West Royalty Commercial Area

Transportation Master Plan

Draft Final Report

CBCL

192651.02 • March 2021

	Draft Final Submission	M. MacDonald	03/10/2021	E. Nicolescu
	Draft submission	M. MacDonald	01/22/2021	E. Nicolescu
Issue or Revision		**Reviewed By:**	**Date**	**Issued By:**

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March 10, 2021

Scott Adams, P.Eng.
Manager of Public Works
City of Charlottetown
199 Queen Street
Charlottetown, PE C1A 4B7

Dear Mr. Adams:

RE: ***West Royalty Commercial Area: Transportation Master Plan – DRAFT FINAL Report***

CBCL Limited (CBCL) is pleased to present the findings of this comprehensive study of vacant lands adjacent to the main commercial area of Charlottetown. We understand there is increasing pressure from several property owners, primarily north and east of the Charlottetown Mall, to obtain City approval to move forward with various development plans. The main objective of this Transportation Master Plan is to assist City staff by providing strategies for future development and street connections to the existing road network needed to support this growth.

Yours very truly,

CBCL Limited

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Contents

Executive Summary 1

Modelling Approach 2

Existing Conditions 6

Future Conditions 7

Findings 11

Recommendations 11

Chapter 1 Introduction 1

1.1 Project Background 1

1.2 Study Objectives 2

1.3 Study Area 2

Chapter 2 Model Development 4

2.1 Overview 4

2.2 Travel Demand 5

AM Peak Hour 8

PM Peak Hour 8

Saturday Peak Hour 8

2.3 Network Coding 9

2.4 Model Calibration 11

AM Peak Hour 12

PM Peak Hour 14

Saturday Peak Hour 15

2.5 Model Validation 16

2.6 Future Conditions 17

Background Growth 17

Future Development - 2031 18

Future Development - 2041 20

Trip Generation 21

Chapter 3 Traffic Analysis 27

3.1 Existing Conditions 28
AM Peak Hour 28
PM Peak Hour 31
Saturday Peak Hour 33
3.2 2031 Conditions 36
Road Network Improvements 36
AM Peak Hour 48
PM Peak Hour 50
Saturday Peak Hour 53
3.3 2041 Conditions 55
Road Network Improvements 55
AM Peak Hour 59
PM Peak Hour 61
Saturday Peak Hour 63
Chapter 4 Other Considerations 65
4.1 Potential UPEI Connector Road 65
4.2 Active Transportation 67
4.3 Transit 67
4.4 Sherwood Residential Area 68
Chapter 5 Conclusions and Recommendations 70

Appendices

A Summary of Traffic Operations - AM Peak Hour
B Summary of Traffic Operations - PM Peak Hour
C Summary of Traffic Operations - Saturday Peak Hour

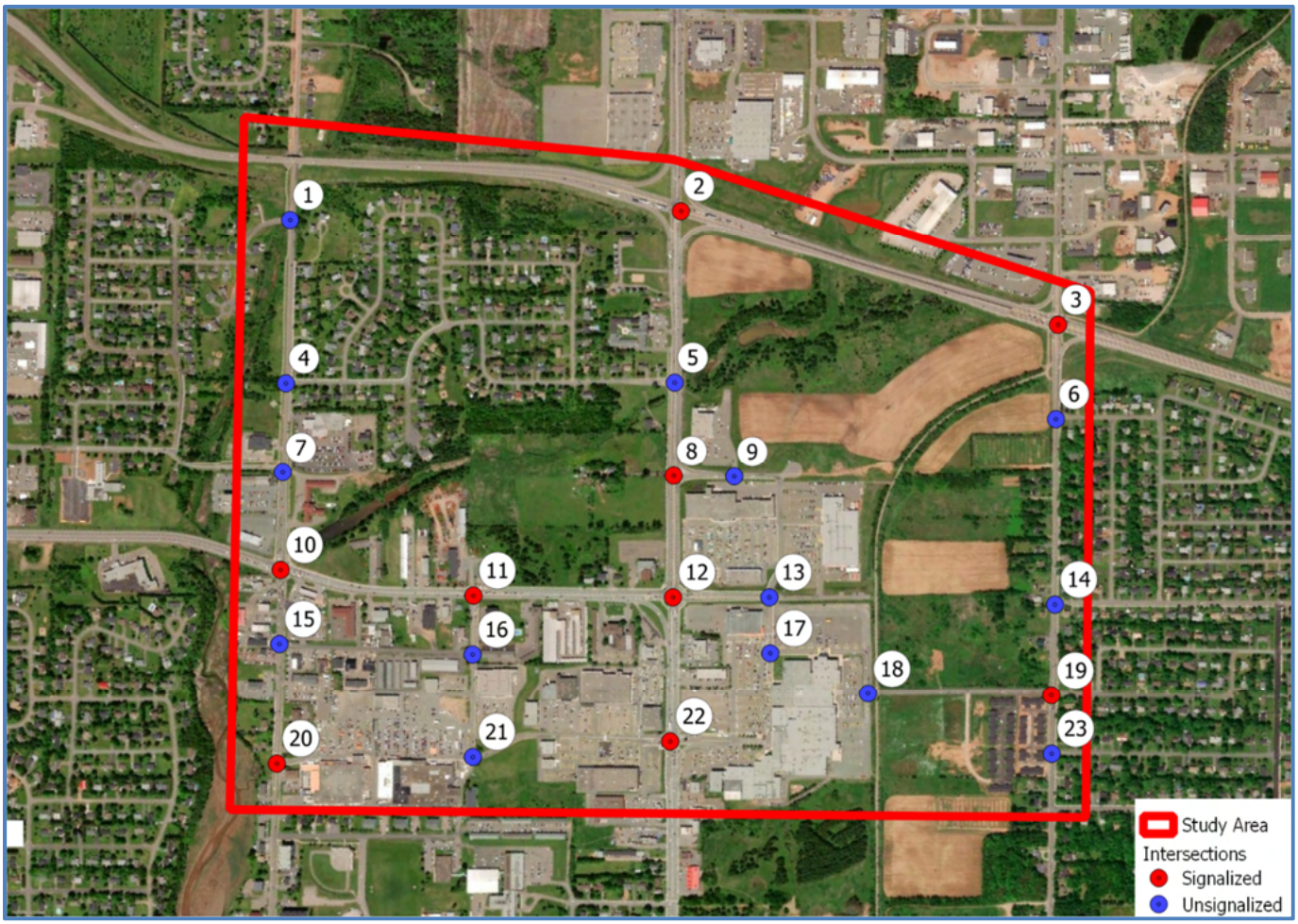
Executive Summary

The City of Charlottetown has been growing steadily in recent years. According to Statistics Canada, as of 2021, the City of Charlottetown has a population of 39,883, while the Charlottetown Region is home to over 80,000 people; this represents growth of over 12% since 2016. This growth has been manifested in significant development pressure, particularly for residential and commercial land uses.

Much of the City's remaining developable green-field land is located in the vicinity of the province's largest commercial area. Several of these property owners are now looking to develop their land so the City of Charlottetown commissioned this study. The main objectives are to forecast the growth in vehicular travel demand associated with development of the vacant lands owned by Saint Dunstan's University and the other undeveloped parcels to the east, north, and northwest of the Charlottetown Mall, and to investigate appropriate roadway extensions and intersection improvements to accommodate expected growth. The main objectives of this assignment are:

- To develop a comprehensive travel demand model for the study area
- To forecast future travel demands for horizon years 2031 and 2041 using the planning information currently available
- To develop a road network improvement strategy for both 2031 and 2041

The study area is generally bounded by North River Road/Lower Malpeque Road to the west, the Bypass to the north, and Mt. Edward Road to the east. The southern boundary is generally defined by a line connecting Burns Avenue with Oak Drive.



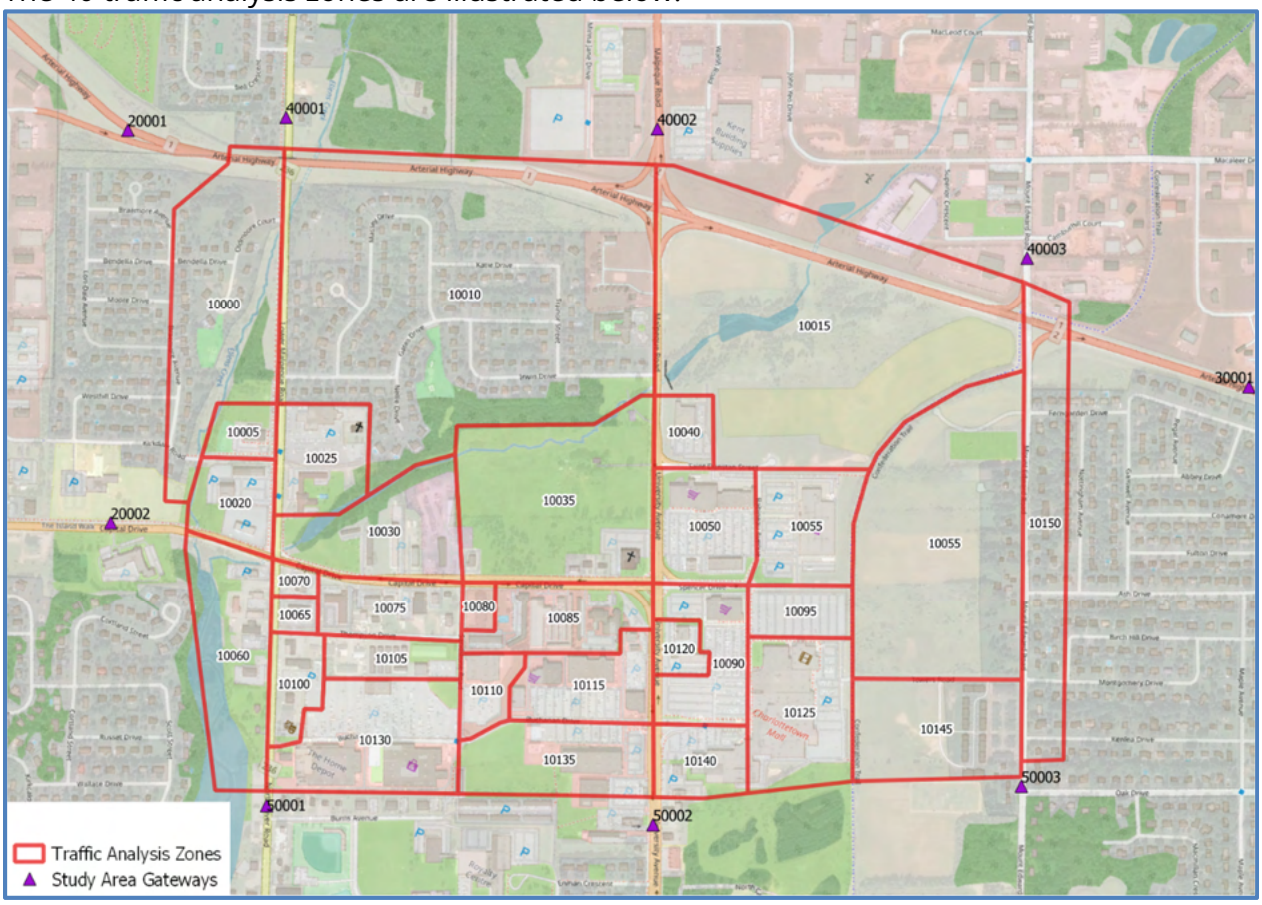
Modelling Approach

To best understand the impacts to traffic operations in the Study Area, a microsimulation model was built using the PTV VISSIM software. The model breaks down all traffic generated in a Study Area into smaller, more manageable Traffic Analysis Zones (TAZ), representative of individual blocks, discrete land uses, or functional clusters such as the Mall. All traffic generated by these TAZ's enters and exits a digital representation of the Study Area's road network via representative parking lots. Trips between TAZ's are loaded onto the road network via Origin-Destination (O-D) matrices, that aggregate individual trips over a given analysis period. Through an iterative process, the model seeks optimal paths over the road network between each O-D pair based on initial travel times, assigns a portion of the total volume on the road network, simulates the movement of each vehicle and road user between TAZ of Origin and TAZ of Destination, and re-iterates the process with updated travel times. The process is repeated until the assignment process converges on an optimal solution; at this point the model is said to have achieved Dynamic User Equilibrium, whereby the optimal paths between each TAZ have been found.

The Study Area was divided into 31 TAZ's representing the area's major functional blocks, bound by major roads and natural boundaries. The Study Area is accessed via nine (9) roadway gateways, each of which is represented by an additional TAZ:

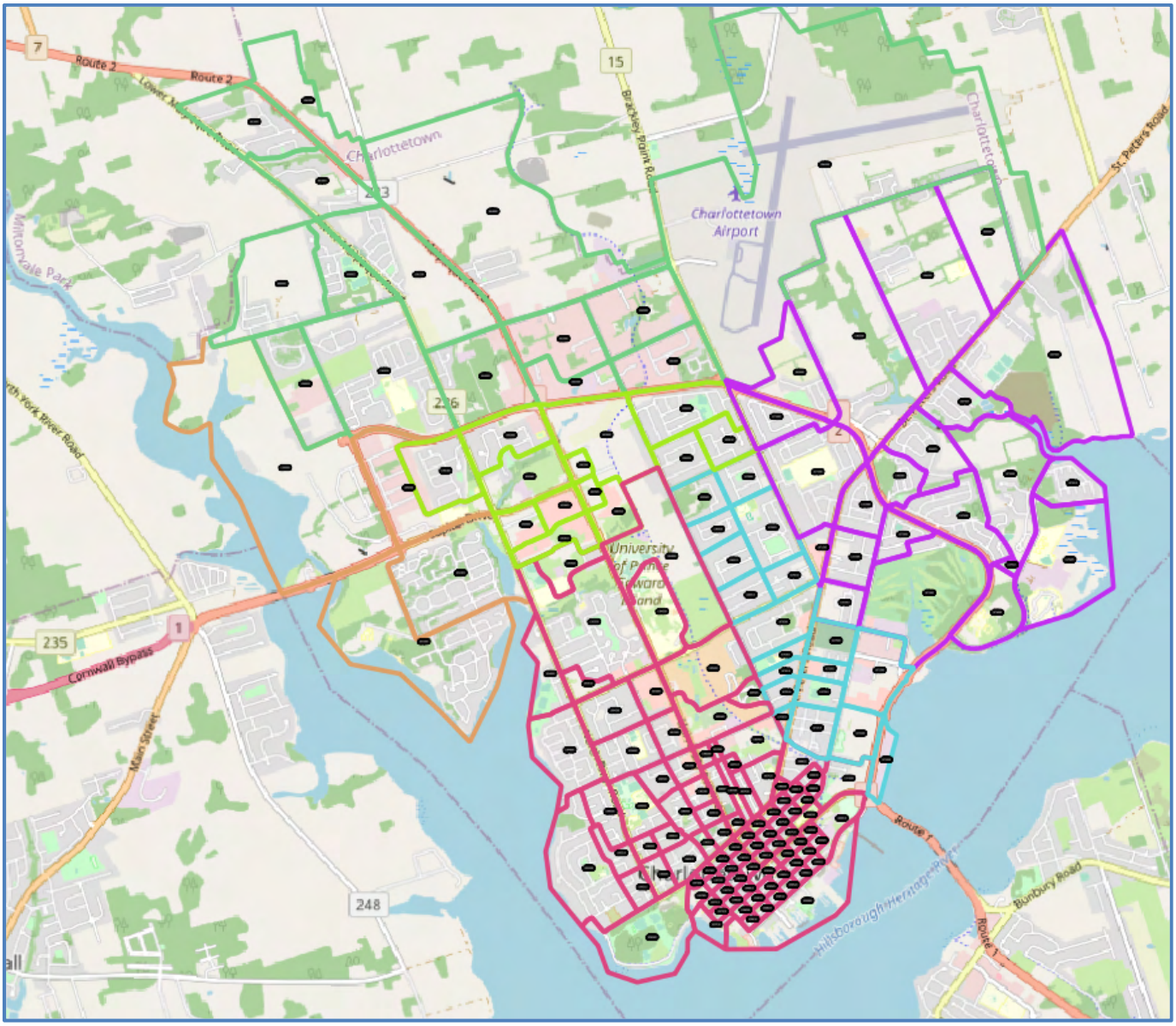
- Charlottetown Bypass Highway (East & West)
- Lower Malpeque Road
- North River Road
- Malpeque Road
- University Avenue
- Capital Drive
- Mount Edward Road (North & South)

The 40 traffic analysis zones are illustrated below.

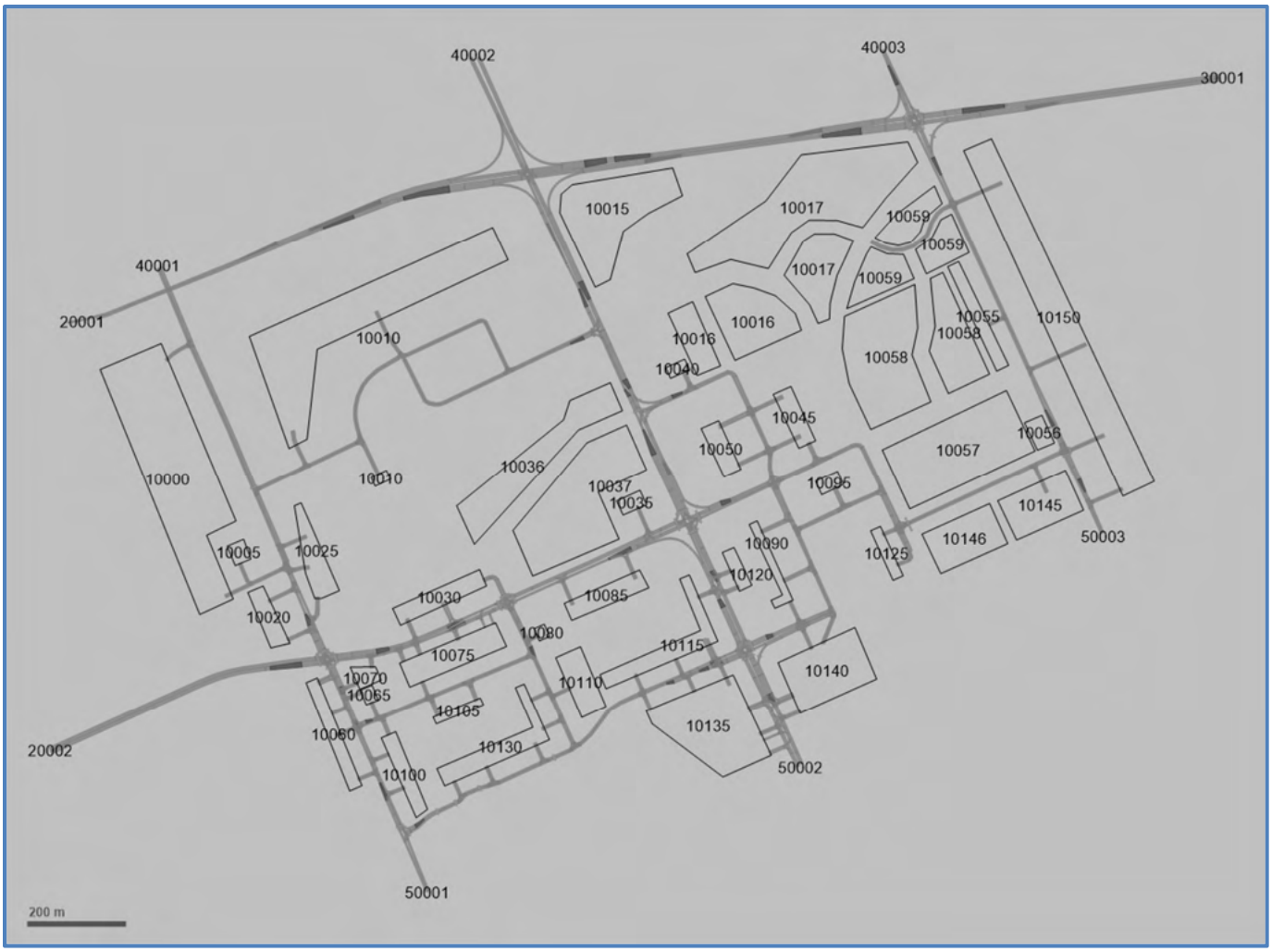


Travel demand, expressed as Origin-Destination matrices representing hourly trips between each of the 40 TAZ, was extracted from the city-wide VISUM travel demand model being built concurrently for the Charlottetown Growth Management Strategy (GMS) project. The detailed description of the VISUM model development is provided under separate cover as part of the GMS project deliverables.

The seed OD matrix extracted from the VISUM model matrix were balanced to the Study Area perimeter counts following the Furness two-factor method. This method iteratively factors origin and destination totals to observed volumes entering and exiting the Study Area perimeter, while maintaining the underlying OD patterns.



The PTV VISSIM platform allows the modelling of complex transportation networks and travel patterns with very high fidelity. The Study Area road network was reproduced in VISSIM with all geometric and functional parameters reflecting reality.



The model was calibrated to intersection turning movement counts undertaken between 2018 and 2020. Comparison with travel times reported by Google Maps demonstrates that the model produces valid travel time results and reproduces well the existing travel patterns.

Existing Conditions

AM Peak Hour

During the weekday AM peak hour, the Study Area is estimated to experience a volume of approximately 7,240 vehicular trips. Most of these trips (62%) are passing through, while the area attracts over 1,700 trips, and generates roughly 1,200 trips. As expected, the dominant local traffic flow is inbound, as regional residents travel to the Study Area for work. Less than 3% of all trips remain within the Study Area.

Traffic modelling suggests that some capacity constraints are currently experienced at the Capital Drive / North River Road intersection, particularly for the eastbound right turn movement, and on Capital Drive at the University/Malpeque/Spencer intersection.

PM Peak Hour

During the weekday PM peak hour, the Study Area experiences its peak travel demand, with over 9,060 vehicular trips. While the through component is still dominant, at 46% of all trips, the inbound and outbound volumes are also higher. We note two dynamics in the travel patterns; on one hand, we see close to 2,700 inbound trips representing both commuters returning home and visitors to the commercial areas; on the other hand, we observe over 3,000 trips outbound from the area, accounted by both commuters and shopping visitors leaving the area. The net effect is that both inbound and outbound volumes are higher than during the AM peak hour. We also note more internal trips, with a larger number of local residents making trips to the area's commercial zones.

During this congested time period, the study area experiences some capacity constraints on outbound movements, as well as on some critical movements at bottlenecks around the Mall.

Saturday Peak Hour

During the Saturday peak hour, the Study Area is estimated to experience a volume of over 7,700 trips moving through the area. Unlike during the weekday peak hours, during the Saturday peak we observe a very balanced distribution between inbound and outbound travel, almost entirely associated with commercial leisure trips. As the major retail hub for both the City and the province, the area attracts a very high volume of vehicular trips. Through movements are noticeably lower, accounting for about 40% of all trips.

Congestion hot spots are observed around the Mall and the Buchanan Drive commercial area, due to the high-level of friction between the various vehicular movements.

Future Conditions

The strength of a Dynamic Traffic Assignment model lies in its ability to simulate changes in traffic circulation, when starting from calibrated and validated conditions, and in response to changes in the road network, capacities and operations. The purpose of this model being to identify the road capacity changes that need to be in place to accommodate anticipated growth, the calibrated base model was expanded to reflect several future changes to the 2031 and 2041 horizons. Future growth will occur first, as a result of regional growth and development, and second, as a result of specific development within the study area.

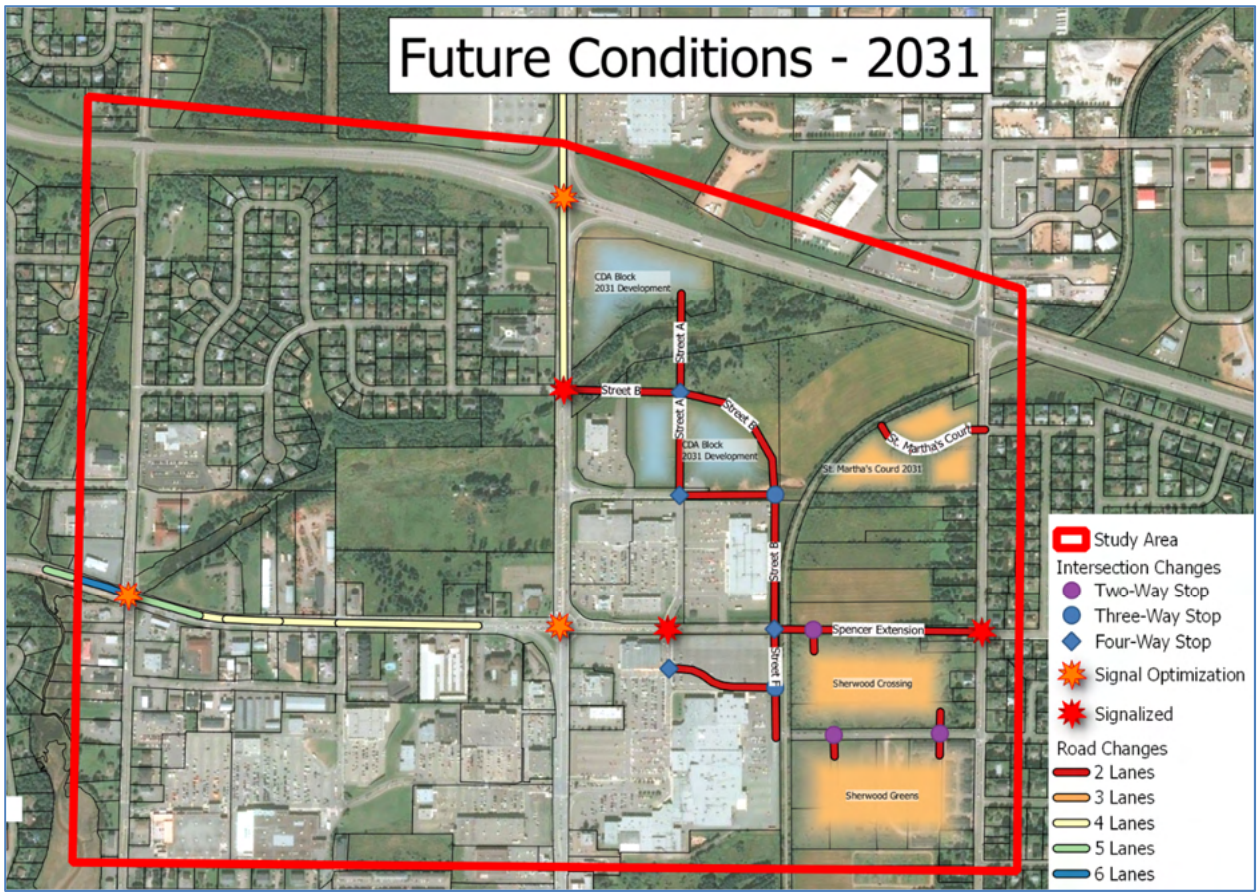
Background Growth

First, the travel demand was factored to account for traffic growth throughout the study area resulting only from changes such as population and employment growth, and new developments within the Charlottetown region, but outside of the study area. This growth was applied to the travel demand OD matrices as background traffic growth rates. The Study Area's commercial zones were applied factors of 10% in 2031 and 20% in 2041, under the assumption that the only background growth destined to the Study Area would be associated with existing commercial development. Origin-Destination pairs between Gateway zones were factored by 6% in 2031 and 10% in 2041 to account for regional growth.

Future Development - 2031

In discussion with City staff, and based on historical and current development patterns, several development scenarios were investigated for the 2031 and 2041 analysis horizons.

By 2031, it was assumed that existing vacant land south of the Spencer Drive alignment, between Mount Edward Road and the Confederation Trail, would be developed primarily as medium and high density residential. The Sherdale Estates residential development is more than 50% complete as of February 2021, and construction of the Sherwood Crossing residential development is expected to get underway in the near future. It is also expected that the planned residential development on St. Martha's Court (across from Fern Garden Drive) will be completed by 2031. The SDU land southeast of the Malpeque Road/Bypass intersection will be somewhat difficult to access due to the adjacent watercourse so it was assumed this would also be developed for residential use. Also, within this timeframe, it was assumed that a large parcel of land north of Canadian Tire would be developed for commercial use.

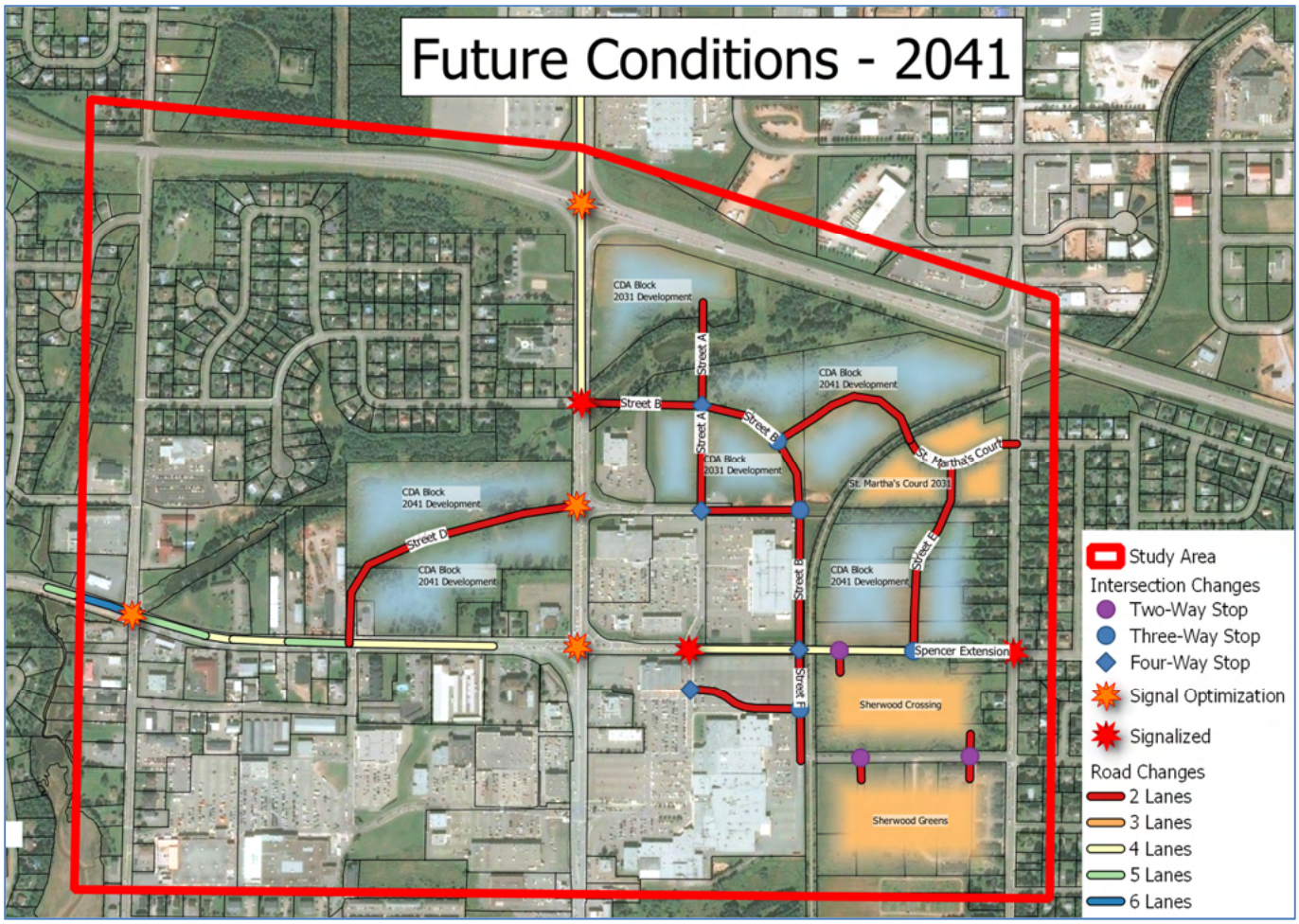


Several new roadways that were assumed to be in place by 2031 to provide access to the newly developed land parcels. These include extending Spencer Drive eastward to connect with Mt. Edward Road and the Ash Drive intersection. It also includes a new road parallel to the Confederation Trail that would extend northward from Towers Road, across Spencer, and behind Canadian Tire before turning westward and tying into Malpeque Road at the Irwin Drive intersection. Also shown are extensions of both Babineau Avenue, to the north across the existing watercourse, and Saint Dunstan Street.

Future Development - 2041

This general development pattern was assumed to continue to 2041, with the lands between Mount Edward Road and the Confederation Trail eventually being developed for residential uses. The large vacant parcel of land northwest of the Malpeque Road / Capital Drive intersection was assumed to be developed with a mix of residential and commercial uses.

New roadways added for the 2041 scenario include a north-south street to connect the Spencer Drive and Fern Garden Drive extensions, a further westward extension of Fern Garden Drive across the Confederation Trail, and a new road to connect the Capital/Rhynes intersection with the Malpeque/Saint Dunstan intersection.


Future Conditions - 2041
CDA Block
2031 Development
Street A
Street B
Street C
CDA Block
2041 Development
St. Martha's Court
St. Martha's Court 2031
CDA Block
2031 Development
Street D
CDA Block
2041 Development
Street E
Street F
Spencer Extension
Sherwood Crossing
Sherwood Greens
Study Area
Intersection Changes
Two-Way Stop
Three-Way Stop
Four-Way Stop
Signal Optimization
Signalized
Road Changes
2 Lanes
3 Lanes
4 Lanes
5 Lanes
6 Lanes

Trip Generation

The properties assumed to undergo development in 2031 and 2041 were divided into developable parcels and used to estimate potential traffic growth according to ongoing development trends. To estimate how much new peak hour traffic would be generated by the assumed future development, trip generation rates from the Institute of Transportation Engineers (ITE) Trip Generation Manual, 10th Edition were used. Rates published in this manual are widely accepted by the engineering community, as they are based on empirical data.

Based on this approach, development of the vacant areas around Charlottetown Mall is expected to generate the following new trips by 2041:

- 1,152 trips (383 in, 789 out) during the weekday AM peak hour
- 1,624 trips (927 in, 697 out) during the weekday PM peak hour
- 1,862 trips (961 in and 901 out) during the Saturday peak hour

Findings

The traffic analyses carried out using the VISSIM microsimulation model demonstrate that the continued regional traffic growth from development of the vacant properties within the study area are developed can be managed effectively. The study area is forecasted to experience an increase of approximately 1,000 trips per peak hour by 2031, and of 2,000-2,500 trips by 2041, of which approximately 50% would result from local development.

The microsimulation model was calibrated and validated to existing weekday AM and PM peak hours and to the Saturday peak hour, as observed through intersection turning movement counts undertaken by the City and CBCL in 2019 and 2020. The latter counts were undertaken at a time when discretionary trip-making had generally recovered to pre-pandemic levels. The model assessment of 2031 and 2041 conditions showed that despite significant growth, it is possible to largely mitigate the impacts associated with increased vehicular traffic through the study area by implementing network-level improvements aimed at extending the road network grid, providing alternative routes along secondary roads, and formalizing existing circulation patterns.

Recommendations

This study ultimately recommends the following interventions:

By 2031:

1. Widen Capital Drive to four lanes from Lower Malpeque Road to Malpeque Road;
2. Widen Malpeque Road southbound from the Bypass to Capital Drive;
3. Extend Spencer Drive from the Confederation Trail to Mount Edward Road;
4. Realign the road along the Cineplex Cinema with the Superstore Aisle;
5. Upgrade the Spencer Drive & Babineau Avenue intersection to signal control;
6. Extend Irwin Drive, Saint Dunstan Street, and Babineau Avenue into the SDU lands;
7. Reconfigure the Capital Drive & Lower Malpeque Road intersection;
8. Reconfigure the Capital Drive & Malpeque Road intersection; and,
9. Reconfigure the Capital Drive & Bypass Highway intersection.

By 2041:

1. Widen Spencer Drive to four lanes from Malpeque Road to Mount Edward Road;
2. Extend the road network into the SDU lands;
3. Extend Rhynes Drive and connect to Saint Dunstan Street;
4. Upgrade the Spencer Drive & Confederation Trail intersection to signal control;
5. Optimize and coordinate signal timings along Capital Drive, Malpeque Road, and Spencer Drive.

Chapter 1 Introduction

1.1 Project Background

The Charlottetown area has been growing steadily, particularly in recent years. According to Statistics Canada, the population of the City of Charlottetown was 36,094 as of the 2016 Census, and has now grown to just under 40,000. However, the Charlottetown Region as defined by Statistics Canada, encompasses Cornwall and Stratford plus a large portion of central PEI including places such as Hunter River, Stanhope, Canoe Cove, and Vernon River. A Statistics Canada report released in early 2021 indicates the Charlottetown Region was home to 71,533 people in 2016, almost double the population of the City by itself. By mid-2020, this figure had grown by 12.3% to 80,347, a growth rate much higher than other parts of the province. The median age of Charlottetown's population is also trending downward, unlike elsewhere in PEI.

These figures demonstrate why development in Charlottetown, particularly for residential and commercial land uses, has been experiencing steady growth. The increased demand for housing and vacant land throughout the capital region is clear from the significant upward trend of real estate prices over the past few years.

Any remaining undeveloped land within the City is at a premium, particularly south of the Bypass Highway. The majority of this land is within the large tract bounded by University Avenue, Allen Street, Mt. Edward Road, and the Bypass. The vacant land within this area south of Belvedere Avenue is owned federally by the Charlottetown Research and Development Centre, and much of the land within ~1.3 km of Belvedere Avenue to the north is owned by the University of Prince Edward Island (UPEI). However, there is considerable remaining vacant land at the north end of this tract; much of it is owned by Saint Dunstan's University (SDU) and the rest by several private landowners. Another large undeveloped parcel is situated northwest of the Malpeque Road/Capital Drive intersection.

Given the current climate of population growth in and around Charlottetown, City staff have been receiving ever-increasing pressure from these property owners to approve developments on their land. But before these projects can be given the green light, the City wants to be comfortable the area transportation system can accommodate the corresponding new traffic.

1.2 Study Objectives

This study was commissioned by the City of Charlottetown to forecast the development potential of the vacant SDU land and the other undeveloped parcels that are situated to the east, north, and northwest of the Charlottetown Mall, and to investigate appropriate roadway extensions and intersection improvements so that the transportation system is ready. The main objectives of this assignment are:

- To develop a comprehensive travel demand model for the study area
- To forecast future travel demands for horizon years 2031 and 2041 using the planning information currently available
- To develop a road network improvement strategy for both 2031 and 2041

1.3 Study Area

The study area for this project is indicated in Figure 1-1. The study intersections used in the model, both signalized and unsignalized, are highlighted. As shown, this area encompasses the area generally bounded by North River Road/Lower Malpeque Road to the west, the Bypass to the north, and Mt. Edward Road to the east. The southern boundary is generally defined by a line connecting Burns Avenue with Oak Drive.

Most of the green space shown in Figure 1-1 is available for future development. An exception to this is the major watercourse that extends northeastward from the Capital Drive/North River Road intersection.

Most of the developed land within the study area is commercial, and it includes the province's largest retail hub. Anchored by the Charlottetown Mall, Wal-Mart, Home Depot, Sobeys, Superstore, and Canadian Tire, this zone is a diverse mix of box stores, smaller retailers, services, and restaurants. Southview Estates is a large single-family residential area in the northwest corner of the study area. A second residential area, medium to high density Sherdale Estates, is under development in the southeast corner of the study.

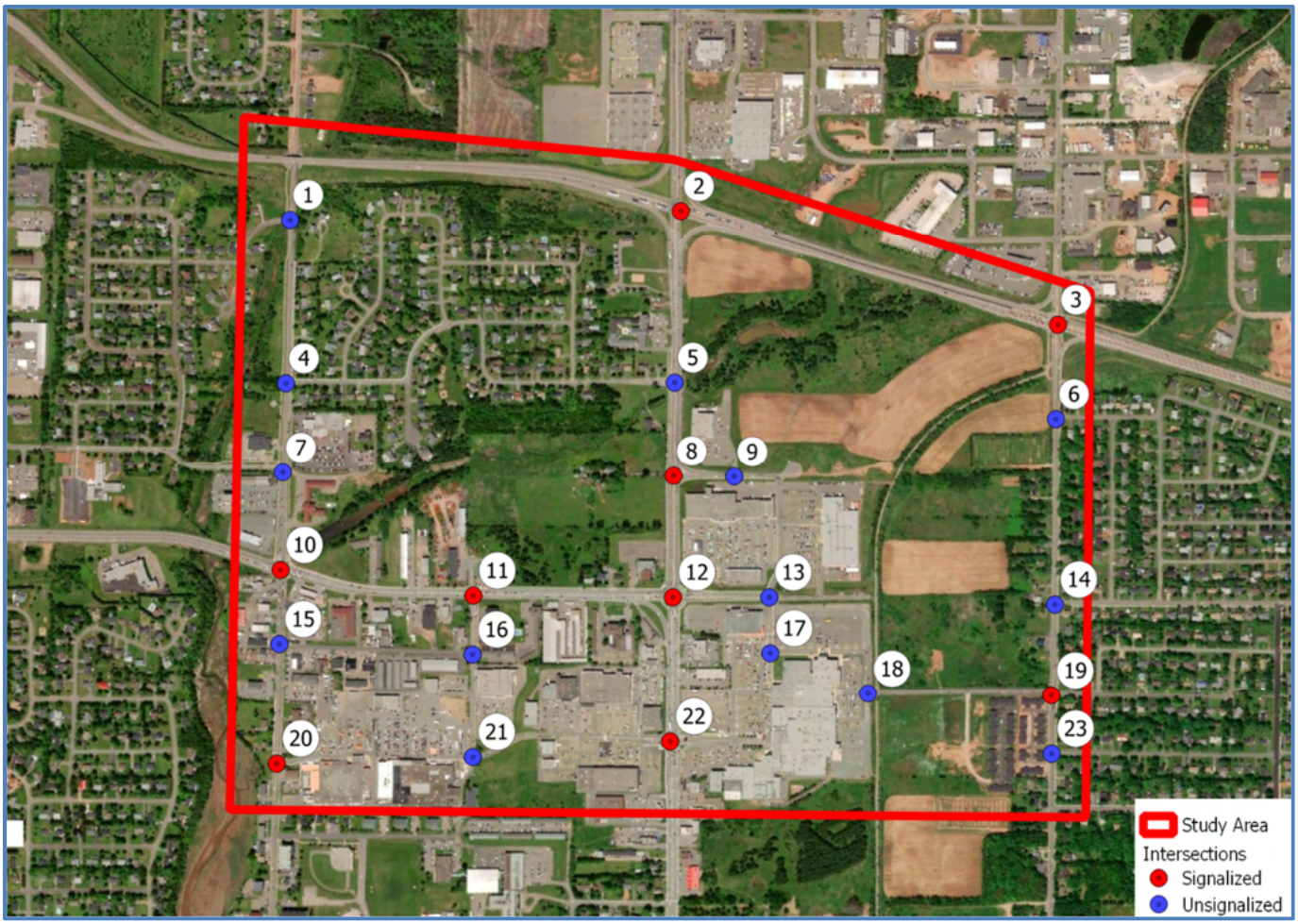


Figure 1-1 Study Area

Chapter 2 Model Development

2.1 Overview

Traffic models are built to produce a robust analysis system that is not only capable of reproducing existing traffic patterns, but is able to reliably forecast future conditions, given changes to the transportation networks and travel demand.

Such modelling is concerned chiefly with two things: the correct estimation of travel demand between two points, and the correct selection of optimal routes between them. Modelling can be undertaken at different scales of analysis, ranging from large macroscopic models that focus on the aggregated estimation of travel at a regional level, to microscopic models that reproduce individual travelling agents at the local level.

To best understand the impacts to traffic operations in the Study Area, a microsimulation model was built using the PTV VISSIM software. A microsimulation model breaks down all traffic generated in a Study Area into smaller, more manageable Traffic Analysis Zones (TAZ), representative of individual blocks, discrete land uses, or functional clusters such as the Mall. All traffic generated by these TAZ enters and exits a digital representation of the Study Area's road network via representative parking lots. Trips between TAZ are loaded onto the road network via Origin-Destination (O-D) matrices, that aggregate individual trips over a given analysis period. Through an iterative process, the model seeks optimal paths over the road network between each O-D pair based on initial travel times, assigns a portion of the total volume on the road network, simulates the movement of each vehicle and road user between TAZ of Origin and TAZ of Destination, and re-iterates the process with updated travel times. The process is repeated until the assignment process converges on an optimal solution; at this point the model is said to have achieved Dynamic User Equilibrium, whereby the optimal paths between each TAZ have been found.

Within this modelling framework, our overall methodology is broadly outlined as follows:

- Divide the Study Area into operational TAZ;
- Build the Study Area road network in detail;
- Estimate travel demand in terms of O-D matrices that are used to load traffic onto the road network;
- Calibrate the microsimulation assignment procedure to reproduce existing traffic conditions as observed through turning movement counts at key major intersections in the Study Area;
- Validate the microsimulation model to travel times along the major roads, as extracted from the Google Maps API;
- Extract performance measures at major intersections under existing conditions;
- Develop future land use scenarios where undeveloped parcels in the Study Area are developed over the short, medium and long terms;
- Forecast future travel demand over the short, medium and long terms, considering background traffic growth across the City, and anticipated developments;
- Update the road network with future roads and transportation services;
- Extract performance measures at major intersection under each future scenario;
- Identify capacity and operational constraints and propose mitigation measures;

2.2 Travel Demand

The Study Area was divided into 31 TAZ representing the area's major functional blocks, bound by major roads and natural boundaries. The Study Area is accessed via nine (9) roadway gateways, each of which is represented by an additional TAZ:

- Charlottetown Bypass Highway (East & West)
- Lower Malpeque Road
- North River Road
- Malpeque Road
- University Avenue
- Capital Drive
- Mount Edward Road (North & South)

The 40 traffic analysis zones are illustrated in Figure 2-1.

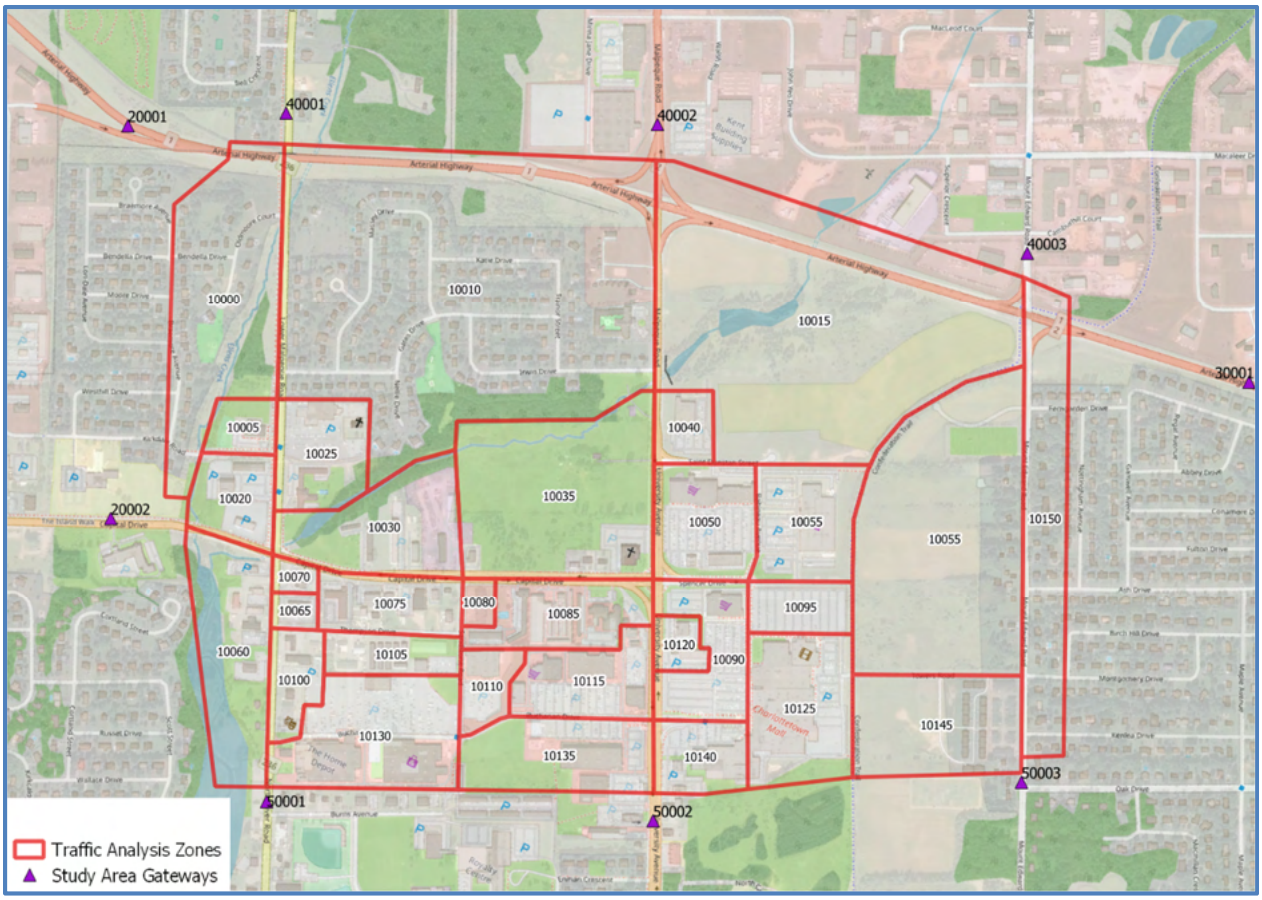


Figure 2-1 Model Zonal System

Travel demand, expressed as Origin-Destination matrices representing hourly trips between each of the 40 TAZ, was extracted from the city-wide VISUM travel demand model being built concurrently for the Charlottetown Growth Management Strategy (GMS) project. The detailed description of the VISUM model development is provided under separate cover as part of the GMS project delivery.

Where the VISSUM TAZ matched the boundaries of the VISUM TAZ, corresponding O-D pair trips were used directly. The VISUM zones outside of the VISSIM Study Area were grouped according to relative directions (as illustrated in Figure 2-2) and assigned proportionally to one of the 9 VISSIM Study Area gateways.

The seed OD matrix extracted from the VISUM model matrix were balanced to the Study Area perimeter counts following the Furness two-factor method. This method iteratively factors origin and destination totals to observed volumes entering and exiting the Study Area perimeter, while maintaining the underlying OD patterns. A total of 50 factor iterations produced acceptable results, with modelled volumes on the perimeter of the Study Area meeting the TMC data within 5-10%.

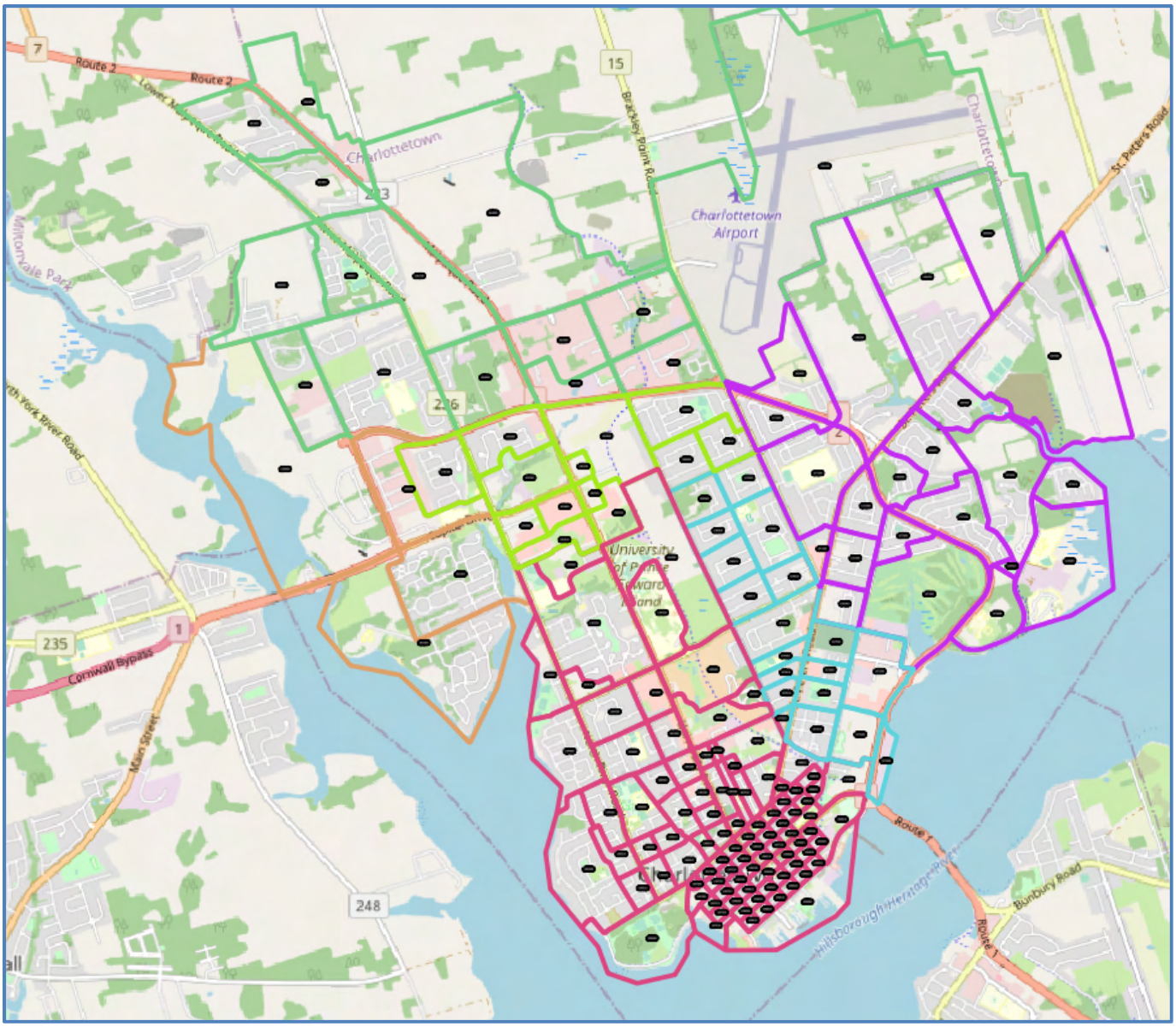


Figure 2-2 Aggregation of VISUM Model TAZ

AM Peak Hour

During the weekday AM peak hour, the Study Area is estimated to experience a volume of approximately 7,240 vehicular trips, as summarized in Table 2.1. Most of these trips (62%) are passing through, while the area attracts over 1,700 trips, and generates roughly 1,200 trips. As expected, the dominant local traffic flow is inbound, as regional residents come to the Study Area for work. Less than 3% of all trips remain in the Study Area.

Table 2.1 AM Peak Hour Matrix

	In	Out	Total
In	175	1,021	1,196
Out	1,554	4,489	6,043
Total	1,729	5,510	7,239

PM Peak Hour

During the weekday PM peak hour, the Study Area experiences its peak travel demand, with over 9,060 vehicular trips, as summarized in Table 2.2. While the through component is still dominant, at 46% of all trips, the inbound and outbound volumes are also higher. We note two dynamics in the travel patterns; on one hand, we see close to 2,700 inbound trips representing both commuters returning home and visitors to the commercial areas; on the other hand, we observe over 3,000 trips outbound from the area, accounted by both commuters and shopping visitors leaving the area. The net effect is that both inbound and outbound volumes are higher than during the AM peak hour. We also note more internal trips, with a larger number of local residents making trips to the area's commercial zones.

Table 2.2 PM Peak Hour Matrix

	In	Out	Total
In	770	2,244	3,014
Out	1,917	4,134	6,051
Total	2,687	6,378	9,065

Saturday Peak Hour

During the Saturday peak hour, the Study Area is estimated to experience a volume of over 7,700 trips moving through the area (see
Table 2.3). Unlike during the weekday peak hours, during the Saturday peak we observe a very balanced distribution between inbound and outbound travel, almost entirely associated with commercial leisure trips. As the City's major retail hub, the area attracts a very high volume of vehicular trips. Through movements are noticeably lower, accounting for 40% of all trips.

Table 2.3 Saturday Peak Hour Matrix

	In	Out	Total
In	490	2,110	2,600
Out	2,005	3,113	5,118
Total	2,495	5,223	7,718

2.3 Network Coding

The PTV VISSIM platform allows the modelling of complex transportation networks and travel patterns with very high fidelity. The Study Area road network was reproduced in VISSIM with all geometric and functional parameters reflecting reality (see Figure 2-3 VISSIM Model).

The road network includes current lane geometries, lane tapers, circulation signs, traffic control devices, and crosswalks. Public Transit routes were coded as routes on the network, based on T3 Transit route maps. Speed limits were coded for each link according to speed limit signs, and the Study Area's nine traffic signals were coded according to signal timing plans provided by City Staff.

Major assumptions across the road network include:

- No coordination between signalized intersections
- Actuated pedestrian signals at signalized intersections

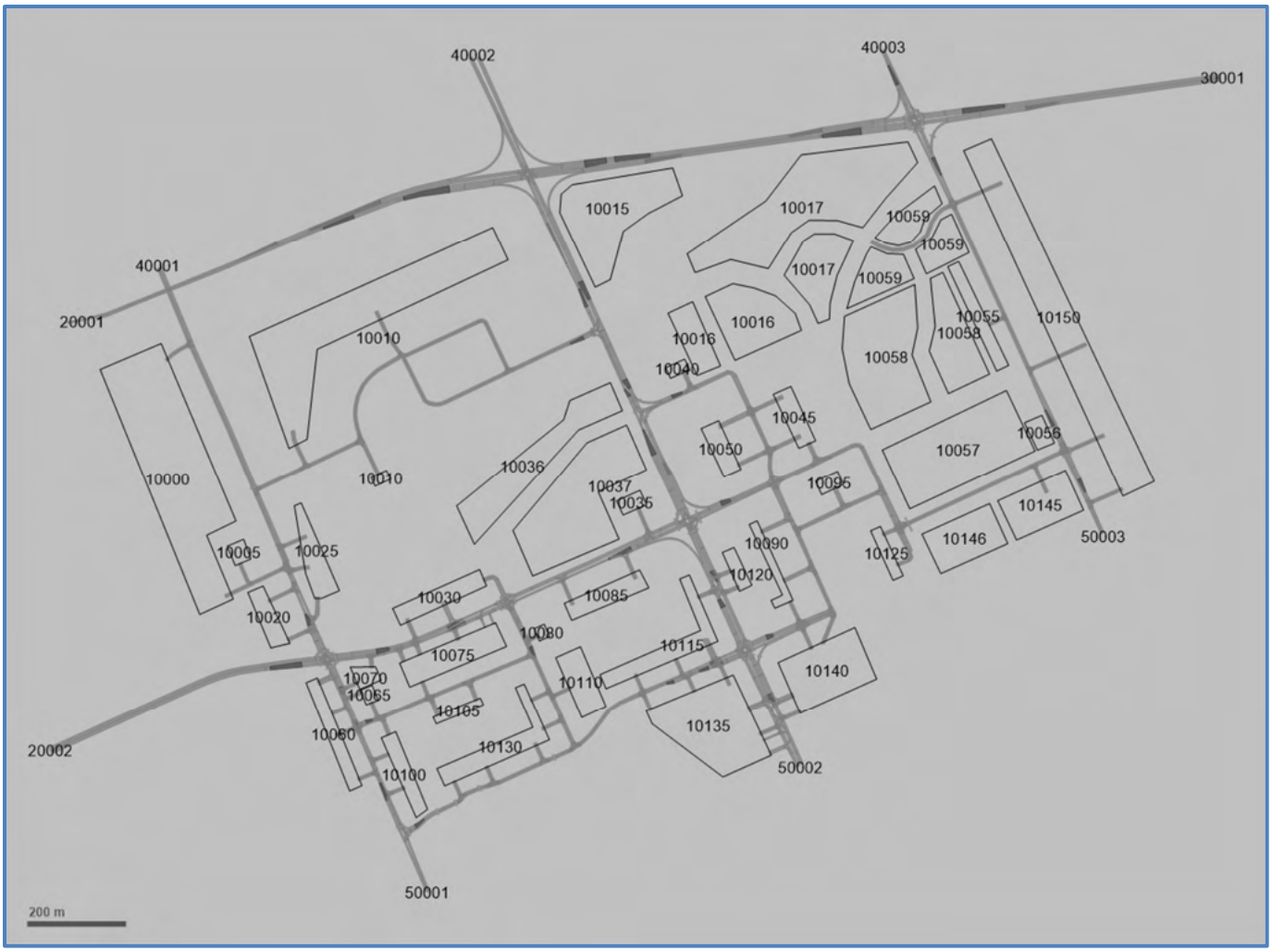


Figure 2-3 VISSIM Model Road Network and Zone System

2.4 Model Calibration

Once the network was reviewed for connectivity, consistency and correct intersection and link operations, the calibration effort focused on reproducing actual travel patterns as observed through intersection Turning Movement Counts (TMC) at major intersections within the Study Area. Recent count data was available for 19 of the 23 study intersections (see Table 2.4). The majority of weekday counts were undertaken in 2019, by both the City and CBCL, using the MioVision Scout camera survey system. Weekend counts were carried out in June 2020 by CBCL, also using Miovision Scouts. Permanent traffic counters on Capital Drive indicated that weekend traffic around that time approached levels consistent with pre-pandemic conditions. While COVID-19 travel restrictions affected weekday commuter traffic significantly, they had a shorter-lasting impact on weekend shopping trips. Combined, these counts were considered to reflect typical travel conditions through the Study Area once all COVID-19 restrictions are lifted.

Table 2.4 Availability of Count Data for Study Area Intersections

ID	Name	Type	Timings	Count Weekday	Count Weekend
1	Lower Malpeque & Oldmoor Ct	Unsignalized	-	-	-
2	Malpeque Rd & Perimeter Hwy	Signalized	y	Y	Y
3	Mt Edward Rd & Perimeter Hwy	Signalized	y	Y	Y
4	Lower Malpeque Rd & Gates Dr	Unsignalized	-	-	-
5	Malpeque Rd & Irwin Dr	Unsignalized	-	-	Y
6	Mt Edward Rd & Fern Garden Dr	Unsignalized	-	Y	Y
7	Lower Malpeque Rd & Kirkdale Rd	Unsignalized	-	-	Y
8	Malpeque Rd & St.Dunstan St	Signalized	Y	Y	Y
9	Babineau Ave & St Dunstan St	Unsignalized	-	-	-
10	Lower Malpeque Rd & Capital Dr	Signalized	Y	Y	-
11	Sandstone Rd & Capital Dr	Signalized	Y	-	Y
12	Malpeque Rd & Capital Dr	Signalized	Y	Y	Y
13	Babineau Ave & Spencer Dr	Unsignalized	-	Y	Y
14	Mt Edward Rd & Ash Dr	Unsignalized	-	Y	Y
15	North River Rd & Thompson Dr	Unsignalized	-	-	Y
16	Sandstone Rd & Thompson Dr	Unsignalized	-	-	Y
17	Babineau Ave & Ch'town Mall	Unsignalized	-	-	Y
18	Ch'town Mall & Towers Rd	Unsignalized	-	Y	Y
19	Mt Edward Rd & Towers Rd	Signalized	Y	Y	Y
20	North River Rd & Buchanan Dr	Signalized	Y	-	Y
21	Sandstone Rd & Buchanan Dr	Unsignalized	-	-	Y
22	University Rd & Buchanan Dr	Signalized	Y	-	Y
23	Mt Edward Rd & Kenlea Dr	Unsignalized	-	-	-

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

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

   GEH= √(〖2(M-C)〗 ^2/(M+C))

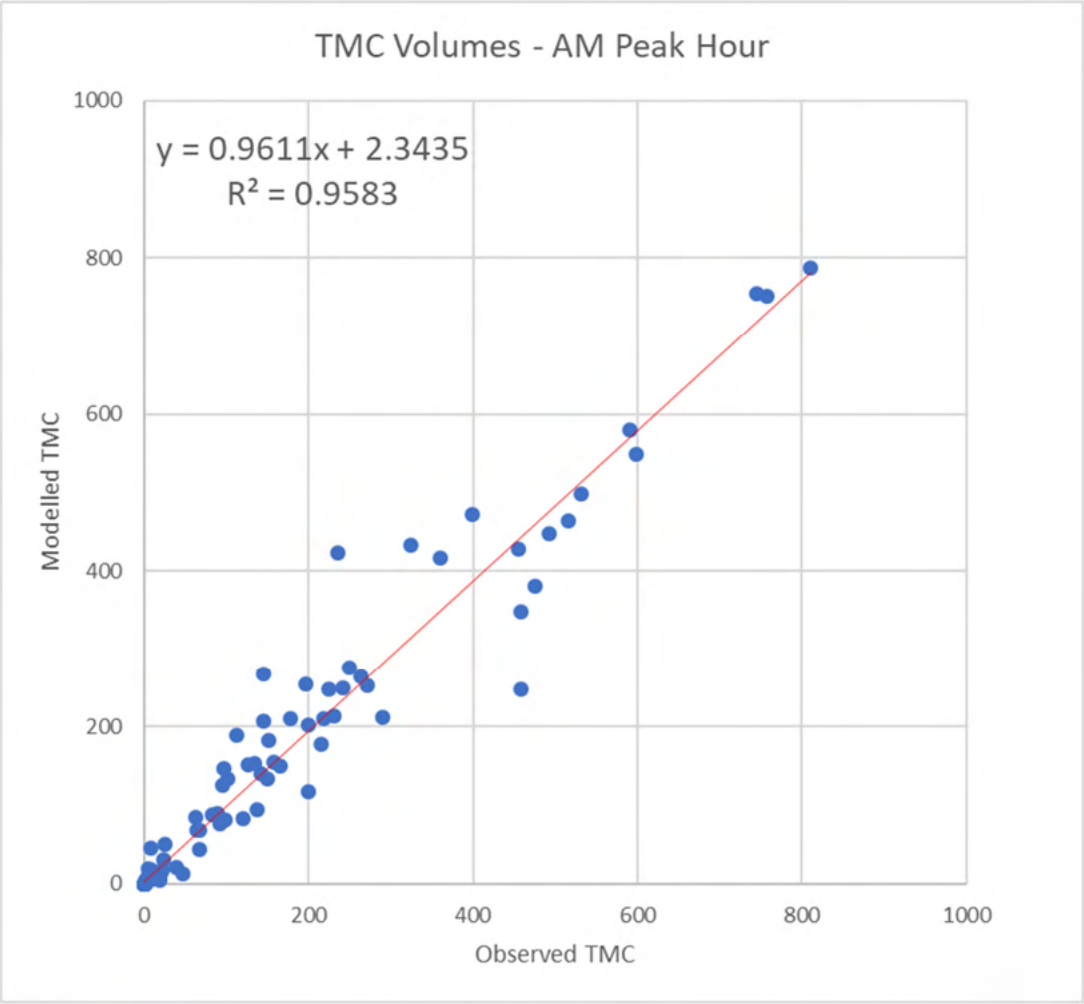
   Where M is the modelled hourly volume, and C is the observed volume

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

AM Peak Hour

Observation of link flows and individual OD paths along the model network found logical routing. Demand favours the most direct paths on the major roads, with a portion of traffic detouring via parallel roads where significant delays are met. This is consistent with our experience of driving behaviour in the Study Area.

The model was found to produce good calibration during the AM Peak Hour. As illustrated below, the model assignment produced an R^2 of over 95% for turn volumes. The model is balanced in that modelled volumes follow the regression line closely on both sides with few outliers; demands are consistent, not systemically over-estimated or underestimated.

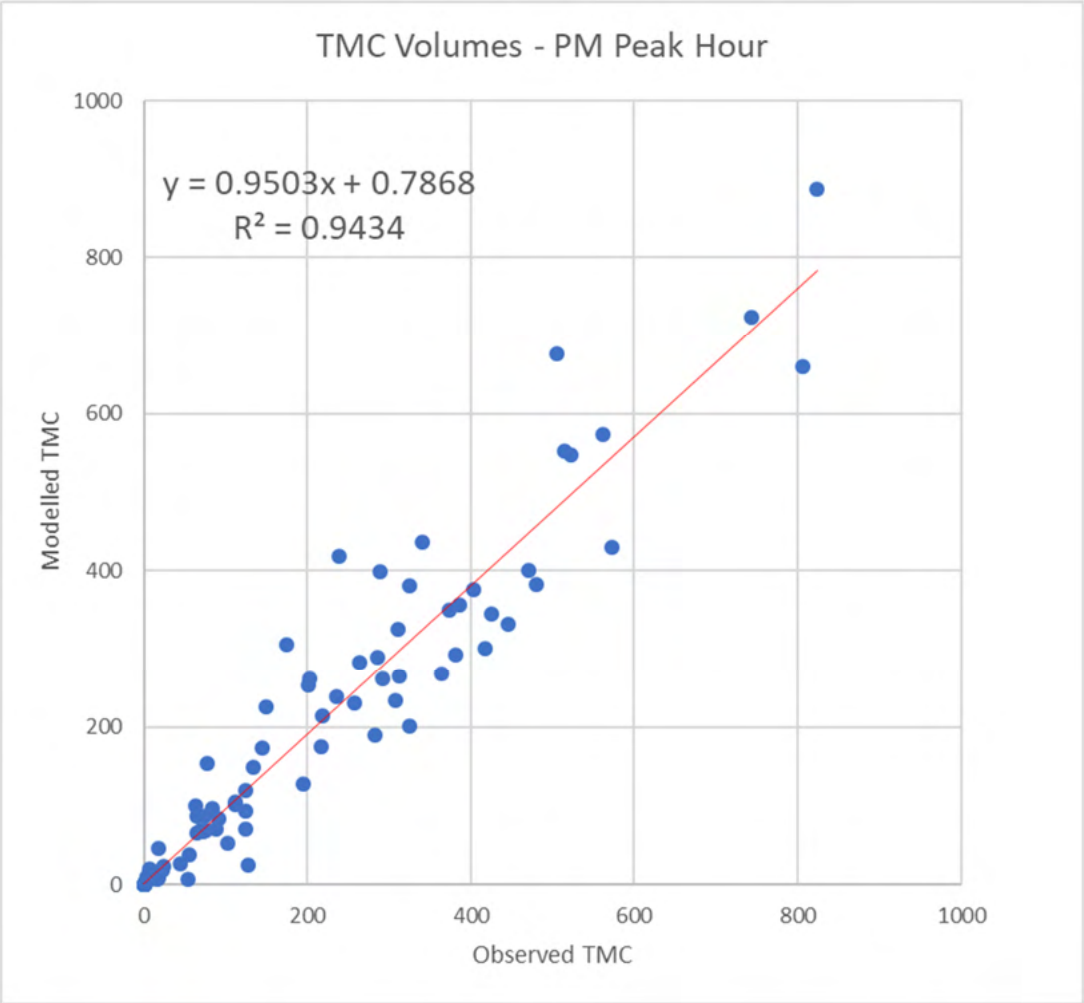


GEH analysis shows that over 88% of turns have a GEH less than 5 exceeding the criteria threshold of 75%; approximately 97% of turns have a GEH less than 10, also exceeding the threshold of 95%. This was achieved equally well across the whole road network, demonstrating that the model overall produced reliable travel patterns across the entire Study Area.

AM Peak Hour	Modelled	Total	Modelled	Target	Check
Turns with GEH <= 5	67	76	88%	75%	OK
Turns with GEH <= 10	74	76	97%	95%	OK

PM Peak Hour

The PM peak hour includes more discretionary trips than the AM peak hour, with more diverse travel distributions. As illustrated below, the PM model Linear Regression R^2 still comfortably exceeds 90%, and modelled volumes deviate slightly from the regression line. Where they do, the model tends to overestimate some of the turns.

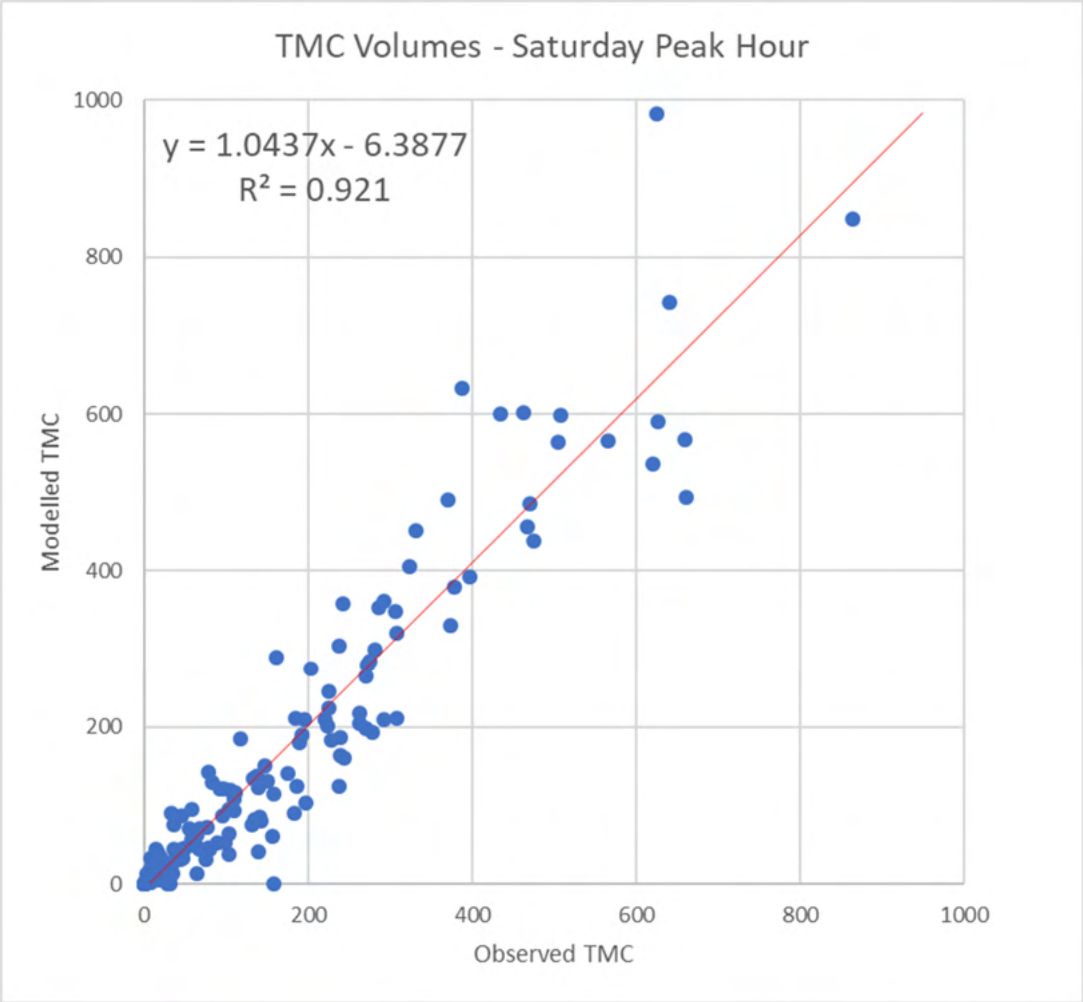


The model meets the GEH calibration criteria for most of the intersection turns in the Study Area.

PM Peak Hour	Modelled	Total	Modelled	Target	Check
Turns with GEH <= 5	58	76	76%	75%	OK
Turns with GEH <= 10	75	76	99%	95%	OK

Saturday Peak Hour

The Saturday peak hour is the most challenging time period to calibrate, on account of the diverse patterns in all directions. Unlike during weekday peak hours, there is no clear inbound/outbound commuter movement. Additionally, the Saturday counts carried out in the summer of 2020 covered more intersections than were available in the weekday counts, and many more turning movements. At the same time, the Saturday dataset did not completely overlap the weekday one, leaving some gaps in the travel pattern analysis. In spite of these complexities, the model was nonetheless well calibrated; the model reproduces patterns well for most turning movements, but it over-estimates some of the movements with larger volumes; It achieves an R^2 of 92%.



The model also meets the GEH criteria, achieving GEH <=5 on 77% of all movements, and a GEH of <=10 on almost all movements.

Saturday Peak Hour	Modelled	Total	Modelled	Target	Check
Turns with GEH <= 5	113	146	77%	75%	OK
Turns with GEH <= 10	143	146	98%	95%	OK

2.5 Model Validation

Once calibrated to observed traffic volumes, the model's validity was subsequently tested against travel times along the major roads in the Study Area. Travel time data was extracted in summarized format from the Google Maps API, which aggregates location-based metrics from mobile devices. The queried travel time dataset, broken down by road and direction, provides typical, pessimistic, and optimistic travel times estimates based on the historical record.

The Google Maps API travel time data and comparative model travel times are summarized in Table 2.5. Overall, most of the travel time segments experience travel times within one minute of observed times, which is considered a close fit. The model is thus considered to produce valid results across all time periods.

Table 2.5 Major Road Travel Times

Road	From	To	Direction	Distance	AM Fast	AM Typical	AM Slow	AM Modelled	AM Difference	PM Fast	PM Typical	PM Slow	PM Modelled	PM Difference	Sat Fast	Sat Typical	Sat Slow	Sat Modelled	Sat Difference
Buchanan Drive	NRiverBuchanan	Walmart	Eastbound	392	110	113	110	49	-64	114	115	122	51	-64	95	106	111	55	-51
Buchanan Drive	Walmart	UniversityBuchanan2	Eastbound	416	75	72	75	50	-22	88	83	89	56	-27	61	70	77	69	-1
Buchanan Drive	UniversityBuchanan2	Walmart	Westbound	426	87	80	87	52	-28	101	105	105	70	-35	68	68	65	64	-4
Buchanan Drive	Walmart	NRiverBuchanan	Westbound	392	114	113	114	57	-56	118	120	116	71	-49	99	105	106	63	-42
Capital Drive	LowerMalpequeCapital	Rhynes	Eastbound	392	91	78	91	35	-43	83	111	145	40	-71	70	84	89	39	-45
Capital Drive	Rhynes	MalpequeCapital1	Eastbound	396	123	116	123	51	-65	116	130	141	69	-61	114	124	123	94	-30
Capital Drive	MalpequeCapital2	Rhynes	Westbound	407	48	40	48	29	-11	43	61	69	39	-22	36	40	41	32	-8
Capital Drive	Rhynes	LowerMalpequeCapital	Westbound	393	54	46	54	58	12	48	72	75	81	9	40	47	52	59	12
Lower Malpeque Road / North River Road	NRiverBuchanan	LowerMalpequeCapital	Northbound	387	57	47	57	82	35	52	82	102	127	45	36	50	58	107	57
Lower Malpeque Road / North River Road	LowerMalpequeCapital	Gates	Northbound	376	35	30	35	34	4	36	45	46	31	-14	32	50	78	29	-21
Lower Malpeque Road / North River Road	Gates	Old Moore	Northbound	323	20	19	20	23	4	20	21	19	24	3	19	19	19	23	4
Lower Malpeque Road / North River Road	Old Moore	Gates	Southbound	323	19	19	19	46	27	19	19	20	24	5	17	19	20	24	5
Lower Malpeque Road / North River Road	Gates	LowerMalpequeCapital	Southbound	376	53	45	53	185	140	49	64	77	96	32	42	51	56	84	33
Lower Malpeque Road / North River Road	LowerMalpequeCapital	NRiverBuchanan	Southbound	387	48	38	48	37	-1	47	69	66	41	-28	32	44	52	36	-8
Malpeque Road / University Avenue	UniversityBuchanan2	MalpequeCapital2	Northbound	298	52	42	52	63	21	48	62	87	72	10	36	47	48	72	25
Malpeque Road / University Avenue	MalpequeCapital1	Irwin1	Northbound	461	50	41	50	31	-10	46	60	84	35	-25	38	47	49	36	-11
Malpeque Road / University Avenue	Irwin2	MalpequeTCH2	Northbound	353	42	36	42	38	2	37	50	61	117	67	36	40	41	104	64
Malpeque Road / University Avenue	MalpequeTCH1	Irwin1	Southbound	341	28	24	28	24	0	25	35	41	24	-11	22	25	36	24	-1
Malpeque Road / University Avenue	Irwin1	MalpequeCapital1	Southbound	442	44	38	44	97	59	44	64	80	105	41	31	38	46	91	53
Malpeque Road / University Avenue	MalpequeCapital1	UniversityBuchanan1	Southbound	271	40	31	40	50	19	41	58	71	52	-6	24	32	36	53	21
Mount Edward Road	Towers	MtEdwardTCH2	Northbound	750	69	64	69	69	5	68	81	83	76	-5	64	68	76	70	2
Mount Edward Road	MtEdwardTCH1	Towers	Southbound	739	55	54	55	66	12	72	80	95	70	-10	53	57	60	66	9
Sandstone Road	Walmart	Rhynes	Northbound	329	69	69	69	41	-28	69	69	70	44	-25	69	70	70	47	-23
Sandstone Road	Rhynes	Walmart	Southbound	329	73	73	73	45	-28	73	73	73	47	-26	73	73	73	45	-28
TCH	MalpequeTCH1	MtEdwardTCH1	Eastbound	792	55	55	63	67	12	56	79	104	66	-13	48	59	71	65	6
TCH	MtEdwardTCH2	MalpequeTCH2	Westbound	796	61	55	61	68	13	55	73	94	69	-4	45	55	79	65	10

AM Peak Hour

Comparison of modelled travel times on the major roads reveals that the model traffic falls well within the minima and maxima of observed travel times, with 88% of road segments within the data band, as illustrated below. Where travel times exceed the surveyed band, 10% are slower and only 3% are faster.

PM Peak Hour

The model behaves equally well during the PM peak hour, with approximately 80% of assessed road segments experiencing travel times within the observed band. Travel times only slightly faster than average on certain segments, while the overall corridor travel times are close to observed averages.

As mentioned, in the absence of curbside friction, driveway delays and midblock turning movements, modelled travelled times tend to be faster than the average observed times.

Saturday Peak Hour

The model behaves equally well during the PM peak hour, with approximately 80% of assessed road segments experiencing travel times within the observed band. Travel times only slightly faster than average on certain segments, while the overall corridor travel times are close to observed averages.

2.6 Future Conditions

The strength of a Dynamic Traffic Assignment model lies in its ability to simulate changes in traffic circulation, when starting from calibrated and validated conditions, and in response to changes in the road network, capacities and operations. The purpose of this model being to identify the road capacity changes that need to be in place to accommodate anticipated growth, the calibrated base model was expanded to reflect several future changes to the 2031 and 2041 horizons. Future growth will occur first, as a result of regional growth and development, and second, as a result of specific development within the study area.

Background Growth

First, the travel demand was factored to account for traffic growth throughout the study area resulting only from changes such as population and employment growth, and new developments that are within the Charlottetown region, but outside of the study area. This growth is applied to the travel demand OD matrices as background traffic growth rates. Growth rates were applied to the Study Area's commercial zones under the assumption that the only background growth destined to the Study Area would be associated with existing commercial development. Factors were also applied to Origin-Destination pairs between Gateway zones (see Table 2.6).

Table 2.6 Future Background Growth Rates

	2031	2041
Commercial Zones	10%	20%
Gateways Zones	6%	10%

Future Development - 2031

In discussion with City staff, and based on historical and current development patterns, several development scenarios were investigated for the 2031 and 2041 analysis horizons.

Assumed future development that would be complete by2031 is illustrated in Figure 2-4. By then, it was assumed that existing vacant land south of the Spencer Drive alignment, between Mount Edward Road and the Confederation Trail, would be developed primarily as medium and high density residential. The Sherdale Estates development is more than 50% complete as of January 2021. It is also expected that additional planned development across from Fern Garden Drive will be completed by 2031. The SDU land southeast of the Malpeque Road/Bypass intersection will be somewhat difficult to access due to the adjacent watercourse so it was assumed this would also be developed for residential uses. Also, within this timeframe, it was assumed that a large parcel of land north of Canadian Tire would be developed for commercial use.

Figure 2-4 also shows several new roadways that were assumed to be in place by 2031 to provide access to the newly developed land parcels. These include extending Spencer Drive eastward to connect with Mt. Edward Road and the Ash Drive intersection. It also includes a new road parallel to the Confederation Trail that would extend northward from Towers Road, across Spencer, and behind Canadian Tire before turning westward and tying into Malpeque Road at the Irwin Drive intersection. Also shown are extensions of both Babineau Avenue, to the north across the existing watercourse, and Saint Dunstan Street.

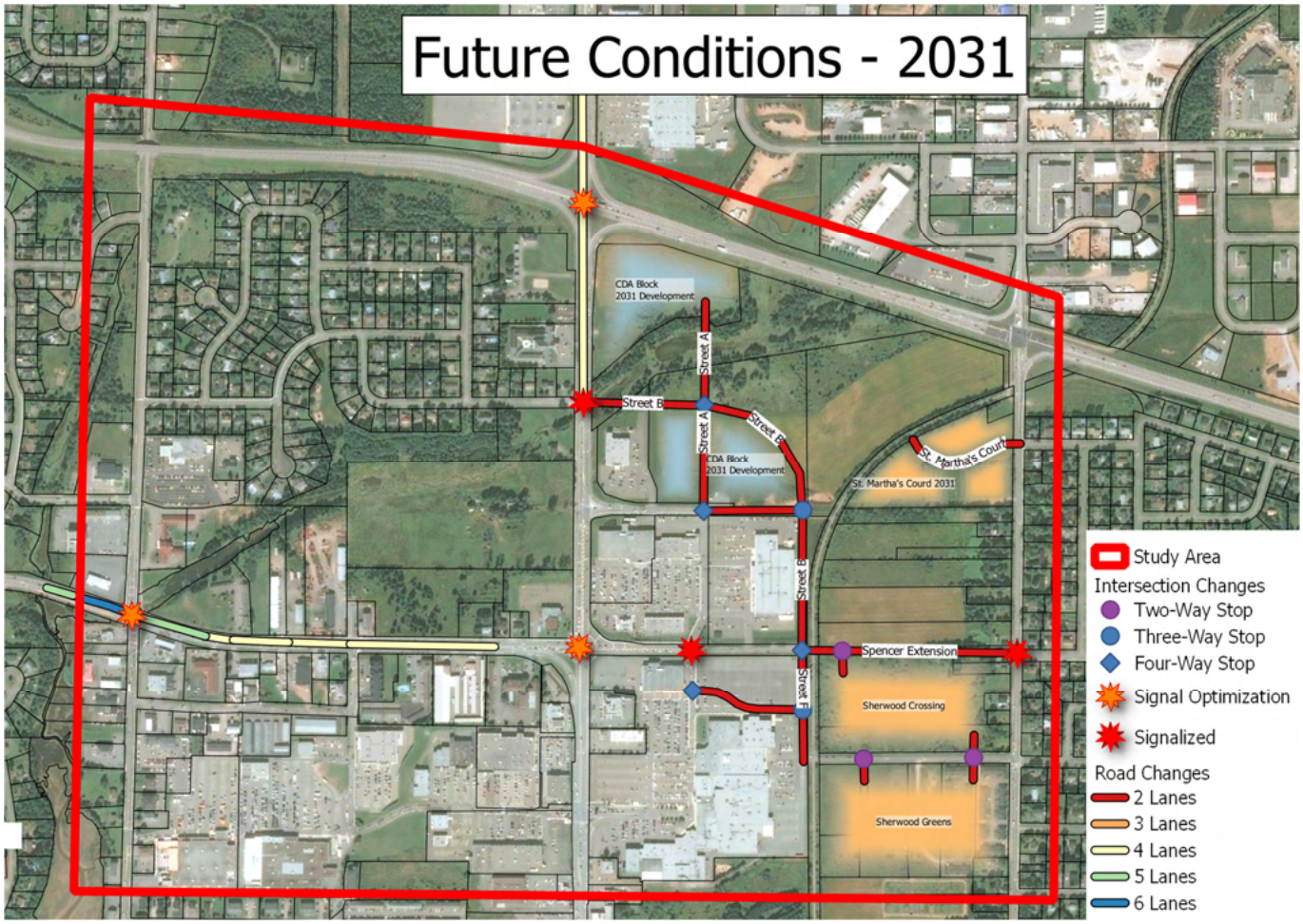


Figure 2-4 2031 Development

Future Development - 2041

This general development pattern was assumed to continue to 2041, with most of the lands between Mount Edward Road and the Confederation Trail eventually being developed with residential uses. The large vacant parcel of land northwest of the Malpeque Road / Capital Drive intersection was assumed to be developed with a mix of residential and commercial uses (see Figure 2-5).

New roadways added for the 2041 scenario include a north-south street to connect the Spencer Drive and Fern Garden Drive extensions, a further westward extension of Fern Garden Drive across the Confederation Trail, and a new road to connect the Capital/Rhynes intersection with the Malpeque/Saint Dunstan intersection.

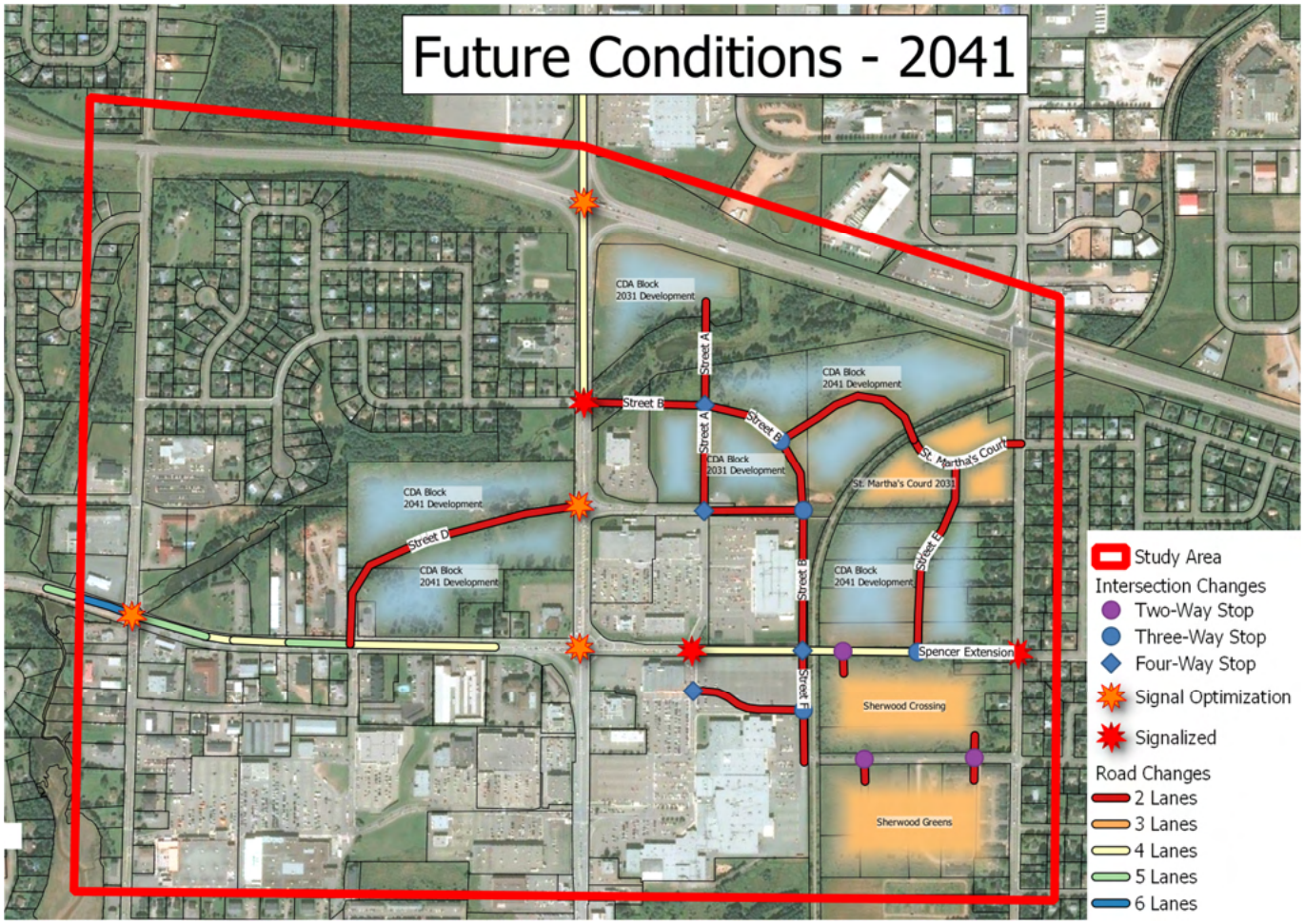


Figure 2-5 2041 Development

Trip Generation

To estimate how much new peak hour traffic would be generated by the assumed future development, trip generation rates from the Institute of Transportation Engineers (ITE) Trip Generation Manual, 10th Edition were used. Rates published in this manual are widely accepted by the engineering community, as they are based on empirical data.

Figure 2-6 illustrates the various development zones, both existing and future.

Figure 2-6 Development Zones

Data Sources

Several previously completed traffic impact studies were referenced to estimate the number of trips each zone would generate based on proposed developments, including:

- Sherwood Crossing, exp, 2020
- SDU Development at Fern Garden, CBCL, 2019
- Plaza Group TIS, ADI, 2009
- Trainor Street Development TIS, CBCL, 2020

The 10th edition of the ITE Trip Generation Manual was also used to update the trip values proposed in the two traffic studies where previous editions of the manual were used.

The City of Charlottetown provided proposed dwelling unit information for the Sherwood Green development (shown as zones 10145 and 10146 on Figure 2-6). It is currently under construction and roughly 70 Townhouses are completed and occupied.

Trip Generation Estimate – ITE Land Uses

The development lots identified in Figure 2-6 were used as a basis for estimating future development and trip generation. Land Use assumptions are summarized in Table 2.7, while Trip Generation Rates and the resulting Trip Generation are summarized in Table 2.8, and Table 2.9, respectively.

The residential development zones were assumed to fall within the ITE's Land Use (LU) Code 220 for 'Multifamily Housing (Low-Rise)'. The LU220 includes apartments, townhomes, and condominiums with at least 3 other dwelling units and have 1 or 2 stories. Although there are likely to be apartment or condominium buildings that are greater than 2 stories, this LU code was conservatively applied as it produces slightly more trips than the LU for multi-unit housing with greater than 2 stories. The number of trips for these residential zones were estimated based on the number of dwelling units for each zone. , The average dwelling unit density for parcels where residential developments are proposed (i.e. Zones 10057, 10059, 10145, and 10146) was applied to the other zones assumed to be residential (i.e. Zones 10015, 10017, 10036, 10058).

The Community Health Building planned for Zone 10056 was assigned LU630 "Clinic", and the number of trips were estimated based on the Gross Leasable Area (GLA).

For the assumed future commercial zones (i.e. 10016 and 10037), LU820 "Shopping Centre" was assigned based on the existing mix of different retailers found in nearby commercial areas (e.g. grocery, box store, restaurant). The number of trips for the commercial zones were estimated based on the GLA. For the zones that do not currently have a definitive GLA proposed, the average GLA per total development land area was determined based on existing commercial developments in Charlottetown, Moncton, and Dieppe.

The average trip rates for the peak hour (PH) of adjacent street traffic were used for each of the LU described previously for both the morning (AM) and afternoon (PM) peak periods. Trips for the adjacent street traffic typically yield a greater number of trips, which results in more conservative estimates.

Conversely, the average trip rate for the PH of generator was used to estimate trips for Saturday traffic where trip data for weekend traffic was limited. It should also be noted that the number of studies for the LU630 "Clinic" was low (data representative of 4 studies). Table 4.1 summarizes the trip rates and proportion of inbound and outbound traffic for each of the ITE Land Uses.

Table 2.7 Land Use Assumptions

VISSIM Zone	Land Use	Source of Data	Polygon Areas (sq. m)	Units / area	ITE LU Code	Number/Units	Total Units OR GLA (1000ft)
10036	Residential	-	31023	N/A	220 - Multifamily Housing (Low-Rise)	Estimated based on average residential units/total land area, and 10% reduction for AT 25% TH	58
10036	Residential	-	31023	N/A	221 - Multifamily Housing (Mid-Rise)	Estimated based on average residential units/total land area, and 10% reduction for AT 75% Apartment	172
10037	Commercial	-	44104	0.25	820 - Shopping Center	Estimated based on similar development GLA/total land area	118.622
10015	Residential	-	34929	N/A	220 - Multifamily Housing (Low-Rise)	Estimated based on average residential units/total land area, and 10% reduction for AT 25% TH	65
10015	Residential	-	34929	N/A	221 - Multifamily Housing (Mid-Rise)	Estimated based on average residential units/total land area, and 10% reduction for AT 75% Apartment	193
10016	Commercial	-	29859	0.25	820 - Shopping Center	Estimated based on similar development GLA/total land area	80.309
10017	Residential	-	77517	N/A	220 - Multifamily Housing (Low-Rise)	Estimated based on average residential units/total land area, and 10% reduction for AT 25% TH	143
10017	Residential	-	77517	N/A	221 - Multifamily Housing (Mid-Rise)	Estimated based on average residential units/total land area, and 10% reduction for AT 75% Apartment	428
10059	Residential	CBCL Traffic Study			220 - Multifamily Housing (Low-Rise)	7 Town Homes;	7

VISSIM Zone	Land Use	Source of Data	Polygon Areas (sq. m)	Units / area	ITE LU Code	Number/Units	Total Units OR GLA (1000ft)
10059	Residential	CBCL Traffic Study			221 - Multifamily Housing (Mid-Rise)	48 Apartment Units; 48 Apartment Units; 40 Apartment Units	136
10058	Residential	-	61963	N/A	220 - Multifamily Housing (Low-Rise)	Estimated based on average residential units/total land area, and 10% reduction for AT	456
10057	Residential	Sherwood Crossing EXP Traffic Study			220 - Multifamily Housing (Low-Rise)	36 Town Homes;	36
10057			49264.46	0.007	221 - Multifamily Housing (Mid-Rise)	314 Apartment Units.	314
10056					630 - Clinic	9000sf Community Health Centre	9
10146	Residential	City of Ch'town	29452	0.009 235	220 - Multifamily Housing (Low-Rise)	50 NEW Town Homes;	50
10146	Residential	City of Ch'town	29452	0.007	221 - Multifamily Housing (Mid-Rise)	72 Apartment Units; 62 Apartment Units; 88 Apartment Units.	222

Table 2.8 ITE land uses trip rate and proportional inbound and outbound traffic

ITE Land Use Code - Description	Weekday, AM PH of Adj. Street (7-9AM)			Weekday, PM PH of Adj. Street (4-6PM)			Saturday, PH of Generator		
	Trip Rate	In	Out	Trip Rate	In	Out	Trip Rate	In	Out
220 - Multifamily Housing (Low-Rise)	0.46	23%	77%	0.56	63%	37%	0.70	54%	46%
820 - Shopping Center	0.94	62%	38%	3.81	48%	52%	4.50	52%	48%
220 - Multifamily Housing (Low-Rise)	0.46	23%	77%	0.56	63%	37%	0.70	54%	46%
820 - Shopping Center	0.94	62%	38%	3.81	48%	52%	4.50	52%	48%

ITE Land Use Code - Description	Weekday, AM PH of Adj. Street (7-9AM)			Weekday, PM PH of Adj. Street (4-6PM)			Saturday, PH of Generator		
	Trip Rate	In	Out	Trip Rate	In	Out	Trip Rate	In	Out
220 - Multifamily Housing (Low-Rise)	0.46	23%	77%	0.56	63%	37%	0.70	54%	46%
220 - Multifamily Housing (Low-Rise)	0.46	23%	77%	0.56	63%	37%	0.70	54%	46%
220 - Multifamily Housing (Low-Rise)	0.46	23%	77%	0.56	63%	37%	0.70	54%	46%
630 - Clinic	3.69	78%	22%	3.28	29%	71%	-	-	-
220 - Multifamily Housing (Low-Rise)	0.46	23%	77%	0.56	63%	37%	0.70	54%	46%

Table 2.9 Trip Generation

			Weekday, AM PH of Adj. Street (7-9AM			Weekday, PM PH of Adj. Street (4-6PM)			Saturday, PH of Generator		
VISSIM Zone	**ITE LU Code**	**Total Units OR GLA (1000ft)**	**TOTAL AM TRIPS**	AM In	AM Out	**TOTAL PM TRIPS**	PM In	PM Out	**TOTAL SAT TRIPS**	Sat In	Sat Out
10036	220 - Multifamily Housing (Low-Rise)	58	**27**	6	21	**32**	20	12	**41**	22	19
10036	221 - Multifamily Housing (Mid-Rise)	172	**62**	16	46	**76**	46	30	**76**	37	39
10037	820 - Shopping Center	118.622	**129**	80	49	**294**	141	153	**386**	200	186
10015	220 - Multifamily Housing (Low-Rise)	65	**30**	7	23	**36**	23	13	**46**	25	21
10015	221 - Multifamily Housing (Mid-Rise)	193	**69**	18	51	**85**	52	33	**85**	42	43

			Weekday, AM PH of Adj. Street (7-9AM			Weekday, PM PH of Adj. Street (4-6PM)			Saturday, PH of Generator		
10016	820 - Shopping Center	80.309	**88**	54	34	**199**	96	103	**261**	136	125
10017	220 - Multifamily Housing (Low-Rise)	143	**66**	15	51	**80**	50	30	**100**	54	46
10017	221 - Multifamily Housing (Mid-Rise)	428	**154**	40	114	**188**	115	73	**188**	92	96
10059	220 - Multifamily Housing (Low-Rise)	7	**3**	1	2	**4**	2	2	**5**	3	2
10059	221 - Multifamily Housing (Mid-Rise)	136	**49**	13	36	**60**	37	23	**60**	29	31
10058	220 - Multifamily Housing (Low-Rise)	456	**210**	48	162	**255**	161	94	**319**	172	147
10057	220 - Multifamily Housing (Low-Rise)	36	**17**	4	13	**20**	13	7	**25**	14	11
10057	221 - Multifamily Housing (Mid-Rise)	314	**113**	29	84	**138**	84	54	**138**	68	70
10056	630 - Clinic	9	**33**	26	7	**30**	9	21	**0**	0	0
10146	220 - Multifamily Housing (Low-Rise)	50	**23**	5	18	**28**	18	10	**35**	19	16
10146	221 - Multifamily Housing (Mid-Rise)	222	**80**	21	59	**98**	60	38	**98**	48	50

Based on the above assumptions, development of the vacant areas around Charlottetown Mall is expected to generate the following new trips by 2041:

- 1,152 trips (383 in, 789 out) during the weekday AM peak hour
- 1,624 trips (927 in, 697 out) during the weekday PM peak hour
- 1,862 trips (961 in and 901 out) during the Saturday peak hour

Chapter 3 Traffic Analysis

Once calibrated and validated, the model was used to evaluate traffic conditions under the existing, 2031 and 2041 scenarios for each of the AM, PM and Saturday peak hours. For each scenario, 10 simulation iterations were evaluated with different "seed" conditions, to account for variability and randomness in driver behaviour. Traffic conditions were collected at each intersection of interest, with several performance indicators averaged over the 10 simulation runs.

The key performance indicators include vehicular volume, average and maximum queues, and average vehicle delay, expressed in terms of Level of Service (LOS). LOS is the key indicator of intersection performance with respect to traffic movement and is defined by the average amount of delay experienced by motorists using each of the various intersection movements. Higher delays result in increased driver discomfort, fuel consumption, and travel time. LOS gives an indication of speed, travel time, traffic interruptions, traffic flow, comfort, and convenience, and is expressed as a scale from 'A' to 'F'. LOS 'A' represents conditions approaching free-flow and LOS 'F' represents a level of delay generally unacceptable to drivers and where traffic volumes usually exceed capacity. LOS 'E' was used as the minimum acceptable level of service during peak periods for this study.

The criteria associated with each LOS are found in Table 2.1. As shown in the table, the delays listed for signalized intersections are higher than for the same level of service at unsignalized intersections; this is because motorists are typically more tolerant of extended delays at signalized intersections.

Table 3.1 Level of Service (LOS) Criteria for Signalized and Unsignalized Intersections

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

3.1 Existing Conditions

An initial evaluation was conducted of the study area road network under existing conditions.

As discussed in Section 2.2, , and as summarized in Table 3.3, the study area currently experiences approximately 7,240 vehicular trips during the weekday AM peak hour, 9,065 trips during the weekday PM peak hour, and approximately 7,720 trips during the Saturday peak hour.

Table 3.2 2031 Traffic Conditions

Time Period	Total Volume
AM Peak Hour	7,239
PM Peak Hour	9,065
Saturday Peak Hour	7,718

AM Peak Hour

During the weekday AM peak hour, the study area road network generally operates well. The arterial and collector roads experience peak direction volumes of 1,000 vehicles or more. Heavy volumes are observed on the eastern portion of the By-pass, as well as in the inbound direction between Capital Drive and North River Road (see Figure 3-1).

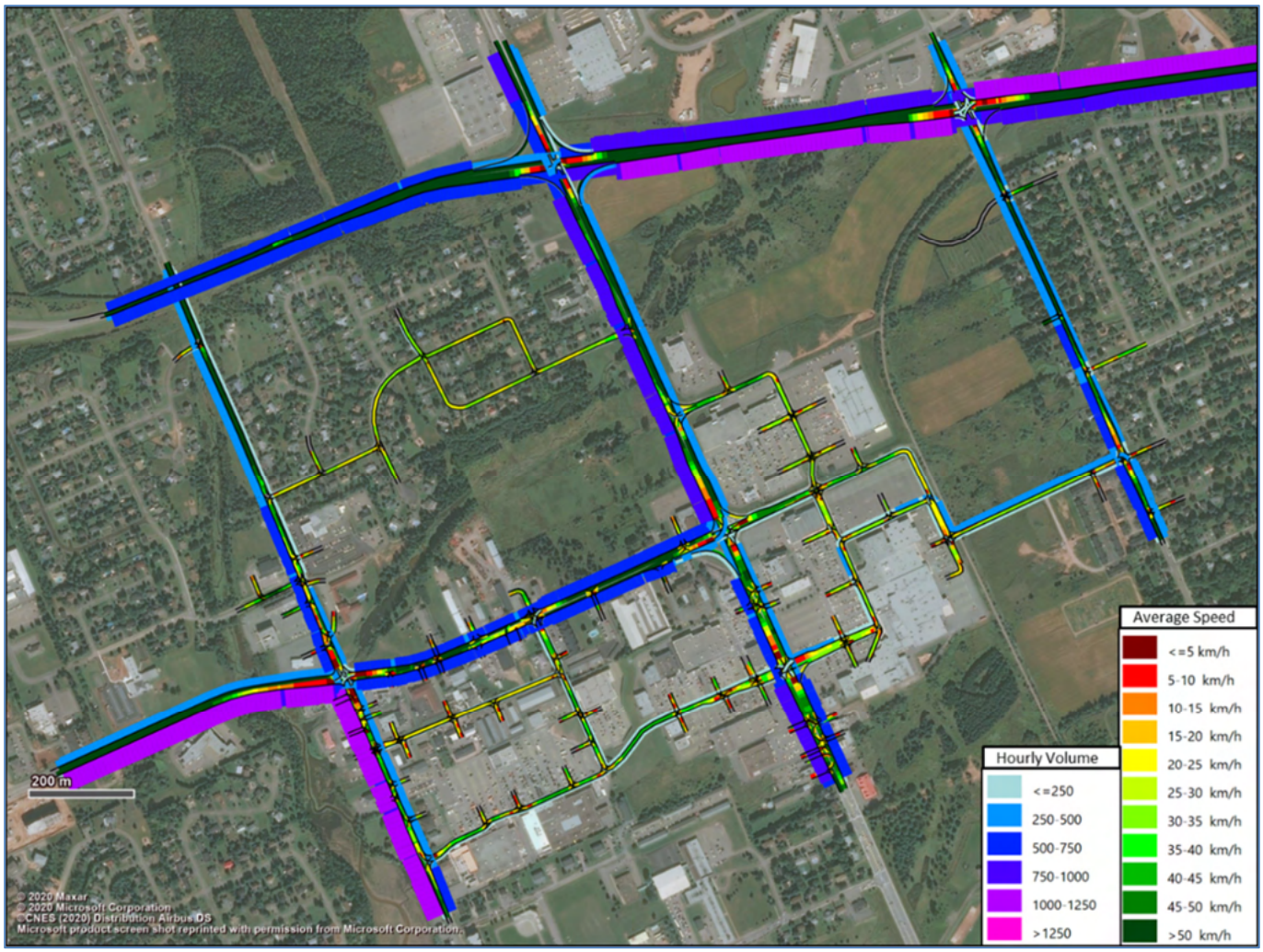


Figure 3-1 Existing Conditions - AM Peak Hour - Speeds and Volumes

Such volumes translate to significant delays and queues at the Capital Drive & North River Road intersection, where high inbound (eastbound) vehicular volumes must compete with the significant southbound-through and eastbound-right movements. This is especially the case for the eastbound-right movement, where a significant flow entering the City from the Trans-Canada Highway is serviced by limited green time with relatively few gap opportunities during red phases. At the same time, the southbound movements also experience delays and queues, partly due to the short green time afforded by the split phasing, and partly due to the short turn storage lanes; southbound movements are constrained to a single lane, with left and right turn bays developing only within 50-100 m of the intersection (see Figure 3-2). The single-lane through movement tends to block vehicles from entering the left and right turning lanes, thereby forming long queues.

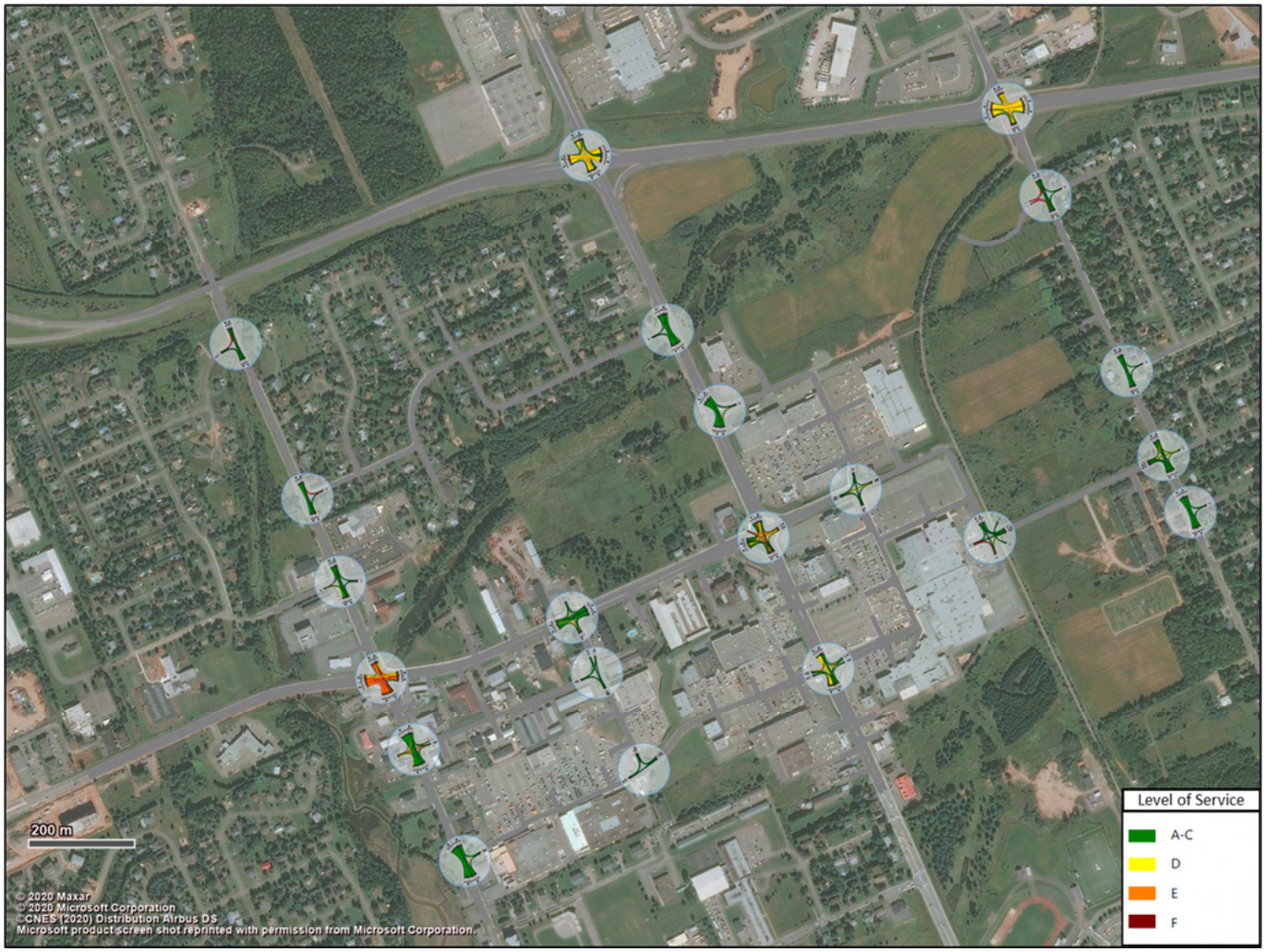


Figure 3-2 Existing Conditions - AM Peak Hour – Level of Service

PM Peak Hour

The study area road network experienced the highest volumes under existing conditions during the weekday PM peak hour. This is currently the most challenging time period, as it experiences both high shopping trip volumes destined to the commercial areas, and high commuter traffic passing through the study area. High vehicular volumes are observed in the outbound direction along the By-pass, Malpeque Road, and Capital Drive, as commuters leave the City. Most of the local roads around the Charlottetown Mall and the Buchanan Drive commercial cluster experience relatively low volumes (less than 500 vehicles per hour, per direction). At the same time, we observe increased activity associated with the commercial areas, as discretionary shopping trips generate more traffic. With increased friction around the Charlottetown Mall, we observe lower average speeds (see Figure 3-3).

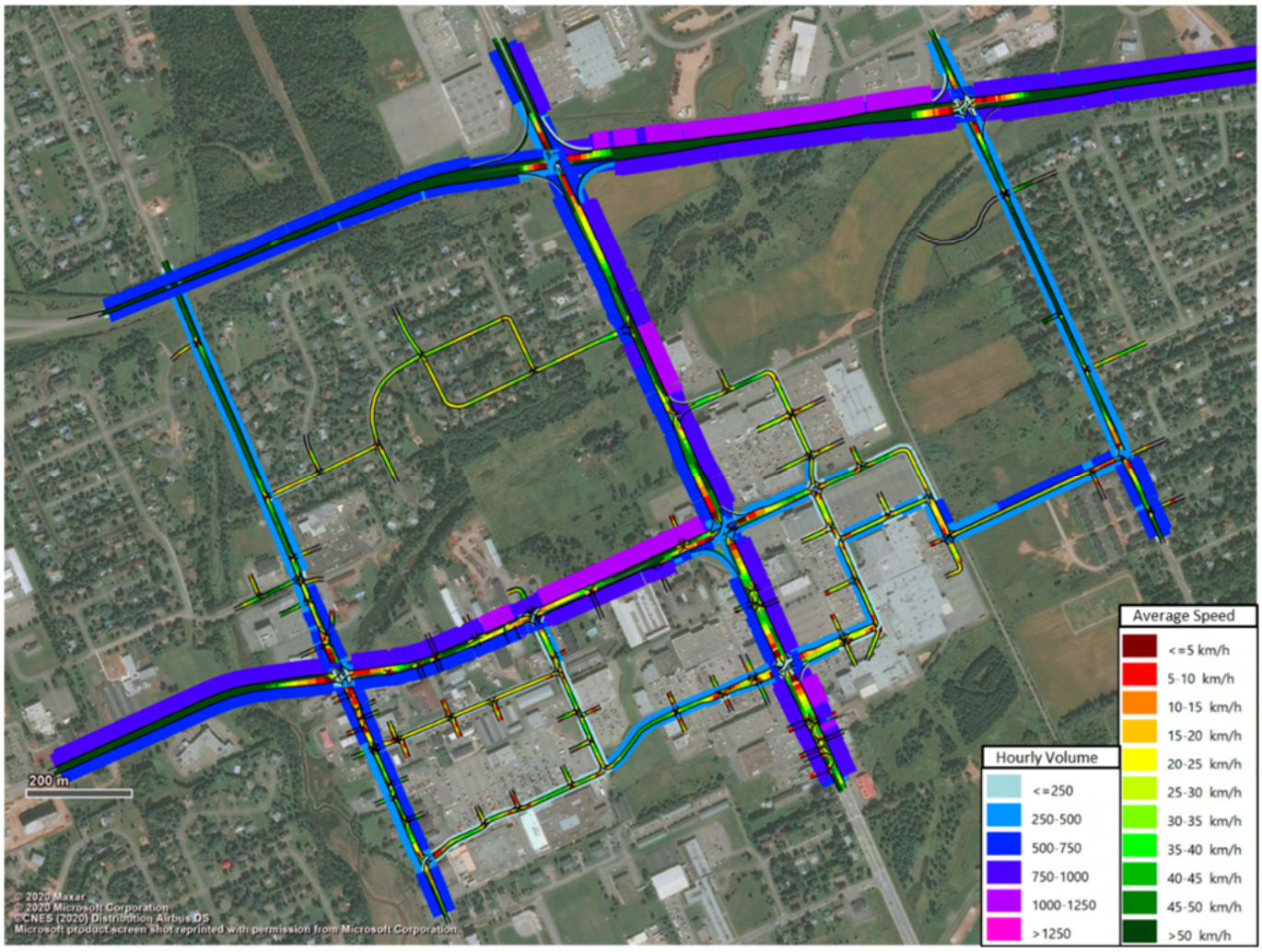


Figure 3-3 Existing Conditions - PM Peak Hour - Speeds and Volumes

This travel pattern translates to higher delays and queues at key intersections within the study area (see Figure 3-4). The most critical intersections are discussed below.

The Malpeque Road & By-Pass intersection experiences an average delay of 35 seconds, corresponding to an overall LOS of D. While most movements operate well, the northbound-through movement experiences capacity constraint, as it is limited to a single lane.

The Capital Drive & North River Road intersection experiences an average delay of 38 seconds, with average queues of 100m on all approaches. This is in part due to the split phasing for the southbound and northbound approaches. While the eastbound, westbound and southbound queues typically remain within storage areas, the northbound queue frequently blocks business driveways; this is especially the case for the northbound-left movement, which currently experiences significant volumes. Queues often conflict with vehicles entering or exiting the Tim Hortons southwest of the intersection, as well as the Esso gas station on the southeast corner. Opportunities to address such conflicts may include restricting some driveways to right-in, right-out movements only. Relocation of the Tim Hortons further south on North River Road would benefit both intersection operations and access to the restaurant.

The Capital Drive & Malpeque Road intersection also experiences capacity constraint on some turning movements, primarily due to the split-phasing, which limits the available green time.

Figure 3-4 Existing Conditions - PM Peak Hour – Level of Service

Within the Charlottetown Mall property, we also observe capacity constraints along Spencer Drive, and at the intersection of Towers Road with the Confederation Trail. The constraint is primarily due to the low operational capacity of the all-way stop at the Babineau Avenue intersection, and the funnel effect of Towers Road, which is the only road link between Mount Edward Road and Capital Drive.

Saturday Peak Hour

During the weekend peak hour, the study area experiences very heavy volumes along Malpeque Road / University Avenue, and along the Charlottetown By-pass east of Malpeque Road. Dominant flows are destined to and from the Mall and commercial areas (see Figure 3-5). At the same time, we also observe relatively high volumes around the Charlottetown Mall, in part due to high in/out traffic from all directions, as well as a strong desire between the large stores on Buchanan Drive and demand to and from Mount Edward Road. Overall conditions, however, are currently better than during the weekday PM peak hour, as the demand pattern is more homogenous.

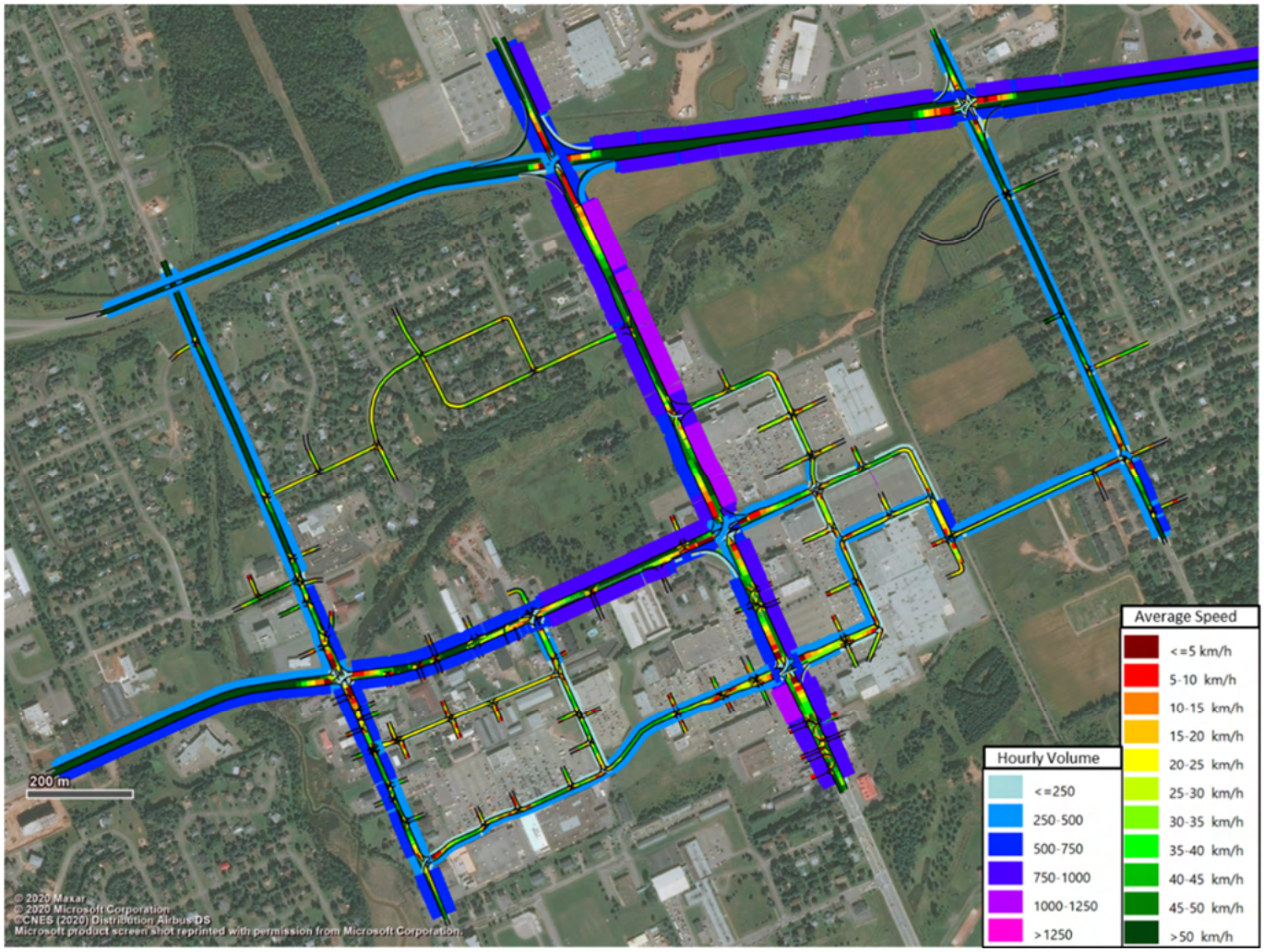


Figure 3-5 Existing Conditions - Saturday Peak Hour - Speeds and Volumes

These travel patterns translate to delays experienced along Malpeque Road, particularly at the By-pass and at Capital Drive (see Figure 3-6).

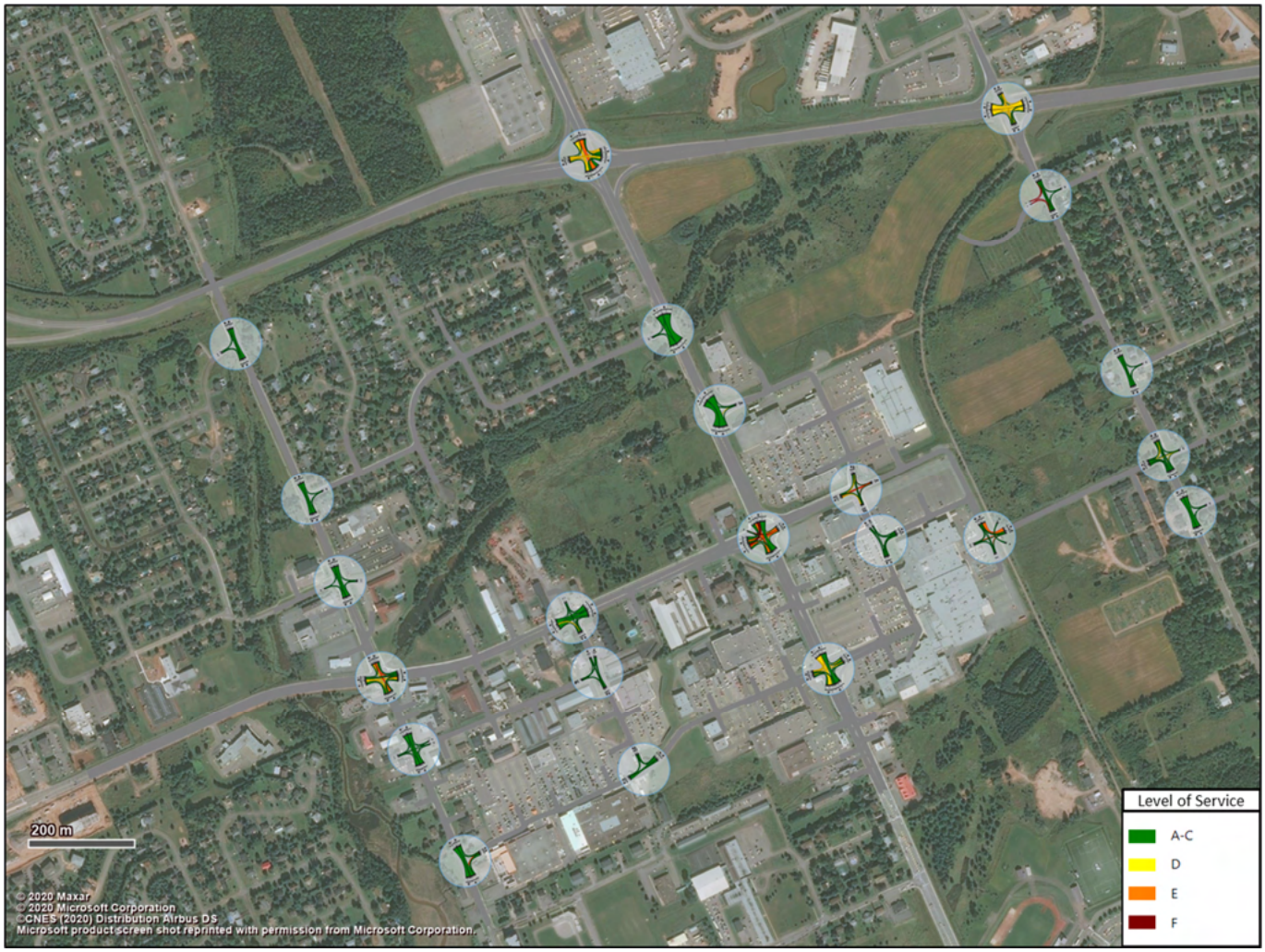


Figure 3-6 Existing Conditions - Saturday Peak Hour – Level of Service

3.2 2031 Conditions

Considering the assumed local and regional growth by 2031, the study area is expected to experience an additional ~1,000 vehicles on the road during all peak hours (see Table 3.3).

Table 3.3 2031 Traffic Conditions

Time Period	Total Volume
AM Peak Hour	8,130
PM Peak Hour	10,290
Saturday Peak Hour	8,920

Road Network Improvements

To accommodate the traffic growth forecasted to 2031, the capacity constraints identified under existing conditions will require addressing. These include both network-level interventions on individual links, as well as intersection-specific improvements. The proposed interventions are outlined below, followed by detailed discussion of each.

1. Capital Drive widening from Lower Malpeque Road to Malpeque Road
2. Malpeque Road widening from the Bypass to Capital Drive + Reconfiguration of the Malpeque Road / Bypass Highway intersection
3. Extension of Spencer Drive from the Confederation Trail to Mount Edward Road
4. Roadway realignment to consolidate the two intersections between the Superstore and Cineplex/Winners
5. Signalization of the Spencer Drive & Babineau Avenue intersection
6. Extensions of Irwin Drive, Saint Dunstan Street, and Babineau Avenue
7. Reconfiguration of the Capital Drive & Lower Malpeque Road intersection
8. Reconfiguration of the Capital Drive & Malpeque Road intersection

1. Capital Drive Widening

During all peak hours, it was observed that Capital Drive is a significant bottleneck to both eastbound and westbound traffic, as it operates with a single through lane for most of its length between North River Road and Malpeque Road. An initial change will therefore consist of widening the road to two lanes in both directions, as illustrated on Figure 3-7 and Figure 3-8.

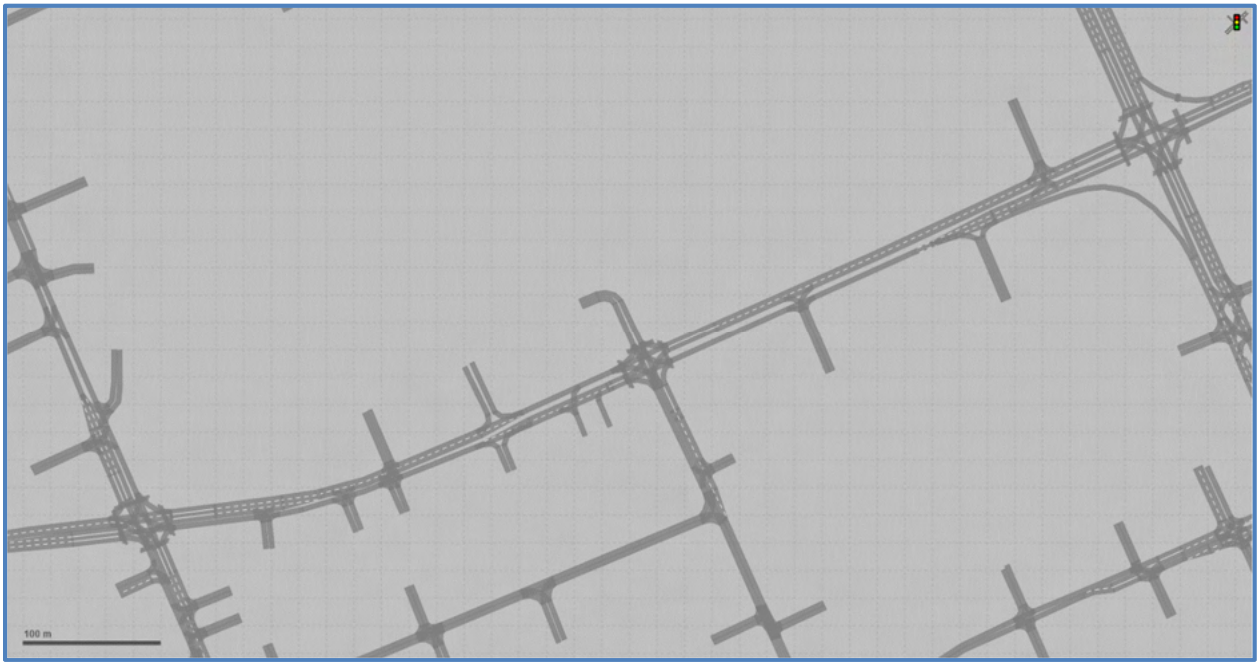


Figure 3-7 Capital Drive - Existing Conditions

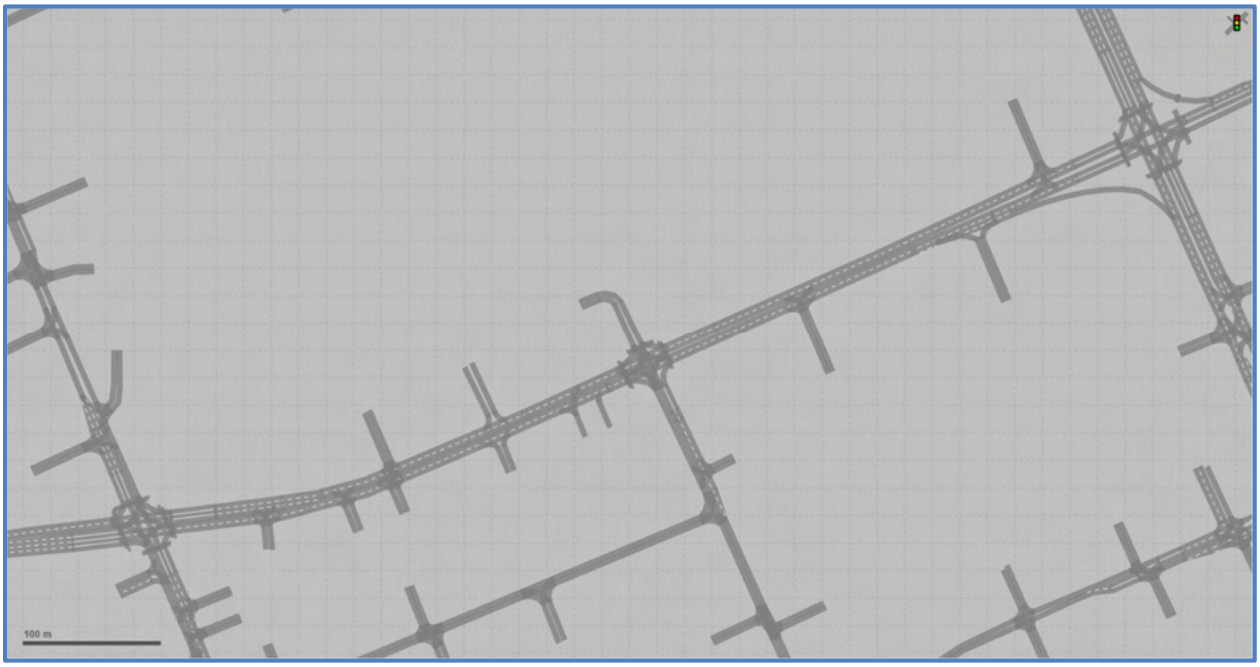


Figure 3-8 Capital Drive - 2031 Widening to Four Lanes

2. Malpeque Road Widening + Reconfiguration of Bypass Intersection

To improve the fluidity of travel through the By-pass intersection, Malpeque Road should be widened to maintain four lanes (two through lanes per direction), from Capital Drive to merge with the existing four-lane cross section north of the By-pass. To achieve this, the existing dedicated northbound and southbound right turn lanes at the Bypass intersection would become shared through/right lanes, both would continue to have free-flow merge lanes downstream. The eastbound and westbound right turn lanes at this intersection, which are currently free-flow, would be modified to yield-controlled right turn movements. Auxiliary turning lanes will be maintained and added at new and existing intersections, as illustrated on Figure 3-9,to Figure 3-12.

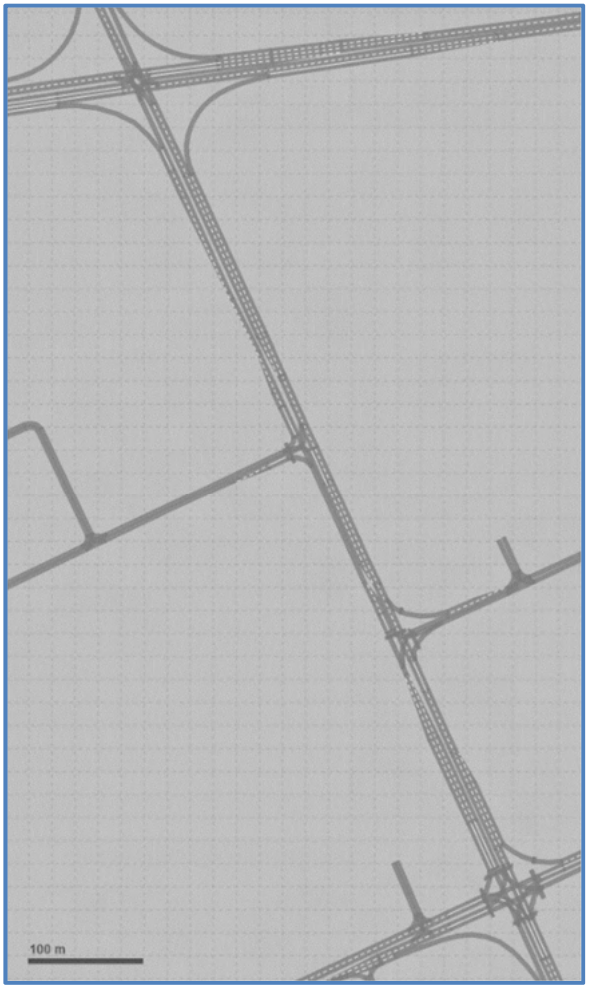


Figure 3-9 Malpeque Road Existing Layout

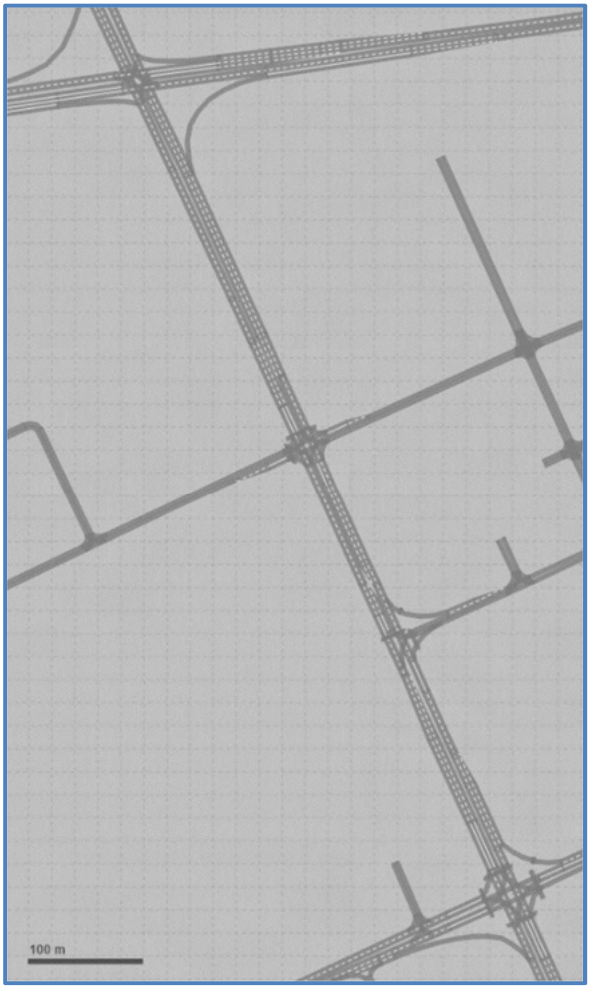


Figure 3-10 Malpeque Road Widening

Figure 3-11 Malpeque Road & Bypass Existing Layout

Figure 3-12 Malpeque Road & Bypass Reconfiguration

3. Spencer Drive Extension

To reduce current and future traffic demand on Towers Road, Spencer Drive should be extended to Mount Edward Road. This new two-lane road would provide access to development parcels, while increasing opportunities to cross the Confederation Trail and reducing congestion on Towers Road. The new road would provide a direct route between Capital Drive and Mount Edward, eliminating the need to cut through the Charlottetown Mall parking lot. Spencer Drive would terminate at Ash Drive with a new signalized intersection on Mount Edward (see Figure 3-13 and Figure 3-14).

Figure 3-13 Spencer Drive Existing Conditions

Figure 3-14 Spencer Drive Extension

4. Roadway Realignment & Intersection Consolidation

The area around the Cineplex Cinema and the Superstore currently experiences high volumes of traffic, much of which is travelling between Capital Drive and Mount Edward Road. Traffic flow here is impeded by the arrangement of the two parking aisles which create two offset T-intersections roughly 25m apart. Significant operational and safety improvements would be achieved by realigning and consolidating these intersections into a single junction (see Figure 3-15 and Figure 3-16). We further note that the existing southbound right turn lane adjacent to the Superstore should be removed. It simply occupies the space previously used for perpendicular parking and it is unnecessary from an operational standpoint. Replacing this unused space with a curb extension and grass/landscaping would provide some beautification.

Figure 3-15 Cineplex Road Existing Layout

Figure 3-16 Cineplex Road Realignment

5. Signalization of the Spencer Drive & Babineau Avenue intersection

This all-way stop intersection currently causes a major bottleneck for the area's circulation as it does not have the operational capacity to accommodate the growing volumes across Towers Road. By 2031, the intersection should be signalized, with the addition of left-turn lanes (see Figure 3-17 and Figure 3-18)

Figure 3-17 Babineau Avenue & Spencer Drive Existing Layout

Figure 3-18 Babineau Avenue & Spencer Drive Signalized

6. Extensions of Irwin Drive, Saint Dunstan Street, and Babineau Avenue

To service the northern-most SDU parcels, the adjacent road network should be extended into the vacant lands. Babineau Avenue should be extended northward, across the creek and wetland, while Irwin Drive should be extended eastward, intersecting Babineau Avenue and curving south to an extension of Saint Dunstan Street. The intersection of Irwin Drive and Malpeque Road would be signalized, while new intersections in the commercial area would be all-way stop controlled (see Figure 3-19 and Figure 3-20).

Figure 3-19 Saint Dunstan Street Existing Layout

Figure 3-20 Saint Dunstan Street Extensions

7. Reconfiguration of the Capital Drive & North River Road intersection

Complementing the widening of Capital Drive to four lanes, the North River Road intersection should be reconfigured so that the current north-south split phasing can be eliminated in favour of more conventional phasing. While all approaches would maintain dedicated left and right turn lanes, the east and west approaches would carry two through lanes (see Figure 3-21 and Figure 3-22). Additionally, the eastbound-right movement would benefit from the installation of a dedicated signal-head that would allow for an overlap right turn phase to operate concurrently with the protected northbound left turn phase.

Figure 3-21 Capital Drive & Lower Malpeque Road Existing Layout

Figure 3-22 Capital Drive & Lower Malpeque Road Reconfiguration

8. **Reconfiguration of the Capital Drive & Malpeque Road intersection**

The intersection currently operates with split phasing which allocates green time sequentially between the northbound and southbound approaches. This limits the green time available to both approaches as they never overlap, resulting in poor efficiency. To address this deficiency, the intersection should be reconfigured to allow for typical phasing; this requires re-assignment of the existing northbound through-left lane. To achieve this, the northbound and southbound approaches should each have one through lane plus one through-right lane. Also, the channelized eastbound right turn ramp should be reconfigured to a yield-controlled merge onto University Avenue; the existing acceleration lane would become the second southbound through lane. These changes are illustrated in Figure 3-23 and Figure 3-24.

Figure 3-23 Capital Drive & Malpeque Road Existing Layout

Figure 3-24 Capital Drive & Malpeque Road Reconfiguration

AM Peak Hour

During the weekday AM peak hour, patterns observed under existing conditions will be amplified, with higher volumes observed on Capital Drive, North River Road, and the By-pass. The road network improvements will improve conditions in some places, while offsetting the pressures of anticipated growth. The Mall area roads will experience less pressure on account of the increased route choices; most significantly, Towers Road will see improved conditions, with lower volumes and better flow (see Figure 3-25).

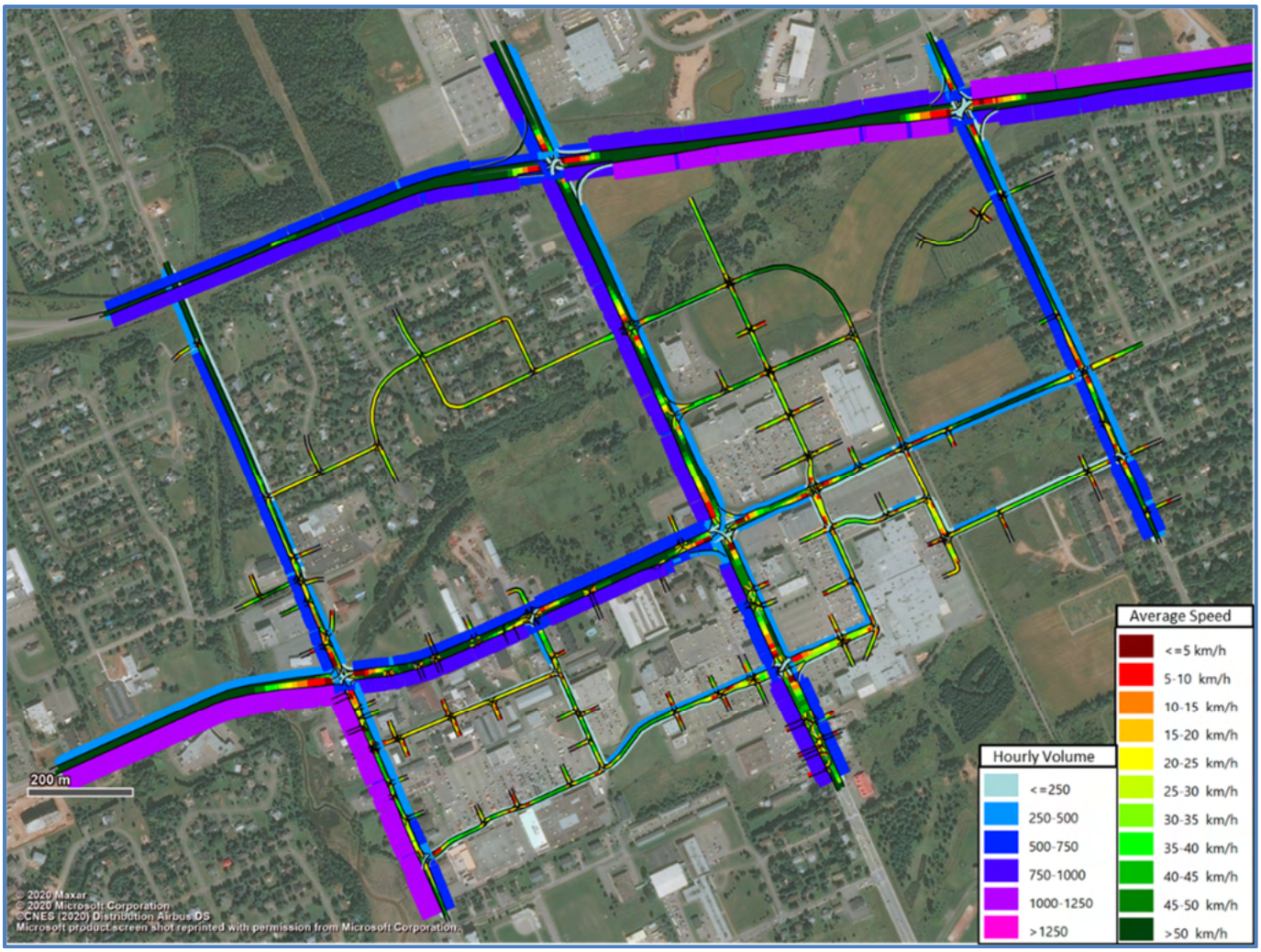


Figure 3-25 2031 Conditions - AM Peak Hour - Speeds and Volumes

The LOS analysis also indicates improved conditions at both the Capital Drive / North River Road intersection and the Capital Drive / Malpeque Road intersection, and no worsening of conditions along the By-pass (see Figure 3-26).

Figure 3-26 2031 Conditions - AM Peak Hour – Level of Service

PM Peak Hour

During the weekday PM peak hour, the major roads will experience a significant increase in vehicular traffic, particularly along the Bypass, Malpeque Road and Capital Drive. Despite this, network-wide operational conditions will remain consistent with existing conditions, and average speeds will not decrease appreciably (see Figure 3-27).

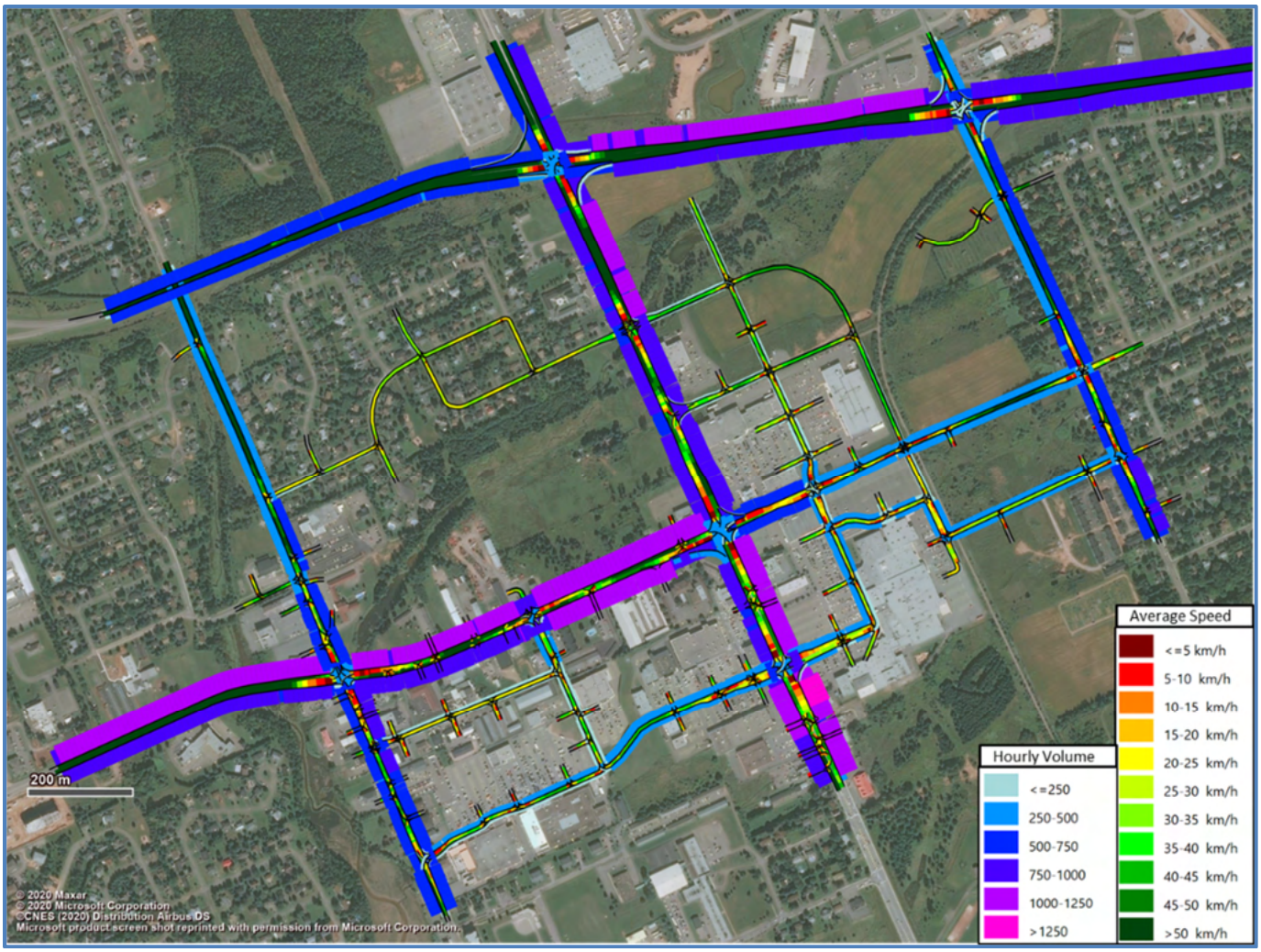


Figure 3-27 2031 Conditions - PM Peak Hour - Speeds and Volumes

Comparison of Levels of Service during the weekday PM peak hour between 2031 conditions (Figure 3-28) and existing conditions (Figure 3-4) suggests that most intersections will continue operating with good or acceptable levels of service, with no significant degradation.

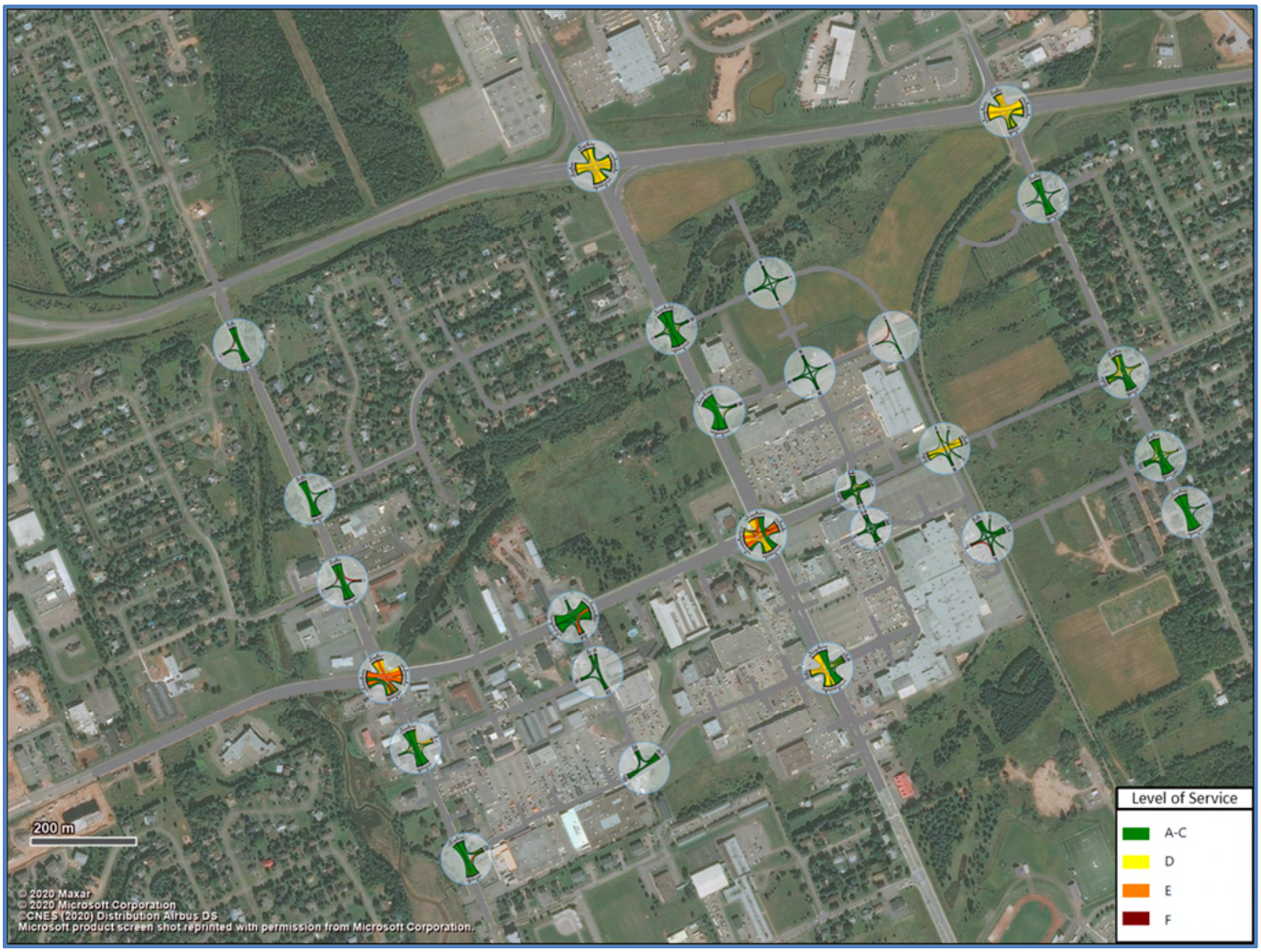


Figure 3-28 2031 Conditions - PM Peak Hour – Level of Service

Saturday Peak Hour

Assessment of future 2031 conditions during the Saturday peak hour demonstrates intensification of activity around the Charlottetown Mall, as shopping activity is focused along the commercial streets. We observe a reduction in vehicular flows along Malpeque Road, as trips to and from Mount Edward Road and the eastern part of the study area routes more directly via Towers Road and Spencer Drive (see Figure 3-29). Activity around Spencer Drive and Babineau will approach the theoretical capacities of those roads, with some observable slow downs.

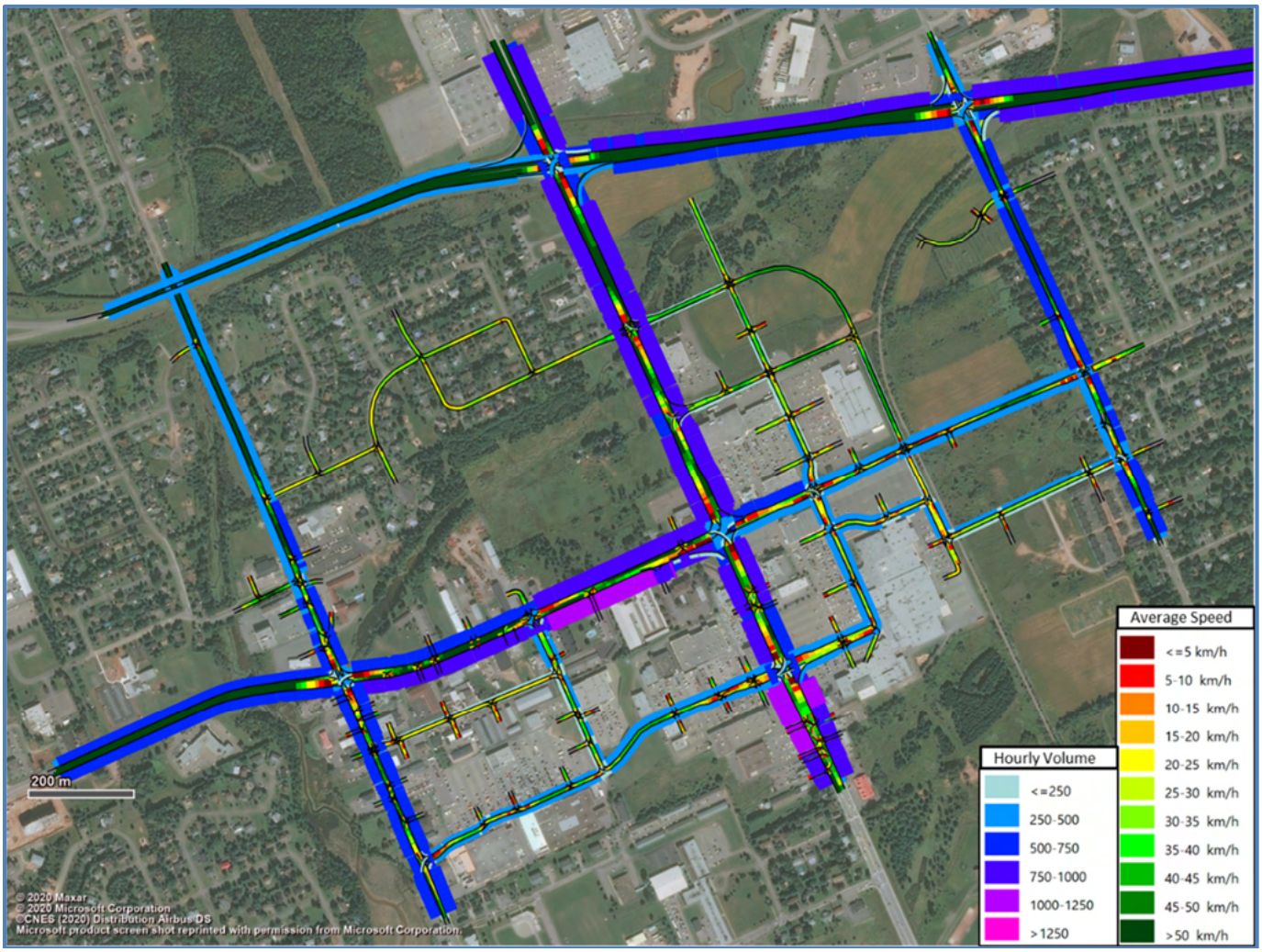


Figure 3-29 2031 Conditions - Saturday Peak Hour - Speeds and Volume

When compared to existing conditions (see Figure 3-6), the LOS analysis of 2031 Saturday peak hour conditions suggests a general spreading of the vehicular pressure and an optimization of flows. While delays may be experienced at the intersection of Spencer Drive and the Confederation Trail, intersections along the Bypass will experience some improvements, as will the Capital Drive / North River Road intersection (see Figure 3-30).

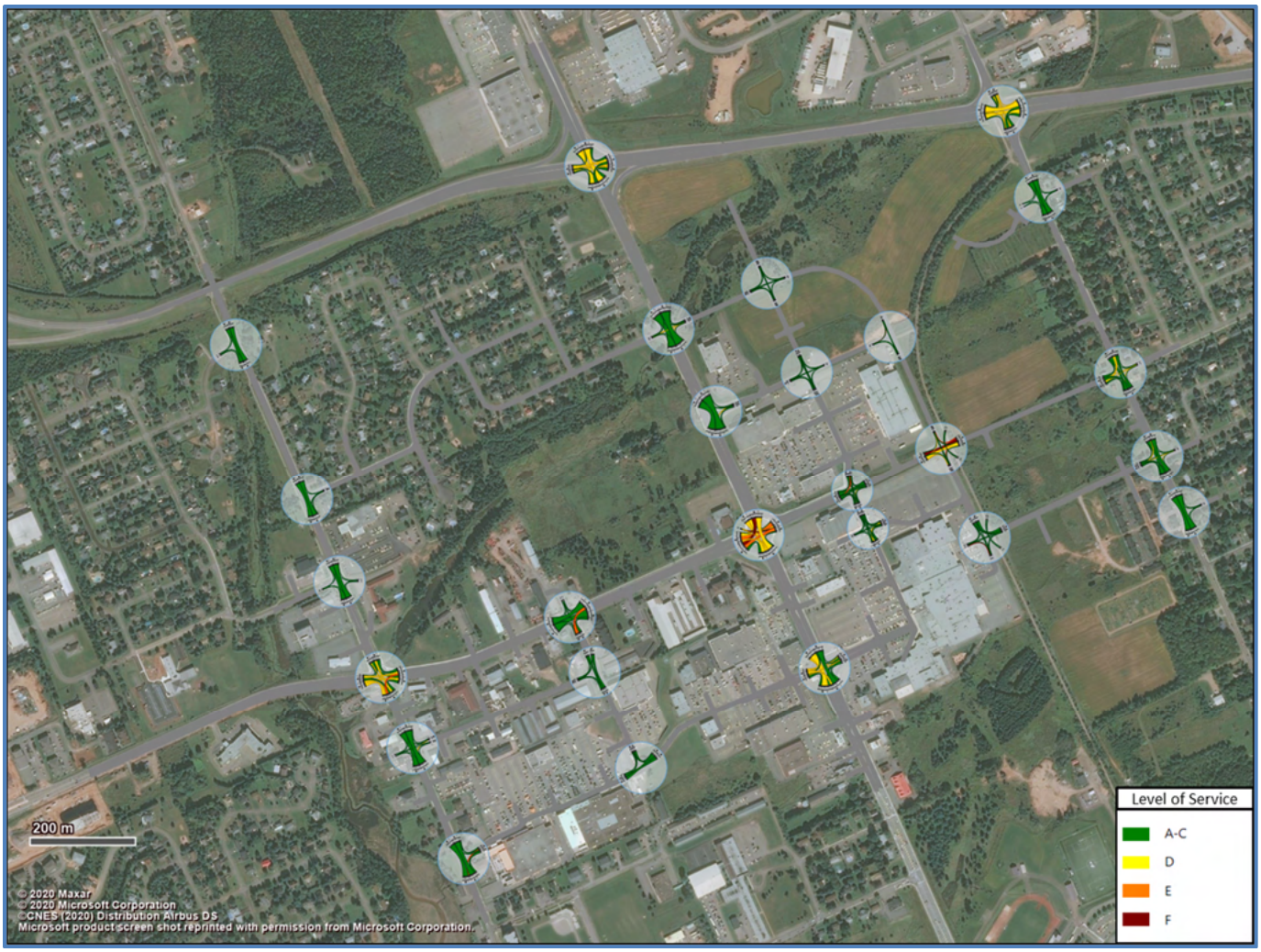


Figure 3-30 2031 Conditions - Saturday Peak Hour – Level of Service

3.3 2041 Conditions

By 2041, it was assumed that the remaining SDU lands would be developed. While the weekday AM peak hour will see a relatively modest growth in trips, both the weekday PM peak hour and the Saturday peak hour will experience more significant trip generation increases associated with the added commercial development. Most noticeably, the study area will experience the highest volume during the Saturday peak hour, with traffic growing by almost 2,500 vehicles versus existing conditions (see Table 3.4).

Table 3.4 2041 Traffic Conditions

Time Period	Total Volume
AM Peak Hour	9,070
PM Peak Hour	11,650
Saturday Peak Hour	12,270

Road Network Improvements

In response to anticipated growth to 2041, the study area road network will require additional roads and widenings:

1. Spencer Drive Widening
2. Saint Dunstan University Lands Road Network
3. Rhynes Drive Extension

1. Spencer Drive Widening

To accommodate continued growth in traffic across the Confederation Trail, Spencer Drive should be widened to two lanes in each direction, between Capital Drive and Mount Edward Road (see Figure 3-31). In this manner it will become a true east-west spine for the SDU lands and complete the natural desire lines across this part of the study area.

Figure 3-31 Spencer Drive Widening to Four Lanes

2. Saint Dunstan University Lands Road Network

To provide access to the last of the SDU lands, Fern Garden Road could be extended across the Confederation Trail to join the Irwin Drive extension, while a new north-south road would provide access to the development parcels between Fern Garden Drive and Spencer Drive (see Figure 3-32). It is assumed that all new intersections will be all-way stop controlled.

Figure 3-32 Saint Dunstan University Lands Road Network

3. Rhynes Drive Extension

Opening access to develop zones 10036 and 10037 will call for the extension of Rhynes Drive, potentially tying into Saint Dunstan Street at its current intersection with Malpeque Road. The extended Rhynes Drive was considered as a two-lane road, with auxiliary turn lanes at the Malpeque Road and Capital Drive signalized intersections (see Figure 3-33).

Figure 3-33 Rhynes Drive Extension

AM Peak Hour

Much of the growth occurring by 2041 will be external, as regional travel patterns are reinforced. Heavy vehicular flows will follow existing patterns along the major roads; the Bypass and Capital Drive/North River Road in particular. This is consistent with the study area's position as Charlottetown's north-western gateway. The central area around the Capital Drive and Malpeque Road intersection will also experience traffic growth, as local traffic routes via the Rhynes Drive extension and Spencer Drive, which in conjunction with Capital Drive will be formalized as the east-west spine through the study area Drive (see Figure 3-34).

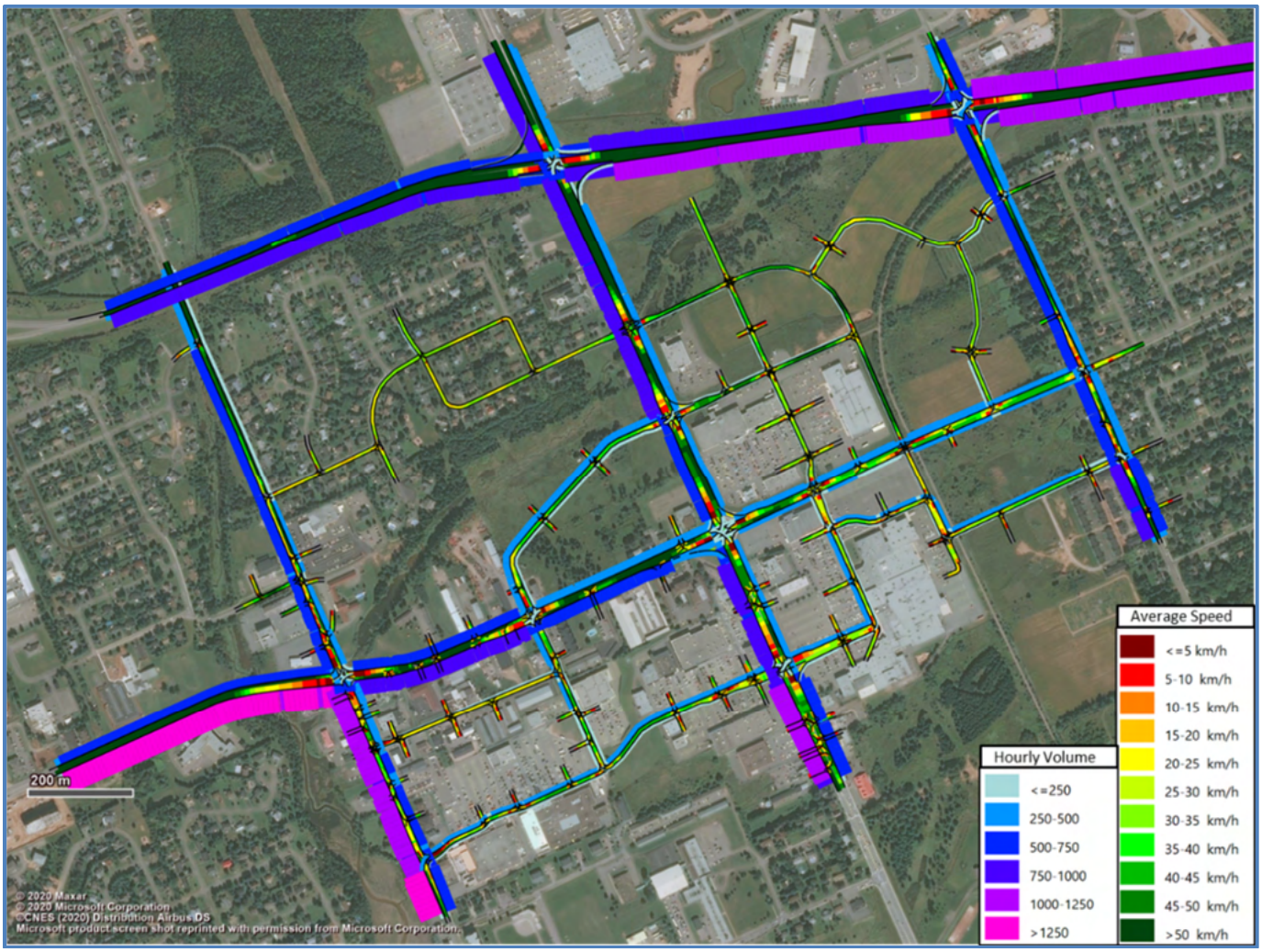


Figure 3-34 2041 Conditions - AM Peak Hour - Speeds and Volume

Comparing the 2041 AM peak hour LOS with existing conditions (see Figure 3-2) suggests that the proposed network improvements will successfully attenuate the impacts of the anticipated local and regional traffic growth. Indeed, the majority of intersection movements will continue operating with similar levels of service (see Figure 3-35).

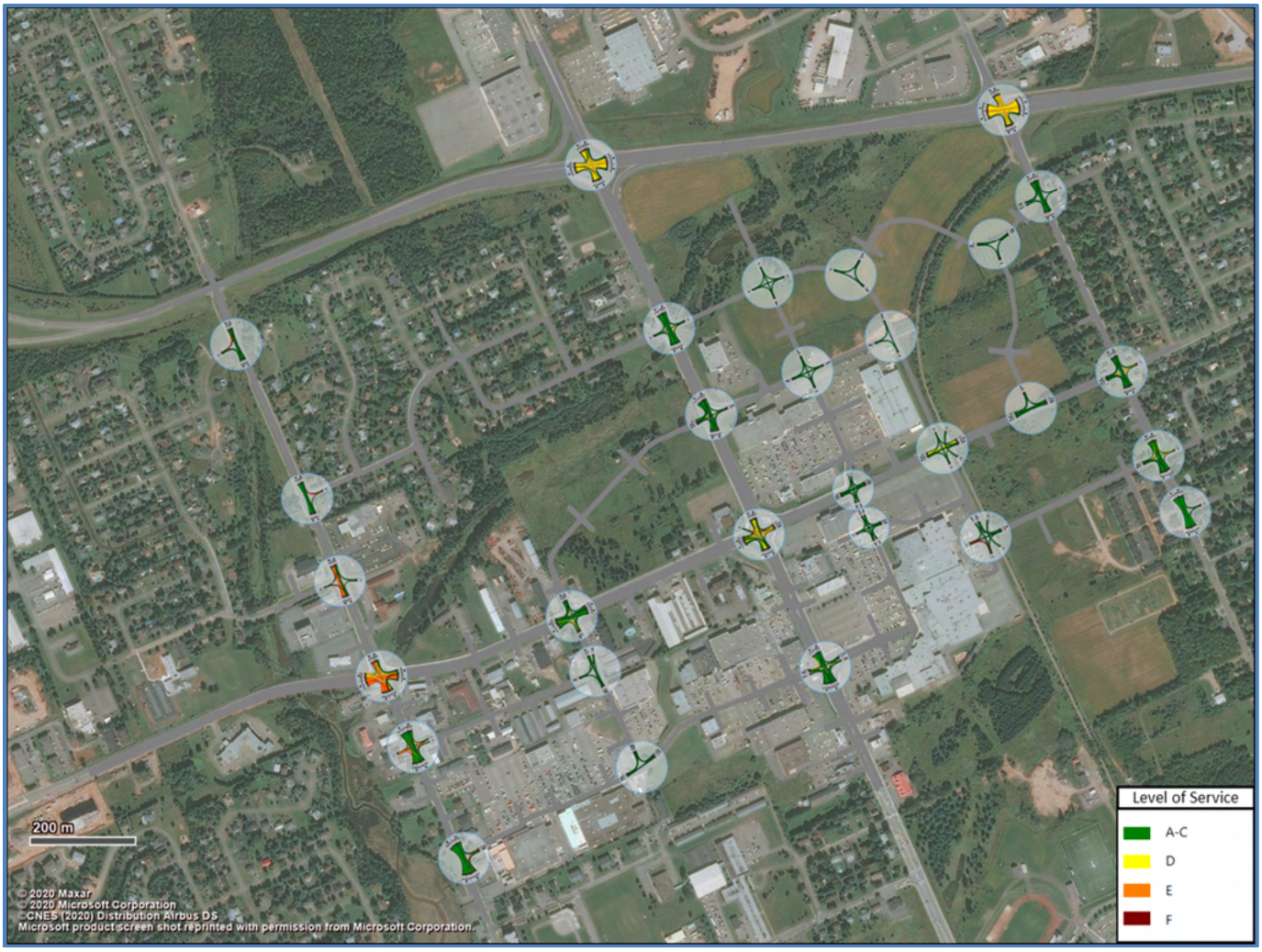


Figure 3-35 2041 Conditions - AM Peak Hour – Level of Service

PM Peak Hour

During the weekday AM peak hour, the study area will experience significant growth on most roads, accommodating both an increase in commuter traffic, and an increase in shopping activity. Significant increase in vehicular flows will be observed along the Bypass, Capital Drive, and Malpeque Road, with growth also observed on several secondary road roads, including Rhynes Drive, Spencer Drive, Buchanan Drive, and Towers Road (see Figure 3-36). This reflects a typical pattern as regional traffic seeks to optimize travel along the most direct arterial routes, while local traffic makes optimal use of the secondary, routes. Most noticeably, Rhynes Road may function as a pressure valve for the Capital Drive / Malpeque Road intersection, which will experience a reduction in eastbound left turn and southbound right turn volumes.

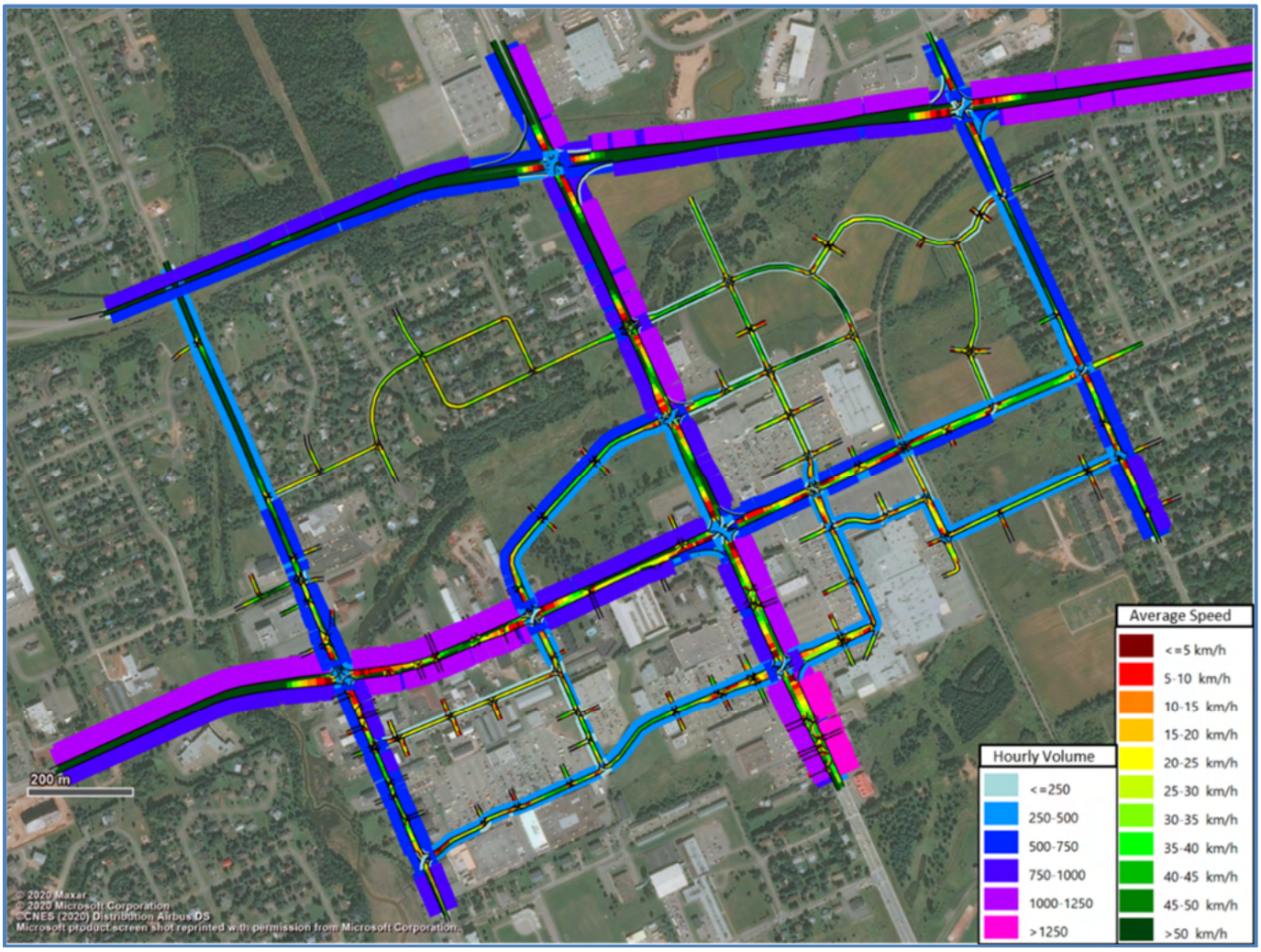


Figure 3-36 2041 Conditions - PM Peak Hour - Speeds and Volume

The LOS analysis of 2041 conditions during the PM peak hour indicates that, largely, the road network will function well, with few bottlenecks. The expansion of the road network through the SDU lands will distribute vehicular loading and generally reduce pressures on single routes. The increase in flows along Rhynes Drive and Capital Drive will lead to increased delays along Capital Drive (see Figure 3-37).

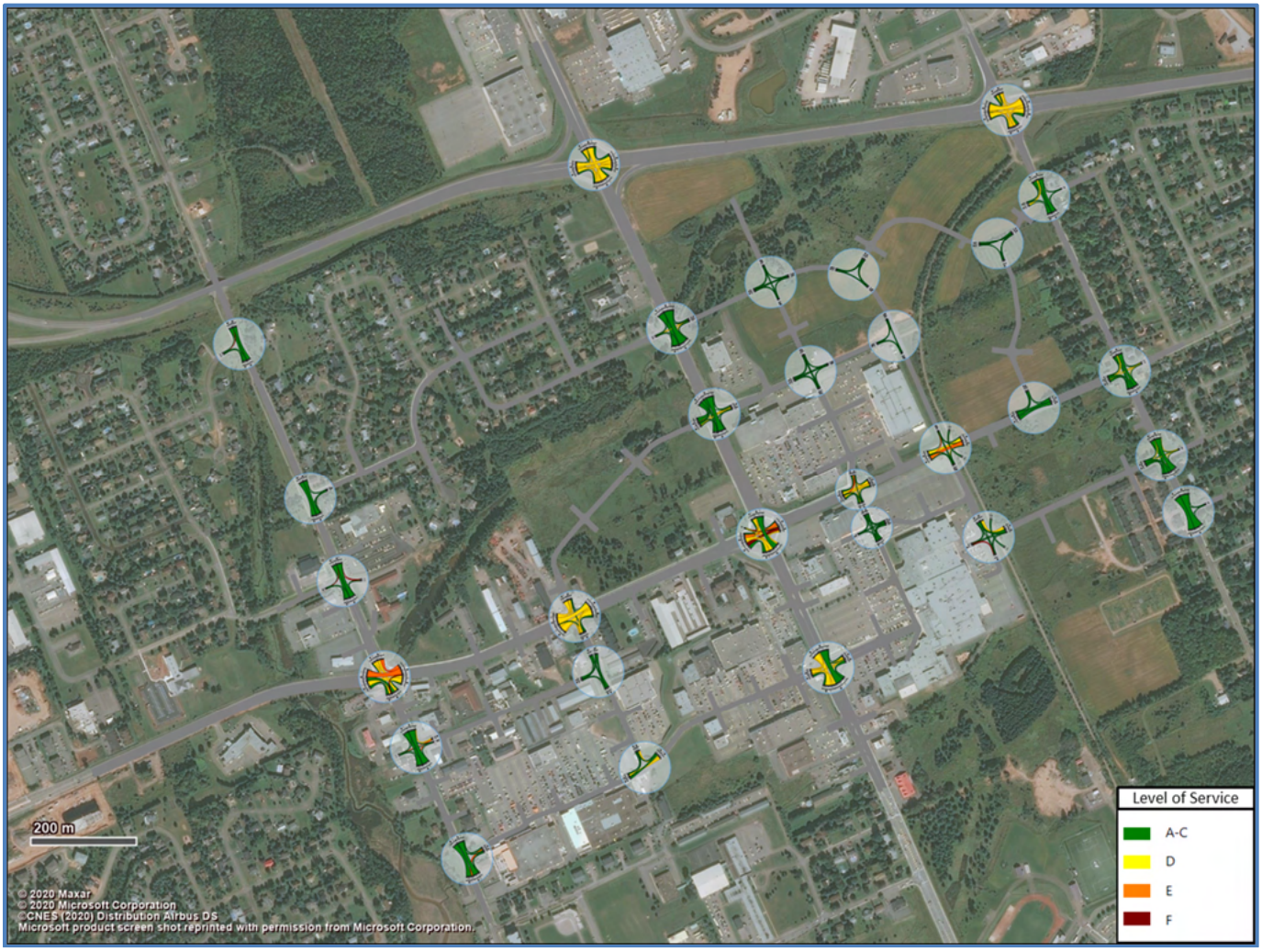


Figure 3-37 2041 Conditions - PM Peak Hour – Level of Service

Saturday Peak Hour

During the Saturday peak hour, the study area road network will experience the heaviest vehicular volumes, particularly around the centre of the area. Malpeque Road will consequently experience heavy volumes (>1,000 vehicles per hour) in both directions (see Figure 3-38).

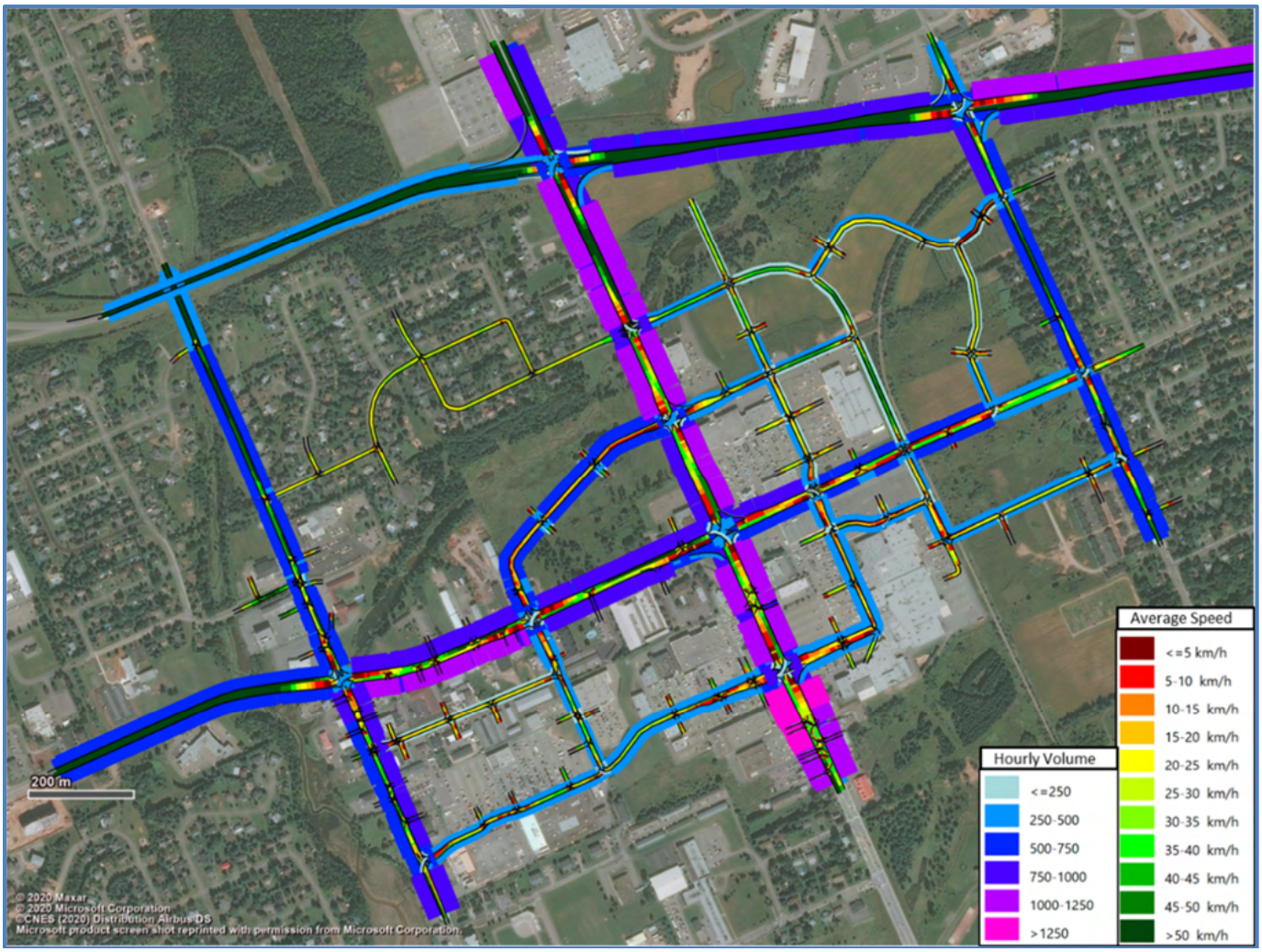


Figure 3-38 2041 Conditions - Saturday Peak Hour - Speeds and Volume

The LOS analysis demonstrates that operational conditions on the road network will begin approaching capacity on several movements at key intersections around the Charlottetown Mall. As illustrated on Figure 3-39, intersections on all four corners of the Mall, along Malpeque Road, Spencer Drive and Towers Road will include at least some movements operating at LOS E or F. This is in part due to the nature of central shopping areas exhibiting high levels of activity in all directions, leading to numerous conflict points and high levels of friction. It is also due to the still-limited opportunities to cross the Confederation Trail corridor south of the Mall. Despite the enhanced connections north of Towers Road, Spencer Drive and Towers Road remain the shortest connect connection between Mount Edward Road and Malpeque Road / University Avenue.

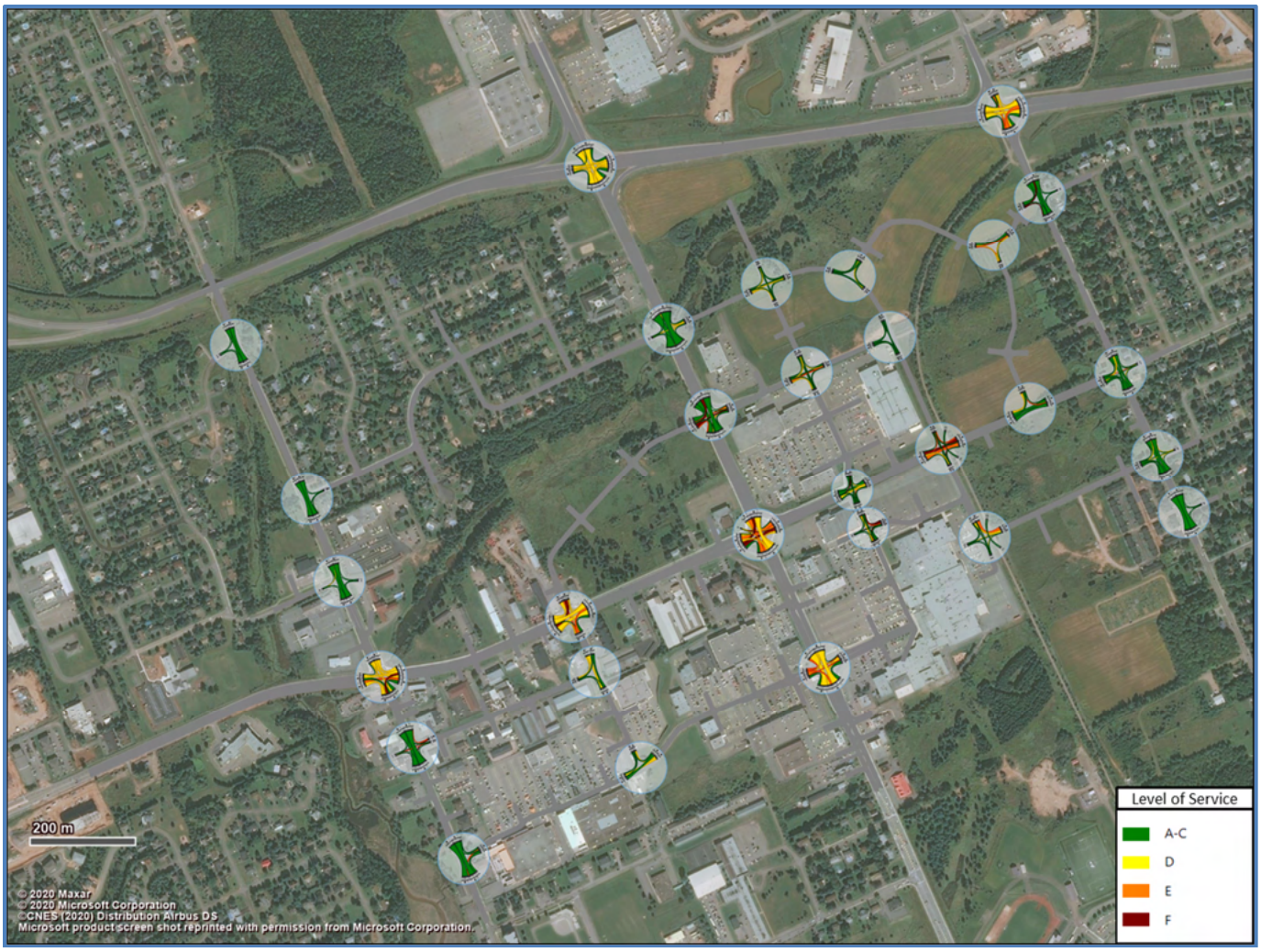


Figure 3-39 2041 Conditions - Saturday Peak Hour – Level of Service

Chapter 4 Other Considerations

This chapter includes discussion and commentary on some additional items related to the Transportation Master Plan.

4.1 Potential UPEI Connector Road

The University of Prince Edward Island (UPEI) campus is situated immediately south of the study area. It is bounded by University Avenue to the west, Belvedere Avenue to the south, and the Confederation Trail to the east. The campus has two main access points:

- University Avenue at Browns Court (signalized intersection)
- Belvedere Avenue (roundabout)

These driveways serve the campus well, particularly for traffic to/from the south, west, and northwest along the Malpeque Road/Route 2 corridor. However, accessing the campus from the north along the Brackley Point Road corridor and some other areas typically requires taking a somewhat indirect route using either Mt. Edward Road or University Avenue. Also, the student/staff population of the campus is large enough now that a third access can be justified for emergency access or as an evacuation route.

To address these concerns, we understand officials from the City and the University have recently been discussing the possibility of constructing a new road that would connect UPEI's Ring Road with Towers Road behind the Charlottetown Mall. It would be parallel to and immediately west of the Confederation Trail, and would be roughly 750m long, roughly as shown in blue in Figure 4-1. This link falls just outside our study area so it wasn't included in the model, but it would have an impact on study area traffic so it deserves some discussion.

This link would benefit the university community because it would reduce travel time between the campus and points north. It would also benefit non-campus travellers by relieving peak period traffic demand at the other campus driveways and congestion at surrounding intersections.

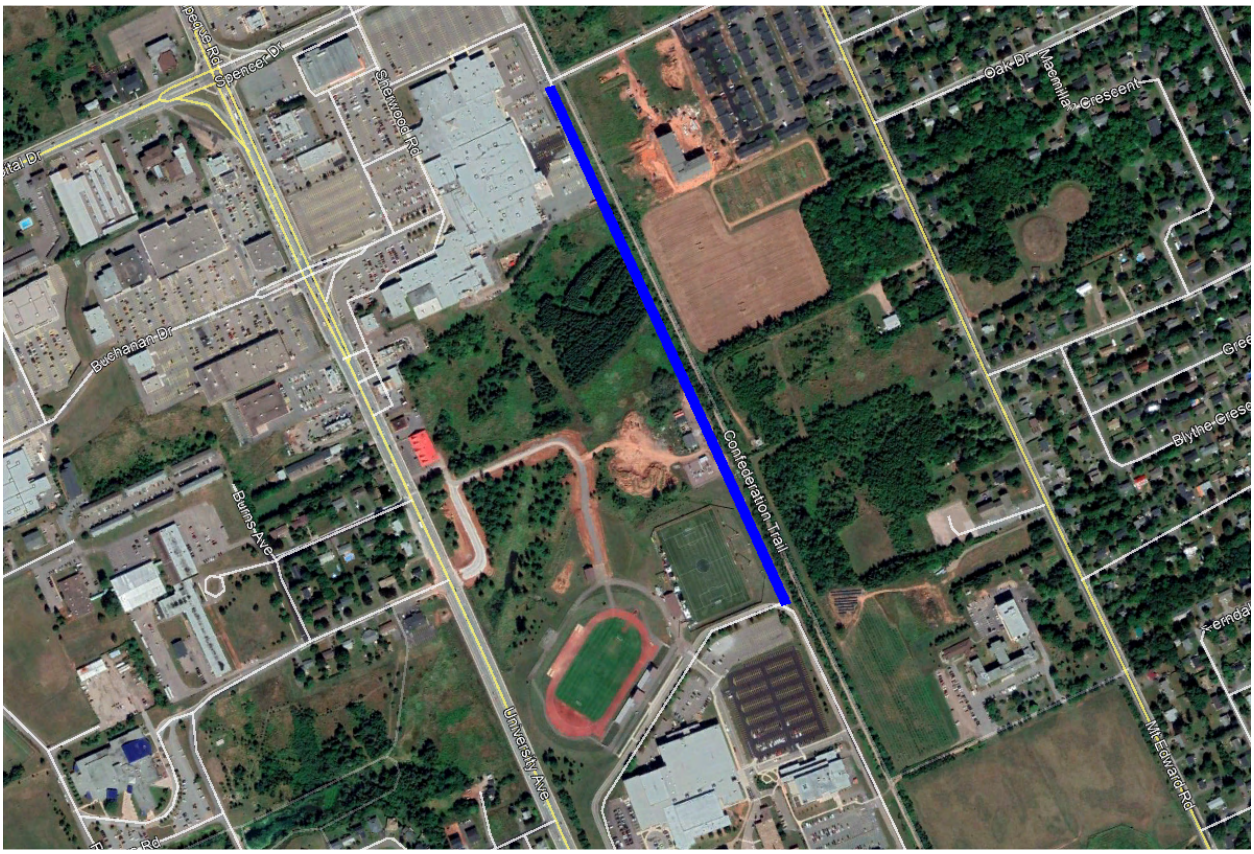


Figure 4-1 Potential UPEI Connector Road

However, UPEI has advised of some concerns they have with building this potential link.

- This new public road, in conjunction with UPEI's ring road, would serve as an alternate north-south route to and from the Charlottetown Mall, and in turn would divert some traffic away from University Avenue and Mt. Edward Road. Therefore, the campus ring road would face demand both from commercial traffic and the existing UPEI traffic, increasing traffic volumes and accelerating deterioration of the road. UPEI is concerned about the additional road maintenance and potential congestion at the various driveways along the ring road.
- Maritime Electric operates an electrical sub-station just north of the turf sports field, and immediately adjacent to the alignment of a potential connector road. UPEI is concerned access to this facility might be compromised.
- There is an existing ring road crossing between the Atlantic Veterinary College (AVC) and the pasture on the east side of the Confederation Trail. It is frequently used to move horses and other large animals from AVC's indoor stables to the outdoor grazing area. UPEI is concerned about the safety of having increase traffic at this crossing.

Therefore, more discussion is required before a UPEI connector road would be built.

It should also be noted that a third campus access (visible under construction in Figure 4-1) was constructed in 2020 to serve the north end of the campus where future development is planned. This access connects to University Avenue at the existing Enman Crescent South signalized intersection, but will not likely be used heavily until the campus expands northward into the area between the sports fields and the Charlottetown Mall. This new roadway does not address the issue of campus access to/from the north so the two main accesses will continue to be used by the large majority of campus traffic until this occurs.

4.2 Active Transportation

The intense commercial land uses and retail developments within the study area typically include large buildings surrounded by several acres of paved parking lots and interspersed roadways and intersections to link it all together. Generally speaking, there is little green space and little space dedicated to active transportation (AT) modes like walking or cycling. There are sidewalks along University Avenue, Malpeque Road, and Capital Drive, as well as crosswalks at most intersections and at entrances to several stores. These serve pedestrians, but there is no cycling infrastructure in the area other than bike lanes along some of the roadways. But there is an overall lack of formal connectivity for AT modes, both between internal destinations and with the external AT network. As an example, the Confederation trail passes through the study area immediately adjacent to Canadian Tire and the Charlottetown Mall and there aren't any formal connections to it.

Considering these points, the ongoing commercial and residential development within the study area presents a significant opportunity. A well-planned network of AT routes to provide safe and convenient travel for non-motorized modes would help to encourage local commuters and shoppers to choose walking or riding instead of driving. PEI has a deep-rooted car culture that is difficult to overcome, but providing AT infrastructure that is well-connected to destinations, separated from motorized traffic, and well maintained can result in fewer cars on area roadways and reduced parking demands.

With considerable residential development envisioned for the area between Mt. Edward Road and the Confederation Trail, the inclusion of strategic AT facilities to connect current and future residents with retail outlets like grocery stores, banks, shops, and restaurants would make the area more livable and vibrant than if the transportation network were designed to accommodate only cars. AT design focused on the human experience will positively influence mode choice among residents and visitors, and help to reduce the negative effects of a transportation system dominated by motorized vehicles.

4.3 Transit

T3 Transit has been serving the greater Charlottetown area since 2005. Routes 1, 2, and 3 serve the study area and connect it with other parts of the City as well as the neighbouring

Towns of Cornwall and Stratford. A robust transit system can move commuters and shoppers efficiently, and can be a solid alternative to owning a car. When an urban area is well-served by public transit, and supplemented by good AT connections, the overall need for car ownership is reduced. This can have financial benefits for both residents whose daily transportation costs are less and developers who don't need to include as many parking spaces with apartments and townhouses.

A transit hub in front of the Charlottetown Mall links Route 1 which travels north-south on University Avenue (to/from downtown) and Routes 2/3 which travel east-west through the study area and circumnavigate Charlottetown in opposite directions. The anticipated residential and commercial development within the study area should trigger extensions to the existing transit routes, or possibly new routes, and enhanced infrastructure. Future roadways and development site plans within the study area should be designed with transit connectivity in mind include adequate lighting and signage at stops; safe, comfortable shelters; and good active transportation connections.

4.4 Sherwood Residential Area

Some residents and property owners within the northerly portion of Sherwood, immediately east of Mt. Edward Road and adjacent to the study area, have expressed concern that the planned extension of Spencer Drive to connect with Mt. Edward Road at the Ash Drive intersection will result in increased traffic within their neighbourhood, particularly along Ash Drive. This area is comprised primarily of single-family homes plus some institutional land uses and green space.

When Spencer Drive is extended, the existing unsignalized Ash Drive T-intersection without any turning lanes will become a signalized four-leg intersection with turning lanes similar to the existing Mt. Edward Road/Towers Road/Montgomery Drive intersection. While this change may attract some local motorists to Ash Drive, for example some who would prefer to make a left turn at a traffic signal, we don't believe there would be a significant increase in Ash Drive traffic demand from neighbourhood residents. Further to this, we would expect practically no increase in Ash Drive traffic due to motorists from outside the neighbourhood. The reasoning behind this conclusion is discussed below.

- This situation has existed at the Mt. Edward/Towers intersection for many years, and yet traffic volumes on Montgomery Drive remain very low. This is because traffic to/from the Sherwood residential area disperses along Mt. Edward Road and to the many other neighbourhood connections, including Pine Drive, Oak Drive, Kenlea Drive, Ash Drive, and Fern Garden Drive.
    - To back this up, we have recent traffic count evidence that traffic on Montgomery comprises approximately 2.0% of all traffic at this signalized intersection. It is acknowledged that the arrangement of Montgomery and Birch Hill Drive provides a less direction connection between Mt. Edward

Road and Maple Avenue than Ash Drive. But nonetheless, Montgomery provides a more direct connection to the Charlottetown Mall than other adjacent streets.

- Ash Drive is a minor collector street within Sherwood, similar to Oak Drive and Pine Drive. However, unlike the other two, Ash Drive does not connect to Brackley Point Road. This fact, coupled with the all-way stop at the Maple Avenue intersection, means it would be unlikely to attract short-cutting traffic from Brackley Point Road or beyond because other routes, including the nearby parallel Perimeter Highway, provide shorter travel times.

To sum up, we think there may be a slight increase in traffic on Ash Drive once the Spencer Drive extension is complete, but we expect it will be due primarily to neighbourhood traffic re-routing from adjacent streets, not from use as a shortcut route by non-local or regional traffic. If short-cutting ended up being an issue, there are a variety of traffic calming strategies that could be considered to discourage motorists from gravitating to Ash Drive.

Chapter 5 Conclusions and Recommendations

The traffic analyses carried out with the VISSIM microsimulation model demonstrate that it is possible to redevelop the vacant SDU properties around the Charlottetown Mall, in the context of continued regional traffic growth. The study area is forecasted to experience an increase of approximately 1,000 trips per peak hour by 2031, and of 2,000-2,500 trips by 2041, of which approximately 50% would result from local development.

The microsimulation model was calibrated and validated to existing weekday AM and PM peak hours and to the Saturday peak hour, as observed through intersection turning movement counts undertaken by the City and CBCL in 2019 and 2020. The latter counts were undertaken at a time when discretionary trip-making had generally recovered to pre-pandemic levels. The model assessment of 2031 and 2041 conditions showed that despite significant growth, it is possible to largely mitigate the impacts associated with increased vehicular traffic through the study area by implementing network-level improvements aimed at extending the road network grid, providing alternative routes along secondary roads, and formalizing existing circulation patterns.

Most significantly, by 2031, some of the area's arterial roads will need widening to include two lanes per direction, with auxiliary turning lanes at major intersections. Additional roads will be needed to provide access to development parcels, and several intersections will require reconfiguration.

Despite the proposed network improvements, several capacity constraints were flagged, particularly along Spencer Drive, Capital Drive and Malpeque Road. Most of the large intersections along the arterial roads are signalized, offering significant capacity; however, signals are not currently coordinated, and large platoons of vehicles do not progress smoothly between intersections. This interrupted flow causes delays and long queues that may, on occasion, block adjacent driveways. These corridors would therefore benefit from a signal optimization exercise and full coordination to ensure good progression through the signals as platoons catch "green waves".

Complementary to the signal timing optimization effort, the widened Spencer Drive will function as an extension of Capital Drive. While it was initially assumed that most intersections along Spencer Drive would be all-way stopped controlled, it is apparent that even when widened to four lanes, Spencer Drive would experience significant delays at the Confederation Trail intersection due to the limited capacity of the stop control. Such conditions are mostly observed during the Saturday peak hour under the 2041 development scenario. Initial assessment suggests that these capacity constraints could be alleviated by reconfiguring this intersection with signal control. In such an operational scenario, Spencer Drive would operate with three signalized intersections between Malpeque Road and the Confederation Trail, with a spacing of ~200m between signals. This arrangement would require signal coordination to ensure smooth progression between Malpeque Road and the Confederation Trail.

As an alternative to signal coordination along Spencer Drive, an initial assessment was conducted of the operation of the Spencer Drive & Babineau Avenue intersection as a roundabout instead of a signal. While the analysis suggests that a roundabout could improve fluidity on Spencer Drive, the dominant east-west flows in the roundabout would leave limited gap opportunity for the north-south entries. This would induce higher delays on Babineau Avenue, and long-term avoidance of Babineau in favour of other routes. At the same time, the roundabout would not meter the westbound approach to the Capital Drive & Malpeque Road intersection as a signal would, thereby leading to higher westbound volumes on that approach and longer delays per signal cycle.

Based on the above, this study recommends the following interventions:

By 2031:

10. Widen Capital Drive to four lanes from Lower Malpeque Road to Malpeque Road;
11. Widen Malpeque Road southbound from the Bypass to Capital Drive;
12. Extend Spencer Drive from the Confederation Trail to Mount Edward Road;
13. Realign the road along the Cineplex Cinema with the Superstore Aisle;
14. Upgrade the Spencer Drive & Babineau Avenue intersection to signal control;
15. Extend Irwin Drive, Saint Dunstan Street, and Babineau Avenue into the SDU lands;
16. Reconfigure the Capital Drive & Lower Malpeque Road intersection;
17. Reconfigure the Capital Drive & Malpeque Road intersection; and,
18. Reconfigure the Capital Drive & Bypass Highway intersection.

By 2041:

6. Widen Spencer Drive to four lanes from Malpeque Road to Mount Edward Road;
7. Extend the road network into the SDU lands;
8. Extend Rhynes Drive and connect to Saint Dunstan Street;
9. Upgrade the Spencer Drive & Confederation Trail intersection to signal control;
10. Optimize and coordinate signal timings along Capital Drive, Malpeque Road, and Spencer Drive.

We trust that this report meets your needs at this time. It provides an overview of potential development scenarios for the remaining tracts of vacant land in this part of Charlottetown plus discussion of road network extensions and improvements to accommodate the additional traffic demands.

Please contact us if you have any questions.

DRAFT FINAL

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APPENDIX A

Summary of Traffic Operations
AM Peak Hour

AM Peak Hour LOS Summary

Intersection	Move-ment	Existing Conditions				2031 Conditions				2041 Conditions			
		Queue (m)		Delay (sec)	LOS	Queue (m)		Delay (sec)	LOS	Queue (m)		Delay (sec)	LOS
		Avg.	Max.			Avg.	Max.			Avg.	Max.		
1: Lower Malpeque Road & Oldmoore Court (Unsignalized)	EBL	0	17	0	A	0	15	0	A	1	15	0	A
	EBR	1	18	8	A	1	17	9	A	1	17	10	A
	NBL	0	7	3	A	0	7	2	A	0	7	2	A
	NBT	0	2	0	A	0	3	0	A	0	2	0	A
	SBR	0	0	0	A	0	0	0	A	0	2	0	A
	SBT	0	0	0	A	0	0	0	A	0	2	1	A
2: Ch'town Perimeter Highway & Malpeque Road (Signalized)	EBL	19	76	21	C	20	74	22	C	21	81	22	C
	EBR	0	0	0	A	0	9	2	A	0	9	2	A
	EBT	19	75	32	C	20	74	33	C	21	81	32	C
	NBL	10	50	29	C	6	29	29	C	6	31	28	C
	NBR	0	0	0	A	0	4	1	A	0	4	1	A
	NBT	10	50	40	D	6	29	35	D	7	32	37	D
	SBL	32	133	28	C	16	68	28	C	18	72	28	C
	SBR	1	21	2	A	0	0	0	A	0	0	0	A
	SBT	32	133	38	D	16	68	30	C	18	72	31	C
	WBL	20	91	34	C	18	84	30	C	17	82	29	C
	WBR	0	4	0	A	0	18	2	A	0	18	2	A
	WBT	20	91	36	D	18	84	34	C	17	82	34	C
3: Ch'town Perimeter Highway & Mt. Edward Road (Signalized)	EBL	28	101	32	C	29	104	30	C	32	106	30	C
	EBR	31	106	8	A	32	109	8	A	35	111	9	A
	EBT	28	100	39	D	29	103	42	D	32	106	44	D
	NBL	9	47	26	C	12	66	30	C	16	84	30	C
	NBR	0	1	1	A	0	5	2	A	0	3	3	A
	NBT	9	47	37	D	12	66	39	D	16	84	41	D
	SBL	14	73	27	C	16	74	30	C	19	83	31	C
	SBR	1	19	2	A	1	20	2	A	1	28	3	A
	SBT	14	73	38	D	16	74	39	D	19	83	42	D
	WBL	35	117	28	C	36	117	31	C	40	129	36	D
	WBR	41	124	40	D	41	125	39	D	44	136	39	D
	WBT	35	117	41	D	36	117	41	D	40	129	42	D

AM Peak Hour LOS Summary

Intersection	Move-ment	Existing Conditions				2031 Conditions				2041 Conditions			
		Queue (m)		Delay (sec)	LOS	Queue (m)		Delay (sec)	LOS	Queue (m)		Delay (sec)	LOS
		Avg.	Max.			Avg.	Max.			Avg.	Max.		
4: Lower Malpeque Road & Gates Drive (Unsignalized)	NBR	0	0	1	A	0	2	1	A	0	4	1	A
	NBT	0	5	0	A	0	9	1	A	0	9	1	A
	SBL	1	44	0	A	7	68	0	A	28	112	0	A
	SBT	1	44	2	A	7	69	7	A	29	112	21	C
	WBL	1	15	11	B	5	23	53	F	34	59	218	F
	WBR	1	18	0	A	6	26	0	A	35	63	0	A
5: Malpeque Road & Irwin Drive	EBL	0	10	11	B	1	13	19	B	0	13	24	C
	EBR	2	26	15	B	1	13	8	A	1	14	8	A
	EBT	0	0	0	A	1	13	27	C	1	13	22	C
	NBL	0	3	7	A	3	39	10	A	3	37	11	B
	NBR	0	0	0	A	3	39	8	A	3	37	8	A
	NBT	0	0	0	A	3	39	11	B	3	37	10	B
	SBL	0	0	0	A	7	67	10	B	7	68	11	B
	SBR	0	2	0	A	7	67	8	A	7	67	6	A
	SBT	0	2	1	A	7	67	10	B	7	68	11	B
	WBL	0	0	0	A	0	5	34	C	0	8	31	C
	WBR	0	0	0	A	0	18	8	A	0	18	8	A
	WBT	0	0	0	A	0	6	37	D	0	8	34	C
6: Mt. Edward Road & Fern Garden Drive (Unsignalized)	EBL	0	0	0	A	0	3	10	A	4	34	13	B
	EBR	0	0	0	A	0	9	13	B	4	37	16	C
	NBL	0	0	0	A	0	5	3	A	0	21	4	A
	NBR	0	0	0	A	0	2	0	A	0	15	0	A
	NBT	0	0	0	A	0	2	0	A	0	15	1	A
	SBL	0	4	1	A	0	7	2	A	0	6	3	A
	SBR	0	2	0	A	0	5	0	A	0	3	1	A
	SBT	0	2	0	A	0	5	0	A	0	3	1	A
	WBL	0	6	4	A	0	8	6	A	0	8	7	A
	WBR	0	13	6	A	0	13	7	A	0	14	8	A

AM Peak Hour LOS Summary

Intersection	Move-ment	Existing Conditions				2031 Conditions				2041 Conditions			
		Queue (m)		Delay (sec)	LOS	Queue (m)		Delay (sec)	LOS	Queue (m)		Delay (sec)	LOS
		Avg.	Max.			Avg.	Max.			Avg.	Max.		
7: Lower Malpeque Road & Kirkdale Road (Unsignalized)	EBL	1	13	0	A	1	14	0	A	1	13	0	A
	EBR	2	23	33	D	3	24	46	E	4	23	62	F
	NBL	1	31	6	A	1	36	7	A	2	37	8	A
	NBR	0	19	2	A	1	25	3	A	1	26	4	A
	NBT	0	19	2	A	1	25	3	A	1	26	3	A
	SBL	18	105	8	A	34	117	26	D	69	144	26	D
	SBR	15	92	10	B	30	104	6	A	61	131	22	C
	SBT	15	92	14	B	30	104	21	C	61	131	42	E
	WBL	0	14	22	C	0	13	16	C	0	12	43	E
	WBR	0	12	7	A	0	11	7	A	0	11	5	A
8: Malpeque Road & Saint Dunstan Street (Signalized)	EBL	0	0	0	A	0	0	0	A	6	41	22	C
	EBR	0	0	0	A	0	0	0	A	6	42	9	A
	EBT	0	0	0	A	0	0	0	A	6	42	26	C
	NBL	0	0	0	A	0	0	0	A	3	32	13	B
	NBR	2	37	4	A	2	38	5	A	6	42	8	A
	NBT	2	28	4	A	2	28	5	A	3	32	12	B
	SBL	5	97	7	A	3	53	7	A	7	62	13	B
	SBR	0	0	0	A	0	0	0	A	8	61	10	B
	SBT	5	96	4	A	3	52	5	A	8	61	15	B
	WBL	0	0	42	D	1	11	43	D	4	24	20	C
	WBR	0	1	2	A	0	2	3	A	0	1	3	A
	WBT	0	0	0	A	0	0	0	A	4	24	31	C
9: Saint Dunstan Street & Babineau Ave. (Unsignalized)	EBL	0	0	0	A	0	1	1	A	0	2	1	A
	EBT	0	0	0	A	0	0	0	A	0	0	0	A
	SBL	0	11	6	A	0	12	6	A	0	13	7	A
	SBR	0	12	7	A	0	13	0	A	0	14	0	A
	WBR	0	0	5	A	0	0	1	A	0	0	1	A
	WBT	0	0	7	A	0	0	1	A	0	0	1	A

AM Peak Hour LOS Summary

Intersection	Move-ment	Existing Conditions				2031 Conditions				2041 Conditions			
		Queue (m)		Delay (sec)	LOS	Queue (m)		Delay (sec)	LOS	Queue (m)		Delay (sec)	LOS
		Avg.	Max.			Avg.	Max.			Avg.	Max.		
10: Capital Drive & Lower Malpeque Road (Signalized)	EBL	137	258	42	D	58	157	29	C	100	196	33	C
	EBR	137	258	50	D	58	157	42	D	100	196	57	E
	EBT	137	258	60	E	58	157	50	D	100	196	57	E
	NBL	25	89	62	E	22	84	32	C	27	88	35	C
	NBR	25	90	15	B	22	84	18	B	27	88	19	B
	NBT	25	89	68	E	22	84	32	C	27	88	34	C
	SBL	80	195	47	D	86	192	27	C	124	196	33	C
	SBR	81	196	13	B	87	193	13	B	125	197	13	B
	SBT	81	195	53	D	86	192	49	D	124	196	65	E
	WBL	18	72	48	D	23	74	72	E	31	81	91	F
	WBR	20	75	29	C	24	77	26	C	32	84	25	C
	WBT	19	72	38	D	24	74	32	C	31	81	34	C
11: Capital Drive & Rhynes Drive/ Sandstone Road (Signalized)	EBL	12	119	8	A	6	83	9	A	18	100	16	B
	EBR	12	119	10	A	6	83	7	A	19	101	20	C
	EBT	12	119	10	A	6	83	7	A	19	100	22	C
	NBL	1	19	29	C	1	15	19	B	1	16	35	C
	NBR	4	32	8	A	2	28	6	A	3	26	7	A
	NBT	1	18	25	C	1	15	16	B	2	20	21	C
	SBL	0	4	23	C	0	4	26	C	16	103	26	C
	SBR	0	5	7	A	0	5	8	A	17	103	18	B
	SBT	0	4	44	D	0	4	31	C	16	103	31	C
	WBL	5	57	7	A	8	58	20	C	8	42	19	B
	WBR	5	57	4	A	8	58	3	A	7	42	11	B
	WBT	4	55	6	A	8	58	7	A	8	42	17	B

AM Peak Hour LOS Summary

Intersection	Move-ment	Existing Conditions				2031 Conditions				2041 Conditions			
		Queue (m)		Delay (sec)	LOS	Queue (m)		Delay (sec)	LOS	Queue (m)		Delay (sec)	LOS
		Avg.	Max.			Avg.	Max.			Avg.	Max.		
12: Capital Drive/ Spence Drive & Malpeque Road/ University Avenue (Signalized)	EBL	19	83	37	D	20	83	30	C	17	74	28	C
	EBR	0	13	2	A	1	31	4	A	1	35	4	A
	EBT	18	82	34	C	20	83	33	C	17	74	37	D
	NBL	5	30	20	B	6	40	27	C	7	44	27	C
	NBR	5	31	8	A	6	38	11	B	7	44	16	B
	NBT	5	30	16	B	7	40	22	C	7	44	26	C
	SBL	41	126	54	D	28	125	22	C	16	79	21	C
	SBR	43	128	18	B	32	128	31	C	18	82	24	C
	SBT	41	125	57	E	30	125	35	C	17	79	32	C
	WBL	7	32	36	D	13	58	22	C	14	58	27	C
	WBR	0	0	3	A	0	0	4	A	0	1	3	A
	WBT	6	31	45	D	13	58	35	D	13	58	33	C
13: Spencer Drive & Babineau Avenue	EBL	7	60	19	C	7	63	20	C	4	33	22	C
	EBR	6	55	19	C	5	58	13	B	2	28	7	A
	EBT	10	67	21	C	7	63	18	C	4	33	16	C
	NBL	0	19	8	A	1	14	13	B	1	16	13	B
	NBR	1	28	5	A	1	20	4	A	2	20	3	A
	NBT	0	14	5	A	1	14	7	A	1	16	8	A
	SBL	1	19	8	A	1	17	17	C	1	12	16	C
	SBR	2	34	9	A	2	27	5	A	1	21	5	A
	SBT	0	14	7	A	1	18	11	B	1	13	11	B
	WBL	1	21	7	A	7	42	25	C	9	37	22	C
	WBR	2	26	6	A	10	50	11	B	12	44	10	A
	WBT	2	25	7	A	7	42	18	C	8	37	17	C

AM Peak Hour LOS Summary

Intersection	Move-ment	Existing Conditions				2031 Conditions				2041 Conditions			
		Queue (m)		Delay (sec)	LOS	Queue (m)		Delay (sec)	LOS	Queue (m)		Delay (sec)	LOS
		Avg.	Max.			Avg.	Max.			Avg.	Max.		
14: Mt. Edward Road & Ash Drive	EBL	0	0	0	A	6	40	30	C	4	34	27	C
	EBR	0	0	0	A	9	45	12	B	7	39	13	B
	EBT	0	0	0	A	6	40	36	D	4	34	39	D
	NBL	0	0	0	A	5	41	15	B	5	45	14	B
	NBR	0	11	1	A	5	41	6	A	5	45	7	A
	NBT	0	11	1	A	5	41	7	A	5	45	7	A
	SBL	2	62	5	A	18	106	8	A	22	115	10	B
	SBR	0	0	0	A	16	102	13	B	21	113	14	B
	SBT	2	57	2	A	18	106	18	B	22	115	20	C
	WBL	1	20	14	B	2	18	40	D	1	16	38	D
	WBR	1	20	9	A	2	18	6	A	1	19	7	A
	WBT	0	0	0	A	2	18	35	D	1	16	35	C
15: North River Road & Thompson Drive (Unsignalized)	EBL	0	26	26	D	1	26	40	E	1	26	64	F
	EBR	1	16	34	D	1	16	29	D	1	19	47	E
	EBT	1	26	42	E	1	26	35	D	1	26	60	F
	NBL	1	19	21	C	0	15	15	B	3	41	44	E
	NBR	1	16	4	A	0	12	3	A	3	37	5	A
	NBT	1	16	2	A	0	12	2	A	3	37	4	A
	SBL	7	107	10	B	21	119	14	B	37	147	32	D
	SBR	8	116	3	A	22	126	4	A	40	155	7	A
	SBT	7	103	4	A	20	115	6	A	36	143	10	B
	WBL	1	15	33	D	9	45	67	F	11	46	89	F
	WBR	1	21	13	B	10	50	20	C	13	52	21	C
	WBT	1	16	114	F	8	45	79	F	11	46	108	F

AM Peak Hour LOS Summary

Intersection	Move-ment	Existing Conditions				2031 Conditions				2041 Conditions			
		Queue (m)		Delay (sec)	LOS	Queue (m)		Delay (sec)	LOS	Queue (m)		Delay (sec)	LOS
		Avg.	Max.			Avg.	Max.			Avg.	Max.		
16: Thompson Drive & Sandstone Road (Unsignalized)	EBL	1	17	8	A	0	13	8	A	0	13	7	A
	EBR	2	26	6	A	1	22	7	A	1	22	6	A
	NBL	2	25	8	A	2	27	10	A	2	27	10	B
	NBT	3	36	10	A	4	39	10	A	4	39	10	B
	SBR	1	25	8	A	4	40	11	B	7	51	13	B
	SBT	1	25	8	A	4	40	11	B	7	51	14	B
18: Towers Road & Mall Road (Unsignalized)	EBL	0	24	6	A	0	24	6	A	0	25	6	A
	EBR	0	20	0	A	0	20	0	A	0	20	0	A
	EBT	0	24	6	A	0	24	6	A	0	25	6	A
	NBL	0	0	0	A	0	0	0	A	0	1	0	A
	NBR	0	0	6	A	0	1	6	A	0	1	6	A
	NBT	0	13	13	B	0	13	12	B	0	13	12	B
	SBL	2	26	12	B	1	19	14	B	1	19	14	B
	SBR	0	16	9	A	0	6	11	B	0	7	11	B
	SBT	1	30	4	A	0	19	6	A	0	19	6	A
	WBL	17	71	21	C	5	37	10	A	7	50	12	B
	WBR	17	71	19	C	5	37	12	B	7	50	14	B
	WBT	17	71	19	C	5	37	9	A	8	50	12	B
19: Mt. Edward Road & Towers Road/ Montgomery Drive (Signalized)	EBL	5	56	30	C	4	40	30	C	4	40	30	C
	EBR	7	61	14	B	6	46	14	B	6	46	16	B
	EBT	5	56	35	C	4	40	29	C	4	41	41	D
	NBL	5	40	12	B	4	45	11	B	6	48	15	B
	NBR	5	40	5	A	4	45	9	A	6	48	7	A
	NBT	5	40	6	A	4	45	6	A	6	48	6	A
	SBL	13	98	11	B	12	112	7	A	21	141	9	A
	SBR	19	111	12	B	17	126	10	A	27	155	11	B
	SBT	13	98	17	B	12	112	11	B	21	141	12	B
	WBL	1	16	36	D	1	15	28	C	1	15	30	C
	WBR	1	16	30	C	1	15	30	C	1	15	30	C
	WBT	2	17	10	B	2	16	13	B	2	16	13	B

AM Peak Hour LOS Summary

Intersection	Move-ment	Existing Conditions				2031 Conditions				2041 Conditions			
		Queue (m)		Delay (sec)	LOS	Queue (m)		Delay (sec)	LOS	Queue (m)		Delay (sec)	LOS
		Avg.	Max.			Avg.	Max.			Avg.	Max.		
20: North River Road & Babineau Drive (Signalized)	NBR	5	66	5	A	6	79	5	A	12	94	8	A
	NBT	4	56	5	A	5	69	6	A	9	84	10	A
	SBL	10	133	8	A	20	178	10	B	29	208	11	B
	SBT	10	133	5	A	20	178	6	A	29	208	8	A
	WBL	3	26	44	D	8	42	42	D	26	102	54	D
	WBR	4	29	11	B	9	45	11	B	28	106	28	C
21: Buchanan Drive & Sandstone Road (Unsignalized)	EBL	1	15	7	A	1	14	7	A	1	15	8	A
	EBT	0	7	7	A	0	4	7	A	0	6	7	A
	SBL	1	22	8	A	2	22	8	A	3	24	8	A
	SBR	2	26	6	A	2	26	7	A	4	28	7	A
	WBR	1	17	6	A	2	19	6	A	2	20	6	A
	WBT	1	17	7	A	2	19	8	A	2	20	8	A
22: University Avenue & Buchanan Drive (Signalized)	EBL	2	19	24	C	2	19	26	C	2	18	26	C
	EBR	2	19	8	A	2	19	8	A	2	18	9	A
	EBT	2	19	40	D	2	19	40	D	2	18	38	D
	NBL	7	40	19	B	9	48	25	C	10	52	26	C
	NBR	2	36	3	A	1	29	2	A	1	33	2	A
	NBT	7	40	17	B	9	48	17	B	10	52	18	B
	SBL	16	78	16	B	18	90	17	B	25	111	18	B
	SBR	16	78	31	C	18	90	27	C	25	111	31	C
	SBT	16	78	29	C	18	90	25	C	25	111	28	C
	WBL	9	55	25	C	10	59	26	C	11	58	26	C
	WBR	3	47	12	B	5	55	13	B	5	53	13	B
	WBT	8	55	29	C	10	59	28	C	11	58	26	C
23: Mt. Edward Road & Kenlea Drive (Unsignalized)	NBR	0	0	0	A	0	0	0	A	0	0	0	A
	NBT	0	0	0	A	0	0	0	A	0	0	0	A
	SBL	0	7	3	A	0	9	2	A	0	15	4	A
	SBT	0	4	0	A	0	6	0	A	0	9	1	A
	WBL	0	11	7	A	0	10	8	A	0	11	9	A
	WBR	0	11	8	A	0	10	9	A	0	12	10	B

AM Peak Hour LOS Summary

Intersection	Move-ment	Existing Conditions				2031 Conditions				2041 Conditions			
		Queue (m)		Delay (sec)	LOS	Queue (m)		Delay (sec)	LOS	Queue (m)		Delay (sec)	LOS
		Avg.	Max.			Avg.	Max.			Avg.	Max.		
101: MR1 & MR2	NBR	0	0	0	A	0	14	6	A	0	15	6	A
	NBT	0	0	0	A	0	14	6	A	0	15	6	A
	SBL	0	0	0	A	4	39	12	B	4	41	12	B
	SBT	0	0	0	A	2	30	10	B	2	32	10	B
	WBL	0	0	0	A	3	23	7	A	3	23	8	A
	WBR	0	0	0	A	3	23	8	A	3	23	8	A
102: Saint Dunstan Street & Babineau Ave.	EBL	0	0	0	A	1	23	6	A	1	18	7	A
	EBR	0	0	0	A	0	14	8	A	0	8	6	A
	EBT	0	0	0	A	0	14	8	A	0	8	8	A
	NBL	0	0	0	A	0	16	10	A	0	16	10	A
	NBR	0	0	0	A	0	19	11	B	0	19	9	A
	NBT	0	0	0	A	0	17	9	A	0	17	8	A
	SBL	0	0	0	A	1	14	10	B	1	19	8	A
	SBR	0	0	0	A	1	20	8	A	2	24	7	A
	SBT	0	0	0	A	1	17	8	A	2	21	9	A
	WBL	0	0	0	A	0	9	6	A	1	14	6	A
	WBR	0	0	0	A	0	0	5	A	0	7	6	A
	WBT	0	0	0	A	0	0	8	A	0	7	8	A
103: Irwin Drive & Babineau Ave.	EBL	0	0	0	A	1	25	7	A	1	21	7	A
	EBR	0	0	0	A	1	19	8	A	0	14	7	A
	EBT	0	0	0	A	1	19	10	A	0	14	9	A
	NBL	0	0	0	A	0	10	9	A	0	11	10	B
	NBR	0	0	0	A	0	13	0	A	0	17	9	A
	NBT	0	0	0	A	0	10	8	A	0	11	7	A
	SBL	0	0	0	A	1	17	6	A	1	15	6	A
	SBR	0	0	0	A	1	26	5	A	1	22	5	A
	SBT	0	0	0	A	1	20	6	A	1	18	6	A
	WBL	0	0	0	A	0	12	6	A	1	14	6	A
	WBR	0	0	0	A	0	0	6	A	0	2	6	A
	WBT	0	0	0	A	0	0	8	A	0	2	8	A

AM Peak Hour LOS Summary

Intersection	Move-ment	Existing Conditions				2031 Conditions				2041 Conditions			
		Queue (m)		Delay (sec)	LOS	Queue (m)		Delay (sec)	LOS	Queue (m)		Delay (sec)	LOS
		Avg.	Max.			Avg.	Max.			Avg.	Max.		
104: Saint Dunstan Street & Irwin Drive	EBR	0	0	0	A	0	28	13	B	1	33	14	B
	EBR	0	0	0	A	0	28	13	B	1	33	14	B
	NBL	0	0	0	A	0	19	14	B	0	19	15	B
	NBL	0	0	0	A	0	19	14	B	0	19	15	B
105: Spencer Drive & MR3	EBL	0	0	0	A	7	54	14	B	6	44	10	A
	EBR	0	0	0	A	3	43	13	B	2	33	6	A
	EBT	0	0	0	A	1	29	13	B	1	28	12	B
	NBL	0	0	0	A	1	13	9	A	0	13	8	A
	NBR	0	0	0	A	1	16	6	A	1	21	6	A
	NBT	0	0	0	A	1	14	9	A	0	14	9	A
	SBL	0	0	0	A	1	15	8	A	1	14	8	A
	SBR	0	0	0	A	1	22	7	A	0	5	6	A
	SBT	0	0	0	A	1	16	10	B	1	15	10	B
	WBL	0	0	0	A	17	74	22	C	29	98	26	D
	WBR	0	0	0	A	17	74	22	C	30	98	6	A
	WBT	0	0	0	A	17	74	23	C	30	98	28	D
106: Spencer Drive & SDU Road	EBL	0	0	0	A	0	0	0	A	2	17	9	A
	EBT	0	0	0	A	0	0	0	A	0	13	7	A
	SBL	0	0	0	A	0	0	0	A	2	23	9	A
	SBR	0	0	0	A	0	0	0	A	2	24	8	A
	WBR	0	0	0	A	0	0	0	A	2	20	8	A
	WBT	0	0	0	A	0	0	0	A	2	20	9	A
107: Fern Garden Road & SDU Road	EBR	0	0	0	A	0	0	0	A	0	11	5	A
	EBT	0	0	0	A	0	0	0	A	0	11	6	A
	NBL	0	0	0	A	0	0	0	A	1	14	11	B
	NBR	0	0	0	A	0	0	0	A	1	16	6	A
	WBL	0	0	0	A	0	0	0	A	2	30	9	A
	WBT	0	0	0	A	0	0	0	A	1	24	8	A
108: Irwin Drive & Fern Garden Drive	EBT	0	0	0	A	0	0	0	A	1	21	13	B
	EBT	0	0	0	A	0	0	0	A	1	21	13	B
	WBT	0	0	0	A	0	0	0	A	2	24	17	C
	WBT	0	0	0	A	0	0	0	A	2	24	17	C

APPENDIX B

Summary of Traffic Operations
PM Peak Hour

PM Peak Hour LOS Summary

Intersection	Move-ment	Existing Conditions				2031 Conditions				2041 Conditions			
		Queue (m)		Delay (sec)	LOS	Queue (m)		Delay (sec)	LOS	Queue (m)		Delay (sec)	LOS
		Avg.	Max.			Avg.	Max.			Avg.	Max.		
1: Lower Malpeque Road & Oldmoore Court (Unsignalized)	EBL	3	13	0	A	0	13	0	A	0	12	0	A
	EBR	4	16	7	A	1	15	8	A	1	15	8	A
	NBL	0	19	3	A	0	23	3	A	0	21	3	A
	NBT	0	12	1	A	0	16	1	A	0	14	1	A
	SBR	12	15	0	A	0	0	0	A	0	0	0	A
	SBT	12	15	0	A	0	0	0	A	0	0	0	A
2: Ch'town Perimeter Highway & Malpeque Road (Signalized)	EBL	13	51	21	C	14	54	19	B	14	54	21	C
	EBR	0	0	0	A	0	8	1	A	0	9	1	A
	EBT	13	51	33	C	14	54	32	C	14	54	32	C
	NBL	82	203	27	C	27	106	31	C	29	122	28	C
	NBR	33	131	2	A	1	32	3	A	2	46	3	A
	NBT	82	203	65	E	27	106	43	D	30	123	43	D
	SBL	31	89	51	D	17	68	35	C	19	67	35	D
	SBR	2	4	0	A	0	0	0	A	0	0	0	A
	SBT	31	89	39	D	17	68	36	D	19	68	38	D
	WBL	36	117	33	C	21	94	30	C	19	90	27	C
	WBR	8	25	0	A	1	30	4	A	2	44	5	A
	WBT	36	117	35	D	21	94	29	C	19	90	30	C
3: Ch'town Perimeter Highway & Mt. Edward Road (Signalized)	EBL	22	88	27	C	24	87	29	C	25	89	27	C
	EBR	25	93	7	A	26	92	7	A	28	94	7	A
	EBT	22	88	35	D	24	86	40	D	25	89	44	D
	NBL	15	69	28	C	20	101	30	C	31	149	33	C
	NBR	0	0	2	A	0	4	4	A	0	5	8	A
	NBT	15	69	39	D	20	101	40	D	31	149	45	D
	SBL	12	56	27	C	16	75	30	C	20	86	31	C
	SBR	0	8	1	A	1	22	2	A	2	31	3	A
	SBT	12	56	38	D	16	75	40	D	20	86	43	D
	WBL	31	106	25	C	30	105	27	C	31	108	30	C
	WBR	36	114	39	D	35	113	35	D	36	116	36	D
	WBT	31	106	42	D	30	105	40	D	31	108	40	D

PM Peak Hour LOS Summary

Intersection	Move-ment	Existing Conditions				2031 Conditions				2041 Conditions			
		Queue (m)		Delay (sec)	LOS	Queue (m)		Delay (sec)	LOS	Queue (m)		Delay (sec)	LOS
		Avg.	Max.			Avg.	Max.			Avg.	Max.		
4: Lower Malpeque Road & Gates Drive (Unsignalized)	NBR	0	0	1	A	0	0	1	A	0	4	1	A
	NBT	0	12	1	A	0	11	1	A	0	14	1	A
	SBL	29	66	9	A	1	42	9	A	1	42	7	A
	SBT	29	66	1	A	1	43	1	A	1	42	1	A
	WBL	16	30	13	B	1	14	12	B	1	15	13	B
	WBR	16	34	7	A	1	17	8	A	1	18	11	B
5: Malpeque Road & Irwin Drive	EBL	0	9	12	B	1	11	26	C	1	10	25	C
	EBR	1	23	12	B	0	12	6	A	0	11	7	A
	EBT	0	0	0	A	0	11	28	C	0	10	34	C
	NBL	0	10	5	A	12	86	12	B	15	98	14	B
	NBR	0	0	0	A	12	86	11	B	15	98	14	B
	NBT	0	0	0	A	12	86	15	B	15	98	17	B
	SBL	0	0	0	A	9	57	18	B	10	61	18	B
	SBR	14	20	0	A	8	57	10	A	10	61	20	B
	SBT	14	20	0	A	9	57	14	B	10	61	16	B
	WBL	0	0	0	A	2	20	28	C	3	24	29	C
	WBR	0	0	0	A	3	30	11	B	5	35	10	B
	WBT	0	0	0	A	1	20	32	C	3	25	36	D
6: Mt. Edward Road & Fern Garden Drive (Unsignalized)	EBL	0	0	0	A	0	3	15	C	8	50	22	C
	EBR	0	0	0	A	0	8	13	B	8	53	23	C
	NBL	0	0	0	A	1	30	3	A	2	49	6	A
	NBR	0	0	0	A	0	25	1	A	2	43	2	A
	NBT	0	0	0	A	0	25	1	A	2	43	3	A
	SBL	1	18	3	A	0	19	4	A	1	24	6	A
	SBR	1	13	0	A	0	14	1	A	0	18	1	A
	SBT	1	13	1	A	0	14	1	A	0	18	2	A
	WBL	0	5	4	A	0	8	9	A	0	8	8	A
	WBR	0	12	7	A	0	13	10	A	0	13	10	B

PM Peak Hour LOS Summary

Intersection	Move-ment	Existing Conditions				2031 Conditions				2041 Conditions			
		Queue (m)		Delay (sec)	LOS	Queue (m)		Delay (sec)	LOS	Queue (m)		Delay (sec)	LOS
		Avg.	Max.			Avg.	Max.			Avg.	Max.		
7: Lower Malpeque Road & Kirkdale Road (Unsignalized)	EBL	6	17	0	A	0	11	0	A	0	10	0	A
	EBR	8	28	18	C	1	21	16	C	1	21	16	C
	NBL	1	39	5	A	2	60	6	A	3	65	7	A
	NBR	1	29	2	A	2	49	2	A	2	54	2	A
	NBT	1	29	2	A	2	49	3	A	2	54	3	A
	SBL	19	45	0	A	1	32	0	A	1	40	0	A
	SBR	17	37	4	A	1	23	1	A	1	30	1	A
	SBT	17	37	3	A	1	23	1	A	1	30	2	A
	WBL	1	16	13	B	0	17	11	B	0	17	13	B
	WBR	1	15	0	A	0	15	0	A	0	16	0	A
8: Malpeque Road & Saint Dunstan Street (Signalized)	EBL	0	0	0	A	0	0	0	A	16	76	28	C
	EBR	0	0	0	A	0	0	0	A	16	77	15	B
	EBT	0	0	0	A	0	0	0	A	17	77	33	C
	NBL	0	0	0	A	0	0	0	A	11	79	17	B
	NBR	6	76	7	A	6	73	6	A	15	89	13	B
	NBT	5	66	6	A	5	63	6	A	11	79	16	B
	SBL	14	97	9	A	3	51	11	B	11	69	17	B
	SBR	0	0	0	A	0	0	0	A	14	71	17	B
	SBT	14	97	5	A	3	51	6	A	14	71	20	B
	WBL	2	15	38	D	4	26	42	D	7	36	23	C
	WBR	0	9	4	A	0	8	4	A	0	8	4	A
	WBT	0	0	0	A	0	0	0	A	7	36	35	C
9: Saint Dunstan Street & Babineau Ave. (Unsignalized)	EBL	0	6	2	A	0	7	2	A	0	11	3	A
	EBT	0	1	0	A	0	3	1	A	0	6	1	A
	SBL	1	20	6	A	1	20	7	A	1	21	8	A
	SBR	1	22	7	A	1	21	7	A	1	24	7	A
	WBR	0	0	5	A	0	0	1	A	0	0	1	A
	WBT	0	0	8	A	0	0	2	A	0	0	2	A

PM Peak Hour LOS Summary

Intersection	Move-ment	Existing Conditions				2031 Conditions				2041 Conditions			
		Queue (m)		Delay (sec)	LOS	Queue (m)		Delay (sec)	LOS	Queue (m)		Delay (sec)	LOS
		Avg.	Max.			Avg.	Max.			Avg.	Max.		
10: Capital Drive & Lower Malpeque Road (Signalized)	EBL	64	158	26	C	21	78	35	D	25	94	40	D
	EBR	64	158	26	C	21	78	21	C	25	94	21	C
	EBT	64	158	39	D	21	78	47	D	25	94	46	D
	NBL	59	138	50	D	38	126	26	C	37	123	27	C
	NBR	59	139	24	C	38	126	15	B	37	123	14	B
	NBT	59	138	68	E	38	126	44	D	37	123	41	D
	SBL	66	158	62	E	31	135	27	C	40	154	31	C
	SBR	67	159	12	B	30	134	9	A	40	155	9	A
	SBT	67	158	54	D	31	135	37	D	40	154	41	D
	WBL	52	126	27	C	46	140	66	E	67	189	73	E
	WBR	55	129	26	C	48	143	42	D	70	191	48	D
	WBT	53	126	26	C	46	140	45	D	68	189	49	D
11: Capital Drive & Rhynes Drive/ Sandstone Road (Signalized)	EBL	39	165	14	B	10	97	22	C	41	129	37	D
	EBR	40	165	17	B	10	97	9	A	40	130	34	C
	EBT	39	165	15	B	10	97	9	A	41	129	34	C
	NBL	7	37	28	C	3	28	23	C	9	55	27	C
	NBR	14	51	11	B	9	41	9	A	14	65	19	B
	NBT	6	37	26	C	3	27	23	C	11	58	28	C
	SBL	0	5	26	C	0	6	23	C	49	200	27	C
	SBR	0	6	10	B	0	7	6	A	49	200	29	C
	SBT	0	5	22	C	0	6	25	C	48	200	41	D
	WBL	42	164	10	B	39	129	51	D	22	78	34	C
	WBR	41	164	11	B	39	129	11	B	21	79	26	C
	WBT	40	162	12	B	39	129	15	B	22	78	29	C

PM Peak Hour LOS Summary

Intersection	Move-ment	Existing Conditions				2031 Conditions				2041 Conditions			
		Queue (m)		Delay (sec)	LOS	Queue (m)		Delay (sec)	LOS	Queue (m)		Delay (sec)	LOS
		Avg.	Max.			Avg.	Max.			Avg.	Max.		
12: Capital Drive/ Spence Drive & Malpeque Road/ University Avenue (Signalized)	EBL	31	104	50	D	61	164	66	E	100	247	47	D
	EBR	1	31	4	A	1	32	6	A	1	36	11	B
	EBT	31	103	44	D	61	164	51	D	100	247	83	F
	NBL	26	90	60	E	24	101	35	C	28	109	36	D
	NBR	27	92	17	B	23	101	23	C	27	109	31	C
	NBT	26	90	20	C	24	101	24	C	28	109	27	C
	SBL	45	110	76	E	38	141	29	C	16	72	24	C
	SBR	49	113	29	C	43	144	37	D	18	75	25	C
	SBT	46	110	64	E	41	142	45	D	16	72	40	D
	WBL	33	104	53	D	52	153	39	D	53	149	44	D
	WBR	0	9	16	B	0	3	16	B	0	8	16	B
	WBT	33	104	72	E	52	152	58	E	52	148	56	E
13: Spencer Drive & Babineau Avenue	EBL	24	97	39	E	16	106	26	D	21	73	52	F
	EBR	21	93	37	E	14	101	17	C	17	68	13	B
	EBT	28	104	38	E	16	106	20	C	21	73	31	D
	NBL	7	28	43	E	5	31	25	D	7	46	23	C
	NBR	9	36	6	A	9	38	8	A	10	50	10	B
	NBT	5	23	8	A	6	31	25	C	7	46	25	D
	SBL	11	44	21	C	11	69	30	D	8	64	32	D
	SBR	16	59	15	B	17	78	22	C	13	73	20	C
	SBT	9	40	12	B	11	69	34	D	8	65	38	E
	WBL	8	33	25	C	18	83	21	C	24	73	30	D
	WBR	10	38	10	B	23	90	22	C	29	80	26	D
	WBT	10	37	27	D	18	83	27	D	24	73	29	D

PM Peak Hour LOS Summary

Intersection	Move-ment	Existing Conditions				2031 Conditions				2041 Conditions			
		Queue (m)		Delay (sec)	LOS	Queue (m)		Delay (sec)	LOS	Queue (m)		Delay (sec)	LOS
		Avg.	Max.			Avg.	Max.			Avg.	Max.		
14: Mt. Edward Road & Ash Drive	EBL	0	0	0	A	13	59	34	C	8	41	28	C
	EBR	0	0	0	A	17	64	12	B	11	45	12	B
	EBT	0	0	0	A	13	59	33	C	8	41	29	C
	NBL	0	0	0	A	8	61	16	B	9	67	13	B
	NBR	0	21	1	A	8	61	7	A	9	67	7	A
	NBT	0	21	1	A	8	61	9	A	9	67	10	A
	SBL	4	54	6	A	16	101	10	A	16	96	14	B
	SBR	0	0	0	A	14	97	15	B	15	95	16	B
	SBT	3	49	7	A	16	101	20	C	16	96	22	C
	WBL	1	21	15	B	2	16	39	D	1	14	44	D
	WBR	1	21	10	B	2	16	11	B	1	18	7	A
	WBT	0	0	0	A	2	16	43	D	1	14	41	D
15: North River Road & Thompson Drive (Unsignalized)	EBL	0	22	14	B	0	22	12	B	0	22	20	C
	EBR	0	11	10	A	0	10	9	A	0	11	13	B
	EBT	0	23	18	C	0	22	22	C	0	22	21	C
	NBL	24	73	13	B	1	40	7	A	2	52	8	A
	NBR	23	68	13	B	1	35	7	A	2	47	9	A
	NBT	23	68	5	A	1	35	3	A	2	47	3	A
	SBL	3	65	11	B	4	70	12	B	8	118	14	B
	SBR	4	72	3	A	5	78	12	B	9	127	6	A
	SBT	3	62	4	A	4	67	4	A	8	115	5	A
	WBL	27	57	31	D	7	63	30	D	8	59	38	E
	WBR	29	64	27	D	9	70	25	D	11	65	24	C
	WBT	26	58	18	C	6	64	30	D	8	59	41	E

PM Peak Hour LOS Summary

Intersection	Move-ment	Existing Conditions				2031 Conditions				2041 Conditions			
		Queue (m)		Delay (sec)	LOS	Queue (m)		Delay (sec)	LOS	Queue (m)		Delay (sec)	LOS
		Avg.	Max.			Avg.	Max.			Avg.	Max.		
16: Thompson Drive & Sandstone Road (Unsignalized)	EBL	2	23	9	A	1	18	8	A	2	25	9	A
	EBR	3	31	7	A	2	27	7	A	4	33	9	A
	NBL	4	31	12	B	4	33	13	B	4	33	13	B
	NBT	7	43	12	B	7	45	13	B	8	45	13	B
	SBR	9	40	10	A	10	58	17	C	12	53	17	C
	SBT	9	40	10	A	10	58	15	B	12	53	16	C
18: Towers Road & Mall Road (Unsignalized)	EBL	2	26	12	B	1	26	7	A	1	26	8	A
	EBR	1	22	0	A	1	22	0	A	1	22	0	A
	EBT	2	26	10	A	1	26	7	A	1	26	7	A
	NBL	1	4	0	A	0	3	0	A	0	3	0	A
	NBR	0	7	11	B	0	8	6	A	0	8	7	A
	NBT	1	16	21	C	1	14	13	B	1	14	13	B
	SBL	10	50	17	C	3	25	17	C	5	29	19	C
	SBR	5	40	8	A	0	14	12	B	1	19	13	B
	SBT	9	53	4	A	2	28	8	A	3	32	8	A
	WBL	125	217	78	F	10	54	15	B	16	66	18	C
	WBR	125	217	77	F	10	54	16	C	16	65	21	C
	WBT	125	217	63	F	10	55	15	C	16	66	19	C
19: Mt. Edward Road & Towers Road/ Montgomery Drive (Signalized)	EBL	26	113	43	D	7	56	33	C	8	65	33	C
	EBR	30	118	30	C	9	61	14	B	10	71	14	B
	EBT	27	113	39	D	7	56	37	D	8	65	30	C
	NBL	12	61	29	C	9	73	13	B	12	86	14	B
	NBR	12	61	13	B	9	73	7	A	12	86	8	A
	NBT	12	61	11	B	9	73	8	A	12	86	9	A
	SBL	15	75	11	B	12	104	10	B	16	115	11	B
	SBR	21	89	28	C	18	118	10	B	22	129	13	B
	SBT	15	75	35	C	12	104	13	B	16	115	15	B
	WBL	1	13	40	D	1	13	26	C	1	13	37	D
	WBR	1	13	34	C	1	13	30	C	1	14	31	C
	WBT	1	14	15	B	1	14	9	A	1	14	11	B

PM Peak Hour LOS Summary

Intersection	Move-ment	Existing Conditions				2031 Conditions				2041 Conditions			
		Queue (m)		Delay (sec)	LOS	Queue (m)		Delay (sec)	LOS	Queue (m)		Delay (sec)	LOS
		Avg.	Max.			Avg.	Max.			Avg.	Max.		
20: North River Road & Babineau Drive (Signalized)	NBR	20	96	12	B	14	97	9	A	19	106	13	B
	NBT	17	87	9	A	11	87	11	B	16	96	14	B
	SBL	3	48	10	B	5	71	13	B	7	74	16	B
	SBT	3	48	5	A	5	71	6	A	7	74	6	A
	WBL	29	70	48	D	18	81	53	D	34	120	63	E
	WBR	31	74	13	B	21	85	16	B	36	123	27	C
21: Buchanan Drive & Sandstone Road (Unsignalized)	EBL	2	22	10	A	2	21	10	A	4	28	11	B
	EBT	0	16	9	A	0	15	9	A	2	23	10	B
	SBL	18	44	10	B	4	27	10	B	5	32	12	B
	SBR	19	48	10	A	5	31	10	A	6	36	11	B
	WBR	32	70	11	B	18	61	19	C	25	74	24	C
	WBT	32	70	12	B	18	61	21	C	25	74	26	D
22: University Avenue & Buchanan Drive (Signalized)	EBL	9	49	30	C	8	52	31	C	11	58	30	C
	EBR	9	49	9	A	8	52	10	A	11	58	11	B
	EBT	9	49	42	D	8	52	44	D	11	58	45	D
	NBL	28	88	24	C	25	97	30	C	27	115	35	C
	NBR	23	87	7	A	17	95	3	A	19	112	4	A
	NBT	28	88	32	C	25	97	26	C	27	115	24	C
	SBL	22	83	29	C	22	91	22	C	22	94	20	C
	SBR	22	83	33	C	22	91	35	D	22	94	36	D
	SBT	22	83	31	C	22	91	31	C	22	94	28	C
	WBL	25	74	27	C	15	69	28	C	15	69	29	C
	WBR	23	73	19	B	12	69	16	B	12	70	17	B
	WBT	25	74	34	C	15	69	36	D	15	69	36	D
23: Mt. Edward Road & Kenlea Drive (Unsignalized)	NBR	1	1	0	A	0	1	0	A	0	6	0	A
	NBT	1	1	3	A	0	1	0	A	0	6	0	A
	SBL	1	31	5	A	1	49	6	A	2	57	8	A
	SBT	0	22	1	A	1	40	2	A	2	48	2	A
	WBL	0	12	16	C	0	12	14	B	0	11	10	A
	WBR	1	12	14	B	0	12	13	B	1	12	15	C

PM Peak Hour LOS Summary

Intersection	Move-ment	Existing Conditions				2031 Conditions				2041 Conditions			
		Queue (m)		Delay (sec)	LOS	Queue (m)		Delay (sec)	LOS	Queue (m)		Delay (sec)	LOS
		Avg.	Max.			Avg.	Max.			Avg.	Max.		
101: MR1 & MR2	NBR	0	0	0	A	1	19	7	A	4	32	10	A
	NBT	0	0	0	A	1	19	7	A	4	32	10	A
	SBL	0	0	0	A	6	43	14	B	7	49	16	C
	SBT	0	0	0	A	2	34	10	B	3	39	11	B
	WBL	0	0	0	A	8	39	12	B	14	53	20	C
	WBR	0	0	0	A	7	39	12	B	13	53	19	C
102: Saint Dunstan Street & Babineau Ave.	EBL	0	0	0	A	2	29	9	A	3	31	9	A
	EBR	0	0	0	A	1	21	9	A	1	22	10	A
	EBT	0	0	0	A	1	21	7	A	1	22	10	B
	NBL	0	0	0	A	4	30	12	B	5	33	13	B
	NBR	0	0	0	A	5	34	14	B	6	36	12	B
	NBT	0	0	0	A	4	32	12	B	6	34	15	B
	SBL	0	0	0	A	1	18	11	B	2	20	12	B
	SBR	0	0	0	A	2	23	10	B	2	26	10	A
	SBT	0	0	0	A	1	20	10	A	2	23	10	B
	WBL	0	0	0	A	0	10	6	A	1	15	7	A
	WBR	0	0	0	A	0	1	6	A	0	8	6	A
	WBT	0	0	0	A	0	1	8	A	0	8	8	A
103: Irwin Drive & Babineau Ave.	EBL	0	0	0	A	1	24	7	A	3	31	9	A
	EBR	0	0	0	A	0	18	8	A	1	24	9	A
	EBT	0	0	0	A	0	18	10	B	1	24	12	B
	NBL	0	0	0	A	1	18	9	A	1	18	9	A
	NBR	0	0	0	A	1	21	7	A	2	24	9	A
	NBT	0	0	0	A	1	18	8	A	1	19	8	A
	SBL	0	0	0	A	1	20	7	A	1	20	7	A
	SBR	0	0	0	A	2	29	6	A	2	27	6	A
	SBT	0	0	0	A	2	23	6	A	2	23	7	A
	WBL	0	0	0	A	0	13	6	A	1	17	7	A
	WBR	0	0	0	A	0	1	6	A	0	5	6	A
	WBT	0	0	0	A	0	1	8	A	0	5	8	A

PM Peak Hour LOS Summary

Intersection	Move-ment	Existing Conditions				2031 Conditions				2041 Conditions			
		Queue (m)		Delay (sec)	LOS	Queue (m)		Delay (sec)	LOS	Queue (m)		Delay (sec)	LOS
		Avg.	Max.			Avg.	Max.			Avg.	Max.		
104: Saint Dunstan Street & Irwin Drive	EBR	0	0	0	A	1	28	13	B	2	35	14	B
	EBR	0	0	0	A	1	28	13	B	2	35	14	B
	NBL	0	0	0	A	1	24	14	B	1	28	15	C
	NBL	0	0	0	A	1	24	14	B	1	28	15	C
105: Spencer Drive & MR3	EBL	0	0	0	A	21	79	27	D	40	107	36	E
	EBR	0	0	0	A	13	68	20	C	31	96	7	A
	EBT	0	0	0	A	5	61	21	C	37	118	35	E
	NBL	0	0	0	A	2	22	11	B	3	25	11	B
	NBR	0	0	0	A	3	25	10	A	5	32	8	A
	NBT	0	0	0	A	2	23	12	B	3	26	12	B
	SBL	0	0	0	A	1	15	8	A	1	17	10	B
	SBR	0	0	0	A	1	21	8	A	0	9	7	A
	SBT	0	0	0	A	1	16	11	B	1	17	11	B
	WBL	0	0	0	A	29	105	30	D	27	95	28	D
	WBR	0	0	0	A	29	105	30	D	27	96	6	A
	WBT	0	0	0	A	29	105	30	D	27	96	28	D
106: Spencer Drive & SDU Road	EBL	0	0	0	A	0	0	0	A	6	26	11	B
	EBT	0	0	0	A	0	0	0	A	2	22	8	A
	SBL	0	0	0	A	0	0	0	A	1	16	10	A
	SBR	0	0	0	A	0	0	0	A	1	16	7	A
	WBR	0	0	0	A	0	0	0	A	2	22	7	A
	WBT	0	0	0	A	0	0	0	A	2	22	9	A
107: Fern Garden Road & SDU Road	EBR	0	0	0	A	0	0	0	A	0	12	5	A
	EBT	0	0	0	A	0	0	0	A	0	12	6	A
	NBL	0	0	0	A	0	0	0	A	1	15	7	A
	NBR	0	0	0	A	0	0	0	A	1	17	6	A
	WBL	0	0	0	A	0	0	0	A	3	30	8	A
	WBT	0	0	0	A	0	0	0	A	1	24	8	A
108: Irwin Drive & Fern Garden Drive	EBT	0	0	0	A	0	0	0	A	2	32	15	B
	EBT	0	0	0	A	0	0	0	A	2	32	15	B
	WBT	0	0	0	A	0	0	0	A	3	33	17	C
	WBT	0	0	0	A	0	0	0	A	3	33	17	C

APPENDIX C

Summary of Traffic Operations
Saturday Peak Hour

Saturday Peak Hour LOS Summary

Intersection	Move-ment	Existing Conditions				2031 Conditions				2041 Conditions			
		Queue (m)		Delay (sec)	LOS	Queue (m)		Delay (sec)	LOS	Queue (m)		Delay (sec)	LOS
		Avg.	Max.			Avg.	Max.			Avg.	Max.		
1: Lower Malpeque Road & Oldmoore Court (Unsignalized)	EBL	0	8	10	B	0	9	12	B	0	10	11	B
	EBR	0	12	8	A	0	13	7	A	1	13	8	A
	NBL	0	8	2	A	0	9	3	A	0	14	3	A
	NBT	0	3	0	A	0	5	0	A	0	10	0	A
	SBR	0	0	0	A	0	0	0	A	0	1	0	A
	SBT	0	0	0	A	0	0	0	A	0	1	0	A
2: Ch'town Perimeter Highway & Malpeque Road (Signalized)	EBL	7	32	19	B	7	33	21	C	8	33	20	C
	EBR	0	0	0	A	0	8	2	A	1	16	5	A
	EBT	7	32	30	C	7	33	30	C	8	33	32	C
	NBL	73	191	31	C	23	106	28	C	28	125	31	C
	NBR	26	118	1	A	1	35	3	A	3	54	4	A
	NBT	73	190	61	E	24	106	40	D	28	126	42	D
	SBL	35	131	44	D	19	71	33	C	34	99	42	D
	SBR	0	20	1	A	0	1	0	A	3	10	4	A
	SBT	35	130	41	D	20	71	34	C	35	99	45	D
	WBL	16	93	27	C	13	84	24	C	22	96	49	D
	WBR	0	7	0	A	1	33	4	A	1	33	4	A
	WBT	16	93	29	C	13	84	28	C	22	95	30	C
3: Ch'town Perimeter Highway & Mt. Edward Road (Signalized)	EBL	21	81	24	C	19	71	25	C	43	103	24	C
	EBR	24	86	6	A	22	76	6	A	46	108	8	A
	EBT	21	81	37	D	19	70	40	D	43	103	46	D
	NBL	10	45	27	C	12	62	30	C	24	122	33	C
	NBR	0	1	1	A	0	6	1	A	0	9	6	A
	NBT	9	45	33	C	12	61	36	D	24	122	46	D
	SBL	9	51	26	C	12	58	27	C	28	86	33	C
	SBR	0	4	1	A	0	8	1	A	8	32	3	A
	SBT	9	51	35	D	12	58	40	D	28	86	46	D
	WBL	22	84	25	C	22	84	27	C	83	156	67	E
	WBR	27	91	32	C	26	92	30	C	86	163	35	C
	WBT	22	84	38	D	22	84	36	D	83	156	41	D

Saturday Peak Hour LOS Summary

Intersection	Move-ment	Existing Conditions				2031 Conditions				2041 Conditions			
		Queue (m)		Delay (sec)	LOS	Queue (m)		Delay (sec)	LOS	Queue (m)		Delay (sec)	LOS
		Avg.	Max.			Avg.	Max.			Avg.	Max.		
4: Lower Malpeque Road & Gates Drive (Unsignalized)	NBR	0	2	1	A	0	0	1	A	0	2	1	A
	NBT	0	13	1	A	0	8	1	A	0	16	1	A
	SBL	1	38	7	A	1	44	5	A	4	62	7	A
	SBT	1	38	1	A	1	45	1	A	4	62	3	A
	WBL	1	12	11	B	1	12	11	B	2	16	22	C
	WBR	1	15	9	A	1	15	10	B	2	19	17	C
5: Malpeque Road & Irwin Drive	EBL	0	9	14	B	1	11	19	B	3	16	22	C
	EBR	1	24	13	B	0	12	7	A	3	16	11	B
	EBT	0	0	0	A	0	11	29	C	3	15	45	D
	NBL	0	5	8	A	13	89	10	B	30	125	17	B
	NBR	0	0	0	A	13	89	14	B	30	125	26	C
	NBT	0	0	0	A	13	89	16	B	30	125	28	C
	SBL	0	0	0	A	8	67	18	B	34	116	31	C
	SBR	0	6	0	A	8	66	9	A	32	116	11	B
	SBT	0	6	1	A	8	67	12	B	34	116	19	B
	WBL	0	0	0	A	2	17	31	C	6	42	30	C
	WBR	0	0	0	A	3	28	10	B	10	51	14	B
	WBT	0	0	0	A	1	18	32	C	6	42	40	D
6: Mt. Edward Road & Fern Garden Drive (Unsignalized)	EBL	0	0	0	A	0	4	11	B	96	139	165	F
	EBR	0	0	0	A	0	9	11	B	98	141	151	F
	NBL	0	0	0	A	0	25	4	A	36	104	9	A
	NBR	0	0	0	A	0	20	1	A	35	97	2	A
	NBT	0	0	0	A	0	20	1	A	35	97	4	A
	SBL	0	9	2	A	0	13	5	A	18	49	6	A
	SBR	0	5	0	A	0	9	1	A	17	44	2	A
	SBT	0	5	0	A	0	9	1	A	17	44	2	A
	WBL	0	6	3	A	0	9	8	A	1	12	17	C
	WBR	0	12	7	A	0	14	8	A	1	18	11	B

Saturday Peak Hour LOS Summary

Intersection	Move-ment	Existing Conditions				2031 Conditions				2041 Conditions			
		Queue (m)		Delay (sec)	LOS	Queue (m)		Delay (sec)	LOS	Queue (m)		Delay (sec)	LOS
		Avg.	Max.			Avg.	Max.			Avg.	Max.		
7: Lower Malpeque Road & Kirkdale Road (Unsignalized)	EBL	0	9	18	C	0	9	17	C	0	9	24	C
	EBR	0	19	12	B	0	19	13	B	1	19	20	C
	NBL	0	22	4	A	1	28	4	A	1	32	6	A
	NBR	0	13	1	A	0	18	1	A	1	22	1	A
	NBT	0	13	1	A	0	18	1	A	1	22	1	A
	SBL	0	14	9	A	1	32	8	A	11	66	10	B
	SBR	0	9	1	A	1	23	1	A	10	55	9	A
	SBT	0	9	1	A	1	23	1	A	10	55	9	A
	WBL	0	18	9	A	0	19	10	A	0	19	16	C
	WBR	0	18	6	A	0	18	10	B	0	19	13	B
8: Malpeque Road & Saint Dunstan Street (Signalized)	EBL	0	0	0	A	0	0	0	A	232	382	76	E
	EBR	0	0	0	A	0	0	0	A	233	383	60	E
	EBT	0	0	0	A	0	0	0	A	232	383	75	E
	NBL	0	0	0	A	0	0	0	A	28	110	27	C
	NBR	7	83	7	A	7	78	8	A	33	120	23	C
	NBT	6	73	7	A	6	69	7	A	28	110	27	C
	SBL	8	126	10	B	3	57	11	B	24	106	28	C
	SBR	0	0	0	A	0	0	0	A	25	107	25	C
	SBT	8	125	5	A	3	57	5	A	25	107	26	C
	WBL	1	8	41	D	5	25	43	D	20	74	35	C
	WBR	0	6	4	A	0	5	4	A	0	4	4	A
	WBT	0	0	0	A	0	0	0	A	20	74	51	D
9: Saint Dunstan Street & Babineau Ave. (Unsignalized)	EBL	0	5	1	A	0	4	1	A	12	50	11	B
	EBT	0	1	0	A	0	1	1	A	11	44	14	B
	SBL	1	27	7	A	1	25	7	A	1	28	14	B
	SBR	1	27	7	A	1	26	6	A	2	31	8	A
	WBR	0	0	0	A	0	0	1	A	1	13	2	A
	WBT	0	0	3	A	0	0	2	A	1	13	2	A

Saturday Peak Hour LOS Summary

Intersection	Move-ment	Existing Conditions				2031 Conditions				2041 Conditions			
		Queue (m)		Delay (sec)	LOS	Queue (m)		Delay (sec)	LOS	Queue (m)		Delay (sec)	LOS
		Avg.	Max.			Avg.	Max.			Avg.	Max.		
10: Capital Drive & Lower Malpeque Road (Signalized)	EBL	13	67	21	C	15	75	27	C	27	99	29	C
	EBR	13	67	12	B	15	75	28	C	27	99	38	D
	EBT	13	67	38	D	15	75	44	D	27	99	50	D
	NBL	31	113	40	D	18	96	17	B	26	121	21	C
	NBR	31	114	14	B	18	96	10	A	26	121	14	B
	NBT	31	114	55	D	18	96	33	C	26	121	36	D
	SBL	26	96	49	D	16	87	23	C	52	155	42	D
	SBR	26	97	8	A	13	85	7	A	49	154	9	A
	SBT	27	96	42	D	16	87	28	C	52	155	44	D
	WBL	14	72	25	C	23	81	54	D	48	120	90	F
	WBR	16	75	20	C	24	84	24	C	49	123	32	C
	WBT	15	72	25	C	23	81	33	C	48	120	38	D
11: Capital Drive & Rhynes Drive/ Sandstone Road (Signalized)	EBL	15	115	11	B	5	57	16	B	135	263	97	F
	EBR	15	115	14	B	5	57	7	A	135	263	47	D
	EBT	15	115	13	B	5	57	7	A	135	263	48	D
	NBL	6	33	28	C	3	24	23	C	22	82	31	C
	NBR	13	46	17	B	9	37	8	A	27	92	26	C
	NBT	6	32	20	B	3	24	23	C	24	86	36	D
	SBL	1	11	23	C	1	10	20	C	176	367	44	D
	SBR	1	12	12	B	1	11	7	A	176	367	41	D
	SBT	1	11	25	C	1	10	22	C	175	367	54	D
	WBL	11	93	8	A	34	113	46	D	45	121	73	E
	WBR	10	93	8	A	34	113	8	A	44	121	30	C
	WBT	10	91	9	A	34	113	15	B	44	120	35	D

Saturday Peak Hour LOS Summary

Intersection	Move-ment	Existing Conditions				2031 Conditions				2041 Conditions			
		Queue (m)		Delay (sec)	LOS	Queue (m)		Delay (sec)	LOS	Queue (m)		Delay (sec)	LOS
		Avg.	Max.			Avg.	Max.			Avg.	Max.		
12: Capital Drive/ Spence Drive & Malpeque Road/ University Avenue (Signalized)	EBL	82	193	93	F	88	203	93	F	99	244	88	F
	EBR	24	101	5	A	0	20	4	A	3	38	15	B
	EBT	82	192	51	D	88	203	48	D	99	244	97	F
	NBL	14	81	24	C	19	74	33	C	40	141	36	D
	NBR	15	82	14	B	19	75	23	C	40	141	37	D
	NBT	14	81	21	C	19	74	30	C	40	141	36	D
	SBL	37	124	42	D	28	119	25	C	37	138	33	C
	SBR	39	127	14	B	32	122	34	C	40	141	39	D
	SBT	37	124	52	D	30	119	38	D	38	138	45	D
	WBL	30	98	33	C	40	134	32	C	63	158	56	E
	WBR	0	1	6	A	0	0	9	A	0	1	22	C
	WBT	29	97	52	D	39	133	46	D	62	157	59	E
13: Spencer Drive & Babineau Avenue	EBL	18	82	29	D	19	104	62	F	40	101	112	F
	EBR	15	77	27	D	16	99	18	C	36	96	19	C
	EBT	22	88	32	D	19	104	21	C	39	101	33	D
	NBL	2	21	9	A	4	29	16	C	8	41	19	C
	NBR	3	30	7	A	6	36	5	A	10	45	5	A
	NBT	0	16	7	A	4	29	10	A	8	41	10	B
	SBL	4	36	13	B	5	58	22	C	24	107	33	D
	SBR	10	51	13	B	8	68	12	B	29	116	29	D
	SBT	2	32	10	B	5	59	14	B	24	108	32	D
	WBL	0	0	0	A	12	63	34	D	26	73	58	F
	WBR	0	0	0	A	16	70	14	B	31	80	23	C
	WBT	0	0	0	A	12	63	21	C	26	72	26	D

Saturday Peak Hour LOS Summary

Intersection	Move-ment	Existing Conditions				2031 Conditions				2041 Conditions			
		Queue (m)		Delay (sec)	LOS	Queue (m)		Delay (sec)	LOS	Queue (m)		Delay (sec)	LOS
		Avg.	Max.			Avg.	Max.			Avg.	Max.		
14: Mt. Edward Road & Ash Drive	EBL	0	0	0	A	23	87	44	D	16	68	33	C
	EBR	0	0	0	A	26	92	15	B	20	72	18	B
	EBT	0	0	0	A	23	87	38	D	16	68	29	C
	NBL	0	0	0	A	7	50	16	B	21	70	28	C
	NBR	0	13	1	A	7	50	5	A	21	70	7	A
	NBT	0	13	1	A	7	50	9	A	21	70	9	A
	SBL	1	39	4	A	21	121	11	B	22	119	14	B
	SBR	0	0	0	A	18	117	16	B	21	117	17	B
	SBT	1	34	1	A	20	120	22	C	22	119	24	C
	WBL	1	21	12	B	2	17	38	D	4	20	40	D
	WBR	1	21	8	A	2	17	13	B	5	23	15	B
	WBT	0	0	0	A	2	17	45	D	4	20	50	D
15: North River Road & Thompson Drive (Unsignalized)	EBL	0	21	10	B	0	20	12	B	0	21	18	C
	EBR	0	9	8	A	0	10	7	A	0	10	18	C
	EBT	0	21	19	C	0	20	24	C	0	21	42	E
	NBL	2	24	3	A	0	5	5	A	2	43	14	B
	NBR	2	22	5	A	0	4	2	A	2	39	3	A
	NBT	2	22	3	A	0	4	2	A	2	39	3	A
	SBL	2	54	6	A	4	71	9	A	30	146	20	C
	SBR	2	62	1	A	4	79	2	A	33	154	4	A
	SBT	1	51	2	A	3	67	3	A	29	142	10	B
	WBL	1	22	16	C	2	41	22	C	27	98	107	F
	WBR	2	29	19	C	4	48	18	C	30	104	48	E
	WBT	1	23	6	A	2	42	21	C	27	99	82	F

Saturday Peak Hour LOS Summary

Intersection	Move-ment	Existing Conditions				2031 Conditions				2041 Conditions			
		Queue (m)		Delay (sec)	LOS	Queue (m)		Delay (sec)	LOS	Queue (m)		Delay (sec)	LOS
		Avg.	Max.			Avg.	Max.			Avg.	Max.		
16: Thompson Drive & Sandstone Road (Unsignalized)	EBL	1	17	8	A	1	18	8	A	6	35	12	B
	EBR	2	25	6	A	2	26	6	A	8	43	10	B
	NBL	4	34	10	B	5	37	14	B	9	48	18	C
	NBT	7	46	12	B	9	49	13	B	15	60	15	B
	SBR	3	35	10	A	8	56	15	B	33	99	31	D
	SBT	3	35	9	A	8	56	14	B	33	99	31	D
18: Towers Road & Mall Road (Unsignalized)	EBL	1	26	7	A	1	26	7	A	2	26	13	B
	EBR	0	21	5	A	0	21	0	A	1	21	5	A
	EBT	1	26	6	A	1	26	6	A	1	26	9	A
	NBL	0	10	8	A	0	11	10	A	2	15	7	A
	NBR	0	24	11	B	1	20	11	B	3	24	18	C
	NBT	1	15	14	B	1	15	12	B	3	20	21	C
	SBL	6	38	14	B	3	23	16	C	9	43	22	C
	SBR	2	28	9	A	0	12	12	B	4	33	14	B
	SBT	7	41	10	B	4	26	14	B	10	46	16	C
	WBL	44	114	39	E	6	42	11	B	57	124	43	E
	WBR	44	114	34	D	6	42	13	B	57	124	45	E
	WBT	44	114	34	D	6	42	11	B	57	124	49	E
19: Mt. Edward Road & Towers Road/ Montgomery Drive (Signalized)	EBL	14	87	34	C	5	46	30	C	25	87	66	E
	EBR	17	93	20	B	7	52	12	B	28	93	36	D
	EBT	14	87	30	C	5	46	34	C	25	87	33	C
	NBL	6	49	13	B	5	49	11	B	17	77	23	C
	NBR	6	49	5	A	5	49	9	A	17	77	9	A
	NBT	6	49	7	A	5	49	7	A	17	77	17	B
	SBL	10	71	9	A	9	90	8	A	17	118	13	B
	SBR	15	85	13	B	13	103	9	A	24	131	12	B
	SBT	10	71	18	B	9	90	12	B	17	118	17	B
	WBL	1	14	32	C	1	14	31	C	2	16	40	D
	WBR	1	14	26	C	1	14	25	C	2	16	38	D
	WBT	1	15	9	A	1	15	8	A	2	17	14	B

Saturday Peak Hour LOS Summary

Intersection	Move-ment	Existing Conditions				2031 Conditions				2041 Conditions			
		Queue (m)		Delay (sec)	LOS	Queue (m)		Delay (sec)	LOS	Queue (m)		Delay (sec)	LOS
		Avg.	Max.			Avg.	Max.			Avg.	Max.		
20: North River Road & Babineau Drive (Signalized)	NBR	9	86	7	A	12	97	8	A	23	108	11	B
	NBT	7	75	8	A	9	86	9	A	19	97	13	B
	SBL	3	54	10	A	5	69	12	B	8	87	19	B
	SBT	4	54	5	A	5	69	5	A	8	87	6	A
	WBL	10	46	47	D	13	62	49	D	26	116	59	E
	WBR	11	49	12	B	15	65	14	B	28	119	21	C
21: Buchanan Drive & Sandstone Road (Unsignalized)	EBL	4	29	11	B	4	26	10	B	21	63	19	C
	EBT	2	24	10	A	1	20	10	A	17	57	17	C
	SBL	2	24	10	A	3	23	10	B	14	55	18	C
	SBR	3	28	8	A	3	27	9	A	15	59	15	C
	WBR	5	34	10	A	12	49	15	B	25	77	24	C
	WBT	5	34	11	B	12	49	17	C	25	77	26	D
22: University Avenue & Buchanan Drive (Signalized)	EBL	12	67	29	C	11	62	27	C	63	146	37	D
	EBR	12	67	11	B	11	62	11	B	63	146	19	B
	EBT	12	67	42	D	11	62	43	D	63	146	92	F
	NBL	14	65	25	C	14	63	29	C	39	115	62	E
	NBR	8	63	4	A	7	60	4	A	33	113	18	B
	NBT	14	65	23	C	14	63	23	C	39	115	32	C
	SBL	20	87	19	B	24	108	18	B	62	177	64	E
	SBR	20	87	32	C	24	108	32	C	62	177	48	D
	SBT	20	87	31	C	24	108	28	C	62	177	42	D
	WBL	16	67	27	C	16	69	27	C	47	122	48	D
	WBR	13	67	14	B	13	69	16	B	44	122	24	C
	WBT	16	67	33	C	15	69	37	D	47	122	49	D
23: Mt. Edward Road & Kenlea Drive (Unsignalized)	NBR	0	0	0	A	0	0	0	A	2	5	0	A
	NBT	0	0	0	A	0	0	0	A	2	5	16	C
	SBL	0	12	3	A	0	17	3	A	1	28	4	A
	SBT	0	7	1	A	0	12	1	A	0	21	1	A
	WBL	0	10	5	A	0	12	6	A	1	15	10	B
	WBR	0	11	8	A	0	12	9	A	2	15	32	D

Saturday Peak Hour LOS Summary

Intersection	Move-ment	Existing Conditions				2031 Conditions				2041 Conditions			
		Queue (m)		Delay (sec)	LOS	Queue (m)		Delay (sec)	LOS	Queue (m)		Delay (sec)	LOS
		Avg.	Max.			Avg.	Max.			Avg.	Max.		
101: MR1 & MR2	NBR	0	0	0	A	1	21	7	A	17	43	9	A
	NBT	0	0	0	A	1	21	7	A	17	43	9	A
	SBL	0	0	0	A	9	54	15	C	30	83	32	D
	SBT	0	0	0	A	5	44	13	B	23	74	32	D
	WBL	0	0	0	A	18	75	22	C	130	229	66	F
	WBR	0	0	0	A	18	75	21	C	130	229	64	F
102: Saint Dunstan Street & Babineau Ave.	EBL	0	0	0	A	3	34	9	A	35	91	36	E
	EBR	0	0	0	A	1	26	9	A	29	83	35	D
	EBT	0	0	0	A	1	26	11	B	29	83	38	E
	NBL	0	0	0	A	2	24	11	B	15	52	24	C
	NBR	0	0	0	A	2	28	7	A	16	55	18	C
	NBT	0	0	0	A	2	26	10	B	16	53	18	C
	SBL	0	0	0	A	2	21	12	B	14	48	41	E
	SBR	0	0	0	A	3	26	10	A	16	53	24	C
	SBT	0	0	0	A	2	24	11	B	15	50	34	D
	WBL	0	0	0	A	0	11	6	A	10	48	18	C
	WBR	0	0	0	A	0	1	6	A	8	43	19	C
	WBT	0	0	0	A	0	1	8	A	8	43	19	C
103: Irwin Drive & Babineau Ave.	EBL	0	0	0	A	3	34	9	A	32	90	27	D
	EBR	0	0	0	A	1	28	10	B	27	83	30	D
	EBT	0	0	0	A	1	28	12	B	27	83	31	D
	NBL	0	0	0	A	1	15	10	A	12	36	14	B
	NBR	0	0	0	A	1	18	10	A	13	42	12	B
	NBT	0	0	0	A	1	16	7	A	12	37	10	B
	SBL	0	0	0	A	1	18	6	A	14	40	12	B
	SBR	0	0	0	A	2	27	6	A	16	46	14	B
	SBT	0	0	0	A	1	21	7	A	15	42	14	B
	WBL	0	0	0	A	0	13	6	A	6	29	21	C
	WBR	0	0	0	A	0	0	6	A	3	20	14	B
	WBT	0	0	0	A	0	0	8	A	3	20	15	B

Saturday Peak Hour LOS Summary

Intersection	Move-ment	Existing Conditions				2031 Conditions				2041 Conditions			
		Queue (m)		Delay (sec)	LOS	Queue (m)		Delay (sec)	LOS	Queue (m)		Delay (sec)	LOS
		Avg.	Max.			Avg.	Max.			Avg.	Max.		
104: Saint Dunstan Street & Irwin Drive	EBR	0	0	0	A	1	31	13	B	17	68	20	C
	EBR	0	0	0	A	1	31	13	B	17	68	20	C
	NBL	0	0	0	A	1	27	15	B	25	106	35	E
	NBL	0	0	0	A	1	27	15	B	25	106	35	E
105: Spencer Drive & MR3	EBL	0	0	0	A	21	85	27	D	57	136	47	E
	EBR	0	0	0	A	14	74	21	C	47	125	34	D
	EBT	0	0	0	A	6	73	21	C	57	152	44	E
	NBL	0	0	0	A	2	19	12	B	15	66	21	C
	NBR	0	0	0	A	2	23	9	A	18	74	18	C
	NBT	0	0	0	A	2	21	12	B	15	67	21	C
	SBL	0	0	0	A	1	17	9	A	7	41	19	C
	SBR	0	0	0	A	2	24	9	A	4	34	12	B
	SBT	0	0	0	A	1	18	12	B	7	41	22	C
	WBL	0	0	0	A	69	171	46	E	124	180	81	F
	WBR	0	0	0	A	69	171	45	E	124	180	38	E
	WBT	0	0	0	A	69	171	47	E	124	180	79	F
106: Spencer Drive & SDU Road	EBL	0	0	0	A	0	0	0	A	19	55	20	C
	EBT	0	0	0	A	0	0	0	A	15	51	20	C
	SBL	0	0	0	A	0	0	0	A	33	93	50	E
	SBR	0	0	0	A	0	0	0	A	34	93	44	E
	WBR	0	0	0	A	0	0	0	A	9	37	19	C
	WBT	0	0	0	A	0	0	0	A	9	37	21	C
107: Fern Garden Road & SDU Road	EBR	0	0	0	A	0	0	0	A	59	129	96	F
	EBT	0	0	0	A	0	0	0	A	59	129	68	F
	NBL	0	0	0	A	0	0	0	A	23	58	25	D
	NBR	0	0	0	A	0	0	0	A	24	60	31	D
	WBL	0	0	0	A	0	0	0	A	17	80	18	C
	WBT	0	0	0	A	0	0	0	A	13	75	19	C
108: Irwin Drive & Fern Garden Drive	EBT	0	0	0	A	0	0	0	A	26	73	18	C
	EBT	0	0	0	A	0	0	0	A	26	73	18	C
	WBT	0	0	0	A	0	0	0	A	29	104	30	D
	WBT	0	0	0	A	0	0	0	A	29	104	30	D

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