terms of Reference has established the locations to be considered for the 107 connection including:

- Connection to the Duke Street Interchange (Exit 4C): NSTPW have developed functional plans for this connection point which have been incorporated into the study (and described in Section 6.11).
- Connection to the Highway 101/Highway 102 Interchange (Exit 4): Direct flow of traffic from Highway 107 to this interchange would allow efficient access to both Highway 101 and Highway 102, provided an acceptable connection can be achieved.

It was recognized at the outset that a connection at Exit 4 would be challenging given the existing network and terrain in the area. A four-day working session (the Value Engineer (VE) session) was held with NSTIR and HRM staff to capitalize on the experience and knowledge of the full Project Team. Various draft conceptual design options were developed through this session where recognized value engineering concepts were applied to the task.

The full report for the VE session was submitted to NSTIR following the VE process. It is identified as ***Appendix J*** and bound separately. The following is a summary of the session and results. The Value Engineering (VE) session was facilitated by Delphi-MRC and Lewis & Zimmerman Associates, Inc on behalf of Stantec for NSTIR and HRM.

7.2 BACKGROUND

Value Engineering (VE) is a systematic and function-based approach to improving the value of products, projects, or processes. VE involves a team of people following a structured process that helps team members communicate across boundaries, understand different perspectives, innovate, and analyze to improve performance, reliability, quality and safety. Simply put, VE improved value. On highway projects, improvements to value might include reducing the life cycle cost of an interchange, enhancing safety in a design, or reducing impacts to the public.

A VE workshop was held from September 10th to 14th 2007, in Halifax using a multidisciplinary team of transportation planning, highway and interchange design, road safety, construction management and structures professionals. As well representatives from DTIR and the HRM were in attendance. This VE workshop examined direct connections of the proposed Highway

107 extension with Highway 101 and the Bedford interchange on Highway 102 – Exit 4 to address the following objectives:

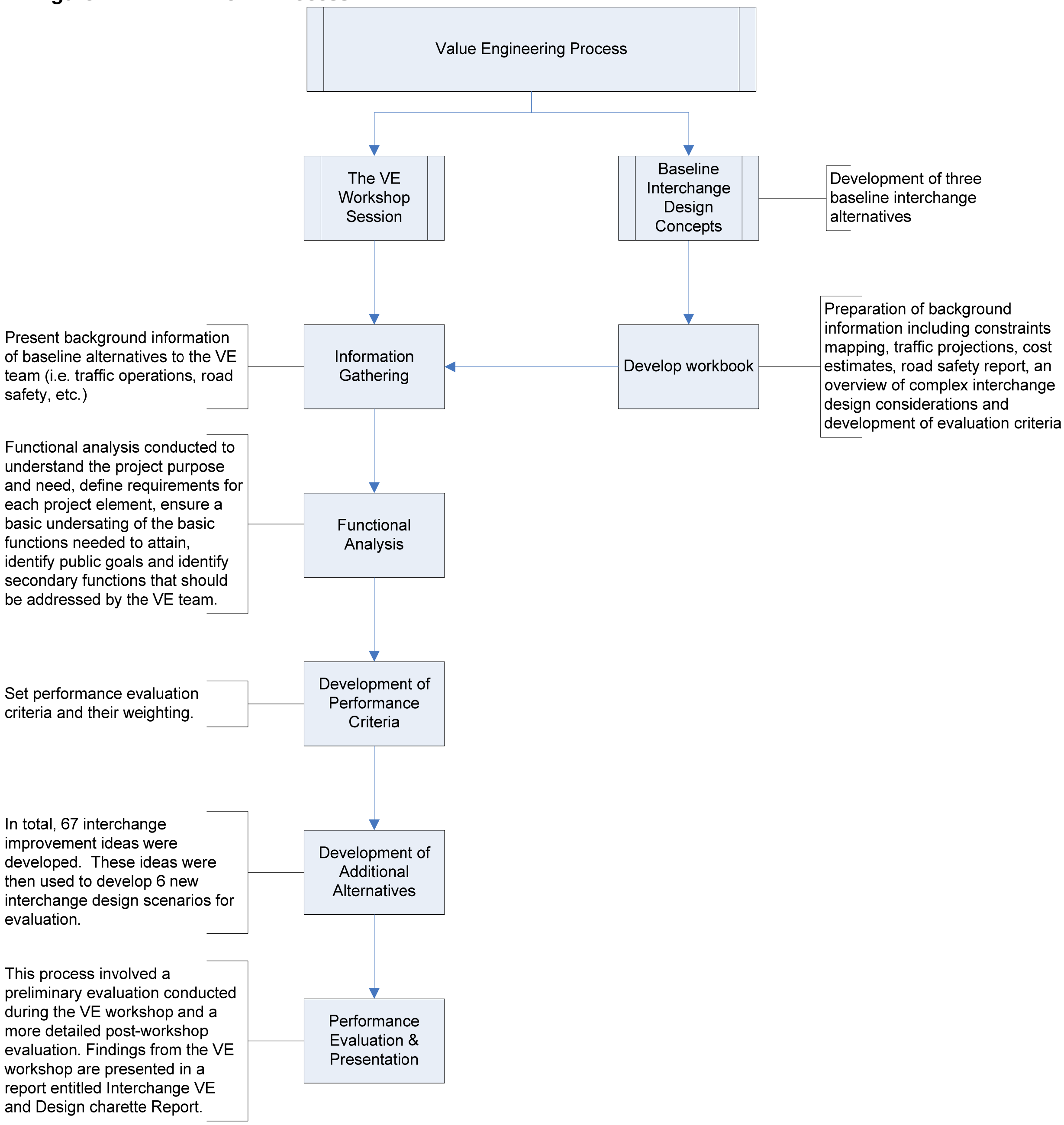
- Provide a remedy for the operational and safety deficiencies caused by the Exit 4 cloverleaf interchange design;
- Provide a linkage between the proposed Highway 107 extension to Highway 102 and Highway 101.

7.3 THE VE PROCESS

The goal of this VE workshop was to develop and evaluate a series of potential interchange configurations to identify candidates to carry forward to a functional design stage. At the start of the workshop, the VE team was presented with three interchange alternatives prepared by MRC. These alternatives were prepared to provide the VE team with a practical starting point upon which modifications could be made and alternate configurations could be explored.

The VE followed a structured thought process to develop and evaluate interchange options. This process is outlined in the following flow chart.

Figure 7.1: The VE Process



7.4 THE FINDINGS

Using the performance evaluation criteria and construction cost estimates developed during the VE workshop, the independent specialists of the VE Panel conducted a performance measurement review and prepared a detailed risk-based safety evaluation for each of the six scenarios developed during the VE workshop. The results of this evaluation are summarized in ***Table 7.1.***

Table 7.1: Final Performance Evaluation Matrix

	Scenario Description	Total Performance	% Performance Improvement	Initial Cost ($ millions)	Value Index (Perf/Cost)	% Value Improvement
1	Initial Design Concept A - Base Case	495	~	44.4	11	~
2	Initial Design Concept B	464	-6%	45.9	10	-9%
3	Initial Design Concept C	481	-3%	44.7	11	-3%
4	Scenario 1: Alt DCB-22 Cloverstack/Roundabout	227	-54%	90	3	-77%
5	Scenario 2: Alt DCB-1A, Alt DCB-1B, and Alt DCB-7	339	-32%	60.8	6	-50%
6	Scenario 3: Alt DCB-13 Cloverstack	239	-52%	89.7	3	-76%
7	Scenario 4: Alt DCC-8A Larger Ramp W of Hwy 102	582	18%	65.2	9	-20%
8	Scenario 5: Alt DCC-8B Variant of Scenario 6	465	-6%	77.1	6	-46%
9	Scenario 6: Alt DCB-14 Collector Distributor & Loop ramps	322	-35%	65.2	5	-56%

The performance criteria for each of the chosen VE design scenarios were compared to the original project performance rating to arrive at a total score. The difference between the score for each of the interchange design scenarios developed during the workshop (highlighted in green) and the score of the selected baseline concept (Alternative A) was expressed as a percentage. A positive value for the percent difference value indicates an improvement over the base case.

According to the criteria selection, weightings and the ratings established by the VE team, the project values are best achieved by the initial design Concept A (the base case). Of the design scenarios developed as part of the workshop, Scenario 4 provided improved performance with slightly degraded value due to a higher cost of implementation.

7.5 CONCLUDING THOUGHTS

This VE study developed and evaluated a series of potential interchange configurations to be carried forward to the functional design stage of this project. In no way is the output of the VE exercise intended to constrain NSTIR's choices or specific new alternatives it may wish to further develop and pursue for this location.

Rather the study findings are intended to provide decision makers with information on a group of candidate design alternatives and specific design elements that appeared to the independent specialists of the VE Panel to offer significant value based on the evaluation criteria and weightings established for the study. The results also identify advantages and limitations associated with all of the scenarios examined.

The findings of this work provide useful technical guidance to help support and nourish future design decisions as the study moves forward. In no way should the contents of the VE report be interpreted as an intention to drive the final design selection.

8.0 Public Information

8.1 INFORMATION SESSIONS

Public Information Sessions were held to explain the study and obtain information and feedback from local residents, businesses, and landowners. The public sessions were advertised in the Chronicle Herald, the Metro News, as well as the Burnside News. The project team members in attendance are listed in ***Table 8.1*** Elected officials as listed in ***Tables 8.2 and 8.3*** were invited by letter or e-mail. Based on the concept plans, a number of property owners were identified who might be directly impacted by the work and were invited to the sessions by letter. As well, meeting notices were delivered door to door for residents in the Bayers Road area.

Prior to the sessions, the study team discussed the format of the sessions and considered separate sessions with only specific information for the Bayers Road area, and then other sessions specific to the Highway 102 and Highway 107 areas. However, it was decided to present the study as it was conducted – as a single corridor where changes to specific sections may have an influence on the whole. The intent was to relay to the public how the corridor areas were linked. The full study scope was presented in different geographic areas with the understanding that concerns expressed would be more local to the attendees at particular sessions. There was considerable criticism of this approach especially from the Bayers Road residents who generally felt that the Highway 102 and Highway 107 work was irrelevant to their concerns. This was considered in the review of comments received.

The following sessions were held:

February Sessions

- Wednesday, February 11, 2009 at the St. Andrew's Centre, 6955 Bayer's Road, Halifax, from 6pm to 9pm with a presentation at 6:30pm
- Thursday, February 12, 2009 at the LeBrun Community Centre, 36 Holland Avenue, Bedford, from 6pm to 9pm with a presentation at 6:30pm.

Following the February sessions, two additional sessions were conducted in response to requests for better coverage of the Sackville and Burnside areas.

March Sessions

- Wednesday, March 25, 2009 at the Sackville High School, 1 Kingfisher Way, Lower Sackville, from 6pm to 9pm with a presentation at 6:30pm
- Thursday, March 26, 2009 at the Park Plaza Hotel and Conference Centre, Ramada Plaza, 240 Brownlow Avenue, Dartmouth, from 4pm to 6pm.

Stantec organized and conducted the sessions on behalf of NSTIR and HRM. Members of the consulting team as well as staff from NSTIR and HRM attended the sessions to answer questions.

The following people from the study team attended:

Table 8.1 Project Team in Attendance

NSTIR and HRM	
Dwayne Cross	NSTIR, Steering Committee Chair
Mike Croft	NSTIR
Brian Ward	NSTIR
Dave McCusker	HRM
Consulting Team	
Bernadette Landry P.Eng.	Stantec Project Manager
James Copeland, P.Eng	Delphi – MRC Traffic Analysis Manager
Patrick Chouinard, P.Eng	Stantec Highway Design Technical Advisor
Gerry Boulos	Stantec Presenter

Table 8.2 Provincial MLAs Invited

Barry Barnet	Hammonds Plains – Upper Sackville
Len Goucher	Bedford – Birch Cove
David Wilson	Sackville - Cobequid
Graham Steele	Halifax, Fairview
Howard Epstein	Halifax, Chebucto
Percy Paris	Waverly – Fall River – Beaver Bank
Diana Whalen	Halifax, Clayton Park
Trevor Zinck	Dartmouth North

Table 8.3 Halifax Regional Municipality Councilors Invited

Steve Streatch	Dist 1
Barry Dalrymple	Dist 2
David Hendsbee	Dist 3
Lorelei Nicoll	Dist 4
Gloria McCluskey	Dist 5
Andrew Younger	Dist 6
Bill Karsten	Dist 7
Jackie Barkhouse	Dist 8
Jim Smith	Dist 9
Mary Wile	Dist 10
Jerry Blumenthal	Dist 11
Dawn Sloane	Dist 12
Sue Uteck	Dist 13
Jennifer Watts	Dist 14
Russell Walker	Dist 15
Debbie Hum	Dist 16

Linda Mosher	Dist 17
Stephen Adams	Dist 18
Brad Johns	Dist 19
Bob Harvey	Dist 20
Tim Outhit	Dist 21
Reg Rankin	Dist 22
Peter Lund	Dist 23

8.2 PRESENTATION MATERIAL

The presentation material at all the sessions included:

- The Bayers Road / Highway 102 concept drawings as presented in ***Appendix I*** of this report including:
  - 1:1000 scale functional design drawings for Bayers Road showing the existing as well as the ultimate build out for the facility in the 2036 horizon year.
  - 1:5000 scale functional design drawings for the Bayers Road - Highway 102 Corridor showing the existing as well as the ultimate build out for the facility (2036 horizon year). These plans showed the existing as well as the proposed configuration of each interchange and intersection within the corridor.
  - Constraints plans as contained in ***Appendix B*** of this report.
- Design drawings for the new Highway 107 Extension (included in the component 3 report) including:
  - 1:5000 scale functional design drawings for the new Highway 107 Extension showing the ultimate build out for the facility in the 2036 horizon year and the proposed connections at Highway 102
  - Constraints plans showing developed land and natural features
  - 1:5000 scale functional design drawings for the new Highway 107 Extension showing the proposed three phases to achieve the ultimate build-out.

In addition to the functional plans, a fact sheet explaining the purpose of the study and the results of the traffic analysis was available for distribution to attendees. Questionnaires were available for attendees to voice their opinion. Samples of the fact sheet, questionnaires and letters of invite are in ***Appendix K.*** In addition to the maps presented a power-point presentation was made to explain the purpose and process of the study. A copy of the presentation slides is also in ***Appendix K***. Following the power-point presentation; the attendees had an opportunity to ask questions of the study team.

8.3 SUMMARY OF FEBRUARY 11, 2009 SESSION

For the February 11th session (the Bayers Road meeting) there were 143 persons who signed the guest book. The vast majority were from the immediate Bayers Road neighbourhood or the peninsula. From those who indicated their address on the guest book, more than 90% were from the peninsula. Our greeters at the door provided each attendee with a fact sheet, map and questionnaire, which were collected at the end of the session. The following is a summary of the feedback received:

<u>Hard – Copy Comment Sheets Received</u>

- 18 comment sheets were deposited in the box at the Information Session on February 11, 2009.
- An additional 21 comment sheets were later mailed or faxed to Stantec. Of the comment sheets that were mailed, only 2 were from the Bedford / Sackville area. The rest were from the Bayers Road area. Therefore, it can be assumed that most of the mailed-in or faxed comments were from people who attended the Bayers Road meeting (February 11th meeting). Therefore, approximately 37 out of the 143 persons attending the February 11th session provided written comments (26%).
- The comment sheet responses are summarized in ***Table K-1*** in ***Appendix K***. Responses 1 through 41.

<u>Question and Answer Periods</u>

- 24 persons presented their concerns and / or asked questions of the panel at the meeting.
- The comments and questions are summarized in ***Appendix K***.

<u>Some Key Concerns Expressed / Questions Asked</u>

- Comment: *The presentation was far too technical for the audience.*
- Comment: *The presentation should be focused on Bayers Road only.*
- **Q:** ***How are property owners who would be directly impacted by the construction compensated?***
  A: Homeowners would receive a sum per square foot for their property as a sum for injurious affection. Both HRM and NSTIR have a process that is followed for the purchase of properties or partial properties.
- ***Q: What about compensation for properties in the vicinity that are not directly impacted by construction?***
  A: Homeowners that are not directly impacted will not be compensated.

- ***Q: What is the timeline for construction?***
  A: The study estimates the time when expansions in certain sections of the study area would be required based on growth projections. However, when projects are done depends on many more factors including funding and political decisions. No funding for Bayers Road / Highway 102 projects is allocated for the next five years.

- ***Q: What happens after this study?***
  A: The study has been done to provide a framework for future and on-going work – including further study for more localized areas. For example, the Larry Uteck interchange is now being planned and designed and the results of this study feed into the planning of that connection.

- **Q*: What is the cost of construction?***
  A: Approximate (ball park) costs for the construction will be included in the final reports.

- **Q*: Why not improve transit instead of widening Bayers Road?***
  A: This study accounts for a percentage of transit ridership. This is based on what was included in the Regional Plan which includes a significant projected increase in transit ridership. As well, HRM has allocated funding for transit initiatives.

- **Q*: What is the impact of allowing more traffic on the peninsula? Where will they park?***
  A: The Regional Plan allows for employment growth on the peninsula. As well the Regional Plan allows for a population growth of 18,000 on the peninsula.
  The employment growth on the peninsula results in more trips to the peninsula. Following the regional planning exercise, the previous plan to expand other roadways was changed. However, the need to widen Bayers Road was not changed and has always been part of the Regional Plan. On the peninsula, beyond Bayers Road, the 25 year planning indicates that existing roads have adequate lane capacity, notwithstanding that localized expansions may be required (such as turning lanes, etc.).

- **Q*: What about the increase in greenhouse gasses due to the increase in traffic? Has this been considered?***
  A: The study has not included an analysis of green house gas emissions. However, the regional plan has studied this. The long term projected increase in transit ridership results in an over reduction in greenhouse gasses.

- **Q*: Congestion is not so bad, so why is this project required?***
  A: The widening is not intended to reduce existing travel times or improve the flow of traffic. The expansion in the future is required to maintain the current level of service so conditions do not degrade further.

- ***Q: What about Pedestrian, Bicycles, Community and Neighbourhood Issues?***
  A: The Study focused on vehicular traffic to determine the lanes required in the corridor. Pedestrian, bicycle and neighborhood access issues were addressed at a high level and included grade separated pedestrian crossings at Romans Avenue and other locations

along Highway 102 as were suggested in HRM's Active Transportation Plan. It is acknowledged that additional work will be required at a more detailed level to address these issues. This is a concept level study.

8.4 SUMMARY OF FEBRUARY 12, 2009 SESSION

At the February 12th session, 31 persons signed the guest book. The majority of these attendees were from the Bedford and/or Sackville area. Again, our greeters at the door provided each attendee with a fact sheet, map and questionnaire, which were collected at the end of the session.

Hard – Copy Comment Sheets Received

- 9 comment sheets were deposited in the box at the Information Session on February 12, 2009.
- The comment sheet responses are summarized in ***Table K-2*** in ***Appendix K***.

Question and Answer Periods

- 24 persons presented their concerns and / or asked questions of the panel.
- The comments and questions are summarized in ***Appendix K***.

Some Key Concerns Expressed / Questions Asked (in addition to February 11, 2009 list)

- ***Q: The Burnside Bypass is needed and overdue, but the phasing is a concern. Why not go directly to Phase 3?***
  A: the phasing will make this a better candidate project for funding

- **Q:** ***Is the Atlantic Gateway motivating this?***
  A: The current plan is to locate an inland terminal close to the proposed Akerley interchange. The new roadway would provide service to Halifax Inland Terminal

- **Q:** ***The money for highways should be spent on paths and bikeways. Will there be a walkway?***
  A: Details for trails and pedestrian access have note been worked out yet, but it is anticipate that the new highway 107 will include a multi-purpose trail in the corridor.

8.5 SUMMARY OF MARCH 25, 2009 SESSION

At the March 25, 2009 session, 43 persons signed the guest book. The majority of these attendees were from the Bedford, Sackville or Fall River areas. Attendees were provided with a fact sheet, map and questionnaire, which were collected at the end of the session.

Hard – Copy Comment Sheets Received

- 12 comment sheets were deposited in the box at the Information Session on March 25, 2009.
- The comment sheet responses are summarized in ***Table K-2*** in ***Appendix K***.

Question and Answer Periods

- 13 persons presented their concerns and / or asked questions of the panel.
- The comments and questions are summarized in ***Appendix K***.

Some Key Concerns Expressed / Questions Asked

- **Q:** ***Natural areas adjacent to Highway 102 should be preserved.***
  A: There are private landowners adjacent to the Highway, where preservation of the natural features may not be possible. There is some opportunity to preserve lands in the Kearney Lake area.
- ***Q: How much traffic can the lights at Glendale handle? Where is the majority of traffic projected to go?***
  A: There are two sets of lights. The supplementary modeling looked at this. Based on the model, the system reaches capacity by year 2026.
  The majority of traffic is projected to take the 107 to the 102 and then to the 101.
- **Q.** ***What about the option to take the 107 directly into the cloverleaf – exit 4. Much of the traffic is going to the 101. What about the 107 connecting to the Bedford Bypass?***
  A: Extensive exercise was undertaken to look at this option. The connection to Exit 4 would be a very complicated, 3 level interchange. A technically suitable connection was not achieved in the study

8.6 SUMMARY OF MARCH 26, 2009 SESSION

The format of the March 26,' 2009 session was changed from the three preceding sessions. Since representatives of the business community were expected, the session was held as an open house from 4pm to 6pm. Forty-four persons signed the guest book. While there was no formal presentation, the power-point, as well as all the display material, was available. Attendees were also provided with a fact sheet, map and questionnaire. There were no written comments received at this session. Most of the attendees were interested in the new Highway 107 construction and considered it a benefit for the Burnside area.

8.7 QUESTIONNAIRE RESULTS

8.7.1 Format of the Questionnaire

The questionnaire was developed based on a format used by NSTIR for past projects. The form is included in ***Appendix K.*** The following was on the form:

- Asked attendees to rank their priorities with respect to Local Business, Natural Resources, Community Life, Property, Environment, Health and Safety
- Provided 6 statements with respect to the project and asked attendees to indicate agreement or disagreement with the statements.
- Provided 3 statements regarding the public session in order to gauge the success of the session in relaying the study information.
- Provided opportunity to provide additional comments

8.7.2 Questionnaire Results

As previously noted, the study team gave consideration to presenting only individual components to individual communities, However, it was decided to present the study as it was conducted – as a single corridor, which was not received well by the Bayers Road community. This may be considered a lesson learned. Also from the questionnaires and comments received, it may be inferred that the public are commenting on essentially opposite ends of the project (i) Bayers Road and (ii) Highway 107. As a result the questionnaires were collated to reflect this division. In effect, the Bayers Road comments are collated as one unit (***Table K-1***) and the Highway 107 comments are collated as a separate unit (***Table K-2***)

The tables are a color-coded compilation of the responses to visually display the level of agreement or disagreement with the project. The pink color represents agreement and gray tone represents disagreement. The following observations are made:

- ***Table K-1*** shows responses 1-41, which were received at the February 11, 2009 meeting or shortly following the meeting. They are primarily residents of the Bayers Road area (including adjacent streets or peninsula residents)
  - Property impacts and Community Life are clearly the main concerns (76% and 52% respectively indicated this as their primary concern).
  - The majority of who provided comments at the February 11th session disagreed with the project. It is assumed that this disagreement applies primarily to the Bayers Road component.
- ***Table K-2*** shows responses 42-63 which were received at the February 12, 2009 and the March 25, 2009 sessions are primarily Bedford and Sackville residents.
  - Health and Safety was indicated most often as the number one priority (47%)
  - The majority of those who provided comments at the February 12, 2009 and March 25, 2009 sessions agree with the project.

8.8 SUMMARY

As a result of the public input received and subsequent discussions with the steering committee, the following changes to the plans are considered appropriate:

- Revise the "transition area" of Bayers Road to bring the inbound lanes adjacent to the outbound lanes, which would cause less disruption to properties and improve access to the Ralston, Wellington Row properties by re-joining these streets to the larger residential neighbourhood.

- Revise the Bayers Road design in the area of the Halifax Shopping Centre to provide for all widening on the outbound side of the road.

In addition to the above, careful consideration of the Highway 107 phase 1 is required. This phase would direct traffic directly to Glendale from the new Highway 107 and this has been identified as a primary concern.

9.0 Summary and Conclusions

9.1 PROPERTY IMPACTS

Property impacts at various areas in the corridor are discussed in **Chapter 6.0**, as a primary factor in the development of the concept design. The concept plans in ***Appendix I*** show the properties which may be impacted by construction. The approximate area of impact is shown (hatched). As well, individual properties are numbered. This information along with HRM GIS data base information was used to notify these property owners of the public information session as described in **Chapter 8.0**. An estimated 90 properties along the Bayers Road Corridor would be directly impacted by the construction. A further 42 properties along the Highway 102 corridor would be directly impacted.

9.2 OPINION OF PROBABLE COST

9.2.1 Basis for the Costing

For planning and phasing purposes, TPW and HRM need to be aware of the approximate capital cost expenditures required to complete the highway improvements including roadworks and structures. Based on the functional designs that have been completed, the design team prepared an opinion of capital costs for the major components of construction. Costs are identified for each phase of the project, and identified in present day (2009) dollars. The opinion of capital cost expenditures have been projected based on the following:

- The team developed preliminary quantity estimates for major cost items such as granulars, pavement, structures, and earthworks for the infrastructure expansions in the corridor.
- Historical construction unit costs were used to develop “cost per unit” rates that were applied to major work categories such as kilometers of roadway and square meters of structure.
- Allowances for other major cost items such as intersection signals were included
- The resulting costs were then increased by an applied percentage to account for miscellaneous items.

We understand that the costing may be used for planning and decision making and the basis of funding and approval processes. However, it must also be understood that, while we use information available to us combined with our judgment and past experience, the specific rationale and conditions forming the basis of contractors' bids, material or equipment pricing, are beyond our knowledge and control. An unknown source stated:

> "*An estimate is an attempt to project what someone else will be willing to contract for in the future to do construction work which has not yet been defined and which is subject to changes in scope, design, and market conditions".*

In addition to scope, design and market conditions, scheduling, phasing, and many other factors will affect the cost of a project. Therefore, the costing in this report is no more than our "opinion" as to what the final costs may be. The basis of our opinion of probable costs and some of the key limitations are noted in the next sections.

9.2.2 Provisional Amounts

Provisional amounts, expressed as a percentage of the construction cost, are added to account for project items that cannot be accurately defined due to insufficient information. The value of the provisional amounts is subject to approval by NSTIR. However, the provisions should not be confused with the accuracy of the estimate. Provisions are expected to be spent. They are to allow for costs for items that will be encountered but are unknown or impossible to accurately estimate at this time. Provisional costs typically include:

- Engineering Costs
- Miscellaneous: Items such as landscaping, signage, culverts and other minor components of construction that have not been determined in the concept design.
- Design Contingency: allowance for unknown factors and changes to the design as the project is better defined.

At this time, engineering costs and design contingencies have not been included in the reported costs. NSTIR is advised to allow for these items in their capital planning as appropriate.

9.2.3 Summary of Highway 102 Corridor Costs

Appendix L contains tables which show the unit costs that were used as well as the projected cost for each component of the corridor improvements. ***Table 9.1*** is an overall summary of the approximate costs for expansions and changes within the Highway 102 corridor.

Table 9.1 - Cost Summary Table

Section	Location	Approximate Cost
	BAYERS ROAD	
1.0	Bayers Road - Windsor Street to Connaught Avenue	$ 2,000,000
2.0	Bayers Road - Connaught Avenue to Roman's Avenue	$ 4,000,000
3.0	Bayers Road - Roman's Avenue To Ashburn Avenue (Transition Section)	$10,000,000
	SECTION 4	
4.1	Interchange: Joseph Howe Drive	$23,000,000
4.2	Highway 102 from Joseph Howe Drive to Northwest Arm Drive	$ 5,000,000
4.3	Interchange: Northwest Arm Drive	$11,000,000
	SECTION 5	
5.1	Highway 102 from Northwest Arm Drive to Highway 103	$ 3,000,000
5.2	Interchange: Highway 103	$20,000,000

Section	Location	Approximate Cost
	SECTION 6	
6.1	Highway 102 from Highway 103 to Lacewood Drive	$13,000,000
6.2	Interchange: Lacewood Drive	$ 3,000,000
	SECTION 7	
7.1	Highway 102 from Lacewood Drive to Kearney Lake Road	$14,000,000
7.2	Interchange: Kearney Lake	$12,000,000
	SECTION 8	
8.1	Highway 102 from Kearney Lake Road to Larry Uteck Drive	$10,000,000
8.2	Interchange: Larry Uteck Drive	$ 9,000,000
	SECTION 9	
9.1	Highway 102 from Larry Uteck Drive to Highway 113	$ 7,000,000
9.2	Interchange: Highway 113	$11,000,000
	SECTION 10	
10.1	Highway 102 from Highway 113 to Hammonds Plains Road	$ 7,000,000
10.2	Interchange: Hammonds Plains Road	$21,000,000
	SECTION 11	
11.1	Highway 102 from Hammonds Plains Road to Bedford Highway	$34,000,000
11.2	Bedford Exit 4 Interchange (Option 1 Costing)	$38,000,000
	SECTION 12	
12.1	Highway 102 from Bedford Highway to Glendale Drive	$ 7,000,000
12.2	Interchange: Glendale / Duke	$0
12.3	Interchange: Highway 107 at Exit 4C (Option 1 Costing)	$14,000,000
	SECTION 13	
13.1	Highway 102 from Glendale to Trunk 2	$ 8,000,000
13.2	Interchange: Trunk 2 at Fall River	$ 6,000,000
	Approximate Total Cost	$292,000,000

9.2.4 Limitations of the Opinion of Probable Cost

The costs have been developed based on the limited information available as well as historical information. This is an order of magnitude estimate. The following items are key limitations in the costs:

- Accuracy of the mapping.
- Potential for design changes based on unknown factors.
- Schedule and phasing of the up-grades.
- Market conditions at the time of tendering.

In addition the following has not been considered in the costing:

- Property acquisition costs
- Utility relocation costs

- Taxes
- Engineering Costs
- Design Contingencies

Stantec does not guarantee the accuracy of this opinion of probable cost. The actual final cost of the project will be determined through the bidding and construction process.

9.3 INFRASTRUCTURE IMPLEMENTATION SCHEDULE

9.3.1 Timeline for Expansions

Component 1 of this study provided the forecast number of mainline lanes required for the Highway 102 corridor. In Component 2, the study area ramps and intersections were analyzed for each of the 2016, 2026 and 2036 planning horizons. The ***Appendix I*** concept drawings are based on the full build-out of the facility to the 2036 horizon. Based on this information, a conceptual timeline for the expansions has been determined and shown in ***Table 9.2***. This approximate timeline shows the roadway components as noted in ***Table 9.2***. In addition to comments provided in the table, the following is noted:

- The interchanges will have to be upgraded before any Hwy 102 widening can occur given that the old structures are tight to the roadway.
- An approximate 2 year time frame is assumed for each component of the work.
- The timing for the Bayers Road widening is adjusted to correspond with the proposed widening on Hwy 102.
- Highway 102 from Joseph Howe to NW Arm widening may be required to 8 lanes in 2035/2036. This has not been shown in the timeline or accounted for in the costing.

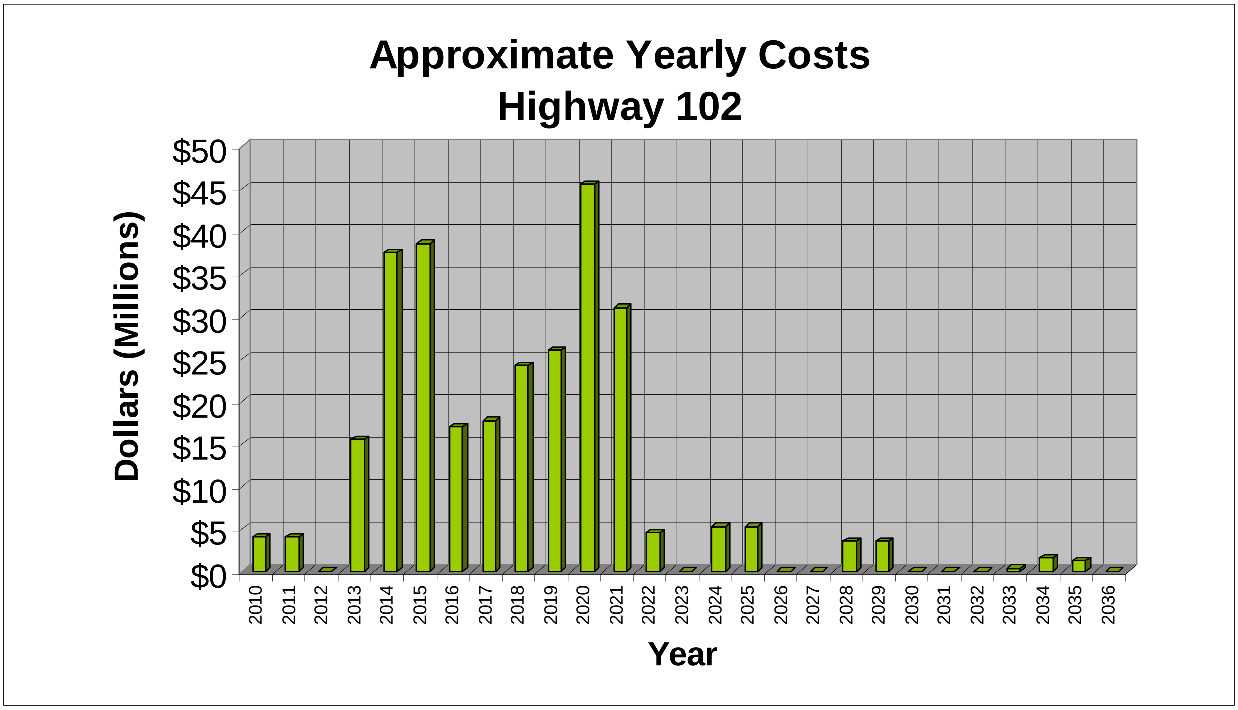
Table 9.2 Timelines

		Horizon Year 2016							Horizon Year 2026										Horizon Year 2036										
No.	Location	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	Notes
	BAYERS ROAD																												
1.0	Windsor St. to Connaught Ave.							■	■																				Timing not an issue as there is no new capacity added
2.0	Connaught Ave.to Roman's Ave.					■	■																						Timing dependent on Hwy 102 upgrades (Sections 4 and 5)
3.0	Roman's To Ashburn					■	■																						
	SECTION 4																												
4.1	Interchange: Joe Howe					■	■																						
4.2	102 from Joe Howe to NW Arm					■	■																						
4.3	Interchange: NW Arm				■	■																							Upgrade interchange with Hwy 103 interchange
	SECTION 5																												
5.1	102 from NW Arm to 103					■	■																						Upgrade Hwy 102 with Hwy 103 interchange
5.2	Interchange: Highway 103				■	■																							Key interchange in corridor, needs ramp widening
	SECTION 6																												
6.1	102 from 103 to Lacewood								■	■																			
6.2	Interchange: Lacewood								■	■		Ramps										Regency Int.			■	■			
	SECTION 7																												
7.1	102 - Lacewood to Kearney Lake									■	■																		
7.2	Interchange: Kearney Lake						■	■																					Intersection widening requires structure upgrade
	SECTION 8																												
8.1	102 - Kearney Lake to Larry Uteck												■	■															
8.2	Interchange: Larry Uteck	■	■																										
	SECTION 9																												
9.1	102 from Larry Uteck to 113																			■	■								Deferred due to demand between 113 and 101
9.2	Interchange: Highway 113								■	■																			Upgrades carried out after HPR upgrades
	SECTION 10																												
10.1	102 from 113 to H. Plains Road								■	■																			Upgrades carried out after HPR upgrades
10.2	Interchange: H Plains Road						■	■																					Intersection widening requires structure upgrade
	SECTION 11																												
11.1	102 from H Plains to Bed. Hwy											■	■																Timing will depend on completion of Hwy 107
11.2	Bedford Exit 4 Interchange										■	■																	Exit 4 ramps require upgrading first
	SECTION 12																												
12.1	102 from Bed. Hwy to Glendale											■	■																Exit 4 to Exit 4C occurs at same time
12.2	Interchange: Glendale / Duke											■	■																
12.3	Interchange: 107 at Exit 4C											■	■																
	SECTION 13																												
13.1	102 from Glendale to Trunk 2															■	■												No new capacity added, minor work
13.2	Interchange: Tr. 2 at Fall River															■	■									■	■		2 separate intersection upgrades required

9.3.2 Approximate Yearly Costs

Based on the approximate costs for each component of the project and the projected timeline, the following ***Figure 9.1*** shows the resulting yearly costs.

Figure 9.1 Approximate Yearly Costs – Highway 102



9.4 A COMPARATIVE REVIEW AND ULTIMATE CAPACITY FORECAST

Infrastructure upgrades to the Highway 102 / Bayers Road corridor were identified in the functional design workshop and the infrastructure needs assessment tasks. These upgrades were then incorporated into the design drawings. At the request of NSTIR the following tasks were carried out:

- The final upgrades were fed back into the transportation demand model. This yielded a new roadway model that reflected the final design and was termed the proposed ultimate lane configuration.
- The modeling software was then executed to determine an estimated point in time when the capacity of the corridor would be reached.

The 2036 corridor modeling results have been displayed in a graphical format and shown with the initial Scenario B roadway network. This type of comparison provides a 'before' and 'after' display of results with the Scenario B network representing the 'before' condition and the proposed ultimate lane configuration representing the 'after' condition. The results are shown in ***Figures 9.2 and 9.3*** for the 2036 AM and PM peaks, respectively.

Figure 9.2: 2036 Horizon AM Peak Results

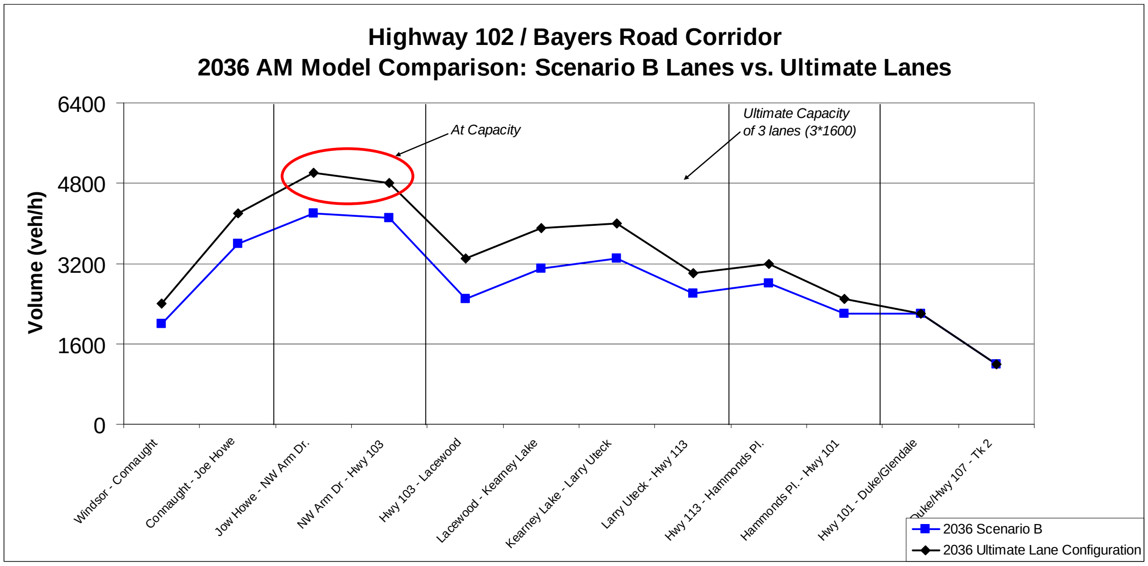
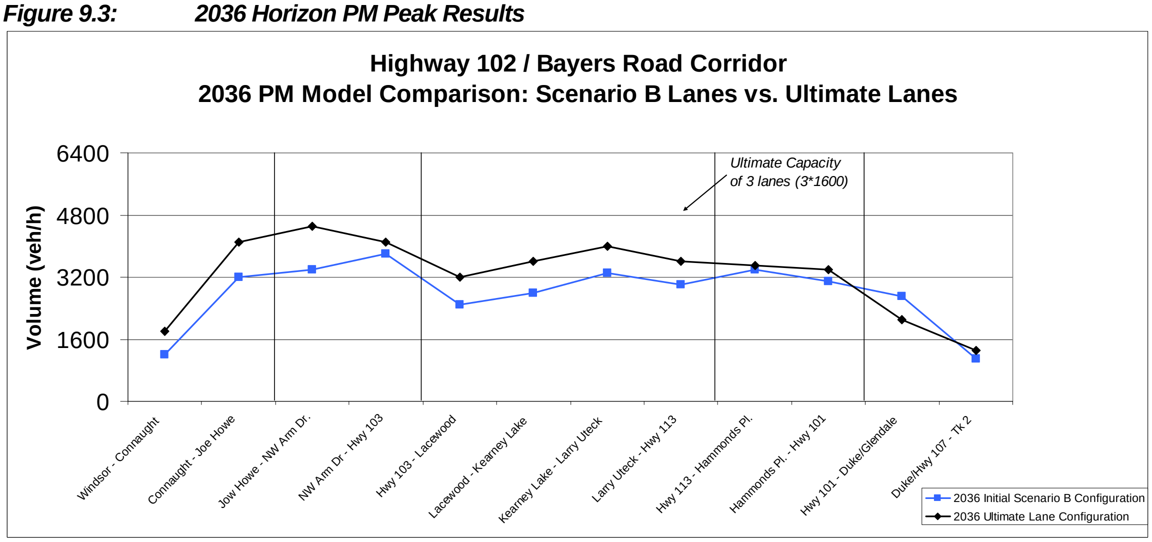


Figure 9.3: 2036 Horizon PM Peak Results



Bayers Road is shown on the left of the graphs and the north end of Highway 102 is shown to the right. The ultimate lane capacities established by the Project Steering Committee are used to demonstrate the volume to capacity ratios for each mid-block section of the corridor. The black line with diamond symbols represents the proposed design roadway and the blue line with square symbols represents the initial Scenario B roadway.

As expected there is a slight increase in demand with the proposed ultimate lane configuration network compared to the initial Scenario B roadway network. All of the midblock sections continue to function with a volume-to-capacity (v/c) ratio of less than 1.0 with the exception of the Joseph Howe-to-Northwest Arm Drive section during the weekday AM peak hour. This section is forecast to operate at capacity with a v/c ratio of 1.04 by the 2036 planning horizon. We recommend that this section of the corridor be monitored into the future. As discussed in earlier sections of this report there may be opportunities to defer the widening of the corridor beyond 6 lanes (three lanes in each direction) through the success of public transit initiatives or the introduction of high occupancy vehicle lanes.

The final step in this task was to determine the point in time when each section of the corridor may reach capacity – if there was residual capacity remaining. We applied an average growth rate of 1.6% per annum (based on the modeled traffic growth from 2001 to 2036) to calculate the results. The results are contained in ***Table 9.3***.

Table 9.3: Capacity timetable beyond 2036 using a 1.6% yearly growth

	2036 Ultimate Lane Configuration						
Description	**AM Peak Volumes**	**PM Peak Volumes**	**Highest Volume**	**# of Basic Lanes**	**V/C Ratio**	**Years Beyond 2036**	**Ultimate Year**
Windsor - Connaught	2400	1800	2400	2	0.67	>20	**>2056**
Connaught - Joe Howe	4200	4100	4200	3	0.88	9	**2045**
Joe Howe - NW Arm Dr.	5000	4500	5000	3	1.04	0	**2036**
NW Arm Dr - Hwy 103	4800	4100	4800	3	1.00	0	**2036**
Hwy 103 - Lacewood	3300	3200	3300	3	0.69	>20	**>2056**
Lacewood - Kearney Lake	3900	3600	3900	3	0.81	14	**2050**
Kearney Lake - Larry Uteck	4000	4000	4000	3	0.83	13	**2049**
Larry Uteck - Hwy 113	3000	3600	3600	3	0.75	>20	**>2056**
Hwy 113 - Hammonds Pl.	3200	3500	3500	3	0.73	>20	**>2056**
Hammonds Pl. - Hwy 101	2500	3400	3400	3	0.71	>20	**>2056**
Hwy 101 - Duke/Glendale	2200	2100	2200	2	0.61	>20	**>2056**
Duke/Hwy 107 - Tk 2	1200	1300	1300	2	0.36	>20	**>2056**

This particular analysis is considered to be an academic exercise given the expected levels of uncertainty associated with very long term forecasting. As such, all results that extend beyond the 55 year horizon (more than 20 years after the year 2036) have not been specifically identified. Caution should be used when interpreting the results.

APPENDIX A
TERMS OF REFERENCE

NOVA SCOTIA

Procurement Services - Public Tenders Office
6176 Young Street, Suite 200
Halifax, Nova Scotia B3K 2A6
Telephone: (902) 424-3333

Date: December 20, 2006

To: All Suppliers

Subject: Addendum

ADDENDUM # 1
Tender 60130901
Highway 102 Corridor Transportation Study for the Department of Transportation & Public Works

The following change are to be noted in the document referenced above.

1.The project scope is to be consistent with a project budget of $275,000.00

2. The proposal closing date has been changed. The new date for closing is Tuesday, January 23, 2007

In your bid, please indicate that you have noted these changes by including the words "Includes Addendum # 1". If there is more than one (1) Addendum issued for this tender, please acknowledge each separately.

Yours truly,

J MacConnell

Jane MacConnell
Senior Procurement Officer

NOVA SCOTIA

Procurement Services - Public Tenders Office
6176 Young Street, Suite 200
Halifax, Nova Scotia B3K 2A6
Telephone: (902) 424-3333

Date: January 10, 2007

To: All Suppliers

Subject: Addendum

ADDENDUM # 2
Tender # 60130901
for the Department of Transportation & Public Works

The following additional information is provided to clarify the scope of work for the above noted Tender.

1. Section 2.1 - This project is being commissioned to determine the ultimate capacity and best use of the Highway 102 corridor. An estimate for the timing of the need to widen the highway is required but is not the focus of the study.

2. Section 2.1 - Functional designs are expected to identify the number of lanes, auxiliary lane requirements, etc. Field survey is not required for completion of the functional designs.

3. Section 2.1 - The purpose of Component 1, Traffic Projections, is to provide the data required to complete Components 2 and 3.

4. Section 2.3.1.5 - No travel time data is available other than what is already in the existing QRS II model. The consultant is responsible for collecting any additional data required to complete the study.

5. Section 2.3.1.7 - The HRM QRS II model is currently calibrated on the basis of 2001 data. Although the study base year is 2006, the model re-calibration is expected to be done using the existing 2001 data. The re-calibration of the existing model is required to refine the model for the purpose of simulating the 100 series highway network and other major arterials. It does not need to be calibrated for local streets. Separate models, calibrated for AM and PM peak hour traffic counts, are required. The final model deliverables are to be in QRS II file format.

6. Section 2.3.2.9 - The working session for the design of the Highway 102/107 interchange is intended to be an opportunity for the consultant to more efficiently access TPW/HRM staff knowledge and feedback on the proposals. Staff will be participating by providing input to and review of the proposals as they are developed. Approximately 12 TPW/HRM staff are expected to participate and they will not require computer set-ups. TPW meeting space can be made available for the session.

7. Section 2.3.3.4 - Environmental field work is not required as part of the functional design work for the Highway 107 alignment.

8. Section 2.4.2 - The functional design of the Larry Uteck interchange is underway and is expected to be made available to the selected consultant in digital format at the time of project award.

Sincerely,

Janice Harland, M.A.Sc., P.Eng.
(902) 424-4206

Please note that the proposal closing date remains unchanged.

In your bid, please indicate that you have noted these changes by including the words " Included Addendum # 2.

Yours truly,

Terry Peitzsche

Procurement Group Supervisor

NOVA SCOTIA Procurement Services

Request for Proposal (RFP)

Tender Number: 60130901

Date Created:	Nov 29, 2006
Contact Person:	Terry Peitzsche
Telephone:	902-424-8069
Document Reference:	60130901

Tender Source:
TENDERS WEBSITE
WWW.GOV.NS.CA/TENDERS
6176 YOUNG ST
HALIFAX NS B3K 2A6

Bidders are responsible for ensuring that they are aware of and have complied with any Addenda by visiting the Procurement Website or contacting the Public Tenders Office.

Send Quotation To:
Public Tenders Office
6176 Young Street, Suite 200
Halifax, NS B3K 2A6
Ph. 902-424-3333, Fax 424-0622

Important Dates:
Closing Date: Jan 09, 2007
Closing Time: 2:00 pm
Bids are opened one half hour after tender closing

Deliver Goods\Services To:
Transportation & Public Works
Halifax NS

Delivery Requested By: 14/12/2007
(DD/MM/YYYY)

For information on other tenders refer to:
www.gov.ns.ca/tenders

Req`n 10021774

*
REQUEST FOR PROPOSALS:
TRANSPORTATION & PUBLIC WORKS
HIGHWAY 102 CORRIDOR TRANSPORTATION STUDY:
A TRANSPORTATION STUDY OF HIGHWAY 102 (BICENTENIAL HIGHWAY) AND THE PROPOSED EXTENSION OF HIGHWAY 107 TO HIGHWAY 102
CONTACT PERSON: JANICE HARLAND PH: 902-424-4206
DOCUMENTS ATTACHED
*
Pls Note: The pricing fields on page 1 and 2 of 2 (NSRFP) form, is not to be completed. A cost proposal is to be provided separately in a sealed envelope.
*

PRICES TO BE QUOTED TAX OUT ONLY

PLEASE COMPLETE THE UNIT, DELIVERY DATE, UNIT PRICE AND EXTENDED PRICE FIELDS

Item	Qty Unit	Material Description	Delivery date	ALL PRICES MUST BE EXTENDED AND TOTALLED Unit Price	Extended Price
00001	1 Perf. unit	HYW 102- CORRIDOR TRANSPORTATION STUDY:			

Tender Number: **60130901**

PRICES TO BE QUOTED TAX OUT ONLY

PLEASE COMPLETE THE UNIT, DELIVERY DATE, UNIT PRICE AND EXTENDED PRICE FIELDS

Item	Qty Unit	Material Description	Delivery date	ALL PRICES MUST BE EXTENDED AND TOTALLED Unit Price	Extended Price

The item covers the following services:

Item	Quanity	Unit	Description Price/Unit
10	1	LOT	See Attachments

THE FOLLOWING INFORMATION MUST BE COMPLETED TO ENSURE TENDERACCEPTANCE **TOTAL:**

BIDDING COMPANY:

REPRESENTATIVE OF BIDDING COMPANY:

PRINT NAME:

PHONE#: FAX#: E-MAIL ADDRESS:

PO BOX: CITY: POSTAL CODE:

STREET: CITY: POSTAL CODE:

DELIVERY PROMISED: TERMS: FOB:

SIGNATURE:

All documents listed here can be found on our web site at www.gov.ns.ca/tenders/policy

If you do not have access to these documents via the Internet, please request a copy from Nova Scotia Procurement, 6176 Young St., PO Box 787, Halifax, NS B3J 2V2, phone (902)424-3333, fax (902)424-0622. Please request the document(s) by name.

NEED HELP? Suggestions and hints to help you reply to this tender are available from the above web page by selecting "Tendering Guides" then "Request for Quotations Completion Guide".

***************INSTRUCTIONS REGARDING THIS PURCHASE*****************

By submitting a response to this tender, you acknowledge that you have read and complied with the applicable Nova Scotia Procurement documents. The following documents apply to this tender, and are available from the above web page by selecting "Terms & Conditions" then selecting the following:

Atlantic Standard Terms and Conditions (revised June 30, 2005)
Supplement - Request for Proposals (revised January 2005)

Req`n 10021774

Rev 060125

NOVA SCOTIA

Procurement Services
Public Tenders Office
6176 Young Street, Suite 200
Halifax, Nova Scotia B3K 2A6
Telephone: (902) 424-3333
Facsimile: (902) 424-0608 or 0622

REQUEST FOR PROPOSALS

Tender Number 60130901

Highway 102 Corridor Study

for the

Department of Transportation and Public Works

and the

Halifax Regional Municipality

THESE SPECIFICATIONS ARE NOT A COMPLETE TENDER DOCUMENT. IN ORDER FOR A TENDER RESPONSE TO BE COMPLETE AND ACCEPTABLE, THESE SPECIFICATIONS MUST ACCOMPANY A NOVA SCOTIA REQUEST FOR PROPOSALS (NSRFP) FORM, WHICH MUST BE COMPLETED AND SIGNED.

Facsimile bids **will not** be accepted for this Request for Proposals

At a minimum, the terms & conditions and supplements listed below apply to this procurement. These documents are available from the Tenders website as shown below. By submitting your response to this Request for Proposals, you acknowledge that you have read and complied with these documents. **Other instructions and supplements may also apply; see the NSRFP form for the complete list of applicable documents and how to obtain them.**
Atlantic Standard Terms and Conditions -and- Supplement-Request for Proposals (RFP)
These documents are available from www.gov.ns.ca/tenders - click on "Terms & Conditions"

Request for Proposals prepared by: Department of Transportation and Public Works

Table of Contents

1.0 Background and Situation Overview

Highway 102 is an intra-provincial, National Highway System highway that begins in Halifax as an extension of Bayers Road and ends in Truro at Highway 104. In addition to connecting to Highway 104, it intersects with other primary arterial highways: Highways 101, 103, 118 and 107(future). Accordingly, it connects the northern and eastern parts of the province with the Halifax Regional Municipality (HRM) and the western end of the province. This important link also serves HRM residents commuting between the urban core and suburban areas such as Hammonds Plains, Bedford, Sackville and Fall River. It is one of the busiest highways in the province with average annual daily traffic volumes in excess of 40,000 vehicles per day in some sections. In addition, development is growing in the communities it serves and has extended up to the right-of-way in many areas.

Highway 107 serves the Dartmouth area of HRM and currently extends from Musquodoboit Harbour to Preston and from the Loon Lake area in Westphal to Akerley Boulevard in Burnside Park. Planning is underway to continue the highway westward to Highway 102. The extension of Highway 107 from Burnside Park to Highway 102 is warranted due to existing traffic volumes on Trunk 7 (Magazine Hill) and the Bedford Bypass, which are approximately 30,000 vehicles per day. The Bedford Bypass was originally built as a temporary facility, required until Highway 107 was completed. A major component of the Highway 107 alignment approved in the early 1990s, included the now abandoned Second Lake Collector. In that plan, Highway 107 connected to Highway 102 at Exit 4C (Glendale/Duke) and continued as the Second Lake Collector to an interchange with Highway 101 west of Sackville. The approved Highway 107 alignment/design is being reconsidered due to the abandonment of the Second Lake Collector and the proximity of the Highway 101/102 interchange. It may be desirable to construct a new interchange in the area which would allow for direct flow of traffic between Highways 101, 102 and 107.

The Department of Transportation and Public Works (TPW) and HRM recognize both the importance of Highway 102 and its limited expansion potential and together are commissioning this study to forecast traffic needs and determine the ultimate expansion capacity and best use of the highway corridor. The section to be studied includes a portion of Bayers Road starting at Windsor Street and continuing to the start of Highway 102 and then along Highway 102 to Exit 5 in Fall River, as shown in Figure 1. Studying this section of Highway 102/Bayers Road as a corridor, rather than as individual sections or interchanges, will allow TPW and HRM to make long term planning decisions on how to best use the corridor and to determine what changes may be required to the interchanges and intersections that connect the highway with the rest of the transportation network. HRM has recently adopted a Regional Plan that will serve to focus development in areas where services, such as transportation, can be more efficiently provided and this study will be undertaken in consideration of the plan. A significant part of the corridor planning involves determining the location of the Highway 107 extension and the functional design of its interchange with Highway 102. This evaluation will include a benefit/cost evaluation of the options.

2.0 Requirements

2.1 Basic Requirements

The study has three primary objectives that are addressed by three separate project components.

- Component 1 - Traffic Projections: Create a calibrated model and develop long term (30 year) traffic projections for the Highway 102/Bayers Road corridor from Exit 5 (Fall River/Highway 118) to Windsor Street including the proposed Highway 107 extension and all other major existing and proposed intersecting roads.

- Component 2 - Highway 102 Upgrades: Determine the ultimate capacity of the Highway 102/Bayers Road corridor from north of Exit 4C (Glendale/Duke) to Windsor Street. Develop short and long term functional plans for expansion of the corridor, including interchanges, to full capacity. Develop functional plans to a level of detail that confirms the feasibility of the proposed designs and provides sufficient information to provide conceptual cost estimates for the proposals.

- Component 3 - Highway 107 Extension: Evaluate the two proposed options for extension of Highway 107 from Burnside Park to Highway 102 (see Figure 1). Perform benefit/cost analyses on the alignment and interchange options.

2.2 Project Scope and Time Frames

The general study area is outlined in Figure 1. A broader focus may be required to determine future traffic volumes and patterns. The time frame for all study components is 30 years with 2006 as the base year.

- Component 1 - Traffic Projections includes the Highway 102/ Bayers Road corridor from Exit 5 (Fall River/Highway 118) to Windsor Street and the proposed Highway107 extension from Highway 102 to Highway 118.

- Component 2 - Highway 102 Upgrades includes Highway 102/Bayers Road corridor from north of Exit 4C (Glendale/Duke) to Windsor Street and includes the portions of all major intersecting roads that are within 500 metres of their interchange with the Highway 102/Bayers Road corridor. This includes proposed and potential future connections, such as the Larry Uteck interchange, the connection of Highway 113 and the Highway 107 interchange. The capacity study will consider two options for the connection of Highway 107: at Exit 4C; and at a redesigned Highway 102 Exit 4 interchange. (Two proposals for the redesign of the Highway 102 Exit 4 interchange are included in the consultant's scope of work.)

- Component 3 - Highway 107 Extension includes the two general Highway 107 alignment options and the Highway 102 interchange connections associated with each option.

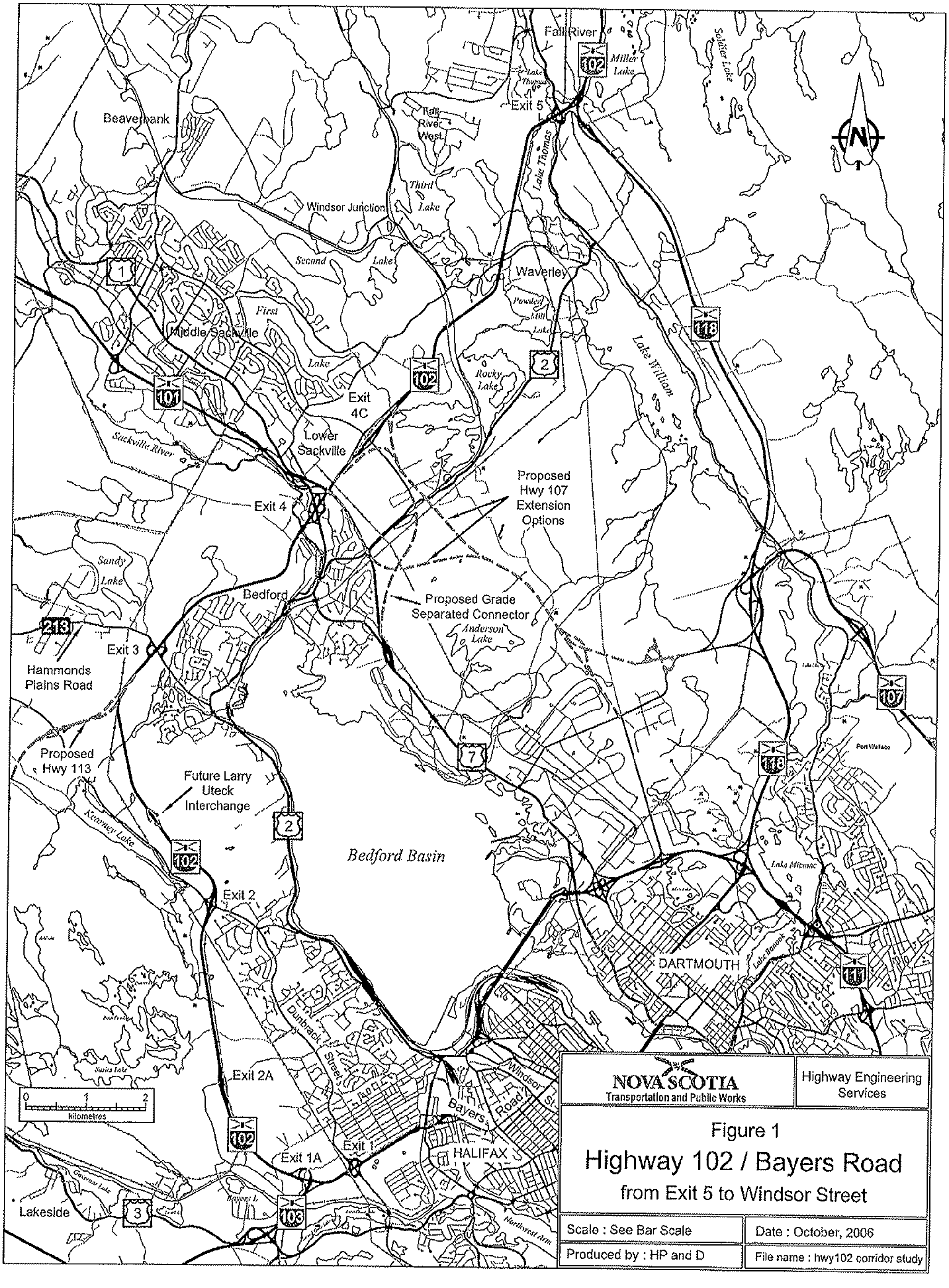


Figure 1
Highway 102 / Bayers Road
from Exit 5 to Windsor Street

2.3 Detailed Technical Requirements

2.3.1 Objective 1 - Traffic Projections

2.3.1.1 Meet with the Project Steering Committee in accordance with the requirements in Section 2.5 - Reporting Requirements and Procedures.

2.3.1.2 Become familiar with the study area including existing, proposed and potential road infrastructure, existing and proposed developments, historic development trends, traffic and transportation studies, regional development potential and municipal development plans.

2.3.1.3 Consider and incorporate HRM's Regional Plan, Active Transportation Plan and Transportation Demand Management Functional Plan (in progress) as they apply to the corridor and traffic projection assumptions.

2.3.1.4 Develop traffic projections. Base regional population growth predictions for 2016 and 2026 on the Regional Plan. Develop predictions for the time frame beyond the Regional Plan horizon (2026) to the study horizon year of 2036.

2.3.1.5 Obtain any traffic data required in addition to the information provided by TPW and HRM. Obtain all required demographic or other data required to develop population and traffic predictions.

2.3.1.6 Confirm population and traffic growth projections with Project Steering Committee.

2.3.1.7 Develop traffic models for the Highway 102 corridor and the proposed Highway 107 extension options. Calibrate HRM's regional QRSII traffic model to represent the 100 series highway network and expand the models to estimate traffic growth in the 2036 horizon year.

Traffic models are required to represent the base year 2006 for existing infrastructure only and the horizon years 2016, 2026 and 2036 for each of the following scenarios:

A - Existing infrastructure and the future Larry Uteck interchange;
B - Scenario A with Highway 113 and Highway 107 connecting at a point just north of Exit 4C (Duke Street); and
C - Scenario A with Highway 113 and Highway 107 connecting with Highway 101 at Exit 4, with a grade separated connection of Trunk 7 and Duke Street.

The models are to be calibrated to both AM and PM peak hours. It is expected that the calibrated models will represent road and ramp volumes within 15 percent of actual volumes. Traffic projections are to be displayed in both graphical and tabular format.

2.3.1.8 Identify highway system capacity constraints in the study area and estimate the time at which they will occur in each scenario.

2.3.1.9 Prepare a draft final report that includes a description of analyses/prediction methods, model results including calibration results and a description of system constraints for each scenario.

2.3.1.10 Consider feedback from Project Steering Committee and finalize report and models.

2.3.2 Objective 2 - Highway 102 Upgrades

2.3.2.1 Meet with the Project Steering Committee in accordance with the requirements specified in Section 2.5 - Reporting Requirements and Procedures.

2.3.2.2 Become familiar with the study area including, existing, proposed and potential road infrastructure and developments, land ownership, terrain and environmental issues.

2.3.2.3 Consider and incorporate HRM's Regional Plan, Active Transportation Plan and Transportation Demand Management Functional Plan (in progress) as they apply to the corridor.

2.3.2.4 Determine the ultimate physical expansion potential of the Highway 102/Bayers Road corridor given the constraints of roadside development. Consider the need for additional through lanes as well as ramp connections between interchanges.

2.3.2.5 Consider the potential uses of additional through lanes. Estimate the number of years the functionality of the corridor will be extended by implementing alternative uses. Identify any potential issues to be considered in implementing these measures. Recommend the appropriate use of all additional through lanes.

2.3.2.6 Develop functional design plans for the corridor. Allow for potential roadside measures in the cross-section and allow for a trail in areas where it is required as part of the Active Transportation Plan.

2.3.2.7 Determine the required functional design capacity of the interchanges and intersections consistent with the ultimate capacity of the corridor.

2.3.2.8 Develop functional plans for the upgrading of all existing and proposed interchanges and intersections along the corridor from Exit 4C (Glendale/Duke) to Windsor Street, including the Highway 101/102 interchange at Exit 4, that will meet the capacity requirements identified in 2.3.2.7. Provide interchange access management plans for minor roads, existing and future, within 500m of the interchange. Base functional designs on current TPW and HRM design standards and consider topography and grade issues. Present functional designs at 1:5000 or larger scales. [Please note: The functional design and access management plan recommendations for the Highway 102/Hammonds Plains Road interchange must be completed as soon as is possible and no later than August 3, 2007.]

2.3.2.9 Develop draft functional design concepts for the redesign of the Highway 101/102 interchange to accommodate connection of Highway 107 as part of a four-day working session to be held in Halifax with TPW and HRM staff. Provide design and technical staff along with necessary models, mapping, hardware, software, traffic and other data and materials required to lead the session and develop concepts towards completed functional designs. (The outcomes of the working session are expected to be two draft functional design options for the redesign of the Highway 101/102 interchange that include direct connection of Highway 107.)

2.3.2.10 Subsequent to the working session, confirm the feasibility of both draft functional design options and complete the functional designs. Present functional designs at 1:5000 or larger scales. Present, in person, the completed designs to the participants of the working session held in 2.3.2.9.

2.3.2.11 Prepare an interim report that includes a description of research, analyses, recommendations and proposed functional design plans for review by the Project Steering Committee. Incorporate review comments.

2.3.2.12 Identify any right-of-way that is required for the functional designs.

2.3.2.13 Develop a schedule for upgrading the corridor, including interchanges. Identify the traffic volumes that should trigger the need for the improvements and estimate the year in which they will occur.

2.3.2.14 Provide cost estimates for the upgrading projects.

2.3.2.15 Update the traffic models produced in 2.3.1.7 for scenarios B and C to reflect the proposed corridor upgrades. Describe the changes in level of service and capacity of the corridor.

2.3.2.16 Estimate the year in which the ultimate capacity of the highway will be matched by demand.

2.3.2.17 Organize, staff and conduct a public information session. The purpose of the session will be to present the study findings and the proposed functional designs. The Consultant is responsible for all costs associated with the session, including the venue, advertising and invitations. All elected officials for the study area are to be invited by letter. Any property owner directly affected by the proposals is to be personally contacted prior to the event and invited. As a minimum, newspaper advertisements are to be placed in three separate editions of both the Chronicle Herald and the Daily News. Advertisements are to be of a size that provides for all necessary details including a brief description of the meeting purpose.

2.3.2.18 Prepare a final draft report and functional plans for review by the Project Steering Committee. The final draft report is to include a summary of the public information session. Be prepared to provide a second final draft report, if the Project Steering Committee determines it is required.

2.3.2.19 Provide a final report, functional plans and traffic models.

2.3.3 Objective 3 - Highway 107 Extension

2.3.3.1 Meet with the Project Steering Committee in accordance with the requirements specified in Section 2.5 - Reporting Requirements and Procedures.

2.3.3.2 Become familiar with the study area including, existing, proposed and potential road infrastructure and developments, land ownership, terrain and environmental issues.

2.3.3.3 Consider and incorporate HRM's Regional Plan, Active Transportation Plan and Transportation Demand Management Functional Plan (in progress) as they apply to the potential Highway 107 corridors.

2.3.3.4 Develop a functional design for the proposed Highway 107 alignment option that connects to Highway 102 at Highway 101. (The functional design of the extension option that terminates at Highway 102 Exit 4C has already been established by TPW and is to be used in completing the project.) Allow for potential roadside measures in the cross-section and allow for a trail in areas where it is required as part of the Active Transportation Plan and consider the need for incorporation of HOV/transit lanes in both design options. Base functional designs on current TPW and HRM design standards and consider topography and grade issues. Present functional designs at 1:5000 or larger scales.

2.3.3.5 Identify the right-of-way that is required for each of the functional designs.

2.3.3.6 Prepare an interim report that includes a description of research, analyses, recommendations and proposed functional design plans for review by the Project Steering Committee. Incorporate review comments.

2.3.3.7 Prepare functional plans for the Highway 107 alignment options for inclusion in the public information session to be held in accordance with item 2.3.2.17.

2.3.3.8 Perform MicroBENCOST or simlar benefit/cost analyses of the Highway 107 alignment/interchange options. This will entail consideration of three different scenarios: Highway 107 connecting to Highways 101 and 102 with two interchange configuration options; and Highway 107 connecting to a potentially redesigned Highway 102 Exit 4C.

2.3.3.9 Prepare a final draft report and functional plans for review by the Project Steering Committee. The final draft report is to include a report on the benefit/cost analyses. Be prepared to provide a second final draft report, if the Project Steering Committee determines it is required.

2.3.3.10 Provide a final report and functional plans.

2.3.3.11 Present the project findings (all three project components) to the project steering committee and other senior TPW and HRM staff.

2.4 TPW and HRM Responsibilities

2.4.1 Meet with the Consultant on an arranged schedule.

2.4.2 Provide the Consultant with the documentation listed below and any other available information that may assist in the completion of the project.

- Provincial ROW plans for Highway 102 corridor (hard copy)
- HRM ROW plans for Bayers Road
- Provincial topographic and property mapping (digital)
- HRM QRSII model
- HRM GIS mapping

- Regional Municipal Planning Strategy
- Active Transportation Plan (SGE Acres, 2006)
- As-built drawings for Highway 102 Corridor from beginning at Bayer's Road to Kearney Lake Road (hard copy, mid 1980s)
- Design Drawings (hard copy only)
  - Highway 107/Akerley interchange
  - Lacewood Drive - Chain Lake Drive to Highway 102, Proposed Traffic Improvements Phase 2 (HRM; 2003)
  - Highway 102 Interchange to Lacewood Drive, Upgrading of Lacewood Drive (TPW; 2002)
  - Highway 102/Route 213 Interchange (widening on Route 213 in approach to ramp terminals) (TPW; 2003)
  - Kearney Lake at Highway 102, Intersection Geometry Plan (intersection widening NB ramp terminals) (TPW; 2006)
  - Highway 102 at Kearney Lake Road, Geometry Layout and Road Signs (improvements to N-E/W ramp terminal and provision of turning lanes for E/W-S ramp) (TPW; 2003)
  - Highway 102 - Intersection of SB Ramps at Kearney Lake Road (TPW; 1991)
- HRM functional sketches: Bayers Road Six-Lane (End of Hwy 102 to Connaught) and Bayers Road Five-Lane (with Median Transit Lane)
- Highway 113 functional design plans (AutoCAD)
- Highway 107 extension (option connecting to Highway 102 at Exit 4C) functional design plans (AutoCAD)
- Other Studies
  - Governor Lake Area Transportation Plan (SGE Acres; 2003)
  - Highway 102 Interchanges Operational Assessment (Dillon; 2006)
  - Bayers Lake Interchange Traffic Study (ARTM; 1999)
  - Highway 113: A Demand and Strategic Context Focus Study (Delphi-MRC; 2006)
  - Final Report Traffic Impact Study, Prince's Lodge/Bedford South Master Plan (ARTM; 2000)
  - Wright Avenue Extension and Highway 118 Interchange Traffic and Functional Design Review (BA Group; 2004)
  - Bedford West Master Plan: Transportation Study (Delphi-MRC; 2004)
  - The Courtyards at Paper Mill Lake Traffic Impact Study (O'Halloran Campbell Consultants; 2004)
  - Northgate Development Traffic Impact Study (Terrain Group; 2006)
  - Butler Property Final Report Traffic Impact Study (Atlantic Road and Traffic Management; 2003)
- Traffic count information described in Attachment A which includes screenline data counted in 2006 for HRM's QRS II model.

2.4.3 Provide review comments and respond to questions in a timely manner.

2.5 Reporting Requirements and Procedures

The activities, schedules and outcomes of all three components of the study are interrelated and, where appropriate, certain activities should be combined for efficiency. However, the three project components (Traffic Projections, Highway 102 Upgrades and Highway 107 Extension) are to be reported separately. Each of the three final reports will be uniform in appearance, referenced as a set but each stand alone.

In person meetings will be required at the initiation of each study component, following the submission of each interim report and following the submission of each draft final report. For Component 1 - Traffic Projections, there will also be a meeting to confirm the traffic and population projections to be used in the models. For Component 2 - Highway 102 Upgrades, a four-day functional planning working session with TPW and HRM staff is to be scheduled along with two additional meetings: (1) post working session; and (2) pre-public consultation. Not including the four-day working session, this amounts to 11 (eleven) in person meetings throughout the course of the project although the schedule may allow for some meetings to be combined. All in person meetings will be held in HRM. The Consultant shall meet with the project Steering Committee within two weeks of notification of project award. The purpose of this initial meeting is to finalize the study requirements, data requirements, study methodologies, etc. It is expected to also serve as the Traffic Projections study component initiation meeting.

Written, biweekly progress updates are to be submitted to the Project Steering Committee Chair. These reports will review progress of the previous reporting period, forecast the work of the upcoming period, identify any changes to the schedule and highlight any issues that may have arisen during the period or are expected to arise.

The Consultant shall provide six (6) copies of each interim and draft final reports including drawings and sixteen (16) bound copies and one (1) unbound copy of each final report including drawings. All copies of the interim and final reports shall be on letter size paper and appropriately titled. The draft final reports must be submitted for comment and possible amendments before the final versions are submitted. The consultant must be prepared to submit second draft final reports if required. The Consultant shall provide two (2) electronic copies of each final report on CD compatible with WordPerfect 11 including all plans (compatible with AutoCAD 2000), tables, diagrams, figures, modelling data files and pictures. All interim, draft final and final reports, including tables, drawings, figures, pictures and diagrams, are to be submitted in PDF in addition to the above requirements.

Required copies of the interim and draft final reports shall be submitted 5 working days prior to the interim and final draft meetings. The final reports shall include executive summaries and reference lists. All reports shall contain copies of functional design plans as specified in Section 2.3 Detailed Technical Requirements. The Terms of Reference shall be attached as an appendix to the final reports.

2.6 Project Management

A Project Steering Committee will administer the technical and analytical work of the Consultant. The team will consist of representatives from TPW and HRM. The Consultant will report to the Project Steering Committee Chair, who will be responsible for overall administration of the study.

Acceptance and approval of the work will take place after the Project Steering Committee has been satisfied that the requirements, as specified in the contract, have been met.

2.7 Project Schedule

The Consultant shall meet with the Project Steering Committee within two (2) weeks of notification of contract award. The overall study shall be completed and the required copies of the final reports presented within twelve (12) months of contract award. Please note: The functional design and access management plan recommendations for the Highway 102/Hammonds Plains Road interchange must be completed as soon as is possible and no later than August 3, 2007.

2.8 Enquiry Contacts

All enquiries related to this Request for Proposal are to be directed to the following person. Information obtained from any other source is not official and may be inaccurate. Enquiries and responses may be recorded and may be distributed to all proponents at the Province's option.

Department Contact:	Procurement Contact:
Janice Harland, P.Eng.	Terry Peitzsche, Procurement Group Supervisor
1672 Granville Street	6176 Young Street, Suite 200
Halifax, NS B3J 3Z8	Halifax, NS B3K 2A6
Telephone: 902-424-4206	Telephone: 902-424-8069
Fax: 902-424-0571	Fax: 902-424-0780
Email: harlanja@gov.ns.ca	Email: peitzsct@gov.ns.ca

2.9 Contract

The standard legal contract that applies to services is available at: http://www.gov.ns.ca/tenders/policy/htm_files/contract.htm. This document will be updated (as a part of the award process) to include the vendor name, contact information, maximum amount payable, dates, etc. Schedule A will be updated to reference the tender documents (including addenda) and the Proposal submitted by the successful supplier, and may be expanded to reference any correspondence or clarifications. Schedule B will be updated to describe the payment/invoicing schedule and the project work plan (if any).

In addition to the above, the following changes will also apply to this standard contract.

Payment Schedule: Payments for professional services rendered will be made monthly in arrears upon receipt of invoices detailing work completed, and subject to the following conditions.
(a) Monthly payments will be issued for up to 90 percent of the amount invoiced. The remaining amount will be paid upon completion and acceptance of the work.
(b) Receipts shall be provided for all expenses if requested.

Insurance: The Consultant shall at his cost maintain such insurance and pay such assessments as will protect the Consultant and the Minister from any claims under the Worker's Compensation Act and from any other claims for damages for bodily injury, personal injury, sickness or disease, including death, or property damage which may arise from operations under the Agreement. The limits of such insurance shall not be less than $2,000,000.00 on an occurrence (not claims made) basis except where noted below. Coverages to be in form and content acceptable to the Minister. Insurance coverage shall include Commercial General Liability insurance covering premises and operations liability, with extensions of coverage to include:

- The Minister as an Additional Named Insured;
- Cross Liability Clause;
- Contractual Liability;
- Employers Liability;
- Completed Operations Liability maintained for a period of not less than twelve (12) months after the completion of the term of the Agreement;
- Non-owned Motor Vehicle Liability;
- Certification of coverage being applicable to the specific Work;
- Broad Form Property Damage;
- Contractors Protective Liability;
- Professional Liability Insurance in an amount not less than $2,000,000.00 insuring his liability for errors and omissions in the performance of his professional services including all Sub-consultant services (This may be on a claims-made basis.); and
- Automobile Liability insurance insuring all licensed vehicles owned, leased or operated by the Consultant in an amount not less than $1,000,000.00.

All insurance policies shall be endorsed to provide a minimum advance written notice of not less than 30 days, in the event of cancellation, termination or reduction in coverage or limits, such notice to be made by the Insurer to the Minister.

The Consultant shall not do or omit to do or suffer anything to be done or omitted to be done which will in any way impair or invalidate such policies or insurance.

Proponents who require any alteration to this standard agreement must indicate the specific changes required in their response, and the extent of the deviations from the standard contract will be taken into account when evaluating proposals. Proponents requesting multiple, major changes to the proposed contract risk having their score reduced, or even disqualification, so amendment requests should reflect vital changes only.

2.10 Consultant Expertise/Eligibility

The project team shall have considerable experience and knowledge in planning, transportation planning, traffic engineering, highway design (particularly interchange design experience) and benefit/cost analysis. The engineering principal shall be registered with the Association of Professional Engineers of Nova Scotia (APENS).

Prospective proponents are not eligible to submit a proposal if current or past corporate or other interests may, in the Province's opinion, give rise to a conflict of interest in connection with this project.

The successful proponent may be required to demonstrate financial stability and may be required to register to conduct business in Nova Scotia.

The Consultant must hold a Letter of Good Standing from an occupational health and safety organization which meets the requirements of the Nova Scotia Environment and Labour (NSEL) or the Workers' Compensation Board of Nova Scotia (WCB), regarding participation in the Occupational Health and Safety External Audit Program, leading to the issuance of a Certificate of Recognition jointly by the occupational health and safety organization and the NSEL or WCB.

The Letter of Good Standing must have a clear expiry date and must be signed by an official of the occupational health and safety organization. If the Letter of Good Standing expires before the completion of the Agreement, a further letter will be required before the time of expiration which indicates that the contracted party continues to actively participate in the occupational health and safety organization's Certificate of Recognition or Safety System Accreditation Program. If a further letter is not provided, this may be regarded as sufficient cause for voiding the Agreement.

The successful Proponent will be expected to develop a safety plan for the project, to be reviewed by the Project Management Team. This plan must deal with hazard recognition, assessment and control, provision of first aid services, and handling of emergencies and it must meet all requirements prescribed by the Occupational Health and Safety Act and regulations. The safety plan is to be reviewed and accepted by the Project Steering Committee prior to any field work commencing.

Prior to award, the selected consultant shall provide insurance documentation for review by the Department. Confirmation of acceptable coverage is required prior to award of the work.

2.11 Liability for Errors

While considerable effort to ensure the accuracy of the information in this Request for Proposal has been made, the information contained in this Request for Proposal is supplied solely as a guideline to Proponents. The information is not guaranteed or warranted, nor is it necessarily comprehensive or exhaustive.

2.12 Extra Work

The Consultant may be required to undertake additional work not specified in the contract. Prior to starting this additional work, the Consultant shall submit a detailed breakdown of the costs, including all expenses, to complete the extra work and obtain written approval from the project Steering Committee.

2.13 Addenda and Amendments

Amendments to the submitted offer will be permitted if received in writing prior to bid closing and if endorsed by the same party or parties who signed the original offer.

Addenda may be issued during the bidding period. All addenda become part of the contract documents. Proponents are responsible for receiving all addenda and including them in the submitted tender documents. All addenda are to accompany each proposal. Proposals that do not contain all the addenda may be immediately returned and the proponent eliminated from further consideration.

Any required addenda will be issued no later than five (5) working days before the date set for receipt of proposals. Verbal answers are only binding when confirmed by written addenda.

2.14 Post Performance Evaluation

The Department will be evaluating the performance of the selected consultant. The evaluation methodology and criteria will be provided to the selected consultant prior to project award.

3.0 Evaluation Criteria

Proposals shall be evaluated based on the "Government Procurement Process: Architects and Professional Services".

The criteria for evaluating proposals, based on technical and managerial merit, will be made based on the following categories and weights.

Qualification and Experience of Corporate Proponent and Individual Team Members on Similar Projects	40 points
Understanding of Objectives/Proposed Methodology	40 points
Project Management	5 points

Accepted proposals will first be evaluated on the basis of their technical and managerial merit and then on the basis of price. The technical submission shall be rated as shown above, out of 85 points, and the remaining 15 points shall be allotted based on price. Only those proposals achieving an aggregate score of 68/85 (80%) or greater will have their sealed cost envelopes opened. The lowest price shall be awarded 15 points (all prices within 5% will receive the same price points). The next lowest price (beyond 5%) will receive 12 points. Points for other submissions will be assigned with 3 fewer points for each successively higher priced price proposal. But again, each time the same score will be awarded if successive prices are within 5% of the last highest price. The proposal with the highest total points will be awarded the contract. Proposals not meeting the required 68/85 will have their unopened cost envelopes returned.

Notwithstanding the technical/managerial and price scores, the Department of Transportation and Public Works reserves the right to reject any proposal where prices are deemed unreasonable relative to other prices bid, typically a 25% variance from the average qualified bid (excluding the bid in question).

TPW reserves the right to negotiate any or all conditions of the Consultant's proposed work plan and reject all submitted proposals. Unsuccessful proponents may request a debriefing meeting following execution of a contract with the successful proponent.

4.0 Proposal Content and Response Guidelines

Failure to provide information outlined in this section may result in disqualification.

Six (6) copies of your proposal (fax copies are not acceptable) are to be delivered by 2:00 pm local time, Tuesday, January 9, 2007 to:

Public Tenders Office
6176 Young Street, Suite 200
Halifax NS B3K 2A6
Tender: 60130901

Proposals and their envelopes should be clearly marked with the name and address of the proponent, the Tender number, the project title and the closing date and time. A public opening will be held on, Tuesday, January 9, 2007 at 2:30 pm local time at the Public Tenders Office. Late proposals will not be accepted and will be returned to the proponent.

Proponents are solely responsible for their own expenses in preparing, delivering and presenting a proposal and for subsequent negotiations with the Province, if any. Proposals must be open for acceptance for at least 90 days after the closing date. Upon acceptance, prices will be firm for the entire contract period unless otherwise specified.

To facilitate efficient review of the proposals, proponents are requested to use the following format. The proposal shall be organized into four chapters and such chapters limited where indicated.

Chapter 1 - Introduction/Project Understanding

This chapter shall include a demonstration of project understanding and insight into its objectives, including potential issues and challenges.

Chapter 2 - Methodology

This chapter is to include the following information.

- List of all information and data sources available to the Consultant and expected to be used in the Study.
- Detailed work plans that identify proposed methodologies including field work. Each of the three project components (Traffic Projections, Highway 102 Upgrades and Highway 107 Extension) are to addressed separately and the interaction/coordination among the activities of the three components are to be identified.
- A single overall project schedule that incorporates the schedules for each of the three project components. The schedule for each component should be easily identifiable within the overall project schedule.
- A project team organization chart with the role of each team member in the study clearly described.

- Time commitment (based on an eight hour day) for each team member for each component of the project.

- Draft tables of contents for the final reports.

Chapter 3 - Project Management

This chapter is to include a discussion of the project management measures and practices that will be used in carrying out the project addressing items such as quality assurance/quality control, cost control and scheduling.

Chapter 4 - Qualifications

This chapter is to include the following information.

- Corporate profile(s) and client references. This shall be a maximum of five pages.

- A summary of relevant corporate (including sub-consultant) experience including project dates. This shall be a maximum of ten pages.

- A summary of project team members' (including sub-consultants') experience in areas related to these terms of reference. This summary shall be a maximum of four pages per team member, and focus on the team member's relevant education and experience. Education and experience descriptions must be supported with dates and a clear description of the person's role in the project experience. Curricula vitae of team members, may be included in an appendix but the proposal evaluation team is not obligated to review or consider this information.

- A brief statement (maximum of 4 pages) explaining why the Proponent is uniquely qualified for this project.

Copies of insurance and safety certification certificates are not required as part of the proposal, but shall be provided by the selected Consultant prior to award of the contract.

One copy of the cost proposal shall be provided, separately sealed in an envelope. The cost proposal shall separately identify the cost (labour and expenses) of each of the three project components as part of the total study cost. The costs for each of the three components shall be upset limit prices and include labour costs, related expenses, printing costs and professional services obtained outside of the firm. In order to assess level of effort and staff roles, time commitments for all team members (excluding labour costs) shall be included in the main body of the proposal. Prices quoted are to be in Canadian dollars and exclusive of federal and provincial taxes. Expenses shall not exceed Nova Scotia provincial rates ($0.3885/km, breakfast $6.00, lunch $12.00, supper $20.00, incidentals $5.00 per night).

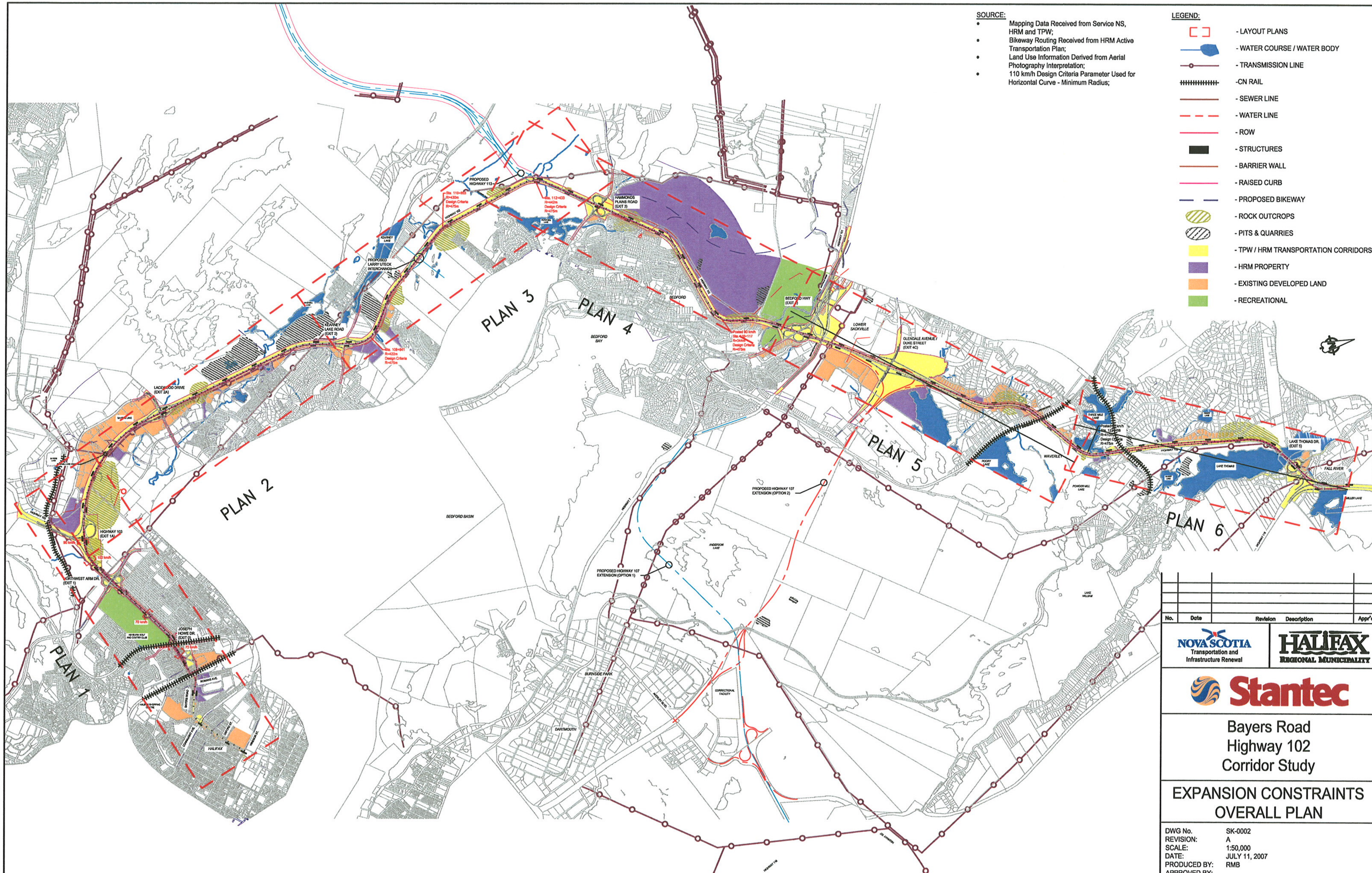
By submitting a proposal, the proponent warrants that all components required to deliver the services requested have been identified in the proposal or will be provided by the Consultant at no additional charge. The technical proposal must be signed by the person(s) authorized to sign on behalf of the proponent and to bind the proponent to statements made in response to this Request for Proposal.

5.0 Proponent Checklist

This checklist has been provided solely for the convenience of the proponent. Its use is not mandatory and it does not have to be returned with the proposal.

- ❑ The requirements of the Request for Proposal have been read and understood by everyone involved in putting together the proposal.
- ❑ The Nova Scotia Request for Proposals (RFP) form that is a part of the Request for Proposals has been signed and included with the Proposal documents.
- ❑ The proposal explicitly addresses everything asked for in the Request for Proposal.
- ❑ The proposal meets all the mandatory requirements of the Request for Proposal.
- ❑ Qualified Nova Scotia based products and services have been identified as an element of the proposal offering.
- ❑ The proposal clearly identifies the proponent, the project, and the Request for Proposal number.
- ❑ The proponent's name and the Request for Proposal number appear on the proposal envelope.
- ❑ The appropriate number of copies of the proposal have been made. (Proposals without the correct number of copies may be rejected.)
- ❑ Every care has been taken to make sure the proposals are at the closing location in plenty of time, as late proposals will be rejected.

APPENDIX B
EXPANSION CONSTRAINTS PLAN AND BAYERS ROAD OPTIONS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- TRANSMISSION LINE
-CN RAIL
- SEWER LINE
- WATER LINE
- ROW
- STRUCTURES
- BARRIER WALL
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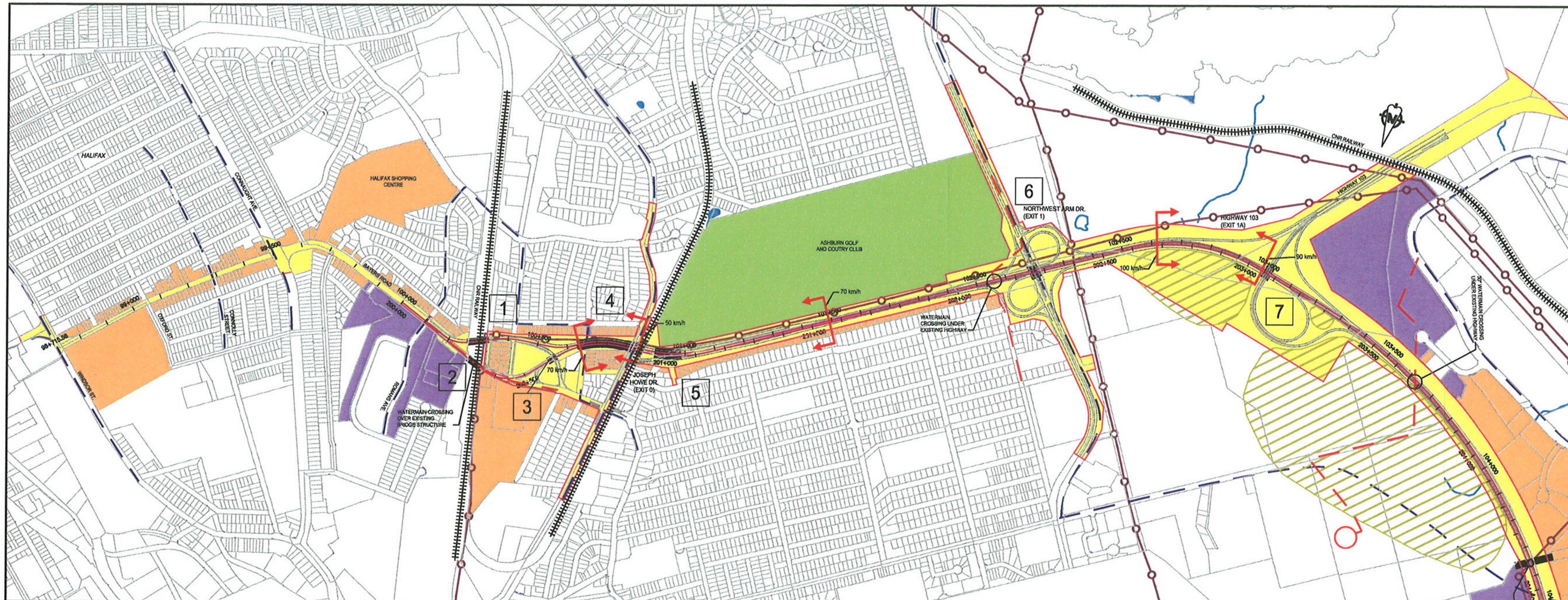
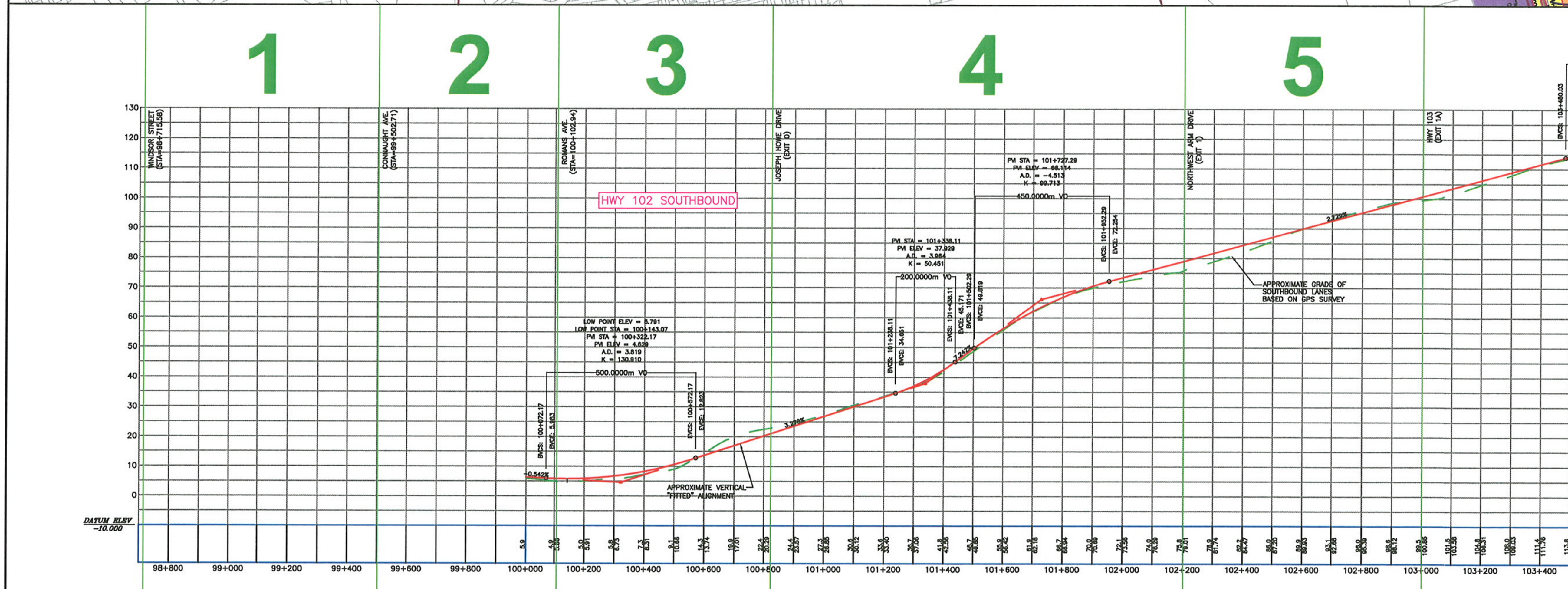
- PITS & QUARRIES
- TPW / HRM TRANSPORTATION CORRIDORS
- HRM PROPERTY
- EXISTING DEVELOPED LAND
- RECREATIONAL
PLAN 1
PLAN 2
PLAN 3
PLAN 4
PLAN 5
PLAN 6
BEDFORD BASIN
No. Date Revision Description Appr'd
NOVA SCOTIA Transportation and Infrastructure Renewal
HALIFAX REGIONAL MUNICIPALITY
Stantec
Bayers Road
Highway 102
Corridor Study
EXPANSION CONSTRAINTS
OVERALL PLAN
DWG No. SK-0002
REVISION: A
SCALE: 1:50,000
DATE: JULY 11, 2007
PRODUCED BY: RMB
APPROVED BY:
Feb 13, 2008 9:05am jclark





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- TPW / HRM TRANSPORTATION CORRIDORS
- HRM PROPERTY
- EXISTING DEVELOPED LAND
- RECREATIONAL
- 3 - BRIDGE NUMBER

SOURCE:

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No.	Date	Revision Description	Appr'd

NOVA SCOTIA Transportation and Infrastructure Renewal

HALIFAX REGIONAL MUNICIPALITY

Stantec

Bayers Road Highway 102 Corridor Study

CONSTRAINTS PLAN PLAN 1

DWG No.	SK-0002
REVISION:	A
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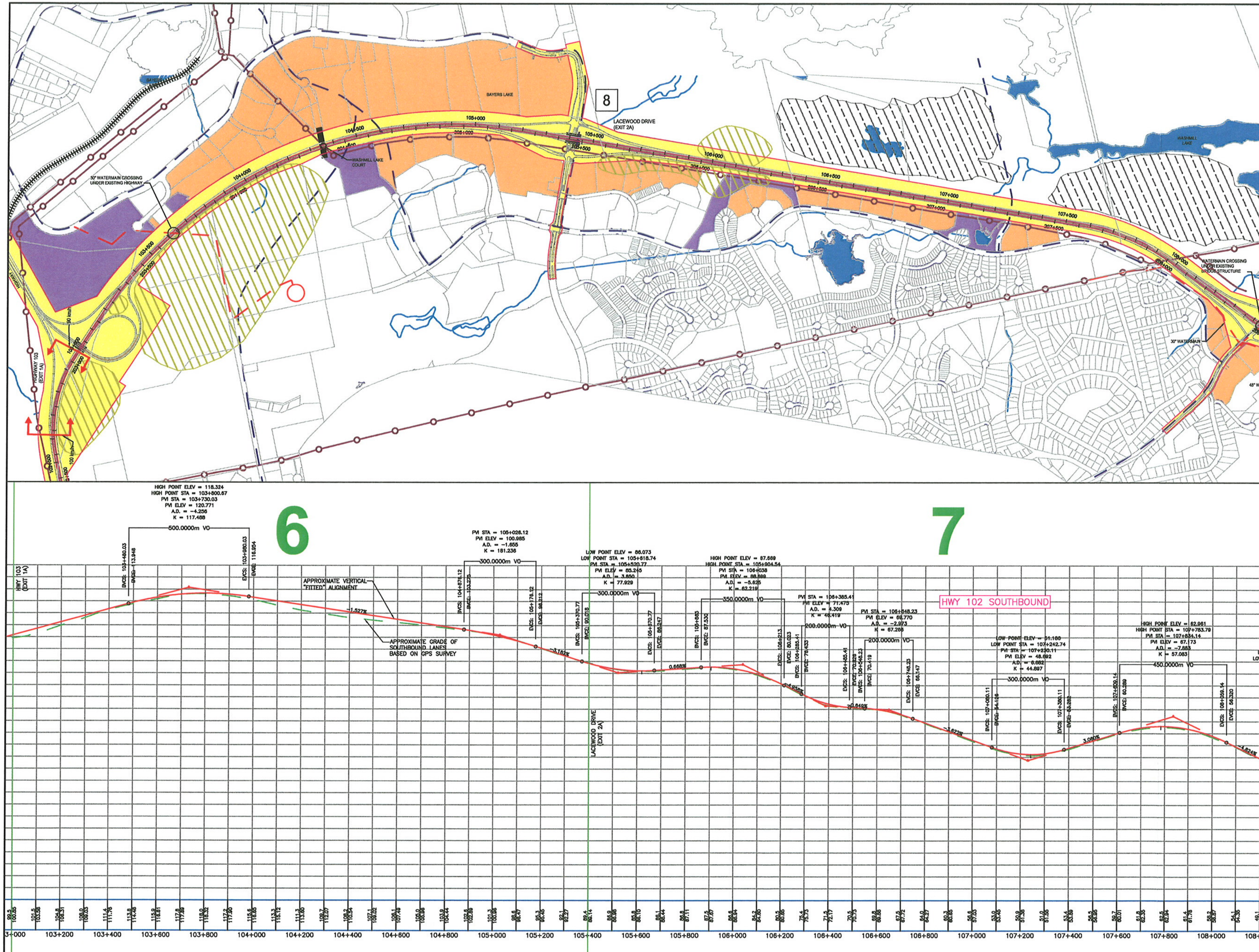

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No.	Date	Revision Description	Appr'd

NOVA SCOTIA Transportation and Infrastructure Renewal

HALIFAX REGIONAL MUNICIPALITY

Stantec

Bayers Road Highway 102 Corridor Study

CONSTRAINTS PLAN PLAN 2

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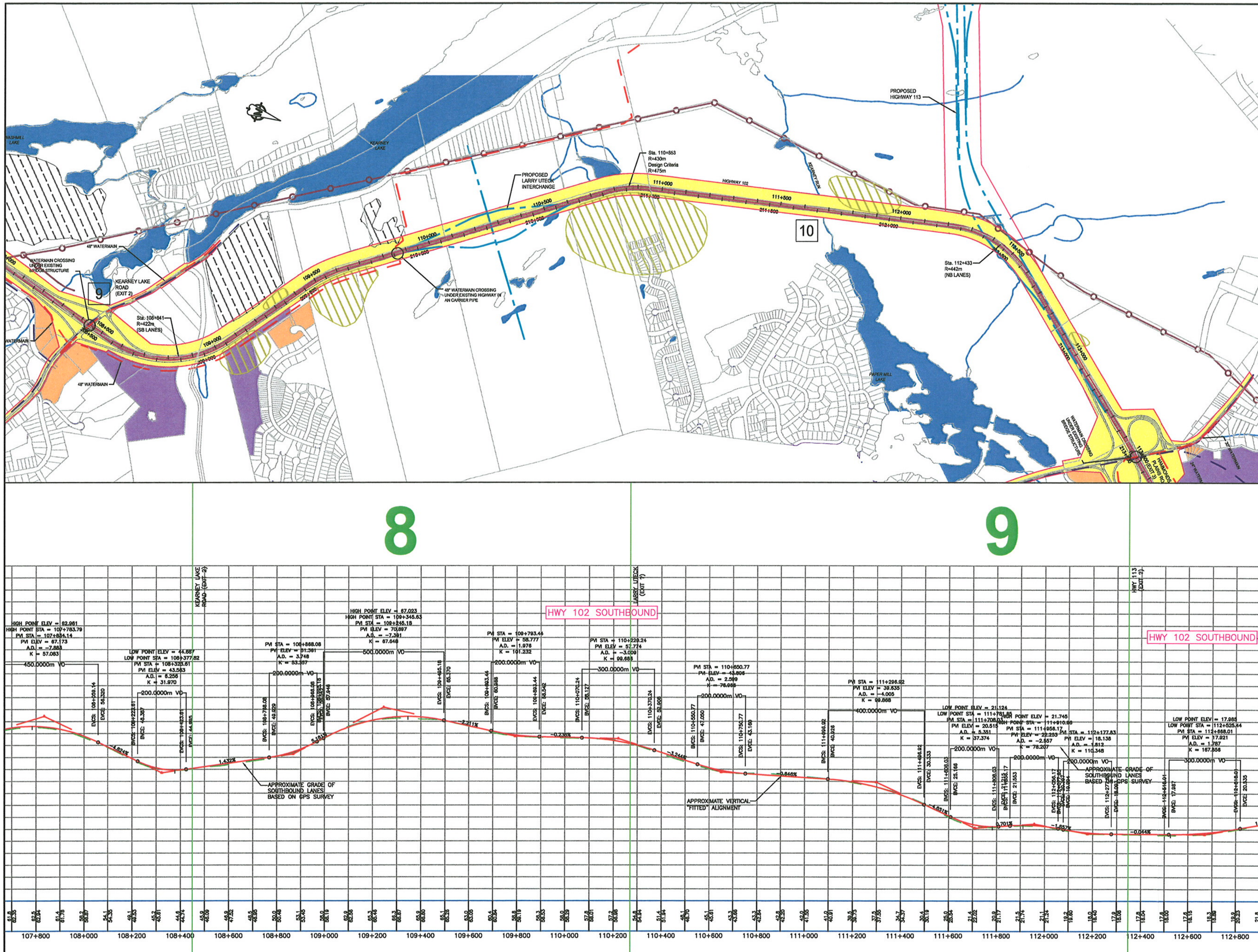

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No.	Date	Revision	Description	Appr'd

NOVA SCOTIA Transportation and Infrastructure Renewal

HALIFAX REGIONAL MUNICIPALITY

Stantec

Bayers Road Highway 102 Corridor Study

CONSTRAINTS PLAN PLAN 3

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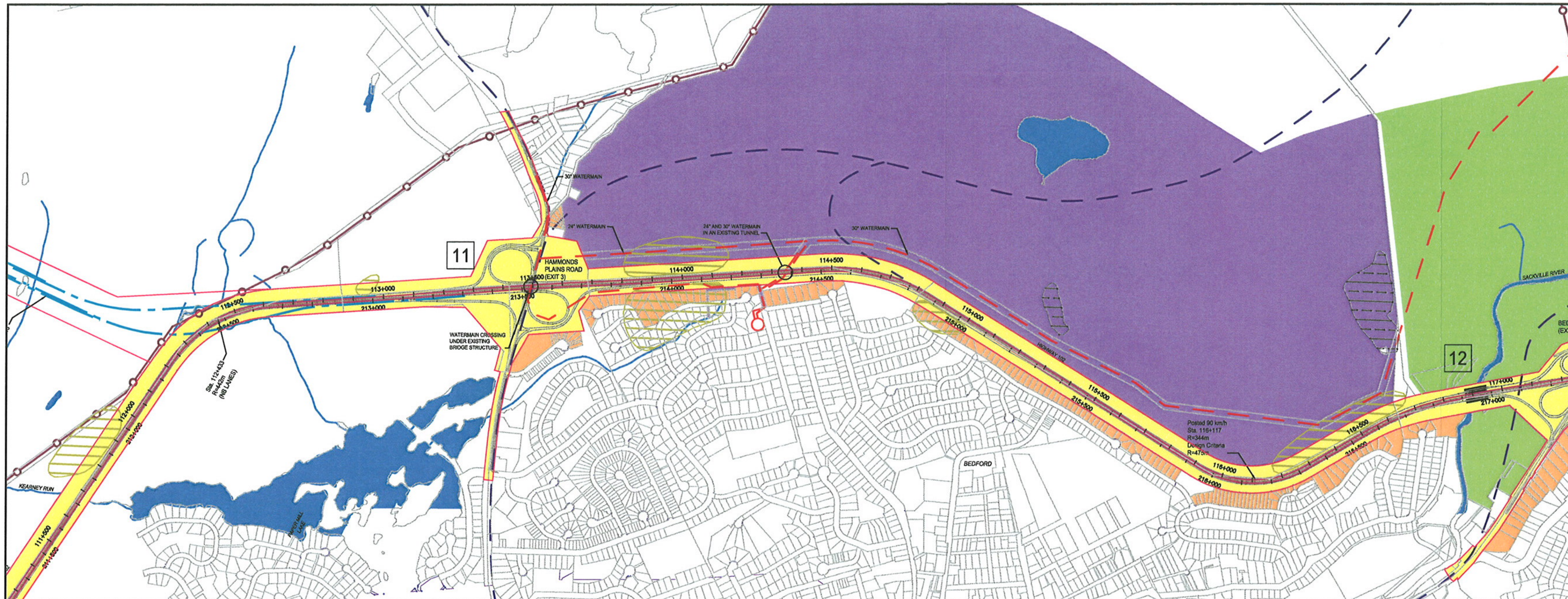

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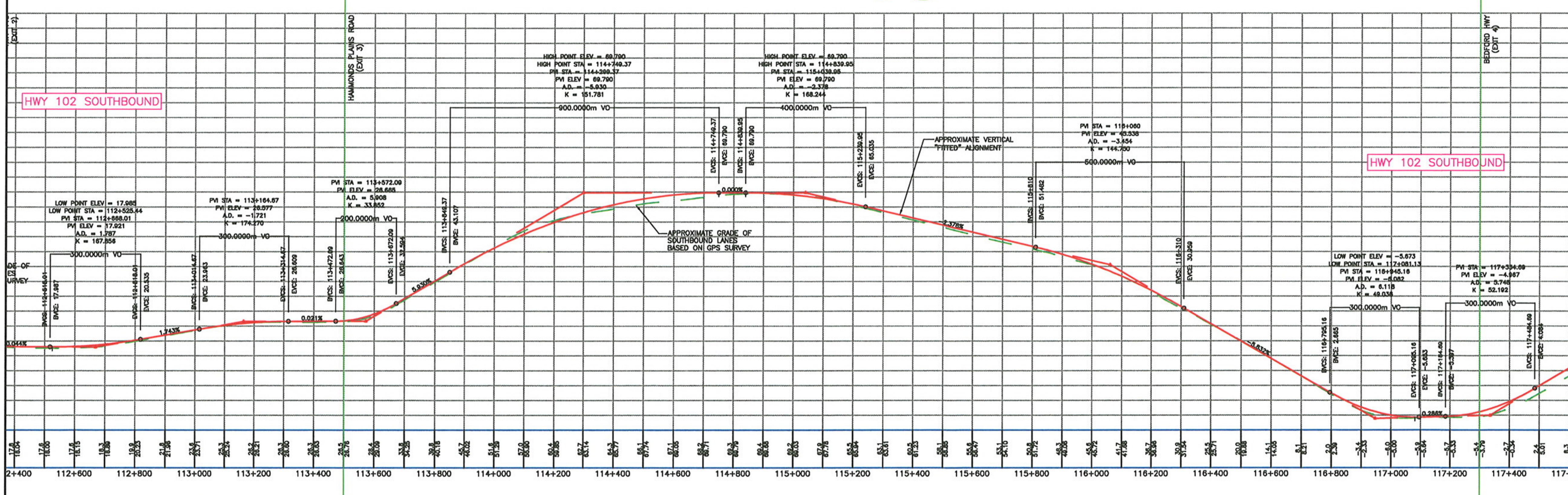

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NOVA SCOTIA Transportation and Infrastructure Renewal

HALIFAX REGIONAL MUNICIPALITY

Stantec

Bayers Road Highway 102 Corridor Study

CONSTRAINTS PLAN
PLAN 4

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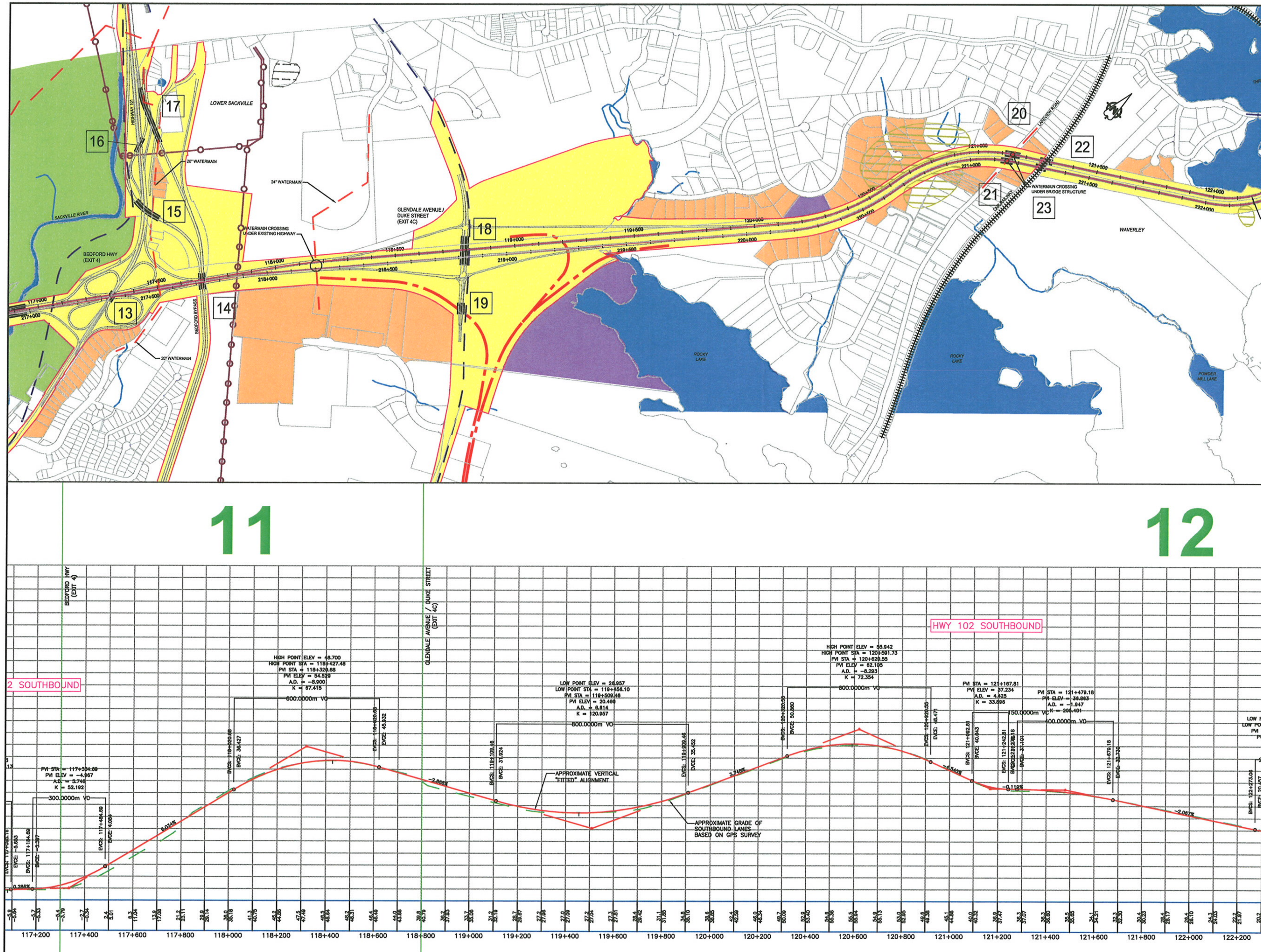

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NOVA SCOTIA Transportation and Infrastructure Renewal

HALIFAX REGIONAL MUNICIPALITY

Stantec

Bayers Road Highway 102 Corridor Study

CONSTRAINTS PLAN
PLAN 5

DWG No.	SK-0002
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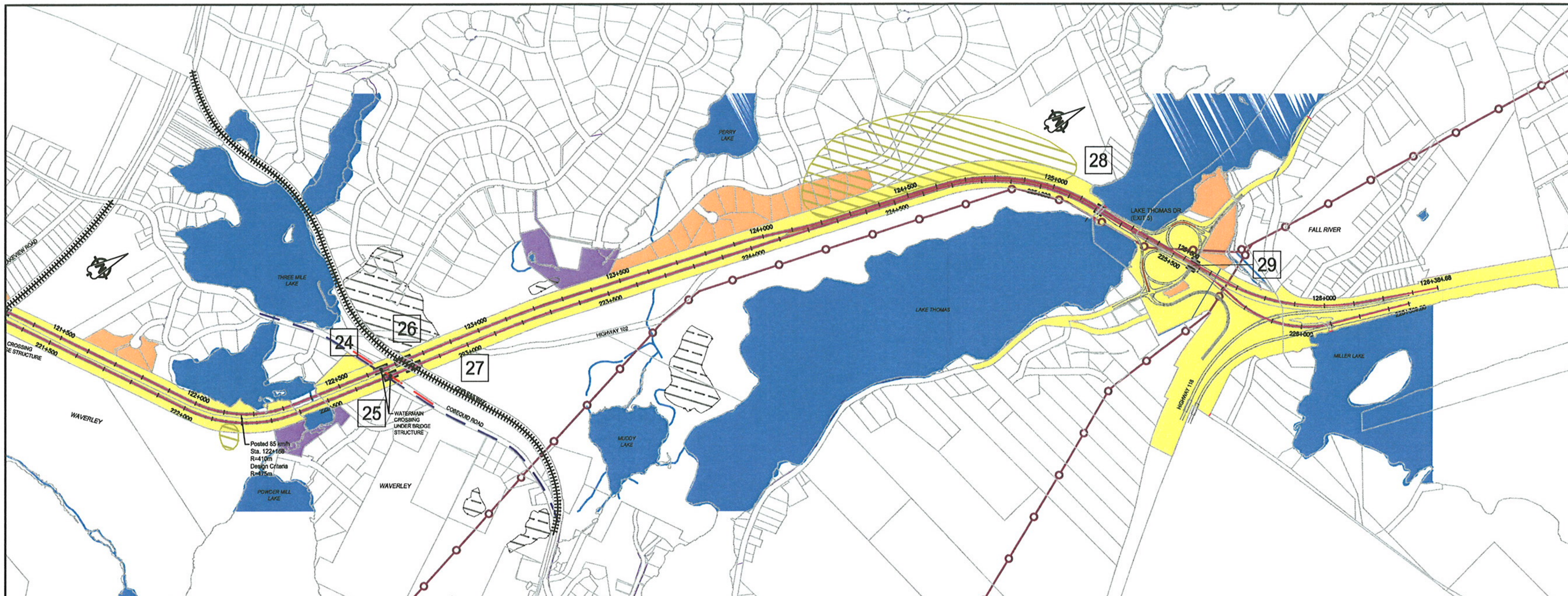

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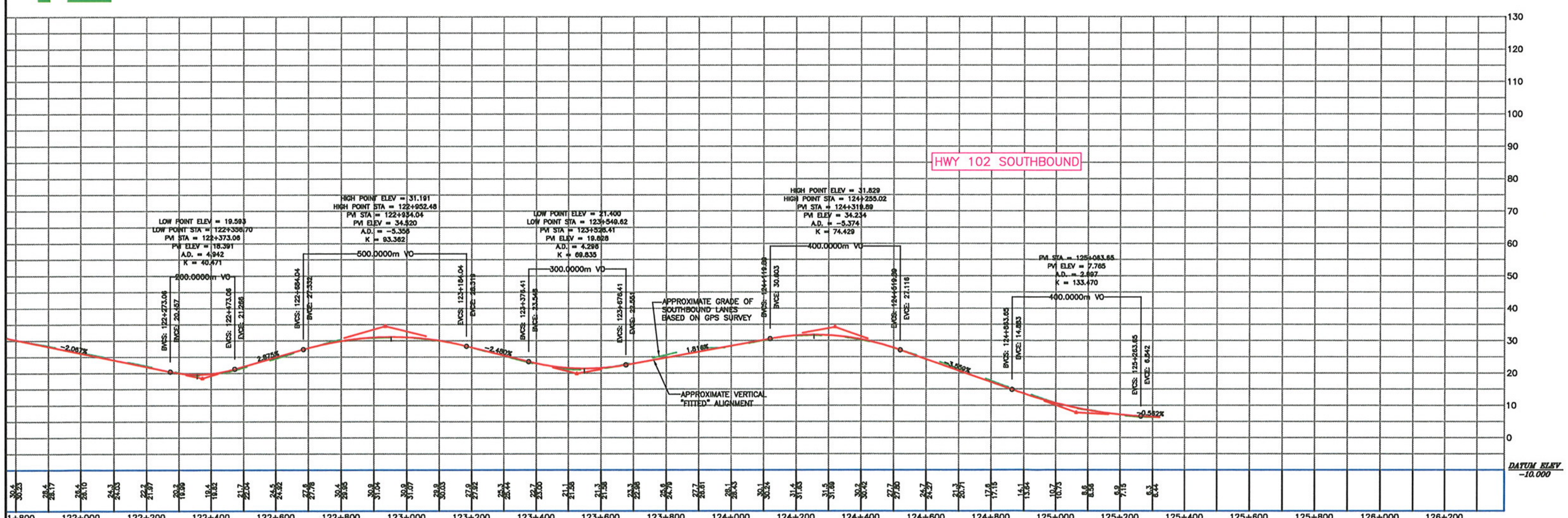

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No.	Date	Revision Description	Appr'd

NOVA SCOTIA Transportation and Infrastructure Renewal

HALIFAX REGIONAL MUNICIPALITY

Stantec

Bayers Road
Highway 102
Corridor Study

CONSTRAINTS PLAN
PLAN 6

DWG No.	SK-0002
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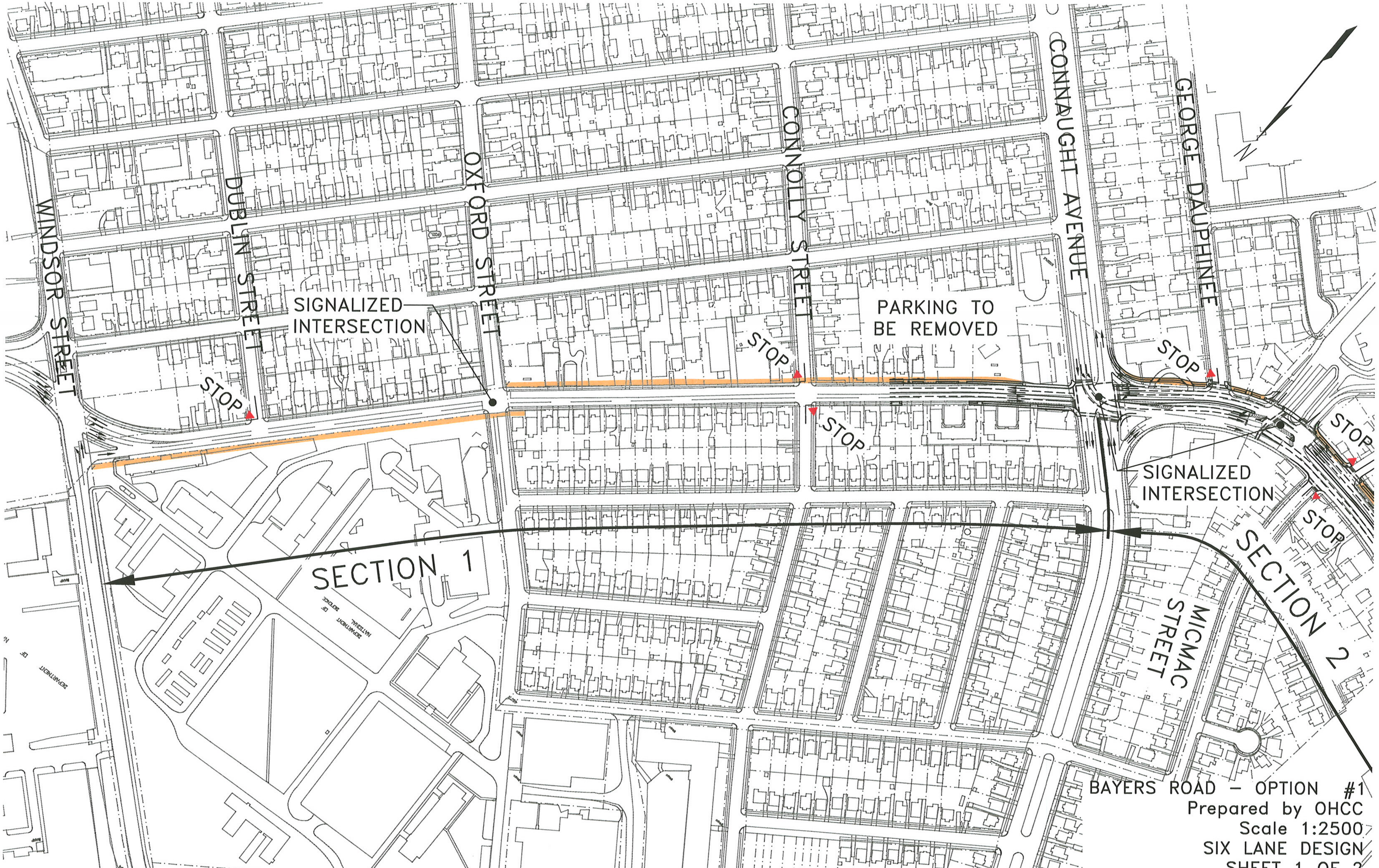
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PARKING TO BE REMOVED
STOP
SIGNALIZED INTERSECTION
SECTION 1
SECTION 2
MICMAC STREET
N
BAYERS ROAD - OPTION #1
Prepared by OHCC
Scale 1:2500
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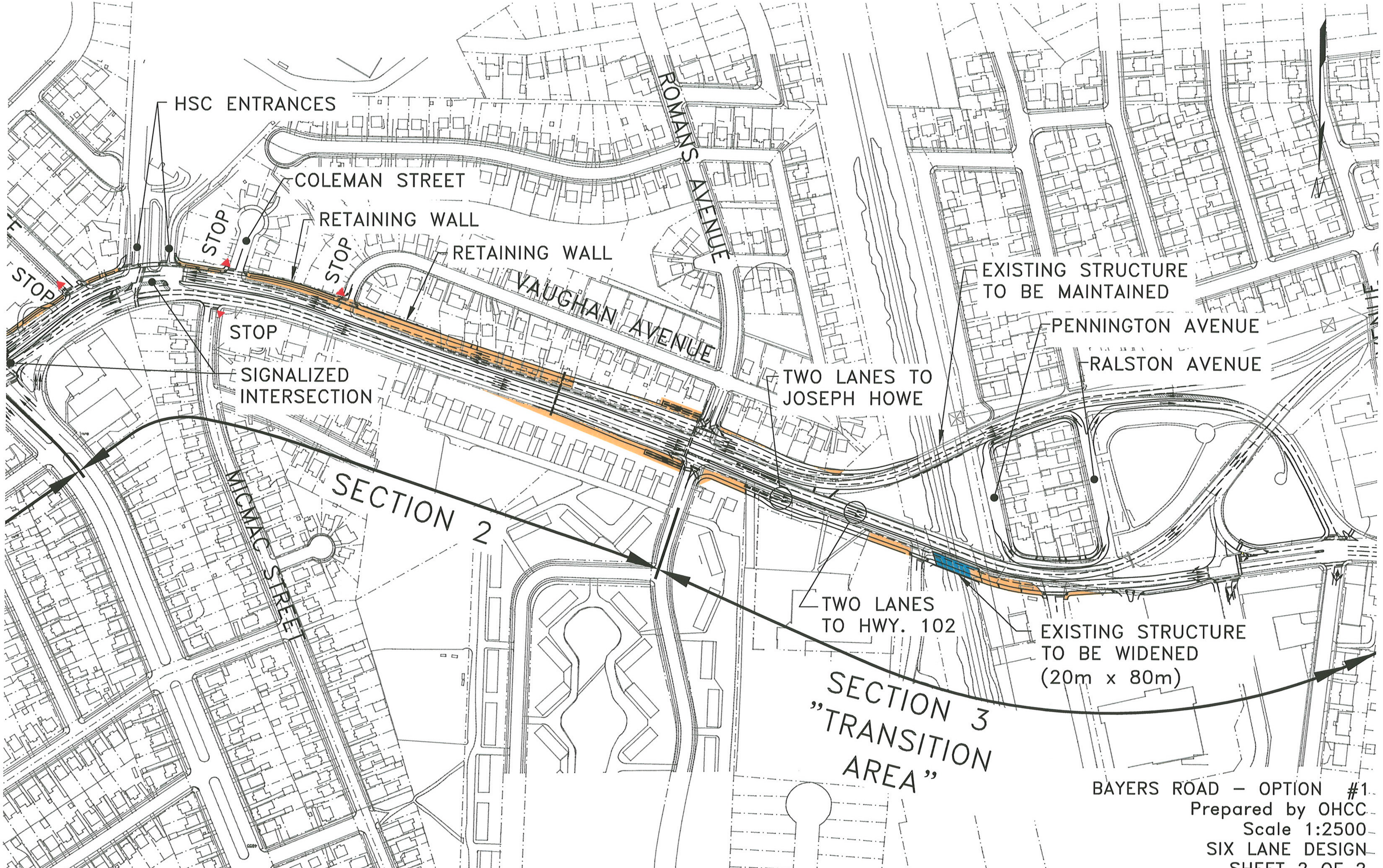
SHEET 1 OF 2



BAYERS ROAD – OPTION #1
Prepared by OHCC
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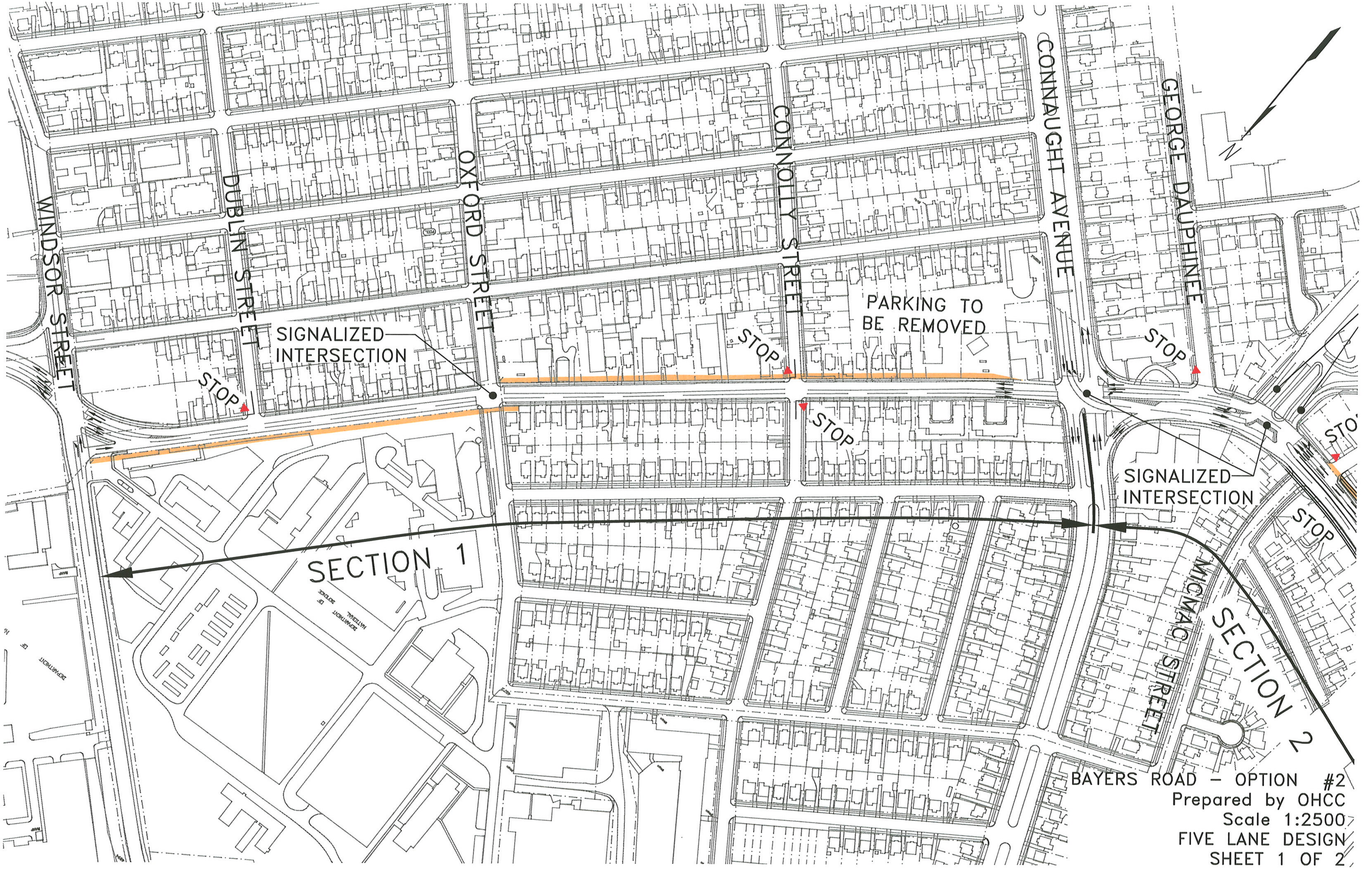
SIX LANE DESIGN
SHEET 2 OF 2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DUBLIN STREET
OXFORD STREET
CONNOLLY STREET
CONNAUGHT AVENUE
GEORGE DAUPHINEE
MICMAC STREET
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SIGNALIZED INTERSECTION
SIGNALIZED INTERSECTION
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STOP
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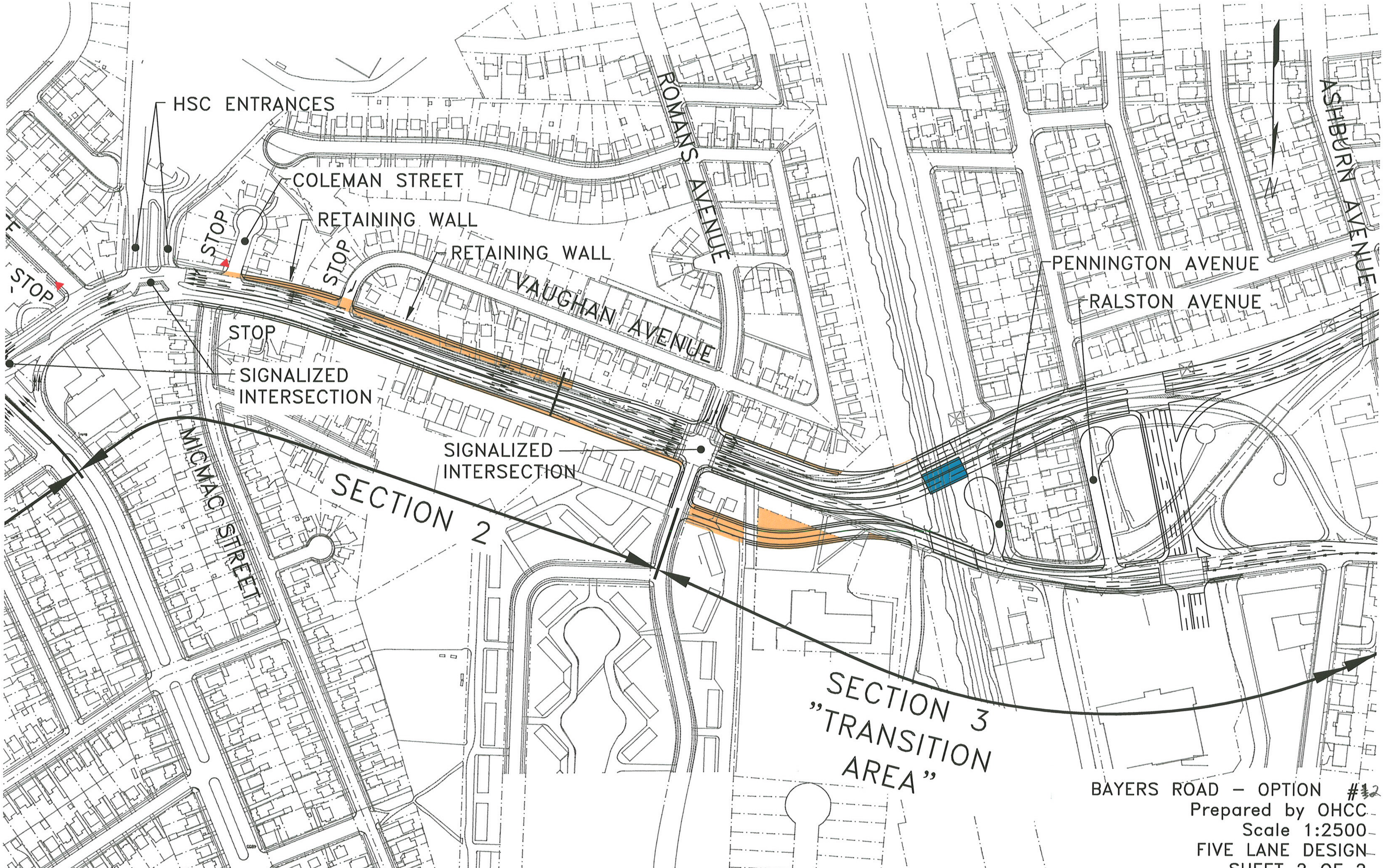
BAYERS ROAD - OPTION #2
Prepared by OHCC
Scale 1:2500
FIVE LANE DESIGN
SHEET 1 OF 2



BAYERS ROAD – OPTION #12
Prepared by OHCC
Scale 1:2500
FIVE LANE DESIGN
SHEET 2 OF 2

APPENDIX C
HIGHWAY 102 HORIZONTAL AND VERTICAL DATA

Table C1: Highway 102 Northbound Grade Information

Direction of Travel

Corridor Section No.	PVI Station	Grade (%)	Length (m)	Uphill	Downhill	Comments
3	200+448	3.28	317	X		
	201+405	7.24	1016	X		Exceeds allowable grade
4	201+794	2.73	389	X		
5	-	-	-			
	203+787	1.53	2003		X	
6	205+074	3.18	1296		X	
	205+566	0.67	494	X		
	206+084	4.96	518		X	
	206+432	0.65	347		X	
	206+695	3.62	263		X	
	207+277	3.06	582	X		
	207+881	4.82	604		X	
7	208+370	1.43	489	X		
	208+915	5.18	545	X		
	209+292	2.21	377		X	
	209+840	0.24	548		X	
8	210+267	3.24	427		X	
	210+697	0.65	430		X	
	211+343	4.65	646		X	
	211+755	0.70	412	X		
	212+003	1.86	248		X	
	212+224	0.04	221		X	
	212+715	1.74	491	X		
9	213+211	0.02	496	X		
	213+619	5.93	408	X		
	214+346	0.00	727			
	215+086	2.38	740		X	
	216+107	5.83	1021		X	
10	216+992	0.29	885	X		
	217+381	6.03	389	X		Exceeds allowable grade
11	218+367	2.87	986		X	
	219+556	3.75	1189	X		
	220+667	4.55	1111		X	
	221+214	0.12	547		X	
	221+526	2.07	312		X	
	222+420	2.88	894	X		
	222+981	2.48	561		X	
	223+573	1.82	592	X		
	224+366	3.56	793		X	
12	225+110	0.56	744		X	

Table C2: Highway 102 Southbound Grade Information

Direction of Travel

Corridor Section No.	PVI Station	Grade (%)	Length (m)	Uphill	Downhill	Comments
3	100+005					
	100+322	3.28	317		X	
4	101+338	7.24	1016		X	Exceeds allowable grade
	101+727	2.73	389		X	
5	-	-	-			
6	103+730	1.53	2003	X		
	105+026	3.18	1296	X		
7	105+520	0.67	494		X	
	106+038	4.96	518	X		
	106+385	0.65	347	X		
	106+648	3.62	263	X		
	107+230	3.06	582		X	
	107+834	4.82	604	X		
	108+323	1.43	489		X	
8	108+868	5.18	545		X	
	109+245	2.21	377	X		
	109+793	0.24	548	X		
	110+220	3.24	427	X		
9	110+650	0.65	430	X		
	111+296	4.65	646	X		
	111+708	0.70	412		X	
	111+956	1.86	248	X		
	112+177	0.04	221	X		
	112+668	1.74	491		X	
	113+164	0.02	496		X	
10	113+572	5.93	408		X	
	114+299	0.00	727			
	115+039	2.38	740	X		
	116+060	5.83	1021	X		
	116+945	0.29	885		X	
11	117+334	6.03	389		X	Exceeds allowable grade
	118+320	2.87	986	X		
12	119+509	3.75	1189		X	
	120+620	4.55	1111	X		
	121+167	0.12	547	X		
	121+479	2.07	312	X		
	122+373	2.88	894		X	
	122+934	2.48	561	X		
	123+526	1.82	592		X	
	124+319	3.56	793	X		
	125+063	0.56	744	X		

Table C3: Highway 102 Northbound Horizontal Information

Corridor Section No.	PI Station	Radius (m)	Curve Length (m)	Lefthand	Righthand	Comments
	200+447	140	170	X		
3	200+747	277	222		X	
4	201+030	470	236	X		70 km/hr design
5	202+827	570	446		X	Substandard radius
6	204+380	1755	2025		X	
	206+053	19989	233		X	
	206+447	16012	376	X		
	206+833	29989	355		X	
7	207+824	889	401		X	
	208+891	434	532	X		Substandard radius
8	209+599	589	190		X	Substandard radius
	210+909	418	170		X	Substandard radius
	212+474	430	397		X	Substandard radius
	213+190	7012	195	X		
9	213+403	7000	205		X	
	213+633	7988	219		X	
	213+858	5012	140	X		
	214+694	573	357		X	Substandard radius
	216+154	350	380	X		Substandard radius
10	216+739	973	350		X	
11	217+925	1896	158		X	
	220+407	910	480	X		
	220+954	585	478		X	Substandard radius
	222+209	450	378	X		Substandard radius
	223+268	2487	184		X	
12	224+931	643	540		X	
	225+646	500	108		X	Substandard radius
	225+947	355	355	X		Substandard radius

Table C4: Highway 102 Southbound Horizontal Information

Corridor Section No.	PI Station	Radius (m)	Curve Length (m)	Lefthand	Righthand	Comments
	100+224	103	81	X		
	100+402	295	96		X	
	100+579	171	80	X		
3	100+717	290	151		X	
4	100+966	460	231	X		70 km/hr design
5	102+761	570	445		X	Substandard radius
6	104+328	1755	2030		X	
	106+007	20000	233		X	
	106+400	16000	376	X		
	106+787	30000	355		X	
7	107+781	900	407		X	
	108+842	422	518	X		Substandard radius
8	109+546	600	194		X	
	110+853	430	174		X	Substandard radius
	112+433	442	407		X	Substandard radius
	113+153	7000	195	X		
9	113+367	7012	205		X	
	113+627	8000	219		X	
	113+822	5000	139	X		
	114+662	585	365		X	Substandard radius
	116+117	344	374	X		Substandard radius
10	116+697	962	346		X	
11	118+125	2300	192		X	
	120+359	870	449	X		
	120+920	615	495		X	
	122+168	410	345	X		Substandard radius
	123+199	2478	185		X	
	123+949	1426	119		X	
	124+173	1475	123	X		
12	124+887	654	549		X	
	125+775	600	251	X		
	126+028	830	255	X		

Table C5: Highway 102 Northbound Vertical Information

Corridor Section No.	PVI Station	K Value	Curve Length (m)	Sag	Crest	Comments
3	200+448	47	199	X		
	201+405	50	200	X		Substandard K value
4	201+794	100	450		X	
5	-	-	-			
	203+787	117	500		X	
6	205+074	181	300		X	
	205+566	78	300	X		
	206+084	62	350		X	Substandard K value
	206+432	46	200	X		Substandard K value
	206+695	67	200		X	Substandard K value
	207+277	45	300	X		Substandard K value
	207+881	57	450		X	Substandard K value
7	208+370	32	200	X		Substandard K value
	208+915	53	200	X		Substandard K value
	209+292	68	500		X	Substandard K value
	209+840	101	200	X		
8	210+267	100	300		X	Substandard K value
	210+697	77	200	X		
	211+343	100	400		X	Substandard K value
	211+755	37	200	X		Substandard K value
	212+003	78	200		X	Substandard K value
	212+224	110	200	X		
	212+715	167	300	X		
9	213+211	174	300		X	
	213+619	34	200	X		Substandard K value
	214+346	152	900		X	
	215+086	168	400		X	
	216+107	145	500		X	
10	216+992	49	300	X		Substandard K value
	217+381	52	300	X		Substandard K value
11	218+367	67	600		X	Substandard K value
	219+556	121	800	X		
	220+667	72	600		X	Substandard K value
	221+214	34	150	X		Substandard K value
	221+526	205	400		X	
	222+420	40	200	X		Substandard K value
	222+981	93	500		X	Substandard K value
	223+573	70	300	X		
	224+366	74	400		X	Substandard K value
12	225+110	133	400	X		

Table C6: Highway 102 Southbound Vertical Information

Corridor Section No.	PVI Station	K Value	Curve Length (m)	Sag	Crest	Comments
3	100+322	131	500	X		
	101+338	50	200	X		Substandard K value
4	101+727	100	450		X	
5	-	-	-			
	103+730	117	500		X	
6	105+026	181	300		X	
	105+520	78	300	X		
	106+038	62	350		X	Substandard K value
	106+385	46	200	X		Substandard K value
	106+648	67	200		X	Substandard K value
	107+230	45	300	X		Substandard K value
	107+834	57	450		X	Substandard K value
7	108+323	32	200	X		Substandard K value
	108+868	53	200	X		Substandard K value
	109+245	68	500		X	Substandard K value
	109+793	101	200	X		
8	110+220	100	300		X	Substandard K value
	110+650	77	200	X		
	111+296	100	400		X	Substandard K value
	111+708	37	200	X		Substandard K value
	111+956	78	200		X	Substandard K value
	112+177	110	200	X		
	112+668	167	300	X		
9	113+164	174	300		X	
	113+572	34	200	X		Substandard K value
	114+299	152	900		X	
	115+039	168	400		X	
	116+060	145	500		X	
10	116+945	49	300	X		Substandard K value
	117+334	52	300	X		Substandard K value
11	118+320	67	600		X	Substandard K value
	119+509	121	800	X		
	120+620	72	600		X	Substandard K value
	121+167	34	150	X		Substandard K value
	121+479	205	400		X	
	122+373	40	200	X		Substandard K value
	122+934	93	500		X	Substandard K value
	123+526	70	300	X		
	124+319	74	400		X	Substandard K value
12	125+063	133	400	X		

APPENDIX D
STRUCTURAL DATA SHEETS

Bridge 1: Bayers Road Overpass at CN Rail on inbound lanes

- No drawings available
- Type of Structure: concrete slab-on-steel girders with cast-in-place concrete abutments
- Year of design/construction is unknown
- Currently 2 travel lanes in the inbound direction only.
- Total available width on deck, curb to curb distance: unknown
- Spans CN track, estimated clear width: unknown
- Coordinates :

Bridge 2: Bayers Road Overpass at CN Rail on outbound lanes

- No drawings received from NSTPW
- Type of Structure: rigid concrete arch
- Year of design/construction is unknown
- Currently 2 travel lanes in the outbound direction only.
- Total available width on deck, curb to curb distance: unknown
- Spans CN track, estimated clear width: unknown
- Coordinates:

Bridge 3: 102 Highway Overpass at Desmond Street (HFX 220)

- No general arrangement drawings available
- Cast-in-place concrete solid slab bridge with cast in place concrete abutments.
- Year of design/construction is unknown, but expected to coincide with the adjacent structure in 1962.
- Currently 2 travel lanes in the Northbound direction only.
- Total available width on deck, curb to curb distance: unknown
- Spans single lane Desmond Street, open abutment, estimated clear width: unknown
- Coordinates 44°39'9.46"N, 63°37'38.82"W

Bridge 4: 102 Highway Overpass at Joseph Howe Avenue

- General arrangement drawing available
- Slab-on-girder bridge with steel girders and cast-in-place concrete abutments and piers.
- Year of design/construction 1962.
- Currently 4 lane deck.
- Deck width: Two 25 ft (7.6 m) clear sections, with a 4 ft (1.2 m) curbed median between, 54 ft (16.4 m) total.
- Ashburn Avenue, Joseph Howe Drive and CNR pass beneath
- Coordinates 44°39'5.81"N, 63°37'49.77"W

Bridge 5: 102 Highway Overpass at Joseph Howe Avenue Interchange Ramp

- No general arrangement drawings available
- Steel beams with cast-in-place concrete abutments
- Year of design/construction is unknown, but expected to coincide with the adjacent structure in 1962.
- Currently 4 travel lanes plus median on the deck
- Total available width curb to curb distance estimate to be 53.8 ft (16.4 m) as Joseph Howe structure
- Structure spans a single lane ramp, closed abutments, estimated width 23 ft (7.0 m)
- Coordinates 44°39'5.34"N, 63°37'55.16"W

Bridge 6: 102 Highway Underpass at North West Arm Drive

- General arrangement drawings available
- Multi spine steel box girder bridge with cast-in-place concrete abutments.
- Year of the original design/construction 1976.
- Currently 2 traveling lanes and a single ramp lane per side.
- Deck width (NW Arm Drive): 82 ft (25m) curb to curb
- Clear span over 102, closed abutments: 116 ft (35.3 m) clear, 6 lanes total, 4 through, 2 auxiliary.
- Coordinates 44°38'44.73"N, 63°38'44.02"W

Bridge 7: 102 Highway Underpass at 103 Highway

- General arrangement drawings available
- Slab-on-girder bridge with steel plate girders with cast-in-place concrete abutments
- Year of the original design/construction 1963.
- Currently 5 lane (Hwy 102) beneath structure, total available width: 71.9 ft (21.9 m) pier to pier distance.
- Deck width (Hwy 103), 47.9 ft (14.6 m), three lanes with median
- Coordinates 44°38'37.22"N, 63°39'17.94"W

Bridge 8: 102 Highway Overpass at Lacewood Drive

- General arrangement drawings available
- Rolled steel beams with cast-in-place concrete abutments
- Year of design/construction 1989.
- Deck width: 104 ft (31.7m) curb to curb, currently 4 lane, width available for future 6 lanes
- Structure designed to span 6 lanes on Lacewood Drive.
- Coordinates 44°39'29.60"N, 63°40'27.07"W

Bridge 9: 102 Highway Overpass at Kearney Lake Road

- General arrangement drawings available
- Slab-on-steel beams with cast-in-place concrete abutments
- The original bridge structure was widened on design drawings dated 1979
- Year of the original design/construction is unknown.
- Currently 2 traveling lanes per side.
- Deck width (Hwy 102): 100’ (30.5m), curb to curb.
- Structure spans 3 lane Kearney Lake Road : clear span 57’ – 9” (17.6m), closed abutment.
- Coordinates 44°41'5.84"N, 63°40'38.92"W

Bridge 10: 102 Highway Box Culvert at Watercourse

- No drawings received from NSTPW
- Double cell box culvert structure.
- Year of design/construction: unknown
- Currently 4 traveled lanes pass over
- Coordinates 44°42'32.81"N, 63°41'47.83"W
- Kearney Run, adjacent proposed Highway 113 connection

Bridge 11: 102 Highway Overpass at Hammonds Plains Road

- General arrangement drawings available
- Slab-on-steel girder with cast-in-place concrete abutments.
- The original bridge structure was widened by the design drawings dated 1979
- Year of the original design/construction is unknown.
- Deck Width (Hwy 102): 130 ft (39.6 m) curb to curb, existing 6 lanes, 4 core lanes and two auxiliary plus gore areas.
- Structure spans Hammonds Plains Road, 2 lanes, closed abutments. 60 ft (18.3 m) clear between abutments
- Coordinates 44°43'24.16"N, 63°41'24.57"W

Bridge 12: Highway 102 Bridge Over Sackville River

- General arrangement drawings available
- Slab-on-concrete girder bridge with cast in place concrete abutments.
- The original bridge structure was widened by the design drawings dated 1979
- Year of the original design/construction is unknown.
- Currently 2 traveling lanes and 1 ramp lane per side (6 lanes total)
- Deck width: 122 ft (37.2 m) curb to curb
- Spans Sackville River: 108 ft (32.9 m) pier to pier
- Coordinates 44°44'30.64"N, 63°39'33.41"W

Bridge 13: 102 Highway Underpass at Bedford Highway

- No drawings available
- Slab-on-steel girder and cast-in-place concrete abutments
- Year of design/construction is unknown.
- Currently 2 traveling lanes (Hwy 102) and one ramp lane per side passing beneath the structure, total of 6 lanes, two span, closed abutment, total available width: unknown
- Deck Width (Hwy 1), 4 lanes, width unknown
- Coordinates 44°44'41.50"N, 63°39'23.14"W

Bridge 14: 102 Highway Underpass at Bedford Bypass

- General arrangement drawings available
- Slab-on-steel girders with cast-in-place concrete abutments
- Year of the original design/construction 1976.
- Currently 2 traveling lanes and one ramp lane per side passing beneath the structure, total of 6 lanes (Highway 102), open abutment, single span, 106 ft (32.3 m) clear span, pier to pier
- There does not appear to be any room for additional lanes without widening the existing structure.
- Deck Width (Bedford Bypass): 64 ft (19.5 m), curb to curb
- Coordinates 44°44'51.81"N, 63°39'13.44"W

Bridge 15: Highway 101 to Bedford Bypass Inbound

- General arrangement drawings available
- Cast-in-place post-tensioned slab and beam bridge with cast-in-place concrete abutments.
- Year of design/construction 1977.
- Currently 3 travel lanes in the inbound direction only.
- Deck width, 45 ft (13.7 m)
- Coordinates 44°44'52.79"N, 63°39'31.11"W

Bridge 16: Sackville Drive Ramp over Bedford Highway to Bedford Bypass Inbound

- No general arrangement drawings available
- Slab-on- steel girder bridge with cast-in-place concrete abutments
- Year of design/construction: unknown
- Currently 2 traveling lanes in the inbound direction only
- Coordinates 44°44'58.16"N, 63°39'40.68"W

Bridge 17: Bedford Bypass Outbound to Highway 101 (over Memory Lane and Sackville Drive)

- No general arrangement drawings available
- Cast-in-place post-tensioned box beam with cast-in-place concrete abutments
- Year of design/construction is unknown.
- Currently 2 traveling lanes in the outbound direction only.
- Deck width: 36 ft (11.0 m), out to out.
- Coordinates 44°45'1.70"N, 63°39'43.47"W

Bridge 18: Highway 102 Underpass at Glendale/Duke

- General arrangement drawings are available
- Slab-on- steel girder bridge with cast-in-place concrete abutments.
- Year of the original design/construction 1995.
- There are currently 2 traveling lanes on the North and South bound lanes.
- Provisions were made during the design of this structure to accommodate future widening or additional ramp lanes beneath the structure.
- Deck Width (Glendale, Duke), 73.8 ft (22.5 m) curb to curb, with a 3.9 ft (1.2 m) median
- Three varying spans over (Hwy 102), open abutment
- Coordinates 44°45'20.15"N, 63°38'44.00"W

Bridge 19: Duke Street Overpass adjacent to Highway 102

- General arrangement drawings available
- Slab-on girder bridge with prestressed concrete girders and MSE abutments.
- Year of the original design/construction 1993
- Deck Width 60.0 ft (18.3 m) curb to curb
- Currently at the transition from 2 to 4 total traveling lanes (Bridge deck – Duke Street).
- Clear span beneath: = 88 ft (26.8 m)
- Apparently placed to accommodate ramp structures for a future interchange.
- Coordinates 44°45'14.70"N, 63°38'36.75"W

Bridge 20: 102 Highway Overpass at Lakeview Road - Southbound Lanes

- No drawings available
- Concrete slab-on-prestressed concrete girder bridge with cast in place concrete abutments.
- Year of the original design/construction: unknown
- Currently 2 traveling lanes side (divided highway)
- Deck Width: unknown
- Coordinates 44º46'58.39"N, 63º37'05.62"W

Bridge 21: 102 Highway Overpass at Lakeview Road - Northbound Lanes

- No general arrangement drawings available
- Slab-on-prestressed concrete girder bridge with cast in place concrete abutments.
- Year of the original design/construction is unknown.
- Photos 51 to 58
- Currently 2 travel lanes over (divided highway). Total deck width: unknown
- Coordinates 44º46'58.93"N, 63º37'04.10"W

Bridge 22: 102 Highway Overpass at CNR Crossings adjacent to Lakeview Road - Southbound Lanes

- General arrangement drawings available.
- Pre-stressed concrete slab-on girder bridge with cast in place concrete abutments.
- Year of the original design/construction 1980.
- Currently 2 travel lanes (divided highway)
- Deck width – Highway 102 (curb to curb): 40.2 ft (12.25 m)
- Coordinates 44º47’00.83”N, 63º37’05.22”N

Bridge 23: 102 Highway Overpass at CNR Crossings adjacent to Lakeview Road - Northbound Lanes

- No general arrangement drawings available
- Slab-on-prestressed concrete girder bridge with cast in place concrete abutments.
- Year of the original design/construction is unknown.
- Currently 2 travel lanes (divided highway)
- Deck width (Hwy 102): unknown
- There does not appear to be any room for additional lanes without widening the existing structure.
- Coordinates 44º47'01.54"N, 63º37'03.65"N

Bridge 24: 102 Highway Overpass at Cobequid Road - Southbound Lanes

- Newer Structure for Southbound Lane
- Drawings received from NSTPW.
- Prestressed concrete slab-on girder bridge with cast in place concrete abutments.
- Year of the original design/construction 1980.
- Currently 2 travel lanes (divided highway)
- Deck width (Hwy 102): 40.2 ft (12.3 m) curb to curb
- Coordinates 44º46'58.39"N, 63º37'05.62"W

Bridge 25: 102 Highway Overpass at Cobequid Road - Northbound Lanes

- No general arrangement drawings available
- Slab-on- prestressed concrete girder bridge with cast in place concrete abutments.
- Year of the original design/construction is unknown.
- Currently 2 travel lanes.
- Total available deck width (Hwy 102): unknown
- Coordinates 44º46'58.93"N, 63º37'04.10"W

Bridge 26: 102 Highway Overpass at CNR Crossings Adjacent to Cobequid Road - Southbound Lanes

- General arrangement drawings available
- Prestressed concrete slab-on-girder bridge with cast in place concrete abutments.
- Year of the original design/construction 1980.
- Currently 2 travel lanes (divided highway).
- Deck width (Hwy 102), curb to curb: 40.2 ft (12.3 m)
- Coordinates 44º47’00.83”N, 63º37’05.22”W

Bridge 27: 102 Highway Overpass at CNR Crossings Adjacent to Cobequid Road - Northbound Lanes

- No general arrangement drawings available.
- slab-on-prestressed concrete girder bridge with cast in place concrete abutments founded on rock.
- Year of the original design/construction is unknown.
- Currently 2 travel lanes (divided highway).
- Total available deck width: unknown
- Coordinates 44º47’01.54”N, 63º37’03.65”W

Bridge 28: Highway 102 Bridge Over Lake Thomas watercourse

- General arrangement drawings available
- Cast-in-place concrete solid slab bridge with cast in place concrete abutments founded on rock.
- The drawings indicate a future widening which appears to have taken place.
- Year of the original design/construction 1961. Date of widening is unknown
- Currently 4 lane section with narrow median
- Deck Width (Highway 102): 38 ft (11.5 m), curb to curb.
- Span (over waterway): 31 ft (9.45 m)
- Coordinates 44º48’14.75”N, 63º36’34.14”W

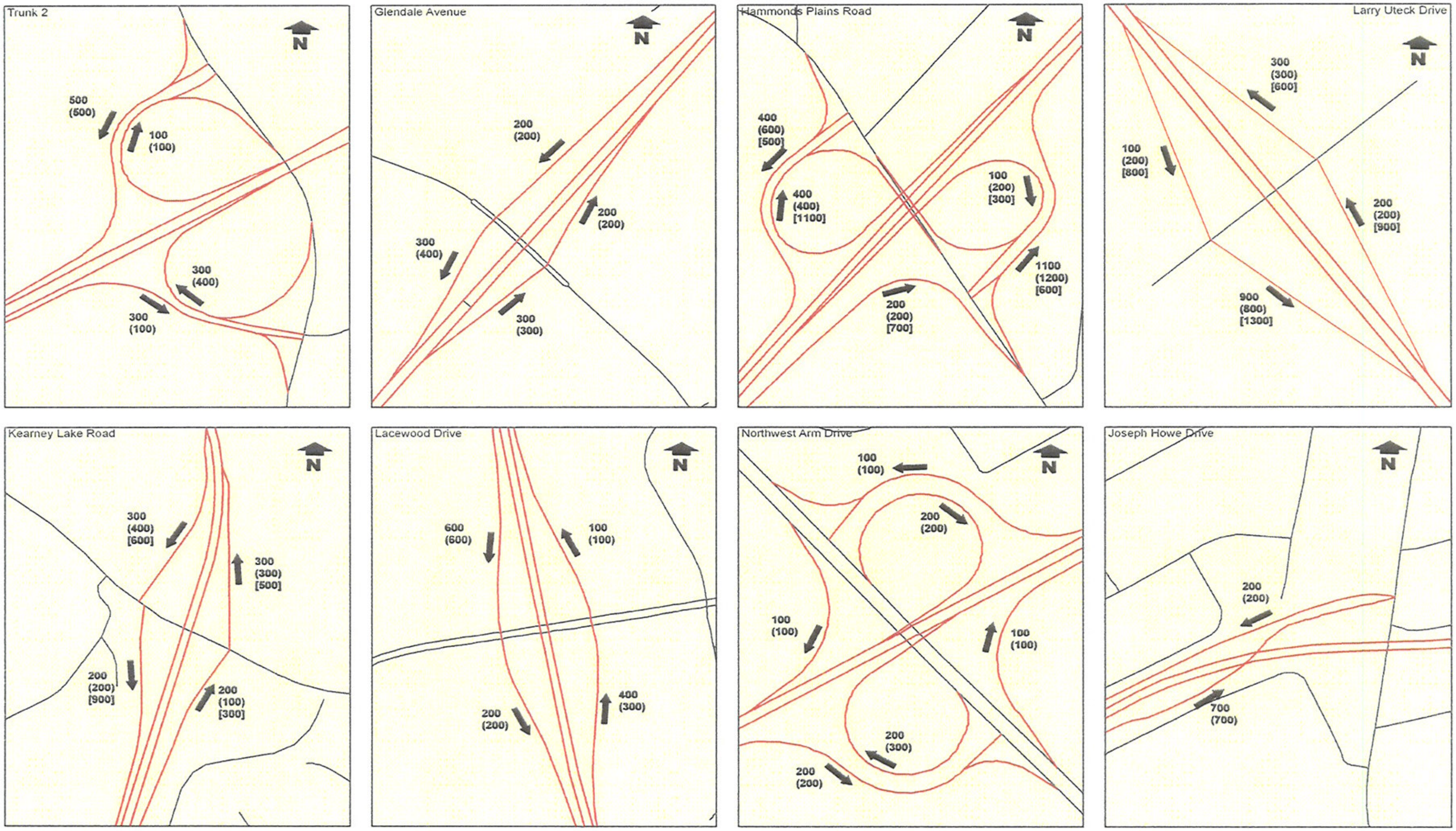
Bridge 29: Highway 102 Overpass at Lake Thomas Drive

- No general arrangement drawings are available
- Slab-on-steel girder with cast-in-place concrete abutments
- The abutment appears to have been cast in three different segments. Perhaps they were originally individual twin structures that were later widened by closing in the space between.
- Year of design/construction unknown.
- Currently 4 through lanes and two auxiliary lanes on deck, 6 lanes total.
- Total available width: unknown
- Structure spans 2-3 lane Lake Thomas Drive, closed abutment, clear span: unknown
- Coordinates 44º48’20.57”N, 63º36’20.29”W

APPENDIX E

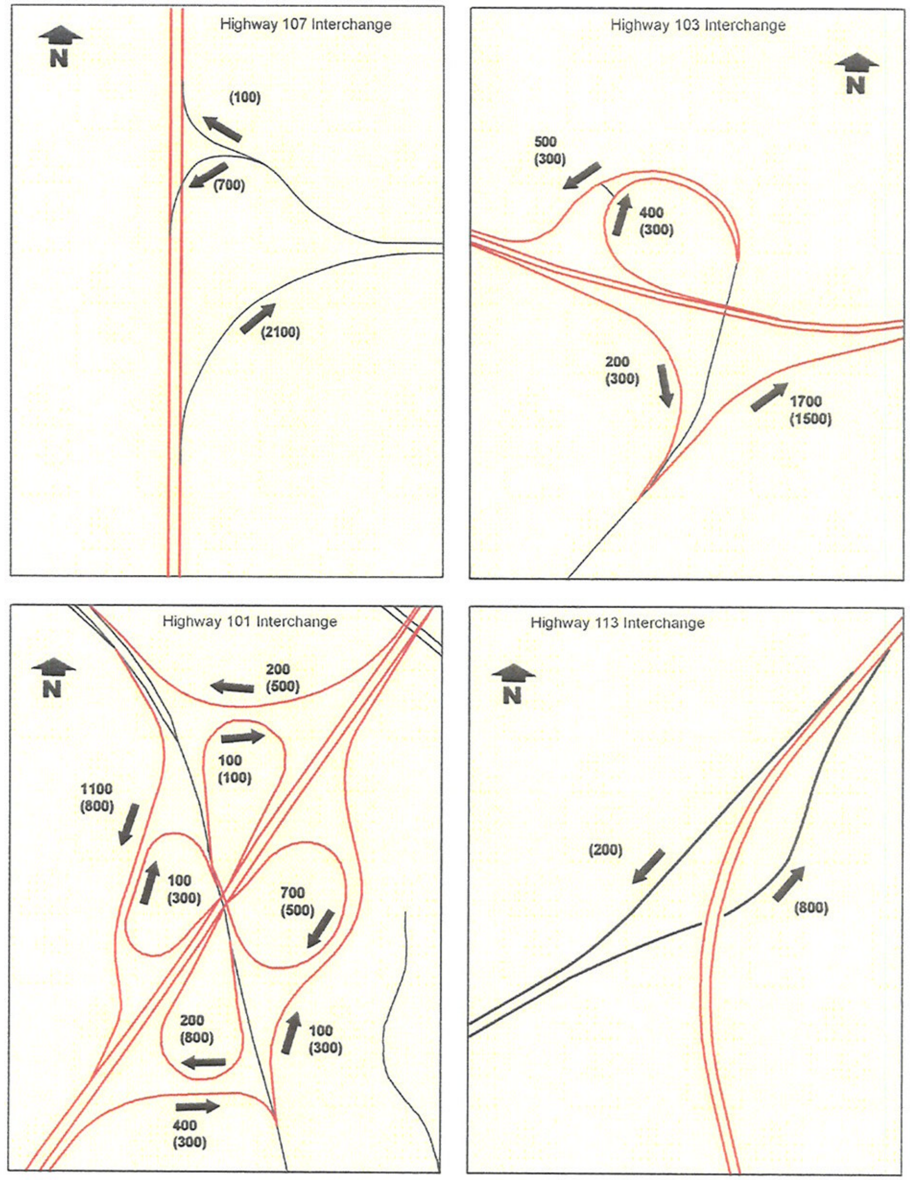
Forecast Corridor Ramp Volumes

Figure E1 Forecast Ramp Volumes - 2016 AM Peak Hour



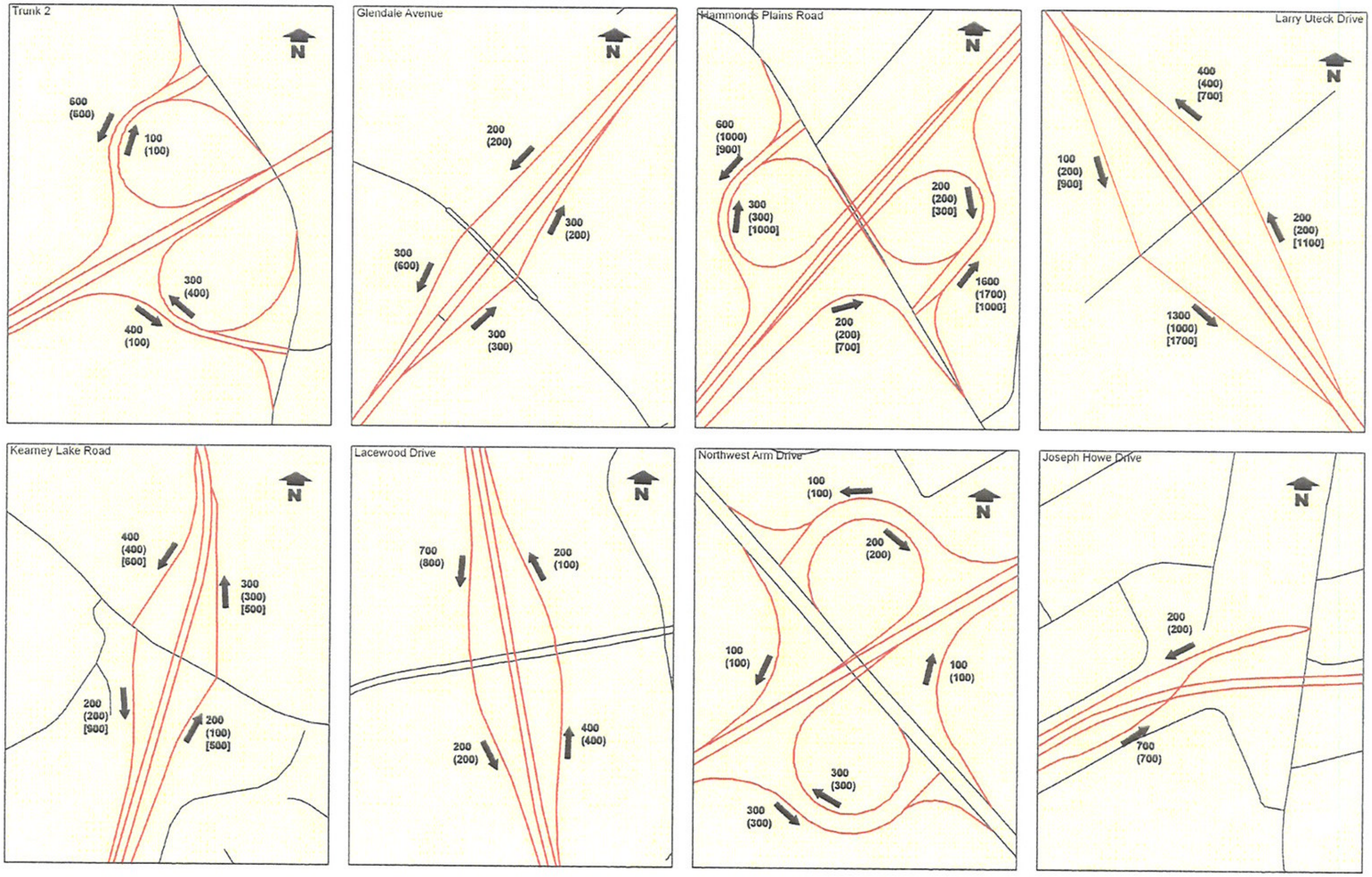
Legend:	
Scenario A Volumes	500
Scenario B & C Volumes	(400)
HRM Study Volumes	[600]

Figure E1 Forecast Ramp Volumes - 2016 AM Peak Hour, Continued



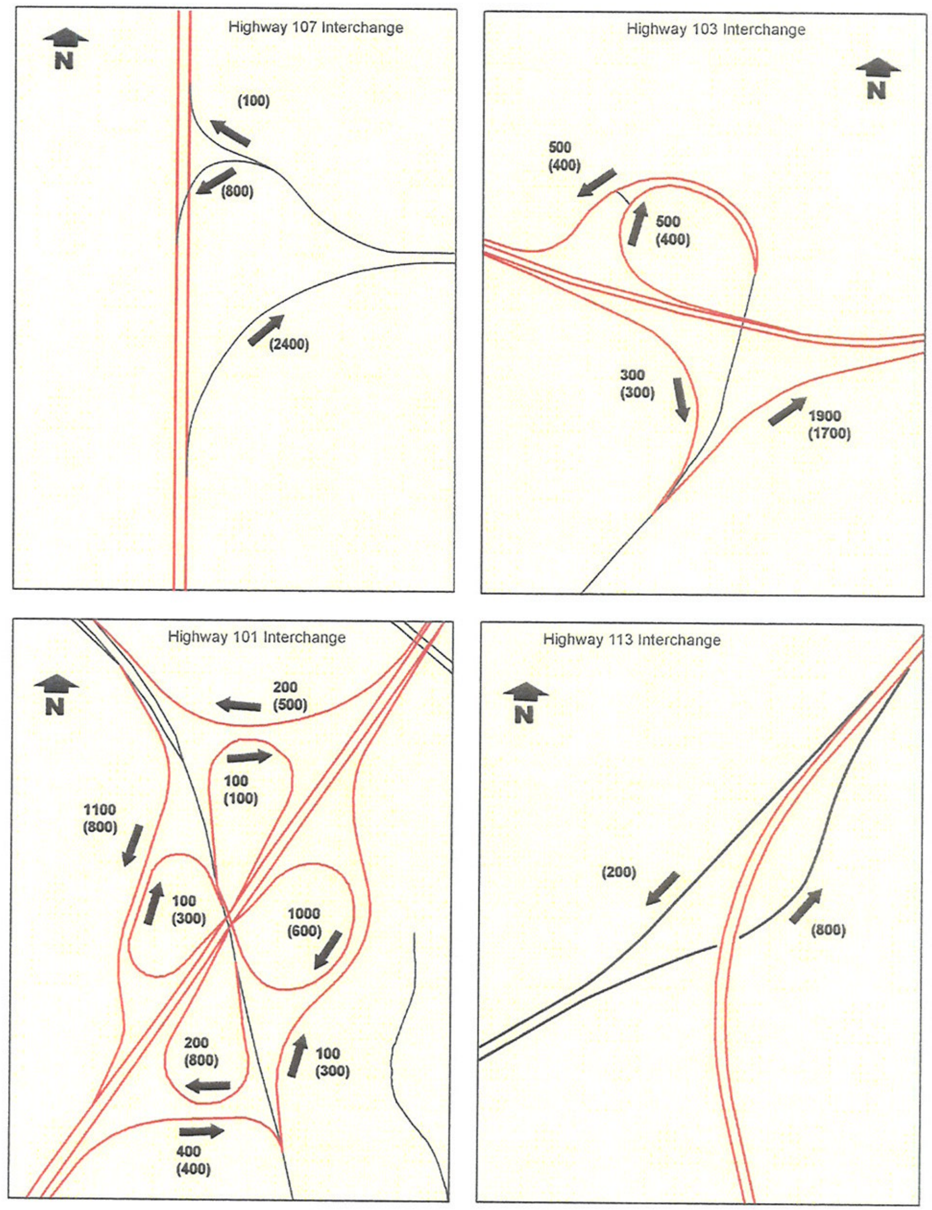
Legend: Scenario A Volumes 500
Scenario B & C Volumes (400)
HRM Study Volumes [600]

Figure E2 Forecast Ramp Volumes - 2026 AM Peak Hour



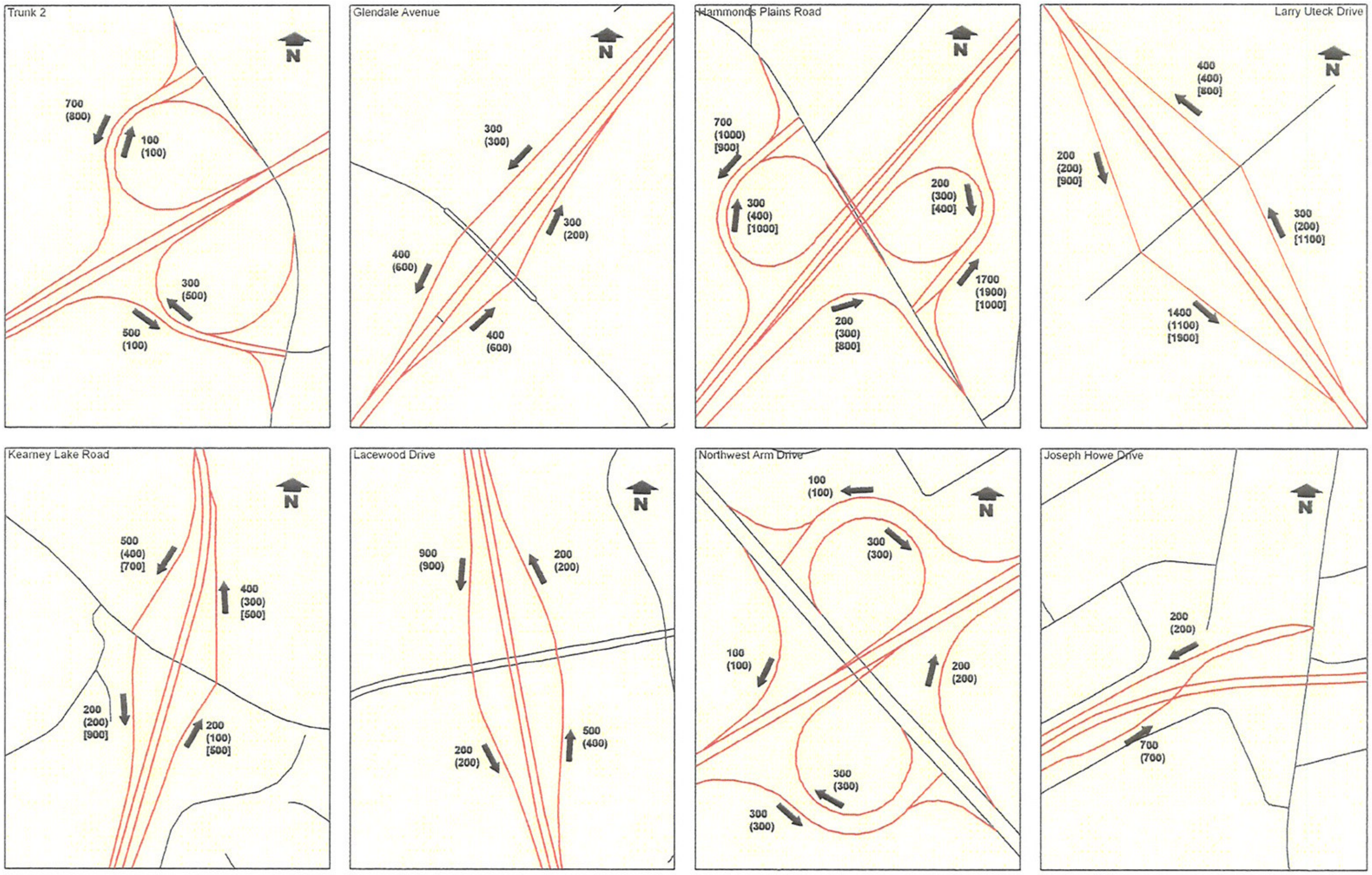
Legend:		
	Scenario A Volumes	500
	Scenario B & C Volumes	(400)
	HRM Study Volumes	[600]

Figure E2 Forecast Ramp Volumes - 2026 AM Peak Hour, Continued



Legend:	Scenario A Volumes	500
	Scenario B & C Volumes	(400)
	HRM Study Volumes	[600]

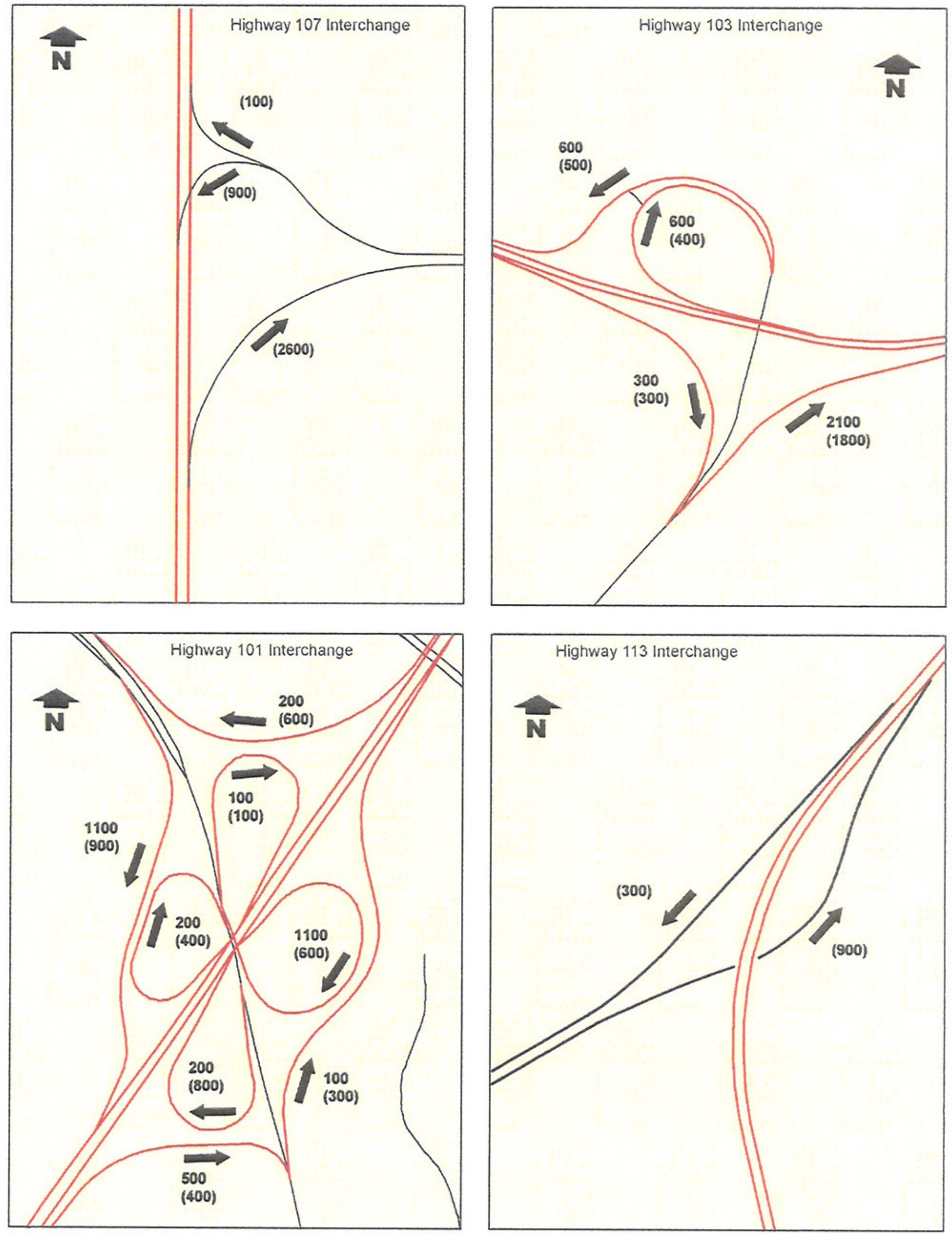
Figure E3 Forecast Ramp Volumes - 2036 AM Peak Hour



Legend:

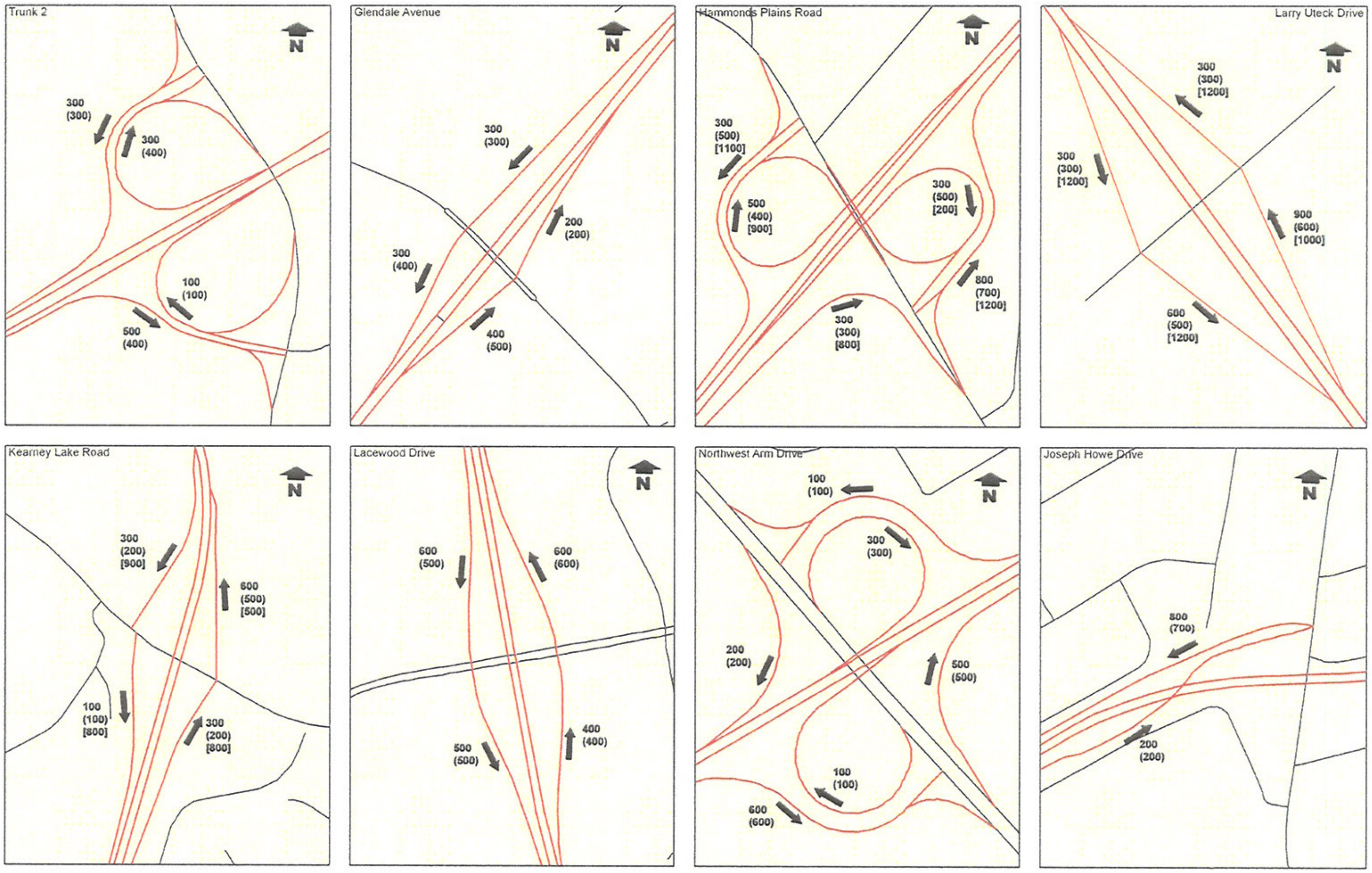
Scenario A Volumes	500
Scenario B & C Volumes	(400)
HRM Study Volumes	[600]

Figure E3 Forecast Ramp Volumes - 2036 AM Peak Hour, Continued



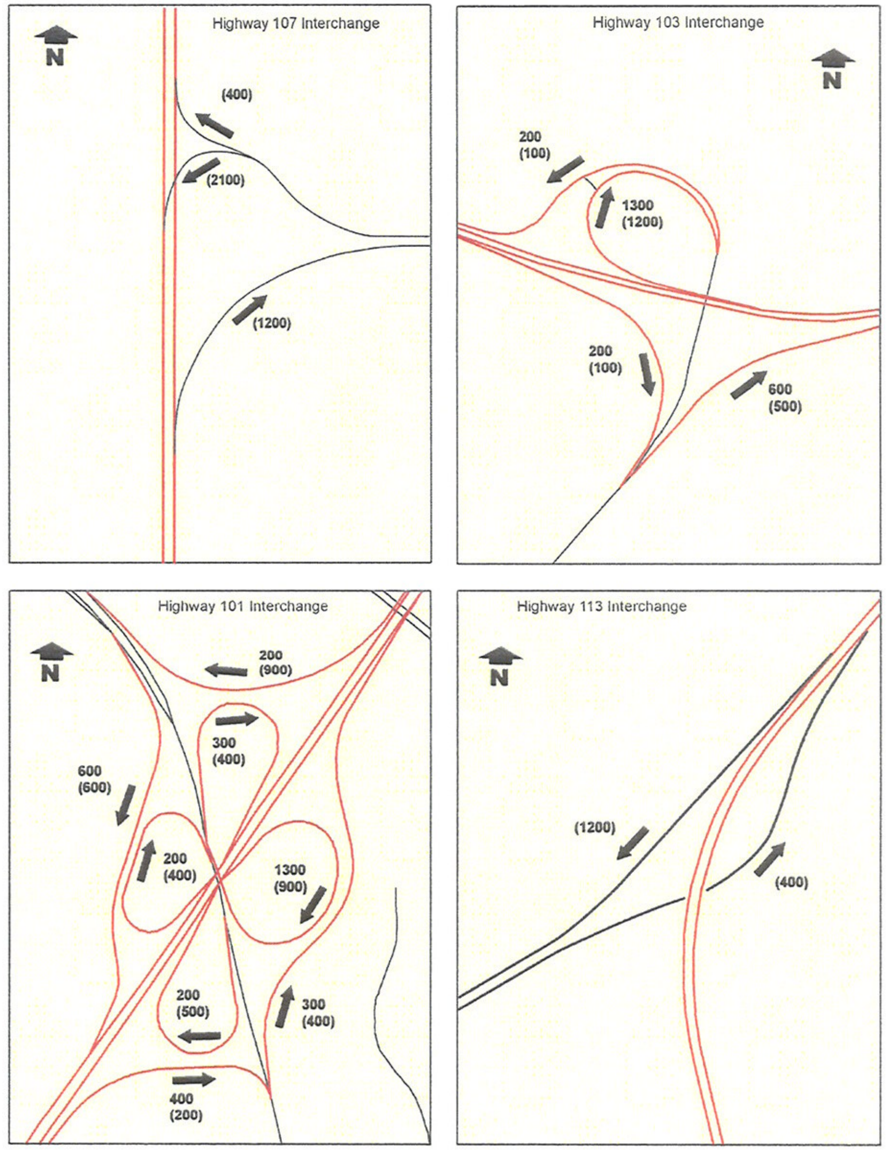
Legend:		
	Scenario A Volumes	500
	Scenario B & C Volumes	(400)
	HRM Study Volumes	[600]

Figure E4 Forecast Ramp Volumes - 2016 PM Peak Hour



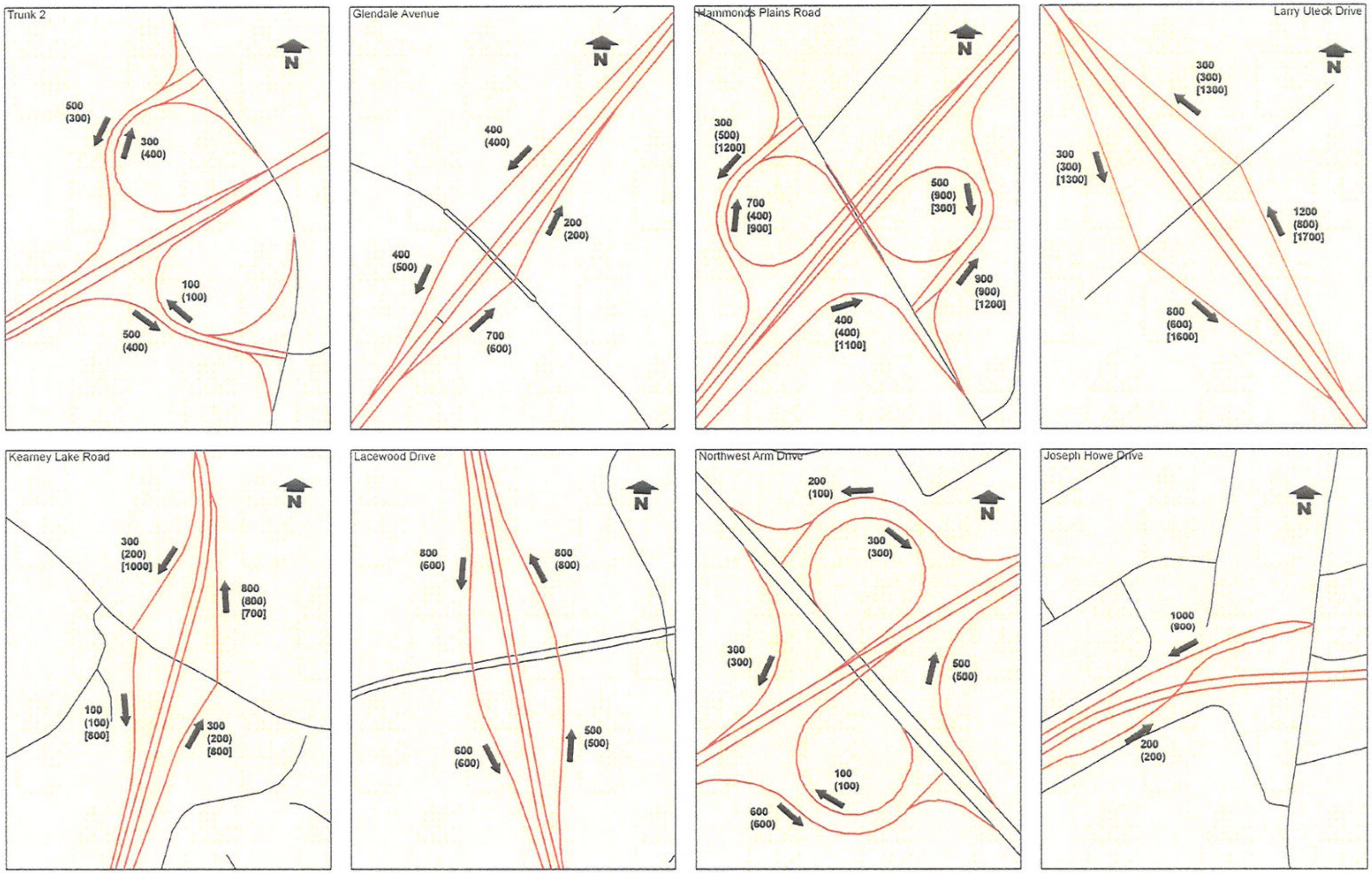
Legend:		
	Scenario A Volumes	500
	Scenario B & C Volumes	(400)
	HRM Study Volumes	[600]

Figure E4 Forecast Ramp Volumes - 2016 PM Peak Hour, Continued



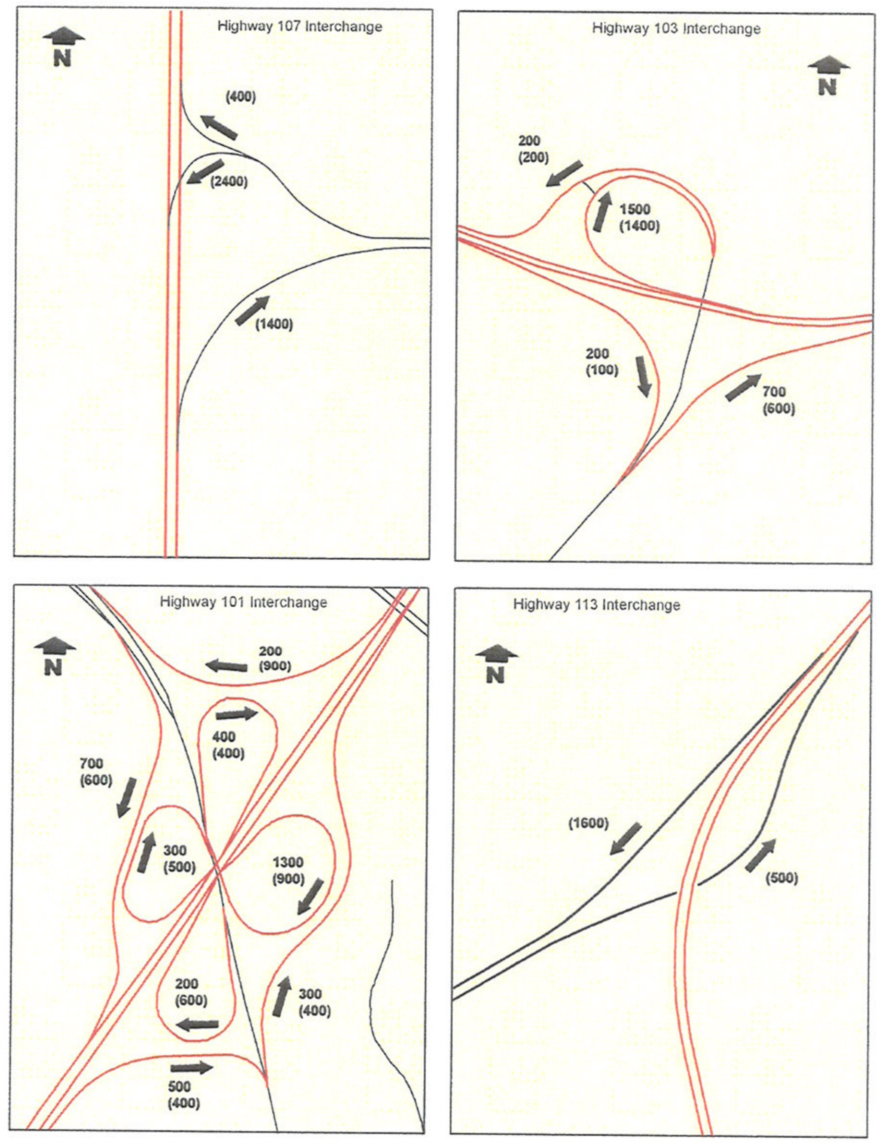
Legend: Scenario A Volumes	500
Scenario B & C Volumes	(400)
HRM Study Volumes	[600]

Figure E5 Forecast Ramp Volumes - 2026 PM Peak Hour



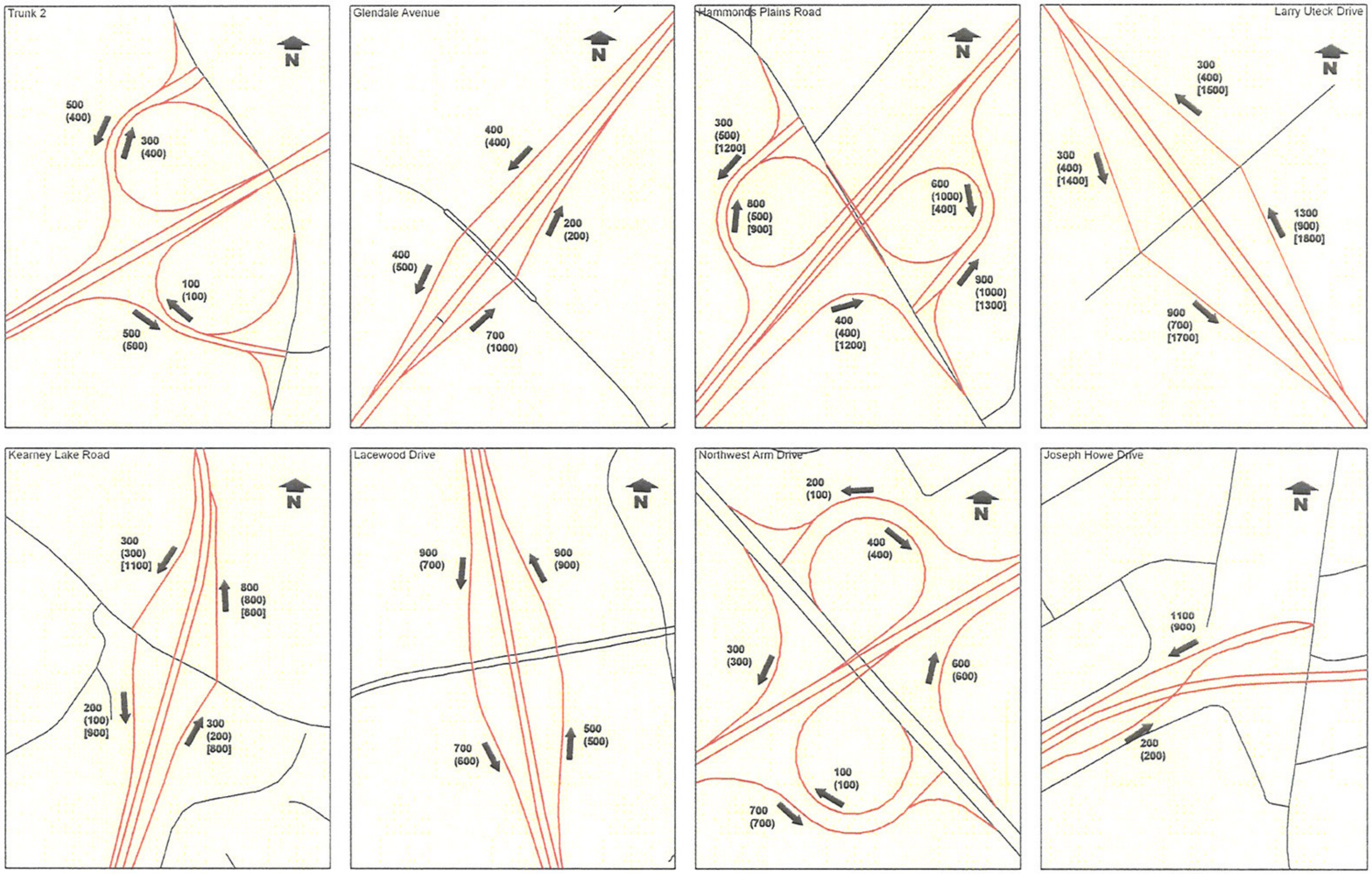
Legend:		
	Scenario A Volumes	500
	Scenario B & C Volumes	(400)
	HRM Study Volumes	[600]

Figure E5 Forecast Ramp Volumes - 2026 PM Peak Hour, Continued



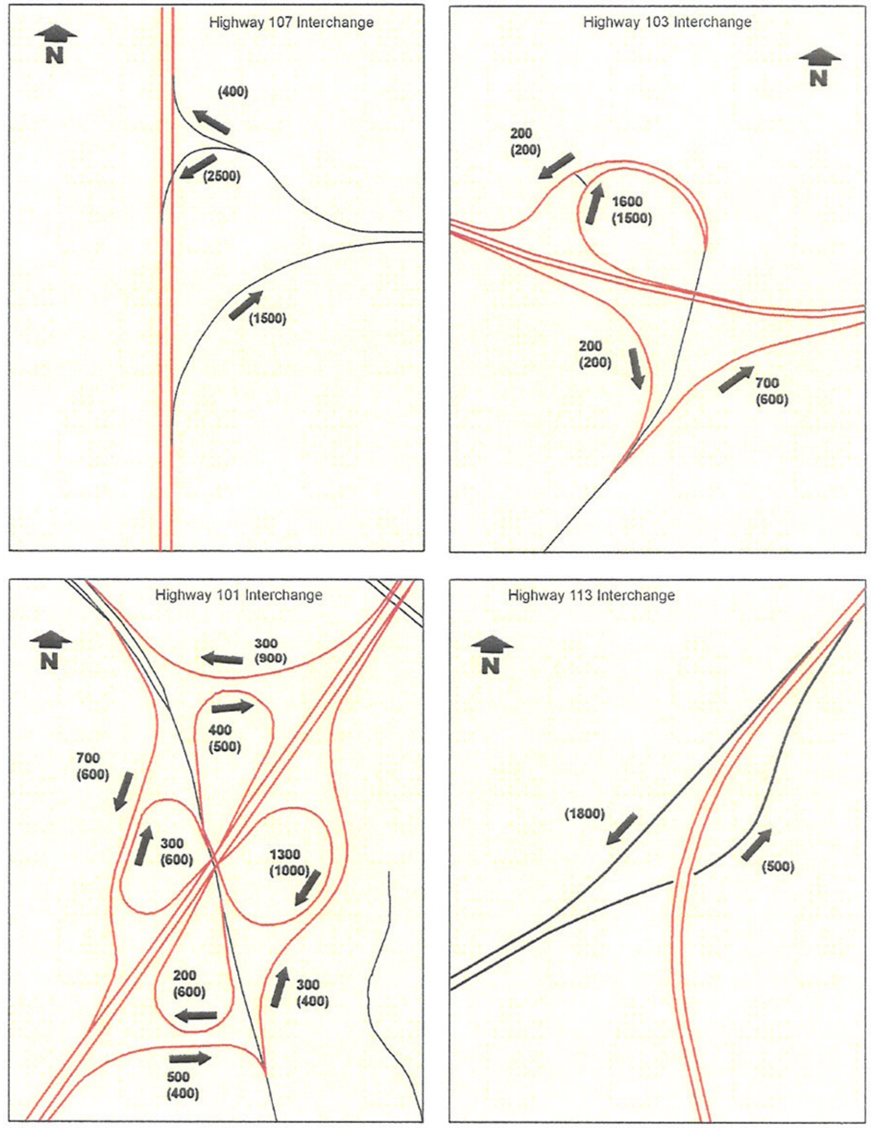
Legend: Scenario A Volumes 500
Scenario B & C Volumes (400)
HRM Study Volumes [600]

Figure E6 Forecast Ramp Volumes - 2036 PM Peak Hour



Legend:		
	Scenario A Volumes	500
	Scenario B & C Volumes	(400)
	HRM Study Volumes	[600]

Figure E6 Forecast Ramp Volumes - 2036 PM Peak Hour, Continued



Legend: Scenario A Volumes 500
Scenario B & C Volumes (400)
HRM Study Volumes [600]

Highway 102 Corridor Ramp Volumes
AM Peak Hour Summary Table - 2001 Observed versus Modeled

Hwy Section	Location	Ramp	Observed 2001 Peak Hr Volume*	Interpolated 2001 Peak Hr Volume**	Back-cast 2001 Peak Hr Volume***	2001 Peak Hr Volume^	Model 2001 Peak Hr Volume	Results			
								Percent Difference	Volume Difference	Difference as a Percent of Ramp Capacity (1200vph)	GEH Statistic
10	Joseph Howe Drive	Southbound Off-ramp	~	~	1019	1019	742	-27%	-277	23%	4.67
10	Joseph Howe Drive	Northbound On-ramp	~	~	375	375	103	-73%	-272	23%	8.8
10	Northwest Arm Drive	Eastbound to Southbound On-ramp	~	~	231	231	98	-58%	-133	11%	5.18
10	Northwest Arm Drive	Northbound Off-ramp	~	~	105	105	47	-55%	-58	5%	3.33
10	Northwest Arm Drive	Eastbound to Northbound On-ramp	~	~	200	200	178	-11%	-22	2%	0.8
15	Northwest Arm Drive	Southbound Off-ramp	~	~	383	383	181	-53%	-202	17%	6.01
15	Northwest Arm Drive	Westbound to Southbound On-ramp	~	~	90	90	35	-61%	-55	5%	3.48
15	Northwest Arm Drive	Westbound to Northbound On-ramp	~	~	95	95	73	-23%	-22	2%	1.2
15	Hwy 103 / Hwy 102	Eastbound to Southbound On-ramp	~	~	1450	1450	1653	14%	203	17%	2.58
20	Hwy 103 / Hwy 102	Southbound to Westbound Off-ramp	~	~	287	287	494	72%	207	17%	5.24
20	Hwy 103 / Hwy 102	Northbound to Westbound Off-ramp	~	~	396	396	309	-22%	-87	7%	2.32
20	Hwy 103 / Hwy 102	Eastbound to Northbound On-ramp	~	~	431	431	455	6%	24	2%	0.57
20	Lacewood	Southbound On-ramp	~	170	301	170	103	-39%	-67	6%	2.87
20	Lacewood	Northbound Off-ramp	~	161	239	161	263	63%	102	9%	3.5
25	Lacewood	Southbound Off-ramp	~	375	340	375	263	-30%	-112	9%	3.14
25	Lacewood	Northbound On-ramp	~	153	208	153	69	-55%	-84	7%	3.99
25	Kearney Lake	Southbound On-ramp	~	~	541	541	589	9%	48	4%	1.01
25	Kearney Lake	Northbound Off-ramp	~	~	165	165	184	12%	19	2%	0.72
30	Kearney Lake	Southbound Off-ramp	248	290	278	248	310	25%	62	5%	1.86
30	Kearney Lake	Northbound On-ramp	~	~	262	262	161	-39%	-101	8%	3.47
30	Hammonds Plains	Northbound to Eastbound Off-ramp	~	~	82	82	109	33%	27	2%	1.38
30	Hammonds Plains	Southbound Off-ramp	~	~	358	358	454	27%	96	8%	2.38
30	Hammonds Plains	Southbound On-ramp	~	~	296	296	215	-27%	-81	7%	2.53
40	Hammonds Plains	Northbound to Westbound Off-ramp	100	~	44	100	5	-95%	-95	8%	6.56
40	Hammonds Plains	Northbound On-ramp	~	~	482	482	551	14%	69	6%	1.52
40	Hwy 101 / Hwy 102	Southbound to Eastbound Off-ramp	~	~	70	70	111	59%	41	3%	2.15
40	Hwy 101 / Hwy 102	Eastbound to Southbound On-ramp	~	~	1027	1027	1045	2%	18	2%	0.28
40	Hwy 101 / Hwy 102	Northbound to Eastbound Off-ramp	~	~	237	237	208	-12%	-29	2%	0.97
40	Hwy 101 / Hwy 102	Eastbound to Northbound On-ramp	~	~	160	160	118	-26%	-42	4%	1.78
45	Hwy 101 / Hwy 102	Southbound to Westbound Off-ramp	~	~	117	117	115	-2%	-2	0%	0.09
45	Hwy 101 / Hwy 102	Westbound to Southbound On-ramp	~	~	109	109	59	-46%	-50	4%	2.73
45	Hwy 101 / Hwy 102	Northbound to Westbound Off-ramp	~	~	397	397	416	5%	19	2%	0.47
45	Hwy 101 / Hwy 102	Westbound to Northbound On-ramp	~	~	77	77	69	-10%	-8	1%	0.47
45	Glendale/Duke Street	Southbound On-ramp	~	~	545	545	485	-11%	-60	5%	1.32
45	Glendale/Duke Street	Northbound Off-ramp	~	~	300	300	49	-84%	-251	21%	9.5
50	Glendale/Duke Street	Southbound Off-ramp	~	~	150	150	98	-35%	-52	4%	2.33
50	Glendale/Duke Street	Northbound On-ramp	~	~	227	227	137	-40%	-90	8%	3.34
50	Tk 2 Fall River	Southbound Off-ramp	~	~	65	65	33	-49%	-32	3%	2.29
50	Tk 2 Fall River	Southbound On-ramp	~	~	285	285	379	33%	94	8%	2.58
50	Tk 2 Fall River	Northbound Off-ramp	147	~	201	147	136	-7%	-11	1%	0.46
50	Tk 2 Fall River	Northbound On-ramp	103	~	121	103	342	232%	239	20%	8.01

** - Observed 2001 ramp volumes provided by TPW/HRM (most accurate method)*
*** - Interpolated 2001 volume using data from years prior and post 2001 (provided by TPW/HRM)*
**** - Using observed 2006 volumes (from TPW) and backcast to obtain a 2001 volume (least accurate method)*
^ - Most accurate volume used to represent the 2001 baseline condition
Note - All observed, interpolated & backcast 2001 volumes have been seasonally adjusted

Highway 102 Corridor Ramp Volumes
PM Peak Hour Summary Table - 2001 Observed versus Modeled

Hwy Section	Location	Ramp	Observed 2001 Peak Hr Volume*	Interpolated 2001 Peak Hr Volume**	Back-cast 2001 Peak Hr Volume***	2001 Peak Hr Volume^	Model 2001 Peak Hr Volume	Results			
								Percent Difference	Volume Difference	Difference as a Percent of Ramp Capacity (1200vph)	GEH Statistic
10	Joseph Howe Drive	Southbound Off-ramp	~	~	486	486	122	-75%	-364	30%	10.44
10	Joseph Howe Drive	Northbound On-ramp	~	~	1038	1038	630	-39%	-408	34%	7.06
10	Northwest Arm Drive	Eastbound to Southbound On-ramp	~	~	111	111	384	246%	273	23%	8.68
10	Northwest Arm Drive	Northbound Off-ramp	~	~	383	383	37	-90%	-346	29%	11.94
10	Northwest Arm Drive	Eastbound to Northbound On-ramp	~	~	227	227	238	5%	11	1%	0.36
15	Northwest Arm Drive	Southbound Off-ramp	~	~	451	451	460	2%	9	1%	0.21
15	Northwest Arm Drive	Westbound to Southbound On-ramp	~	~	71	71	9	-87%	-62	5%	4.9
15	Northwest Arm Drive	Westbound to Northbound On-ramp	~	~	215	215	278	29%	63	5%	2.01
15	Hwy 103 / Hwy 102	Eastbound to Southbound On-ramp	~	~	584	584	506	-13%	-78	7%	1.67
20	Hwy 103 / Hwy 102	Southbound to Westbound Off-ramp	~	~	459	459	122	-73%	-337	28%	9.89
20	Hwy 103 / Hwy 102	Northbound to Westbound Off-ramp	~	~	1129	1129	1171	4%	42	4%	0.62
20	Hwy 103 / Hwy 102	Eastbound to Northbound On-ramp	~	~	443	443	113	-74%	-330	28%	9.9
20	Lacewood	Southbound On-ramp	~	435	557	435	370	-15%	-65	5%	1.62
20	Lacewood	Northbound Off-ramp	~	566	728	566	376	-34%	-190	16%	4.38
25	Lacewood	Southbound Off-ramp	~	436	493	436	510	17%	74	6%	1.7
25	Lacewood	Northbound On-ramp	~	553	673	553	528	-5%	-25	2%	0.54
25	Kearney Lake	Southbound On-ramp	~	~	276	276	455	65%	179	15%	4.68
25	Kearney Lake	Northbound Off-ramp	~	~	411	411	476	16%	65	5%	1.54
30	Kearney Lake	Southbound Off-ramp	276	307	324	276	183	-34%	-93	8%	3.07
30	Kearney Lake	Northbound On-ramp	~	~	423	423	194	-54%	-229	19%	6.52
30	Hammonds Plains	Northbound to Eastbound Off-ramp	~	~	348	348	218	-37%	-130	11%	3.86
30	Hammonds Plains	Southbound Off-ramp	~	~	649	649	418	-36%	-231	19%	5
30	Hammonds Plains	Southbound On-ramp	~	~	245	245	174	-29%	-71	6%	2.45
40	Hammonds Plains	Northbound to Westbound Off-ramp	284	~	65	284	24	-92%	-260	22%	10.48
40	Hammonds Plains	Northbound On-ramp	~	~	560	560	503	-10%	-57	5%	1.24
40	Hwy 101 / Hwy 102	Southbound to Eastbound Off-ramp	~	~	133	133	103	-23%	-30	3%	1.38
40	Hwy 101 / Hwy 102	Eastbound to Southbound On-ramp	~	~	580	580	505	-13%	-75	6%	1.61
40	Hwy 101 / Hwy 102	Northbound to Eastbound Off-ramp	~	~	374	374	156	-58%	-218	18%	6.7
40	Hwy 101 / Hwy 102	Eastbound to Northbound On-ramp	~	~	156	156	154	-1%	-2	0%	0.08
45	Hwy 101 / Hwy 102	Southbound to Westbound Off-ramp	~	~	258	258	191	-26%	-67	6%	2.24
45	Hwy 101 / Hwy 102	Westbound to Southbound On-ramp	~	~	331	331	170	-49%	-161	13%	5.09
45	Hwy 101 / Hwy 102	Northbound to Westbound Off-ramp	~	~	1092	1092	1171	7%	79	7%	1.17
45	Hwy 101 / Hwy 102	Westbound to Northbound On-ramp	~	~	181	181	248	37%	67	6%	2.29
45	Glendale/Duke Street	Southbound On-ramp	~	~	353	353	217	-39%	-136	11%	4.03
45	Glendale/Duke Street	Northbound Off-ramp	~	~	591	591	389	-34%	-202	17%	4.56
50	Glendale/Duke Street	Southbound Off-ramp	~	~	208	208	201	-3%	-7	1%	0.24
50	Glendale/Duke Street	Northbound On-ramp	~	~	196	196	113	-42%	-83	7%	3.34
50	Tk 2 Fall River	Southbound Off-ramp	~	~	112	112	295	163%	183	15%	6.41
50	Tk 2 Fall River	Southbound On-ramp	~	~	298	298	209	-30%	-89	7%	2.79
50	Tk 2 Fall River	Northbound Off-ramp	317	~	360	317	479	51%	162	14%	4.06
50	Tk 2 Fall River	Northbound On-ramp	93	~	74	93	95	2%	2	0%	0.1

** - Observed 2001 ramp volumes provided by TPW/HRM (most accurate method)*
*** - Interpolated 2001 volume using data from years prior and post 2001 (provided by TPW/HRM)*
**** - Using observed 2006 volumes (from TPW) and backcast to obtain a 2001 volume (least accurate method)*
^ - Most accurate volume used to represent the 2001 baseline condition
Note - All observed, interpolated & backcast 2001 volumes have been seasonally adjusted

Table E3 - Ramp Volumes Summary Table

Ramp No.	Ramp Name	Pk Vol (vph) for Planning yr 2036	Lanes Required
Interchange: Joseph Howe Drive			
1	Joseph Howe Dr. / Hwy 102 SB Off-Ramp	1000	1
2	Joseph Howe Dr. / Hwy 102 NB On-Ramp	1100	1
Interchange: Northwest Arm Drive			
1	Northwest Arm Drive / Hwy 102 EB to SB On-Ramp	600	1
2	Northwest Arm Drive / Hwy 102 NB Off-Ramp	400	1
3	Northwest Arm Drive / Hwy 102 EB to NB On-Ramp	400	1
4	Northwest Arm Drive / Hwy 102 SB Off-Ramp	700	1
5	Northwest Arm Drive / Hwy 102 WB to SB On-Ramp	300	1
6	Northwest Arm Drive / Hwy 102 WB to NB On-Ramp	300	1
Interchange: Hwy 103			
1	Hwy 103 / Hwy 102 EB to SB On-Ramp	2100	2
2	Hwy 103 / Hwy 102 SB to WB OFF-Ramp	500	1
3	Hwy 103 / Hwy 102 NB to WB OFF-Ramp	1600	2
4	Hwy 103 / Hwy 102 EB to NB On-Ramp	600	1
Interchange: Lacewood			
1	Lacewood Drive / Hwy 102 SB On-Ramp	700	1
2	Lacewood Drive / Hwy 102 NB Off-Ramp	600	1
3	Lacewood Drive / Hwy 102 SB Off-Ramp	900	1
4	Lacewood Drive / Hwy 102 NB On-Ramp	900	1
Interchange: Kearney Lake			
1	Kearney Lake / Hwy 102 SB On-Ramp	900	1
2	Kearney Lake / Hwy 102 NB Off-Ramp	800	1
3	Kearney Lake / Hwy 102 SB Off-Ramp	1100	1
4	Kearney Lake / Hwy 102 NB On-Ramp	800	1
Interchange: Larry Uteck			
1	Larry Uteck Drive / Hwy 102 SB On-Ramp	1900	2
2	Larry Uteck Drive / Hwy 102 NB Off-Ramp	1800	2
3	Larry Uteck Drive / Hwy 102 SB Off-Ramp	1400	2
4	Larry Uteck Drive / Hwy 102 NB On-Ramp	1500	2
Interchange: Highway 113			
1	Hwy 113 / Hwy 102 SB Off-Ramp	1800	2
2	Hwy 113 / Hwy 102 NB On-Ramp	900	2
Interchange: Hammonds Plains			
1	Hammonds Plains / Hwy 102 NB to EB Off-Ramp	1200	1
2	Hammonds Plains / Hwy 102 SB Off-Ramp	1100	1
3	Hammonds Plains / Hwy 102 SB On-Ramp	1200	1
4	Hammonds Plains / Hwy 102 NB to WB Off-Ramp	1000	1
5	Hammonds Plains / Hwy 102 NB On-Ramp	1900	2
Interchange: Highway 101			
1	Hwy 101 / Hwy 102 SB to EB Off-Ramp	600	1
2	Hwy 101 / Hwy 102 EB to SB On-Ramp	1100	1
3	Hwy 101 / Hwy 102 NB to EB Off-Ramp	500	1
4	Hwy 101 / Hwy 102 EB to NB On-Ramp	800	1
5	Hwy 101 / Hwy 102 SB to WB Off-Ramp	900	1
6	Hwy 101 / Hwy 102 WB to SB On-Ramp	500	1
7	Hwy 101 / Hwy 102 NB to WB Off-Ramp	1300	2
8	Hwy 101 / Hwy 102 WB to NB On-Ramp	400	1
Interchange: Glendale / Duke			
1	Glendale Ave and Duke Street / Hwy 102 SB On-Ramp	600	1
2	Glendale Ave and Duke Street / Hwy 102 NB Off-Ramp	1000	1
3	Glendale Ave and Duke Street / Hwy 102 SB Off-Ramp	400	1
4	Glendale Ave and Duke Street / Hwy 102 NB On-Ramp	300	1
Interchange: Trunk 2			
1	Trunk 2 / Hwy 102 SB Off-Ramp	400	1
2	Trunk 2 / Hwy 102 SB On-Ramp	800	1
3	Trunk 2 / Hwy 102 NB Off-Ramp	500	1
4	Trunk 2 / Hwy 102 NB On-Ramp	500	1

Interchange: Joseph Howe Drive

Ramp 1 Joseph Howe Dr. / Hwy 102 SB Off-Ramp

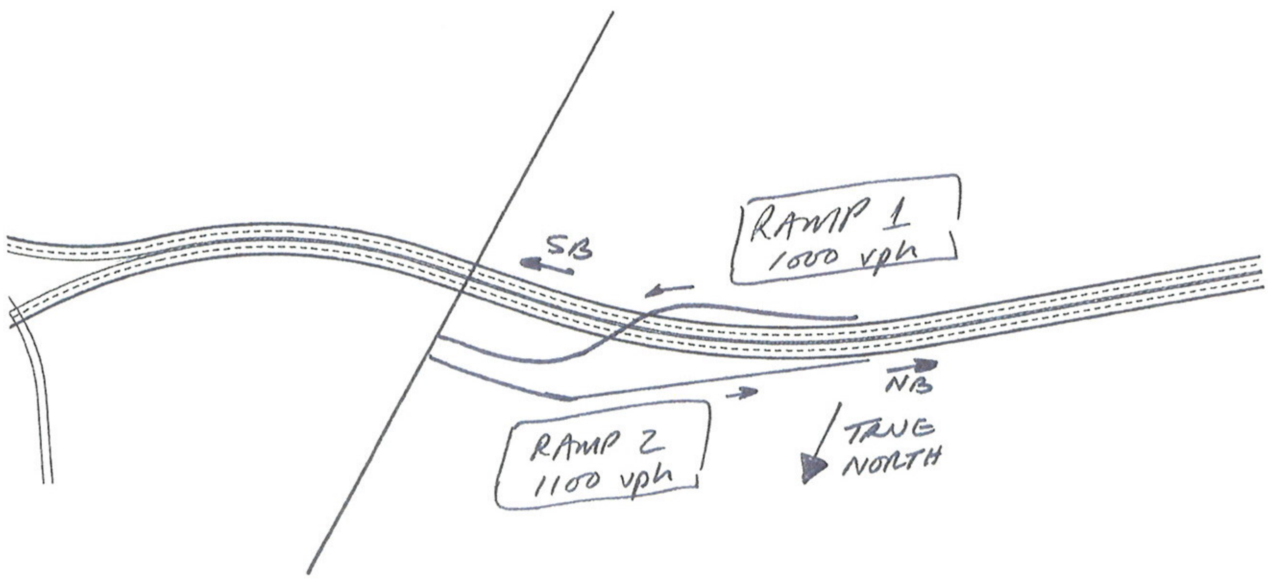
Source:	Model	Model	HRM	Backcast	Model	Model	HRM	Backcast
Scenario:	A	B + C		or Actual	A	B + C		or Actual
AM /PM:	AM	AM	AM	AM	PM	PM	PM	PM
YEAR								
2001	742	-	-	1019	122	-	-	486
2016	700	700	-		200	200	-	
2026	700	700	-		200	200	-	
2036	700	700	-		200	200	-	

Rounded Maximum Volume for Functional Planning = 1000

Ramp 2 Joseph Howe Dr. / Hwy 102 NB On-Ramp

Source:	Model	Model	HRM	Backcast	Model	Model	HRM	Backcast
Scenario:	A	B + C		or Actual	A	B + C		or Actual
AM /PM:	AM	AM	AM	AM	PM	PM	PM	PM*
YEAR								
2001	103	-	-	375	630	-	-	1038
2016	200	200	-		800	700	-	
2026	200	200	-		1000	900	-	
2036	200	200	-		1100	900	-	

Rounded Maximum Volume for Functional Planning = 1100



Interchange: Northwest Arm Drive

Ramp 1 Northwest Arm Drive / Hwy 102 EB to SB On-Ramp

Source:	Model	Model	HRM	Backcast	Model	Model	HRM	Backcast
Scenario:	A	B + C		or Actual	A	B + C		or Actual
AM /PM:	AM	AM	AM	AM	PM	PM	PM	PM
YEAR								
2001	98			231	384			111
2016	100	100			500	500		
2026	100	100			500	500		
2036	200	200			600	**600**		

Rounded Maximum Volume for Functional Planning = **600**

Ramp 2 Northwest Arm Drive / Hwy 102 NB Off-Ramp

Source:	Model	Model	HRM	Backcast	Model	Model	HRM	Backcast
Scenario:	A	B + C		or Actual	A	B + C		or Actual
AM /PM:	AM	AM	AM	AM	PM	PM	PM	PM
YEAR								
2001	47			105	37			**383**
2016	100	100			100	100		
2026	100	100			200	100		
2036	100	100			200	100		

Rounded Maximum Volume for Functional Planning = **400**

Ramp 3 Northwest Arm Drive / Hwy 102 EB to NB On-Ramp

Source:	Model	Model	HRM	Backcast	Model	Model	HRM	Backcast
Scenario:	A	B + C		or Actual	A	B + C		or Actual
AM /PM:	AM	AM	AM	AM	PM	PM	PM	PM
YEAR								
2001	178			200	238			227
2016	200	200			300	300		
2026	200	200			300	300		
2036	300	300			400	**400**		

Rounded Maximum Volume for Functional Planning = **400**

Ramp 4 Northwest Arm Drive / Hwy 102 SB Off-Ramp

Source:	Model	Model	HRM	Backcast	Model	Model	HRM	Backcast
Scenario:	A	B + C		or Actual	A	B + C		or Actual
AM /PM:	AM	AM	AM	AM	PM	PM	PM	PM
YEAR								
2001	181			383	460			451
2016	200	200			600	600		
2026	300	300			600	600		
2036	300	300			700	**700**		

Rounded Maximum Volume for Functional Planning = **700**

Ramp 5 Northwest Arm Drive / Hwy 102 WB to SB On-Ramp

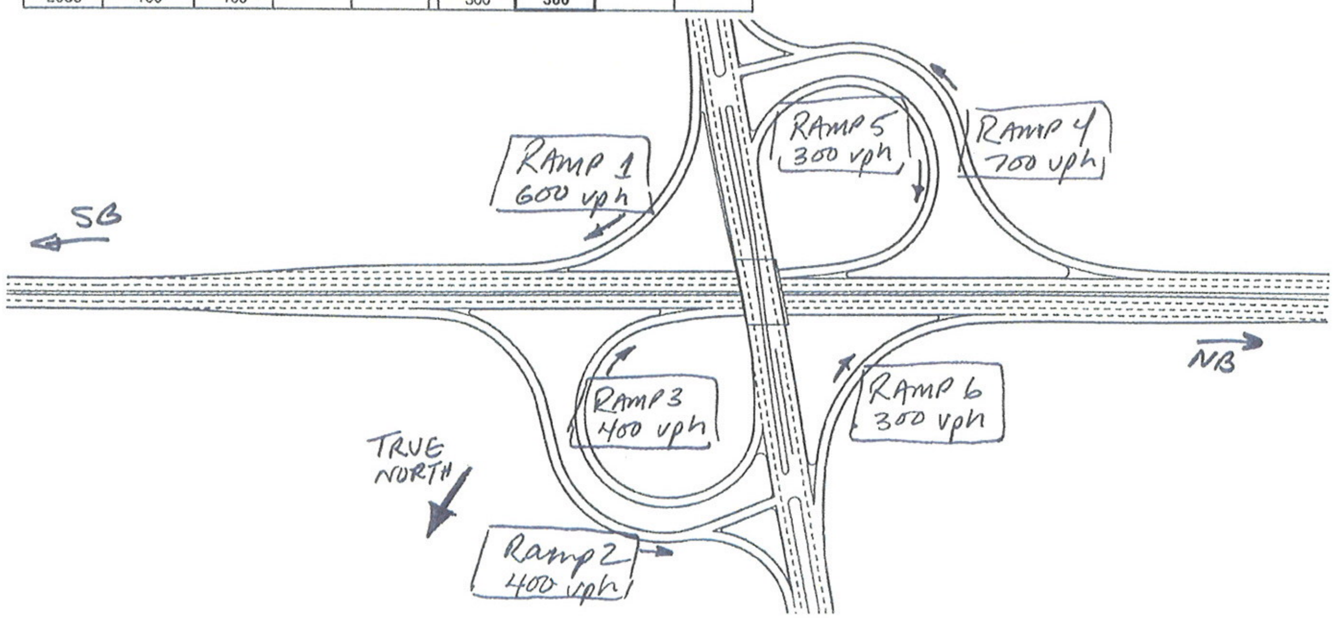
Source:	Model	Model	HRM	Backcast	Model	Model	HRM	Backcast
Scenario:	A	B + C		or Actual	A	B + C		or Actual
AM /PM:	AM	AM	AM	AM	PM	PM	PM	PM
YEAR								
2001	35			90	9			71
2016	200	300			100	100		
2026	300	300			100	100		
2036	300	**300**			100	100		

Rounded Maximum Volume for Functional Planning = **300**

Ramp 6 Northwest Arm Drive / Hwy 102 WB to NB On-Ramp

Source:	Model	Model	HRM	Backcast	Model	Model	HRM	Backcast
Scenario:	A	B + C		or Actual	A	B + C		or Actual
AM /PM:	AM	AM	AM	AM	PM	PM	PM	PM
YEAR								
2001	73			95	278			215
2016	100	100			200	200		
2026	100	100			300	300		
2036	100	100			300	**300**		

Rounded Maximum Volume for Functional Planning = **300**



Interchange: Highway 103

Ramp 1 Hwy 103 / Hwy 102 EB to SB On-Ramp

Source: Scenario: AM /PM:	Model A AM	Model B + C AM	HRM AM	Backcast or Actual AM	Model A PM	Model B + C PM	HRM PM	Backcast or Actual PM
YEAR								
2001	1653	-	-	1450	506	-	-	584
2016	1700	1500	-	-	600	500	-	-
2026	1900	1700	-	-	700	600	-	-
2036	**2100**	1800	-	-	700	600	-	

Rounded Maximum Volume for Functional Planning = **2100**

Ramp 2 Hwy 103 / Hwy 102 SB to WB OFF-Ramp

Source: Scenario: AM /PM:	Model A AM	Model B + C AM	HRM AM	Backcast or Actual AM	Model A PM	Model B + C PM	HRM PM	Backcast or Actual PM
YEAR								
2001	**494**	-	-	287	122	-	-	459
2016	200	300	-	-	200	100	-	-
2026	300	300	-	-	200	100	-	-
2036	300	300	-	-	200	200	-	

Rounded Maximum Volume for Functional Planning = **500**

Ramp 3 Hwy 103 / Hwy 102 NB to WB OFF-Ramp

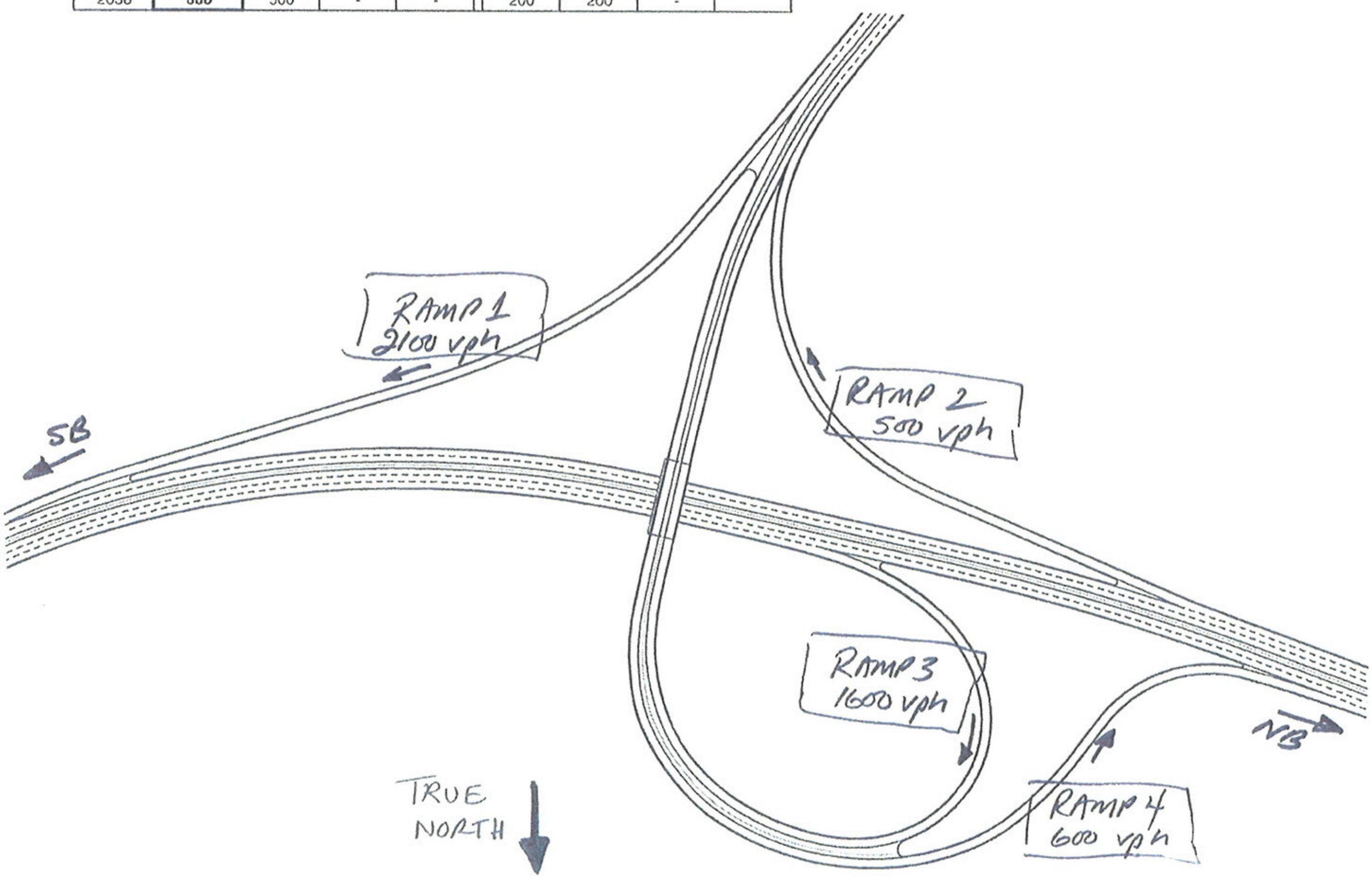
Source: Scenario: AM /PM:	Model A AM	Model B + C AM	HRM AM	Backcast or Actual AM	Model A PM	Model B + C PM	HRM PM	Backcast or Actual PM
YEAR								
2001	309	-	-	396	1171	-	-	1129
2016	400	300	-	-	1300	1200	-	-
2026	500	400	-	-	1500	1400	-	-
2036	600	400	-		**1600**	1500	-	-

Rounded Maximum Volume for Functional Planning = **1600**

Ramp 4 Hwy 103 / Hwy 102 EB to NB On-Ramp

Source: Scenario: AM /PM:	Model A AM	Model B + C AM	HRM AM	Backcast or Actual AM	Model A PM	Model B + C PM	HRM PM	Backcast or Actual PM
YEAR								
2001	455	-	-	431	113	-	-	443
2016	500	300	-	-	200	100	-	-
2026	500	400	-	-	200	200	-	-
2036	**600**	500	-	-	200	200	-	

Rounded Maximum Volume for Functional Planning = **600**



Interchange: Lacewood Drive

Ramp 1 Lacewood Drive / Hwy 102 SB On-Ramp

Source:	Model	Model	HRM	Backcast	Model	Model	HRM	Backcast
Scenario:	A	B + C		or Actual	A	B + C		or Actual
AM /PM:	AM	AM	AM	AM	PM	PM	PM	PM
YEAR								
2001	103	-	-	170	370	-	-	435
2016	200	200	-		500	500	-	
2026	200	200	-		600	600	-	
2036	200	200	-		**700**	600	-	

Rounded Maximum Volume for Functional Planning = **700**

Ramp 2 Lacewood Drive / Hwy 102 NB Off-Ramp

Source:	Model	Model	HRM	Backcast	Model	Model	HRM	Backcast
Scenario:	A	B + C		or Actual	A	B + C		or Actual
AM /PM:	AM	AM	AM	AM	PM	PM	PM	PM
YEAR								
2001	263	-	-	161	376	-	-	**566**
2016	400	300	1	-	400	400	1	
2026	400	400	1	-	500	500	1	
2036	500	400	1	-	500	500	1	

Rounded Maximum Volume for Functional Planning = **600**

Ramp 3 Lacewood Drive / Hwy 102 SB Off-Ramp

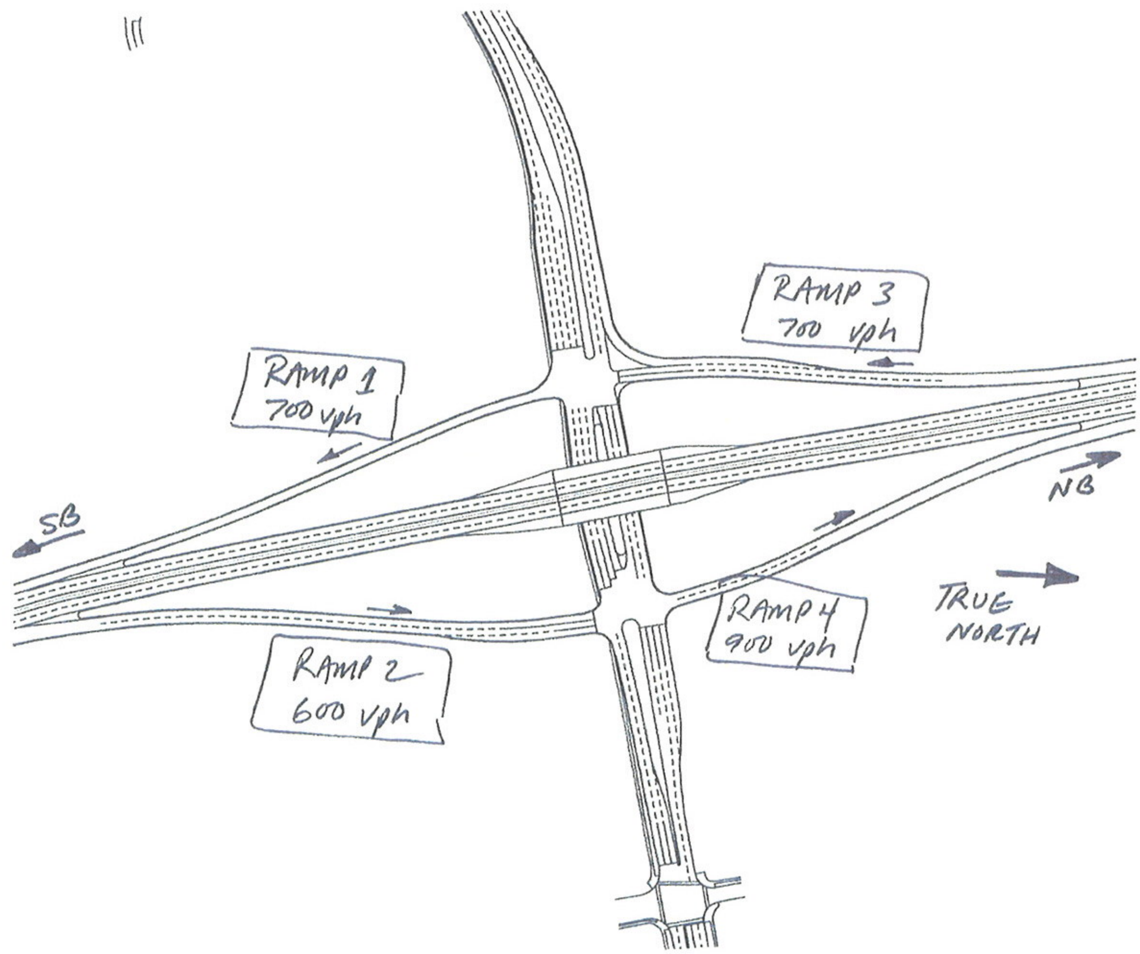
Source:	Model	Model	HRM	Backcast	Model	Model	HRM	Backcast
Scenario:	A	B + C		or Actual	A	B + C		or Actual
AM /PM:	AM	AM	AM	AM	PM	PM	PM	PM
YEAR								
2001	263	-	-	375	510	-	-	436
2016	600	600	1		600	500	1	
2026	700	800	1		800	600	1	
2036	900	**900**	1		900	700	1	

Rounded Maximum Volume for Functional Planning = **900**

Ramp 4 Lacewood Drive / Hwy 102 NB On-Ramp

Source:	Model	Model	HRM	Backcast	Model	Model	HRM	Backcast
Scenario:	A	B + C		or Actual	A	B + C		or Actual
AM /PM:	AM	AM	AM	AM	PM	PM	PM	PM
YEAR								
2001	69	-	-	153	528	-	-	553
2016	100	100	1		600	600	1	
2026	200	100	1		800	800	1	
2036	200	200	1		900	**900**	1	

Rounded Maximum Volume for Functional Planning = **900**



Interchange: Kearney Lake Road

Ramp 1 Kearney Lake / Hwy 102 SB On-Ramp

Source:	Model	Model	HRM	Backcast	Model	Model	HRM	Backcast
Scenario:	A	B + C		or Actual	A	B + C		or Actual
AM /PM:	AM	AM	AM	AM	PM	PM	PM	PM
YEAR								
2001	589	-	-	541	455	-	-	276
2016	200	200	900	-	100	100	800	-
2026	200	200	900	-	100	100	800	-
2036	200	200	900	-	200	100	**900**	-

Rounded Maximum Volume for Functional Planning = **900**

Ramp 2 Kearney Lake / Hwy 102 NB Off-Ramp

Source:	Model	Model	HRM	Backcast	Model	Model	HRM	Backcast
Scenario:	A	B + C		or Actual	A	B + C		or Actual
AM /PM:	AM	AM	AM	AM	PM	PM	PM	PM
YEAR								
2001	184	-	-	165	476	-	-	411
2016	200	100	300	-	300	200	800	-
2026	200	100	500	-	300	200	800	-
2036	200	100	500	-	300	200	**800**	-

Rounded Maximum Volume for Functional Planning = **800**

Ramp 3 Kearney Lake / Hwy 102 SB Off-Ramp

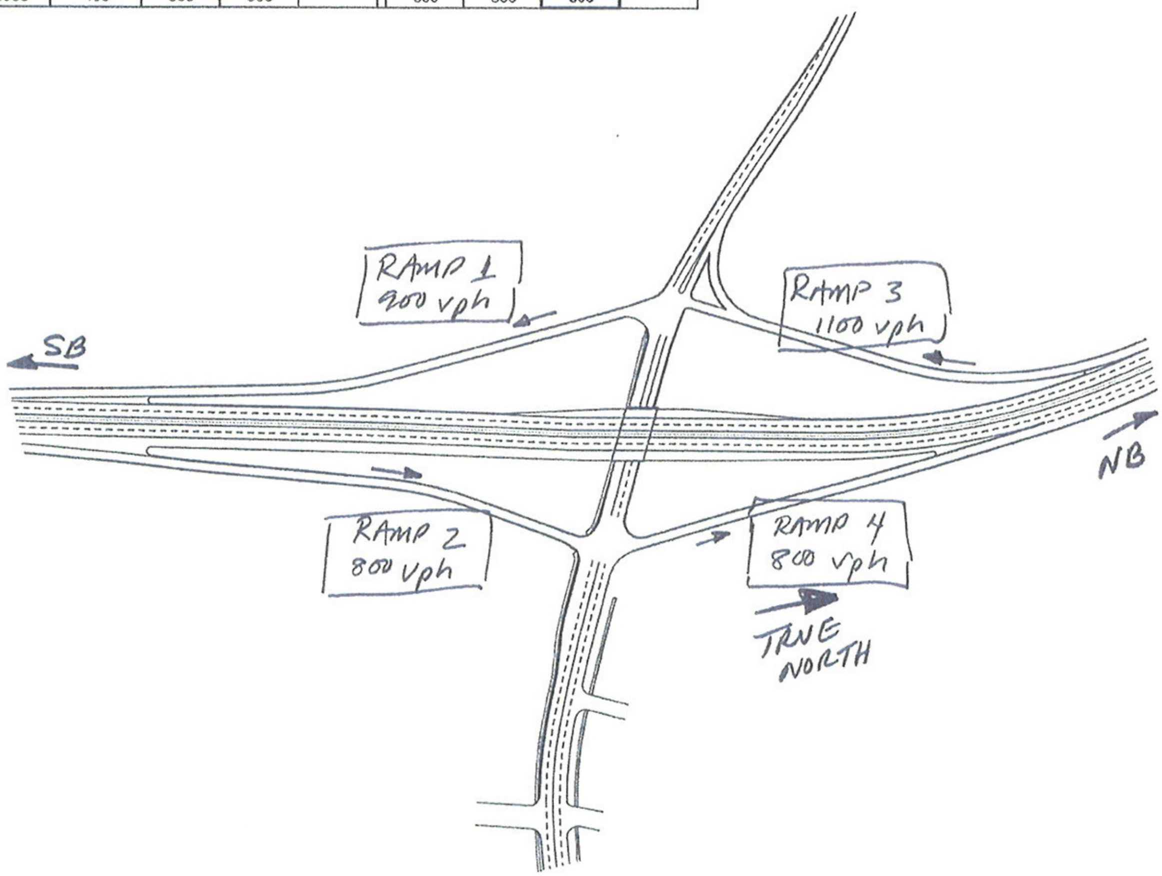
Source:	Model	Model	HRM	Backcast	Model	Model	HRM	Backcast
Scenario:	A	B + C		or Actual	A	B + C		or Actual
AM /PM:	AM	AM	AM	AM	PM	PM	PM	PM
YEAR								
2001	310	-	-	248	183	-	-	276
2016	300	400	600	-	300	200	900	
2026	400	400	600	-	300	200	1000	
2036	500	400	700	-	300	200	**1100**	

Rounded Maximum Volume for Functional Planning = **1100**

Ramp 4 Kearney Lake / Hwy 102 NB On-Ramp

Source:	Model	Model	HRM	Backcast	Model	Model	HRM	Backcast
Scenario:	A	B + C		or Actual	A	B + C		or Actual
AM /PM:	AM	AM	AM	AM	PM	PM	PM	PM
YEAR								
2001	161	-	-	262	194	-	-	423
2016	300	300	500		600	500	500	
2026	300	300	500		800	800	700	
2036	400	300	500		800	800	**800**	

Rounded Maximum Volume for Functional Planning = **800**



Interchange: Larry Uteck Drive

Ramp 1 Larry Uteck Drive / Hwy 102 SB On-Ramp

Source:	Model	Model	HRM	Backcast	Model	Model	HRM	Backcast
Scenario:	A	B + C		or Actual	A	B + C		or Actual
AM /PM:	AM	AM	AM	AM	PM	PM	PM	PM
YEAR								
2001	-	-	-	-	-	-	-	-
2016	900	800	1300		600	500	1200	
2026	1300	1000	1700		800	600	1600	
2036	1400	1100	**1900**		900	700	1700	

Rounded Maximum Volume for Functional Planning = **1900**

Ramp 2 Larry Uteck Drive / Hwy 102 NB Off-Ramp

Source:	Model	Model	HRM	Backcast	Model	Model	HRM	Backcast
Scenario:	A	B + C		or Actual	A	B + C		or Actual
AM /PM:	AM	AM	AM	AM	PM	PM	PM	PM
YEAR								
2001	-	-	-	-	-	-	-	-
2016	200	200	900	-	900	600	1000	-
2026	200	200	1100	-	1200	800	1700	-
2036	300	200	1100	-	1300	900	**1800**	-

Rounded Maximum Volume for Functional Planning = **1800**

Ramp 3 Larry Uteck Drive / Hwy 102 SB Off-Ramp

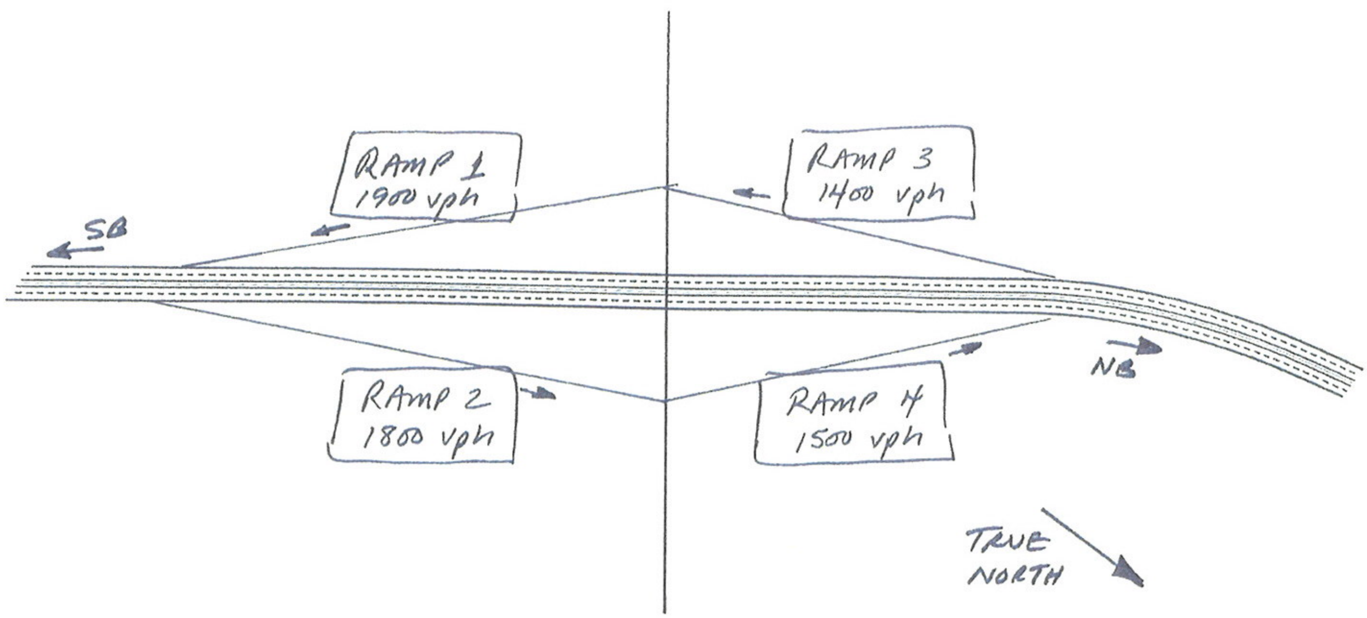
Source:	Model	Model	HRM	Backcast	Model	Model	HRM	Backcast
Scenario:	A	B + C		or Actual	A	B + C		or Actual
AM /PM:	AM	AM	AM	AM	PM	PM	PM	PM
YEAR								
2001	-	-	-	-	-	-	-	-
2016	100	200	800	-	300	300	1200	-
2026	100	200	900	-	300	300	1300	-
2036	200	200	900	-	300	400	**1400**	-

Rounded Maximum Volume for Functional Planning = **1400**

Ramp 4 Larry Uteck Drive / Hwy 102 NB On-Ramp

Source:	Model	Model	HRM	Backcast	Model	Model	HRM	Backcast
Scenario:	A	B + C		or Actual	A	B + C		or Actual
AM /PM:	AM	AM	AM	AM	PM	PM	PM	PM
YEAR								
2001	-	-	-	-	-	-	-	-
2016	300	300	600	-	300	300	1200	-
2026	400	400	700	-	300	300	1300	-
2036	400	400	800	-	300	400	**1500**	-

Rounded Maximum Volume for Functional Planning = **1500**



Interchange: Highway 113

Ramp 1 Hwy 113 / Hwy 102 SB Off-Ramp

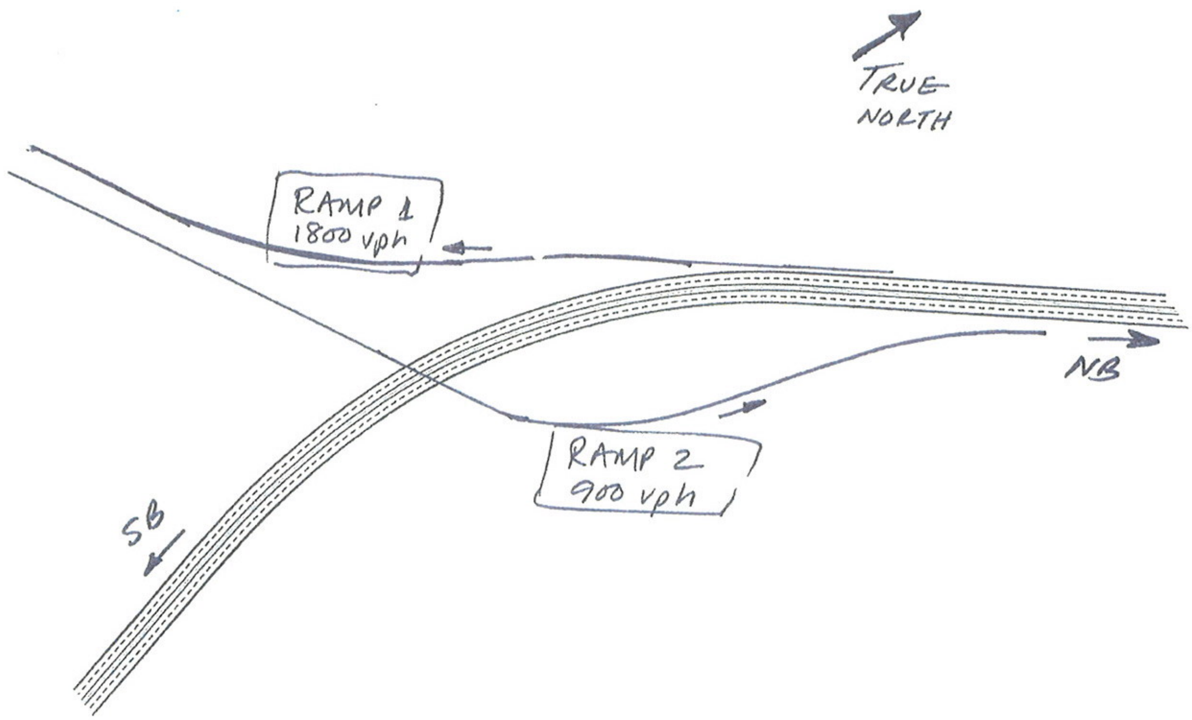
Source: / Scenario: / AM /PM:	Model A AM	Model B + C AM	HRM AM	Backcast or Actual AM	Model A PM	Model B + C PM	HRM PM	Backcast or Actual PM
YEAR								
2001	-	-	-	-	-	-	-	-
2016	-	200	-	-	-	1200	-	-
2026	-	200	-	-	-	1600	-	-
2036	-	300	-	-	-	**1800**	-	-

Rounded Maximum Volume for Functional Planning = **1800**

Ramp 2 Hwy 113 / Hwy 102 NB On-Ramp

Source: / Scenario: / AM /PM:	Model A AM	Model B + C AM	HRM AM	Backcast or Actual AM	Model A PM	Model B + C PM	HRM PM	Backcast or Actual PM*
YEAR								
2001	-	-	-	-	-	-	-	-
2016	-	800	-	-	-	400	-	-
2026	-	800	-	-	-	500	-	-
2036	-	**900**	-	-	-	500	-	-

Rounded Maximum Volume for Functional Planning = **900**



Interchange: Hammonds Plains Road

Ramp 1 Hammonds Plains / Hwy 102 NB to EB Off-Ramp

Source:	Model	Model	HRM	Backcast	Model	Model	HRM	Backcast
Scenario:	A	B + C		or Actual	A	B + C		or Actual
AM /PM:	AM	AM	AM	AM	PM	PM	PM	PM
YEAR								
2001	109	-	-	82	218	-	-	348
2016	200	200	700	-	300	300	800	
2026	200	200	700	-	400	400	1100	
2036	200	300	800	-	400	400	**1200**	

Rounded Maximum Volume for Functional Planning = **1200**

Ramp 2 Hammonds Plains / Hwy 102 SB Off-Ramp

Source:	Model	Model	HRM	Backcast	Model	Model	HRM	Backcast
Scenario:	A	B + C		or Actual	A	B + C		or Actual
AM /PM:	AM	AM	AM	AM	PM	PM	PM	PM
YEAR								
2001	454	-	-	358	418	-	-	649
2016	400	400	**1100**	-	500	400	900	-
2026	300	300	1000	-	700	400	900	-
2036	300	400	1000	-	800	500	900	-

Rounded Maximum Volume for Functional Planning = **1100**

Ramp 3 Hammonds Plains / Hwy 102 SB On-Ramp

Source:	Model	Model	HRM	Backcast	Model	Model	HRM	Backcast
Scenario:	A	B + C		or Actual	A	B + C		or Actual
AM /PM:	AM	AM	AM	AM	PM	PM	PM	PM
YEAR								
2001	215	-	-	296	174	-	-	245
2016	400	600	500		300	500	1100	
2026	600	1000	900		300	500	1200	
2036	700	1000	900		300	500	**1200**	

Rounded Maximum Volume for Functional Planning = **1200**

Ramp 4 Hammonds Plains / Hwy 102 NB to WB Off-Ramp

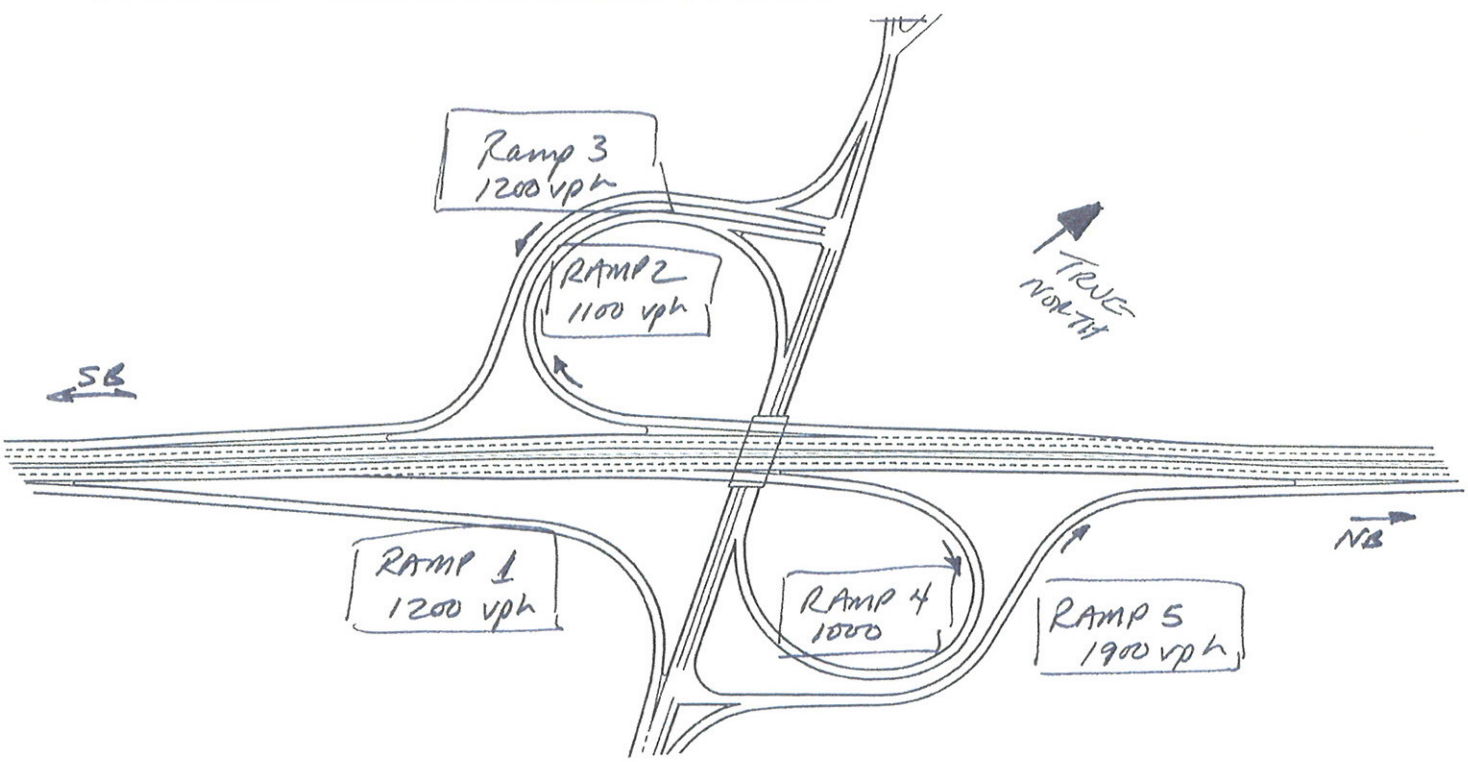
Source:	Model	Model	HRM	Backcast	Model	Model	HRM	Backcast
Scenario:	A	B + C		or Actual	A	B + C		or Actual
AM /PM:	AM	AM	AM	AM	PM	PM	PM	PM
YEAR								
2001	5	-	-	100	24	-	-	284
2016	100	200	300		300	500	200	
2026	200	200	300		500	900	300	
2036	200	300	400		600	**1000**	400	

Rounded Maximum Volume for Functional Planning = **1000**

Ramp 5 Hammonds Plains / Hwy 102 NB On-Ramp

Source:	Model	Model	HRM	Backcast	Model	Model	HRM	Backcast
Scenario:	A	B + C		or Actual	A	B + C		or Actual
AM /PM:	AM	AM	AM	AM	PM	PM	PM	PM
YEAR								
2001	551	-	-	482	503	-	-	560
2016	1100	1200	600	-	800	700	1200	
2026	1600	1700	1000	-	900	900	1200	
2036	1700	**1900**	1000	-	900	1000	1300	

Rounded Maximum Volume for Functional Planning = **1900**



Interchange: Hwy 101 / Hwy 102

Ramp 1 Hwy 101 / Hwy 102 SB to EB Off-Ramp

Source:	Model	Model	HRM	Backcast	Model	Model	HRM	Backcast
Scenario:	A	B		or Actual	A	B		or Actual
AM /PM:	AM	AM	AM	AM	PM	PM	PM	PM
YEAR								
2001	111	-	-	70	103	-	-	133
2016	100	300	-	-	200	400	-	
2026	100	300	-	-	300	500	-	
2036	200	400	-	-	300	**600**	-	

Rounded Maximum Volume for Functional Planning = **600**

Ramp 2 Hwy 101 / Hwy 102 EB to SB On-Ramp

Source:	Model	Model	HRM	Backcast	Model	Model	HRM	Backcast
Scenario:	A	B		or Actual	A	B		or Actual
AM /PM:	AM	AM	AM	AM	PM	PM	PM	PM
YEAR								
2001	1045	-	-	1027	505	-	-	580
2016	1100	800	-	-	600	600	-	
2026	1100	800	-	-	700	600	-	
2036	**1100**	900	-	-	700	600	-	

Rounded Maximum Volume for Functional Planning = **1100**

Ramp 3 Hwy 101 / Hwy 102 NB to EB Off-Ramp

Source:	Model	Model	HRM	Backcast	Model	Model	HRM	Backcast
Scenario:	A	B		or Actual	A	B		or Actual
AM /PM:	AM	AM	AM	AM	PM	PM	PM	PM
YEAR								
2001	208	-	-	237	156	-	-	374
2016	400	300	-	-	400	200	-	
2026	400	400	-	-	500	400	-	
2036	500	400	-	-	**500**	400	-	

Rounded Maximum Volume for Functional Planning = **500**

Ramp 4 Hwy 101 / Hwy 102 EB to NB On-Ramp

Source:	Model	Model	HRM	Backcast	Model	Model	HRM	Backcast
Scenario:	A	B		or Actual	A	B		or Actual
AM /PM:	AM	AM	AM	AM	PM	PM	PM	PM
YEAR								
2001	118	-	-	160	154	-	-	156
2016	200	800	-		200	500	-	
2026	200	800	-		200	600	-	
2036	200	**800**	-		200	600	-	

Rounded Maximum Volume for Functional Planning = **800**

Ramp 5 Hwy 101 / Hwy 102 SB to WB Off-Ramp

Source:	Model	Model	HRM	Backcast	Model	Model	HRM	Backcast
Scenario:	A	B		or Actual	A	B		or Actual
AM /PM:	AM	AM	AM	AM	PM	PM	PM	PM*
YEAR								
2001	115	-	-	117	191	-	-	258
2016	200	500	-	-	200	900	-	
2026	200	500	-	-	200	900	-	
2036	200	600	-	-	300	**900**	-	

Rounded Maximum Volume for Functional Planning = **900**

Ramp 6 Hwy 101 / Hwy 102 WB to SB On-Ramp

Source:	Model	Model	HRM	Backcast	Model	Model	HRM	Backcast
Scenario:	A	B		or Actual	A	B		or Actual
AM /PM:	AM	AM	AM	AM	PM	PM	PM	PM*
YEAR								
2001	59	-	-	109	170	-	-	331
2016	100	100	-	-	300	400	-	
2026	100	100	-	-	400	400	-	
2036	100	100	-	-	400	**500**	-	

Rounded Maximum Volume for Functional Planning = **500**

Ramp 7 Hwy 101 / Hwy 102 NB to WB Off-Ramp

Source:	Model	Model	HRM	Backcast	Model	Model	HRM	Backcast
Scenario:	A	B		or Actual	A	B		or Actual
AM /PM:	AM	AM	AM	AM	PM	PM	PM	PM
YEAR								
2001	416	-	-	397	1171	-	-	1092
2016	700	500	-	-	1300	900	-	-
2026	1000	600	-	-	1300	900	-	-
2036	1100	600	-	-	**1300**	1000	-	-

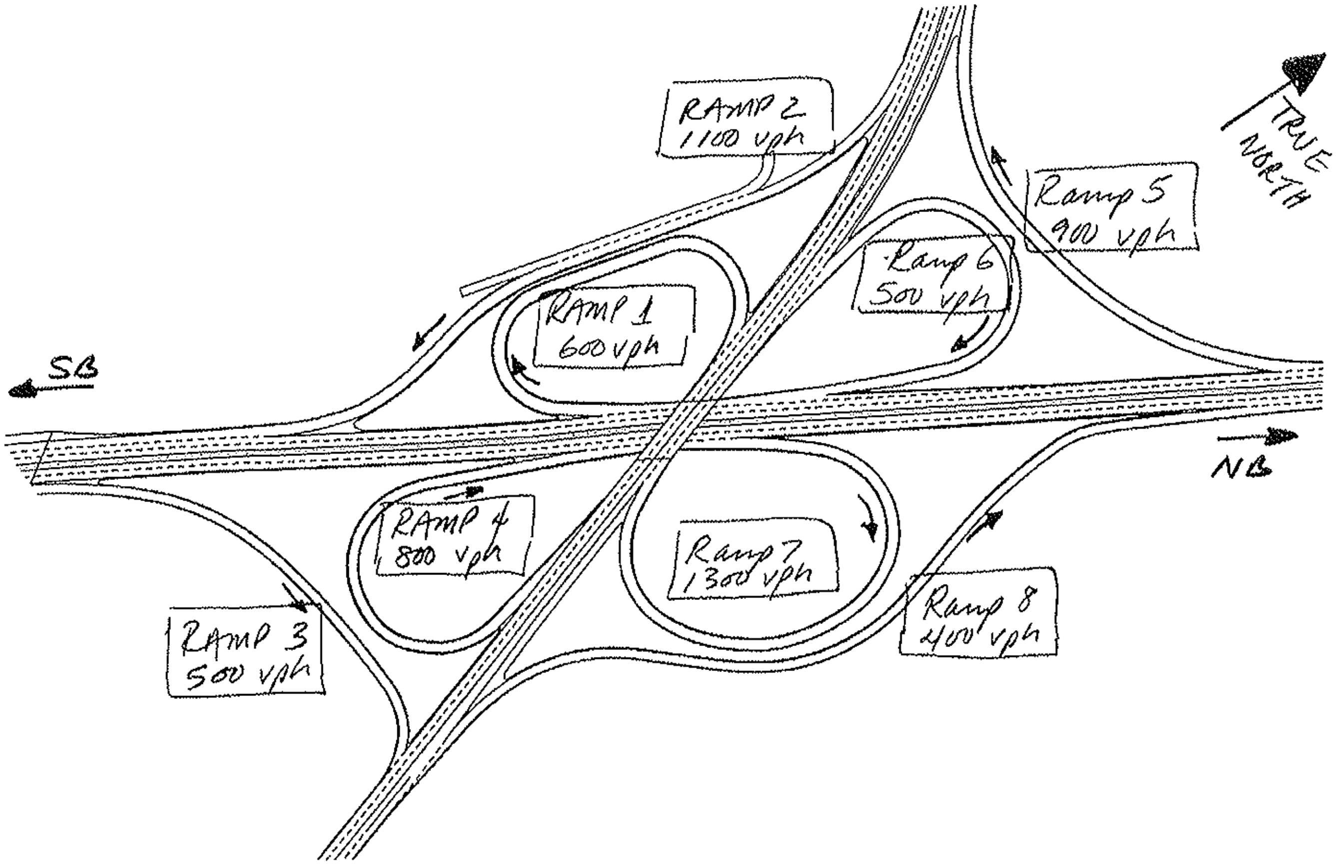
Rounded Maximum Volume for Functional Planning = **1300**

Ramp 8 Hwy 101 / Hwy 102 WB to NB On-Ramp

Source:	Model	Model	HRM	Backcast	Model	Model	HRM	Backcast
Scenario:	A	B		or Actual	A	B		or Actual
AM /PM:	AM	AM	AM	AM	PM	PM	PM	PM
YEAR								
2001	69	-	-	77	248	-	-	181
2016	100	300	-	-	300	400	-	-
2026	100	300	-	-	300	400	-	-
2036	100	300	-	-	300	**400**	-	-

Rounded Maximum Volume for Functional Planning = **400**

HWY 102 / 101


RAMP 2
1100 vph
TRUE
NORTH
Ramp 5
900 vph
Ramp 6
500 vph
RAMP 1
600 vph
SB
NB
RAMP 4
800 vph
Ramp 7
1300 vph
Ramp 8
400 vph
RAMP 3
500 vph

Interchange: Glendale Avenue / Duke Street

Ramp 1 Glendale Ave and Duke Street / Hwy 102 SB On-Ramp

Source: Scenario: AM / PM:	Model A AM	Model C AM	HRM AM	Backcast or Actual AM	Model A PM	Model B + C PM	HRM PM	Backcast or Actual PM
YEAR								
2001	485	-	-	545	217	-	-	353
2016	300	400	-		300	400	-	
2026	300	600	-		400	500	-	
2036	400	**600**	-		400	500	-	

Rounded Maximum Volume for Functional Planning = **600**

Ramp 2 Glendale Ave and Duke Street / Hwy 102 NB Off-Ramp

Source: Scenario: AM / PM:	Model A AM	Model C AM	HRM AM	Backcast or Actual AM	Model A PM	Model B + C PM	HRM PM	Backcast or Actual PM
YEAR								
2001	49	-	-	300	389	-	-	591
2016	300	300	-	-	400	500	-	-
2026	300	300	-	-	700	600	-	-
2036	400	600	-		700	**1000**	-	-

Rounded Maximum Volume for Functional Planning = **1000**

Ramp 3 Glendale Ave and Duke Street / Hwy 102 SB Off-Ramp

Source: Scenario: AM / PM:	Model A AM	Model C AM	HRM AM	Backcast or Actual AM	Model A PM	Model B + C PM	HRM PM	Backcast or Actual PM
YEAR								
2001	98	-	-	150	201	-	-	208
2016	200	200	-	-	300	300	-	-
2026	200	200	-	-	400	400	-	-
2036	300	300	-	-	400	**400**	-	-

Rounded Maximum Volume for Functional Planning = **400**

Ramp 4 Glendale Ave and Duke Street / Hwy 102 NB On-Ramp

Source: Scenario: AM / PM:	Model A AM	Model C AM	HRM AM	Backcast or Actual AM	Model A PM	Model B + C PM	HRM PM	Backcast or Actual PM
YEAR								
2001	137	-	-	227	113	-	-	196
2016	200	200	-	-	200	200	-	-
2026	300	200	-	-	200	200	-	-
2036	**300**	200	-	-	200	200	-	-

Rounded Maximum Volume for Functional Planning = **300**

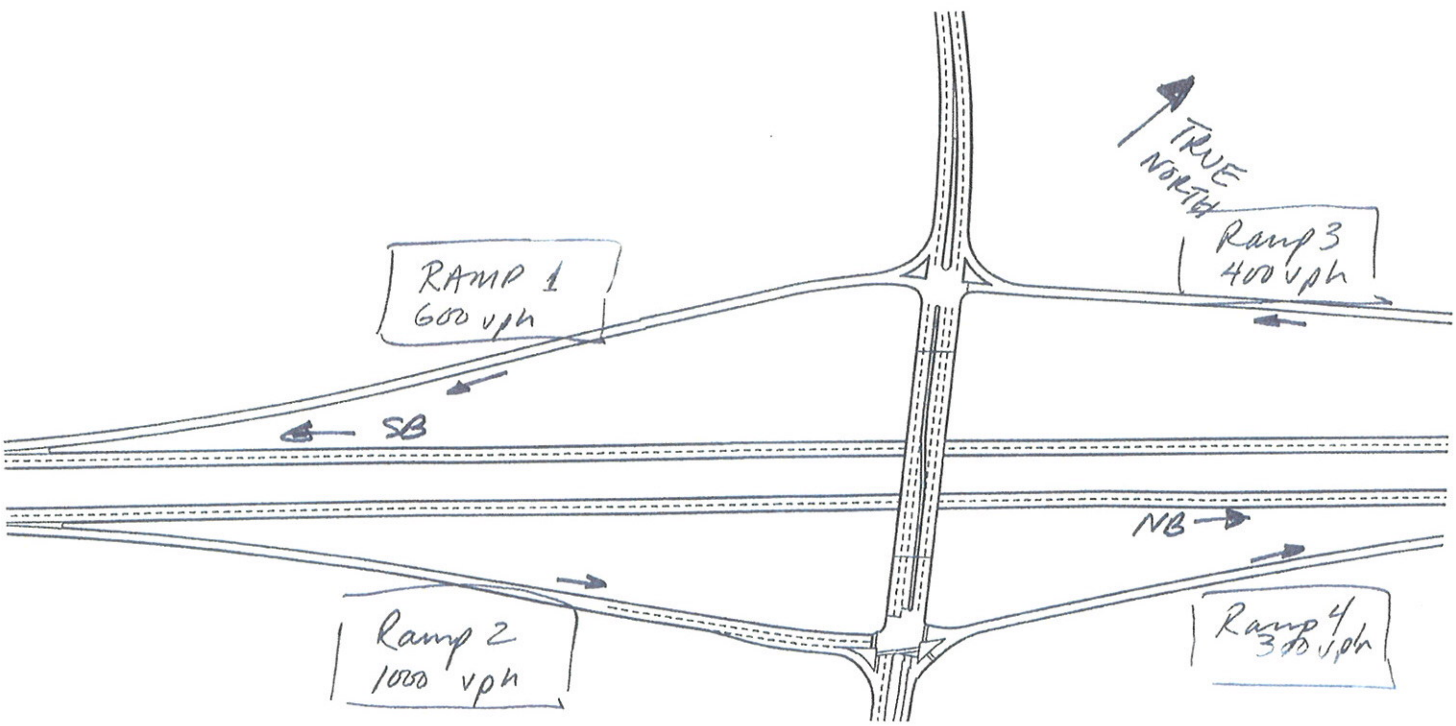


Table E13b - Interchange: Highway 107

Ramp 1 **Hwy 107 / Hwy 102 NB On-Ramp**

Source: Scenario: AM /PM:	Model A AM	Model B + C AM	HRM AM	Backcast or Actual AM	Model A PM	Model B + C PM	HRM PM	Backcast or Actual PM
YEAR								
2001	-	-	-	-	-	-	-	-
2016	-	100	-	-	-	400	-	-
2026	-	100	-	-	-	400	-	-
2036	-	100	-	-	-	**400**	-	-

Rounded Maximum Volume for Functional Planning = **400**

Ramp 2 **Hwy 107 / Hwy 102 SB On-Ramp**

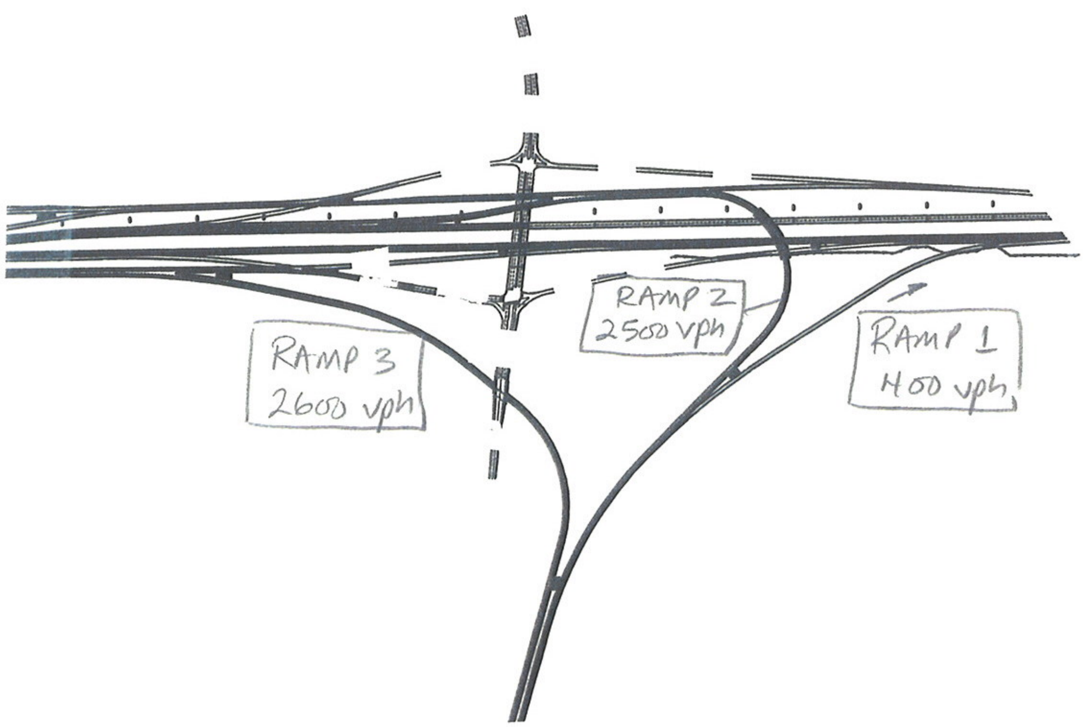
Source: Scenario: AM /PM:	Model A AM	Model B + C AM	HRM AM	Backcast or Actual AM	Model A PM	Model B + C PM	HRM PM	Backcast or Actual PM*
YEAR								
2001	-	-	-	-	-	-	-	-
2016	-	700	-	-	-	2100	-	-
2026	-	800	-	-	-	2400	-	-
2036	-	900	-	-	-	**2500**	-	-

Rounded Maximum Volume for Functional Planning = **2500**

Ramp 3 **Hwy 107 / Hwy 102 NB Off-Ramp**

Source: Scenario: AM /PM:	Model A AM	Model B + C AM	HRM AM	Backcast or Actual AM	Model A PM	Model B + C PM	HRM PM	Backcast or Actual PM*
YEAR								
2001	-	-	-	-	-	-	-	-
2016	-	2100	-	-	-	1200	-	-
2026	-	2400	-	-	-	1400	-	-
2036	-	**2600**	-	-	-	1500	-	-

Rounded Maximum Volume for Functional Planning = **2600**



Interchange: Trunk 2 Fall River

Ramp 1 Trunk 2 / Hwy 102 SB Off-Ramp

Source:	Model	Model	HRM	Backcast	Model	Model	HRM	Backcast
Scenario:	A	B + C		or Actual	A	B + C		or Actual
AM / PM:	AM	AM	AM	AM	PM	PM	PM	PM
YEAR								
2001	33	-	-	65	295	-	-	112
2016	100	100	-	-	300	400	-	-
2026	100	100	-	-	300	400	-	-
2036	100	100	-	-	300	**400**	-	-

Rounded Maximum Volume for Functional Planning = **400**

Ramp 2 Trunk 2 / Hwy 102 SB On-Ramp

Source:	Model	Model	HRM	Backcast	Model	Model	HRM	Backcast
Scenario:	A	B + C		or Actual	A	B + C		or Actual
AM / PM:	AM	AM	AM	AM	PM	PM	PM	PM
YEAR								
2001	379	-	-	285	209	-	-	298
2016	500	500	-	-	300	300	-	-
2026	600	600	-	-	500	300	-	-
2036	700	**800**	-	-	500	400	-	-

Rounded Maximum Volume for Functional Planning = **800**

Ramp 3 Trunk 2 / Hwy 102 NB Off-Ramp

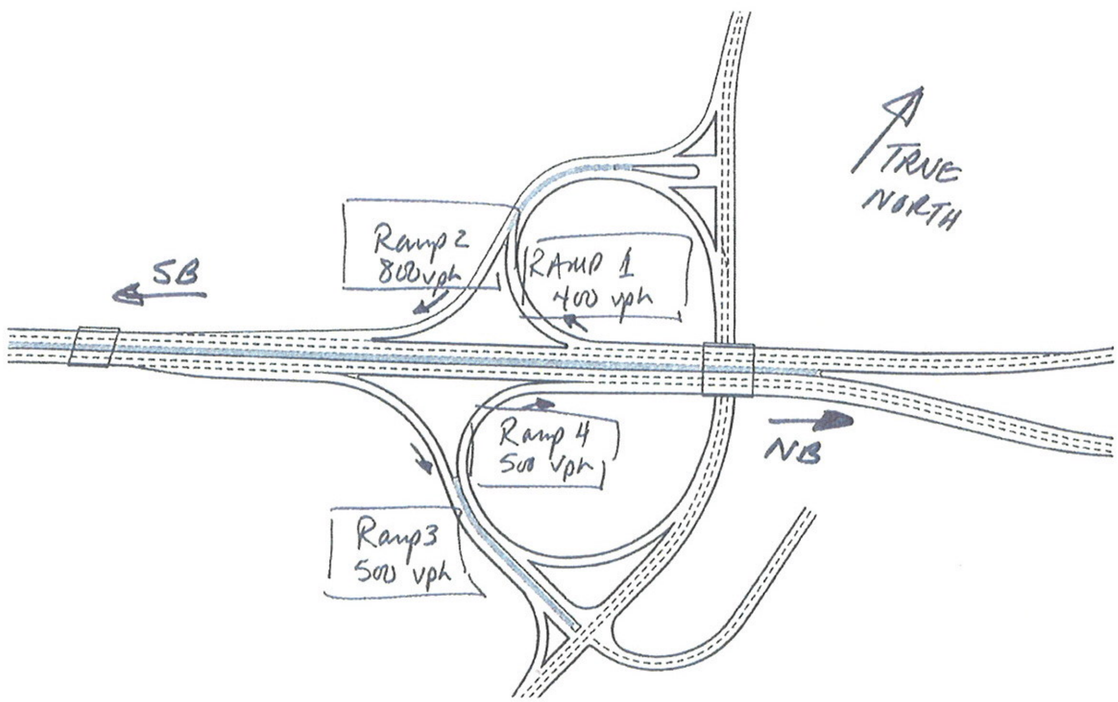
Source:	Model	Model	HRM	Backcast	Model	Model	HRM	Backcast
Scenario:	A	B + C		or Actual	A	B + C		or Actual
AM / PM:	AM	AM	AM	AM	PM	PM	PM	PM
YEAR								
2001	136	-	-	147	479	-	-	317
2016	300	100	-	-	500	400	-	-
2026	400	100	-	-	500	400	-	-
2036	500	100	-	-	500	**500**	-	-

Rounded Maximum Volume for Functional Planning = **500**

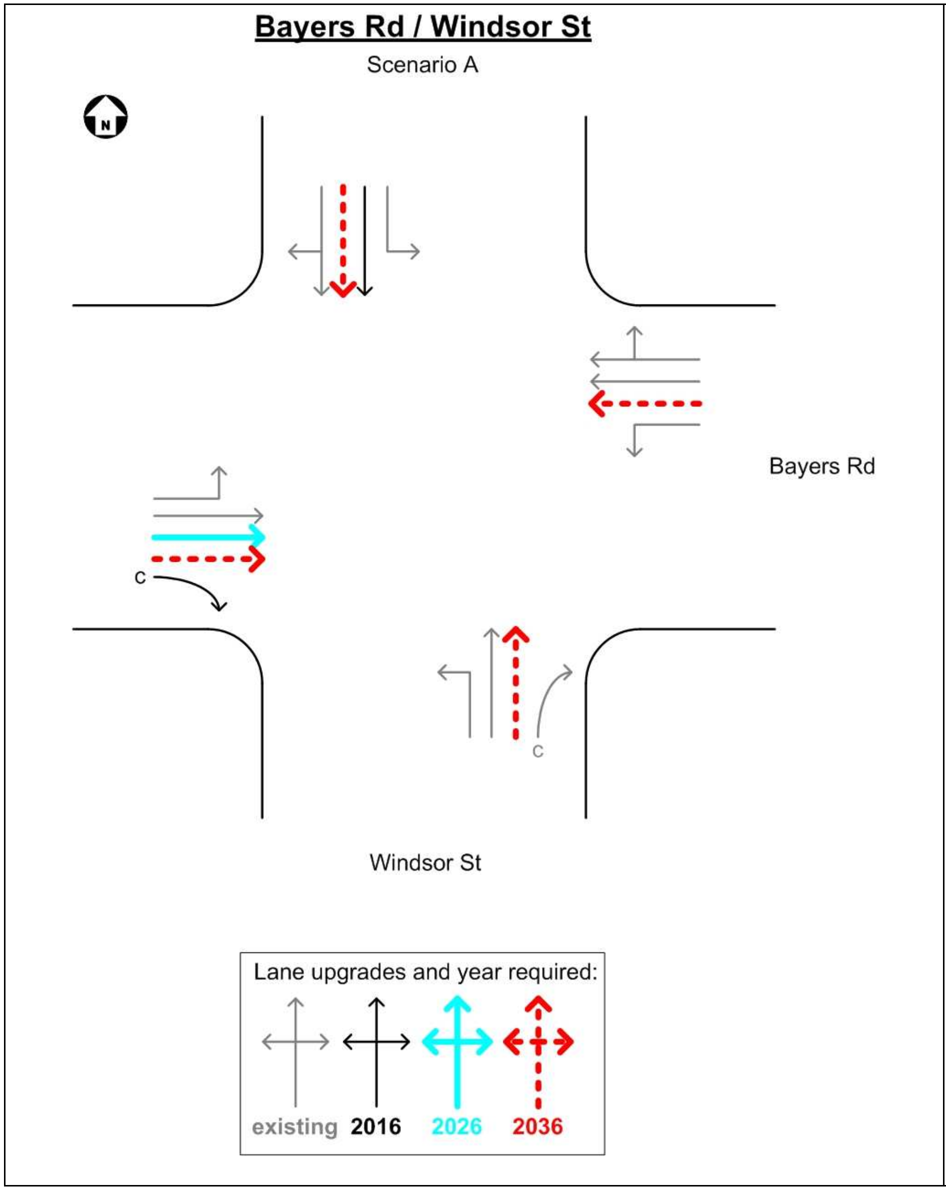
Ramp 4 Trunk 2 / Hwy 102 NB On-Ramp

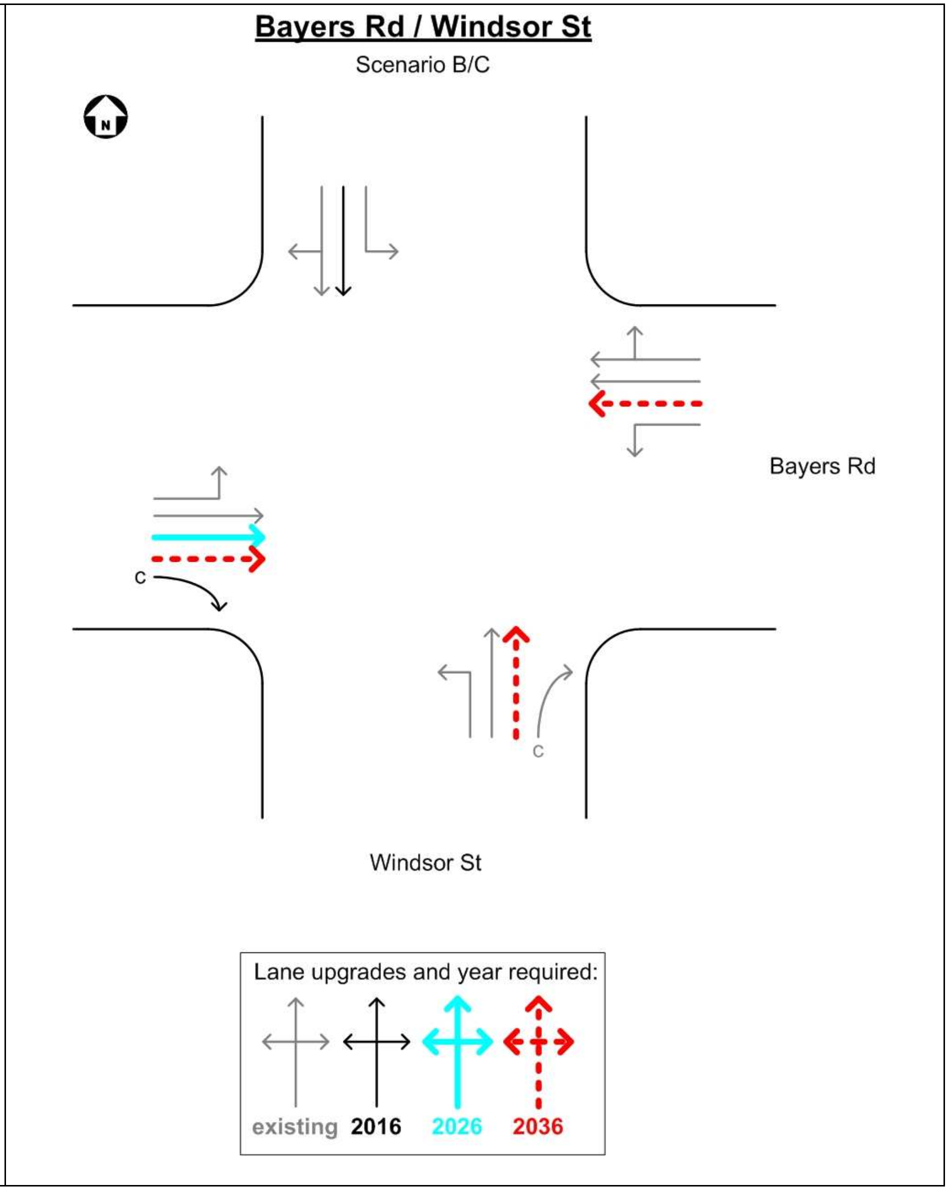
Source:	Model	Model	HRM	Backcast	Model	Model	HRM	Backcast
Scenario:	A	B + C		or Actual	A	B + C		or Actual
AM / PM:	AM	AM	AM	AM	PM	PM	PM	PM
YEAR								
2001	342	-	-	103	95	-	-	93
2016	300	400	-	-	100	100	-	-
2026	300	400	-	-	100	100	-	-
2036	300	**500**	-	-	100	100	-	-

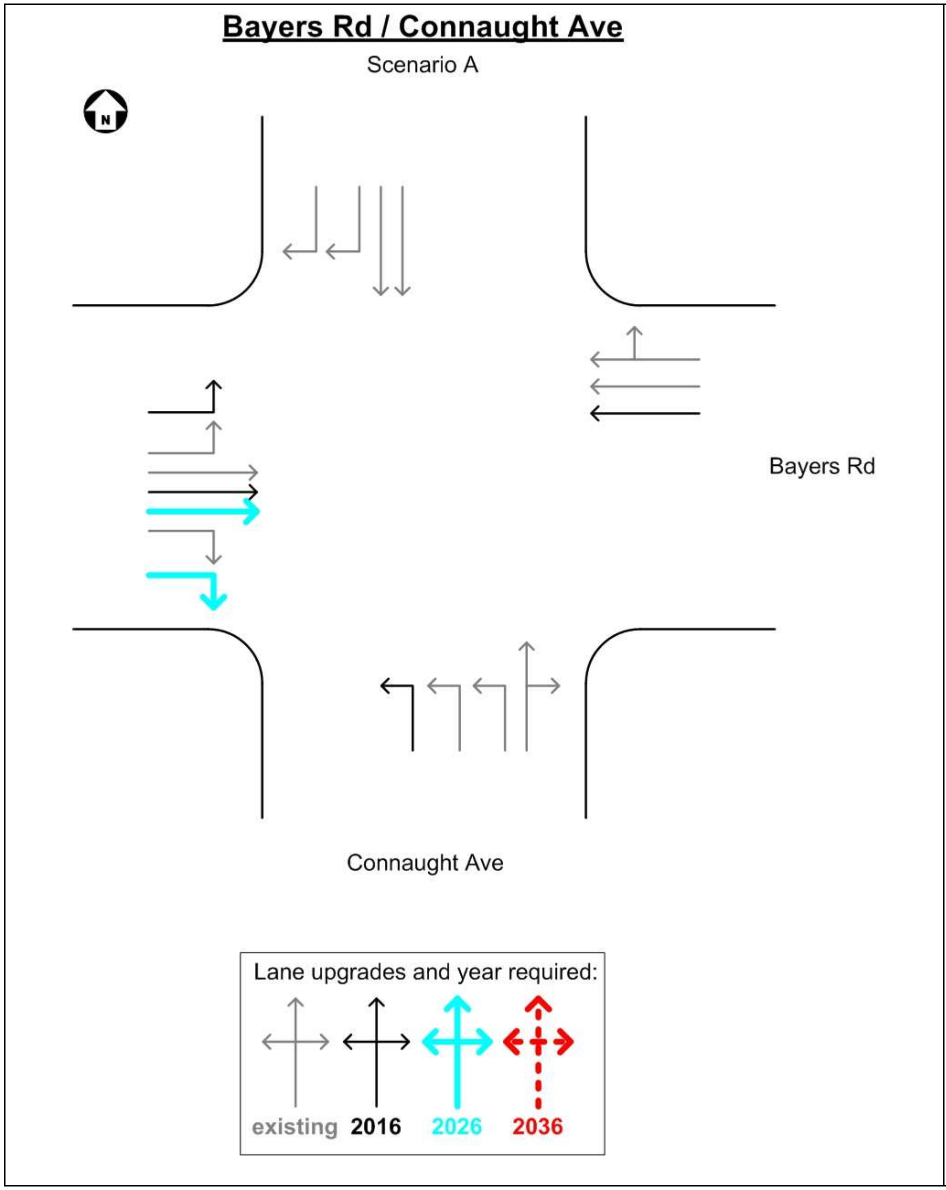
Rounded Maximum Volume for Functional Planning = **500**

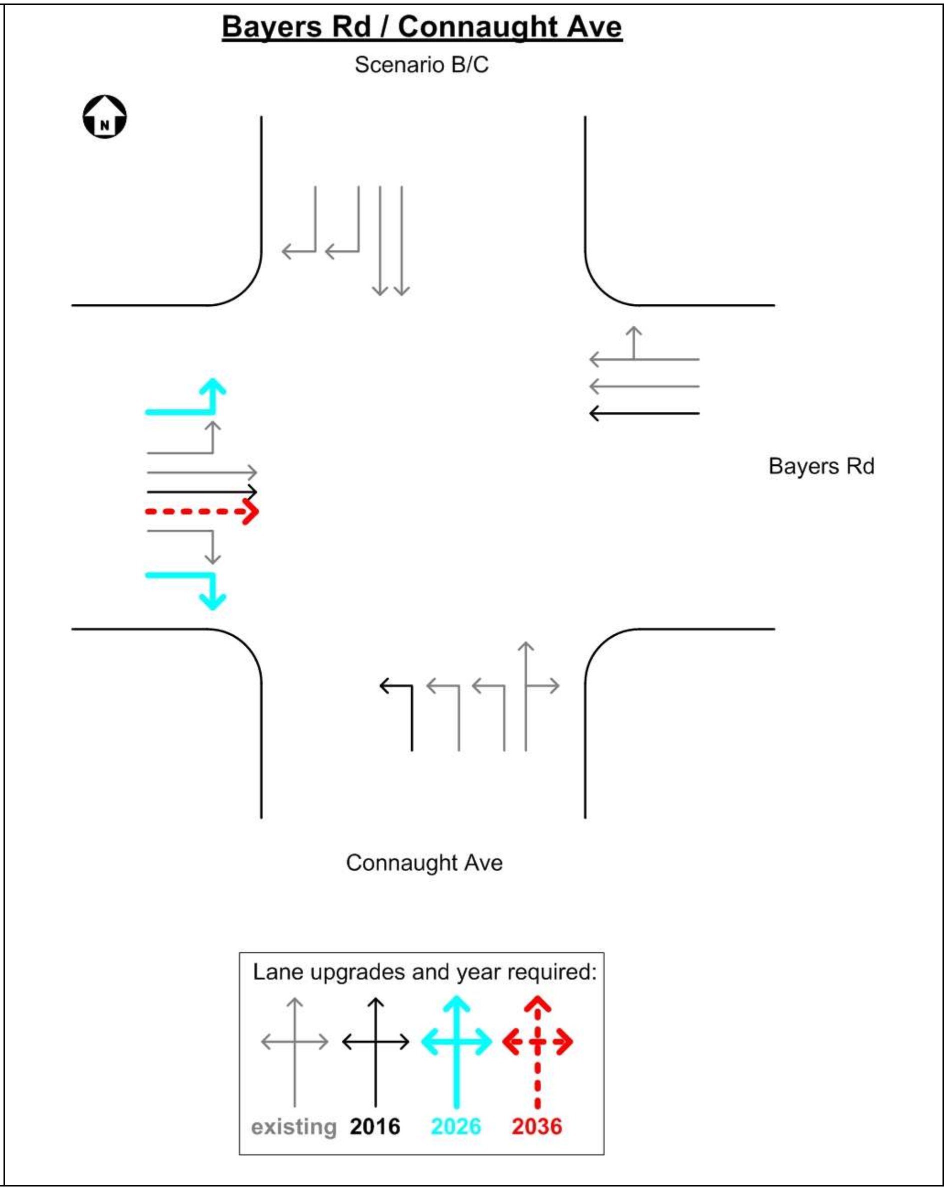


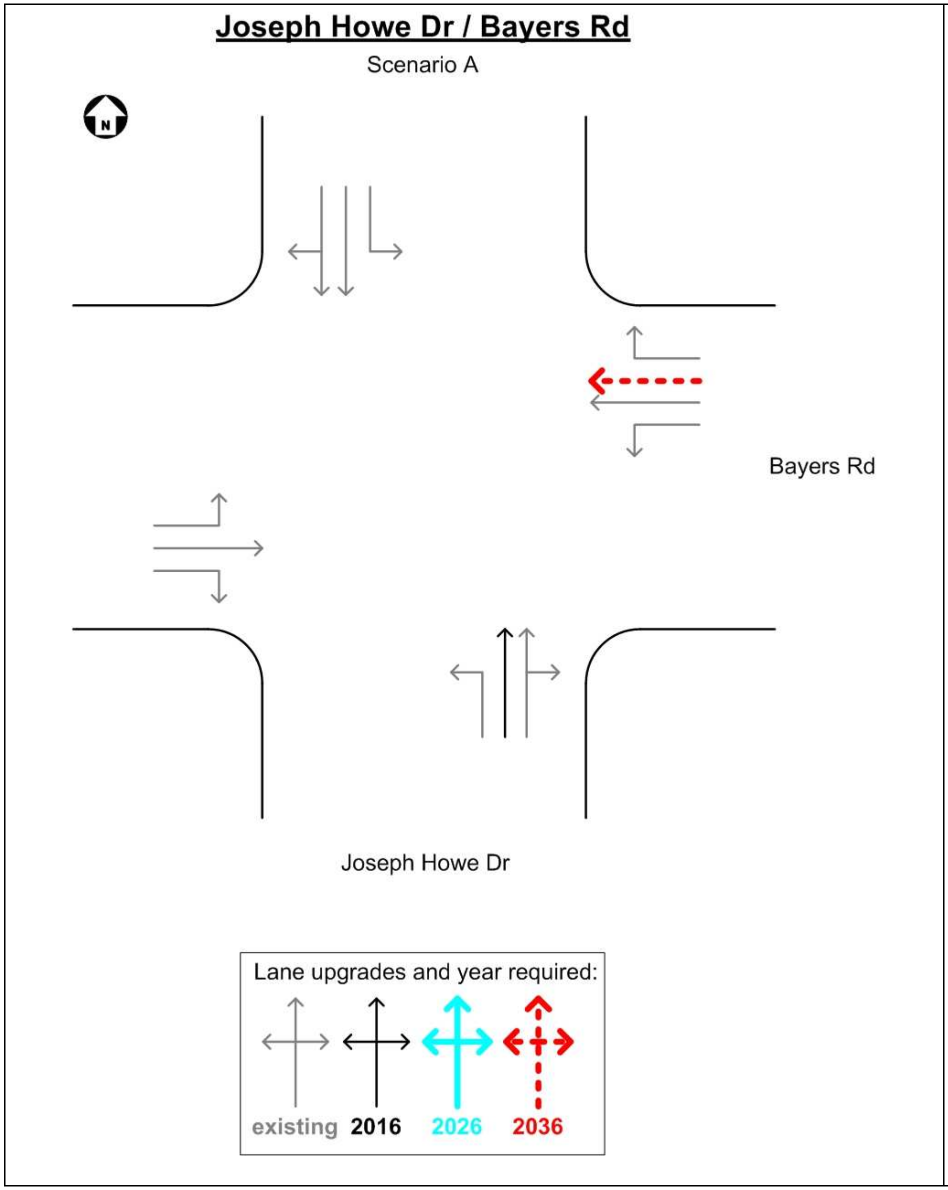
APPENDIX F
CORRIDOR INTERSECTION NEEDS AND STAGING

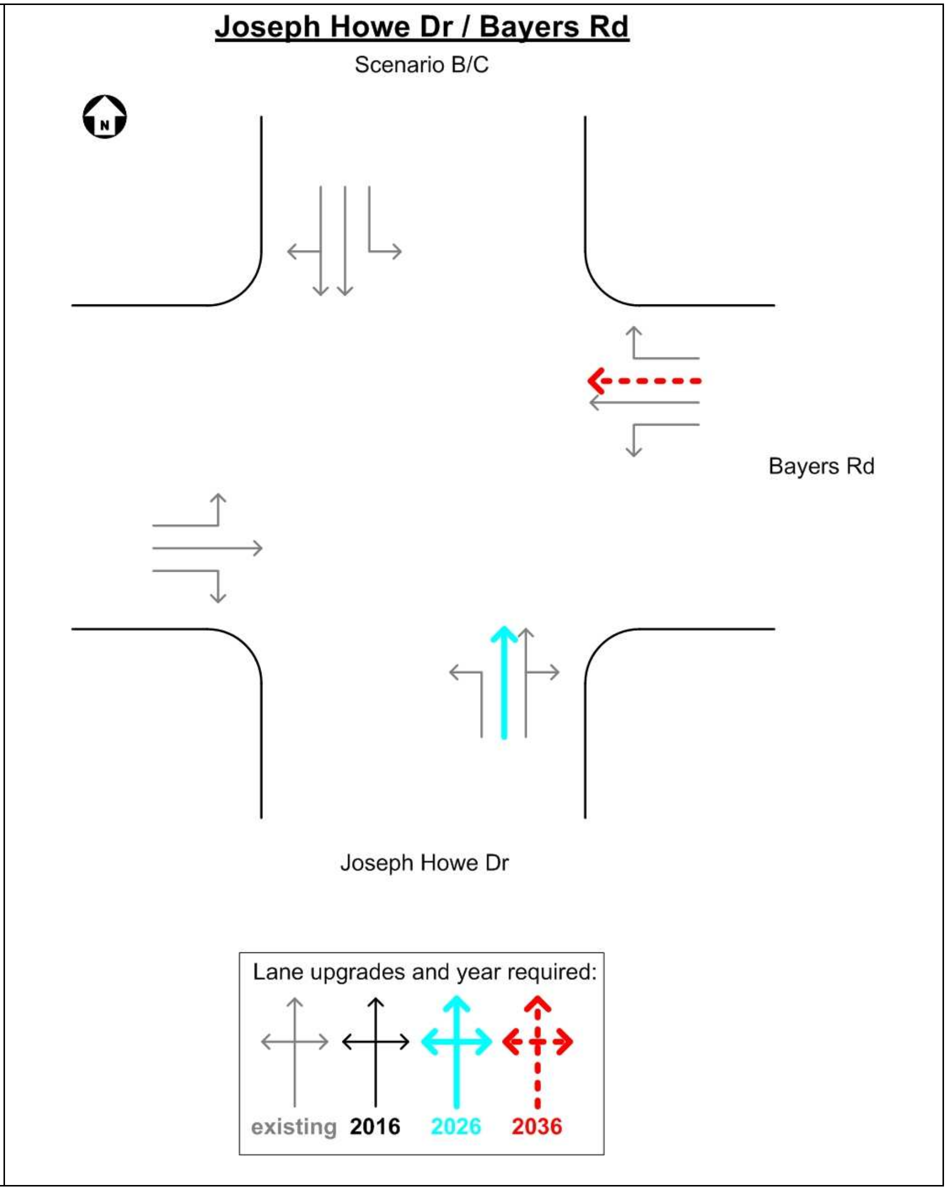

Bayers Rd / Windsor St
Scenario A
N
Bayers Rd
C
C
Windsor St
Lane upgrades and year required:
existing
2016
2026
2036

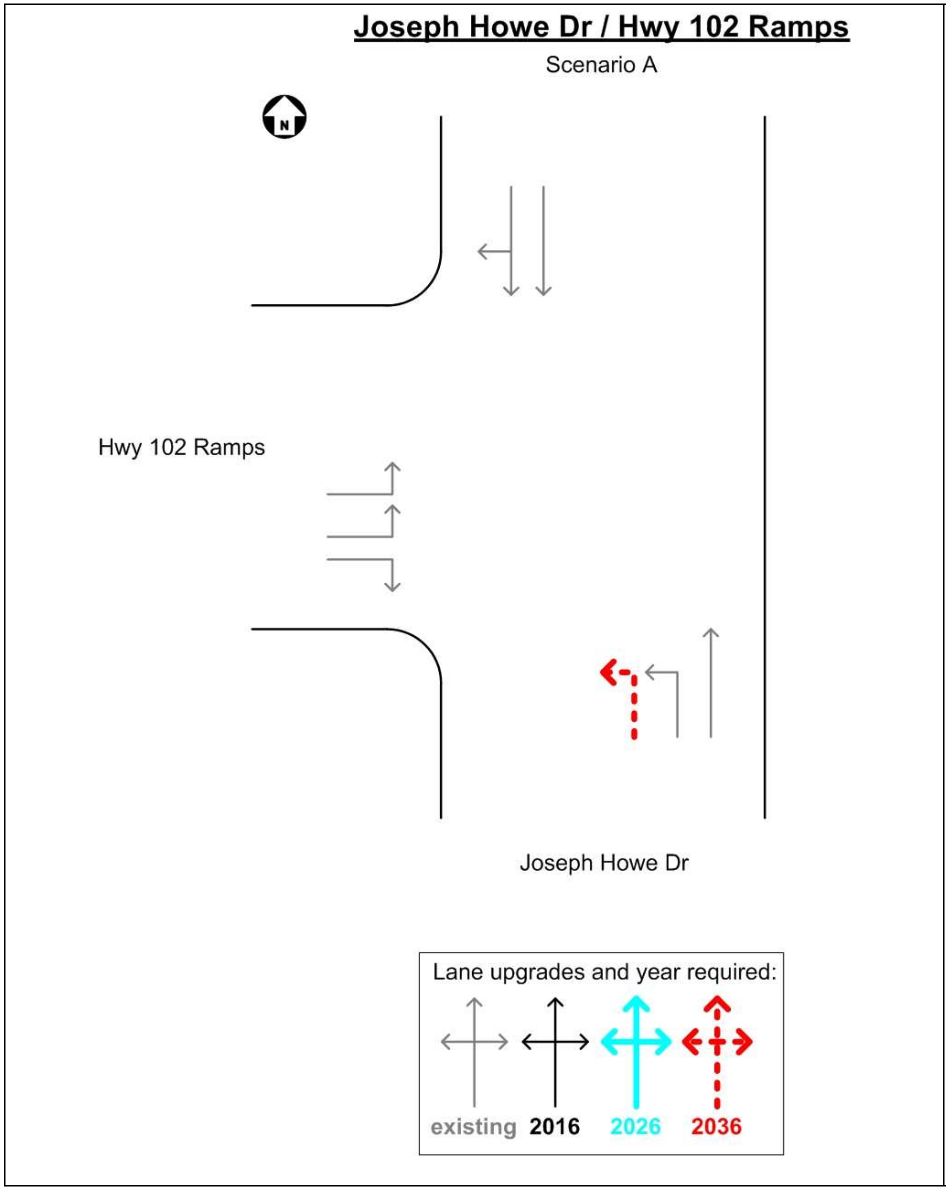

Bayers Rd / Windsor St
Scenario B/C
N
Bayers Rd
C
C
Windsor St
Lane upgrades and year required:
existing
2016
2026
2036

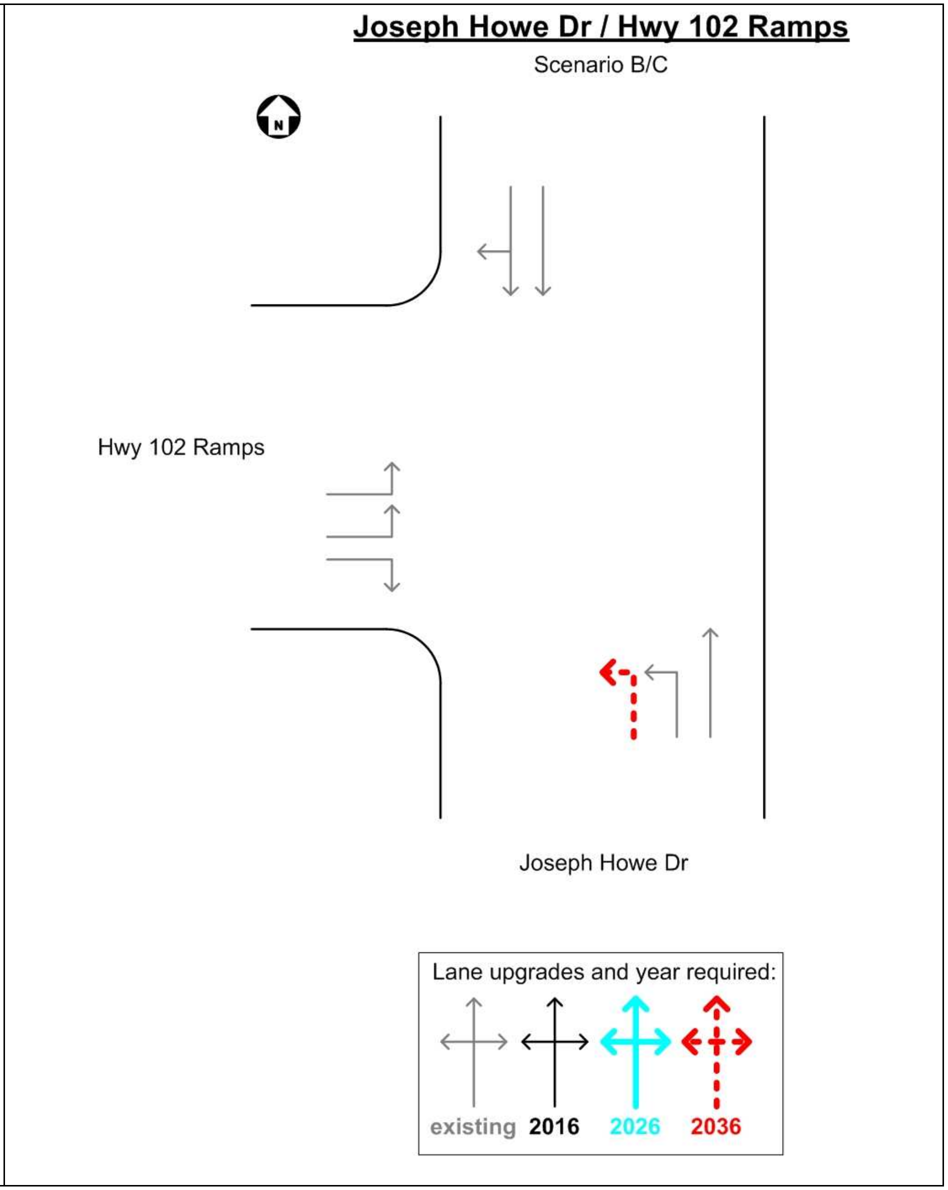

Bayers Rd / Connaught Ave
Scenario A
N
Bayers Rd
Connaught Ave
Lane upgrades and year required:
existing
2016
2026
2036

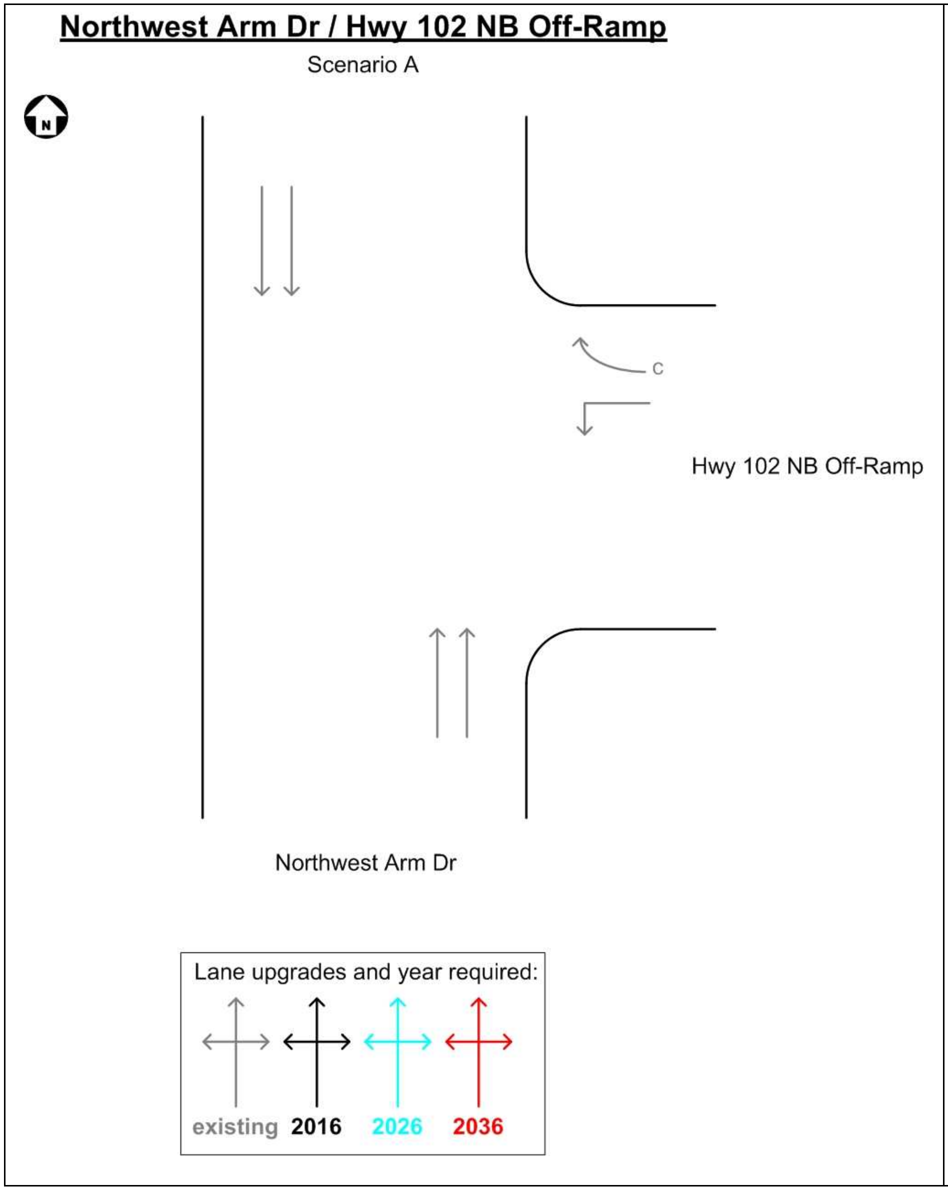

Bayers Rd / Connaught Ave
Scenario B/C
N
Bayers Rd
Connaught Ave
Lane upgrades and year required:
existing
2016
2026
2036

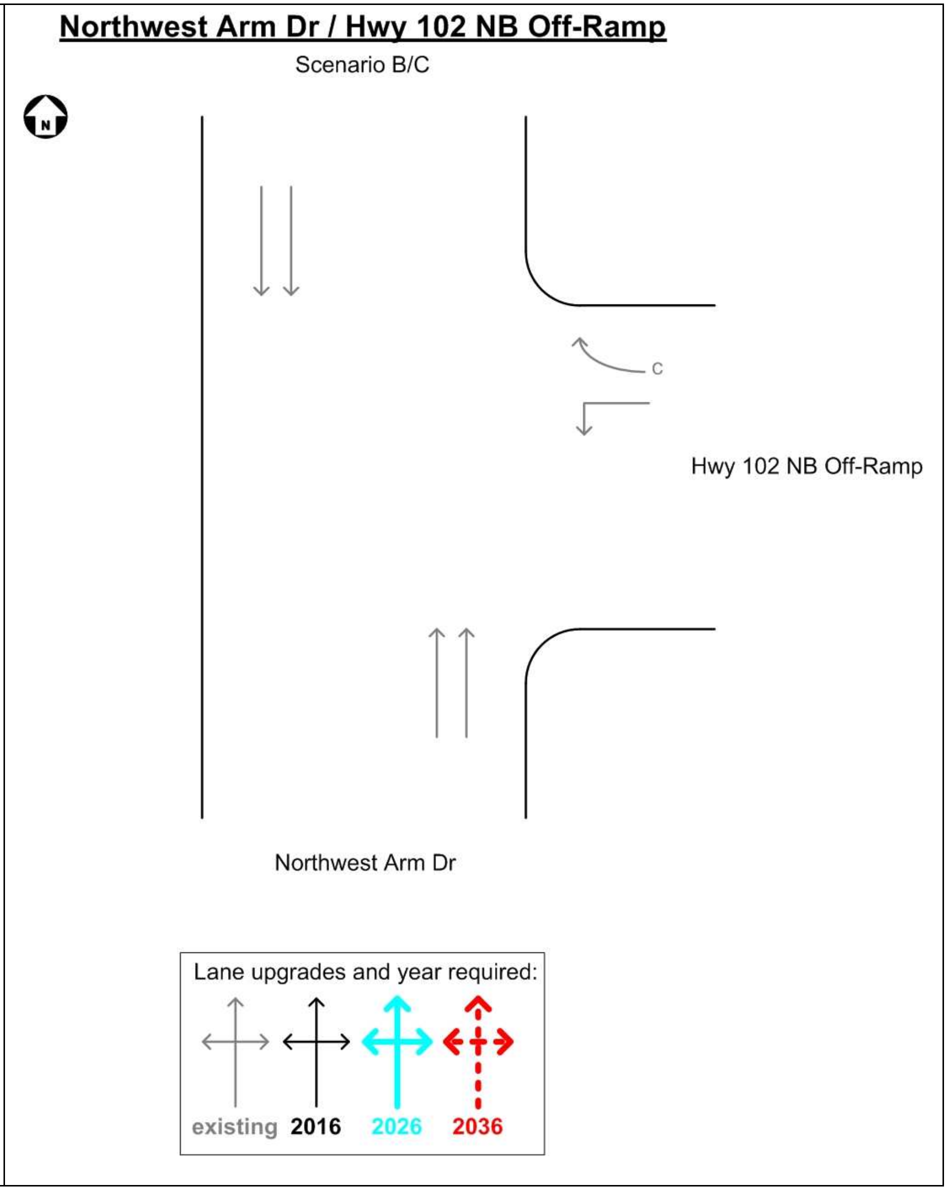

Joseph Howe Dr / Bayers Rd
Scenario A
N
Bayers Rd
Joseph Howe Dr
Lane upgrades and year required:
existing
2016
2026
2036


Joseph Howe Dr / Bayers Rd
Scenario B/C
N
Bayers Rd
Joseph Howe Dr
Lane upgrades and year required:
existing
2016
2026
2036


Joseph Howe Dr / Hwy 102 Ramps
Scenario A
Hwy 102 Ramps
Joseph Howe Dr
Lane upgrades and year required:
existing
2016
2026
2036

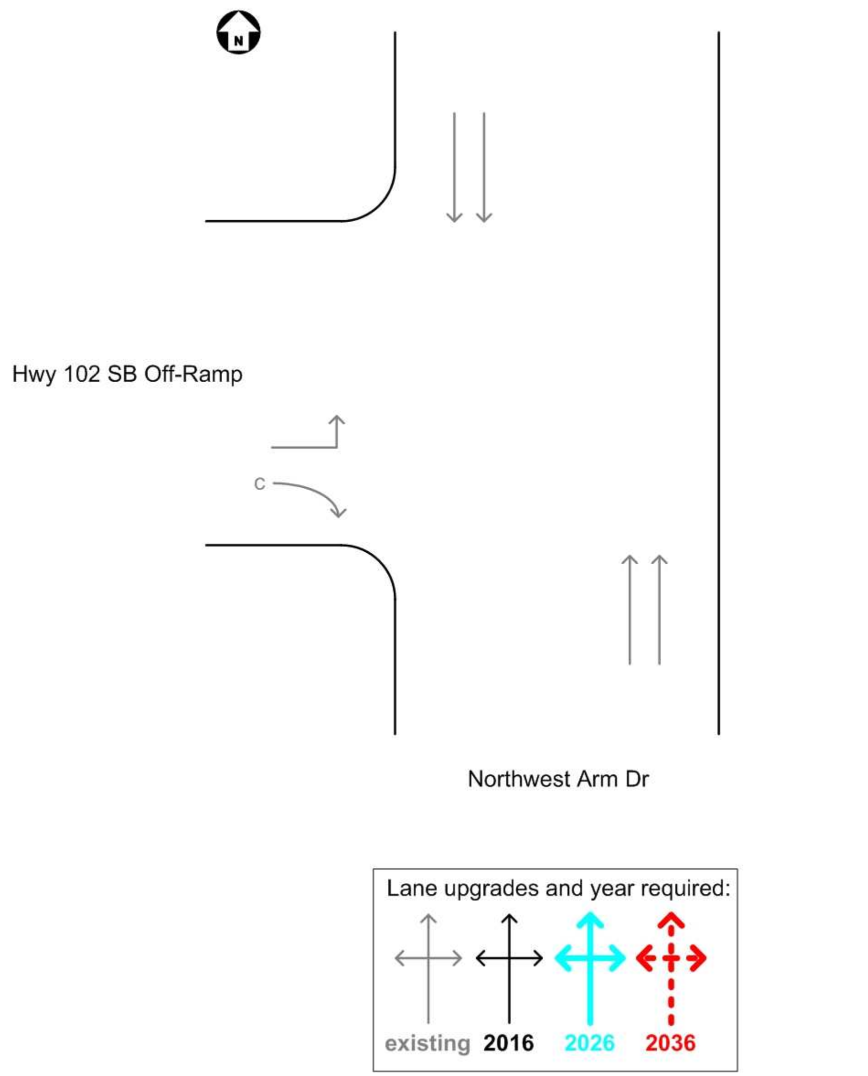

Joseph Howe Dr / Hwy 102 Ramps
Scenario B/C
Hwy 102 Ramps
Joseph Howe Dr
Lane upgrades and year required:
existing
2016
2026
2036


Northwest Arm Dr / Hwy 102 NB Off-Ramp
Scenario A
N
C
Hwy 102 NB Off-Ramp
Northwest Arm Dr
Lane upgrades and year required:
existing
2016
2026
2036


Northwest Arm Dr / Hwy 102 NB Off-Ramp
Scenario B/C
N
C
Hwy 102 NB Off-Ramp
Northwest Arm Dr
Lane upgrades and year required:
existing
2016
2026
2036

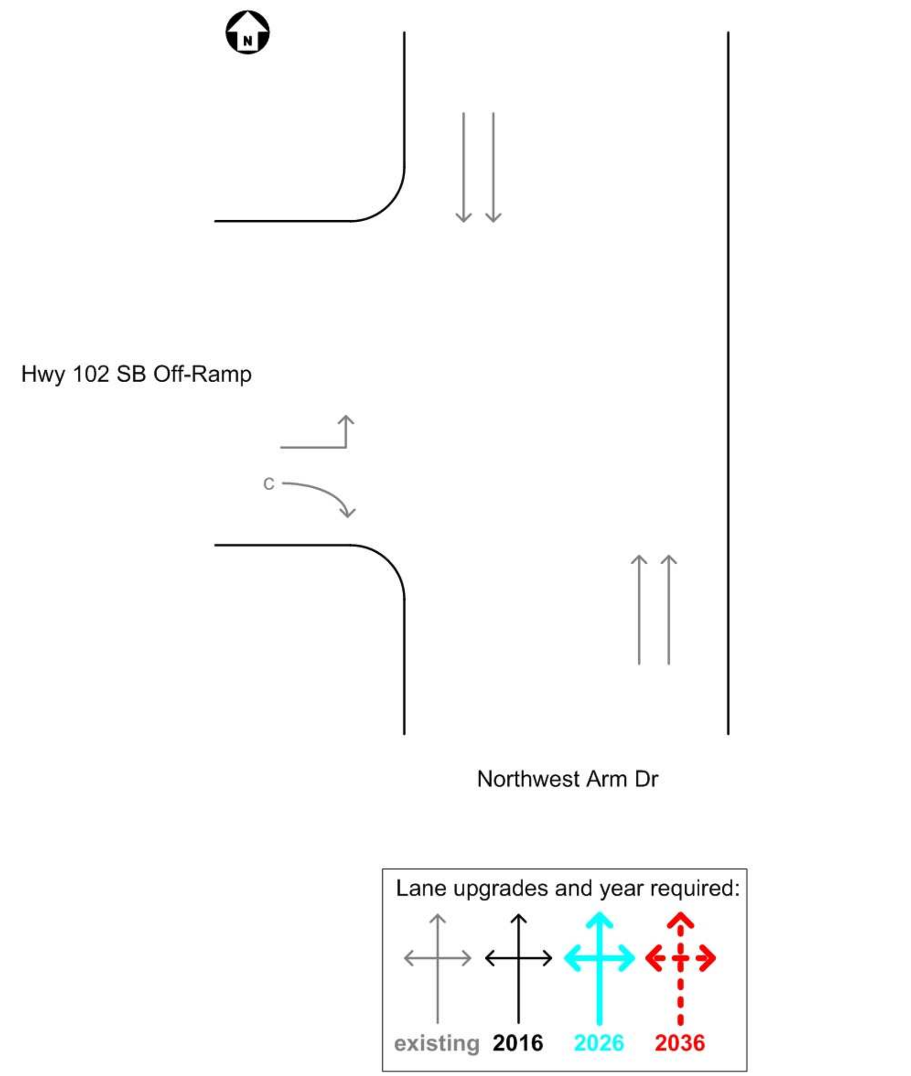
Northwest Arm Dr / Hwy 102 SB Off-Ramp

Scenario A



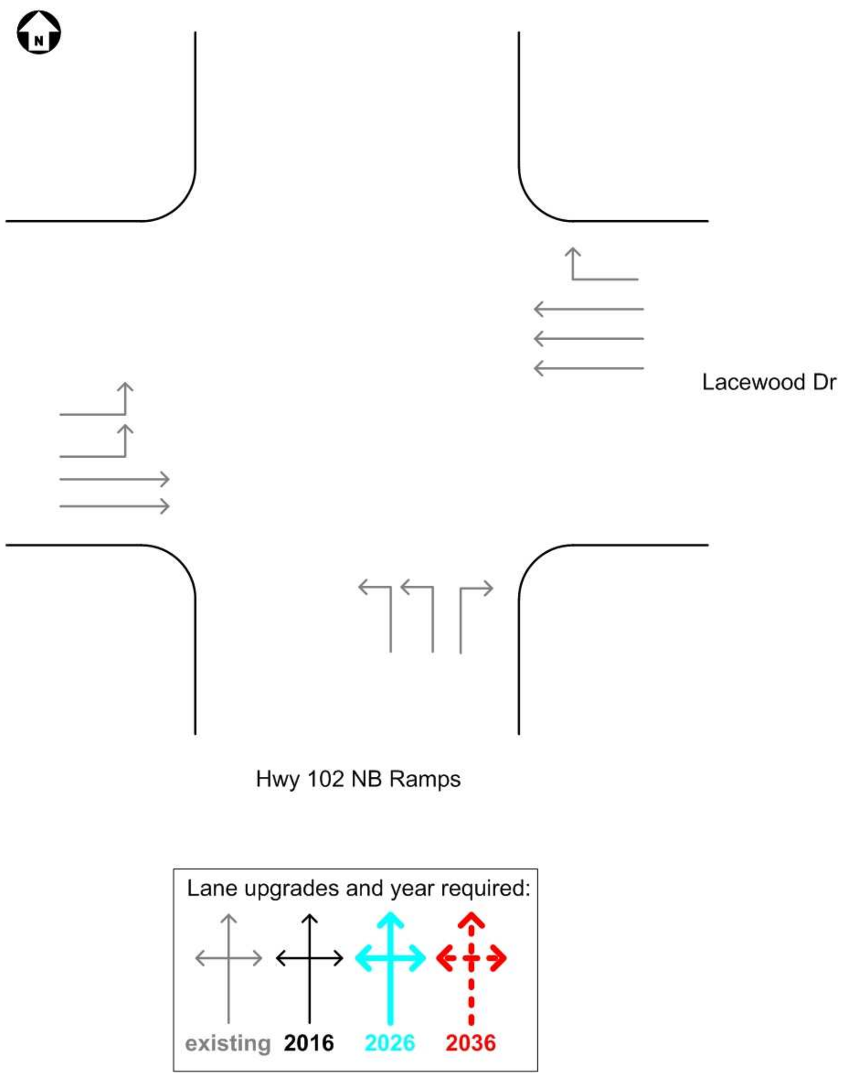
Northwest Arm Dr / Hwy 102 SB Off-Ramp

Scenario B/C



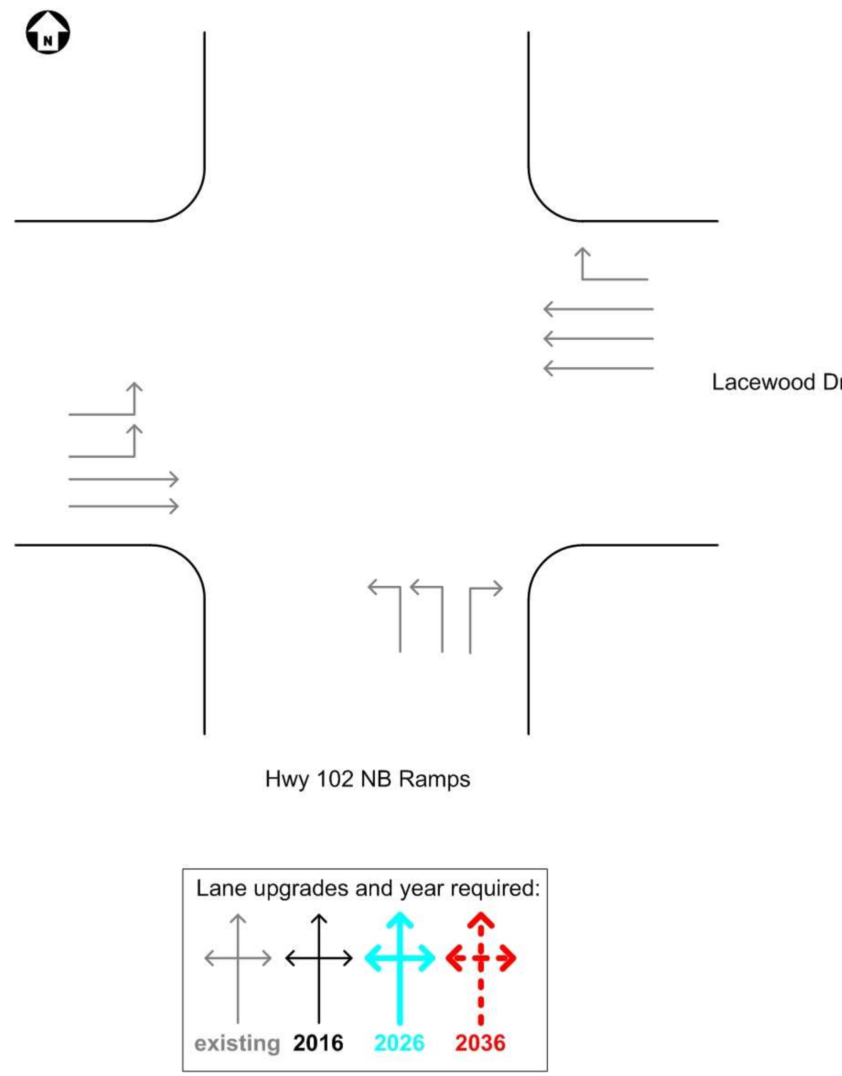
Lacewood Dr / Hwy 102 NB Ramps

Scenario A



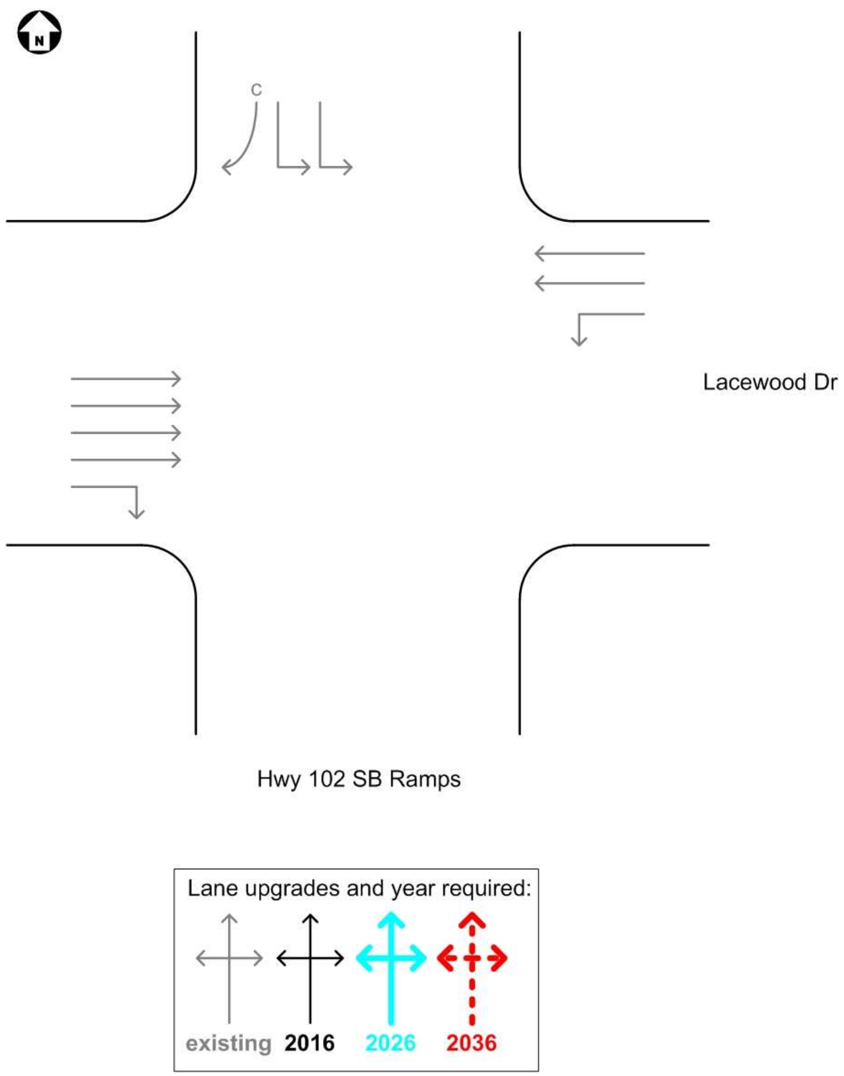
Lacewood Dr / Hwy 102 NB Ramps

Scenario B/C



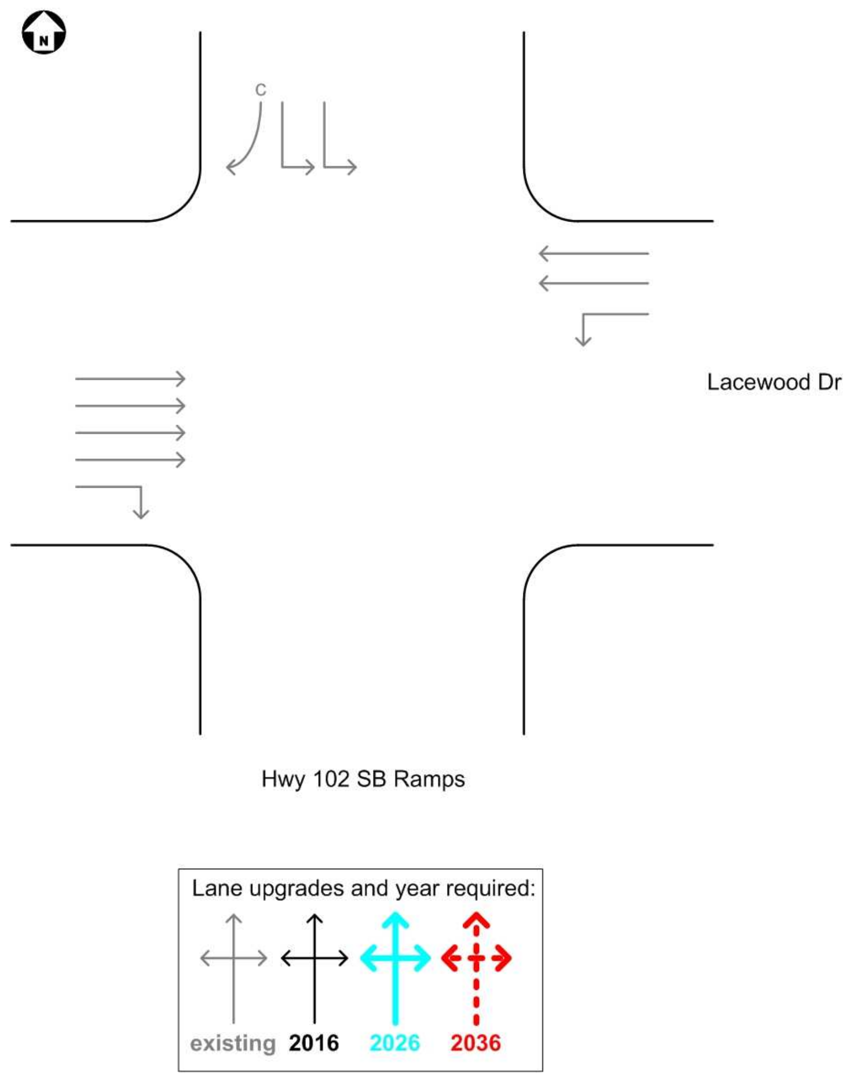
Lacewood Dr / Hwy 102 SB Ramps

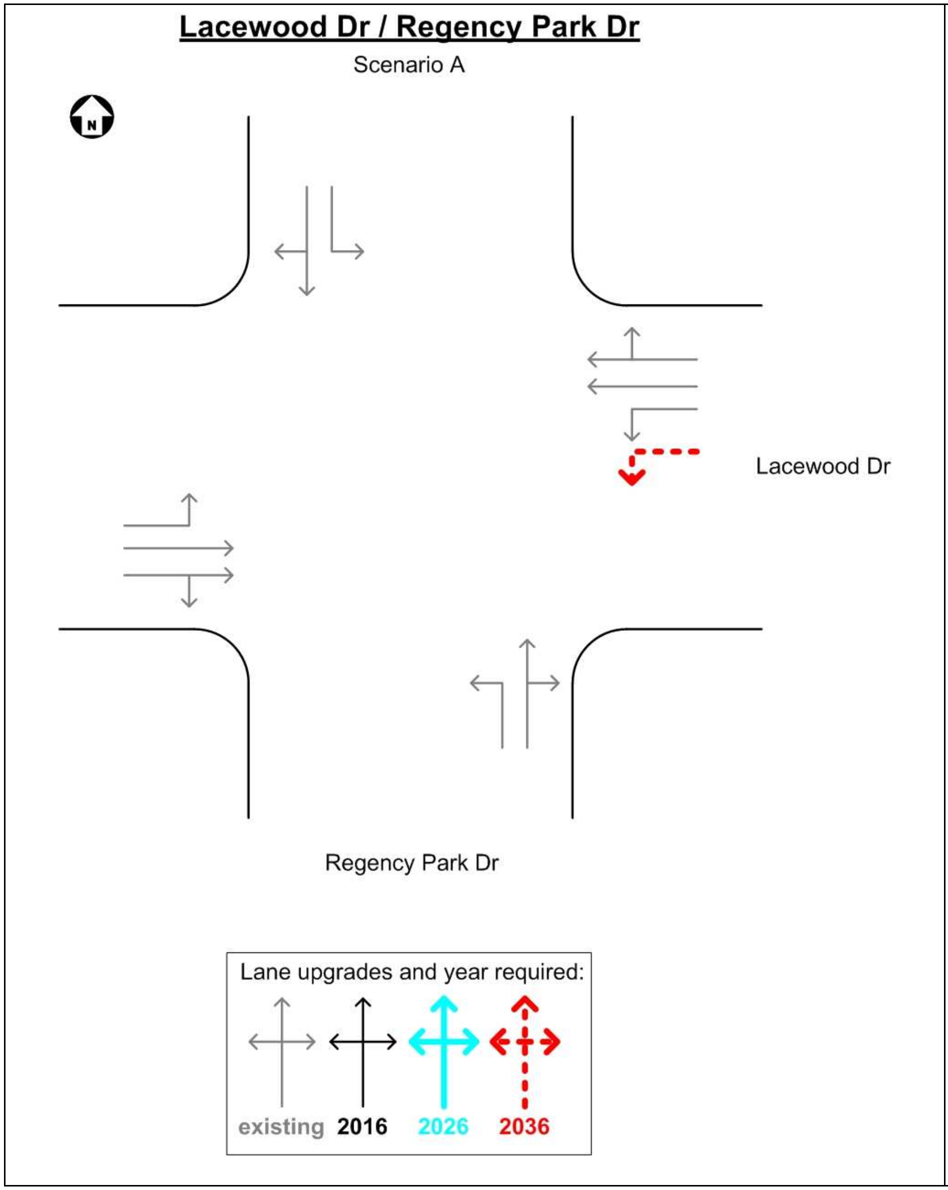
Scenario A

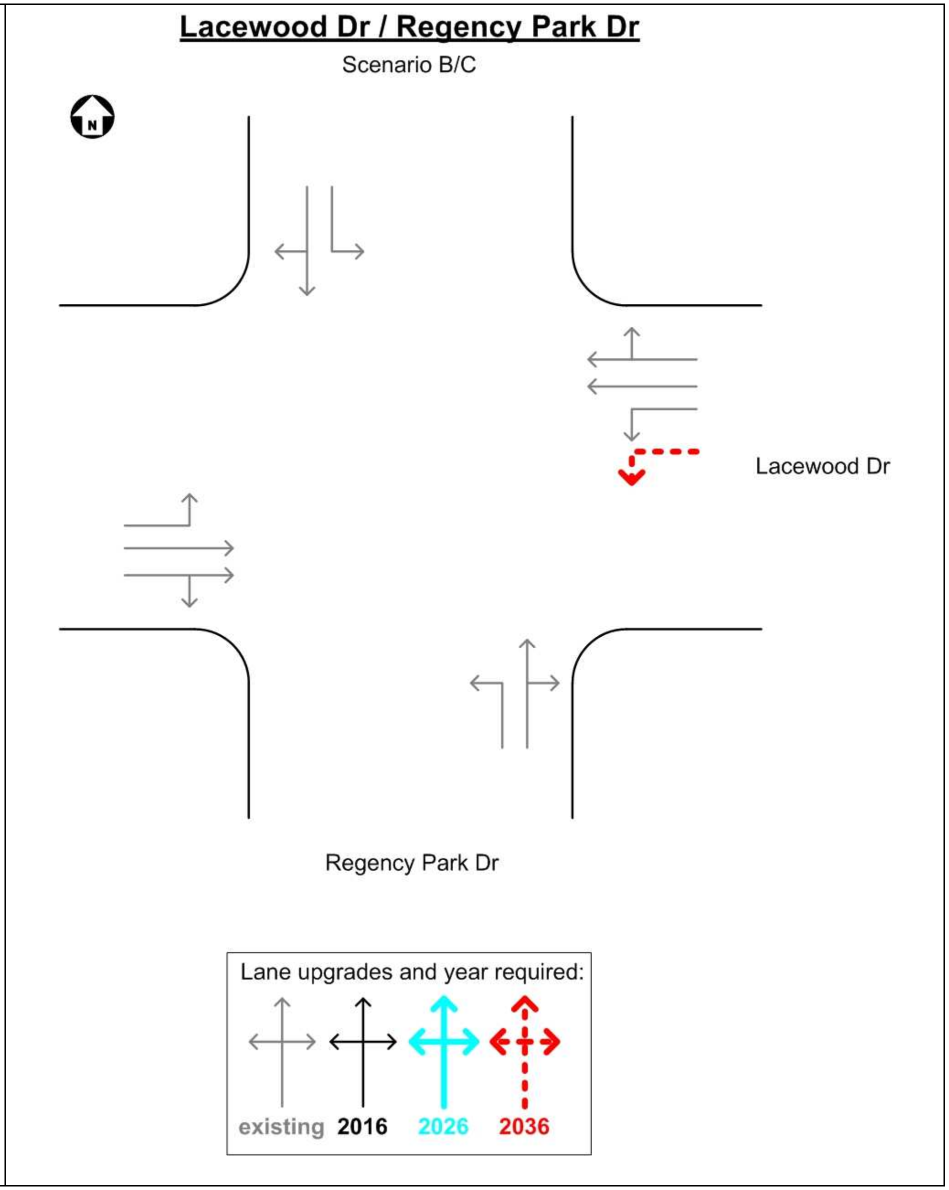


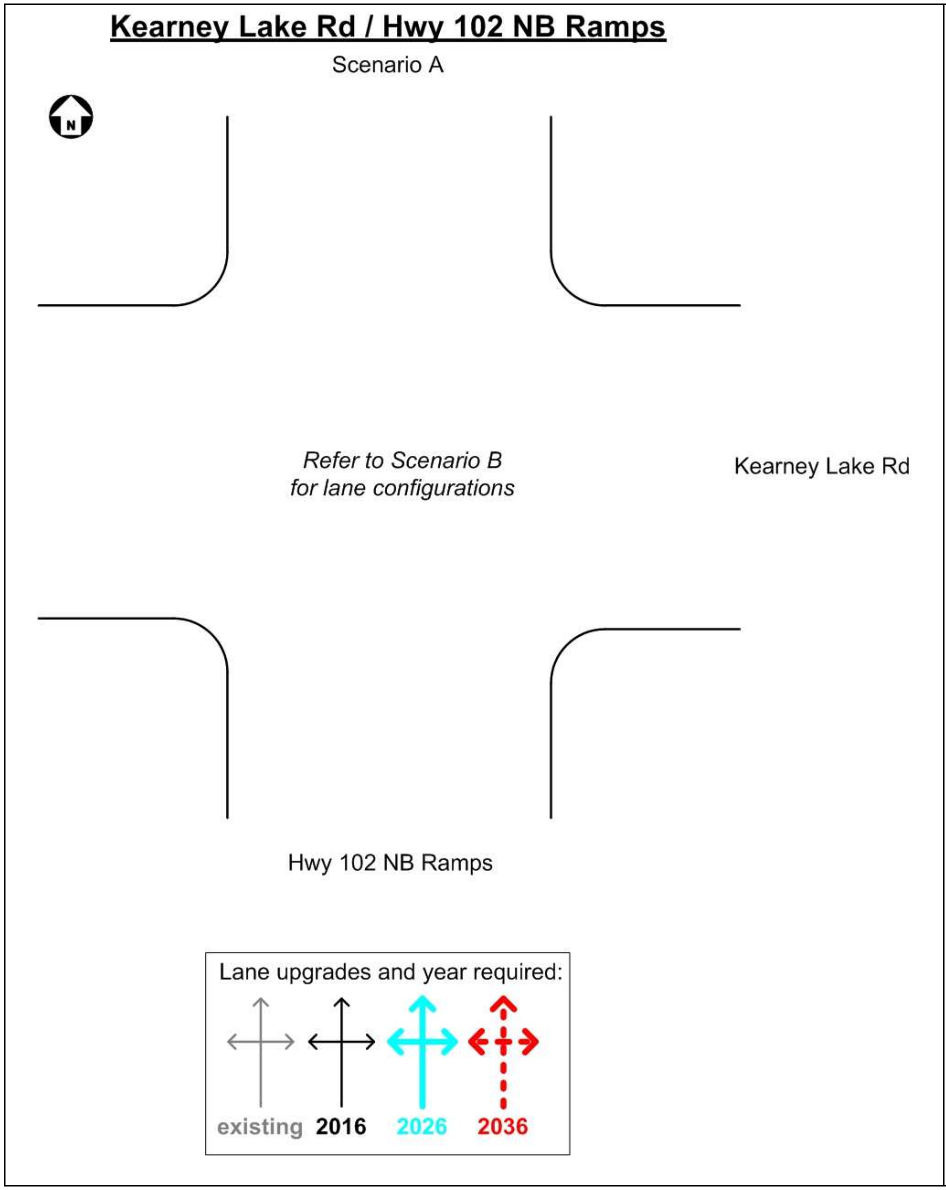
Lacewood Dr / Hwy 102 SB Ramps

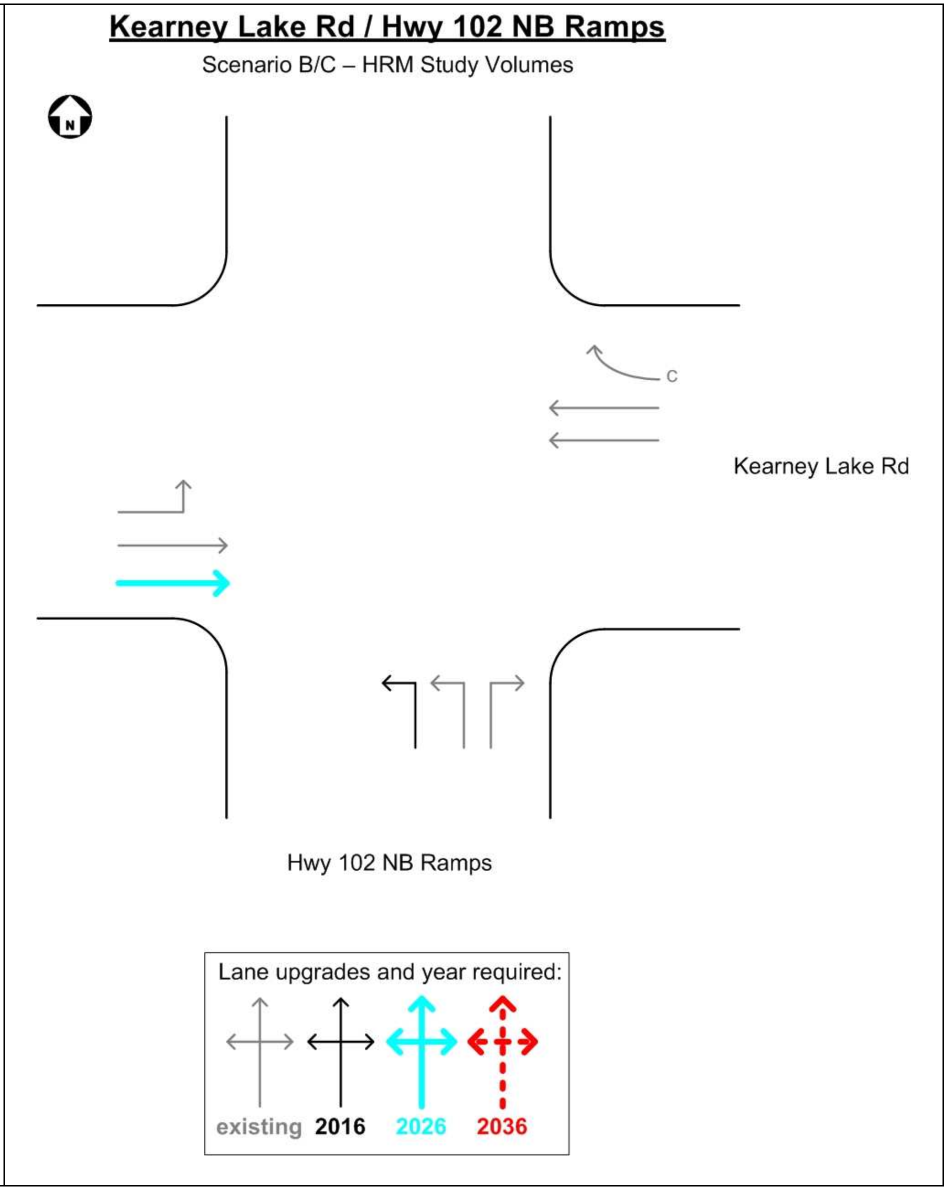
Scenario B/C

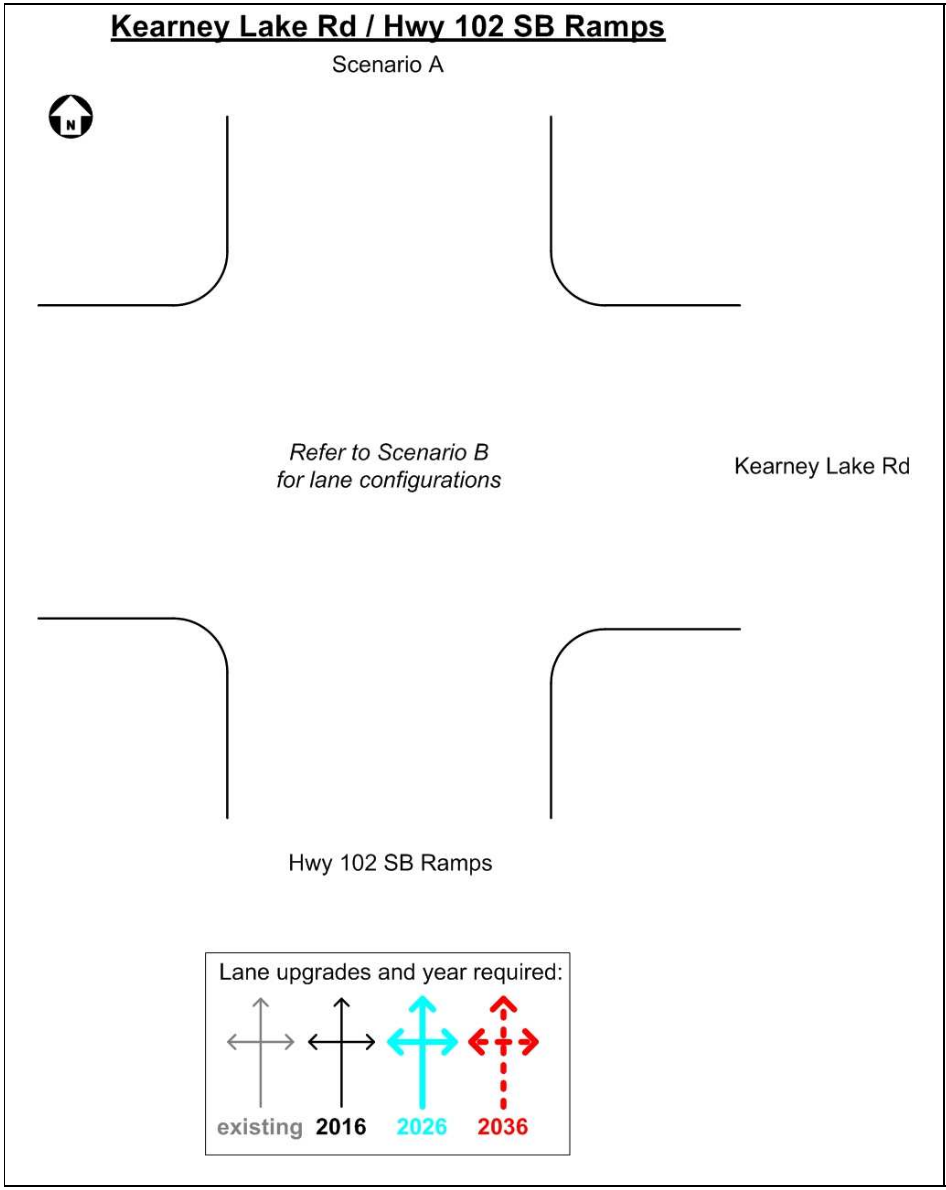


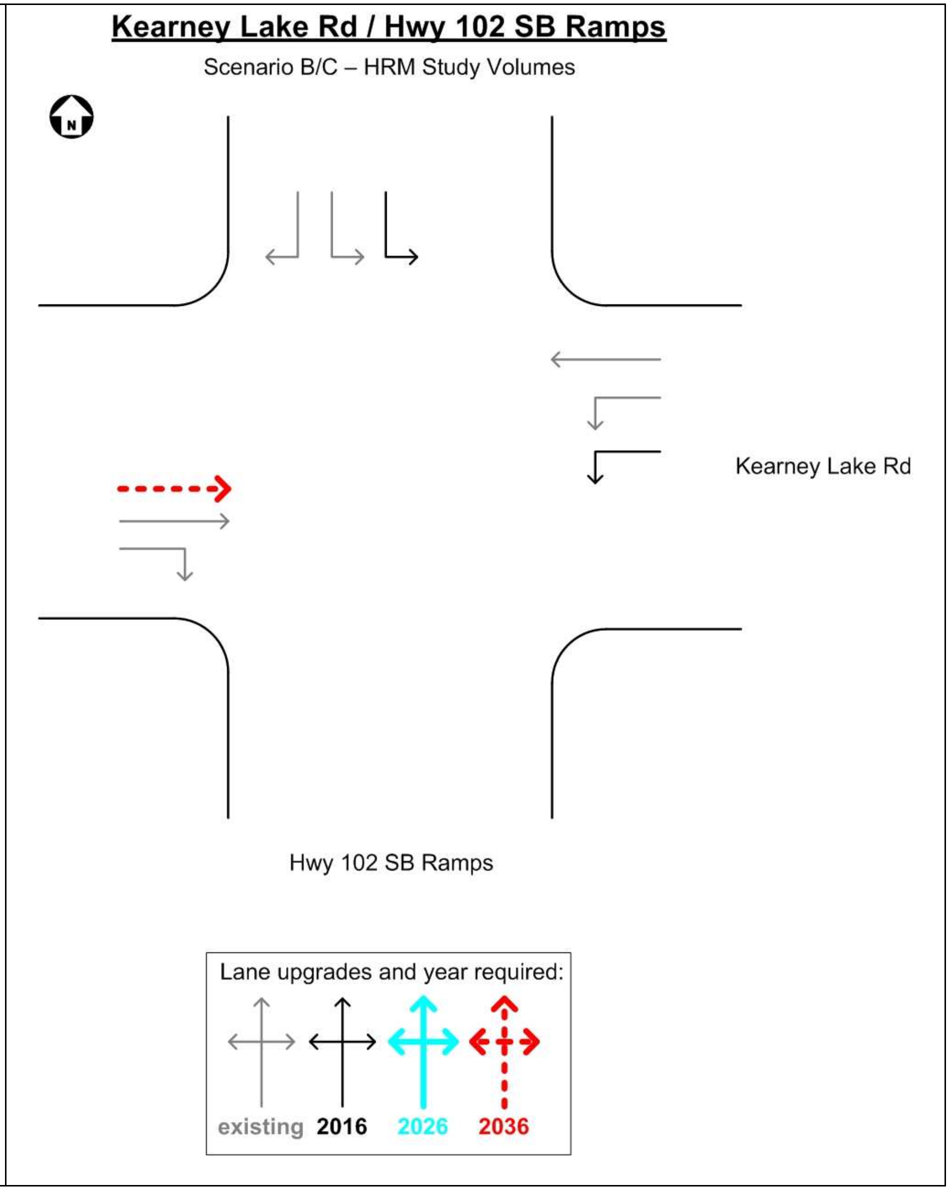

Lacewood Dr / Regency Park Dr
Scenario A
N
Lacewood Dr
Regency Park Dr
Lane upgrades and year required:
existing
2016
2026
2036

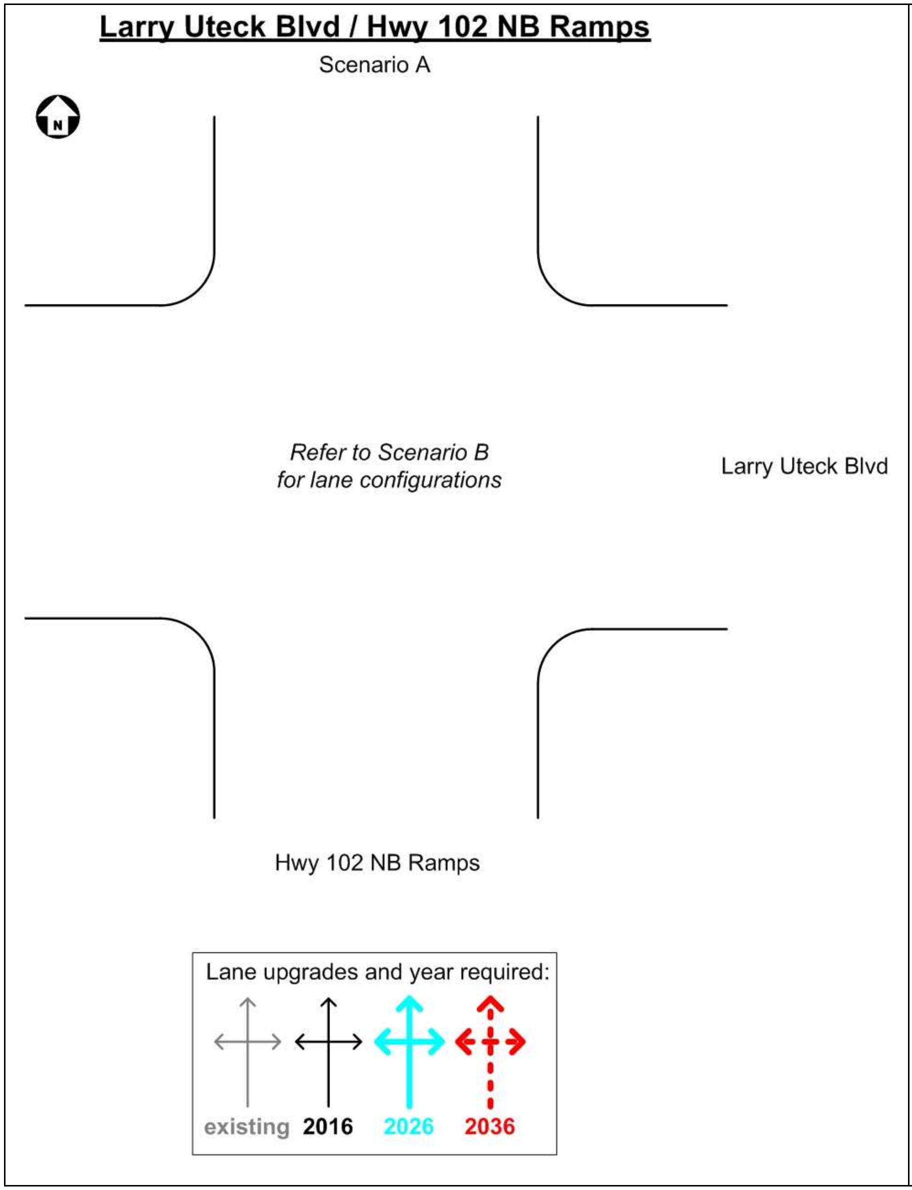

Lacewood Dr / Regency Park Dr
Scenario B/C
N
Lacewood Dr
Regency Park Dr
Lane upgrades and year required:
existing
2016
2026
2036

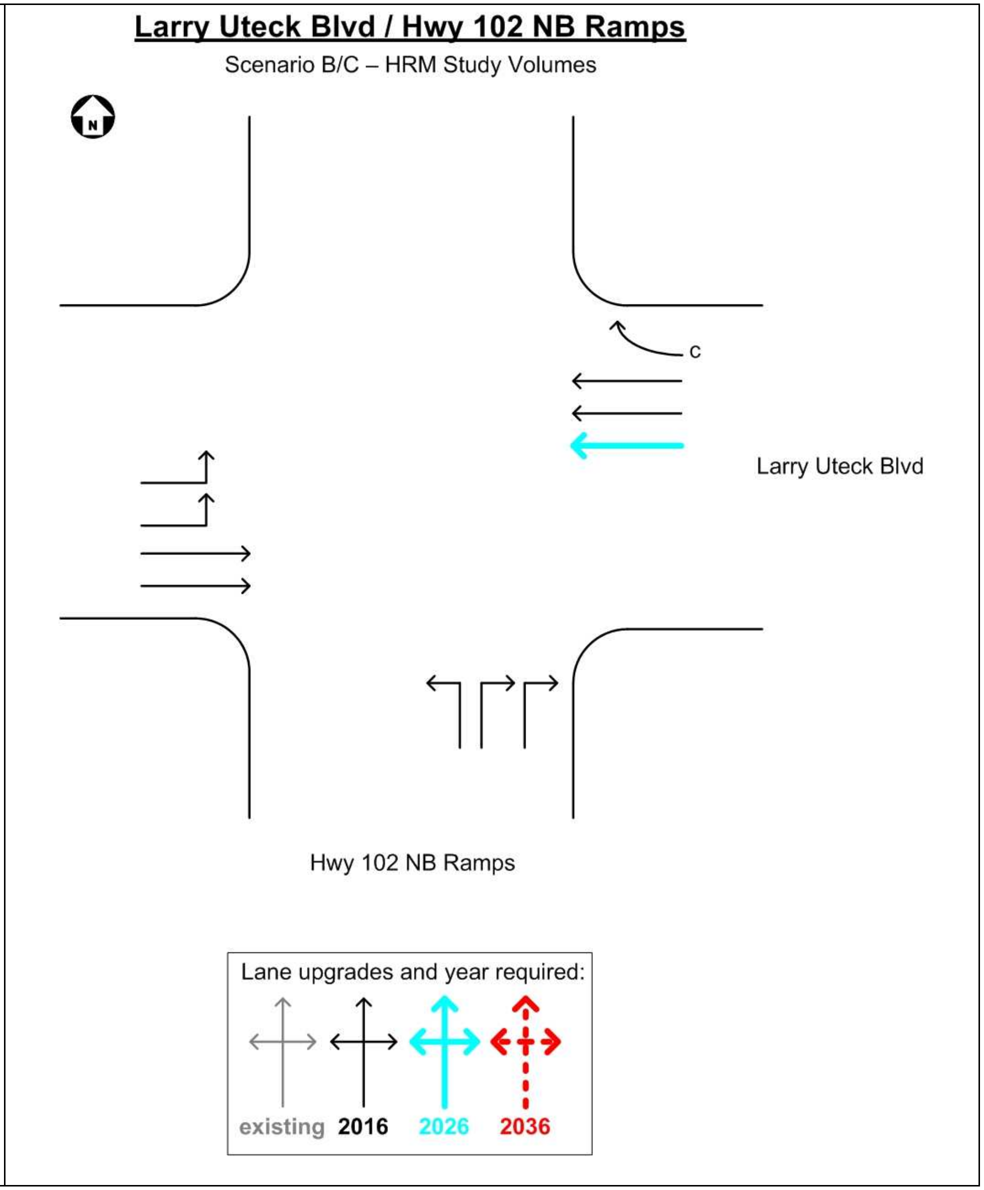

Kearney Lake Rd / Hwy 102 NB Ramps
Scenario A
N
Refer to Scenario B
for lane configurations
Kearney Lake Rd
Hwy 102 NB Ramps
Lane upgrades and year required:
existing
2016
2026
2036


Kearney Lake Rd / Hwy 102 NB Ramps
Scenario B/C – HRM Study Volumes
N
C
Kearney Lake Rd
Hwy 102 NB Ramps
Lane upgrades and year required:
existing
2016
2026
2036


Kearney Lake Rd / Hwy 102 SB Ramps
Scenario A
N
Refer to Scenario B for lane configurations
Kearney Lake Rd
Hwy 102 SB Ramps
Lane upgrades and year required:
existing
2016
2026
2036

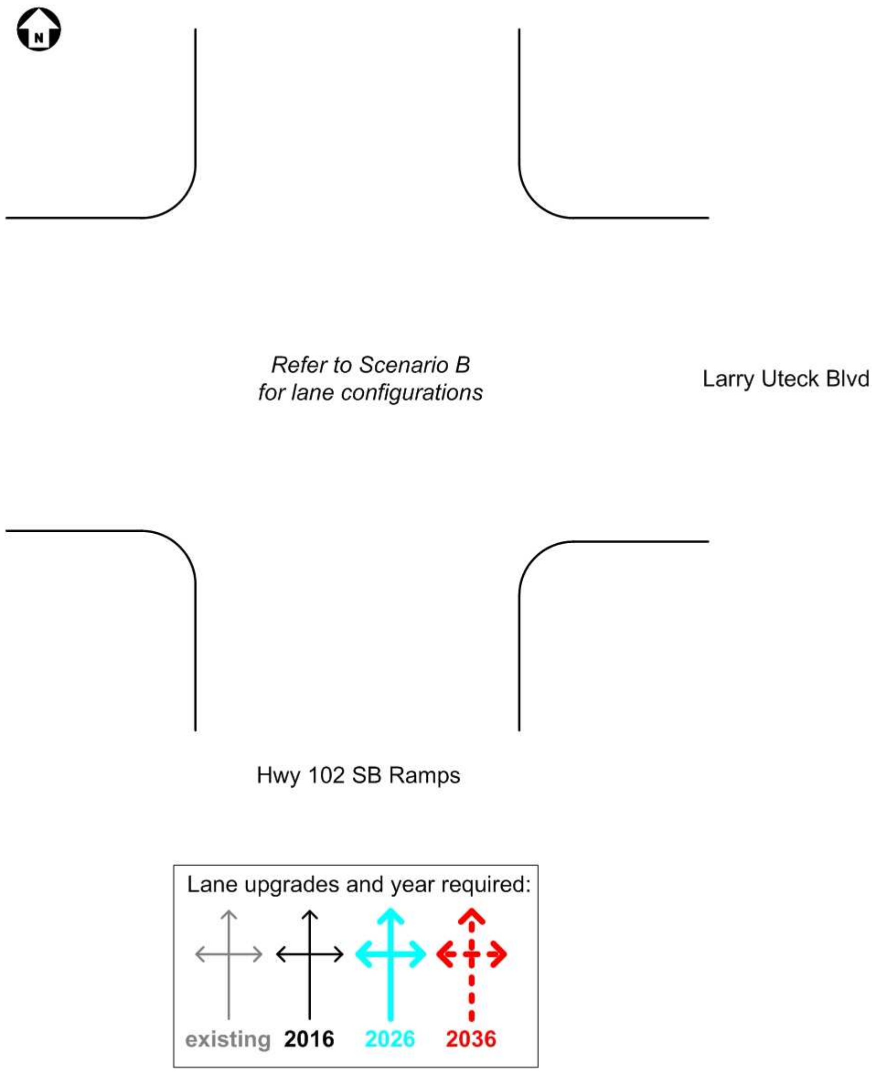

Kearney Lake Rd / Hwy 102 SB Ramps
Scenario B/C – HRM Study Volumes
N
Kearney Lake Rd
Hwy 102 SB Ramps
Lane upgrades and year required:
existing
2016
2026
2036


Larry Uteck Blvd / Hwy 102 NB Ramps
Scenario A
N
Refer to Scenario B
for lane configurations
Larry Uteck Blvd
Hwy 102 NB Ramps
Lane upgrades and year required:
existing
2016
2026
2036


Larry Uteck Blvd / Hwy 102 NB Ramps
Scenario B/C – HRM Study Volumes
N
c
Larry Uteck Blvd
Hwy 102 NB Ramps
Lane upgrades and year required:
existing
2016
2026
2036

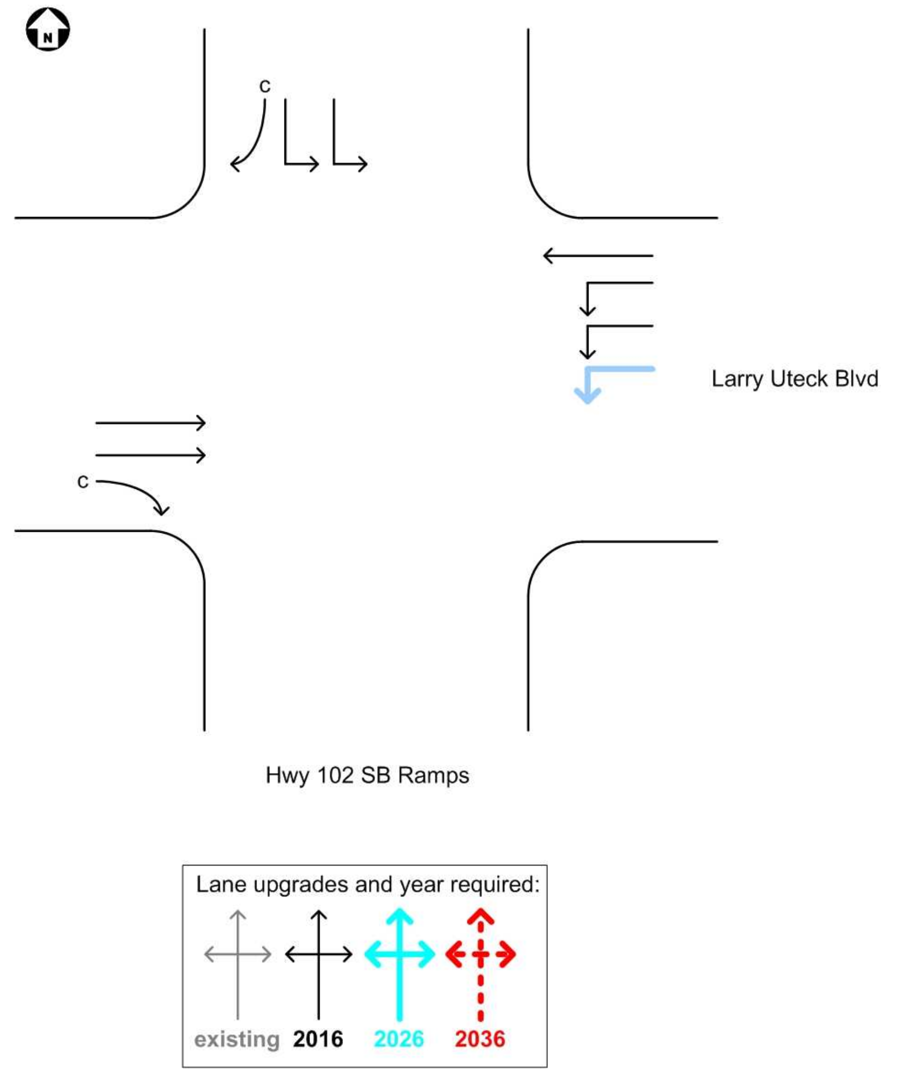
Larry Uteck Blvd / Hwy 102 SB Ramps

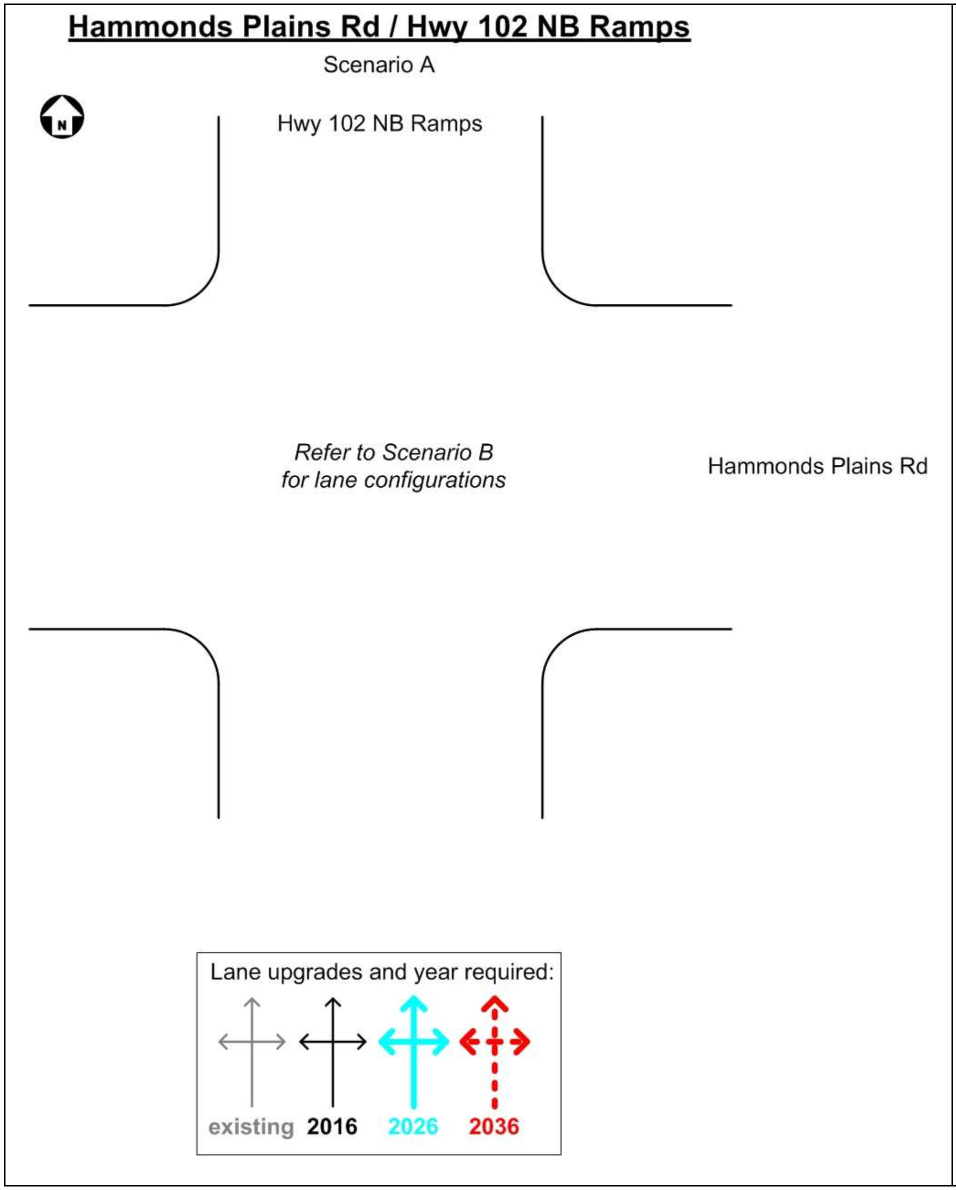
Scenario A

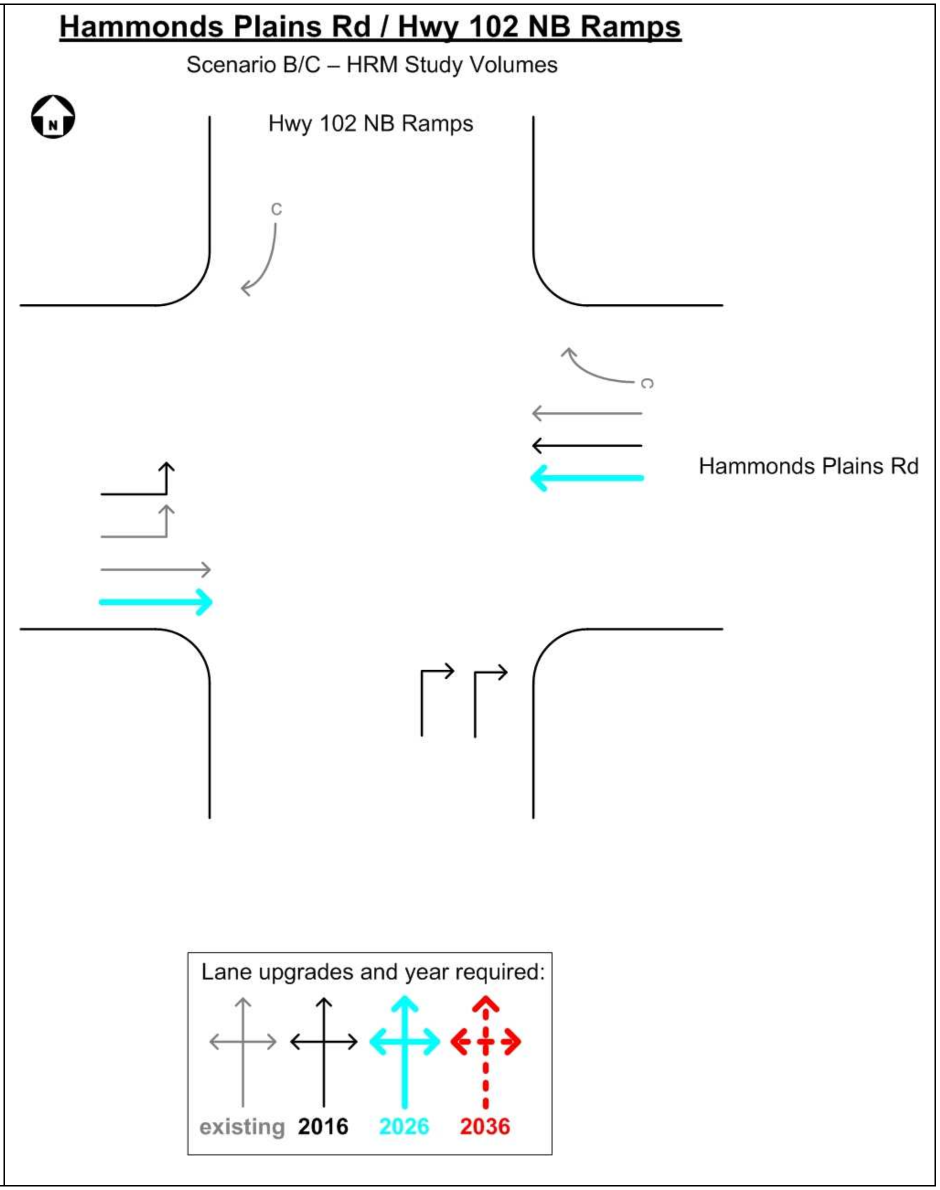


Larry Uteck Blvd / Hwy 102 SB Ramps

Scenario B/C – HRM Study Volumes

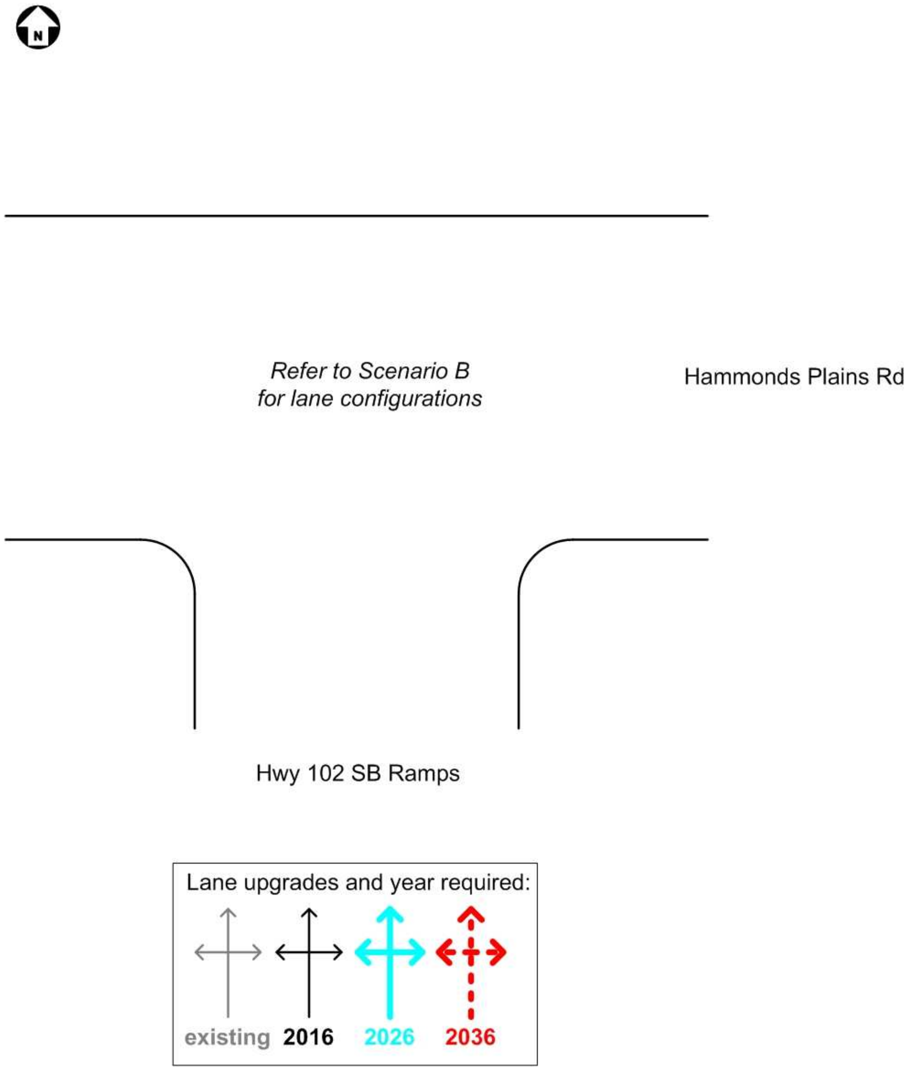



Hammonds Plains Rd / Hwy 102 NB Ramps
Scenario A
Hwy 102 NB Ramps
Refer to Scenario B for lane configurations
Hammonds Plains Rd
Lane upgrades and year required:
existing
2016
2026
2036


Hammonds Plains Rd / Hwy 102 NB Ramps
Scenario B/C – HRM Study Volumes
Hwy 102 NB Ramps
C
C
Hammonds Plains Rd
Lane upgrades and year required:
existing
2016
2026
2036

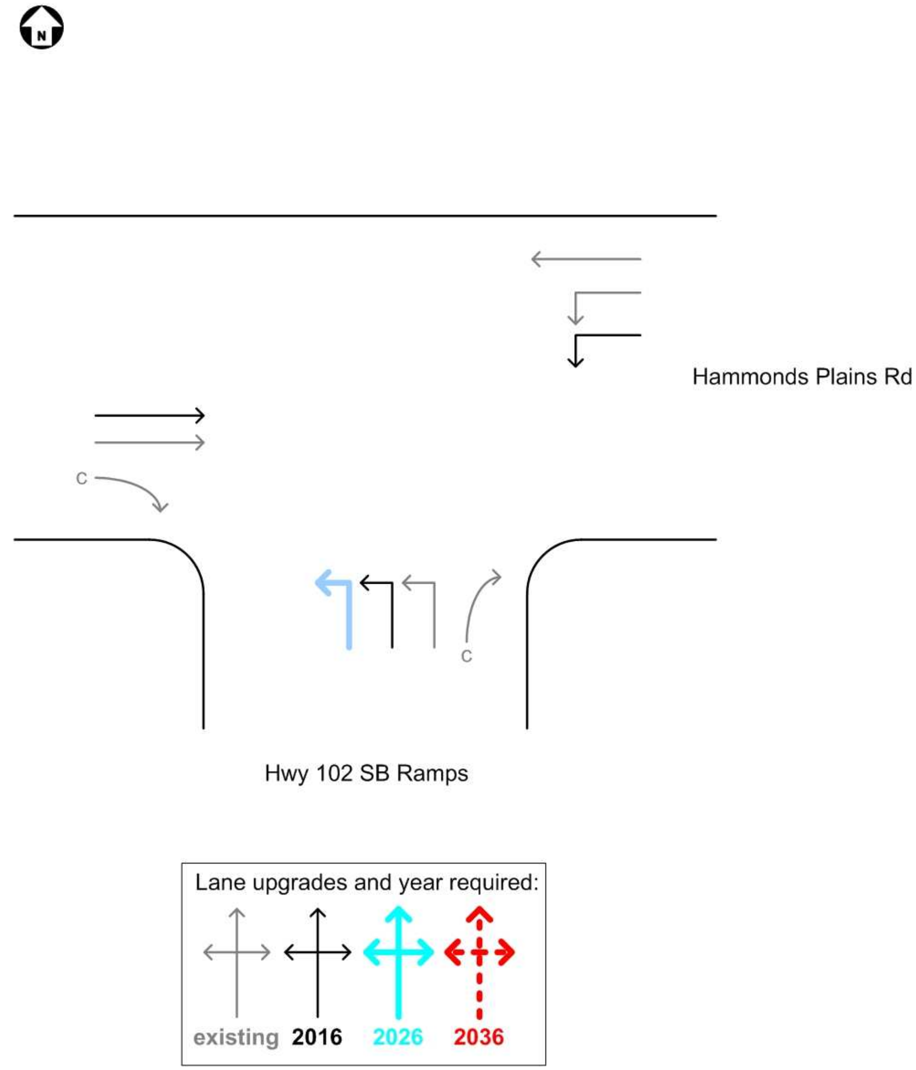
Hammonds Plains Rd / Hwy 102 SB Ramps

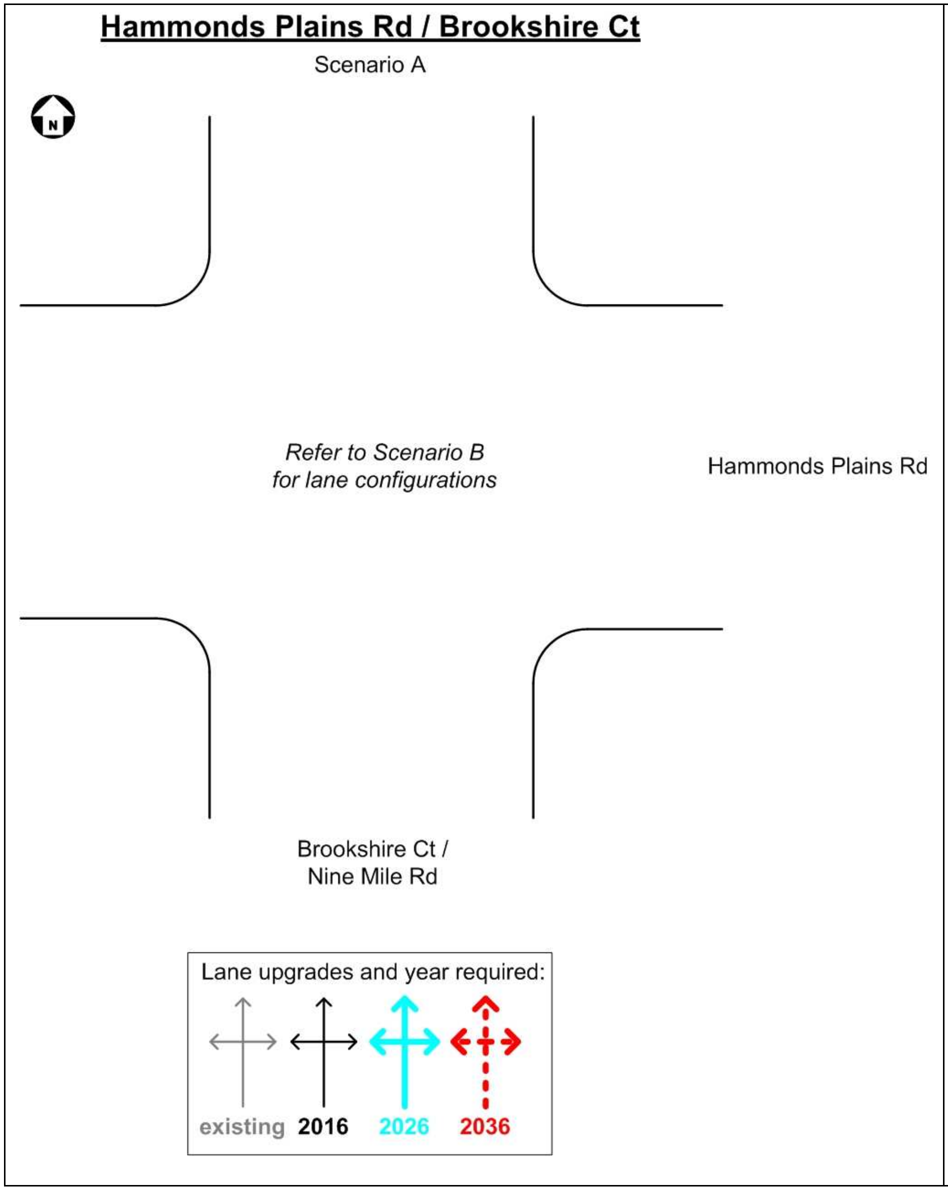
Scenario A

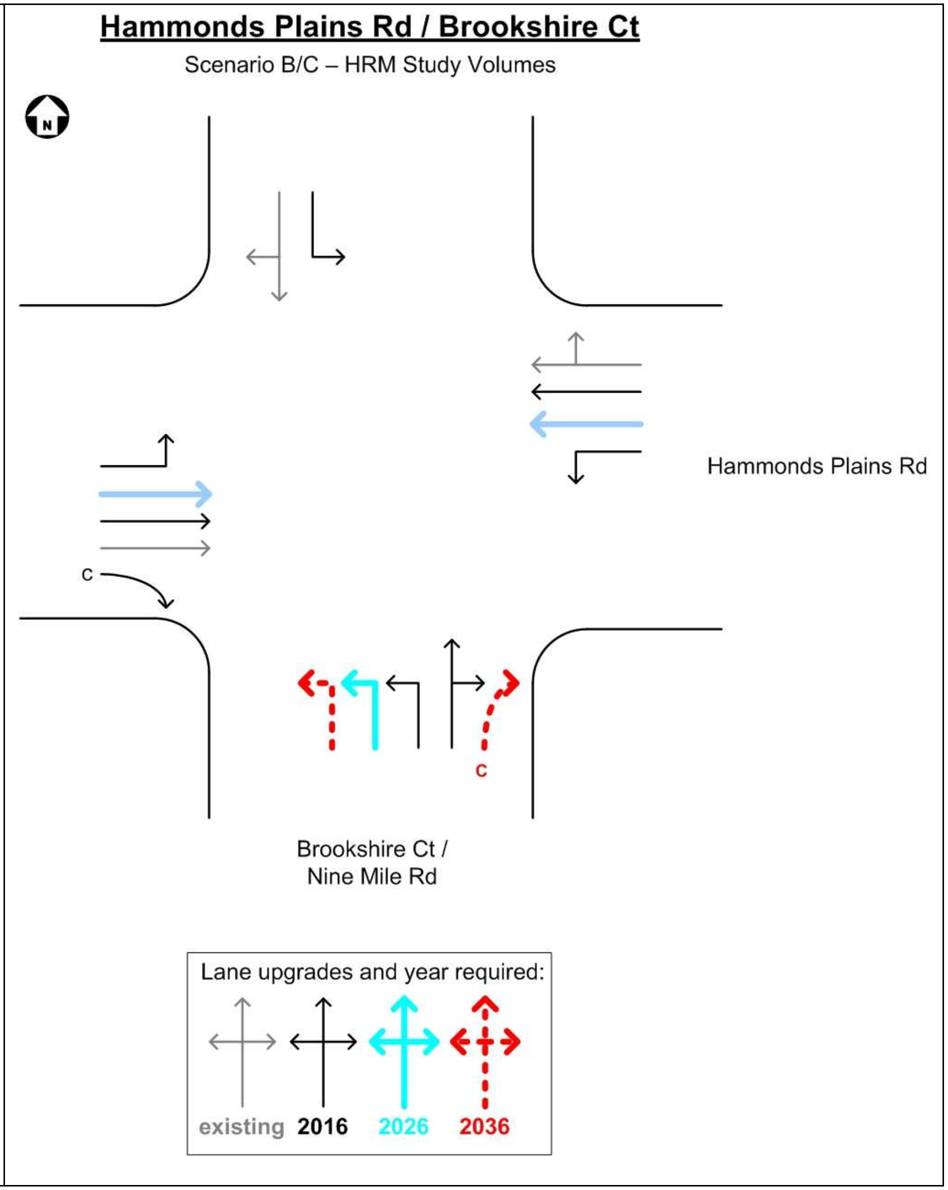


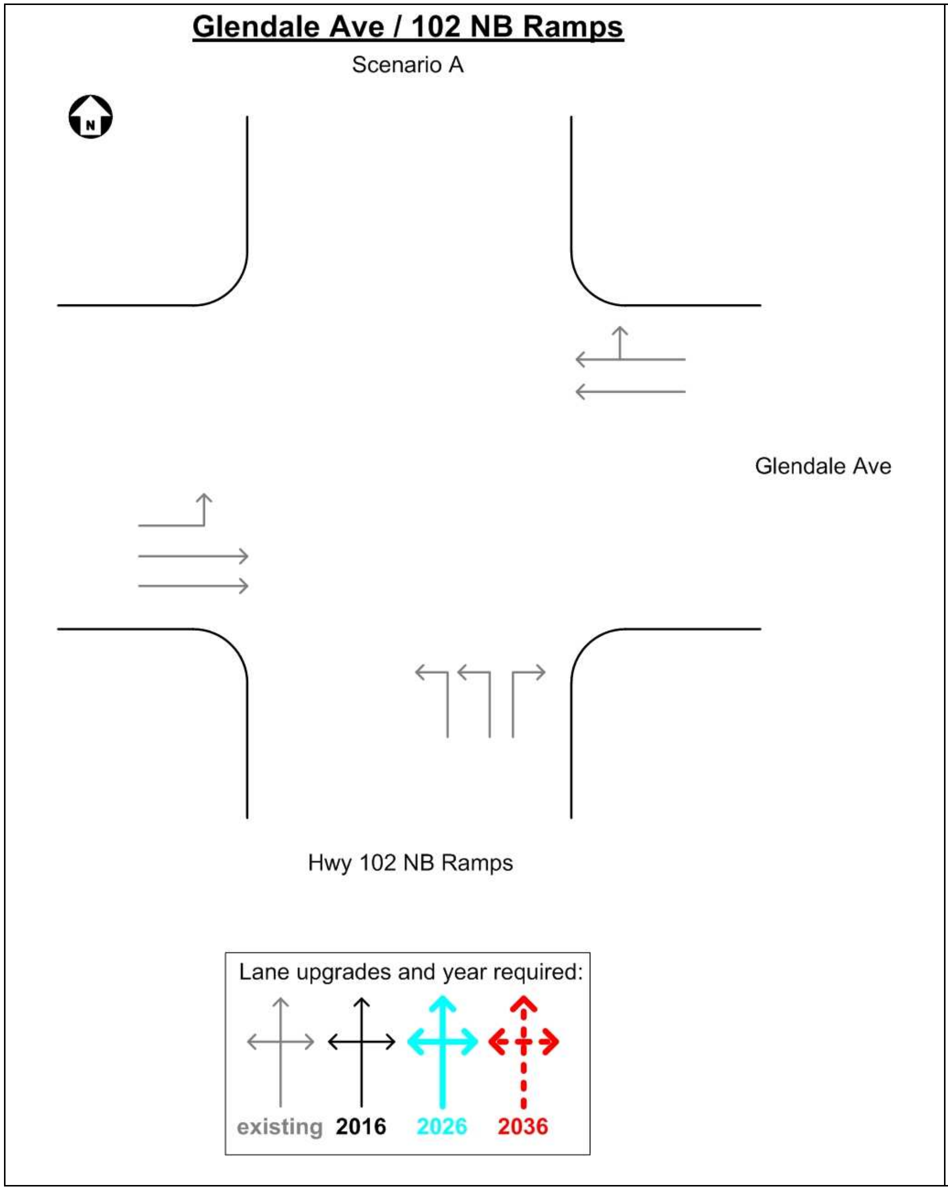
Hammonds Plains Rd / Hwy 102 SB Ramps

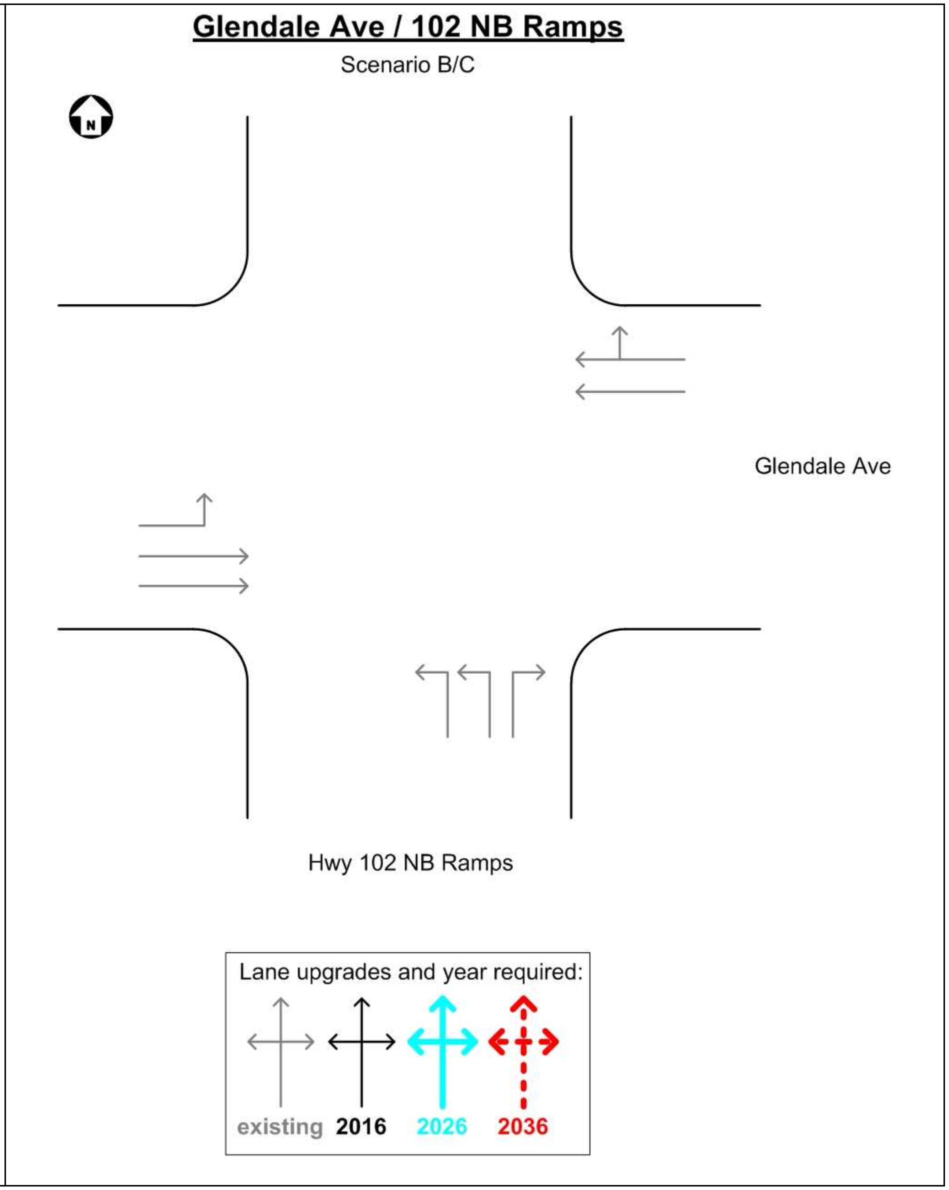
Scenario B/C – HRM Study Volumes




Hammonds Plains Rd / Brookshire Ct
Scenario A
N
Refer to Scenario B
for lane configurations
Hammonds Plains Rd
Brookshire Ct /
Nine Mile Rd
Lane upgrades and year required:
existing
2016
2026
2036

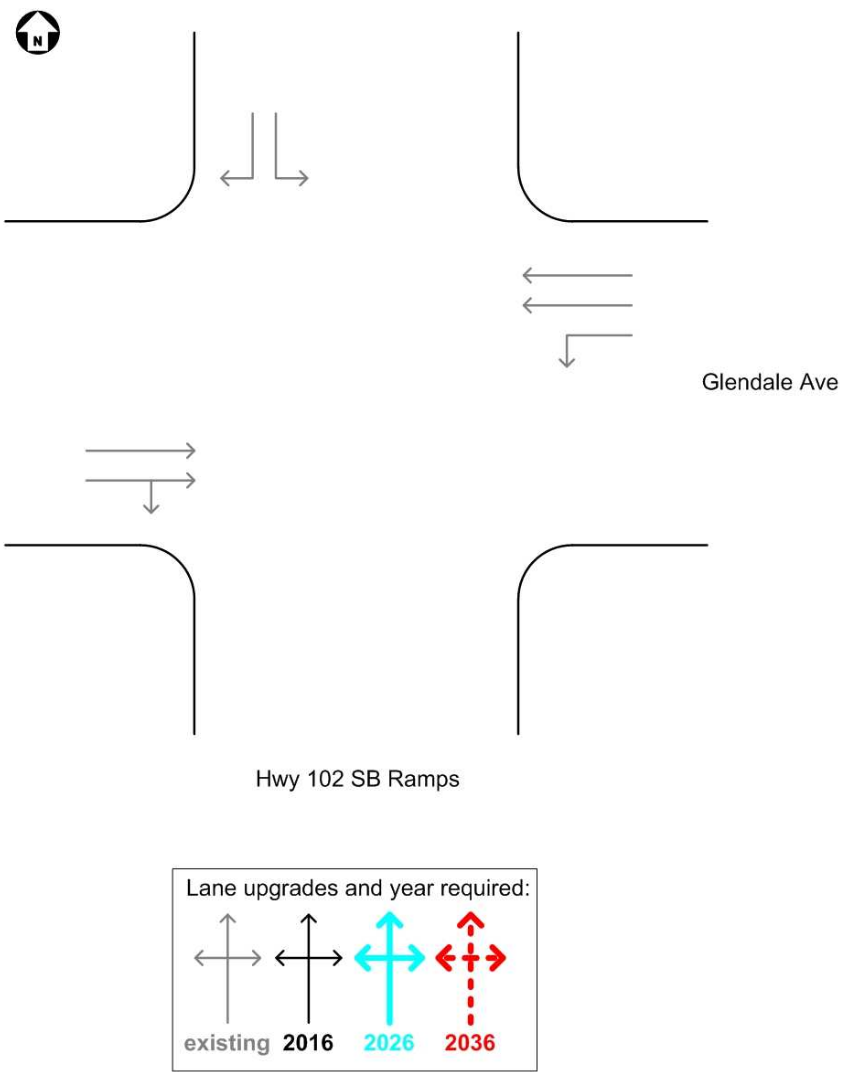

Hammonds Plains Rd / Brookshire Ct
Scenario B/C – HRM Study Volumes
N
Hammonds Plains Rd
C
C
Brookshire Ct /
Nine Mile Rd
Lane upgrades and year required:
existing
2016
2026
2036


Glendale Ave / 102 NB Ramps
Scenario A
Glendale Ave
Hwy 102 NB Ramps
Lane upgrades and year required:
existing
2016
2026
2036


Glendale Ave / 102 NB Ramps
Scenario B/C
Glendale Ave
Hwy 102 NB Ramps
Lane upgrades and year required:
existing
2016
2026
2036

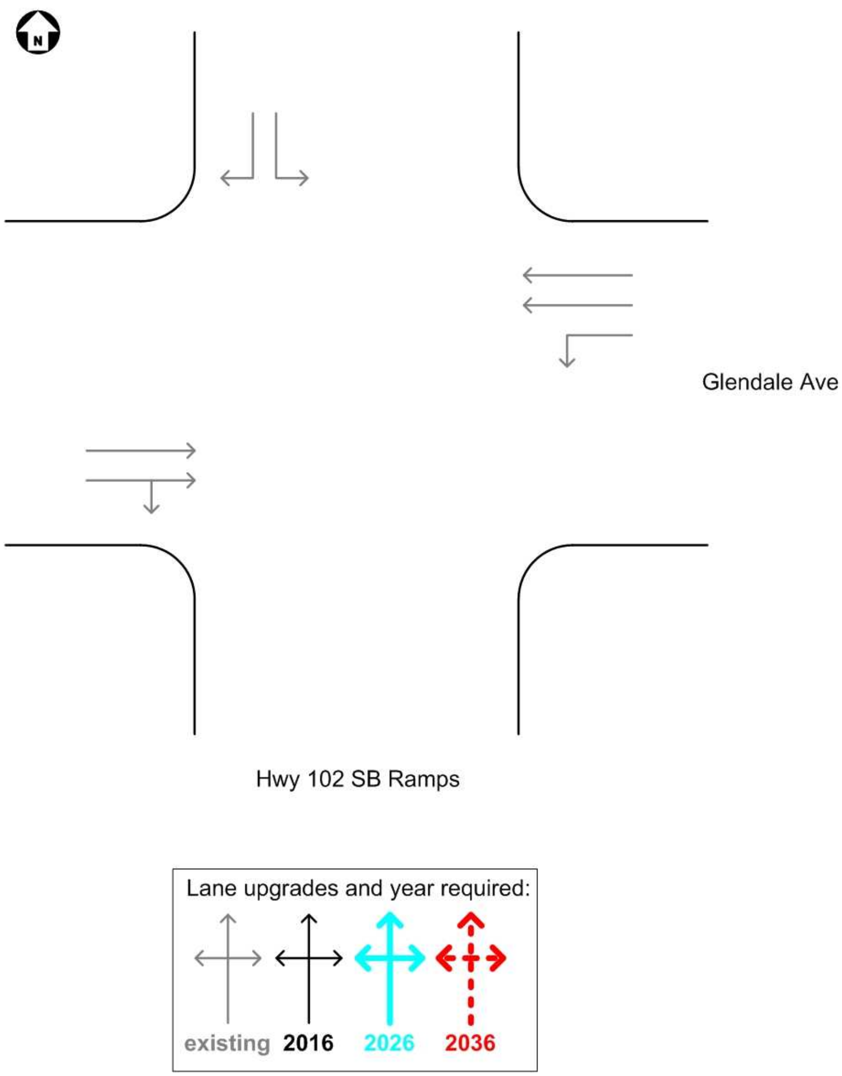
Glendale Ave / 102 SB Ramps

Scenario A



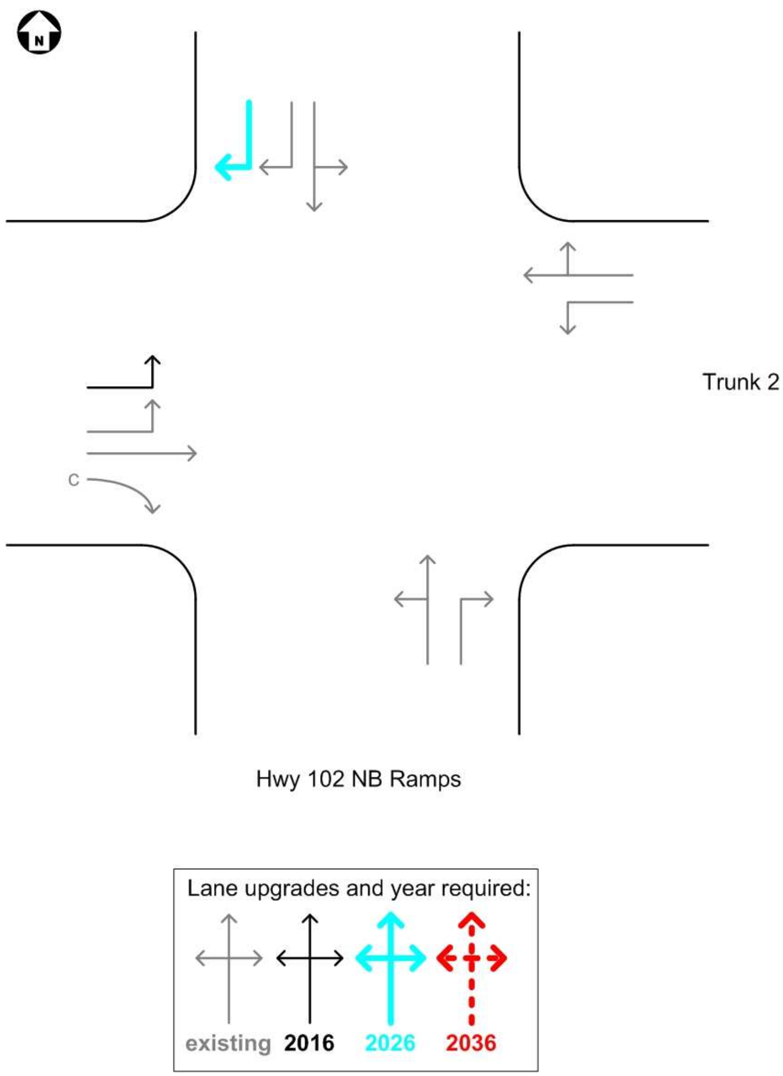
Glendale Ave / 102 SB Ramps

Scenario B/C



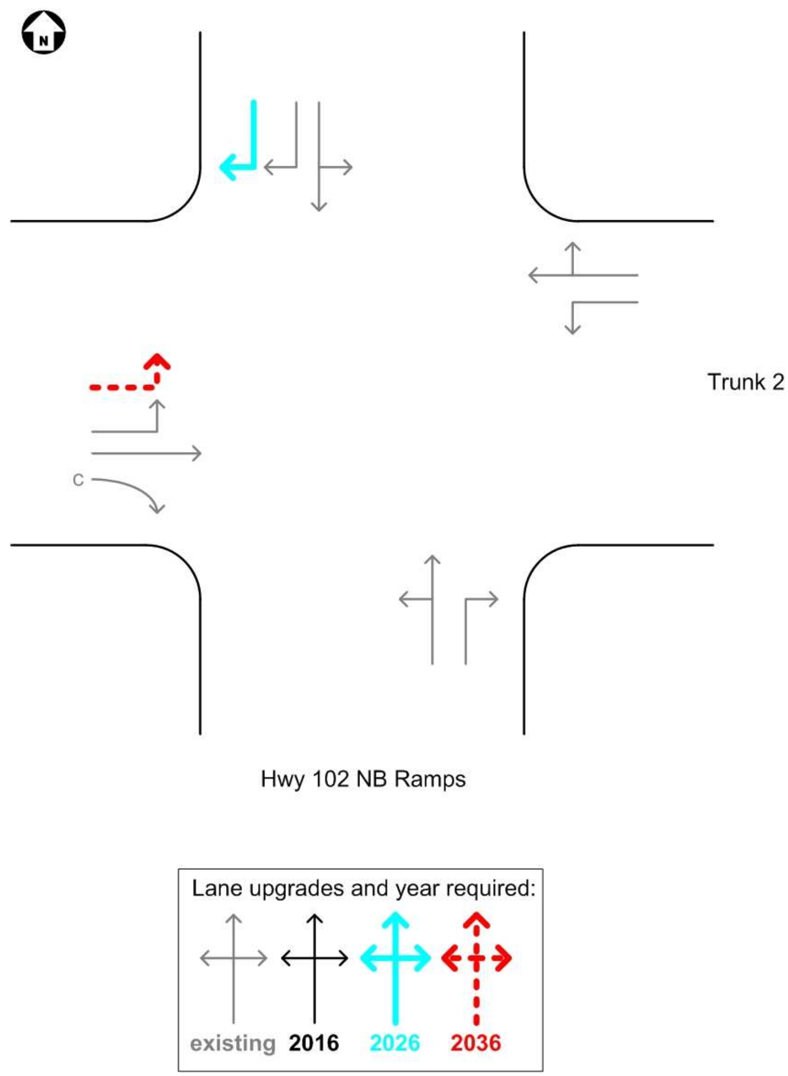
Trunk 2 / Hwy 102 NB Ramps

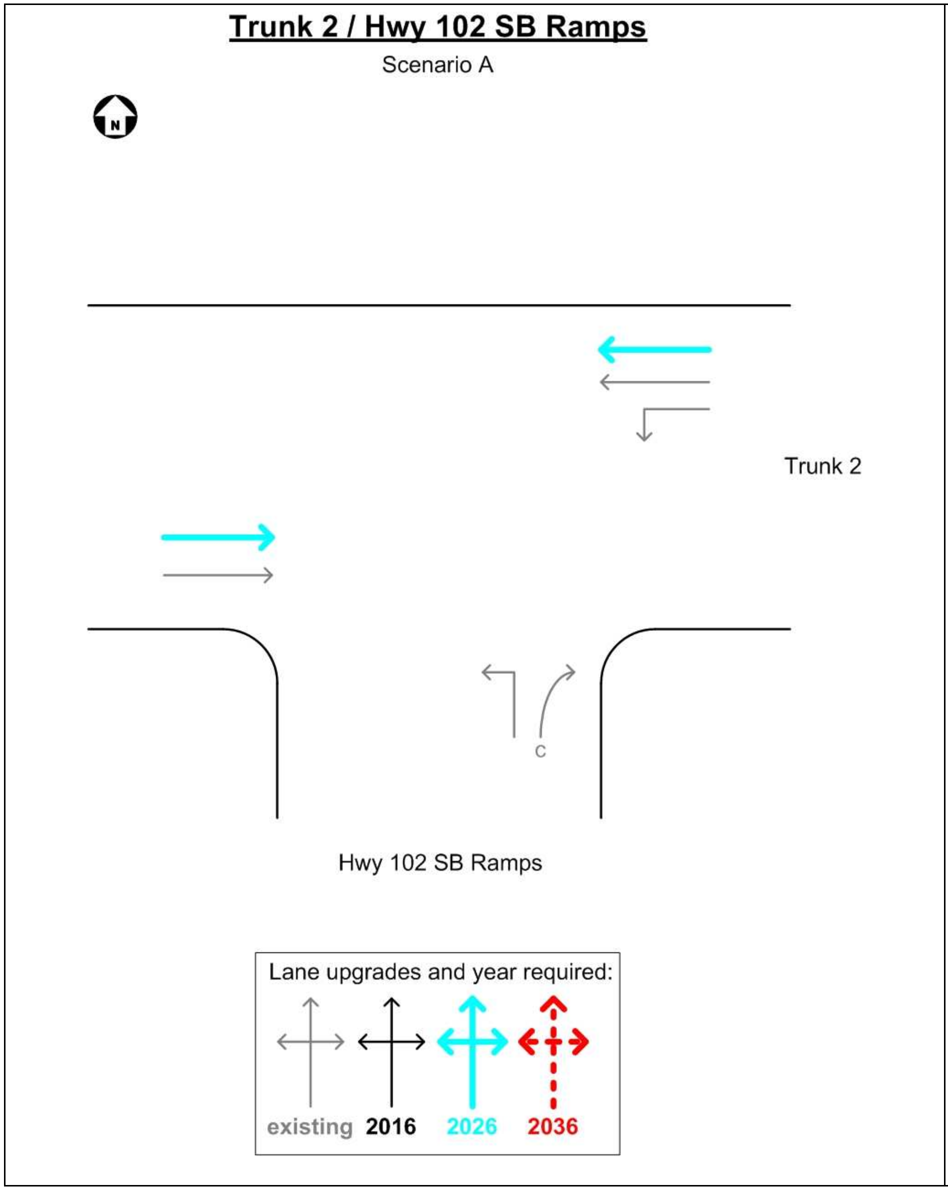
Scenario A

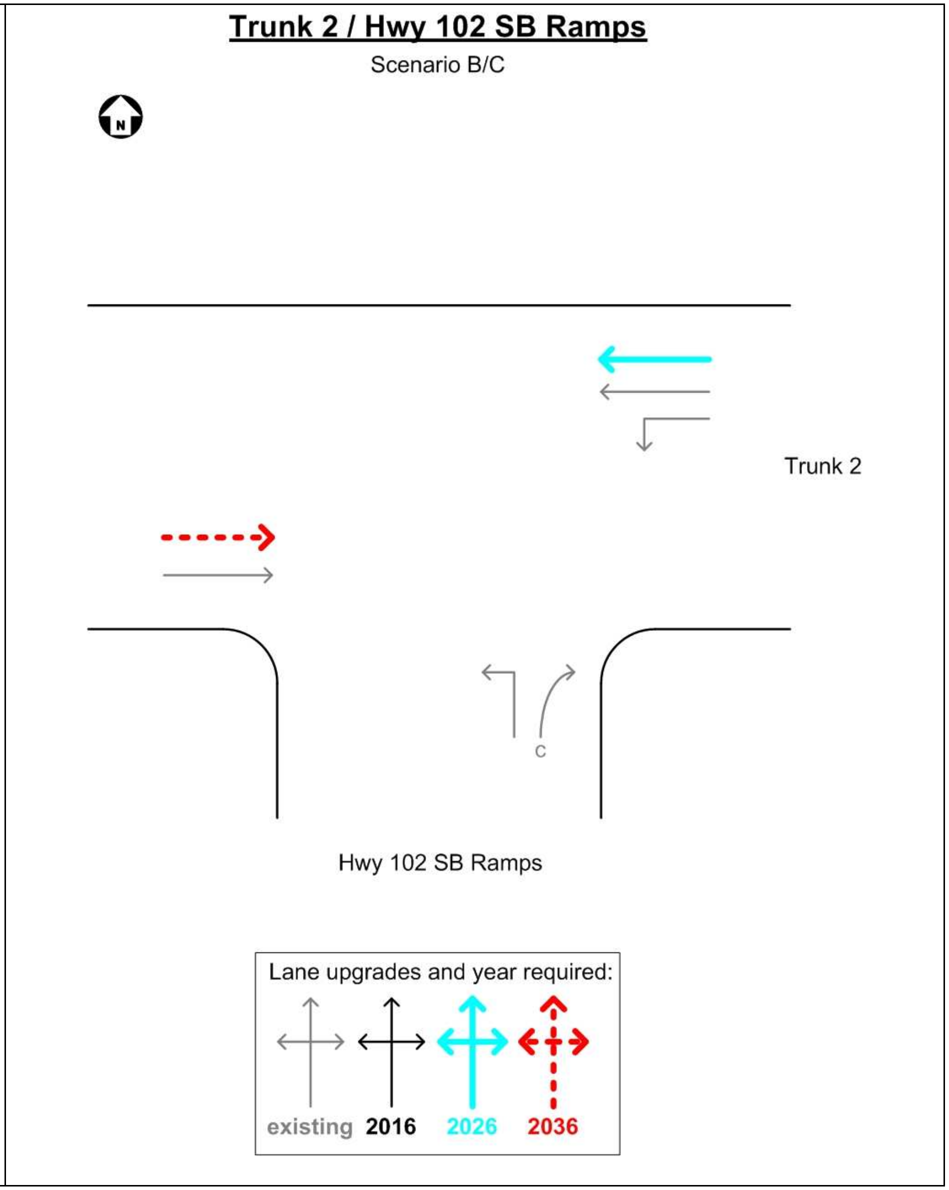


Trunk 2 / Hwy 102 NB Ramps

Scenario B/C




Trunk 2 / Hwy 102 SB Ramps
Scenario A
N
Trunk 2
C
Hwy 102 SB Ramps
Lane upgrades and year required:
existing
2016
2026
2036


Trunk 2 / Hwy 102 SB Ramps
Scenario B/C
N
Trunk 2
C
Hwy 102 SB Ramps
Lane upgrades and year required:
existing
2016
2026
2036

APPENDIX G
HOV Analysis Results

Project Name:	Hwy 102 Corridor - "add-a-lane" HOV Analysis
Facility:	Highway 102 (Hwy 101 to Joseph Howe)
Horizon/Peak:	2016 AM peak Hour (Scenario A)
Description:	Two lanes in peak direction, Add a HOV lane (2+1) Using the Incremental Mode-Choice Model Methodology

	2016 AM peak Hour (Scenario A) Conditions	**HOV Alternative**	**Change**
Vehicle Trips (vph)	3,700	3,489	-211
Person Trips (vph)	4,220	4,220	0
Vehicle-kms of Travel	61,050	57,569	-3482
Vehicle-hours of Travel	1,737	845	-892
Person-kms of Travel	69,630	69,630	0
Person-hours of Travel	1,981	965	-1016
Tavel Time:			
Regular lanes (min)	28.16	15.33	-12.83
HOV Lane(s) (min)	n/a	9.92	n/a
V/C Ratios:			
Regular lanes	1.16	0.93	-0.23
HOV Lane(s)	n/a	0.33	n/a
Avg Vehicle Occupancy	1.14	1.21	0.07

Project Name:	Hwy 102 Corridor - "add-a-lane" HOV lane Analysis
Facility:	Highway 102 (Hwy 101 to Joseph Howe)
Horizon/Peak:	2016 AM peak hour (Scenario A)
Description:	Three lanes in peak direction, add one HOV lane (3+1) Using the Incremental Mode-Choice Model Methodology

	2016 AM peak hour (Scenario A) Conditions	**HOV Alternative**	**Change**
Vehicle Trips (vph)	3,800	3,776	-24
Person Trips (vph)	4,330	4,330	0
Vehicle-kms of Travel	62,700	62,304	-396
Vehicle-hours of Travel	771	690	-81
Person-kms of Travel	71,445	71,445	0
Person-hours of Travel	879	782	-97
Travel Time:			
Regular lanes (min)	12.17	11.09	-1.08
HOV Lane(s) (min)	n/a	9.90	n/a
V/C Ratios:			
Regular lanes	0.79	0.70	-0.09
HOV Lane(s)	n/a	0.25	n/a
Avg Vehicle Occupancy	1.14	1.15	0.01

Project Name:	Hwy 102 Corridor - "take-a-lane" HOV lane Analysis
Facility:	Highway 102 (Hwy 101 to Joseph Howe)
Horizon/Peak:	2016 AM peak hour (Scenario A)
Description:	Three lanes in peak direction, change one to HOV lane (2+1) Using the Incremental Mode-Choice Model Methodology

	2016 AM peak hour (Scenario A) Conditions	HOV Alternative	Change
Vehicle Trips (vph)	3,800	3,776	-24
Person Trips (vph)	4,330	4,330	0
Vehicle-kms of Travel	62,700	62,304	-396
Vehicle-hours of Travel	771	1,246	475
Person-kms of Travel	71,445	71,445	0
Person-hours of Travel	879	1,338	459
Travel Time:			
Regular lanes (min)	12.17	20.97	8.79
HOV Lane(s) (min)	n/a	9.90	n/a
V/C Ratios:			
Regular lanes	0.79	1.06	0.26
HOV Lane(s)	n/a	0.25	n/a
Avg Vehicle Occupancy	1.14	1.15	0.01

Project Name:	Hwy 102 Corridor - "add-a-lane" HOV Analysis
Facility:	Highway 102 (Hwy 101 to Joseph Howe)
Horizon/Peak:	2016 PM peak Hour (Scenario A)
Description:	Two lanes in peak direction, Add a HOV lane (2+1) Using the Incremental Mode-Choice Model Methodology

	2016 PM peak Hour (Scenario A) Conditions	**HOV Alternative**	**Change**
Vehicle Trips (vph)	3,400	3,282	-118
Person Trips (vph)	3,880	3,880	0
Vehicle-kms of Travel	56,100	54,153	-1947
Vehicle-hours of Travel	1,211	752	-459
Person-kms of Travel	64,020	64,020	0
Person-hours of Travel	1,382	851	-531
Tavel Time:			
Regular lanes (min)	21.37	14.32	-7.05
HOV Lane(s) (min)	n/a	9.91	n/a
V/C Ratios:			
Regular lanes	1.06	0.89	-0.17
HOV Lane(s)	n/a	0.26	n/a
Avg Vehicle Occupancy	1.14	1.18	0.04

Project Name:	Hwy 102 Corridor - "add-a-lane" HOV lane Analysis
Facility:	Highway 102 (Hwy 101 to Joseph Howe)
Horizon/Peak:	2016 PM peak hour (Scenario A)
Description:	Three lanes in peak direction, add one HOV lane (3+1) Using the Incremental Mode-Choice Model Methodology

	2016 PM peak hour (Scenario A) Conditions	HOV Alternative	Change
Vehicle Trips (vph)	3,400	3,388	-12
Person Trips (vph)	3,880	3,880	0
Vehicle-kms of Travel	56,100	55,902	-198
Vehicle-hours of Travel	631	593	-38
Person-kms of Travel	64,020	64,020	0
Person-hours of Travel	720	674	-46
Travel Time:			
Regular lanes (min)	11.13	10.57	-0.57
HOV Lane(s) (min)	n/a	9.90	n/a
V/C Ratios:			
Regular lanes	0.71	0.63	-0.08
HOV Lane(s)	n/a	0.22	n/a
Avg Vehicle Occupancy	1.14	1.15	0.00

Project Name: Hwy 102 Corridor - "take-a-lane" HOV lane Analysis
Facility: Highway 102 (Hwy 101 to Joseph Howe)
Horizon/Peak: 2016 PM peak hour (Scenario A)
Description: Three lanes in peak direction, change one to HOV lane (2+1)
Using the Incremental Mode-Choice Model Methodology

	2016 PM peak hour (Scenario A) Conditions	HOV Alternative	Change
Vehicle Trips (vph)	3,400	3,388	-12
Person Trips (vph)	3,880	3,880	0
Vehicle-kms of Travel	56,100	55,902	-198
Vehicle-hours of Travel	631	873	242
Person-kms of Travel	64,020	64,020	0
Person-hours of Travel	720	954	234
Travel Time:			
Regular lanes (min)	11.13	16.10	4.96
HOV Lane(s) (min)	n/a	9.90	n/a
V/C Ratios:			
Regular lanes	0.71	0.95	0.24
HOV Lane(s)	n/a	0.22	n/a
Avg Vehicle Occupancy	1.14	1.15	0.00

Project Name:	Hwy 102 Corridor - "add-a-lane" HOV Analysis
Facility:	Highway 102 (Hwy 101 to Joseph Howe)
Horizon/Peak:	2026 AM peak Hour (Scenario A)
Description:	Two lanes in peak direction, Add a HOV lane (2+1) Using the Incremental Mode-Choice Model Methodology

	2026 AM peak Hour (Scenario A) Conditions	**HOV Alternative**	**Change**
Vehicle Trips (vph)	4,300	3,672	-628
Person Trips (vph)	4,900	4,900	0
Vehicle-kms of Travel	70,950	60,588	-10362
Vehicle-hours of Travel	3,700	791	-2909
Person-kms of Travel	80,850	80,850	0
Person-hours of Travel	4,217	1,000	-3217
Tavel Time:			
Regular lanes (min)	51.63	13.77	-37.86
HOV Lane(s) (min)	n/a	10.21	n/a
V/C Ratios:			
Regular lanes	1.34	0.87	-0.47
HOV Lane(s)	n/a	0.55	n/a
Avg Vehicle Occupancy	1.14	1.33	0.19

Project Name:	Hwy 102 Corridor - "add-a-lane" HOV lane Analysis
Facility:	Highway 102 (Hwy 101 to Joseph Howe)
Horizon/Peak:	2026 AM peak hour (Scenario A)
Description:	Three lanes in peak direction, add one HOV lane (3+1) Using the Incremental Mode-Choice Model Methodology

	2026 AM peak hour (Scenario A) Conditions	**HOV Alternative**	**Change**
Vehicle Trips (vph)	4,300	4,246	-54
Person Trips (vph)	4,900	4,901	1
Vehicle-kms of Travel	70,950	70,059	-891
Vehicle-hours of Travel	1,031	839	-192
Person-kms of Travel	80,850	80,867	16.5
Person-hours of Travel	1,175	947	-228
Travel Time:			
Regular lanes (min)	14.39	12.10	-2.29
HOV Lane(s) (min)	n/a	9.91	n/a
V/C Ratios:			
Regular lanes	0.90	0.79	-0.11
HOV Lane(s)	n/a	0.29	n/a
Avg Vehicle Occupancy	1.14	1.15	0.01

Project Name:	Hwy 102 Corridor - "take-a-lane" HOV lane Analysis
Facility:	Highway 102 (Hwy 101 to Joseph Howe)
Horizon/Peak:	2026 AM peak hour (Scenario A)
Description:	Three lanes in peak direction, change one to HOV lane (2+1) Using the Incremental Mode-Choice Model Methodology

	2026 AM peak hour (Scenario A) Conditions	HOV Alternative	Change
Vehicle Trips (vph)	4,300	4,246	-54
Person Trips (vph)	4,900	4,901	1
Vehicle-kms of Travel	70,950	70,059	-891
Vehicle-hours of Travel	1,031	1,986	955
Person-kms of Travel	80,850	80,867	16.5
Person-hours of Travel	1,175	2,094	919
Travel Time:			
Regular lanes (min)	14.39	30.32	15.93
HOV Lane(s) (min)	n/a	9.91	n/a
V/C Ratios:			
Regular lanes	0.90	1.18	0.28
HOV Lane(s)	n/a	0.29	n/a
Avg Vehicle Occupancy	1.14	1.15	0.01

Project Name:	Hwy 102 Corridor - "add-a-lane" HOV Analysis
Facility:	Highway 102 (Hwy 101 to Joseph Howe)
Horizon/Peak:	2026 PM peak Hour (Scenario A)
Description:	Two lanes in peak direction, Add a HOV lane (2+1) Using the Incremental Mode-Choice Model Methodology

	2026 PM peak Hour (Scenario A) Conditions	HOV Alternative	Change
Vehicle Trips (vph)	4,000	3,631	-369
Person Trips (vph)	4,560	4,560	0
Vehicle-kms of Travel	66,000	59,912	-6089
Vehicle-hours of Travel	2,529	867	-1662
Person-kms of Travel	75,240	75,240	0
Person-hours of Travel	2,883	1,022	-1861
Tavel Time:			
Regular lanes (min)	37.94	15.31	-22.62
HOV Lane(s) (min)	n/a	9.97	n/a
V/C Ratios:			
Regular lanes	1.25	0.93	-0.32
HOV Lane(s)	n/a	0.42	n/a
Avg Vehicle Occupancy	1.14	1.26	0.12

Project Name:	Hwy 102 Corridor - "add-a-lane" HOV lane Analysis
Facility:	Highway 102 (Hwy 101 to Joseph Howe)
Horizon/Peak:	2026 PM peak hour (Scenario A)
Description:	Three lanes in peak direction, add one HOV lane (3+1) Using the Incremental Mode-Choice Model Methodology

	2026 PM peak hour (Scenario A) Conditions	HOV Alternative	Change
Vehicle Trips (vph)	4,000	3,967	-33
Person Trips (vph)	4,560	4,560	0
Vehicle-kms of Travel	66,000	65,456	-545
Vehicle-hours of Travel	861	746	-115
Person-kms of Travel	75,240	75,240	0
Person-hours of Travel	982	844	-138
Travel Time:			
Regular lanes (min)	12.91	11.44	-1.47
HOV Lane(s) (min)	n/a	9.91	n/a
V/C Ratios:			
Regular lanes	0.83	0.74	-0.10
HOV Lane(s)	n/a	0.27	n/a
Avg Vehicle Occupancy	1.14	1.15	0.01

Project Name: Hwy 102 Corridor - "take-a-lane" HOV lane Analysis
Facility: Highway 102 (Hwy 101 to Joseph Howe)
Horizon/Peak: 2026 PM peak hour (Scenario A)
Description: Three lanes in peak direction, change one to HOV lane (2+1)
Using the Incremental Mode-Choice Model Methodology

	2026 PM peak hour (Scenario A) Conditions	**HOV Alternative**	**Change**
Vehicle Trips (vph)	4,000	3,967	-33
Person Trips (vph)	4,560	4,560	0
Vehicle-kms of Travel	66,000	65,456	-545
Vehicle-hours of Travel	861	1,503	642
Person-kms of Travel	75,240	75,240	0
Person-hours of Travel	982	1,600	618
Travel Time:			
Regular lanes (min)	12.91	24.26	11.35
HOV Lane(s) (min)	n/a	9.91	n/a
V/C Ratios:			
Regular lanes	0.83	1.11	0.27
HOV Lane(s)	n/a	0.27	n/a
Avg Vehicle Occupancy	1.14	1.15	0.01

Project Name:	Hwy 102 Corridor - "add-a-lane" HOV Analysis
Facility:	Highway 102 (Hwy 101 to Joseph Howe)
Horizon/Peak:	2036 AM peak Hour (Scenario A)
Description:	Two lanes in peak direction, Add a HOV lane (2+1) Using the Incremental Mode-Choice Model Methodology

	2036 AM peak Hour (Scenario A) Conditions	**HOV Alternative**	**Change**
Vehicle Trips (vph)	4,700	3,501	-1199
Person Trips (vph)	5,360	5,361	1
Vehicle-kms of Travel	77,550	57,767	-19784
Vehicle-hours of Travel	6,107	678	-5429
Person-kms of Travel	88,440	88,457	16.5
Person-hours of Travel	6,965	1,075	-5890
Tavel Time:			
Regular lanes (min)	77.97	10.88	-67.08
HOV Lane(s) (min)	n/a	12.82	n/a
V/C Ratios:			
Regular lanes	1.47	0.68	-0.79
HOV Lane(s)	n/a	0.83	n/a
Avg Vehicle Occupancy	1.14	1.53	0.39

Project Name:	Hwy 102 Corridor - "add-a-lane" HOV lane Analysis
Facility:	Highway 102 (Hwy 101 to Joseph Howe)
Horizon/Peak:	2036 AM peak hour (Scenario A)
Description:	Three lanes in peak direction, add one HOV lane (3+1) Using the Incremental Mode-Choice Model Methodology

	2036 AM peak hour (Scenario A) Conditions	**HOV Alternative**	**Change**
Vehicle Trips (vph)	4,700	4,600	-100
Person Trips (vph)	5,360	5,360	0
Vehicle-kms of Travel	77,550	75,900	-1650
Vehicle-hours of Travel	1,349	980	-369
Person-kms of Travel	88,440	88,440	0
Person-hours of Travel	1,538	1,106	-432
Travel Time:			
Regular lanes (min)	17.22	13.16	-4.06
HOV Lane(s) (min)	n/a	9.92	n/a
V/C Ratios:			
Regular lanes	0.98	0.85	-0.13
HOV Lane(s)	n/a	0.34	n/a
Avg Vehicle Occupancy	1.14	1.17	0.02

Project Name:	Hwy 102 Corridor - "take-a-lane" HOV lane Analysis
Facility:	Highway 102 (Hwy 101 to Joseph Howe)
Horizon/Peak:	2036 AM peak hour (Scenario A)
Description:	Three lanes in peak direction, change one to HOV lane (2+1) Using the Incremental Mode-Choice Model Methodology

	2036 AM peak hour (Scenario A) Conditions	HOV Alternative	Change
Vehicle Trips (vph)	4,700	4,600	-100
Person Trips (vph)	5,360	5,360	0
Vehicle-kms of Travel	77,550	75,900	-1650
Vehicle-hours of Travel	1,349	2,812	1463
Person-kms of Travel	88,440	88,440	0
Person-hours of Travel	1,538	2,937	1399
Travel Time:			
Regular lanes (min)	17.22	40.25	23.03
HOV Lane(s) (min)	n/a	9.92	n/a
V/C Ratios:			
Regular lanes	0.98	1.27	0.29
HOV Lane(s)	n/a	0.34	n/a
Avg Vehicle Occupancy	1.14	1.17	0.02

Project Name: Hwy 102 Corridor - "add-a-lane" HOV Analysis
Facility: Highway 102 (Hwy 101 to Joseph Howe)
Horizon/Peak: 2036 PM peak Hour (Scenario A)
Description: Two lanes in peak direction, Add a HOV lane (2+1)
Using the Incremental Mode-Choice Model Methodology

	2036 PM peak Hour (Scenario A) Conditions	**HOV Alternative**	**Change**
Vehicle Trips (vph)	4,300	3,672	-628
Person Trips (vph)	4,900	4,900	0
Vehicle-kms of Travel	70,950	60,588	-10362
Vehicle-hours of Travel	3,700	791	-2909
Person-kms of Travel	80,850	80,850	0
Person-hours of Travel	4,217	1,000	-3217
Tavel Time:			
Regular lanes (min)	51.63	13.77	-37.86
HOV Lane(s) (min)	n/a	10.21	n/a
V/C Ratios:			
Regular lanes	1.34	0.87	-0.47
HOV Lane(s)	n/a	0.55	n/a
Avg Vehicle Occupancy	1.14	1.33	0.19

Project Name:	Hwy 102 Corridor - "add-a-lane" HOV lane Analysis
Facility:	Highway 102 (Hwy 101 to Joseph Howe)
Horizon/Peak:	2036 PM peak hour (Scenario A)
Description:	Three lanes in peak direction, add one HOV lane (3+1) Using the Incremental Mode-Choice Model Methodology

	2036 PM peak hour (Scenario A) Conditions	HOV Alternative	Change
Vehicle Trips (vph)	4,300	4,246	-54
Person Trips (vph)	4,900	4,901	1
Vehicle-kms of Travel	70,950	70,059	-891
Vehicle-hours of Travel	1,031	839	-192
Person-kms of Travel	80,850	80,867	16.5
Person-hours of Travel	1,175	947	-228
Travel Time:			
Regular lanes (min)	14.39	12.10	-2.29
HOV Lane(s) (min)	n/a	9.91	n/a
V/C Ratios:			
Regular lanes	0.90	0.79	-0.11
HOV Lane(s)	n/a	0.29	n/a
Avg Vehicle Occupancy	1.14	1.15	0.01

Project Name:	Hwy 102 Corridor - "take-a-lane" HOV lane Analysis
Facility:	Highway 102 (Hwy 101 to Joseph Howe)
Horizon/Peak:	2036 PM peak hour (Scenario A)
Description:	Three lanes in peak direction, change one to HOV lane (2+1) Using the Incremental Mode-Choice Model Methodology

	2036 PM peak hour (Scenario A) Conditions	**HOV Alternative**	**Change**
Vehicle Trips (vph)	4,300	4,246	-54
Person Trips (vph)	4,900	4,901	1
Vehicle-kms of Travel	70,950	70,059	-891
Vehicle-hours of Travel	1,031	1,986	955
Person-kms of Travel	80,850	80,867	16.5
Person-hours of Travel	1,175	2,094	919
Travel Time:			
Regular lanes (min)	14.39	30.32	15.93
HOV Lane(s) (min)	n/a	9.91	n/a
V/C Ratios:			
Regular lanes	0.90	1.18	0.28
HOV Lane(s)	n/a	0.29	n/a
Avg Vehicle Occupancy	1.14	1.15	0.01

Project Name:	Hwy 102 Corridor - "add-a-lane" HOV Analysis
Facility:	Highway 102 (Hwy 101 to Joseph Howe)
Horizon/Peak:	2016 AM peak Hour (Scenario B/C)
Description:	Two lanes in peak direction, Add a HOV lane (2+1) Using the Incremental Mode-Choice Model Methodology

	2016 AM peak Hour (Scenario B/C) Conditions	**HOV Alternative**	**Change**
Vehicle Trips (vph)	3,400	3,282	-118
Person Trips (vph)	3,880	3,880	0
Vehicle-kms of Travel	56,100	54,153	-1947
Vehicle-hours of Travel	1,211	752	-459
Person-kms of Travel	64,020	64,020	0
Person-hours of Travel	1,382	851	-531
Tavel Time:			
Regular lanes (min)	21.37	14.32	-7.05
HOV Lane(s) (min)	n/a	9.91	n/a
V/C Ratios:			
Regular lanes	1.06	0.89	-0.17
HOV Lane(s)	n/a	0.26	n/a
Avg Vehicle Occupancy	1.14	1.18	0.04

Project Name:	Hwy 102 Corridor - "add-a-lane" HOV lane Analysis
Facility:	Highway 102 (Hwy 101 to Joseph Howe)
Horizon/Peak:	2016 AM peak hour (Scenario B/C)
Description:	Three lanes in peak direction, add one HOV lane (3+1) Using the Incremental Mode-Choice Model Methodology

	2016 AM peak hour (Scenario B/C) Conditions	**HOV Alternative**	**Change**
Vehicle Trips (vph)	3,400	3,388	-12
Person Trips (vph)	3,880	3,880	0
Vehicle-kms of Travel	56,100	55,902	-198
Vehicle-hours of Travel	631	593	-38
Person-kms of Travel	64,020	64,020	0
Person-hours of Travel	720	674	-46
Travel Time:			
Regular lanes (min)	11.13	10.57	-0.57
HOV Lane(s) (min)	n/a	9.90	n/a
V/C Ratios:			
Regular lanes	0.71	0.63	-0.08
HOV Lane(s)	n/a	0.22	n/a
Avg Vehicle Occupancy	1.14	1.15	0.00

Project Name:	Hwy 102 Corridor - "take-a-lane" HOV lane Analysis
Facility:	Highway 102 (Hwy 101 to Joseph Howe)
Horizon/Peak:	2016 AM peak hour (Scenarios B/C)
Description:	Three lanes in peak direction, change one to HOV lane (2+1) Using the Incremental Mode-Choice Model Methodology

	2016 AM peak hour (Scenarios B/C) Conditions	**HOV Alternative**	**Change**
Vehicle Trips (vph)	3,400	3,388	-12
Person Trips (vph)	3,880	3,880	0
Vehicle-kms of Travel	56,100	55,902	-198
Vehicle-hours of Travel	631	873	242
Person-kms of Travel	64,020	64,020	0
Person-hours of Travel	720	954	234
Travel Time:			
Regular lanes (min)	11.13	16.10	4.96
HOV Lane(s) (min)	n/a	9.90	n/a
V/C Ratios:			
Regular lanes	0.71	0.95	0.24
HOV Lane(s)	n/a	0.22	n/a
Avg Vehicle Occupancy	1.14	1.15	0.00

Project Name:	Hwy 102 Corridor - "add-a-lane" HOV Analysis
Facility:	Highway 102 (Hwy 101 to Joseph Howe)
Horizon/Peak:	2016 PM peak Hour (Scenario B/C)
Description:	Two lanes in peak direction, Add a HOV lane (2+1) Using the Incremental Mode-Choice Model Methodology

	2016 PM peak Hour (Scenario B/C) Conditions	**HOV Alternative**	**Change**
Vehicle Trips (vph)	3,100	3,038	-62
Person Trips (vph)	3,530	3,530	0
Vehicle-kms of Travel	51,150	50,127	-1023
Vehicle-hours of Travel	868	641	-227
Person-kms of Travel	58,245	58,245	0
Person-hours of Travel	988	722	-266
Tavel Time:			
Regular lanes (min)	16.80	13.02	-3.78
HOV Lane(s) (min)	n/a	9.90	n/a
V/C Ratios:			
Regular lanes	0.97	0.84	-0.13
HOV Lane(s)	n/a	0.22	n/a
Avg Vehicle Occupancy	1.14	1.16	0.02

Project Name:	Hwy 102 Corridor - "add-a-lane" HOV lane Analysis
Facility:	Highway 102 (Hwy 101 to Joseph Howe)
Horizon/Peak:	2016 PM peak hour (Scenario B/C)
Description:	Three lanes in peak direction, add one HOV lane (3+1) Using the Incremental Mode-Choice Model Methodology

	2016 PM peak hour (Scenario B/C) Conditions	HOV Alternative	Change
Vehicle Trips (vph)	3,100	3,094	-6
Person Trips (vph)	3,530	3,530	0
Vehicle-kms of Travel	51,150	51,051	-99
Vehicle-hours of Travel	550	529	-21
Person-kms of Travel	58,245	58,245	0
Person-hours of Travel	626	601	-25
Travel Time:			
Regular lanes (min)	10.64	10.31	-0.34
HOV Lane(s) (min)	n/a	9.90	n/a
V/C Ratios:			
Regular lanes	0.65	0.58	-0.07
HOV Lane(s)	n/a	0.20	n/a
Avg Vehicle Occupancy	1.14	1.14	0.00

Project Name:	Hwy 102 Corridor - "take-a-lane" HOV lane Analysis
Facility:	Highway 102 (Hwy 101 to Joseph Howe)
Horizon/Peak:	2016 PM peak hour (Scenarios B/C)
Description:	Three lanes in peak direction, change one to HOV lane (2+1) Using the Incremental Mode-Choice Model Methodology

	2016 PM peak hour (Scenarios B/C) Conditions	**HOV Alternative**	**Change**
Vehicle Trips (vph)	3,100	3,094	-6
Person Trips (vph)	3,530	3,530	0
Vehicle-kms of Travel	51,150	51,051	-99
Vehicle-hours of Travel	550	686	136
Person-kms of Travel	58,245	58,245	0
Person-hours of Travel	626	758	132
Travel Time:			
Regular lanes (min)	10.64	13.68	3.04
HOV Lane(s) (min)	n/a	9.90	n/a
V/C Ratios:			
Regular lanes	0.65	0.87	0.22
HOV Lane(s)	n/a	0.20	n/a
Avg Vehicle Occupancy	1.14	1.14	0.00

Project Name:	Hwy 102 Corridor - "add-a-lane" HOV Analysis
Facility:	Highway 102 (Hwy 101 to Joseph Howe)
Horizon/Peak:	2026 AM peak Hour (Scenario B/C)
Description:	Two lanes in peak direction, Add a HOV lane (2+1) Using the Incremental Mode-Choice Model Methodology

	2026 AM peak Hour (Scenario B/C) Conditions	HOV Alternative	Change
Vehicle Trips (vph)	4,000	3,631	-369
Person Trips (vph)	4,560	4,560	0
Vehicle-kms of Travel	66,000	59,912	-6089
Vehicle-hours of Travel	2,529	867	-1662
Person-kms of Travel	75,240	75,240	0
Person-hours of Travel	2,883	1,022	-1861
Tavel Time:			
Regular lanes (min)	37.94	15.31	-22.62
HOV Lane(s) (min)	n/a	9.97	n/a
V/C Ratios:			
Regular lanes	1.25	0.93	-0.32
HOV Lane(s)	n/a	0.42	n/a
Avg Vehicle Occupancy	1.14	1.26	0.12

Project Name:	Hwy 102 Corridor - "add-a-lane" HOV lane Analysis
Facility:	Highway 102 (Hwy 101 to Joseph Howe)
Horizon/Peak:	2026 AM peak hour (Scenario B/C)
Description:	Three lanes in peak direction, add one HOV lane (3+1) Using the Incremental Mode-Choice Model Methodology

	2026 AM peak hour (Scenario B/C) Conditions	**HOV Alternative**	**Change**
Vehicle Trips (vph)	4,000	3,967	-33
Person Trips (vph)	4,560	4,560	0
Vehicle-kms of Travel	66,000	65,456	-545
Vehicle-hours of Travel	861	746	-115
Person-kms of Travel	75,240	75,240	0
Person-hours of Travel	982	844	-138
Travel Time:			
Regular lanes (min)	12.91	11.44	-1.47
HOV Lane(s) (min)	n/a	9.91	n/a
V/C Ratios:			
Regular lanes	0.83	0.74	-0.10
HOV Lane(s)	n/a	0.27	n/a
Avg Vehicle Occupancy	1.14	1.15	0.01

Project Name:	Hwy 102 Corridor - "take-a-lane" HOV lane Analysis
Facility:	Highway 102 (Hwy 101 to Joseph Howe)
Horizon/Peak:	2026 AM peak hour (Scenarios B/C)
Description:	Three lanes in peak direction, change one to HOV lane (2+1) Using the Incremental Mode-Choice Model Methodology

	2026 AM peak hour (Scenarios B/C) Conditions	HOV Alternative	Change
Vehicle Trips (vph)	4,000	3,967	-33
Person Trips (vph)	4,560	4,560	0
Vehicle-kms of Travel	66,000	65,456	-545
Vehicle-hours of Travel	861	1,503	642
Person-kms of Travel	75,240	75,240	0
Person-hours of Travel	982	1,600	618
Travel Time:			
Regular lanes (min)	12.91	24.26	11.35
HOV Lane(s) (min)	n/a	9.91	n/a
V/C Ratios:			
Regular lanes	0.83	1.11	0.27
HOV Lane(s)	n/a	0.27	n/a
Avg Vehicle Occupancy	1.14	1.15	0.01

Project Name:	Hwy 102 Corridor - "add-a-lane" HOV Analysis
Facility:	Highway 102 (Hwy 101 to Joseph Howe)
Horizon/Peak:	2026 PM peak Hour (Scenario B/C)
Description:	Two lanes in peak direction, Add a HOV lane (2+1) Using the Incremental Mode-Choice Model Methodology

	2026 PM peak Hour (Scenario B/C) Conditions	**HOV Alternative**	**Change**
Vehicle Trips (vph)	3,700	3,489	-211
Person Trips (vph)	4,220	4,220	0
Vehicle-kms of Travel	61,050	57,569	-3482
Vehicle-hours of Travel	1,737	845	-892
Person-kms of Travel	69,630	69,630	0
Person-hours of Travel	1,981	965	-1016
Tavel Time:			
Regular lanes (min)	28.16	15.33	-12.83
HOV Lane(s) (min)	n/a	9.92	n/a
V/C Ratios:			
Regular lanes	1.16	0.93	-0.23
HOV Lane(s)	n/a	0.33	n/a
Avg Vehicle Occupancy	1.14	1.21	0.07

Project Name:	Hwy 102 Corridor - "add-a-lane" HOV lane Analysis
Facility:	Highway 102 (Hwy 101 to Joseph Howe)
Horizon/Peak:	2026 PM peak hour (Scenario B/C)
Description:	Three lanes in peak direction, add one HOV lane (3+1) Using the Incremental Mode-Choice Model Methodology

	2026 PM peak hour (Scenario B/C) Conditions	**HOV Alternative**	**Change**
Vehicle Trips (vph)	3,700	3,680	-20
Person Trips (vph)	4,220	4,220	0
Vehicle-kms of Travel	61,050	60,720	-330
Vehicle-hours of Travel	732	664	-68
Person-kms of Travel	69,630	69,630	0
Person-hours of Travel	834	753	-81
Travel Time:			
Regular lanes (min)	11.86	10.94	-0.93
HOV Lane(s) (min)	n/a	9.90	n/a
V/C Ratios:			
Regular lanes	0.77	0.69	-0.08
HOV Lane(s)	n/a	0.24	n/a
Avg Vehicle Occupancy	1.14	1.15	0.01

Project Name:	Hwy 102 Corridor - "take-a-lane" HOV lane Analysis
Facility:	Highway 102 (Hwy 101 to Joseph Howe)
Horizon/Peak:	2026 PM peak hour (Scenarios B/C)
Description:	Three lanes in peak direction, change one to HOV lane (2+1) Using the Incremental Mode-Choice Model Methodology

	2026 PM peak hour (Scenarios B/C) Conditions	**HOV Alternative**	**Change**
Vehicle Trips (vph)	3,700	3,680	-20
Person Trips (vph)	4,220	4,220	0
Vehicle-kms of Travel	61,050	60,720	-330
Vehicle-hours of Travel	732	1,137	405
Person-kms of Travel	69,630	69,630	0
Person-hours of Travel	834	1,226	392
Travel Time:			
Regular lanes (min)	11.86	19.55	7.69
HOV Lane(s) (min)	n/a	9.90	n/a
V/C Ratios:			
Regular lanes	0.77	1.03	0.26
HOV Lane(s)	n/a	0.24	n/a
Avg Vehicle Occupancy	1.14	1.15	0.01

Project Name: Hwy 102 Corridor - "add-a-lane" HOV Analysis
Facility: Highway 102 (Hwy 101 to Joseph Howe)
Horizon/Peak: 2036 AM peak Hour (Scenario B/C)
Description: Two lanes in peak direction, Add a HOV lane (2+1)
Using the Incremental Mode-Choice Model Methodology

	2036 AM peak Hour (Scenario B/C) Conditions	HOV Alternative	Change
Vehicle Trips (vph)	4,300	3,672	-628
Person Trips (vph)	4,900	4,900	0
Vehicle-kms of Travel	70,950	60,588	-10362
Vehicle-hours of Travel	3,700	791	-2909
Person-kms of Travel	80,850	80,850	0
Person-hours of Travel	4,217	1,000	-3217
Tavel Time:			
Regular lanes (min)	51.63	13.77	-37.86
HOV Lane(s) (min)	n/a	10.21	n/a
V/C Ratios:			
Regular lanes	1.34	0.87	-0.47
HOV Lane(s)	n/a	0.55	n/a
Avg Vehicle Occupancy	1.14	1.33	0.19

Project Name:	Hwy 102 Corridor - "add-a-lane" HOV lane Analysis
Facility:	Highway 102 (Hwy 101 to Joseph Howe)
Horizon/Peak:	2036 AM peak hour (Scenario B/C)
Description:	Three lanes in peak direction, add one HOV lane (3+1) Using the Incremental Mode-Choice Model Methodology

	2036 AM peak hour (Scenario B/C) Conditions	**HOV Alternative**	**Change**
Vehicle Trips (vph)	4,300	4,246	-54
Person Trips (vph)	4,900	4,901	1
Vehicle-kms of Travel	70,950	70,059	-891
Vehicle-hours of Travel	1,031	839	-192
Person-kms of Travel	80,850	80,867	16.5
Person-hours of Travel	1,175	947	-228
Travel Time:			
Regular lanes (min)	14.39	12.10	-2.29
HOV Lane(s) (min)	n/a	9.91	n/a
V/C Ratios:			
Regular lanes	0.90	0.79	-0.11
HOV Lane(s)	n/a	0.29	n/a
Avg Vehicle Occupancy	1.14	1.15	0.01

Project Name:	Hwy 102 Corridor - "take-a-lane" HOV lane Analysis
Facility:	Highway 102 (Hwy 101 to Joseph Howe)
Horizon/Peak:	2036 AM peak hour (Scenarios B/C)
Description:	Three lanes in peak direction, change one to HOV lane (2+1) Using the Incremental Mode-Choice Model Methodology

	2036 AM peak hour (Scenarios B/C) Conditions	HOV Alternative	Change
Vehicle Trips (vph)	4,300	4,244	-56
Person Trips (vph)	4,920	4,920	0
Vehicle-kms of Travel	70,950	70,026	-924
Vehicle-hours of Travel	1,031	1,959	928
Person-kms of Travel	81,180	81,180	0
Person-hours of Travel	1,180	2,071	891
Travel Time:			
Regular lanes (min)	14.39	29.97	15.58
HOV Lane(s) (min)	n/a	9.91	n/a
V/C Ratios:			
Regular lanes	0.90	1.18	0.28
HOV Lane(s)	n/a	0.30	n/a
Avg Vehicle Occupancy	1.14	1.16	0.02

Project Name:	Hwy 102 Corridor - "add-a-lane" HOV Analysis
Facility:	Highway 102 (Hwy 101 to Joseph Howe)
Horizon/Peak:	2036 PM peak Hour (Scenario B/C)
Description:	Two lanes in peak direction, Add a HOV lane (2+1) Using the Incremental Mode-Choice Model Methodology

	2036 PM peak Hour (Scenario B/C) Conditions	**HOV Alternative**	**Change**
Vehicle Trips (vph)	4,000	3,631	-369
Person Trips (vph)	4,560	4,560	0
Vehicle-kms of Travel	66,000	59,912	-6089
Vehicle-hours of Travel	2,529	867	-1662
Person-kms of Travel	75,240	75,240	0
Person-hours of Travel	2,883	1,022	-1861
Tavel Time:			
Regular lanes (min)	37.94	15.31	-22.62
HOV Lane(s) (min)	n/a	9.97	n/a
V/C Ratios:			
Regular lanes	1.25	0.93	-0.32
HOV Lane(s)	n/a	0.42	n/a
Avg Vehicle Occupancy	1.14	1.26	0.12

Project Name:	Hwy 102 Corridor - "add-a-lane" HOV lane Analysis
Facility:	Highway 102 (Hwy 101 to Joseph Howe)
Horizon/Peak:	2036 PM peak hour (Scenario B/C)
Description:	Three lanes in peak direction, add one HOV lane (3+1) Using the Incremental Mode-Choice Model Methodology

	2036 PM peak hour (Scenario B/C) Conditions	**HOV Alternative**	**Change**
Vehicle Trips (vph)	4,000	3,967	-33
Person Trips (vph)	4,560	4,560	0
Vehicle-kms of Travel	66,000	65,456	-545
Vehicle-hours of Travel	861	746	-115
Person-kms of Travel	75,240	75,240	0
Person-hours of Travel	982	844	-138
Travel Time:			
Regular lanes (min)	12.91	11.44	-1.47
HOV Lane(s) (min)	n/a	9.91	n/a
V/C Ratios:			
Regular lanes	0.83	0.74	-0.10
HOV Lane(s)	n/a	0.27	n/a
Avg Vehicle Occupancy	1.14	1.15	0.01

Project Name:	Hwy 102 Corridor - "take-a-lane" HOV lane Analysis
Facility:	Highway 102 (Hwy 101 to Joseph Howe)
Horizon/Peak:	2036 PM peak hour (Scenarios B/C)
Description:	Three lanes in peak direction, change one to HOV lane (2+1) Using the Incremental Mode-Choice Model Methodology

	2036 PM peak hour (Scenarios B/C) Conditions	**HOV Alternative**	**Change**
Vehicle Trips (vph)	4,000	3,967	-33
Person Trips (vph)	4,560	4,560	0
Vehicle-kms of Travel	66,000	65,456	-545
Vehicle-hours of Travel	861	1,503	642
Person-kms of Travel	75,240	75,240	0
Person-hours of Travel	982	1,600	618
Travel Time:			
Regular lanes (min)	12.91	24.26	11.35
HOV Lane(s) (min)	n/a	9.91	n/a
V/C Ratios:			
Regular lanes	0.83	1.11	0.27
HOV Lane(s)	n/a	0.27	n/a
Avg Vehicle Occupancy	1.14	1.15	0.01

APPENDIX H
Design Criteria Tables

Table H1 – Vertical Alignment Summary

Corridor Section No.		PVI Station	K Value	Curve Length (m)	Desirable Design Speed	Standards	Comments	Approximate Safe Operating Speed	Location Comments and Proposed Action
1	Windsor Street to Connaught Avenue				70	Standard 25 TAC, 25 TIR	OK / No Action		
2	Connaught Avenue to Romans Avenue				70	Standard 25 TAC, 25 TIR	OK / No Action		
3	Romans Avenue to Ashburn Avenue - ("Transition Section") to Joseph Howe Drive	100+322 Sag	131	500	70	Standard 25 TAC, 25 TIR	OK / No Action		
4	Joseph Howe Drive (Exit 0) to North West Arm Drive (Exit 1)	101+338 Sag	50	200	70	Standard 25 TAC, 25 TIR	OK / No Action		
		101+727 Crest	100	450	100	Standard 80 TAC, 70 TIR	OK / No Action		
5	North West Arm Drive (Exit 1) to Highway 103 (Exit 1A)						No crests or sags in section		
6	Highway 103 (Exit 1A) to Lacewood Drive (Exit 2A)	103+730 Crest	117	500	110	Standard 110 TAC, 85 TIR	OK / No Action		
		105+026 Crest	181	300	110	Standard 110 TAC, 85 TIR	OK / No Action		
7	Lacewood Drive (Exit 2A) to Kearney Lake Road (Exit 2)	105+520 Sag	78	300	110	Std 62 TAC, 55 TIR	OK / No Action		
		106+038 Crest	62	350	110	Standard 110 TAC, 85 TIR	Substandard K value	93	TBD
		106+385 Sag	46	200	110	Std 62 TAC, 55 TIR	Substandard K value	91	TBD
		106+648 Crest	67	200	110	Standard 110 TAC, 85 TIR	Substandard K value	94	TBD
		107+230 Sag	45	300	110	Std 62 TAC, 55 TIR	Substandard K value	91	TBD
		107+834 Crest	57	450	110	Standard 110 TAC, 85 TIR	Substandard K value	91	TBD
		108+323 Sag	32	200	110	Std 62 TAC, 55 TIR	Substandard K value	77	At Kearny Lake Interchange – provide lighting, curve meets criteria for comfort (30)
8	Kearney Lake Road (Exit 2) to Larry Uteck Drive (Exit ?)	108+868 Sag	53	200	110	Std 62 TAC, 55 TIR	Substandard K value	98	Short curve length is less than length of sight distance required, No Action
		109+245 Crest	68	500	110	Standard 110 TAC, 85 TIR	Substandard K value	94	Reconstruct curve to meet TAC 110 km/hr design speed
		109+793 Sag	101	200	110	Std 62 TAC, 55 TIR	OK / No Action		
		110+220 Crest	100	300	110	Standard 110 TAC, 85 TIR	Substandard K value	105	Meets TIR Standard but located at Larry Uteck. Reconstruct to 110 km / hr standard
9	Larry Uteck Drive (Exit ?) to Hwy 113 interchange	110+650 Sag	77	200	110	Std 62 TAC, 55 TIR	OK / No Action		
		111+296 Crest	100	400	110	Standard 110 TAC, 85 TIR	Substandard K value,	105	Meets TIR Standard, No Action
		111+708 Sag	37	200	110	Std 62 TAC, 55 TIR	Substandard K value	85	At new Hwy 113, reconstruct to 110 km/hr standard
		111+956 Crest	78	200	110	Standard 110 TAC, 85 TIR	Substandard K value	100	At new Hwy 113, reconstruct to 110 km/hr standard
		112+177 Sag	110	200	110	Std 62 TAC, 55 TIR	OK / No Action		
10	Highway 113 (Exit ?) to Hammonds Plains Road (Exit 3)	112+668 Sag	167	300	110	Std 62 TAC, 55 TIR	OK / No Action		
		113+164 Crest	174	300	110	Standard 110 TAC, 85 TIR	OK/ No Action		
11	Hammonds Plains Road (Exit 3) to Highway 1 / 101 (Exit 4)	113+572 Sag	34	200	110	Std 62 TAC, 55 TIR	Substandard K value	80	At Hammonds Interchange – provide lighting, curve meets criteria for comfort (30)
		114+299 Crest	152	900	110	Standard 110 TAC, 85 TIR	OK/ No Action		
		115+039 Crest	168	400	110	Standard 110 TAC, 85 TIR	OK/ No Action		
		116+060 Crest	145	500	110	Standard 110 TAC, 85 TIR	OK/ No Action		
		116+945 Sag	49	300	110	Std 62 TAC, 55 TIR	Substandard K value	98	At Bedford Interchange – provide lighting, curve meets criteria for comfort (30)
12	Highway 1 / 101 (Exit 4) to Glendale / Duke Street (Exit 4C)	117+334 Sag	52	300	110	Std 62 TAC, 55 TIR	Substandard K value	98	At Bedford Interchange – provide lighting, curve meets criteria for comfort (30)
		118+320 Crest	67	600	110	Standard 110 TAC, 85 TIR	Substandard K value	94	Reconstruct curve to meet TAC 110 km/hr design speed
13	Glendale / Duke Street (Exit 4C) to Lake Thomas Drive (Exit 5)	119+509 Sag	121	800	110	Std 62 TAC, 55 TIR	OK/ No Action		
		120+620 Crest	72	600	110	Standard 110 TAC, 85 TIR	Substandard K value	95	No other work planned, curve meets TIR Standard for 100 km/hr design speed, No Action.
		121+167 Sag	34	150	110	Std 62 TAC, 55 TIR	Substandard K value	85	Short curve length is less than length of sight distance required, No Action
		121+479 Crest	205	400	110	Standard 110 TAC, 85 TIR	OK/ No Action		
		122+373 Sag	40	200	110	Std 62 TAC, 55 TIR	Substandard K value	90	No other work planned, curve meets TIR Standard for 100 km/hr design speed, No Action
		122+934 Crest	93	500	110	Standard 110 TAC, 85 TIR	Substandard K value,	105	Meets TIR Standard for 110 km/hr design speed, No Action
		123+526 Sag	70	300	110	Std 62 TAC, 55 TIR	OK/ No Action		
		124+319 Crest	74	400	110	Standard 110 TAC, 85 TIR	Substandard K value	98	Meets TIR Standard for 110 km/hr design speed, No Action
		125+063 Sag	133	400	110	Std 62 TAC, 55 TIR	OK/ No Action		

TABLE H2: BAYERS ROAD / HIGHWAY 102 MAINLINE CORRIDOR DESIGN CRITERIA SUMMARY TABLE

CorridorSection No	Station to Station	Corridor Sections	Posted Speed	Desirable Design Speed and Design Criteria	Existing Limiting Horizontal Feature	Comments on Horizontal / Action Proposed	Existing Limiting Vertical Feature	Comments on Vertical / Action Proposed	Proposed Design Speed and Design Criteria
1	98+715 to 99+502	Windsor Street to Connaught Avenue	50 km/hr	60km/hr Normal Crown Rmin =150 m K(crest)=13 K(sag)= 18	Straight alignment, no limiting horizontal feature	Low speed urban design. No changes are proposed.	profile to be extended and checked	Proposed ROW of 22m. See proposed 4 lane typical section	50km/hr Normal Crown
2	99+502 to 100+102	Connaught Avenue to Romans Avenue	50 km/hr	60km/hr Normal Crown Rmin =150 m K(crest)=13 K(sag)= 18	Curve at HSC is radius of approximately 110m	Low speed urban design. No changes are proposed.	No limiting vertical features	No proposed change to vertical alignment	50km/hr
3	100+102 to 100+820	Romans Avenue to Ashburn Avenue - ("Transition Section") to Joseph Howe Drive	50 km/hr – 70 km/hr	70 km / hr Rmin=190m 6% super K(crest)=23 K(sag)= 25	Existing lanes have radius of 103m relating to design speed of approx 55 km/hr (sheet 5)	This represents transition section from Freeway to Urban Arterial. Posted speed is 70 going to 50 km/hr	No limiting vertical features	No proposed change to vertical alignment	Varies 50-70 km/hr
4	100+820 to 102+197	Joseph Howe Drive (Exit 0) to North West Arm Drive (Exit 1)	70- 90 km/hr	100 km/hr / Rmin=440m 6% super K(crest)=80 K(sag)= 50 (headlight) K(sag)= 25 (comfort)	Radius of 171 on inbound lanes relates to design speed of 60km/hr. Radius of 460m over the structures meets the 70 km / hr design speed for the area. (Sheet 6)	No changes are proposed. Maintain horizontal alignment consistent with existing alignments.	Slope of 7.2% exceeds maximum desirable slope of 6%, but section is within 70 km / hr zone and therefore considered acceptable	No proposed change to vertical alignment	Varies 70 km/hr to 100 km/hr 70 km / hr Rmin=190m to 440 6% super K(crest)=23 to 80 K(sag)= 25 to 50 (headlight)
5	102+197 to103+010	North West Arm Drive (Exit 1) to Highway 103 (Exit 1A)	90 - 100 km/hr	110 km/hr / Rmin=600m 6% super K(crest)=110 K(sag)= 62 (headlight)30 (comfort)	NB lanes have radius of 570m. (sheets 8-9)	Reconstruction of lanes is required anyway, improve radius to 600m, 6% super	No limiting vertical features	No proposed change to vertical alignment	110 km/hr / Rmin=600m 6% super K(crest)=110 K(sag)= 62 (headlight)
6	103+010 to 105+414	Highway 103 (Exit 1A) to Lacewood Drive (Exit 2A)	100 km/hr	110 km/hr / Rmin=600m 6% super K(crest)=110 K(sag)= 62 (headlight 30 (comfort)	Horizontal alignment meets desirable design criteria	No change to existing horizontal curvature, superelevation to be confirmed.	No limiting vertical features	No proposed change to vertical alignment	110 km/hr / Rmin=600m 6% super K(crest)=110 K(sag)= 62 (headlight)
7	105+414 to 108+441	Lacewood Drive (Exit 2A) to Kearney Lake Road (Exit 2)	100 km/hr	110 km/hr / Rmin=600m 6% super K(crest)=110 K(sag)= 62 (headlight) K(sag)= 30 (comfort)	Horizontal alignment meets desirable design criteria	No change to existing horizontal curvature, super elevation to be confirmed.	Limiting Vertical Features: Crest K = 62, Sta Sag K= 46 Crest K = 67 Sag K = 45 Crest K = 57	Decision required on improvements to series of crests and sags between Lacewood and Kearney Lake	TBD based on decision on vertical alignment
8	108+441 to 110+397	Kearney Lake Road (Exit 2) to Larry Uteck Drive (Exit ?)	100 km/hr	110 km/hr / Rmin=600m 6% super K(crest)=110 K(sag)= 62 (headlight) K(sag)= 30 (comfort)	SB lanes just north of Kearney Lake Interchange are R= 422m (sheet Next curve R= 589	Reconstruction of lanes is required anyway, improve radius to 600m, 6% super. Next curve is only slightly sub-standard. Improve to R=600 with reconstruction. Confirm superelevation	Limiting Vertical Features: Sag K= 32 Sag K= 53 Crest K = 68 Crest K = 100 at Larry Uteck	New Vertical alignment required north of Kearney Lake - improve sag and re-construct crest. Flatten curve at Larry Uteck with construction of interchange.	110 km/hr / Rmin=600m 6% super K(crest)=110 K(sag)= 62 (headlight)
9	110+397 to 112+231	Larry Uteck Drive (Exit ?) to Hwy 113 interchange	100 km/hr	110 km/hr / Rmin=600m 6% super K(crest)=110 K(sag)= 62 (headlight 30 (comfort)	Short curve on NB lanes just north of Larry Uteck are R= 418m	Suggested to be improved as part of Larry Uteck Design. Impacts rock slope	Crest K = 100 at Larry Uteck Sag K= 37 Crest K = 78	Suggested to be improved as part of Larry Uteck Design. Impacts rock slope	110 km/hr / Rmin=600m 6% super K(crest)=110 K(sag)= 62 (headlight)
10	112+231 to 113+490	Highway 113 (Exit ?) to Hammonds Plains Road (Exit 3)	100 km/hr	110 km/hr / Rmin=600m 6% super K(crest)=110 K(sag)= 62 (headlight 30 (comfort)	NB Curve at 113 is R=430	Suggested to be improved as part of 113 interchange Design.	Sag K= 34	Suggested to be improved as part of Hammonds Plains Interchange design or provide lighting	110 km/hr / Rmin=600m 6% super K(crest)=110 K(sag)= 62 (headlight) K(sag)= 30 (comfort)
11	113+490 to 117+305	Hammonds Plains Road (Exit 3) to Highway 1 / 101 (Exit 4)	100 km/hr (one curve posted at 90 km /hr)	110 km/hr / Rmin=600m 6% super K(crest)=110 K(sag)= 62 (headlight) K(sag)= 30 (comfort)	Curve to North of Hammonds Plains is R= 573 Next curve is R=344m and posted at 90 km /hr	Curve is only slightly sub-standard. Improve to R=600 with reconstruction. Confirm super. Limiting horizontal curve of R=344 should be improved to be consistent. HRM land is impacted	Sag K= 34 Sag K = 52 Sub-standard sags at the Sackville River and the Bedford Interchange	Improve sags with re-construction of Interchange and structures or provide lighting	110 km/hr / Rmin=600m 6% super K(crest)=110 K(sag)= 62 (headlight) K(sag)= 30 (comfort)
12	117+305 to 118+798	Highway 1 / 101 (Exit 4) to Glendale / Duke Street (Exit 4C)	100 km/hr	110 km/hr / Rmin=600m 6% super K(crest)=110 K(sag)= 62 (headlight) 30 (comfort)	Short section on straight alignment. Horizontal alignment meets desirable design criteria	No changes required	Crest K = 67 just south of Glendale / Duke Street	Improve crest to design standard for 110 km / hr design speed	110 km/hr / Rmin=600m 6% super K(crest)=110 K(sag)= 62 (headlight)
13	118+798 to 125+534	Glendale / Duke Street (Exit 4C) to Lake Thomas Drive (Exit 5)	100 km/hr (one curve posted at 85 km / hr)	110 km/hr / Rmin=600m 6% super K(crest)=110 K(sag)= 62 (headlight) K(sag)= 30 (comfort)	4 major horizontal curves R=870, R=585 R=410, to avoid water body, posted at 85 R=500 south of Lake Thomas	No other work required in this section. Improvement to R=410 curve will impact water body. Check accident statistics and monitor effectiveness of signage	Crest K= 72 Sag K= 34 Sag K= 40 Crest K = 93 Crest K = 74	Varies 100 to 110 at 8% superelevation (no changes to existing road are proposed.)No other work required in this section.	Varies 100 to 110 at 8% superelevation (no changes to existing road are proposed.)

Table H3
Joseph Howe Drive Interchange – Summary of Ramp Design Criteria

Ramps Design Criteria Item	Ramp 1 Southbound Off-Ramp	Ramp 2 Northbound On-ramp
Planning Volume/Planned lanes	1000 vph, 1 lane	1100 vph, 1 lane
Connection Type	Freeway to Arterial, non-loop	Arterial to Freeway, non-loop
Desirable Design Speed (km/hr)	70 km / hr	70 km / hr
Proposed Design Speed and Minimum Radius (m) / Maximum Superelevation Based on existing horizontal geometry)	70 km/hr 190 m / 6%	70 km/hr 190 m / 6%
Minimum Crest K (TAC Table 2.1.3.2)	23	23
Minimum Sag K (TAC Table 2.1.3.4) Headlight Control / Comfort Control	25 / 12	25 / 12
Minimum Stopping Sight Distance (TAC Table 1.2.5.3)	110 m	110 m
Deceleration Length TAC Design Length Range (TAC Table 2.4.6.2, Flat Grade) excluding taper	80-110 m (based on Hwy 102 design speed of 90km/hr)	
Acceleration Length TAC Design Length Range (TAC Table 2.4.6.5,Flat Grade) excluding taper		40-145 m (based on Hwy 102 design speed of 90km/hr)
Assumed Standard (excluding 90m taper) for 0-3% grades	110 m	145 m
Highway 102 Grade at Ramp Approach / Terminal and applicable factor (TAC Table 2.4.6.3)	>6%% down, factor 1.4	>6.0% up, factor 2.2 Based on Hwy 102 design speed of 90 km/hr
Proposed Acceleration Length excluding taper		319 m
Proposed Deceleration Length excluding taper	154 m	
Notes	Continuous ramp lane from the Highway 103 interchange.	Existing ramp is approx 500m in length with direct taper length of 220m. No change to existing ramp is proposed. Assuming operating speed of 90 km/hr for Highway 102

Table H4
North West Arm Drive Interchange – Summary of Ramp Design Criteria

On-Ramps Design Criteria Item	Ramp 1 and Ramp 5 EB and WB to SB On-Ramp	Ramp 3 EB to NB On-ramp	Ramp 6 WB to NB on-ramp
Planning Volume / Planned lanes	900 vph, 1 lane	400 vph, 1 lane	300 vph, 1 lane
Connection Type	Arterial to Freeway, inner loop	Arterial to Freeway, inner loop	Arterial to Freeway, non-loop
Desirable Design Speed (km/hr)	40 km/hr	40 km/hr	70 km/hr
Proposed Design Speed and Minimum Radius (m) / Maximum Superelevation (Based on existing horizontal geometry)	40 km/hr 55 m / 6%	40 km/hr 50 m / 8%	50 km/hr 80 m / 8%
Minimum Crest K (TAC Table 2.1.3.2)	4	4	7
Minimum Sag K (TAC Table 2.1.3.4) Headlight Control / Comfort Control	7 / 4	7 / 4	12 / 6
Minimum Stopping Sight Distance	45 m	45 m	65 m
Acceleration Length TAC Design Length Range (TAC Table 2.4.6.5, Flat Grade) excluding taper	225-405 m Based on Hwy 100 km/hr design speed	225-405 m Based on Hwy 100 km/hr design speed	140-250 m (Assuming 90 km / hr operating speed on hwy lane)
Assumed Standard (excluding 90m taper) for 0-3% grades	405	405	250 m
Highway 102 Grade at Ramp Approach / Terminal and applicable factor (TAC Table 2.4.6.3)	2.7% down / factor 1.0	2.7% up / factor 1.0	2.7 % up / factor 1.0
Proposed Acceleration Length excluding taper	405 m		250 m
Notes		Ramp lane is continuous to Highway 103 Interchange off-ramp. No change to existing ramp because of property constraints	Ramp lane merges into slower continuous ramp lane (Ramp 3)

Off-Ramps Design Criteria Item	Ramp 2 Northbound Off-Ramp	Ramp 4 Southbound Off-ramp
Planning Volume / Planned lanes	400 vph, 1 lane	700 vpd, 2 lane*
Connection Type	Freeway to Arterial, non-loop	Freeway to Arterial, non-loop
Desirable Design Speed (km/hr)	70 km / hr	70 km/hr
Proposed Design Speed and Minimum Radius (m) / Maximum Superelevation Based on existing horizontal geometry)	40 km/hr 50 m / 8%	70 km/hr 190m / 6%
Minimum Crest K (TAC Table 2.1.3.2)	4	23
Minimum Sag K (TAC Table 2.1.3.4) Headlight Control / Comfort Control	7 / 4	25 / 12
Minimum Stopping Sight Distance	45 m	110 m
Deceleration Length TAC Design Length Range (TAC Table 2.4.6.2, Flat Grade) excluding taper	145-200 m Based on 100 km/hr hwy design speed	120 - 190 m
Assumed Standard (excluding 90m taper) for 0-3% grades	200 m	190 m
Highway 102 Grade at Ramp Approach / Terminal and applicable factor (TAC Table 2.4.6.3)	3.0% up, factor 1.0	2.7% down, factor 1.0
Proposed Deceleration Length excluding taper	200 m Approximately 100 m existing	190 m
Notes	No change to existing ramp due to property constraints	Two lane ramp to allow traffic from Highway 103 and double left at intersection

Table H5
Highway 103 Interchange – Summary of Ramp Design Criteria

On-Ramps Design Criteria Item	**Ramp 1 EB to Southbound On-Ramp**	**Ramp 4 EB to Northbound On-ramp**
Planning Volume / Planned lanes	2100 vph, 2 lane	600 vph, 1 lane
Connection Type	Freeway to Freeway, non-loop	Freeway to Freeway, loop
Desirable Design Speed (km/hr)	100 km/hr	100 km/hr
Proposed Design Speed and Minimum Radius (m) / Maximum Superelevation	100 km/hr 440m / 6%	70 km/hr 190m / 6%
Minimum Crest K (TAC Table 2.1.3.2)	80	23
Minimum Sag K (TAC Table 2.1.3.4) Headlight Control / Comfort Control	50 / 25	25 / 12
Minimum Stopping Sight Distance	210 m	110 m
Acceleration Length TAC Design Length Range (TAC Table 2.4.6.5, Flat Grade) excluding taper	N/A	150 - 475 m
Assumed Standard (excluding 90m taper) for 0-3% grades	N/A	475 m
Highway 102 Grade at Ramp Approach / Terminal and applicable factor (TAC Table 2.4.6.3)	2.7% down, factor 1.0	<2% up, factor 1.0
Proposed Acceleration Length excluding taper	N/A	475 m
Notes	Directional Ramp designed for 100 km/hr. Continuous auxiliary lane to Joe Howe is proposed	Continuous auxiliary lane to Lacewood is proposed

Off-Ramps Design Criteria Item	**Ramp 2 SB to WB Off-Ramp**	**Ramp 3 NB to WB Off-ramp**
Planning Volume / Planned lanes	500 vph, 1 lane	1600 vpd, 2 lane
Connection Type	Freeway to Freeway, non-loop	Freeway to Freeway, loop
Desirable Design Speed (km/hr)	100 km/hr	100 km/hr
Proposed Design Speed and Minimum Radius (m) / Maximum Superelevation Based on existing horizontal geometry)	50 km/hr 90 m / 6%	50 km/hr 90 m / 6%
Minimum Crest K (TAC Table 2.1.3.2)	7	7
Minimum Sag K (TAC Table 2.1.3.4) Headlight Control / Comfort Control	12 / 6	12 / 6
Minimum Stopping Sight Distance	65 m	65 m
Deceleration Length TAC Design Length Range (TAC Table 2.4.6.2, Flat Grade) excluding taper	150-220 m	150 - 220 m
Assumed Standard (excluding 90m taper) for 0-3% grades	220 m	220 m
Highway 102 Grade at Ramp Approach / Terminal and applicable factor (TAC Table 2.4.6.3)	< 2% down, factor 1.0	2.7% up, factor 1.0
Proposed Deceleration Length excluding taper	220 m	220 m
Notes	Continuous auxiliary lane from Lacewood is proposed	Continuous auxiliary lane from N.W. Arm Drive is proposed

Table H6
Lacewood Interchange – Summary of Ramp Design Criteria

On-Ramps Design Criteria Item	Ramp 1 Southbound On-Ramp	Ramp 4 Northbound On-ramp
Planning Volume / Planned lanes	700 vph, 1 lane	900 vph, 1 lane
Connection Type	Arterial to Freeway, non-loop	Arterial to Freeway, non-loop
Desirable Design Speed (km/hr)	70 km/hr	70 km/hr
Proposed Design Speed and Minimum Radius (m) / Maximum Superelevation	70 km/hr 190 m / 6%	70 km/hr 190 m / 6%
Minimum Crest K (TAC Table 2.1.3.2)	23	23
Minimum Sag K (TAC Table 2.1.3.4) Headlight Control / Comfort Control	25 / 12	25 / 12
Minimum Stopping Sight Distance	110 m	110 m
Acceleration Length TAC Design Length Range (TAC Table 2.4.6.5, Flat Grade) excluding taper	150 - 475 m	150 - 475 m
Assumed Standard (excluding 90m taper) for 0-3% grades	475 m	475 m
Highway 102 Grade at Ramp Approach / Terminal and applicable factor (TAC Table 2.4.6.3)	1.5% up, factor 1.0	<3%, factor 1.0
Proposed Acceleration Length excluding taper	475 m	475 m
Notes	Straight ramp – acceleration can occur on ramp. Continuous auxiliary lane to Hwy 103 is proposed	Straight ramp – acceleration can occur on ramp

Off-Ramps Design Criteria Item	Ramp 2 Northbound Off-Ramp	Ramp 3 Southbound Off-ramp
Planning Volume / Planned lanes	600 vph, 1 lane	700 vpd, 1 lane
Connection Type	Freeway to Arterial, non-loop	Freeway to Arterial, non-loop
Desirable Design Speed (km/hr)	70 km/hr	70 km/hr
Proposed Design Speed and Minimum Radius (m) / Maximum Superelevation	70 km/hr 190 m / 6%	70 km/hr 190 m / 6%
Minimum Crest K (TAC Table 2.1.3.2)	23	23
Minimum Sag K (TAC Table 2.1.3.4) Headlight Control / Comfort Control	25 / 12	25 / 12
Minimum Stopping Sight Distance	110 m	110 m
Deceleration Length TAC Design Length Range (TAC Table 2.4.6.2, Flat Grade) excluding taper	120 - 190 m	120 - 190 m
Assumed Standard (excluding 90m taper) for 0-3% grades	190 m	190 m
Highway 102 Grade at Ramp Approach / Terminal and applicable factor (TAC Table 2.4.6.3)	1.5% down, factor 1.0	<3%, factor 1.0
Proposed Deceleration Length excluding taper	190 m	190 m
Notes	Straight ramp – deceleration can occur on ramp. Continuous auxiliary lane from Hwy 103 is proposed	Straight ramp – deceleration can occur on ramp

Table H7
Kearney Lake Road Interchange – Summary of Ramp Design Criteria

On-Ramps **Design Criteria Item**	**Ramp 1** **Southbound On-Ramp**	**Ramp 4** **Northbound On-ramp**
Planning Volume / Planned lanes	900 vph, 1 lane	800 vph, 1 lane
Connection Type	Arterial to Freeway, non-loop	Arterial to Freeway, non-loop
Desirable Design Speed (km/hr)	70 km/hr	70 km/hr
Proposed Design Speed and Minimum Radius (m) / Maximum Superelevation	70 km/hr 190 m / 6%	70 km/hr 190 m / 6%
Minimum Crest K (TAC Table 2.1.3.2)	23	23
Minimum Sag K (TAC Table 2.1.3.4) Headlight Control / Comfort Control	25 / 12	25 / 12
Minimum Stopping Sight Distance	110 m	110 m
Acceleration Length TAC Design Length Range (TAC Table 2.4.6.5, Flat Grade) excluding taper	150 - 475 m	150 - 475 m
Assumed Standard (excluding 90m taper) for 0-3% grades	475 m	475 m
Highway 102 Grade at Ramp Approach / Terminal and applicable factor (TAC Table 2.4.6.3)	3% to 4.8 % up, assume factor 1.0	< 5.2% up, factor 2.7
Proposed Acceleration Length excluding taper	475 m	1283 m
Notes	735 m provided to carry over crest	Continuous lane to Larry Uteck is proposed – approximate length is 1330m

Off-Ramps **Design Criteria Item**	**Ramp 2** **Northbound Off-Ramp**	**Ramp 3** **Southbound Off-ramp**
Planning Volume / Planned lanes	800 vph, 1 lane	1100 vpd, 1 lane
Connection Type	Freeway to Arterial, non-loop	Freeway to Arterial, non-loop
Desirable Design Speed (km/hr)	70 km/hr	70 km/hr
Proposed Design Speed and Minimum Radius (m) / Maximum Superelevation	70 km/hr 190 m / 6%	70 km/hr 190 m / 6%
Minimum Crest K (TAC Table 2.1.3.2)	23	23
Minimum Sag K (TAC Table 2.1.3.4) Headlight Control / Comfort Control	25 / 12	25 / 12
Minimum Stopping Sight Distance	110 m	110 m
Deceleration Length TAC Design Length Range (TAC Table 2.4.6.2, Flat Grade) excluding taper	120 - 190 m	120 - 190 m
Assumed Standard (excluding 90m taper) for 0-3% grades	190 m	190 m
Highway 102 Grade at Ramp Approach / Terminal and applicable factor (TAC Table 2.4.6.3)	4.8% down, factor 1.2	< 5.2% down, factor 1.4
Proposed Deceleration Length excluding taper	228 m	266 m
Notes	Approximately 320 m provided	430m is provided since lane is on a horizontal curve – taper location on the tangent

Table H8
Highway 113 Interchange – Summary of Ramp Design Criteria

Ramps **Design Criteria Item**	**Ramp 1** **Southbound Off-Ramp**	**Ramp 2** **Northbound On-Ramp**
Planning Volume/Planned lanes	1800 vph, 2 lane	900 vph, 2 lane
Connection Type	Freeway to Freeway, directional	Freeway to Freeway, directional
Desirable Design Speed (km/hr)	100 km/hr	100 km/hr
Proposed Design Speed and Minimum Radius (m) / Maximum Superelevation	100 km/hr 440 m / 6%	100 km/hr 440 m / 6%
Minimum Crest K (TAC Table 2.1.3.2)	80	80
Minimum Sag K (TAC Table 2.1.3.4) Headlight Control Comfort Control	50 / 25	50 / 25
Minimum Stopping Sight Distance	210 m	210 m
Acceleration Length TAC Design Length Range (TAC Table 2.4.6.5, Flat Grade) excluding taper		N/A
Deceleration Length TAC Design Length Range (TAC Table 2.4.6.2, Flat Grade) excluding taper	N/A	
Assumed Standard (excluding 90m taper) for 0-3% grades	N/A	N/A
Highway 102 Grade at Ramp Approach / Terminal and applicable factor (TAC Table 2.4.6.3)	N/A	N/A
Proposed Acceleration Length excluding taper	N/A	
Proposed Deceleration Length excluding taper		N/A
Notes:	Directional ramps are designed for 100 km/hr speed, therefore acceleration / deceleration not considered	Directional ramps are designed for 100 km/hr speed, therefore acceleration / deceleration not considered

Table H9
Hammonds Plains Road Interchange – Summary of Ramp Design Criteria

On-Ramps Design Criteria Item	Ramp 3 SB On-Ramp	Ramp 5 NB On-ramp
Planning Volume / Planned lanes	1200 vph, 1 lane	1900 vph, 2 lane
Connection Type	Arterial to Collector, non-loop	Arterial to Freeway, non-loop
Desirable Design Speed (km/hr)	70 km/hr	70 km/hr
Proposed Design Speed and Minimum Radius (m) / Maximum Superelevation	50 km/hr 90 m / 6%	60 km/hr 130 m / 6%
Minimum Crest K (TAC Table 2.1.3.2)	7	13
Minimum Sag K (TAC Table 2.1.3.4) Headlight Control / Comfort Control	12 / 6	18 / 9
Minimum Stopping Sight Distance	65 m	85 m
Acceleration Length TAC Design Length Range (TAC Table 2.4.6.5, Flat Grade) excluding taper	150 - 475 m	210 - 525 m
Assumed Standard (excluding 90m taper) for 0-3% grades	475 m	525 m
Highway 102 Grade at Ramp Approach / Terminal and applicable factor (TAC Table 2.4.6.3)	< 3%, factor 1.0	5.9% up, factor 2.4
Proposed Acceleration Length excluding taper	475 m	1140 m
Notes	Ramp lane is continuous to Hwy 113 off-ramp, weave distance = 700m (BN to BN)	Existing land development limits changes to ramp alignment

Off-Ramps Design Criteria Item	Ramp 1 NB to EB Off-Ramp	Ramp 2 SB to EB Off-Ramp	Ramp 4 NB to WB Off-Ramp
Planning Volume / Planned lanes	1200 vph, 1 lane	1100 vpd, 1 lane	1000 vpd, 1 lane
Connection Type	Freeway to Collector to Arterial, non loop	Freeway to Arterial, inner-loop	Collector to Arterial, inner loop
Desirable Design Speed (km/hr)	70 km/hr	60 km/hr	60 km/hr
Proposed Design Speed and Minimum Radius (m) / Maximum Superelevation	50 km/hr 90 m / 6%	40 km/hr 50 m / 6%	40 km/hr 50 m / 6%
Minimum Crest K (TAC Table 2.1.3.2)	7	4	4
Minimum Sag K (TAC Table 2.1.3.4) Headlight Control / Comfort Control	12 / 6	7 / 4	7 / 4
Minimum Stopping Sight Distance	65 m	45 m	45 m
Deceleration Length TAC Design Length Range (TAC Table 2.4.6.2, Flat Grade) excluding taper	135-185 m Based on collector design speed of 100 km/hr	160 - 230 m	145-200 m Based on collector design speed of 100 km/hr
Assumed Standard (excluding 90m taper) for 0-3% grades	185 m	230 m	230 m
Highway 102 Grade at Ramp Approach / Terminal and applicable factor (TAC Table 2.4.6.3)	< 3%, factor 1.0	5.9% down, factor 1.4	< 3%, factor 1.0
Proposed Deceleration Length excluding taper	185 m	322 m	230 m
Notes	200 m provided from BN to stop bar		250m provided from split with collector (BN) to controlling curve

Table H10
Bedford Interchange – Summary of Ramp Design Criteria

On-Ramps Design Criteria Item	Ramp 2 + 6 SB On-Ramp	Ramp 4 EB to NB on-Ramp	Ramp 8 Northbound On-Ramp
Planning Volume / Planned lanes	1600 vph, 2 lane	800 vph, 1 lane	900 vph, 1 lanes
Connection Type	Freeway to Freeway (Ramp 2) Arterial to Freeway (Ramp 6), non-loop	Freeway to Collector, loop	Arterial to Collector, non-loop
Desirable Design Speed (km/hr)	100 km/hr	60 km /hr	70 km/hr
Proposed Design Speed (km/hr) and Minimum Radius (m) / Maximum Superelevation	70 km/hr 190 m / 6%	60 km/hr 130m / 6%	60 km/hr 130m / 6%
Minimum Crest K (TAC Table 2.1.3.2)	23	13	13
Minimum Sag K (TAC Table 2.1.3.4) Headlight Control / Comfort Control	25 / 12	18 / 9	18 / 9
Minimum Stopping Sight Distance	110 m	85 m	85 m
Acceleration Length TAC Design Length Range (TAC Table 2.4.6.5, Flat Grade) excluding taper	150 - 475 m	140-325 m Based on design speed of 100km/hr on Collector	140-325 m Based on design speed of 100km/hr on Collector
Assumed Standard (excluding 90m taper) for 0-3% grades	475 m	325 m	325 m
Highway 102 Grade at Ramp Approach / Terminal and applicable factor (TAC Table 2.4.6.3)	5.8% up, factor 2.7	6% up, factor 2.4	6% up, factor 2.4
Proposed Acceleration Length excluding taper	1283 m	780 m	780 m
Notes	Check left turn lane from Bedford Highway Approximately 1100m provided	Ramp moved from Bedford Highway to Bedford Bypass. Merges with Ramp 8 to weave on collector	Merges with Ramp 4 to weave on collector

Off-Ramps Design Criteria Item	Ramp 1 SB to EB Off-Ramp	Ramp 3 NB to EB Off-Ramp	Ramp 5 SB to WB Off-Ramp	Ramp 7 NB to WB Off-Ramp
Planning Volume / Planned lanes	600 vph, 1 lane	500 vph, 1 lane	900 vph, 1 lane	1300 vpd, 2 lane
Connection Type	Freeway to Arterial, inner loop	Freeway to Arterial, non loop	Collector to Freeway, non loop	Freeway to Freeway inner-loop
Desirable Design Speed (km/hr)	70 km/hr	70 km/hr	100 km/hr	100 km/hr
Proposed Design Speed (km/hr) and Minimum Radius (m) / Maximum Superelevation	35 km/hr 50 m / 6%	40 km/hr 60m / 6%	70 km/hr 190m / 6%	40 km/hr 60m / 6%
Minimum Crest K (TAC Table 2.1.3.2)	4	4	23	4
Minimum Sag K (TAC Table 2.1.3.4) Headlight Control / Comfort Control	7 / 4	7 / 4	25 / 12	7 / 4
Minimum Stopping Sight Distance	45 m	45 m	110 m	45 m
Deceleration Length TAC Design Length Range (TAC Table 2.4.6.2, Flat Grade) excluding taper	170 - 240 m	160 - 230 m	120 – 190 m	160 - 230 m
Assumed Standard (excluding 90m taper) for 0-3% grades	240 m	230 m	190 m	230 m
Highway 102 Grade at Ramp Approach / Terminal and applicable factor (TAC Table 2.4.6.3)	6% down, factor 1.4	5.8 % down, factor 1.4	6% down, factor 1.4	< 6% down, factor 1.4
Proposed Deceleration Length excluding taper	336 m	322 m	266 m	322 m
Notes	Improve minimum radius to R=50m		Ramp moved from Bedford Highway to Bedford Bypass	

Table H11
Glendale / Duke Interchange – Summary of Ramp Design Criteria

On-Ramps Design Criteria Item	**Ramp 1 Southbound On-Ramp**	**Ramp 4 Northbound On-Ramp**
Planning Volume / Planned lanes	600 vph, 1 lane	300 vph, 1 lane
Connection Type	Arterial to Collector, non-loop	Arterial to Freeway, non-loop
Desirable Design Speed (km/hr)	70 km/hr	70 km/hr
Proposed Design Speed and Minimum Radius (m) / Maximum Superelevation Based on existing horizontal geometry)	70 km/hr 190 m / 6%	70 km/hr 190 m / 6%
Minimum Crest K (TAC Table 2.1.3.2)	23	23
Minimum Sag K (TAC Table 2.1.3.4) Headlight Control / Comfort Control	25 / 12	25 / 12
Minimum Stopping Sight Distance	110 m	110 m
Acceleration Length TAC Design Length Range (TAC Table 2.4.6.5, Flat Grade) excluding taper	100 - 285 m Based on collector design speed of 100 km/hr	150 - 475 m
Assumed Standard (excluding 90m taper) for 0-3% grades	285 m	475 m
Highway 102 Grade at Ramp Approach / Terminal and applicable factor (TAC Table 2.4.6.3)	< 3%, factor 1.0 (at crest)	< 3%, factor 1.0 (in sag)
Proposed Acceleration Length excluding taper	285 m	475 m
Notes	Straight, long ramp, Lane is continuous to weave on collector	Straight, long ramp. Acceleration can occur on ramp

Off-Ramps Design Criteria Item	**Ramp 2 Northbound Off-Ramp**	**Ramp 3 Southbound Off-Ramp**
Planning Volume / Planned lanes	1000 vph, 1 lane	400 vpd, 1 lane
Connection Type	Collector to Arterial, non-loop	Freeway to Arterial, non-loop
Desirable Design Speed (km/hr)	70 km/hr	70 km/hr
Proposed Design Speed and Minimum Radius (m) / Maximum Superelevation Based on existing horizontal geometry)	70 / 190 m / 6%	70 / 190 m / 6%
Minimum Crest K (TAC Table 2.1.3.2)	23	23
Minimum Sag K (TAC Table 2.1.3.4) Headlight Control / Comfort Control	25 / 12	25 / 12
Minimum Stopping Sight Distance	110 m	110 m
Deceleration Length TAC Design Length Range (TAC Table 2.4.6.2, Flat Grade) excluding taper	100 - 145 m Based on CD design speed of 100 km/hr	120 - 190 m
Assumed Standard (excluding 90m taper) for 0-3% grades	145 m	190 m
Highway 102 Grade at Ramp Approach / Terminal and applicable factor (TAC Table 2.4.6.3)	< 3%, factor 1.0	< 3%, factor 1.0
Proposed Deceleration Length excluding taper	145 m	190 m
Notes	Straight Ramp, from weave on collector deceleration can occur on ramp. Ramp length to intersection = 260 m	Straight Ramp, deceleration can occur on ramp. Ramp length to intersection = 1050m

Table H12
Highway 107 Interchange – Summary of Ramp Design Criteria

On-Ramps Design Criteria Item	107 WB to 102 SB On-Ramp	107 WB to 102 NB On-Ramp
Planning Volume / Planned lanes	2 lane	1 lane
Connection Type	Freeway to Collector, directional	Arterial to Freeway, directional
Desirable Design Speed (km/hr)	100 km/hr	100 km/hr
Proposed Design Speed and Minimum Radius (m) / Maximum Superelevation Based on existing horizontal geometry)	60 km/hr (previous design R = 125m) 60 km/hr 130m / 6%	80 km/hr (previous design R = 250m) 80 km/hr 250m / 6%
Minimum Crest K (TAC Table 2.1.3.2)	13	36
Minimum Sag K (TAC Table 2.1.3.4) Headlight Control / Comfort Control	18 / 9	32 / 16
Minimum Stopping Sight Distance	85 m	140 m
Acceleration Length TAC Design Length Range (TAC Table 2.4.6.5, Flat Grade) excluding taper	140 - 325 m Based on collector design speed of 100 km/hr	100 - 410 m
Assumed Standard (excluding 90m taper) for 0-3% grades	325 m	410 m
Highway 102 Grade at Ramp Approach / Terminal and applicable factor (TAC Table 2.4.6.3)	< 3%, factor 1.0	3.7 % up, factor 1.8
Proposed Acceleration Length excluding taper	325 m	738 m Existing design length approx 780 m
Notes		

** While ramps do not exist at this time, the interchange has been constructed based on detailed design of the future ramps

Off-Ramps Design Criteria Item	102 NB to 107 EB	192 Southbound to 102 EB
Planning Volume / Planned lanes	2 lane	
Connection Type	Collector to Freeway, directional	
Desirable Design Speed (km/hr)	100 km/hr	
Proposed Design Speed and Minimum Radius (m) / Maximum Superelevation Based on existing horizontal geometry)	70 km/hr (Existing min radius = 200m) 70 km/hr 190m / 6%	
Minimum Crest K (TAC Table 2.1.3.2)	23	
Minimum Sag K (TAC Table 2.1.3.4) Headlight Control / Comfort Control	25 / 12	
Minimum Stopping Sight Distance	110 m	
Deceleration Length TAC Design Length Range (TAC Table 2.4.6.2, Flat Grade) excluding taper	100 - 145 m Based on collector design speed of 100 km/hr	
Assumed Standard (excluding 90m taper) for 0-3% grades	145 m	
Highway 102 Grade at Ramp Approach / Terminal and applicable factor (TAC Table 2.4.6.3)	< 3%, factor 1.0	
Proposed Deceleration Length excluding taper	145 m	
Notes	Long ramp deceleration can occur on ramp	Ramp movement not provided. Low demand, vehicles expected to use Highway 118

Table H13
Trunk 2/Lake Thomas Road Interchange – Summary of Ramp Design Criteria

On-Ramps Design Criteria Item	Ramp 2 Southbound On-Ramp	Ramp 4 Northbound On-Ramp
Planning Volume / Planned lanes	800 vph, 1 lane	500 vph, 1 lane
Connection Type	Arterial to Freeway, non-loop	Arterial to Freeway, loop
Desirable Design Speed (km/hr)	70 km /hr	50 km/hr
Proposed Design Speed / Minimum Radius (m) / Maximum Superelevation Based on existing horizontal geometry)	50 km/hr (Existing min radius = 60m) 50 km/hr 80 m / 8%	30 km/hr (Existing min radius = 40m) 40 km/hr 50 m / 8%
Minimum Crest K (TAC Table 2.1.3.2)	7	4
Minimum Sag K (TAC Table 2.1.3.4) Headlight Control / Comfort Control	12 / 6	7 / 4
Minimum Stopping Sight Distance	65 m	45 m
Acceleration Length TAC Design Length Range (TAC Table 2.4.6.5, Flat Grade) excluding taper	260 - 575 m	290 - 600 m
Assumed Standard (excluding 90m taper) for 0-3% grades	575 m	600 m
Highway 102 Grade at Ramp Approach / Terminal and applicable factor (TAC Table 2.4.6.3)	Less than 3 % up, factor 1.0	Less than 3%, factor 1.0
Proposed Acceleration Length excluding taper	575 m Existing length is 120m - direct taper Widening of Hwy 102 required to extend lane	600 m Existing length approx 340m
Notes	No changes proposed for existing ramp	No changes proposed for existing ramp. Reconstruction required to improve design speed

Off-Ramps Design Criteria Item	Ramp 3 Northbound Off-Ramp	Ramp 1 Southbound Off-Ramp
Planning Volume / Planned lanes	500 vph, 1 lane	400 vpd, 1 lane
Connection Type	Freeway to Arterial, non-loop	Freeway to Arterial, loop
Desirable Design Speed (km/hr)	70 km /hr	50 km/hr
Proposed Design Speed and Minimum Radius (m) / Maximum Superelevation Based on existing horizontal geometry)	50 km/hr (Existing min radius = 60m) 50 km/hr 80 m / 8%	40 km/hr (Existing min radius = 50m) 40 km/hr 50 m / 8%
Minimum Crest K (TAC Table 2.1.3.2)	7	4
Minimum Sag K (TAC Table 2.1.3.4) Headlight Control / Comfort Control	12 / 6	7 / 4
Minimum Stopping Sight Distance	65 m	45 m
Deceleration Length TAC Design Length Range (TAC Table 2.4.6.2, Flat Grade) excluding taper	150 - 220 m	160 - 230 m
Assumed Standard (excluding 90m taper) for 0-3% grades	575 m	230 m
Highway 102 Grade at Ramp Approach / Terminal and applicable factor (TAC Table 2.4.6.3)	Less than 3 % up, factor 1.0	Less than 3%, factor 1.0
Proposed Deceleration Length excluding taper	220 m	230 m
Notes	No changes proposed for existing ramp	No changes proposed for existing ramp.

APPENDIX I
Conceptual Plans
(bound separately)

APPENDIX J
VE Session Report
(bound separately)

APPENDIX K
Public Information Session Material

NOVA SCOTIA

Transportation and Infrastructure Renewal

HALIFAX

REGIONAL MUNICIPALITY

Public Information Sessions

BAYERS ROAD / HIGHWAY 102 / HIGHWAY 107 CORRIDOR STUDY

There will be two Public Information Sessions for the Bayers Road / Highway 102 / Highway 107 Corridor Study. NSTIR, HRM and Consultant staff will be in attendance at the Public Information Sessions to discuss the study and answer questions. A presentation will be made.

The objective of the study is to identify transportation infrastructure needs and preserve the corridor for potential expansion of the roadways sometime in the future. This process does not imply that construction will take place.

The schedule is as follows:

Wednesday, March 25, 2009 at the Sackville High School, 1 Kingfisher Way, Lower Sackville, from 6pm to 9pm with a presentation at 6:30pm

Thursday, March 26, 2009 at the Park Plaza Hotel and Conference Centre, Ramada Plaza, 240 Brownlow Avenue, Dartmouth, from 4pm to 6pm.

Project Description

The Nova Scotia Department of Transportation and Infrastructure Renewal (NSTIR) and Halifax Regional Municipality (HRM) are exploring the future best use of the Bayers Road / Highway 102 Corridor from Windsor Street, Halifax to Fall River. The study includes traffic projections and functional designs which could be implemented in stages over a 30 year period. The location of the proposed Highway 107 from Akerley Blvd in Burnside to Highway 102 near Duke Street (Exit 4C) has also been updated and evaluated. The study, conducted by Stantec Consulting Ltd. on behalf of NSTIR and HRM, commenced in March, 2007.

Background

The main purpose of the 100 series highway network in Nova Scotia is the safe and efficient movement of large volumes of people and goods at high speeds over long distances while minimizing negative economic, social and environmental impacts. Highway 102 is an important primary highway link for northern and eastern parts of the province, linking HRM to the Trans Canada Highway 104 in Truro. Highway 102 within the study area serves HRM as an urban commuter highway. Highway 102 includes the full length of Bayers Road from Windsor Street on the Halifax peninsula to the start of the access controlled Highway 102 at Joseph Howe Drive a distance of approximately 2.5 kilometres. The controlled access Highway within the study area; from Joseph Howe Drive to Exit 5 is approximately 24 km in total length with a total of nine (9) existing interchanges with arterial roadways or other 100 series Highways. The full project study area is shown on the attached ***Figure 1.0***

The study has three main components with specific objectives:

- Complete Traffic Projections for Highway 102 and 107 (Component 1)
- Identify Highway 102 Upgrade Requirements based on Component 1 (Component 2)
- Review the Highway 107 Extension to Highway 102 (Component 3)

Transportation Infrastructure Forecasts

The study has identified many potential changes to the corridor over a long section. The study analysis is based on modeling of population growth, trip generation and includes projected transit use. The results of the study indicate that ultimately in the 30 year design horizon, the existing four-lane Highway 102 would require to be expanded to a six lane highway to maintain an acceptable level of service. The expanded Highway 102 and new Highway 107 would be divided, controlled access highways with narrow medians and design speeds of up to 120 km/h. Construction would be phased over 30 years. Additional auxiliary lanes to interchange ramps would be provided as warranted.

At this stage in the planning, economic, environmental, and social impacts have been considered at a high level. Further study is required. This study has focused on traffic impacts and the safe transportation of the travelling public.

Public Information Session

Several factors including, but not limited to public input, environmental impact, and design issues play a vital role in the development of highway infrastructure. The purpose of these Public Information Sessions is to explain the study and obtain information and feedback from local residents, businesses, and land owners. Public involvement in this project will enable us to continue with planning for the future.

Time Line / Next Steps

The phases required prior to consideration of any future construction include further study, further public Information Sessions, and environmental assessment. The next step is to finalize the study report and conduct a cost / benefit analysis for the proposed Highway 107 extension. As well, a Transit Corridor Study will be undertaken by HRM.

Additional Information

For Additional Information, please contact:

Dwayne Cross, P. Eng.
NSTIR , Highway Planning and Design
Tel: 424-2940 or by e-mail at crossdw@gov.ns.ca

Dave McCusker, P.Eng.
HRM Regional Transportation
Tel: 490-6696 or by email at mccuskd@halifax.ca

Or visit: www.halifax.ca

HALIFAX
REGIONAL MUNICIPALITY

NOVA SCOTIA
Transportation and
Infrastructure Renewal

PUBLIC INFORMATION SESSIONS
BAYERS ROAD / HIGHWAY 102 / HIGHWAY 107 CORRIDOR STUDY
COMMENT FORM

Thank you for taking the time to visit us today. Your input is a valuable tool which will help us move forward with infrastructure planning which best satisfies the needs of the communities and the travelling public. We would appreciate if you would take a few minutes to answer the following questions. Either complete this form today and leave in the drop-off box, or return by mail or fax **by April 03, 2009.** Contact information is at the bottom of Page 2

PLEASE NOTE: The results of the comment forms will be summarized in a Report, but individual forms and names will be kept private and confidential.

Name: ______________________________

Organization (if any): ______________________________

Mailing address: ______________________________

____

Telephone: ______________

E-mail: ______________

A) **Which potential impacts concern you the most regarding the functional drawings presented?** Please rank from 1 to 6, with **1** being the ***most important*** and **6** being the ***least important***.

_____ Local Business	_____ Property
_____ Natural Resources	_____ Environment
_____ Community Life	_____ Health and Safety

B) We are early in the study process, and **we want to be made aware of any information, concerns, environmental features, etc.** you may have or know of that will assist us with defining the scope of future studies. Use the back of the form if more space is required.

____

____

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____

C) The following statements review a few issues **related to the Bayers Road / Highway 102 / Highway 107 Corridor Study** and allow you to rank their importance in relation to your personal opinion. **Please circle the answer that best reflects your views.**

1	The Corridor is being studied as one unit since the roadways are linked and influence each other. This is a good approach in the initial study.	Agree	Somewhat Agree	Neutral	Somewhat Disagree	Disagree	No Opinion
	Comment:						
2	Congestion at some locations in the existing corridor is having a negative affect on public health and safety.	Agree	Somewhat Agree	Neutral	Somewhat Disagree	Disagree	No Opinion
	Comment:						
3	The expanded roadways will have a positive impact on public health and safety and community life.	Agree	Somewhat Agree	Neutral	Somewhat Disagree	Disagree	No Opinion
	Comment:						

4	The expanded roadways will increase economic development activities and opportunities.	Agree	Somewhat Agree	Neutral	Somewhat Disagree	Disagree	No Opinion
	Comment:						
5	Some of the suggested roadway changes will improve the current conditions	Agree	Somewhat Agree	Neutral	Somewhat Disagree	Disagree	No Opinion
	Comment (which changes do you agree with?):						
6	Some of the suggested roadway changes will degrade the current conditions	Agree	Somewhat Agree	Neutral	Somewhat Disagree	Disagree	No Opinion
	Comment (which changes do you disagree with?):						

D) The following statements review a number of issues related to **today's session** and allow you to rank their importance in relation to your personal opinion. **Please circle the answer that best reflects your views.**

1	Having a presentation at the start of the information session was useful.	Agree	Somewhat Agree	Neutral	Somewhat Disagree	Disagree	No Opinion
	Comment:						
2	The information session was well organized and easy to understand.	Agree	Somewhat Agree	Neutral	Somewhat Disagree	Disagree	No Opinion
	Comment:						
3	There was enough background information regarding the study to provide an informed opinion on the results and what might be considered in future study.	Agree	Somewhat Agree	Neutral	Somewhat Disagree	Disagree	No Opinion
	Comment:						

E) Please answer the following questions on today's working session:

1. How did you **first** find out about the public consultation? **Please check one.**

( ) Information in mailbox
( ) Newspaper
( ) Radio
( ) From someone you know

2. We will be returning to the public at future dates with more information regarding specific areas of the overall study. Is there a change in the format of the event you would like to see?

____

____

____

____

3. Do you have any additional comments which have not been discussed or requested of you today?

____

____

____

____

____

____

____

Stantec Consulting Ltd.
ATT: Bernadette Landry, P.Eng.
#1 South, 130 Eileen Stubbs Avenue
Halifax, Nova Scotia B3B 2C4
tel: 902-434-7331 fax: 902-462-1660
e-mail: bernadette.landry@stantec.com

Stantec

Stantec Consulting Ltd.
#1 South 130 Eileen Stubbs Avenue
Dartmouth NS B3B 2C4
Tel: (902) 434-7331
Fax: (902) 462-1660

March 16, 2009
File: 1333-20639/3A

«Owner1»
«MailingAddress1»
«MailingAddress2»

Dear Sir / Madame:

RE: Bayers Road / Highway 102 / Highway 107 Corridor Study

Stantec Consulting Ltd. is working on behalf of The Nova Scotia Department of Transportation and Infrastructure Renewal (NSTIR) and Halifax Regional Municipality (HRM). We are studying the Bayers Road/ Highway 102 Corridor from Windsor Street, Halifax, to Fall River and Highway 107 from Burnside to Bedford. A description of the study is included on the attached Fact Sheet and map. The objective of the study is to identify transportation infrastructure needs and preserve the corridor for potential expansion of the roadways sometime in the future. This process does not imply that construction will take place.

The purpose of the Public Information Sessions is to provide an opportunity for land owners and the general public to review the results of the study and have input in the process. Our staff, as well as NSTIR and HRM representatives, will be in attendance at the Public Information Sessions to discuss the study and answer any questions.

The study team has located properties that may be affected by the changes being considered for the roadways. You have been identified as the owner of a property which may be affected. The following Public information Sessions will be held:

- **Wednesday, March 25, 2009 at the Sackville High School, 1 Kingfisher Way, Lower Sackville, from 6pm to 9pm with a presentation at 6:30pm,**
- **Thursday, March 26, 2009 at the Park Plaza Hotel and Conference Centre, Ramada Plaza, 240 Brownlow Avenue, Dartmouth, from 4pm to 6pm.**

If you have questions regarding the upcoming public information sessions, please do not hesitate to contact me at 434-7331 or by e-mail at bernadette.landry@stantec.com As well contacts for NSTIR and HRM respectively are Mr. Dwayne Cross at 424-2940, crossdw@gov.ns.ca and Mr. Dave McCusker at 490-6696, mccuskd@halifax.ca .

Sincerely,

STANTEC CONSULTING LTD.

B. Landry

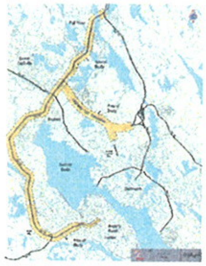
Bernadette Landry, P.Eng., Project Manager
Attachments: Fact Sheet and Study Area Map

Bayers Road / Highway 102 / Highway 107

Corridor Study

Public Information Session Presentation

February 11th & 12th, 2009



One Team. Infinite Solutions

Stantec

Study Team (Steering Committee)

NOVA SCOTIA
Transportation and Infrastructure Renewal

TIR
Dwayne Cross
Mike Croft
Brian Ward

HALIFAX REGIONAL MUNICIPALITY

HRM
Dave McCusker
Alan Taylor

Stantec
delphiMRC

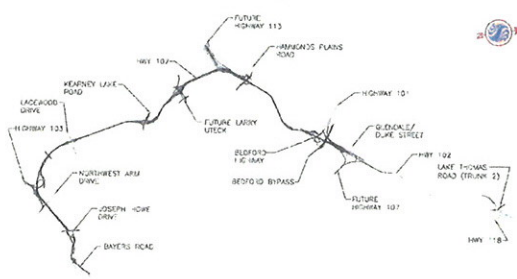
STANTEC
Bernadette Landry
Jamie Copeland
Pat Chouinard
Gerry Boulos

Stantec

Study Area

Stantec

Study Area and Existing Conditions



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Scope of the Study

The study has three main components with specific objectives:

- **Component 1:** Traffic Projections for Bayers Road / Highway 102 and Highway 107
- **Component 2:** Identify Bayers Rd / Highway 102's lane requirements
- **Component 3:** Review the Highway 107 Extension to Highway 102

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Context of the Study

- The Study has a defined scope
- The Study has a defined Study Area
- Traffic Projections (forecasting the future)
- Roadway Widening and New Roads
- Regional Planning Considerations

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Context of the Study

Other studies and work done:
- Regional planning work
- Harbour crossing studies
- Armdale Rotary and Chebucto Road work

The network beyond the Study Area may require changes to provide the desirable performance within the corridor
- Peninsular Halifax, Highway 103, Hammonds Plains Road

Suggested changes may be considered too severe and conscious decisions to not implement the changes might be made
- Unacceptable Property or Environmental Impacts

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Study Objectives

Objectives:
- to identify transportation infrastructure needs
- to preserve the corridor for potential expansion of the roadways sometime in the future.

Note:

- This process does not imply that construction will take place.

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Component 1
Traffic Projections

Modeling – HRM QRSII
- Demographics: Population Forecasts and Employment Distribution
- Single Vehicles versus Transit Use

Regional Planning
- Projected transit use is aggressive
- Funding is allocated for Transit Initiatives
- Funding is not allocated for the roadwork suggested here

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Component 1 – Traffic Projections

Analysis Methodology - Scenarios and Time Horizons

Future Road Network Scenarios

Scenario A – Existing road infrastructure + currently planned network upgrades (traffic signals, new roads, etc)

Scenario B – All the upgrades in Scenario A with Highway 113 + Highway 107 extension connecting at Exit 4C (Duke Street)

Scenario C – All the upgrades in Scenario A + Highway 113 + Highway 107 extension connecting directly with Highway 101 (Bedford Cloverleaf Interchange)

Time Horizons	Peak Hours
2016	AM
2026	PM
2036	

This resulted in 18 model scenarios

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Component 1 – Traffic Projections

Traffic Analysis Results

*Exhibit 1: Forecast number of mainline lanes for Scenario A (both directions)**

Location	Forecast Mainline Lanes - Scenario A		
	2016	2026	2036
Windsor St. to Connaught	4	6	6
Connaught to Joseph Howe Dr	6	6	6
Joseph Howe Dr to Hwy 103	6	6	8
Hwy 103 to Hammonds Plains	4	6	6
Hammonds Plains to Hwy 101	4	4	6
Hwy 101 to Hwy 118	4	4	4

*Exhibit 2: Forecast number of mainline lanes for Scenarios B & C (both directions)**

Location	Forecast Mainline Lanes - Scenarios B & C		
	2016	2026	2036
Windsor St. to Connaught	4	4	6
Connaught to Joseph Howe Dr	4	6	6
Joseph Howe Dr to Hwy 103	6	6	6
Hwy 103 to Hwy 113	4	6	6
Hwy 113 to Hwy 101/107	4	6	6
Hwy 101/107 to Hwy 118	4	4	4

*The forecast number of lanes is based on accommodating the peak flow for both directions. Reversing lanes are not considered.

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Component 2
Bayers Road and Hwy 102

- Infrastructure Needs Assessment
- Potentials and Constraints
- HOV (High Occupancy Vehicle) Lanes
- Design Criteria
- Concept Drawings

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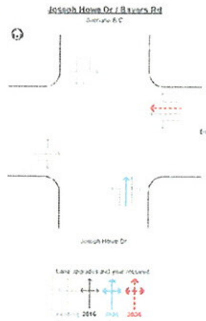
Component 2 – Bayers Road and Highway 102

Forecast of Infrastructure Needs – Intersections

Intersection Needs and Staging
- Laning requirements for 19 intersections,
- Three road network scenarios and
- Three time horizons per intersection



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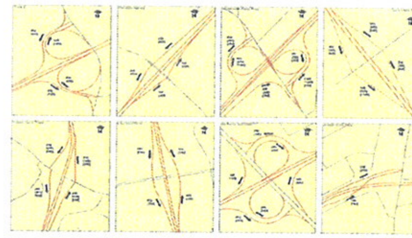
Component 2 – Bayers Road and Highway 102

Forecast of Infrastructure Needs - Ramps

Forecast Corridor Ramp Volumes
- Laning requirements for 12 interchanges (9 existing and 3 new)
- Approximately 50 ramps
- Three network scenarios and three time horizons per ramp



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Component 2 – Bayers Road and Highway 102

Expansion Potential and Constraints

Some Key Considerations at the Outset:
- **The current right-of-way limits**
- **Adjacent property that is owned by HRM or NSTIR**
- **Adjacent property that is currently developed**
- **Environmental**
- **Power transmission lines**
- **Trunk municipal infrastructure**
- **Horizontal and vertical road geometry**
- **Bridge structures**
- **Rock outcrops**
- **Active Transportation paths / bikeways**

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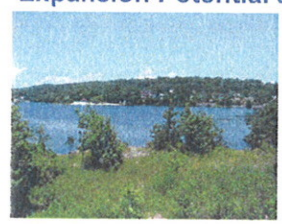
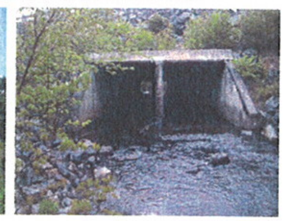
Component 2 – Bayers Road and Highway 102

Expansion Potential and Constraints





Environmental

Major Water Bodies within the Study Area
- **The Sackville River**
- **Kearney Run**
- **Wetland at Highway 113**
- **Lake Thomas**
- **Anderson Lake**

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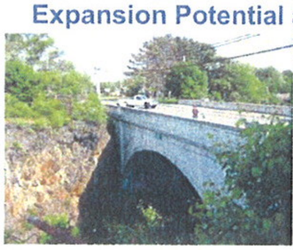
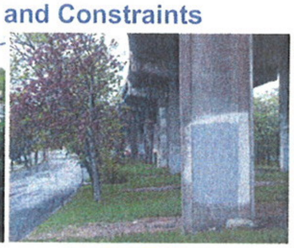
Component 2 – Bayers Road and Highway 102

Expansion Potential and Constraints





Structures
- 29 existing bridge structures within the study area
- Age varies. Many constructed in the 1960's
- Replacement and Rehabilitation

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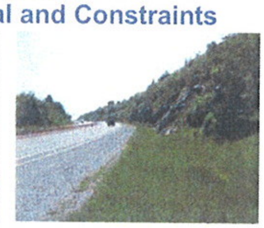
Component 2 – Bayers Road and Highway 102

Expansion Potential and Constraints



Other Built Infrastructure and Natural Features
- Power Transmission Lines
- Water Transmission Mains
- Rock

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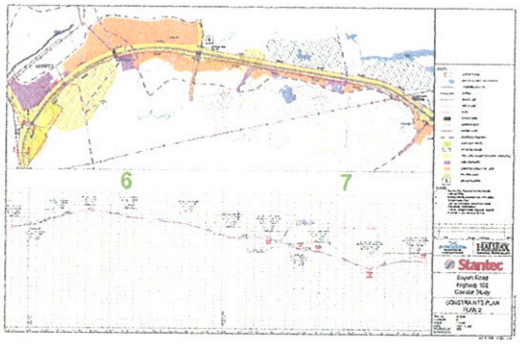
Component 2 – Bayers Road and Highway 102

Expansion Potential and Constraints



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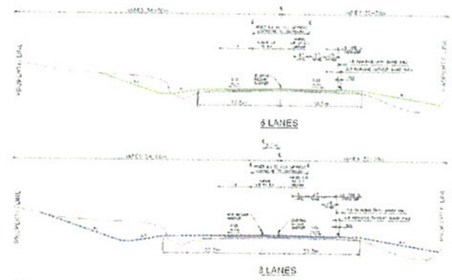
Component 2 – Bayers Road and Highway 102

Expansion Potential and Constraints



Typical Cross Section of Highway 102
- Red line represents existing ground
- Green and Blue lines show new roadway

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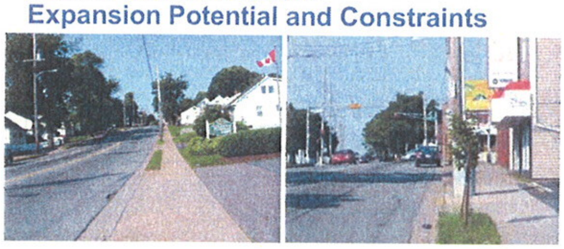
Component 2 – Bayers Road and Highway 102

Expansion Potential and Constraints



Commercial and Private Properties
- Bayers Road
- School Avenue in Fairview
- Other Properties along Highway 102 and Highway 107

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Component 2 – Bayers Road and Highway 102

Expansion Potential and Constraints

In summary, the primary objectives for the expansion design concepts are:
- to provide sufficient capacity for horizon traffic
- to maximize safety features (correction of sub-standard features)
- to minimize environmental impact
- to avoid impact to developed properties
- to minimize property acquisition
- to minimize impact to other municipal and power infrastructure

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Component 2 – Bayers Road and Highway 102

A Strategic Review of HOV (High Occupancy Vehicle) Lane Use

Objective:
Is there a benefit to adding HOV lanes in the corridor?

General Findings
- Corridor appears well suited to HOV lanes
- Highway 102 & Bayers Road are candidate sites
- Additional infrastructure could be deferred
- Will require constant management and enforcement
- More detailed analysis required – Region-wide Plan

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Component 2 – Bayers Road and Highway 102

Conceptual Drawings

The purpose of producing conceptual drawings is to apply the results of the Needs Assessment at the ultimate build-out year (2036 for this Study) and see what this looks like.

The results outlined so far including

- Mainline Lane Needs
- Intersection and Interchange Ramp Needs
- Design Criteria

were applied to terrain mapping of the corridor.

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Component 3
Highway 107

- History
- Connection to Highway 102 Options
- Alignment Options
- Design Criteria
- Phasing

Component 3 – Highway 107

Highway 107 Connection to Highway 102

Two key options considered

- Connection to the Duke Street Interchange (Exit 4C)
- Connection to the Highway 101 / Highway 102 Interchange (Exit 4)

Component 3 – Highway 107

Phasing Evaluation - 1

Burnside Drive Extension Concept

- Extend Burnside Drive to Duke Street
- Major Intersection at Akerley Blvd and Rocky Lake Rd
- No other connection points

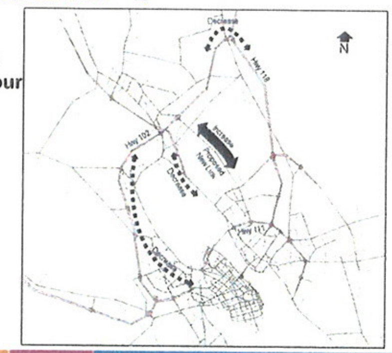
General Findings

- Strong desire for drivers to use facility
- 4-lane cross-section to the 2026 horizon
- The following upgrades should be considered:
  - The Highway 111/Burnside Drive interchange by 2016
  - The Akerley Boulevard intersection by 2026

Component 3 – Highway 107

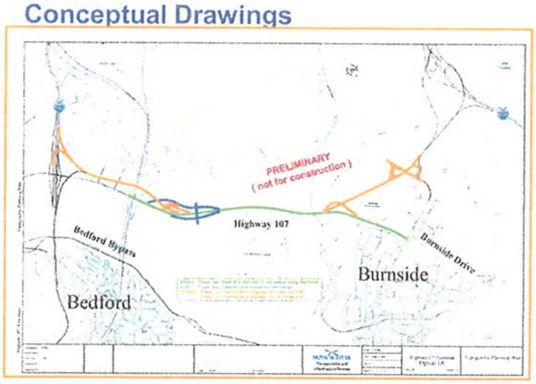
Phasing Evaluation - 2

Impacts to the Travel Behaviour



Component 3 – Highway 107

Conceptual Drawings



Next Steps

- **Finalize the Study Report**
- **Conduct a Cost Benefit Analysis for Highway 107 Extension**

The Study Report will guidance for future work such as

- **Overpass and Interchange ramp rehabilitation**
- **Design of Larry Uteck Interchange**
- **Design of Washmill Lake Court (Bayers Lake) Underpass**
- **Development of HRM's Transit Corridor**
- **Review of development applications**

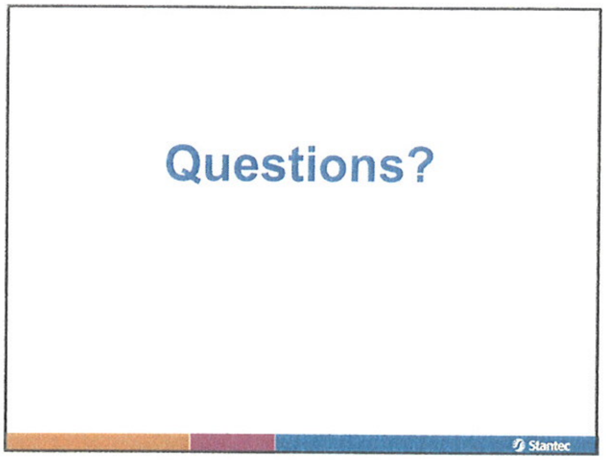

Questions?
Stantec

TABLE K-1

Response	PRIORITIES						C1	C2	C3	C4	C5	C6	D1	D2	D3	Source
	Local Business	Natural Resources	Community Life	Property	Environment	Health and Safety	Corridor studied as one unit is good idea	Congestion at some locations in the corridor is having a negative affect on health and safety	Expansion will have positive Impact on health and Safety, Community	Expansion will have positive Impact on Economy	Expansion will Improve health and safety conditions	Expansion will degrade health and safety conditions	Presentation at Start was useful	Session was well organized	There was sufficient background info	Mailbox / Radio / Newspaper / Friend
1	2	2	2	1	2	2	Disagree	Somewhat Agree	Disagree	Disagree	Disagree	Neutral	Disagree	-	Disagree	Mail-box
2	6	5	3	4	1	2	Disagree	Disagree	Disagree	Disagree	Disagree	Agree	Somewhat Agree	Somewhat Disagree	Disagree	Newspaper
3	-	-	-	-	-	-	Disagree	-	Disagree	Disagree	No Opinion	-	-	-	-	Other Person
4	6	1	1	1	1	1	Disagree	Agree	Disagree	Disagree	Disagree	Disagree	Neutral	Neutral	Somewhat Disagree	Mail-box
5	-	-	1	1	-	1	-	Disagree	Disagree	Disagree	Disagree	Agree	Agree	Agree	Somewhat Agree	Mail-box
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	e-mail
7	1	1	1	1	1	1	Somewhat Agree	Somewhat Agree	Disagree	Disagree	Agree	Agree	Neutral	Neutral	Neutral	Mail-box
8	-	-	1	-	-	-	Agree	-	-	-	-	-	Somewhat Agree	Somewhat Disagree	Agree	Newspaper
9	2	2	1	1	1	1	Somewhat Agree	Disagree	Disagree	Disagee	Disagree	Agree	Disagree	Disagree	Somewhat Agree	Other Person
10	1	1	1	1	1	1	Disagree	Disagree	Disagree	Disagee	Disagree	Agree	Somewhat Agree	Disagree	Disagree	Newspaper
11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	-	-	-	-	-	-	Disagree	Disagree	Disagree	Disagree			Disagree	Disagree	Disagree	Newspaper
13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14	6	5	1	3	2	4	Disagree	Disagree	Disagree	Agree	Disagree	Agree	Agree	Disagree	Disagree	Other Person
15	2	4	3	1	6	5	Agree	Agree	Agree	Agree	Agree	Disagree	Agree	Agree	Agree	Newspaper
16	6	4	1	5	2	3	Neutral	Neutral	Somewhat Disagree	Somewhat Disagree	Somewhat Disagree	Disagree	Neutral	Neutral	Neutral	Newspaper
17	2	1	1	1	1	1	Somewhat Disagree	Neutral	Somewhat Agree	Disagree	Agree	Agree	Disagree	Neutral	Disagree	Mail-box
18	-	-	-	-	-	-	Agree	Neutral	Neutral	Agree	Neutral	Neutral	Agree	Agree	Agree	Mail-box
19	6	5	4	1	2	3	Agree	Disagree	Disagree	Neutral	Disagree	Agree	Agree	Disagree	Disagree	Mail-box
20	-	-	-	-	-	-	Somewhat Agree	Agree	Disagree	Disagree	Disagree	Agree	Disagree	Disagree	Disagree	Mail-box
21	-	-	-	-	-	-	Somewhat Agree	Agree	Disagree	Disagree	Agree	Agree	Disagree	No Opinion	Disagree	Mail-box
22	6	5	4	2	3	1	Somewhat Disagree	Somewhat Agree	Disagree	Disagree	Somewhat Disagree	Agree	No Opinion	No Opinion	No Opinion	Other Person
23	6	5	4	3	2	1	Agree	Somewhat Agree	Disagree	Disagree	Disagree	Agree	Somewhat Agree	Somewhat Disagree	Disagree	Mail-box
24	1	1	1	1	1	1	Neutral	Neutral	Neutral	Neutral	Somewhat Agree	Somewhat Agree	Somewhat Disagree	Somewhat Disagree	Disagree	Mail-box
25	4	5	1	1	2	2	Disagree	No Opinion	Disagree	Disagree	Disagree	Agree	Disagree	Disagree	Disagree	-
26	-	-	-	-	-	-	Disagree	Disagree	Disagree	Disagree	Disagree	Agree	Disagree	Disagree	Disagree	Radio
27	6	5	3	4	1	2	Disagree	Disagree	Disagree	Neutral	-	-	Somewhat Agree	Disagree	Disagree	Newspaper
28	3	6	2	1	5	4	Disagree	Neutral	Somewhat Disagree	Somewhat Agree	Somewhat Agree	Agree	Disagree	Somewhat Disagree	Neutral	Other Person
29	5	2	4	6	1	3	Somewhat Agree	Somewhat Agree	-	Agree	Agree	Agree	No Opinion	No Opinion	Somewhat Disagree	Other Person
30	5	6	4	1	3	2	Disagree	Somewhat Disagree	Disagree	Disagree	Somewhat Disagree	Agree	Disagree	Disagree	Somewhat Disagree	Newspaper
31	-	-	-	-	-	-	Disagree	Agree	Disagree	-	-	-	Agree	Disagree	-	Other Person
32	6	6	6	6	6	6	Disagree	Disagree	Disagree	Disagree	Disagree	Agree	Somewhat Agree	Disagree	Disagree	Other Person
33	3	6	1	1	2	1	Somewhat Disagree	Somewhat Disagree	Disagree	Disagree	Disagree	Somewhat Agree	Agree	Disagree	Disagree	Mail-box
34	-	-	-	-	-	-	Disagree	Somewhat Disagree	Disagree	Disagree	Disagree	Agree	Disagree	Disagree	Disagree	Radio
35	3	6	4	1	5	2	Agree	Somewhat Disagree	Disagree	No Opinion	Somewhat Agree	Somewhat Agree	Somewhat Agree	Agree	Neutral	Mail-box
36	6	2	4	1	3	5	Neutral	Agree	Neutral	Agree	Agree	-	Agree	Somewhat Agree	Agree	Other Person
37	1	1	1	1	1	1	Somewhat Disagree	Disagree	Disagree	Somewhat Agree	Somewhat Agree	Somewhat Agree	Somewhat Agree	Somewhat Agree	-	Newspaper
38	1	1	1	1	1	1	-	Somewhat Agree	Disagree	-	-	Agree	-	Disagree	-	Mail-box
39	1	1	1	1	1	1	Disagree	Somewhat Agree	Disagree	Disagree	Disagree	Agree	Neutral	Disagree	Disagree	Mail-box
40	-	-	2	1	-	-	Disagree	Somewhat Disagree	Disagree	Disagree	Disagree	Agree	Disagree	Somewhat Disagree	Disagree	Other Person
41	1	-	-	1	-	1	Disagree	Disagree	Disagree	Disagree	Disagree	Agree	Disagree	Disagree	Disagree	Mail-box

Total Respons	27	26	29	29	26	28
1st Priority Ind	26%	31%	52%	72%	46%	50%

	C1	C2	C3	C4	C5	C6	D1	D2	D3	Average
Total Responses	36	37	36	35	34	33	36	38	34	**35**
% Negative wrt Study and Results	64%	49%	86%	69%	65%	85%	39%	71%	68%	**66%**
% Positive wrt Study and Results	28%	35%	6%	20%	29%	9%	44%	11%	18%	**22%**
% Neutral / No Opinion	8%	16%	8%	11%	6%	6%	17%	18%	15%	**12%**

TABLE K-2

Response No.	PRIORITIES						C1	C2	C3	C4	C5	C6	D1	D2	D3	Source
	Local Business	Natural Resources	Community Life	Property	Environment	Health and Safety	Corridor studied as one unit is good idea	Congestion at some locations in the corridor is having a negative affect on health and safety	Expansion will have positive Impact on health and Safety, Community	Expansion will have positive Impact on Economy	Expansion will Improve health and safety conditions	Expansion will degrade health and safety conditions	Presentation at Start was useful	Session was well organized	There was sufficient background info	Mailbox / Radio / Newspaper / Friend
42	6	4	1	5	3	2	Agree	Agree	Agree	Agree	Somewhat Agree	Somewhat Agree	Agree	Agree	Agree	Radio
43	-	-	-	-	-	-	Agree	Disagree	Agree	-	-	-	-	-	-	-
44	3	6	1	5	2	4	Agree	Agree	Agree	Somewhat Agree	Agree	Neutral	Agree	Somewhat Disagree	Agree	Other Person
45	6	3	2	4	1	5	No Opinion	Neutral	Disagree	No Opinion	No Opinion	No Opinion	Agree	Agree	Disagree	Other Person
46	6	4	2	5	3	1	Agree	Agree	Agree	Agree	Agree	Somewhat Agree	Agree	Somewhat Agree	Somewhat Agree	Newspaper
47	6	4	2	5	3	1	Somewhat Agree	Agree	Agree	No Opinion	Agree	No Opinion	Agree	Agree	Agree	Newspaper
48	6	3	4	5	2	1	Neutral	Agree	Somewhat Agree	Agree	Agree	Agree	Agree	Somewhat Agree	Neutral	Radio
49	-	1	1	-	1	-	Agree	Agree	Neutral	Neutral	Somewhat Agree	Neutral	Agree	Agree	Somewhat Agree	Newspaper
50	5	4	3	6	1	2	Agree	Somewhat Agree	Disagree	Somewhat Disagree	Somewhat Agree	Somewhat Agree	Agree	Somewhat Agree	Somewhat Agree	Newspaper
51	5	4	2	6	3	1	-	Agree	Somewhat Agree	Agree	Agree	Somewhat Agree	Agree	Somewhat Agree	Agree	Other Person
52	3	5	2	6	4	1	Agree	Agree	Agree	Agree	Agree	Disagree	Agree	Agree	Agree	Other Person
53	4	6	1	5	2	3	Agree	Agree	Agree	Agree	Agree	Somewhat Agree	Somewhat Agree	Somewhat Agree	-	Newspaper
54	6	2	3	5	1	4	No Opinion	No Opinion	Disagree	No Opinion	No Opinion	Agree	Agree	Agree	Agree	Other Person
55	-	-	-	-	-	-	Agree	-	-	-	-	-	Agree	Agree	Disagree	Newspaper
56	2	6	3	4	5	1	Disagree	Agree	Agree	Agree	Agree	Disagree	Agree	Neutral	Somewhat Agree	Newspaper
57	-	-	-	-	1	-	Agree	Somewhat Agree	Agree	Somewhat Agree	-	-	Agree	Somewhat Agree	Somewhat Agree	Newspaper
58	6	1	3	5	2	4	Somewhat Disagree	Neutral	Somewhat Disagree	Somewhat Agree	Somewhat Agree	Somewhat Agree	No Opinion	Somewhat Agree	Somewhat Agree	Other Person
59	3	5	2	4	6	1	Agree	Neutral	Agree	Agree	Agree	Neutral	Agree	Agree	Agree	Newspaper
60	6	1	1	6	1	1	Neutral	Somewhat Agree	Somewhat Disagree	Agree	Agree	Agree	Agree	Agree	Agree	-
61	1	4	6	5	2	3	Neutral	Agree	Agree	Agree	Agree	Disagree	-	-	-	-
62	1	6	4	3	5	2	Disagree	Agree	Agree	Agree	Agree	Somewhat Agree	No Opinion	Somewhat Agree	Somewhat Agree	Newspaper
63	5	4	2	6	3	1	Agree	Agree	Somewhat Agree	Somewhat Agree	Somewhat Agree	Neutral	-	Somewhat Agree	Neutral	Other Person

Total Responses	19	20	20	19	21	19
1st Priority Indicated	11%	15%	25%	0%	29%	47%

	C1	C2	C3	C4	C5	C6	D1	D2	D3	Average
Total Responses	21	22	22	21	20	19	21	21	20	**21**
% Negative wrt Study and Results	14%	5%	23%	5%	0%	42%	0%	5%	10%	**11%**
% Positive wrt Study and Results	62%	77%	73%	76%	90%	26%	90%	90%	80%	**74%**
% Neutral / No Opinion	24%	18%	5%	19%	10%	32%	10%	5%	10%	**15%**

APPENDIX L
Costing

Typical Road Construction Costs including excavation

Pavement Widening **Square Meter Cost including Common Excavation**

Description	Unit Price	Unit	Assumed Depth mm	Conversion Factor tonne/cu.m.	Cost per sq m	Say
Asphalt - surface course - Type C	$120.00	tonne	50	2.55	$15.30	$16.00
Asphalt - base course - Type B (two lifts)	$110.00	tonne	100	2.45	$26.95	$27.00
Gravels - Type 1	$25.00	tonne	150	2.2	$8.25	$9.00
Gravels - Type 2	$25.00	tonne	400	2	$20.00	$20.00
Common Excavation	$25.00	cu m	700	1	$17.50	$18.00
Total			700		$88.00	**$90.00**

Gravel Shoulder Structure - Square Meter Cost including Common Excavation (unpaved)

Description	Unit Price	Unit	Assumed Depth mm	Conversion Factor tonne/cu.m.	Cost per sq m	Say
Gravels - Type 1S	$30.00	tonne	150	2.2	$9.90	$10.00
Gravels - Type 1	$25.00	tonne	150	2.2	$8.25	$9.00
Gravels - Type 2	$25.00	tonne	400	2	$20.00	$20.00
Common Excavation	$16.00	cu m	700	1	$11.20	$12.00
Total			700		$49.35	**$51.00**

Highway Shoulder Construction - Wide shoulder with guard rail

Description	Unit Price	Quantity per m	unit	per		Cost per m of Road	
Paved Part of Shoulder	$90.00	2.50	sq m	m of road		$225.00	
Unpaved Part of Shoulder	$51.00	3.90	sq m	m of road		$198.90	
Guard Rail	$80.00			m of road		$80.00	
Misc Items Landscaping / Painting / Trees / Signs	- not included here, added to final estimate						
(no sanitary or water services)							say
						$503.90	**$500.00**

Ramp Shoulder Construction - Narrow shoulder, no guard rail

Description	Unit Price	Quantity per m	unit	per		Cost per m of Road	
Paved Part of Shoulder	$90.00	0.50	sq m	m of road		$45.00	
Unpaved Part of Shoulder	$51.00	3.35	sq m	m of road		$170.85	
Guard Rail	$50.00			m of road		$50.00	
Misc Items Landscaping / Painting / Trees / Signs	- not included here, added to final estimate						
(no sanitary or water services)							say
						$265.85	**$300.00**

4 lane Urban Arterial with bike lanes, raised median, Pavement Width = 16 m

Description	Unit Price	Quantity per m	unit	per		Cost per m of Road	
Pavement Structure	$90.00	16.00	sq m	m of road		$1,440.00	
Curb and gutter	$75.00	4.00	m	m of road		$300.00	
Concrete Sidewalk - both sides + median	$90.00	4.50	sq m	m of road		$405.00	
Storm Sewer - Local Drainage (see calc. below)	$430.00	1.00	m	m of road		$430.00	
Misc Items Landscaping / Painting / Trees / Signs	- not included here, added to final estimate						
(no sanitary or water services)							say
						$2,575.00	**$2,600.00**
				5 lane Urban Arterial add	$315.00	$2,890.00	**$2,900.00**
				6 lane Urban Arterial add	$630.00	$3,205.00	**$3,300.00**

2 lane urban local, 9m width, no median , Pavement Width = 9 m

Description	Unit Price	Quantity per m	unit	per		Cost per m of Road	
Pavement Structure	$90.00	9.00	sq m	m of road		$810.00	
Curb and gutter	$75.00	2.00	m	m of road		$150.00	
1.8 Concrete Sidewalk - both sides	$90.00	3.60	sq m	m of road		$324.00	
Storm Sewer - Local Drainage (see calc. below)	$430.00	1.00	m	m of road		$430.00	
Sanitary + Water Service	$500.00	1.00	m	m of road		$500.00	
Misc Items Landscaping / Painting / Trees / Signs	- not included here, added to final estimate						
							say
						$2,214.00	**$2,300.00**

4 lane rural section Highway with 5.6m Narrow Median with Jersey Barrier, Pavement Width = 20.4 m

Description	Unit Price	Quantity per m	unit	per		Cost per m of Road	
Pavement Structure	$90.00	20.40	sq m	m of road		$1,836.00	
Wide Shoulder with guard rail	$500.00	2.00	m	m of road		$1,000.00	
Storm Sewer **	$60.00	1.00	m	m of road		$60.00	
Jersey Barrier	$200.00	1.00	m	m of road		$200.00	
Misc Items Landscaping / Painting / Trees / Signs	- not included here, added to final estimate						
(no sanitary or water services)							say
**CB's and leads would be required for superelevated sections						$3,096.00	**$3,100.00**
				5 lane Highway add	$333.00	$3,429.00	**$3,500.00**
				6 lane Highway add	$666.00	$3,762.00	**$3,800.00**
				7 lane Highway add	$999.00	$4,095.00	**$4,100.00**
				8 lane Highway add	$1,332.00	$4,428.00	**$4,500.00**

Single Lane Ramp - Rural Section, Pavement Width = 5 m

6 lane rural section Highway with narrow median, jersey barrier	Unit Price	Quantity per m	unit	per		Cost per m of Road	
pavement structure	$90.00	5.00	sq m	m of road		$450.00	
Wide Shoulder (right) with guard rail	$500.00	1.00	m	m of road		$500.00	
Narrow Shoulder (left), no guard rail	$300.00	1.00	m	m of road		$300.00	
Misc Items Landscaping / Painting / Trees / Signs	- not included here, added to final estimate						
(no storm, sanitary or water services)							say
						$1,250.00	**$1,300.00**
				2 lane Ramp add	$216.00	$1,466.00	**$1,500.00**
				3 lane Ramp add	$549.00	$1,799.00	**$1,800.00**

Storm Sewer Typical Cost

	Unit Price	Quantity per m	unit	per		Cost per m of Road
Storm Sewer - Local Drainage	$300.00	1.00	m	m of road		$300.00
MH's	$3,000.00	1.00	each	100	m of road	$30.00
CB's	$2,500.00	2.00	each	50	m of road	$100.00
						$430.00
Storm Sewer - New CB's and Leads Only for widening	$3,000.00	1.00	each	50	m of road	**$60.00**

MASTER LIST USED IN COST TABLES

Code	Item	Cost	Unit
	WIDENING / EXCAVATION / ASSOCIATED ROADWAY WORK		
1	Pavement Widening	$90.00	m2
2	Highway Shoulder Construction - Wide shoulder with guard ra	$500.00	m
3	Excavation -Unclassified -	$25.00	m3
5	Curb and Gutter	$75.00	m
6	1.8 m Concrete Sidewalk	$150.00	m
7	Storm Leads and CB's	$60.00	m
8	Raised narrow median	$200.00	m
9	Storm Sewer with MH's, CB's - local drainage	$430.00	m
10	Crown Shift and New Jersey Barrier	$500.00	m
11	Retaining Wall - 1-3 m in height	$1,500.00	m
12	Retaining Wall - 3-7 m in height	$5,000.00	m
15	Trail with 300mm gravel and 50mm asphalt	$40.00	m2
	NEW ROADWAYS (including excavation for roadbase)		
19	local road - 9 m width	$2,300.00	m
20	4 Lane arterial roadway	$2,600.00	m
21	5 lane arterial roadway	$2,900.00	m
22	6 lane arterial roadway	$3,300.00	m
23	4-lane freeway with narrow median	$3,100.00	m
24	5-lane freeway with narrow median	$3,500.00	m
25	6-lane freeway with narrow median	$3,800.00	m
26	7-lane freeway with narrow median	$4,100.00	m
27	8-lane freeway with narrow median	$4,500.00	m
	NEW ROADWAYS (excluding excavation for roadbase)		
28	4 Lane arterial roadway	$2,300.00	m
29	4-lane freeway with narrow median	$2,800.00	m
29.3	5-lane freeway with narrow median	$3,000.00	m
29.6	6-lane freeway with narrow median	$3,300.00	m
	NEW RAMPS (including excavation for roadbase)		
30	Single Lane Ramp	$1,300.00	m
31	Two lane Ramp	$1,500.00	m
32	Three Lane Ramp	$1,800.00	m
	NEW RAMPS (excluding excavation for roadbase)		
33	Single Lane Ramp	$1,200.00	m
34	Two lane Ramp	$1,400.00	m
35	Three Lane Ramp	$1,600.00	m
	STRUCTURES		
40	New Bridge Structure	$3,500.00	m2
41	Expand Existing Bridge Structure	$5,000.00	m2
	INTERSECTIONS		
50	Intersection Signals	$150,000.00	each
51	Roundabout	$100,000.00	each
	DEMOLITION		
61	Bridge Demolition	$1,000.00	m2
62	Ramp / Road decommissioning	$200.00	m
	PROVISIONAL AMOUNTS		
70	Allowance for Engineering	0%	
71	Miscellaneous Items (Landscaping, paint, signage, etc.)	15%	
72	Design Contingency	0%	