Final Report

PREPARED FOR THE CITY OF NANAIMO

Nanaimo Hospital Area Neighbourhood Transportation Plan

312 – 645 Fort Street,
Victoria, BC V8W 1G2 | T: 250.220.7060

March 2018 | File: 1296.0055.01

Nanaimo Hospital Area Neighbourhood Transportation Plan

FINAL REPORT

Client: City of Nanaimo
455 Wallace Street
Nanaimo, BC V9R 5J6

Prepared by: Urban Systems Ltd.
312 – 645 Fort Street
Victoria, BC V8W 1G2
Tel: (250) 220-7060

Prepared by: Natasha Elliott, P.Eng.
Transportation Engineer

Reviewed by: Shaun Heffernan, MPlan, MCIP, RPP
Community Planner

Date issued: March 7, 2018

Project No.: 1296.0055.01

TABLE OF CONTENTS

URBAN systems

APPENDICES

1.0 INTRODUCTION

The Nanaimo Hospital Area Neighbourhood Transportation Plan is one component in the larger Hospital Area Plan that includes consideration of land use, local services, parks and open spaces, public realm and neighbourhood character, and parking.

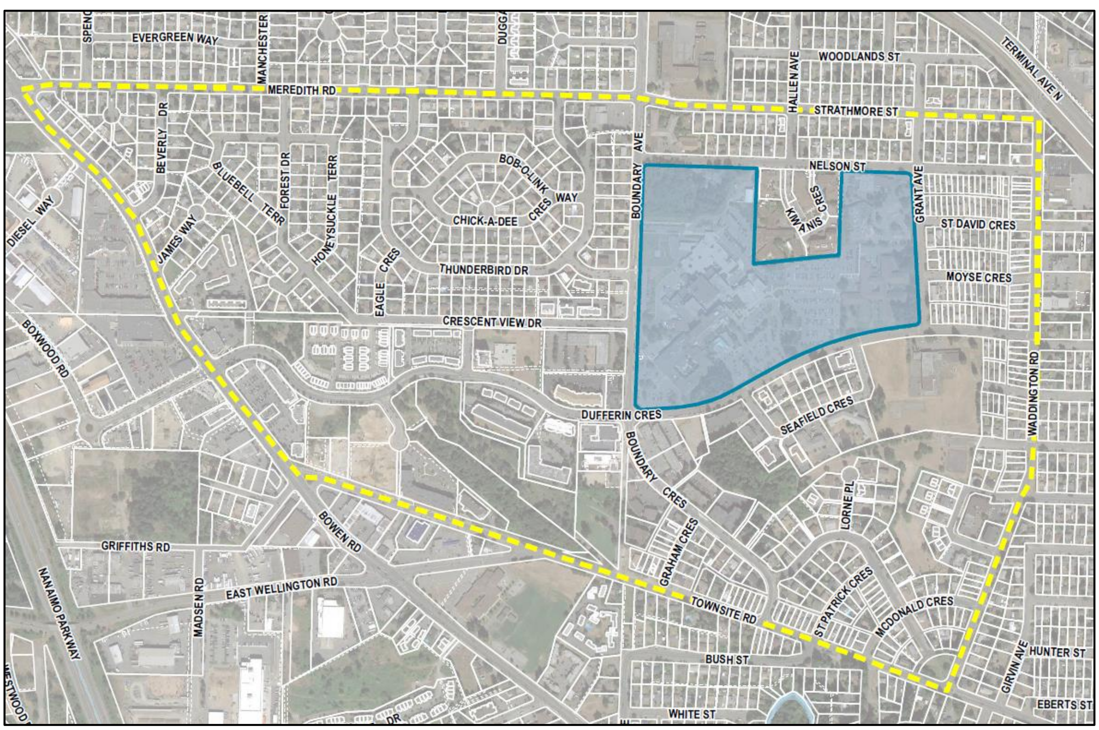
The intention of this study is to consider the current and future transportation needs of the study area from a holistic perspective including all travel modes. The road network and intersection assessment will be concluded with opportunities and options for improvement. Other objectives of this study include providing input to the streetscape design process being led by Urban Forum Associates Ltd.

1.1 Study Area

The study area is the neighbourhood immediately adjacent to the hospital as shown on **Figure 1.1**, below. While the analysis may include some locations outside the study area to provide some context and ensure any spill back effects on study area intersections from intersections outside the study area are captured. Recommendations will be focused on the study area.

The population of the City of Nanaimo is 90,504 (2016 Census), an increase of 8.0% since the 2011 Census (approximately 1.4% per annum). Nanaimo Regional General Hospital (NRGH) is the primary centre for health services in the Nanaimo region and beyond and is one of the City's largest employers. Surrounding the hospital campus is a mixed density residential neighbourhood and commercial development along the Bowen Road and Boundary Ave corridors.

Figure 1.1: Study Area



1.2 Background Documents

A number of studies have been completed which provide context to the Nanaimo Hospital Area Neighbourhood Transportation Plan including the Nanaimo Transportation Master Plan (NTMP, 2014), planNanaimo or the Official Community Plan (OCP, 2008), and the Transit Future Plan (2014). A brief summary of each of these documents is provided below, while relevant details of these documents are discussed further in the applicable sections.

1.2.1 Nanaimo Transportation Master Plan (2014)

The Nanaimo Transportation Master Plan (NTMP) aims to help guide the city toward its "aspirations for sustainable growth patterns", aligning with other City plans and policies. A key project driver is multi-modal transportation and complete streets improvements to better integrate between the street and surrounding land uses. In terms of historic growth and demographics within the city, the NTMP found that

- The City has grown by more than 70% since 1986;
- The growth rate is expected to continue, resulting in an additional 38,000 new residents by 2041;
- Today, approximately 20% of the City's residents are aged 65 and over, and 30% between the ages of 45-64; and
- By 2041, approximately one third of Nanaimo's population will be aged 65 and over.

Based on these projections, it is expected that the transit and road network will see a significant increase in pressure over the coming years.

The goal of the NTMP is to double the sustainable travel mode share trips by 2041, from 12 to 24%. Recognizing that the Hospital area is the primary health services centre in region surrounding Nanaimo as well as a large employer, the plan highlights the need for a strong walking, cycling, and transit network including high quality transit services to and around the hospital campus. The Hospital area was identified as a "mobility hub" reinforcing the importance of multiple and effective modes of transportation.

Intersection improvements were identified for Northfield Road / Boundary Crescent / Inland Highway (Short-Term) near the study area. Corridor improvements were identified on Terminal Avenue (phased), also near but outside of the study area.

1.2.2 Transit Future Plan (2014)

The Regional District of Nanaimo (RDN) has developed a Regional Growth Strategy which establishes a policy framework and guidelines to move towards sustainable development. The Plan envisions the RDN transit network 25-years into the future and describes the services, infrastructure and investments that are needed to achieve that vision. Of the 14 routes that serve the City of Nanaimo, the top four (including the #30 – Hospital route) were found to account for 67% of the system's total ridership (2012/2013).

The ridership target set in the Transit Future Plan (TFP) is for 5% of all trips to be by transit by 2039. This would mean an increase from the existing (2014) 2.7 million to 13.5 million trips per year. The TFP identified two new or improved future routes near the Hospital Plan study area: a Rapid Transit route servicing the Inland Highway from Woodgrove Centre to Cedar (Sandstone), and a Frequent Transit route along Bowen Road operating between Woodgrove Centre and Port Place Mall (downtown Nanaimo). Restructuring the #30- Hospital route was also recommended as part of the short, medium and long-term implementation strategies, which consists of increasing service levels as demand warrants, peak times, and evening and weekend service,

1.2.3 planNanaimo (2008)

The Official Community Plan (OCP) of the City of Nanaimo, aptly named planNanaimo, highlights the Hospital Area as an "Urban Node." Urban Nodes in the context of the OCP are defined as centres of concentrated urban use, with a focus on higher density growth and activity and a distinct focus and character. Urban Nodes are intended as centres of development, major employment, residential density meeting all demographic needs, transit, parks and open spaces, and social and community services. For the Hospital Area Neighbourhood Urban Node, the OCP recognizes the area as a core district for health services and plans to support the needs of the community in terms of accessibility and mobility for all ages and groups, including parking and emergency services access.

Goal six of planNanaimo is to "improve mobility and servicing efficiency," where mobility is directed to all transportation modes, including pedestrian, cycling, and transit, and servicing refers to utilities and infrastructure. One of the key points under Goal six is to implement traffic demand management (TDM) strategies.

1.2.4 Nanaimo Regional General Hospital Master Site Development Plan (Vancouver Island Health Authority & Resource Planning Group Inc., May 2010)

The Master Site Development Plan was organized into five sections:

1. Project Parameters: Horizon year of 2020/2021.
2. Master Program: identifies the major functional components of the building; (increase of
3. Site and existing facilities documentation and analysis: many buildings found to be inadequate. A current and future parking shortage was identified (708 stalls short by 2021).
4. Planning Strategies: Including, but not limited to, respecting site neighbours, site capacity, density and consolidation, internal circulation and wayfinding, functional zoning, and vehicular movement and parking.
5. Demonstration Plans: Includes a new Inpatient Tower, Cancer Centre, Emergency Department/PICU, Energy Plant, and Ambulance Services. The preferred option also requires the loss of the Rehabilitation Building, Ambulance Care Building, and Temporary Finance trailers.

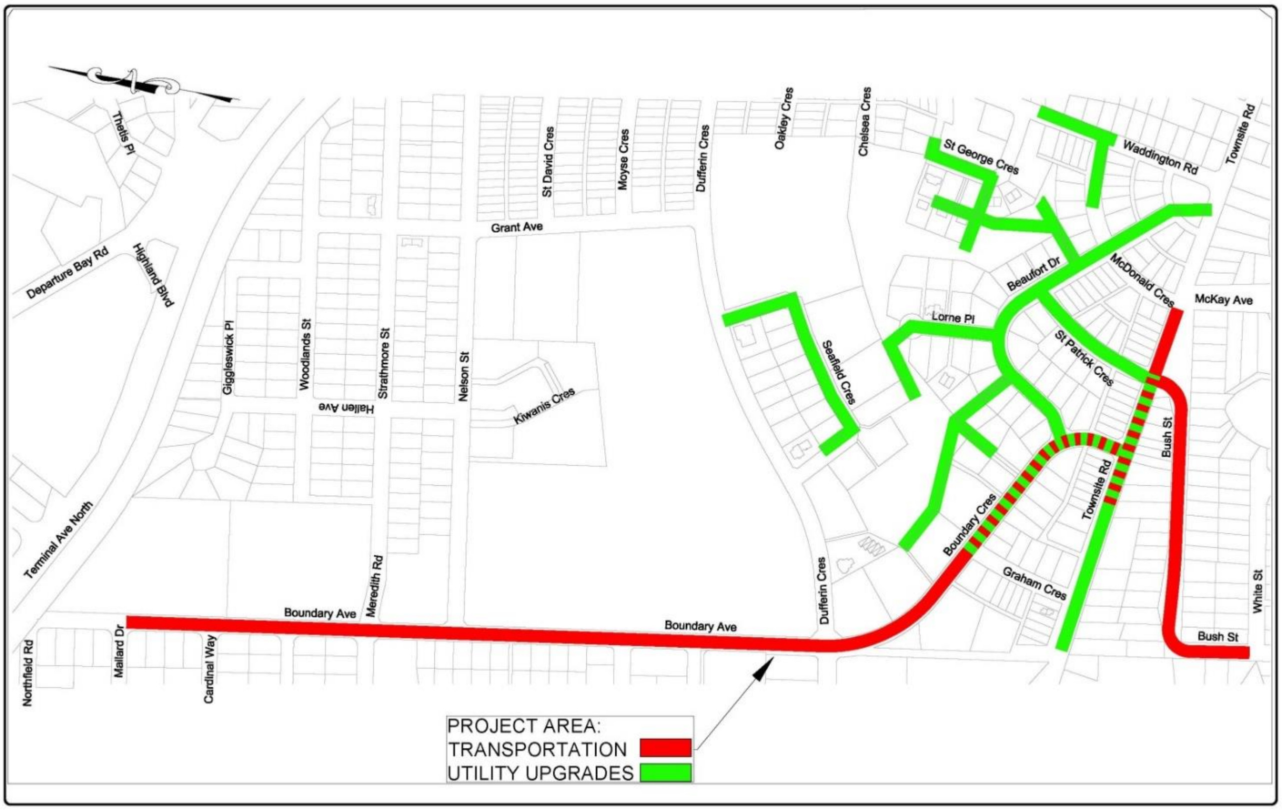
Option 2 was recommended, of the two Demonstration Plans, with a Phased construction approach. The current Hospital footprint is approximately 35,550 sq. m with a desire to expand to a size of 54,390 sq. m by 2021 (a 35% increase).

The new Emergency wing was opened to patients in October 2012.

1.2.5 Boundary Transportation Corridor Upgrades (Completed Fall 2015)

Transportation and utility upgrades were completed within the study area in 2015 on the streets illustrated in red in **Figure 1.2**, below. The transportation upgrades consisted of pedestrian facility improvements and the addition of dedicated cycling facilities on Bush Street, Pryde Avenue, Townsite Road, Boundary Crescent and Boundary Avenue, highlighted in red in the graphic below.

Figure 1.2: 2015 Transportation and Utility Upgrades



(Source: City of Nanaimo project website: http://www.nanaimo.ca/EN/main/departments/Engineering-Public-Works/EngineeringProjects/hospital-area-project.html)

2.0 FUTURE DEVELOPMENT AND GROWTH

Future growth in travel demand is a consequence of new developments or changes in land use plus general background growth associated with a growing City. Within the study area, future expansion at NRGH and the approved developments should be specifically considered as part of this study and the future travel demand.

2.1 Development

The following developments within the study area have been approved:

- 1515 Dufferin Crescent (Colvile Medical Centre): Approved
  - Zoning: CC5 Hospital Urban Centre
  - Site Area: 30,838 square feet
  - 203 parking spaces provided
  - Building area: 21,750 square feet

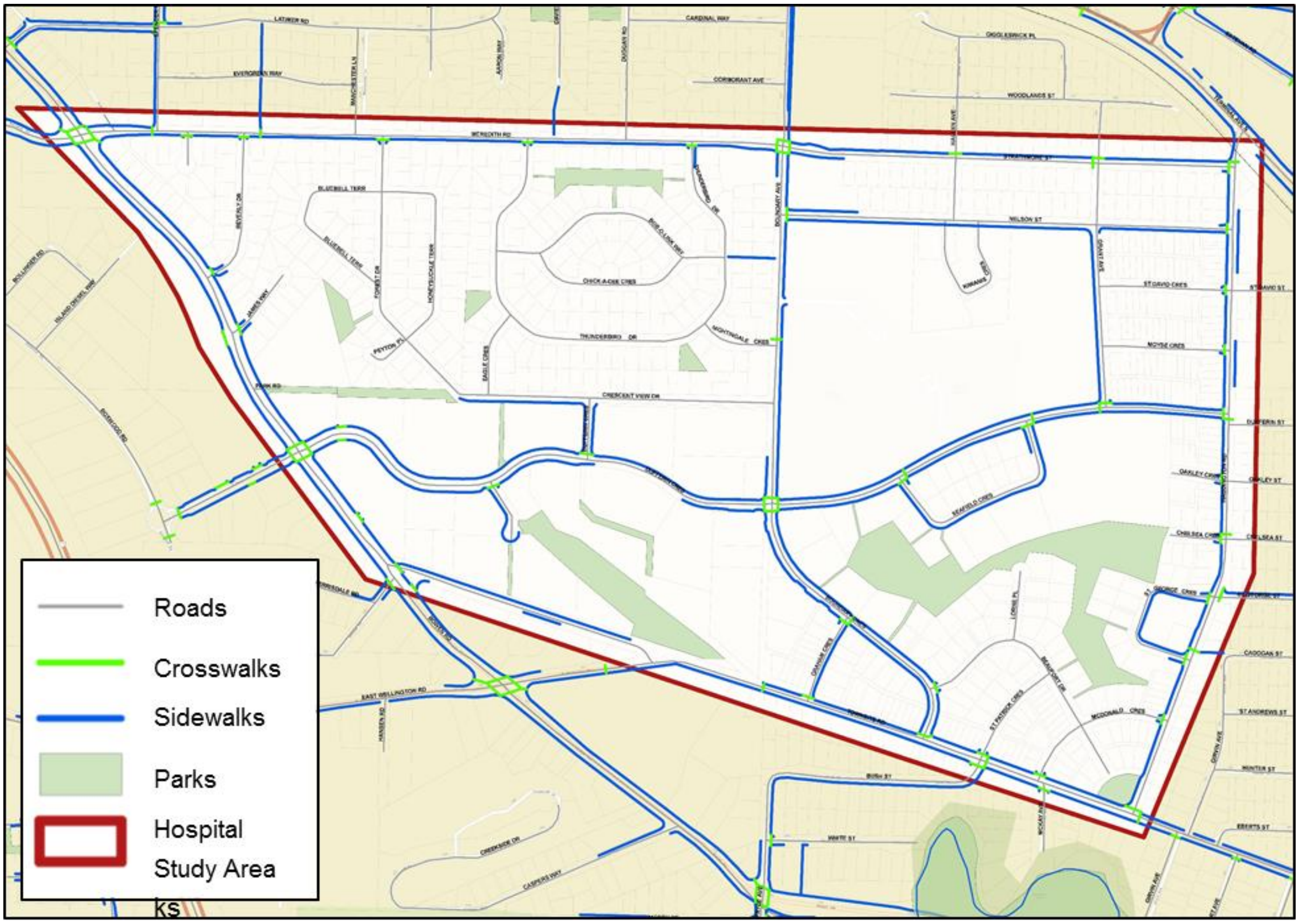
- 1800 Summerhill Place: Approved – Jan 2017
  - Zoning: R8 – Medium Density Residential
  - Site area: 29,364 square feet
  - Parking: 24 spaces (2/unit)
  - 27% building coverage
  - 12 units

- 1805 Summerhill Place: Approved – June 2016
  - Zoning: Multi-Family Residential
  - Site Area: 50,179 square feet
  - Site coverage: 30.6 percent
  - 80 units (36 studio, 35 one bedroom, 9 two bedroom)
  - Parking: 132 vehicles and 88 bikes

3.0 PEDESTRIANS

Within the study area most streets have a sidewalk on at least one side and marked crosswalks at intersections, as shown on **Figure 3.1**, below

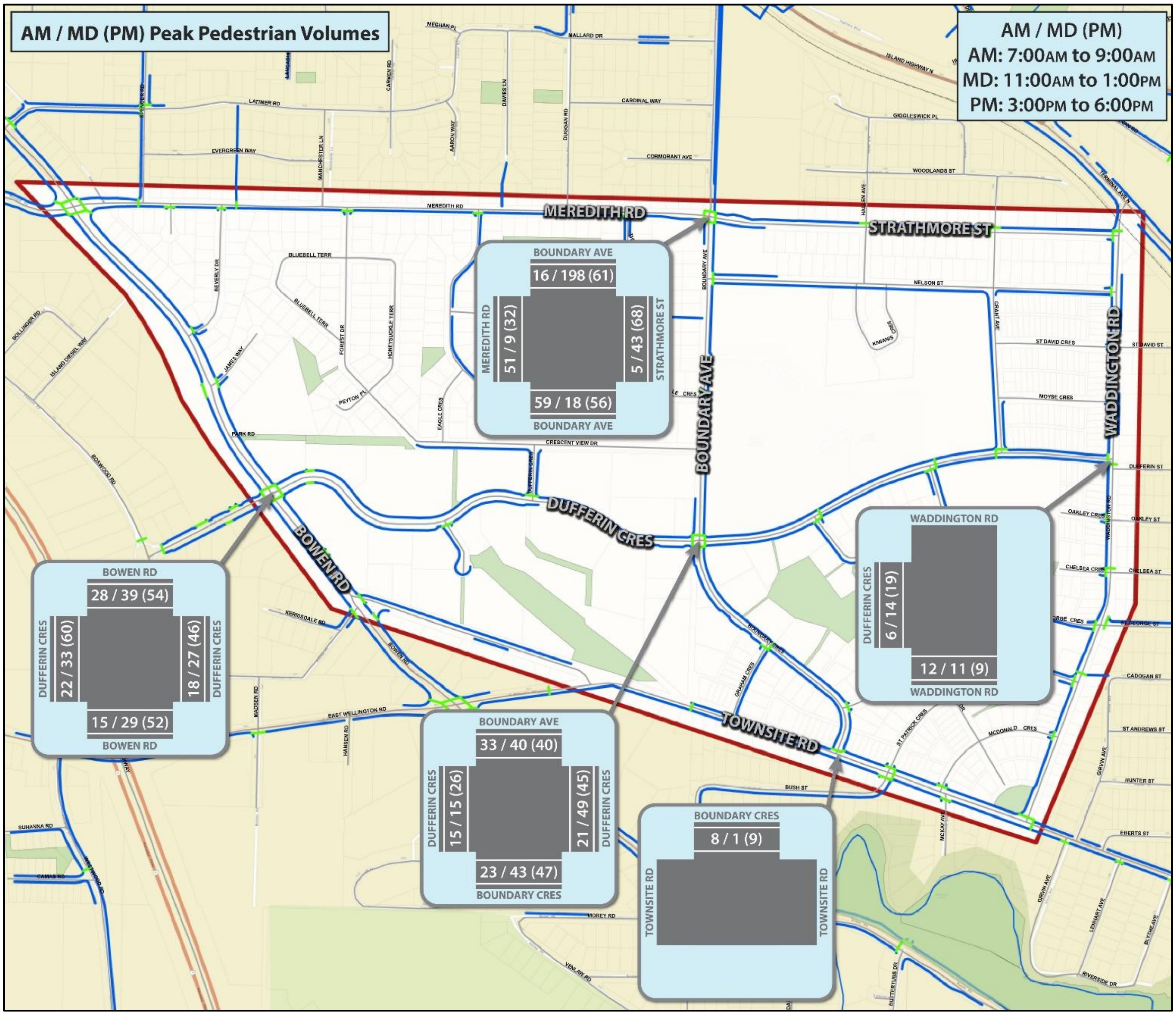
Figure 3.1: Pedestrian Facilities



No future plans for pedestrian facilities are identified in the Nanaimo Transportation Master Plan. The City of Nanaimo has indicated that it has plans for pedestrian and sidewalk upgrades between 2017 and 2022 at the intersections along Dufferin Crescent at Bowen Road and Dufferin Crescent (link to Crescent View Drive).

Pedestrian volumes at various intersections in the study area have been compiled and are shown on **Figure 3.2,** below, for the AM (7am to 9am), midday (11am to 1pm), and PM (3pm to 6pm) periods. The data was collected on various dates throughout 2015 and 2017. No seasonal adjustments have been made to the pedestrian data.

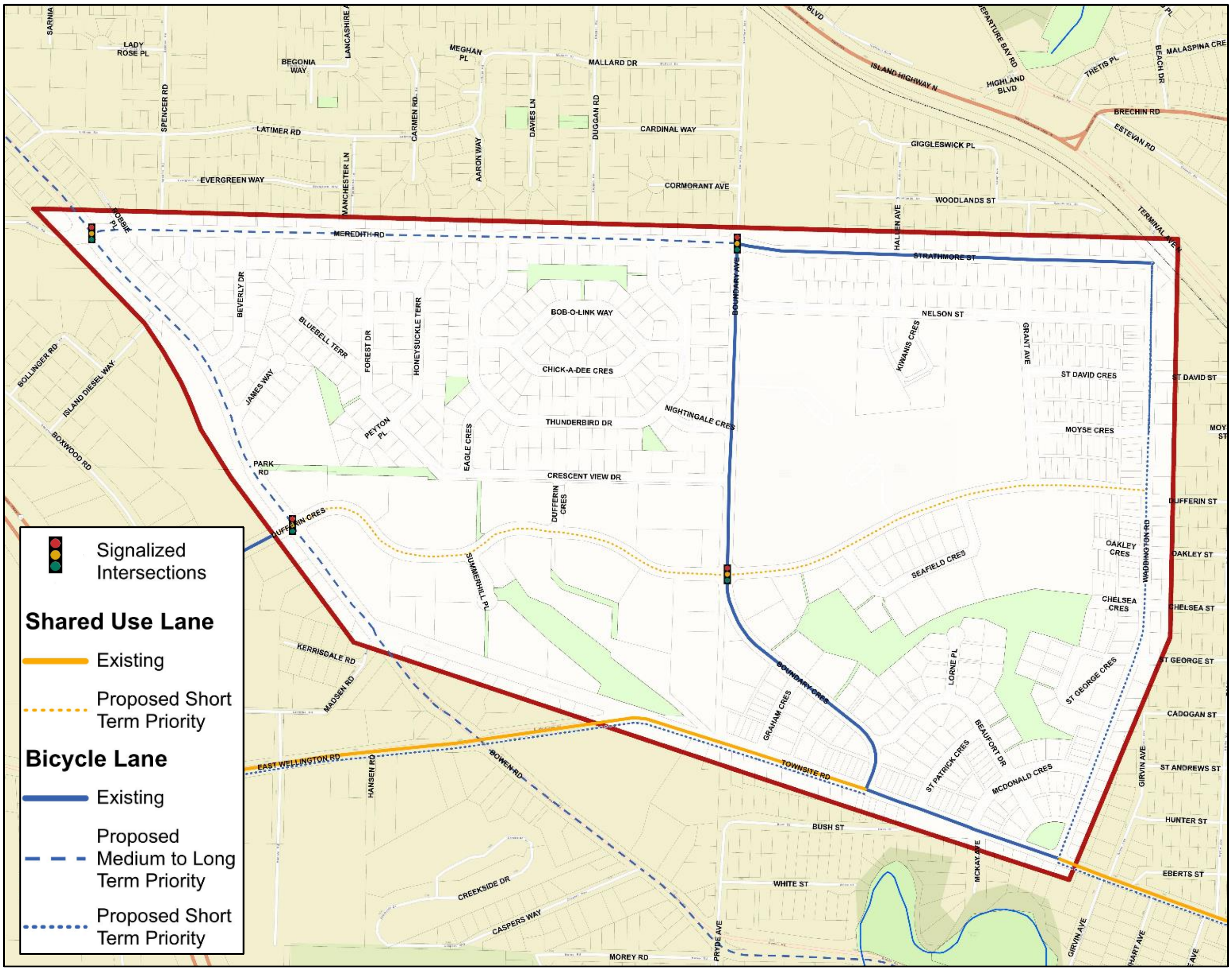
Figure 3.2: Peak Pedestrian Volumes



4.0 CYCLISTS

Figure 4.1, below, shows the existing and future cycling network planned for the study area based on the City of Nanaimo's Transportation Master Plan.

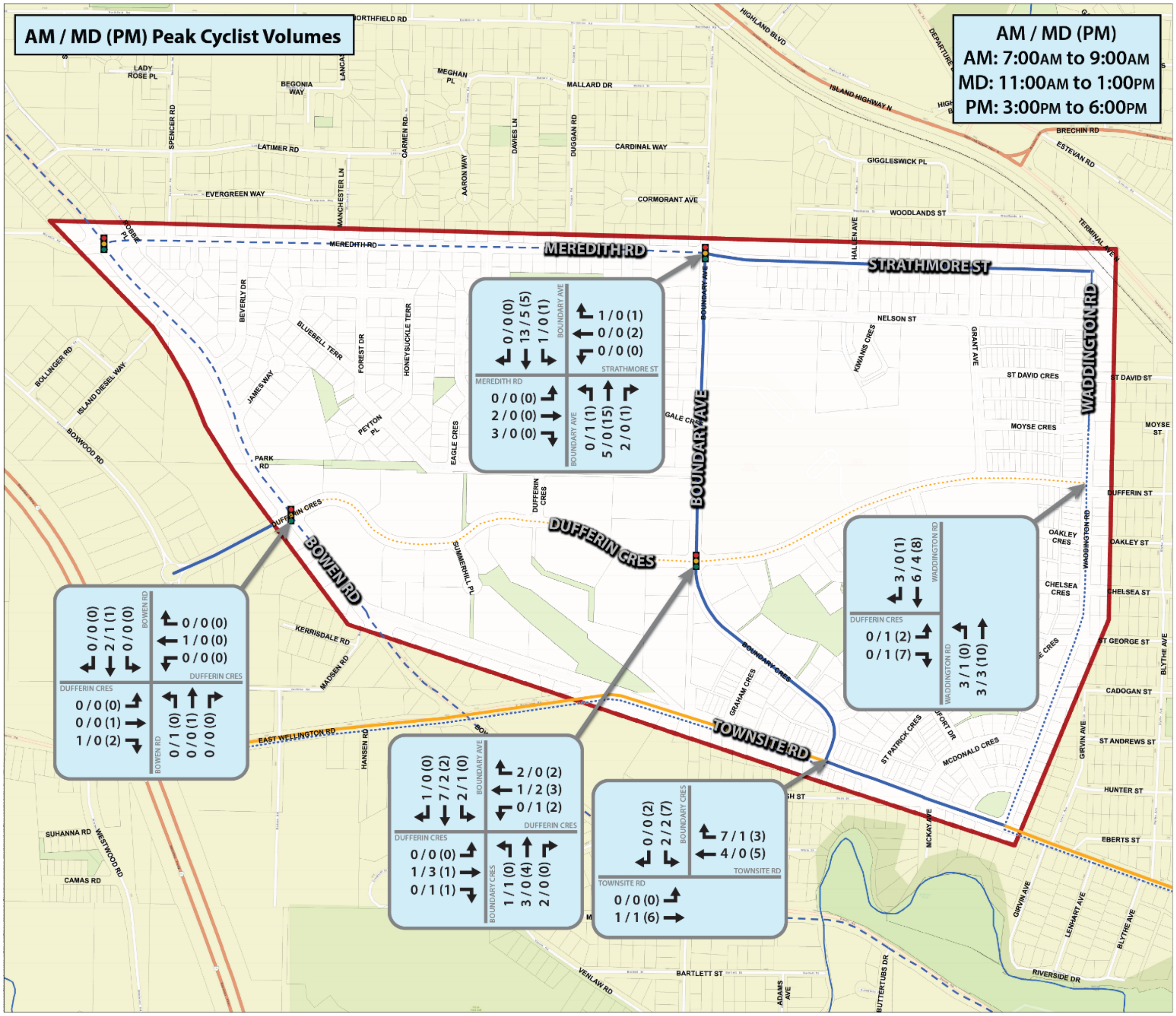
Figure 4.1: Study Area Bicycle Routes



Currently there is an existing bike lane on Boundary Avenue within the study area. The Transportation Master Plan identifies a more extensive network for the future with a combination of on-street bike lanes and shared use lanes. However, given the recent trend towards developing bicycle facilities appropriate for all ages and abilities, prior to implementing any new bicycle facilities the traffic volumes and speeds should be reviewed to determine the most appropriate facility type for the local context.

Cyclist volumes at various intersections in the study area have been compiled and are shown on **Figure 4.2,** below, for the AM, midday, and PM peak periods. The data was collected on various dates throughout 2015 and 2017. No seasonal adjustments have been made to the cyclist data.

Figure 4.2: Peak Cyclist Volumes

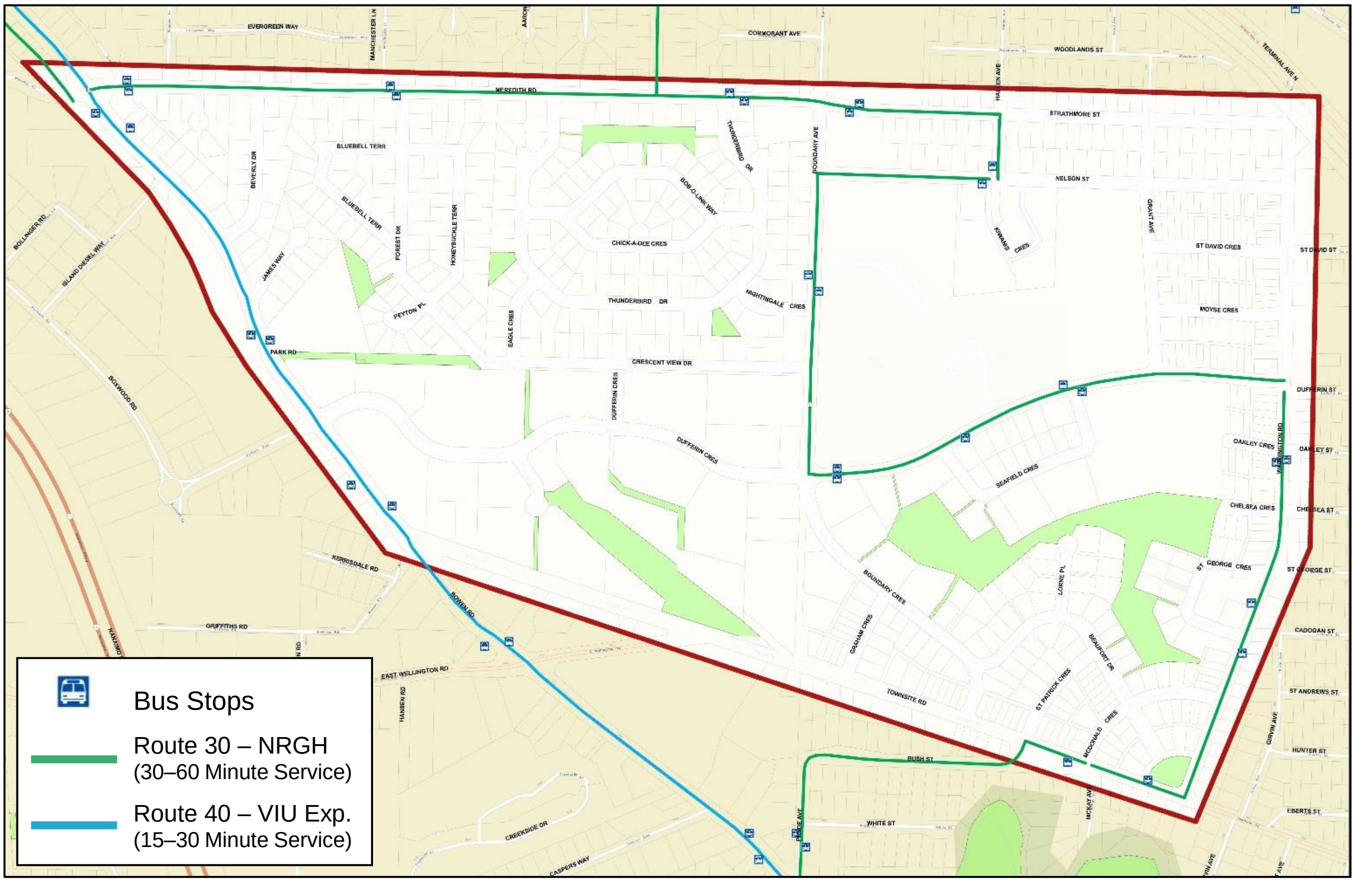


5.0 PUBLIC TRANSIT

As shown on **Figure 5.1**, there are two bus routes that operate within the study area:

- Route 30 -NRGH local route, and
- Route 40 -VIU Express.

Figure 5.1: Public Transit Routes



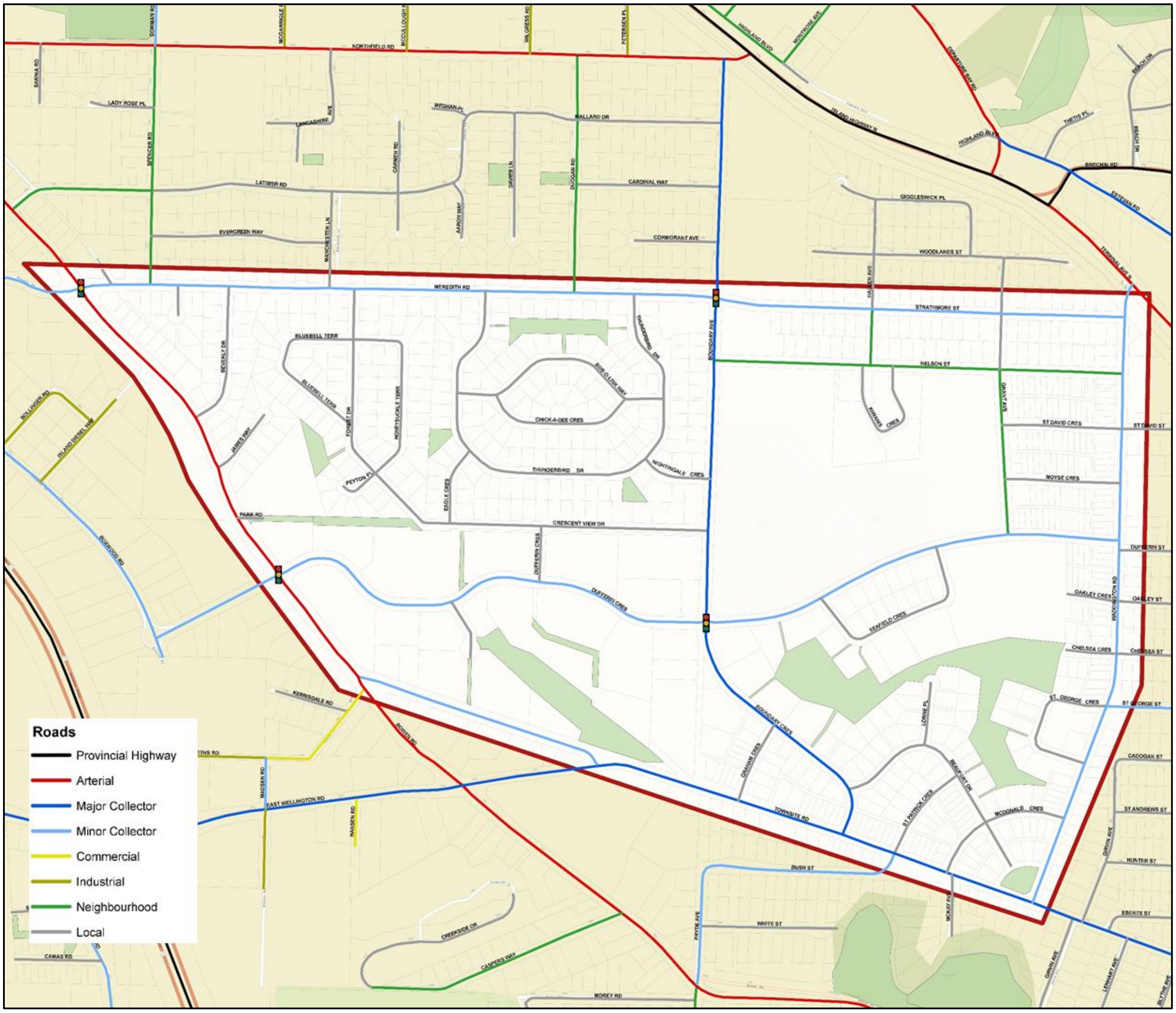
Route 30 is a local route which uses a variety of local roads to travel between Woodgrove Centre and Prideaux Bus Exchange downtown via Nanaimo Regional General Hospital. It generally operates every 30 to 60 minutes. There are 3 to 4 stops along the hospital frontages on Dufferin Crescent and Boundary Avenue in each direction.

Route 40 is a much more direct route also travelling between Woodgrove Centre and Prideaux Bus Exchange. It is a frequent route with generally 15 to 30-minute service. It travels along the edge of the study area on Bowen Road.

6.0 TRAFFIC

Within the study area there are a variety of road classifications as shown on **Figure 6.1**. Bowen Road is an urban arterial while Boundary Road and Townsite Road are major collectors, Meredith Road / Strathmore Street, Waddington Road, and Dufferin Crescent are minor collectors. Bowen Road is the only truck route within the study area.

Figure 6.1: Road Classification



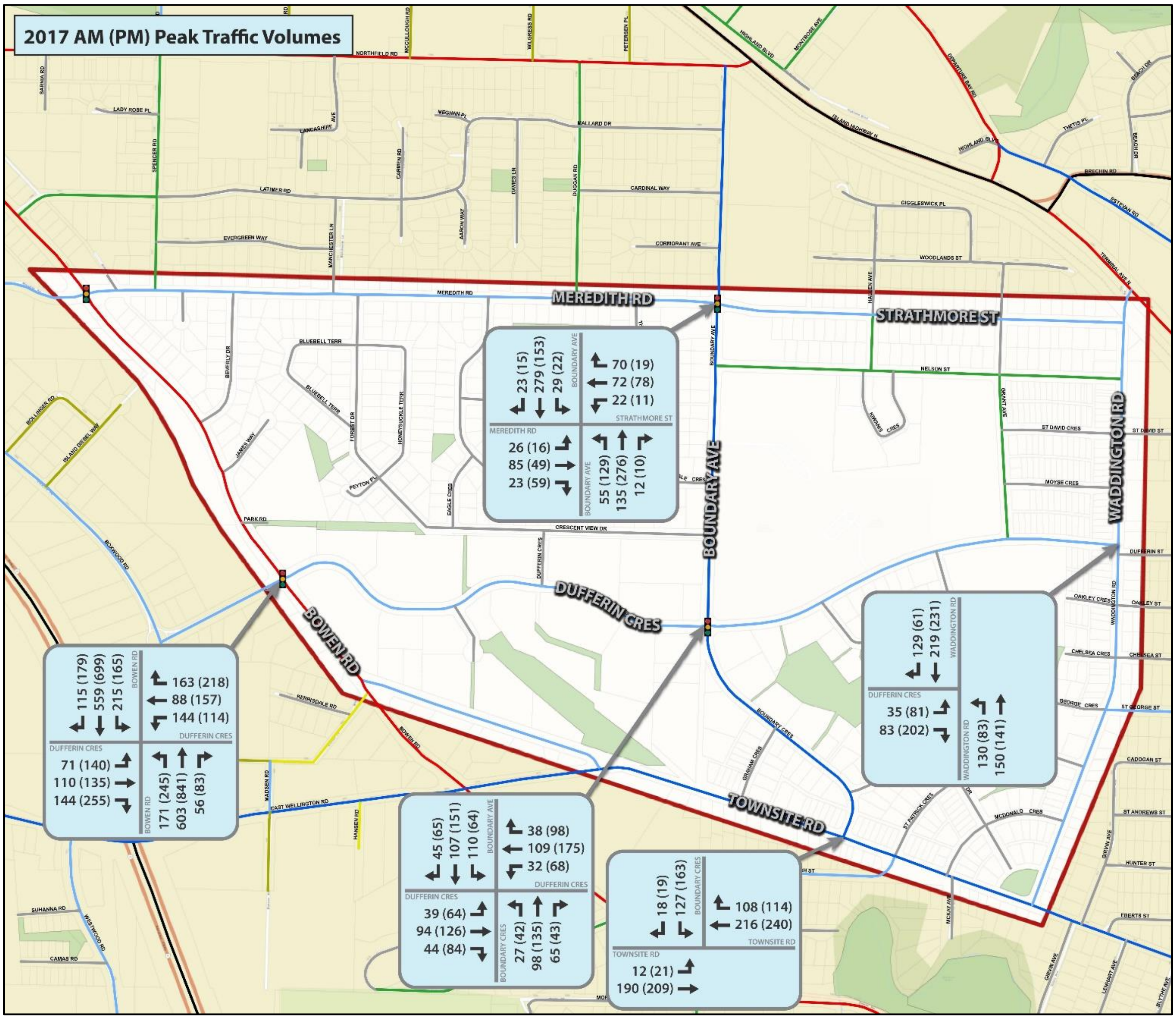
6.1 Existing Traffic Volumes

Turning movement count (TMC) data for the following five intersections was used to develop the existing and future traffic volumes for the study:

- Bowen Road and Dufferin Crescent -TMC on April 7, 2017,
- Boundary Avenue and Dufferin Crescent -TMC on September 22, 2017,
- Boundary Crescent and Townsite Road -TMC on September 20, 2017,
- Waddington Road and Dufferin Crescent -TMC on September 21, 2017, and
- Boundary Avenue and Strathmore Street -TMC on September 23, 2015.

The 2015 count data was adjusted to represent 2017 traffic volumes. The 2017 base volumes used in the analysis are shown, below, in **Figure 6.2**.

Figure 6.2: Existing Traffic Volumes (2017) - AM and PM Peak Volumes



6.2 Mobility Performance Parameters

The mobility performance of the study network was assessed using Trafficware's Synchro 10 and SimTraffic software for stop controlled and signalized intersections. Synchro 10 refers to the Highway Capacity Manual (HCM)

2010 version for calculating the performance measures including the volume to capacity ratio (v/c ratio), the 95th percentile queue length (queue length), average vehicle delay, and the level of service (LOS).

The v/c ratio is used as a measurement of the traffic capacity for a particular traffic lane or lane group. Generally, values up to 0.90 for individual lanes or lane groups and a v/c ratio of 1.0 or greater indicates that the traffic operation is over-capacity and results in a LOS of 'F'. The LOS measure is directly related to the average delay experienced by drivers for turning movements and for the overall intersection. Generally, a LOS of 'D' or better is considered desirable for high traffic movements and for the overall intersection. The six levels of service and the corresponding delay thresholds are illustrated in **Table 6.1**.

Table 6.1: Mobility Level of Service Parameters

Level of Service (LOS)	Control Delay (s)	
	Stop Control	Signal
A	0-10	0-10
B	>10-15	>10-20
C	>15-25	>20-35
D	>25-35	>35-55
E	>35-50	>55-80
F	>50	>80

It should be noted that HCM 2010 does not calculate an overall intersection LOS for two-way stop control intersections as the overall delay is typically biased by the free-flow through movements.

6.3 Existing Mobility Performance Results

Intersection performance results for 2017 AM and PM peak traffic volumes are summarized in **Table 6.2** and **Table 6.3**, respectively. Complete Synchro and SimTraffic reports can be found in **Appendix A**. The critical movement indicated in the table represents the worst performing movement at the intersection. It is determined based on the lane with the highest volume to capacity (v/c) ratio. The 95th percentile queue was determined from SimTraffic analysis, based on the average of five simulation runs. The intersection performance for the signalized intersections is based on existing timing plans, except at Boundary Avenue and Dufferin Crescent where the pedestrian clearance time was adjusted to be based on 1 meter per second walking speed.

Table 6.2: AM Peak Intersection Performance Summary (2017)

		AM Peak						
		Overall Intersection		Critical Movement				
Node #	Intersection	Delay (s)	LOS	Critical Movement	v/c	Delay (s)	LOS	95th % Queue (m)
6	Bowen Rd & Dufferin Cres	24.3	C	NBTR	0.77	29.1	C	54.9
10*	Dufferin Cres & Waddington Rd	4.4	-	EBLR	0.351	16.8	C	23.6
17*	Boundary Rd & Townsite Rd	3.8	-	SBLR	0.372	16.1	C	22.8
20	Strathmore St / Meredith Rd & Boundary Ave	8.8	A	SBTR	0.51	8.0	A	30.6
21**	Dufferin Cres & Boundary Ave	6.7	A	SBL	-	9.5	A	23.9

* HCM 2010 does not calculate an overall intersection LOS for two-way stop control intersections
** Delay performance and queue based on SimTraffic modeling as HCM 2010 equations give unrealistic performance results for shared left and through lane.

During the AM peak in 2017 all intersections operate well with all movements experiencing LOS C or better.

Table 6.3: PM Peak Intersection Performance Summary (2017)

		PM Peak						
		Overall Intersection		Critical Movement				
Node #	Intersection	Delay (s)	LOS	Critical Movement	v/c	Delay (s)	LOS	95th % Queue (m)
6	Bowen Rd & Dufferin Cres	40.5	D	SBTR	1.01	68.5	F	97.2
10*	Dufferin Cres & Waddington Rd	7.5	-	EBLR	0.591	20.5	C	29.6
17*	Boundary Rd & Townsite Rd	4.8	-	SBLR	0.487	20.1	C	27.7
20	Strathmore St / Meredith Rd & Boundary Ave	7.5	A	WBTR	0.39	10.9	B	18.1
21**	Dufferin Cres & Boundary Ave	9.0	A	NBL	-	13.5	B	14.4

* HCM 2010 does not calculate an overall intersection LOS for two-way stop control intersections
** Delay performance and queue based on SimTraffic modeling as HCM 2010 equations give unrealistic performance results for shared left and through lane.

During the PM peak in 2017 most intersections operate well however, some movements at the Bowen Road and Dufferin Crescent intersection experience decreased performance.

6.4 Future Traffic Volumes

The future traffic analysis is focused on the 2041 horizon year to align with the EMME modelling horizons and provide a long-term view of what traffic volumes could be like in the future. Future traffic volumes have been developed based on a combination of general background traffic growth and confirmed future developments.

6.4.1 Background Traffic Growth

The general background traffic growth aspect of the future conditions analysis takes into account the general increase in traffic volumes on the road network as a consequence of growth throughout Nanaimo and the wider region. For this study, a 1.2 percent per annum growth rate has been adopted and applied to all turning movements.

The background growth rate was determined based on the anticipated traffic growth in the area in the City EMME model. The growth rate at six different screenlines in the vicinity was analyzed and on this basis an average of 1.2 percent was derived.

6.4.2 Future Development Traffic

In addition to general background traffic growth, the trips from two approved larger developments in the hospital area have also been considered when developing the future traffic volume forecasts:

- Colvile Medical Centre at 1515 Dufferin Crescent -21,750 square feet
- 1805 Summerhill Place Multi-Family -80 units

The Colvile Medical Centre is located on the southeast corner of Dufferin Crescent and Boundary Avenue with access on the south side of Dufferin Crescent. The multi-family development is located on the southwest corner of Dufferin Crescent and Summerhill Place. The development at 1800 Summerhill Place was not included in the future development traffic since it is only 12 units and will have a negligible traffic impact.

The ITE Trip Generation Manual was used to determine the additional trips generated by these developments. As the EMME model already includes developments and growth in the area, the ITE Trip Generation rates were reduced by 50 percent before being added to the background growth. **Table 6.4**, below, summarizes the trips added to the future traffic forecast to take into account the approved developments in the area.

Table 6.4: Trip Generation Rates and Totals

ITE Code	Land Use	Unit	Quantity	Total AM			Total PM		
				Avg Rate[1]	In	Out	Avg Rate[1]	In	Out
720	Medical-Dental Office Building	Square Feet	21,750	1.81	26	13	2.23	19	29
230	Residential Condo/Townhouse	Dwellings	80	0.22	3	15	0.26	13	8

[1] ITE Trip Generation Rate reduced by 50 percent to take into account growth already accounted for in the EMME model.

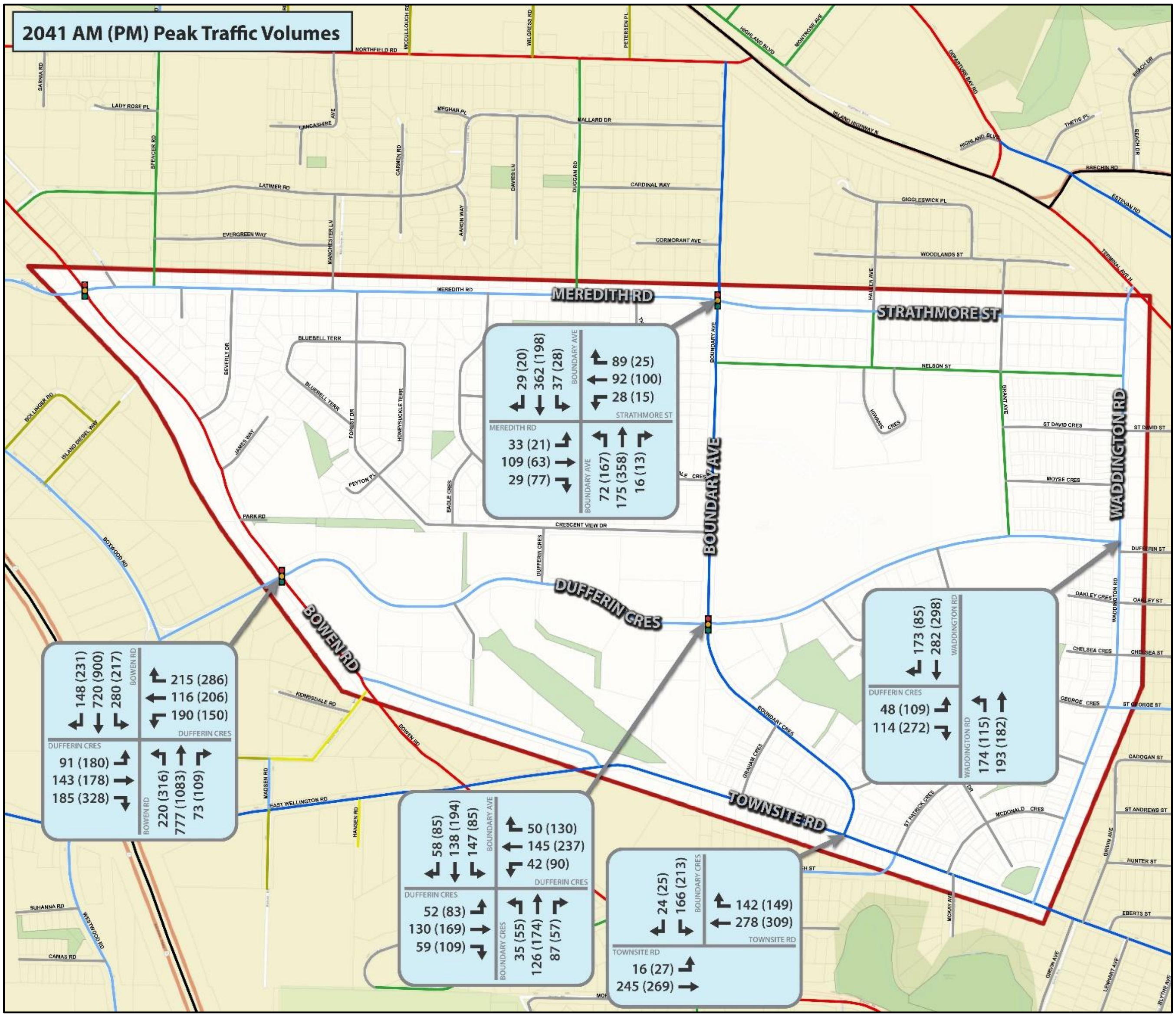
As the focus of this study is to understand how the network will perform in the future rather than the impact of individual developments, only one scenario has been analyzed by combing the 2041 background traffic and trips generated by the two developments.

6.4.3 Trip Distribution

Based on the trip generation outlined above the trips were distributed to the network based on the turning movement proportions, our understanding of travel patterns in the study area, and engineering judgement. In reality, the road system is a network and motorists will adapt and change their patterns to find the most efficient route between their origin and destination. Different traffic control at an intersection, changes in signal phasing and a variety of other factors within the study area or on the wider network can make a route more or less appealing to motorists and cause them to choose alternate routes.

Figure 6.3 shows total 2041 peak hour volumes when background traffic and development traffic are combined. This is our best estimate based on our understanding of potential development and changes that could occur over the next 24 years. However, there are likely to be many unforeseen changes and the future traffic analysis should be interpreted as a general understanding of key areas of concern rather than a detailed analysis of which specific movements will fail.

Figure 6.3: Forecast 2041 Peak Hour Traffic Volumes



6.5 Future Mobility Performance Results

The future conditions at the 2041 horizon were analyzed using Synchro 10 and SimTraffic software. The network performance is summarized below in **Table 6.5** and **Table 6.6**, for the AM and PM peak periods, respectively. The critical movement at each intersection was determined based on the highest volume to capacity ratio (v/c). The 95th percentile queue lengths were obtained from SimTraffic based on the average of five simulation runs. Complete Synchro and SimTraffic reports are included in **Appendix B**.

To best represent future conditions signal timing was optimized and limited to a 120 second cycle time. In addition, the pedestrian clearance time at Dufferin Crescent and Boundary Avenue was increased based on a 1.0 m/s walking speed without including yellow time.

Table 6.5: AM Peak Intersection Performance Summary (2041)

		AM Peak						
		Overall Intersection		Critical Movement				
Node #	Intersection	Delay (s)	LOS	Critical Movement	v/c	Delay (s)	LOS	95th % Queue (m)
6	Bowen Rd & Dufferin Cres	43.4	D	NBTR	0.94	51.3	D	87.8
10	Dufferin Cres & Waddington Rd	7.8	-	EBLR	0.663	34.1	D	32.7
17*	Boundary Rd & Townsite Rd	6.1	-	SBLR	0.602	25.9	D	26.4
20	Strathmore St / Meredith Rd & Boundary Ave	10.5	B	SBTR	0.63	9.8	A	41.9
21**	Dufferin Cres & Boundary Ave	8.5	A	SBL	-	12.8	B	33.4

* HCM 2010 does not calculate an overall intersection LOS for two-way stop control intersections
** Delay performance and queue based on SimTraffic modeling as HCM 2010 equations give unrealistic performance results for shared left and through lane.

In the AM Peak, all intersections included in the study are found to generally operate at an acceptable level of service, but many are approaching capacity with LOS D for some movements. Simulation modelling of Bowen Road and Dufferin Crescent intersection shows the queues in the westbound left turn lane exceeds the storage capacity and at times blocks the westbound through and right lane on Dufferin Crescent.

Table 6.6: PM Peak Intersection Performance Summary (2041)

		PM Peak						
		Overall Intersection		Critical Movement				
Node #	Intersection	Delay (s)	LOS	Critical Movement	v/c	Delay (s)	LOS	95th % Queue (m)
6	Bowen Rd & Dufferin Cres	103.5	F	WBL	1.54	341.0	F	46.9
10*	Dufferin Cres & Waddington Rd	28.5	-	EBLR	1.021	80.3	F	59.1
17*	Boundary Rd & Townsite Rd	11.2	-	SBLR	0.818	47.5	E	56.4
20	Strathmore St / Meredith Rd & Boundary Ave	8.9	A	NBTR	0.48	6.6	A	38.2
21**	Dufferin Cres & Boundary Ave	11.9	B	NBL	-	17.4	B	17.3

* HCM 2010 does not calculate an overall intersection LOS for two-way stop control intersections
** Delay performance and queue based on SimTraffic modeling as HCM 2010 equations give unrealistic performance results for shared left and through lane.

In the PM Peak, increased traffic volume results in the overall failure at the intersection of Bowen Road and Dufferin Crescent. Simulation modelling indicates in the PM peak the queues for the through movements often block access to the left-turn bays at the Bowen Road and Dufferin Crescent intersection. Additionally, the westbound left-turn queue occasionally extends beyond the turn bay and blocks the single approach lane resulting in westbound though and right-turn traffic not being able to reach the intersection. In 2041, performance is also significantly reduced on the stop-controlled approaches at the intersections of Dufferin Crescent and Waddington Road, and Boundary Avenue and Townsite Road.

7.0 PUBLIC ENGAGEMENT FEEDBACK

A variety of community engagement activities have been completed at different stages of the project. These include:

- Community meeting with Hospital Area Neighbourhood Association (HANA) June 22, 2017,
- Stakeholder meeting June 20 and 22, 2017,
- Online survey June to August 2017, and

A summary of the feedback received at each of these events is provided below

7.1 Hospital Area Neighbourhood Association Community Meeting

A community meeting was held with Hospital Area Neighbourhood Association (HANA) on June 22, 2017. The following summary outlines opportunities raised in response to transportation related issues in the Hospital Area neighbourhood.

Participants noted that the lack of curbs and sidewalks exacerbates on-street vehicle parking problems near driveways and intersections. Therefore, infrastructure throughout the Hospital Area should be upgraded to address the infrastructure deficit.

Participants also stated that pedestrians have safety concerns because of congested streets, busy roads, and lack of pedestrian infrastructure in the hospital area. They have noted the following as suggestions to address safety issues with active transportation:

- Develop/ improve pedestrian infrastructure in the hospital area
- Install lighted crosswalks to encourage pedestrian movements in the hospital area, especially along Dufferin Crescent
- Improve pedestrian safety at the intersection of Dufferin Crescent and Boundary Road

7.2 Stakeholders' Meeting

A Stakeholder meeting was held June 20 and 22, 2017. Following is a summary of issues raised in response to transportation issues in the Hospital Area. The comments are sorted into the following categories:

- Land Use,
- Active Transportation,
- Transportation, and
- Public Transit.

7.2.1 Land Use

Stakeholders stated that parks and open spaces are neither linked in the hospital area nor between the hospital area and the rest of the city. The following were discussed to address this:

- link existing parks and open spaces in the hospital area; and
- link the hospital area to the existing network of trails and parks throughout the city

7.2.2 Active Transportation

The following opportunities were discussed to resolve active transportation issues.

- Provide secure and convenient bicycle storage, showers, etc. in new hospital area developments to incentivize cycling and cycle-commuting in the hospital area.
- Formal carpooling initiative is created but not used extensively by hospital staff. Hospital administration should examine parking in context of transportation management
- Evaluate function of Boundary Avenue cycling lane and modify, if required to address the perception that cycling lane on Boundary Avenue is dangerous.
- It is difficult to walk safely on Dufferin Crescent because there are only a few sidewalks. A Plan should be developed and implement plan to construct sidewalks throughout the neighbourhood.
- Two options were suggested to address pedestrian safety at the Dufferin-Boundary intersection pedestrian crossing times:
  - Traffic lights should be programmed with longer walk-times, or
  - Traffic lights should be programmed with all-way vehicle stop to allow more pedestrian movements.
- Evaluate the existing infrastructure in the hospital area and develop and implement a plan to replace infrastructure as curbs and sidewalks are currently not constructed to accommodate walkers/ disabled.

7.2.3 Transportation

Participants suggested the following to address the perception that Dufferin Crescent is not built to accommodate the current volume of traffic/parked vehicles:

- The capacity of Dufferin Crescent to support vehicles, cycling, and on-street parking should be evaluated;
- Enforce parking bylaw.

7.2.4 Public Transit

The following were discussed to address issues with Transit in the Hospital Area:

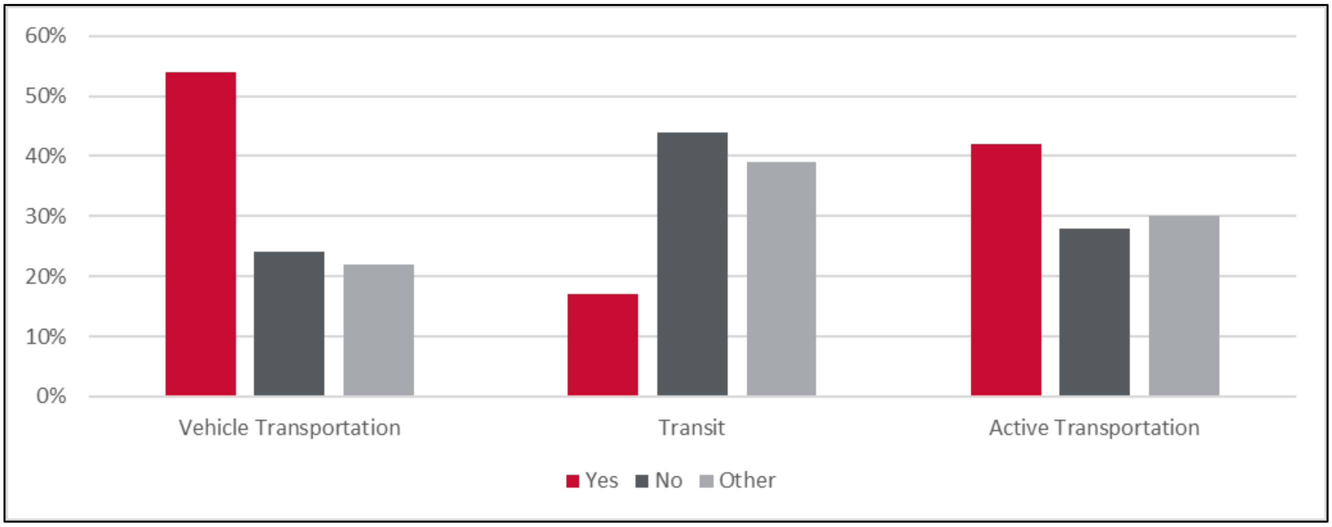
- Examine potential changes to the transit schedule that would better serve hospital staff,
- Examine the feasibility of locating a bus stop on the hospital site to encourage staff/patients to take transit for trips to/ from hospital, and
- Evaluate options to improve service to hospital area for hospital employees as transit service to the hospital is perceived to be infrequent and slow.

7.3 Online Survey

An online survey was available to the public between June and August 2017 There were 504 participants. The survey had a total of 23 questions about Issues and Opportunities in the Hospital Area, out of which, 7 questions were directly related to transportation. The following section provides an overall summary of the responses. More detailed information on each survey question is provided in **Appendix C**.

Respondents were asked, does the transportation network met their needs for vehicle transportation, transit, and active transportation (walking or cycling). The results shown in **Figure 7.1**, below, indicates that most people (54 percent) find the vehicle transportation network meets their needs. About 40 percent indicated the walking and cycling network met their needs while only 17 percent indicated transit met their needs.

Figure 7.1: Responses to Does the Transportation Network Meet Your Transportation Needs



When asked what could be done to improve transportation in the hospital area the most common responses related to the following topics:

- Island Highway-Northfield-Boundary Intersection,
- Transit improvements,
    - Frequency,
    - Service hours,
    - Match schedule to hospital staff schedule,
    - Improve routes, and
    - Hospital express
- Road network,
- Crosswalks,
- Cycling lanes,
- Sidewalks,
- Intersection safety, and
- Parking.

8.0 PROBLEM STATEMENT

The Hospital Area neighbourhood is the primary centre for health services in the Nanaimo region and beyond. It is also one of the City's largest employers. The area is anchored by the hospital campus and surrounded by mixed density residential neighbourhoods and commercial development along the Bowen Road and Boundary Ave corridors. In future, professional offices, senior's facilities, community services, services and medium to high density residential uses are encouraged in planNanaimo to enhance the area as a neighbourhood to live, work and support services. On the basis the current conditions and anticipated future development and change a brief problem statement has been create. This will be used to guide the development of options to ensure the recommendations respond to the current and future needs of the area.

- **Pedestrians** -The current pedestrian facilities (sidewalks, curb letdowns, crosswalks) in the area are quite varied in their age and the user experience they provide. For example, some streets lack sidewalks on both sides, pedestrian crossing times at some intersections may be insufficient for people with mobility challenges and some older letdown are challenging to navigate with mobility aids. Given the high number of seniors living in the area combined with the medical services ensuring, a high-quality pedestrian realm will enhance mobility for all members of the community.

- **Cyclists** -Currently the cycling facilities with the study area are limited. Given the concentration of employment and desire to see more medium to high density residential development in the area, provision of high-quality cycling facilities will support more people in choosing active transportation over driving to meet some of their mobility needs.

- **Public Transit** -Public Transit within the study area is extremely limited. The one bus route which goes near the hospital is infrequent and has a very indirect route. Additionally, the scheduling is such that it does not align well with many staff schedules at the hospital. In the online survey only, 17 percent of respondents indicated that public transit in the area met their needs.

- **Motor Vehicles** -Currently the road network tends to operate well with only some localized reductions in the level of service at some intersection. In the future, the performance of some intersections is anticipated to reduce further. Opportunities to reduce travel demand and the use of single occupant vehicles should be explored in addition to any opportunities to make adjustments to the network to improve future intersection performance.

9.0 OPTION DEVELOPMENT

Following the existing and future conditions analysis presented above, there are a variety of options which can be considered to improve the transportation system in the study area. In this section a variety of improvement options are summarized along with any applicable considerations. Based on the merits of the various options a package of improvements is recommended in Section 10. It is important to recognize that this is a long-term plan and it is not anticipated that the various options will be implemented immediately but staged over an extended period.

9.1 Vehicle Improvements

Given the developed nature of the area there are limited opportunities to increase vehicular capacity beyond localized adjustments at some intersections. The focus should be on optimizing the existing vehicle network and reducing the demand for vehicular travel. The large concentration of employees in the study area associated with the hospital is a significant opportunity to develop and implement a comprehensive travel demand management program. Research has shown that comprehensive travel demand management programs can achieve reductions of 20 to 40 percent in motor vehicle travel compared to no travel demand management efforts[2]. An effective travel demand management initiative could significantly reduce travel demands to the hospital area in addition to reducing parking demands.

To improve the level of service at intersections within the study area and mitigate the identified performance issues, various intersection improvement options were explored.

9.1.1 Dufferin Crescent and Bowen Avenue

Limited opportunities exist to reduce delays at the Dufferin Crescent and Bowen Avenue intersection. However, extension of the left-turn bays to better separate the left-turn movements from the through movements and minimize the impacts of long queues on the other movement has been considered:

- **Westbound Approach** -Removal of the midblock westbound left-turn into Westhill Centre (1800-1816 Bowen Road) would allow for the Bowen Avenue left turn bay to be extended by 55 meters. This change would minimize the frequency of left-turn queues completely blocking access to the Dufferin Crescent and Bowen Avenue intersection for through and right-turn traffic.
- **Eastbound Approach -**Removal of the midblock westbound left-turn into the McDonalds, condo development, and other businesses (1835 Bowen Road) will allow the eastbound left turn bay to be extended by 25 meters. However, the eastbound through queue length tends to exceed the left-turn queue length. While extending the left-turn bay would enable left turning traffic to access the lane sooner and reduce some driver frustration it will not make a significant difference to the intersection performance.
- **Northbound Approach -**Removal of the midblock northbound left-turn into businesses located on the southwest corner of the intersection (1815/1825 Bowen Road) will allow the northbound left turn bay to be extended by 47 meters. At peak times the thorough queue length tends to exceed the left-turn queue length. While extending the left-turn bay would enable left turning traffic to access the lane sooner and reduce some driver frustration it will not make a significant difference to the intersection performance.

[2] Transportation Management Programs -Victoria Transport Policy Institute (http://www.vtpi.org/tdm/tdm42.htm)

- **Southbound Approach -**Removal of 30 meters of raised median on the southbound approach would allow for the southbound left turn bay to be extended by 30 meters. Similar to the northbound approach, the through queue length tends to exceed the left-turn queue length and while extending the left-turn bay would enable left turning traffic to access the lane sooner it will not have a significant impact on the intersection performance.

Any left-turn bay extensions should focus on the westbound approaches on Dufferin Crescent as the left-turn queues can completely block through traffic on Dufferin Crescent. In contrast, blockages from left-turn spill over into the north and south approaches are mitigated by additional through lanes on Bowen Road.

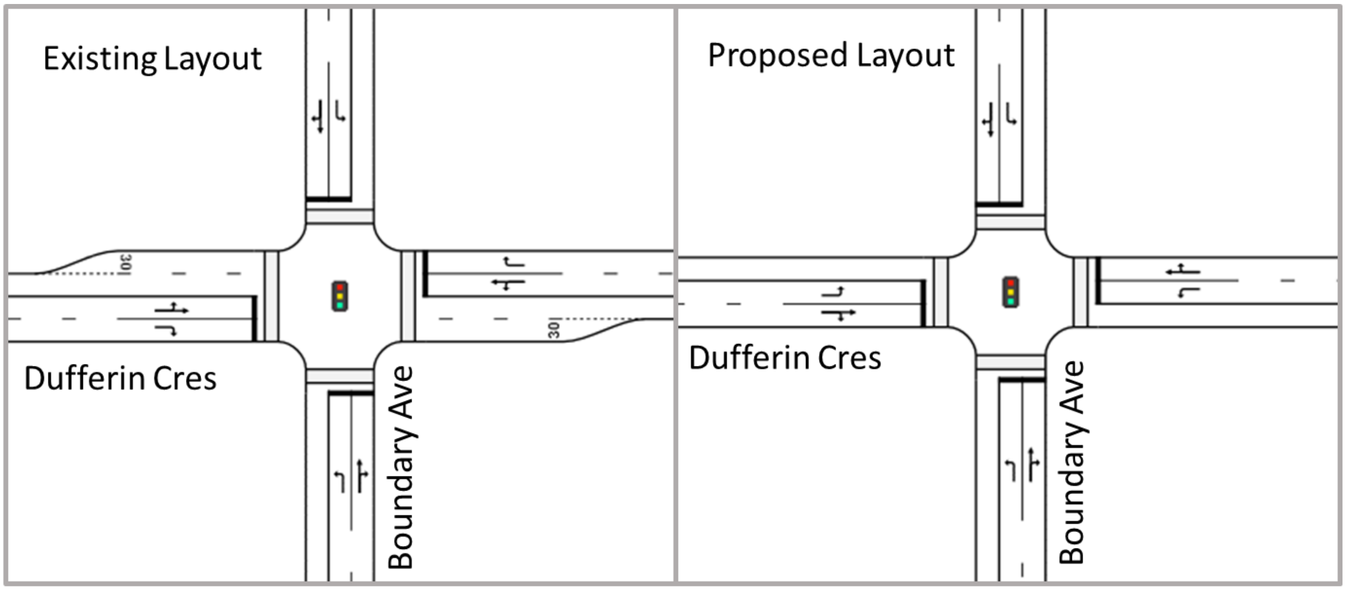
In addition to the left-turn bay adjustments outlined above, adjusting the pedestrian clearance intervals to be based on a slower walking speed which is consistent with many users in the area was also explored. The Flashing Don't Walk times have been recalculated to reflect a walking sped of 1.0 m/s at this intersection. Currently, at this intersection, the yellow clearance interval is included in the pedestrian clearance interval. Typically, the yellow clearance interval is not included in the pedestrian clearance interval. However, to maintain consistency with the current approach the yellow clearance interval has been included in the pedestrian clearance interval. If the pedestrian clearance intervals at this intersection are adjusted the current approach should be reviewed.

9.1.2 Dufferin Crescent and Boundary Avenue

At the Dufferin Crescent and Boundary Avenue intersection, the lane allocation on Dufferin Crescent with a shared through and left-turn lane and a dedicated right turn lane is unconventional given that the right and left-turn volumes are approximately equal. By changing the lane allocation on the Dufferin Crescent approaches to a dedicated left turn lane and a shared right-turn and through lane, as shown in **Figure 9.1**, the lane layout would follow a more conventional and safer configuration more familiar to drivers. Eliminating left-turn lane off-set would improve sight lines and the shared through and right-turn lane would minimize conflict between right turning vehicles and pedestrians.

Additionally, on Dufferin Crescent a single exit lane can be provided rather than the current configuration with two exit lanes which immediately merge to one lane. The additional cross section width created through the reduction in the number of lanes create an opportunity to reduce the pedestrian crossing distance or provide enhanced bicycle facilities at the intersection.

Figure 9.1: Dufferin Cres and Boundary Ave Existing and Proposed Layout



The adjustments to the lane allocation will have a negligible impact on the delays experienced by drivers at the intersection, as shown in the modelling results presented below, but provides many benefits in-terms of sightlines and following typical intersection conventions.

9.1.3 Dufferin Crescent and Waddington Road

In the future traffic on Dufferin Crescent will experience delays of approximately 1 minute and 20 seconds when trying to turn onto Waddington Road. For many drivers they will find this delay unacceptable and make riskier maneuvers. As shown on **Figure 9.2**, below, opposite Dufferin Crescent is Dufferin Street. It has a significant offset which creates some challenges when considering options to reduce the delay for Dufferin Crescent traffic.

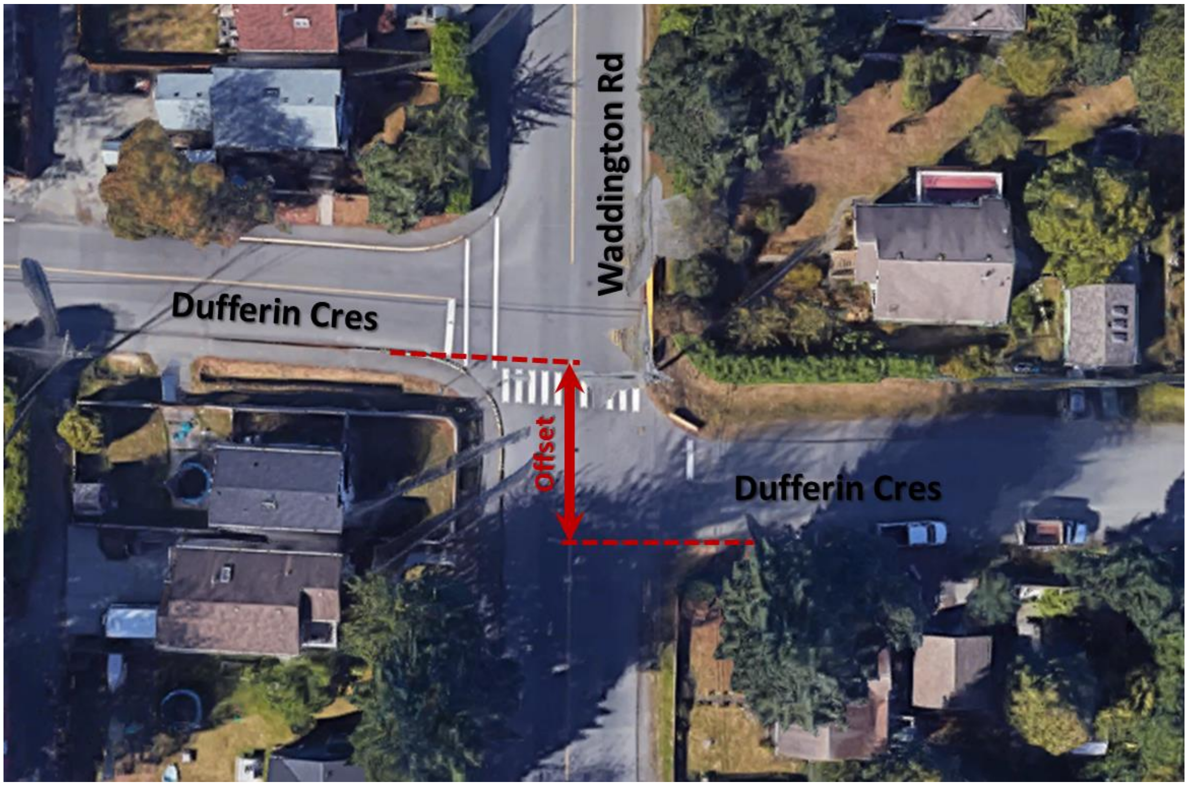
If the current layout was converted to an all-way stop or signal, the intersection would be extremely elongated with the stop bars on Waddington Road located south of Dufferin Street and north of Dufferin Crescent. If full turning movements are maintained there would be conflicts between drivers turning left from Waddington Road to Dufferin Crescent and Dufferin Street. Many drivers would also find the offset layout confusing and not be certain as to which vehicles they need to give-way to versus when they have the right-of-way.

To be able to adjust the intersection control and reduce the delays for traffic on Dufferin Crescent there are two options:

- Realign Dufferin Street to eliminate the offset with Dufferin Crescent. This would require a significant amount of private property, or
- Close Dufferin Street at Waddington Road. The Dufferin Street residents would use Oakley Street instead to access their homes. By closing Dufferin Street, it would enable Dufferin Crescent and Waddington Road to operate as a typical 3-legged intersection. Alternatively, a right-in to Dufferin Street could be maintained.

By changing the intersection from stop control on Dufferin Crescent only to an all-way stop controlled intersection, the delay for Dufferin Crescent traffic is significantly reduced but results in significant delays for Waddington Road traffic. Overall average delay at the intersection remains approximately the same but is just more evenly divided among vehicles on all three approaches. As shown in **Table 9.1** and **Table 9.2** the future intersection performance can be improved with the introduction of a signal. In conjunction with the signal Dufferin Street would need to be realigned or closed.

Figure 9.2: Dufferin Cres and Waddington Rd Existing Layout



9.1.4 Boundary Crescent and Townsite Road

By 2041, with the current intersection control, traffic on Boundary Crescent is anticipated to experience significant delays. Changing this intersection to an all-way stop will reduce delay for the Boundary Crescent traffic at the cost of increasing delay for Townsite Road without any overall reduction in average delay for all vehicles. As shown in **Table 9.1** and **Table 9.2,** changing the intersection control to a signal will offer reduction in overall delay and queues in 2041.

9.1.5 Strathmore Street and Meredith Road and Boundary Avenue

Overall, the Strathmore Street, Meredith Road and Boundary Avenue is found to operate well for vehicles in 2041. No vehicular capacity improvements are anticipated to be needed. However, there are potential properties for redevelopment in the vicinity, including a vacant school site. Redevelopment of these properties could impact future traffic at the intersection.

Given the area's demographics with many seniors and other people with physical challenges accessing the medical facilities, adjusting the Flashing Don't Walk times to be based on a 1.0m/s walking speed should be considered. As shown in **Table 9.1** and **Table 9.2**, below, increasing these intervals has only a slight effect on performance and the intersection maintains an excellent level of service in 2041.

9.1.6 Future Intersection Performance with Improvements

Based on the improvement opportunities outlined in the preceding sections the future intersection performance has been analysed. The performance measures reported in **Table 9.1** and **Table 9.2**, below, are based on the following intersection changes:

- **Bowen Road and Dufferin Crescent** -Intersection turning bays extended on all approaches and Flashing Don't Walk walking time based on 1.0 m/s walking speed with yellow time included
- **Dufferin Crescent and Waddington Road** -Intersection control changed to a signal and Dufferin Street closed or re-aligned.
- **Boundary Road and Townsite Road** -Intersection control changed to a signal
- **Strathmore Street, Meredith Road and Boundary Avenue** -Flashing Don't Walk time based on 1.0 m/s, exclusive of the yellow clearance interval
- **Dufferin Crescent and Boundary Avenue** -Intersection lane configuration changed to dedicated left turn lanes and shared through and right lanes on the Dufferin Crescent approaches

Complete Synchro and SimTraffic reports are included in **Appendix D**.

Table 9.1: AM Peak Intersection Performance Summary with Improvements (2041)

		AM Peak						
		Overall Intersection		Critical Movement				
Node #	**Intersection**	**Delay (s)**	**LOS**	**Critical Movement**	**v/c**	**Delay (s)**	**LOS**	**95th % Queue (m)**
6	**Bowen Rd & Dufferin Cres**	42.3	D	WBL	0.94	85.3	F	59.2
10	**Dufferin Cres & Waddington Rd**	8.5	A	EBLR	0.75	18.9	B	30.2
17*	**Boundary Rd & Townsite Rd**	7.0	A	SBLR	0.58	9.6	A	27.5
20	**Strathmore St / Meredith Rd & Boundary Ave**	10.7	B	SBTR	0.62	10.0	A	42.2
21**	**Dufferin Cres & Boundary Ave**	8.9	A	NBL	-	13.5	B	15.7

* HCM 2010 does not calculate an overall intersection LOS for two-way stop control intersections
** Delay performance and queue based on SimTraffic modeling as HCM 2010 equations give unrealistic performance results for shared left and through lane.

In the AM peak these changes do not have a significant impact on intersection performance with the exception of the reduction in delays for the minor (stop controlled) approach at the two stop-controlled intersections which are converted to signals.

Table 9.2: PM Peak Intersection Performance Summary with Improvements (2041)

		PM Peak						
		Overall Intersection		Critical Movement				
Node #	Intersection	Delay (s)	LOS	Critical Movement	v/c	Delay (s)	LOS	95th % Queue (m)
6	Bowen Rd & Dufferin Cres	106.6	F	WBL	1.51	324.1	F	48.4
10*	Dufferin Cres & Waddington Rd	14.3	B	EBLR	0.84	22.2	C	49.3
17*	Boundary Rd & Townsite Rd	7.7	A	SBLR	0.64	10.5	B	31.5
20	Strathmore St / Meredith Rd & Boundary Ave	9.0	A	NBTR	0.47	6.6	A	38.1
21**	Dufferin Cres & Boundary Ave	13.3	B	NBL	-	19.1	B	19.1

* HCM 2010 does not calculate an overall intersection LOS for two-way stop control intersections
** Delay performance and queue based on SimTraffic modeling as HCM 2010 equations give unrealistic performance results for shared left and through lane.

In the PM peak the impact of the intersection improvements are more significant. As anticipated, at Bowen Road and Dufferin Crescent extending the left-turn bays generally does not generally have a significant impact on overall performance and the intersection continues to experience significant delays. However, extending the westbound left-turn bay will prevent left-turn queues from extending past the current left-turn bay and completely blocking all through and right turn traffic in the adjacent lane.

The Dufferin Crescent and Waddington Road, and Boundary Road and Townsite Road intersections experience a reduction in the overall average delay and all approaches operate well with an acceptable level of service of service.

At Strathmore Street, Meredith Road and Boundary Avenue the increase in the pedestrian clearance interval will have a negligible impact on vehicular delays.

Changing the lane allocation on Dufferin Crescent at Boundary Avenue will provide a more conventional intersection layout and safety benefits while having no negative impact on vehicular performance.

9.2 Pedestrian Improvements

To support the use of alternative modes and reduce the reliance on private vehicles ensuring the pedestrian experience provides safe and comfortable journey is important. Building upon the existing conditions analysis and public and stakeholder feedback the following potential improvement options for pedestrians have been identified:

- **Sidewalk Network Deficiencies** -Sidewalk network deficiencies are related to both locations which lack a sidewalk as well as existing sidewalks which could be improved. A sidewalk inventory and improvement priority list should be created. It should include the following components:
    - Arterial and collector road with sidewalks on only one side
    - Local roads with no sidewalks
    - Missing links between existing sidewalks and parks/trails
    - Existing sidewalks which are missing letdowns at intersections/crosswalks

  - Existing sidewalks with trip hazards/uneven section
  - Existing sidewalks that are less than 1.5m to 1.8m wide or obstructions within the sidewalks which reduce the effective width to less than 1.5m
  - Any other impediments to users with mobility challenges.

  Once the inventory of missing and deficient sidewalks is complete a prioritized list should be developed which considers the severity of the issue, cost to rectify, and location relative to pedestrian demands (bus stops, medical facilities, commercial, multi-family residential)

- **Pedestrian Clearance Intervals -**Adjust pedestrian clearance time at signalized intersections based on a walking speed of 1.0m/s to better accommodate seniors and users with mobility challenges. The signal timing at Dufferin Crescent and Boundary Avenue has already been adjusted and should be maintained. The pedestrian clearance intervals at the Bowen Road and Dufferin Crescent, and Strathmore Street, Meredith Road and Boundary Avenue intersections should also be adjusted.

- **Mid-block Pedestrian Crossings** -Based on our review of the study area there two potential locations for mid-block pedestrian crossings were identified:
  - Dufferin Crescent at Discover Montessori School, and
  - Dufferin Crescent between Summerhill Place and Bowen Road to connect the multi-family residential to the Westhill Shopping Centre (Pharmasave, Tim Hortons, etc.)

  For both of these locations a pedestrian crossing control warrant could be completed to confirm whether a mid-block pedestrian crossing is actually warranted, and if warranted the most appropriate crossing control type. Given the width of Dufferin Crescent, it is likely on the cusp of overhead pedestrian crossing signs being recommended if a mid-block pedestrian crossing is warranted and desired.

- **Pedestrian links to Existing Parks and Trails -**Increasing network connectivity for pedestrians by establishing links to existing parks and trails is always a positive. Any missing links should be identified and included as part of an overall sidewalk deficiencies priority list. To maximize the benefit of these linkages the focus should be on connections between pedestrian generators, such as high density residential, commercial and medical land uses rather than single family homes.

9.3 Cycling Improvements

To support the use of alternative modes and reduce the reliance on private vehicles, the following cycling improvements have been identified. These build upon the existing conditions analysis and public and stakeholder feedback:

- **Dufferin Crescent Bicycle Facility** - Provide a high-quality cycling facility on Dufferin Crescent to encourage a variety of citizens to consider cycling as a viable mode of transportation. Based on the current speeds and traffic volumes on Dufferin Crescent the most appropriate facility type is likely to be one which provides separation between the cyclists and vehicles (both parked and moving). Separation means there more physical separation between cyclists and vehicles than a sing paint line. Depending upon context, separation can take the form of a painted buffer (with or without additional delineation such as bollards or planters), or a completely separate bike facility such as a multi-use path.

- **E&N Trail Connection** -Provide linkages to the wider cycling network, including the E&N Trail. Currently there appears to be an informal link to the E&N Trail at the eastern end of Dufferin Street. Formalizing this connection would provide good connectivity from the future enhanced cycling facility on Dufferin Crescent. However, accommodation of the cyclists at the Dufferin Crescent and Waddington Road should be considered as part of any vehicle capacity improvements in this location.

- **Transportation Master Plan Bike Network** -Continue working towards implementation of the bike network identified as part of the Transportation Master Plan, both within the study area and beyond to ensure a well-developed continuous network. As projects are identified for design and construction the facility type should be reviewed and considered in light of the latest guidance regarding accommodation of users of varying ages and experience.

- **End of Trip Facilities -**Ensure the provision of secure and convenient bicycle storage, showers, etc. in all new developments and at the Nanaimo Regional General Hospital

9.4 Transit Improvements

As part of the online survey less than 20 percent of respondents indicated that transit met their transportation needs which suggests there are significant opportunities to make improvements and make transit a more appealing transportation option. Nanaimo Regional General Hospital is a significant employer and represents a large opportunity to encourage more people to use transit. The following opportunities have been identified:

- **Bus Schedule and Routing** -Explore opportunities to provide more frequent and direct transit service to the hospital which aligns with staff shift schedules.
- **Bus Stops** -Provide clean, safe and lit bus shelters with consideration to Crime Prevention Through Environmental Design (CPTED) principles at key stops such as those adjacent to the hospital.
- **On-Site Bus Stop at Hospital** -Examine the feasibility of locating a bus stop on the hospital site to encourage staff/patients to take transit for trips to/ from hospital. The convenience to transit passengers boarding or alighting at the hospital should be weighed against the increased travel time for passengers who do not board or alight at the hospital.

9.5 Travel Demand Management

As growth occurs in the area there are limited opportunities to increase vehicular capacity to accommodate this growth. As mentioned above, research has shown that comprehensive travel demand management programs can achieve reductions of 20 to 40 percent in motor vehicle travel compared to no travel demand management efforts[3]. An effective travel demand management initiative could significantly reduce travel demands to the hospital area in addition to reducing parking demands. The Hospital Area Parking Management Strategy is addressing parking demands in greater detail.

[3] Transportation Management Programs -Victoria Transport Policy Institute (http://www.vtpi.org/tdm/tdm42.htm)

While potential infrastructure improvements by mode have been identified in the preceding sections, a travel demand management program would provide a cohesive view of how to better support the use of alternative transportation from a higher level including more of the education and encouragement perspective. There may be opportunities to partner with the hospital on the development of a comprehensive travel demand management program since they are the largest trip generator in the vicinity.

10.0 RECOMMENDATIONS

Based on the analysis presented in this report a variety of recommendations for each mode have been developed. As the focus of the analysis has been on the 2041 horizon year rather than intermediate years, no timing estimates have been provided. These improvements should be viewed as forming a long-term plan. For the vehicular improvements network performance should be monitored and improvements made as volumes and performance warrants.

- Develop a **Travel Demand Management Plan** for the area encourage and support the use of alternatives to the private vehicle. As Nanaimo Regional General Hospital is the major employer in the area, a Travel Demand Management Plan for the hospital is likely to be the most effective in this situation. The City should work with the hospital to encourage and support the development of a Travel Demand Management Plan.

- **Dufferin Crescent and Bowen Avenue** - Revise pedestrian clearance intervals based on 1m/s walk speed. Monitor left-turn queue lengths and extend left-turn lanes when consistently impacting traffic with a particular focus on the westbound approach

- **Dufferin Crescent and Boundary Avenue** -Change lane allocation on Dufferin Crescent to a dedicated left-turn lane and a shared through and right-turn lane.

- **Dufferin Crescent and Waddington Road** -Monitor delays on Dufferin Crescent and consider a traffic signal in conjunction with closure of Dufferin Street, when warranted. An all-way stop could be explored as an interim improvement.

- **Boundary Crescent and Townsite Road** -Monitor delays on Boundary Crescent and consider a traffic signal when warranted. An all-way stop could be explored as an interim improvement.

- **Strathmore Street, Meredith Road and Boundary Avenue** -Revise pedestrian clearance intervals based on 1m/s walk speed.

- Develop and implement a **Sidewalk Inventory and Improvement Priority List**. The sidewalk inventory should identify both missing and deficient sidewalk.

- Complete pedestrian crossing control warrants for potential **Mid-Block Pedestrian Crossings** on Dufferin Crescent.

- Design and construct a high-quality **bike facility on Dufferin Crescent**. Based on vehicle volumes and speeds, separation between the cyclists and vehicles (both moving and parked) should be considered.

- Continue implementing the **Bicycle Network identified in the Transportation Master Plan** both with the study area and on the wider network.

- Explore opportunities to **improve the bus routing and schedule** to provide more frequent and direct transit service to the hospital.

- Use CPTED principles to provide **high quality bus stops and shelters** adjacent to the hospital.

- Transportation network **Monitoring** has the potential to take a range of forms depending upon available resources. One approach is purely reactive and waits for issues and complaints regarding traffic performance in the area. An alternative proactive approach is to regularly to observe traffic movement in the area and look for signs of increasing congestion at critical intersections such a lengthy vehicle queues and delays for motorists. If signs of deteriorating conditions are observed, traffic counts for use in a signal warrant/intersection modelling to quantify the delays and intersection level of service are recommended.

APPENDIX A

Existing Conditions Mobility Performance

Intersection: 6: Bowen Road & Dufferin Cres

Movement	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	TR	L	T	R	L	T	TR	L	T	TR
Maximum Queue (m)	35.0	56.0	30.4	33.1	28.3	39.5	66.6	61.4	47.1	66.0	67.2
Average Queue (m)	12.2	27.9	21.6	13.2	13.1	18.5	41.8	34.0	24.5	35.9	33.2
95th Queue (m)	27.3	48.2	33.0	27.5	23.6	33.0	62.6	54.9	40.3	57.4	56.0
Link Distance (m)		170.7									
Upstream Blk Time (%)											
Queuing Penalty (veh)											
Storage Bay Dist (m)	43.8		27.4			68.5			63.4		
Storage Blk Time (%)	0	1	6	1			0			0	
Queuing Penalty (veh)	0	1	6	1			0			1	

Intersection: 10: Waddington Road & Dufferin Cres

Movement	EB	B15	B15	NB	SB
Directions Served	LR	T		LT	TR
Maximum Queue (m)	29.6	1.1	1.3	15.4	6.4
Average Queue (m)	12.4	0.0	0.0	7.5	0.6
95th Queue (m)	23.6	0.8	0.9	12.8	4.0
Link Distance (m)	634.9	69.8	69.8		
Upstream Blk Time (%)				7	
Queuing Penalty (veh)				0	
Storage Bay Dist (m)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 17: Townsite Road & Boundary Cres

Movement	EB	SB
Directions Served	LT	LR
Maximum Queue (m)	12.0	29.4
Average Queue (m)	0.7	13.6
95th Queue (m)	5.1	22.8
Link Distance (m)		
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 20: Boundary Ave & Meredith Road/Strathmore St

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (m)	14.2	26.4	13.6	29.8	19.9	22.9	17.7	40.0
Average Queue (m)	4.6	11.9	4.2	11.9	8.3	9.6	4.8	17.0
95th Queue (m)	12.8	23.3	11.8	22.5	17.2	19.8	13.4	30.6
Link Distance (m)						537.5		139.6
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (m)	56.9		38.8		47.5		31.2	
Storage Blk Time (%)				0				1
Queuing Penalty (veh)				0				0

Intersection: 21: Boundary Cres/Boundary Ave & Dufferin Cres

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	LT	R	LT	R	L	TR	L	TR
Maximum Queue (m)	30.1	13.7	31.6	18.8	11.8	28.5	27.8	37.0
Average Queue (m)	14.9	5.5	11.9	5.0	3.4	13.1	12.8	11.5
95th Queue (m)	27.1	12.7	21.9	14.1	10.3	23.9	23.5	26.5
Link Distance (m)			69.8					537.5
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (m)		24.0		50.0	35.6		35.7	
Storage Blk Time (%)	1	0					0	0
Queuing Penalty (veh)	1	0					0	0

Zone Summary

Zone wide Queuing Penalty: 10

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	71	110	144	144	88	163	171	603	56	215	559	115
Future Volume (veh/h)	71	110	144	144	88	163	171	603	56	215	559	115
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1861	1900	1900	1863	1863	1881	1845	1900	1863	1848	1900
Adj Flow Rate, veh/h	80	139	176	157	116	209	251	744	72	234	608	125
Adj No. of Lanes	1	1	0	1	1	1	1	2	0	1	2	0
Peak Hour Factor	0.89	0.79	0.82	0.92	0.76	0.78	0.68	0.81	0.78	0.92	0.92	0.92
Percent Heavy Veh, %	2	1	1	0	2	2	1	3	3	2	3	3
Cap, veh/h	408	252	319	300	628	534	402	967	94	372	853	175
Arrive On Green	0.34	0.34	0.34	0.34	0.34	0.34	0.13	0.30	0.30	0.12	0.29	0.29
Sat Flow, veh/h	1051	747	946	1081	1863	1583	1792	3230	312	1774	2902	595
Grp Volume(v), veh/h	80	0	315	157	116	209	251	404	412	234	367	366
Grp Sat Flow(s),veh/h/ln	1051	0	1694	1081	1863	1583	1792	1752	1790	1774	1755	1743
Q Serve(g_s), s	4.2	0.0	11.0	10.0	3.2	7.3	6.8	15.2	15.2	6.4	13.5	13.6
Cycle Q Clear(g_c), s	7.4	0.0	11.0	21.0	3.2	7.3	6.8	15.2	15.2	6.4	13.5	13.6
Prop In Lane	1.00		0.56	1.00		1.00	1.00		0.17	1.00		0.34
Lane Grp Cap(c), veh/h	408	0	571	300	628	534	402	525	536	372	516	512
V/C Ratio(X)	0.20	0.00	0.55	0.52	0.18	0.39	0.62	0.77	0.77	0.63	0.71	0.71
Avail Cap(c_a), veh/h	447	0	634	342	700	595	474	564	576	453	541	537
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	19.6	0.0	19.5	28.1	17.0	18.3	16.1	23.1	23.1	16.6	22.8	22.8
Incr Delay (d2), s/veh	0.2	0.0	0.8	1.4	0.1	0.5	1.5	6.0	5.9	1.5	4.2	4.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.2	0.0	5.2	3.1	1.7	3.3	3.5	8.2	8.3	3.2	7.1	7.1
LnGrp Delay(d),s/veh	19.8	0.0	20.4	29.5	17.1	18.8	17.7	29.1	29.0	18.1	27.0	27.1
LnGrp LOS	B		C	C	B	B	B	C	C	B	C	C
Approach Vol, veh/h		395			482			1067			967	
Approach Delay, s/veh		20.3			21.9			26.3			24.9	
Approach LOS		C			C			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	14.7	27.4		30.3	15.1	27.0		30.3
Change Period (Y+Rc), s	6.0	* 5.7		5.9	6.0	* 5.7		* 5.9
Max Green Setting (Gmax), s	12.0	* 23		27.1	12.0	* 22		* 27
Max Q Clear Time (g_c+I1), s	8.4	17.2		13.0	8.8	15.6		23.0
Green Ext Time (p_c), s	0.3	4.5		4.4	0.3	4.6		1.4

Intersection Summary	
HCM 2010 Ctrl Delay	24.3
HCM 2010 LOS	C

Notes

Intersection	
Int Delay, s/veh	4.4

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	35	83	130	150	219	129
Future Vol, veh/h	35	83	130	150	219	129
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	58	80	90	71	91	83
Heavy Vehicles, %	3	7	3	2	1	0
Mvmt Flow	60	104	144	211	241	155

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	818	319	396	0	-	0
Stage 1	319	-	-	-	-	-
Stage 2	499	-	-	-	-	-
Critical Hdwy	6.43	6.27	4.13	-	-	-
Critical Hdwy Stg 1	5.43	-	-	-	-	-
Critical Hdwy Stg 2	5.43	-	-	-	-	-
Follow-up Hdwy	3.527	3.363	2.227	-	-	-
Pot Cap-1 Maneuver	344	710	1157	-	-	-
Stage 1	735	-	-	-	-	-
Stage 2	608	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	295	710	1157	-	-	-
Mov Cap-2 Maneuver	295	-	-	-	-	-
Stage 1	631	-	-	-	-	-
Stage 2	608	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	16.8	3.5	0
HCM LOS	C		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1157	-	468	-	-
HCM Lane V/C Ratio	0.125	-	0.351	-	-
HCM Control Delay (s)	8.6	0	16.8	-	-
HCM Lane LOS	A	A	C	-	-
HCM 95th %tile Q(veh)	0.4	-	1.6	-	-

Intersection	
Int Delay, s/veh	3.8

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	12	190	216	108	127	18
Future Vol, veh/h	12	190	216	108	127	18
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	Yield	-	None
Storage Length	-	-	-	363	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	60	71	92	82	76	75
Heavy Vehicles, %	17	6	2	4	4	0
Mvmt Flow	20	268	235	132	167	24

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	235	0	-	0	543	235
Stage 1	-	-	-	-	235	-
Stage 2	-	-	-	-	308	-
Critical Hdwy	4.27	-	-	-	6.44	6.2
Critical Hdwy Stg 1	-	-	-	-	5.44	-
Critical Hdwy Stg 2	-	-	-	-	5.44	-
Follow-up Hdwy	2.353	-	-	-	3.536	3.3
Pot Cap-1 Maneuver	1249	-	-	-	497	809
Stage 1	-	-	-	-	799	-
Stage 2	-	-	-	-	741	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1249	-	-	-	488	809
Mov Cap-2 Maneuver	-	-	-	-	488	-
Stage 1	-	-	-	-	784	-
Stage 2	-	-	-	-	741	-

Approach	EB	WB	SB
HCM Control Delay, s	0.6	0	16.1
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1249	-	-	-	514
HCM Lane V/C Ratio	0.016	-	-	-	0.372
HCM Control Delay (s)	7.9	0	-	-	16.1
HCM Lane LOS	A	A	-	-	C
HCM 95th %tile Q(veh)	0	-	-	-	1.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	26	85	23	22	72	70	55	135	12	29	279	23
Future Volume (veh/h)	26	85	23	22	72	70	55	135	12	29	279	23
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1750	1900	1900	1859	1900	1792	1866	1900	1900	1866	1900
Adj Flow Rate, veh/h	39	97	31	46	138	115	61	159	16	45	344	38
Adj No. of Lanes	1	1	0	1	1	0	1	1	0	1	1	0
Peak Hour Factor	0.66	0.88	0.74	0.48	0.52	0.61	0.90	0.85	0.75	0.64	0.81	0.61
Percent Heavy Veh, %	0	10	10	0	4	4	6	2	2	0	2	2
Cap, veh/h	409	370	118	514	273	228	459	682	69	642	675	75
Arrive On Green	0.29	0.29	0.29	0.29	0.29	0.29	0.41	0.41	0.41	0.41	0.41	0.41
Sat Flow, veh/h	1144	1272	407	1282	939	782	959	1669	168	1229	1652	182
Grp Volume(v), veh/h	39	0	128	46	0	253	61	0	175	45	0	382
Grp Sat Flow(s),veh/h/ln	1144	0	1679	1282	0	1721	959	0	1836	1229	0	1834
Q Serve(g_s), s	1.0	0.0	2.0	1.0	0.0	4.1	1.7	0.0	2.1	0.8	0.0	5.2
Cycle Q Clear(g_c), s	5.0	0.0	2.0	2.9	0.0	4.1	6.9	0.0	2.1	2.9	0.0	5.2
Prop In Lane	1.00		0.24	1.00		0.45	1.00		0.09	1.00		0.10
Lane Grp Cap(c), veh/h	409	0	489	514	0	501	459	0	751	642	0	750
V/C Ratio(X)	0.10	0.00	0.26	0.09	0.00	0.50	0.13	0.00	0.23	0.07	0.00	0.51
Avail Cap(c_a), veh/h	900	0	1209	1064	0	1239	815	0	1432	1098	0	1431
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	11.9	0.0	9.1	10.2	0.0	9.8	9.9	0.0	6.4	7.4	0.0	7.4
Incr Delay (d2), s/veh	0.1	0.0	0.3	0.1	0.0	0.8	0.2	0.0	0.2	0.1	0.0	0.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.3	0.0	0.9	0.3	0.0	2.0	0.5	0.0	1.1	0.3	0.0	2.7
LnGrp Delay(d),s/veh	12.0	0.0	9.3	10.3	0.0	10.6	10.1	0.0	6.6	7.4	0.0	8.0
LnGrp LOS	B		A	B		B	B		A	A		A
Approach Vol, veh/h		167			299			236			427	
Approach Delay, s/veh		10.0			10.6			7.5			7.9	
Approach LOS		A			B			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		18.6		14.7		18.6		14.7
Change Period (Y+Rc), s		5.0		5.0		5.0		5.0
Max Green Setting (Gmax), s		26.0		24.0		26.0		24.0
Max Q Clear Time (g_c+I1), s		8.9		7.0		7.2		6.1
Green Ext Time (p_c), s		2.9		1.7		6.4		3.8

Intersection Summary	
HCM 2010 Ctrl Delay	8.8
HCM 2010 LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	39	94	44	32	109	38	27	98	65	110	107	45
Future Volume (veh/h)	39	94	44	32	109	38	27	98	65	110	107	45
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1839	1900	1900	1845	1638	1900	1802	1900	1827	1876	1900
Adj Flow Rate, veh/h	52	152	60	44	136	56	36	111	80	133	135	52
Adj No. of Lanes	0	1	1	0	1	1	1	1	0	1	1	0
Peak Hour Factor	0.75	0.62	0.73	0.73	0.80	0.68	0.75	0.88	0.81	0.83	0.79	0.87
Percent Heavy Veh, %	1	1	0	3	3	16	0	5	5	4	1	1
Cap, veh/h	226	390	440	218	400	379	603	357	257	579	472	182
Arrive On Green	0.27	0.27	0.27	0.27	0.27	0.27	0.37	0.37	0.37	0.37	0.37	0.37
Sat Flow, veh/h	258	1434	1615	234	1470	1392	1215	975	703	1164	1291	497
Grp Volume(v), veh/h	204	0	60	180	0	56	36	0	191	133	0	187
Grp Sat Flow(s),veh/h/ln	1692	0	1615	1704	0	1392	1215	0	1678	1164	0	1788
Q Serve(g_s), s	0.0	0.0	0.8	0.0	0.0	0.9	0.6	0.0	2.4	2.7	0.0	2.1
Cycle Q Clear(g_c), s	2.6	0.0	0.8	2.3	0.0	0.9	2.8	0.0	2.4	5.0	0.0	2.1
Prop In Lane	0.25		1.00	0.24		1.00	1.00		0.42	1.00		0.28
Lane Grp Cap(c), veh/h	616	0	440	618	0	379	603	0	614	579	0	654
V/C Ratio(X)	0.33	0.00	0.14	0.29	0.00	0.15	0.06	0.00	0.31	0.23	0.00	0.29
Avail Cap(c_a), veh/h	1673	0	1503	1622	0	1247	1205	0	1446	1277	0	1725
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	8.6	0.0	8.0	8.5	0.0	8.0	7.5	0.0	6.6	8.4	0.0	6.5
Incr Delay (d2), s/veh	0.3	0.0	0.1	0.3	0.0	0.2	0.0	0.0	0.3	0.2	0.0	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.4	0.0	0.4	1.2	0.0	0.4	0.2	0.0	1.1	0.9	0.0	1.1
LnGrp Delay(d),s/veh	9.0	0.0	8.1	8.8	0.0	8.2	7.5	0.0	6.9	8.6	0.0	6.8
LnGrp LOS	A		A	A		A	A		A	A		A
Approach Vol, veh/h		264			236			227			320	
Approach Delay, s/veh		8.8			8.6			7.0			7.5	
Approach LOS		A			A			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		15.7		13.3		15.7		13.3
Change Period (Y+Rc), s		* 5.1		5.4		* 5.1		5.4
Max Green Setting (Gmax), s		* 25		27.0		* 28		26.0
Max Q Clear Time (g_c+I1), s		4.8		4.6		7.0		4.3
Green Ext Time (p_c), s		2.9		3.4		3.6		3.0

Intersection Summary	
HCM 2010 Ctrl Delay	8.0
HCM 2010 LOS	A

Notes

6: Bowen Road & Dufferin Cres Performance by lane

Lane	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB	SB	All
Movements Served	L	TR	L	T	R	L	T	TR	L	T	TR	
Denied Del/Veh (s)												0.8
Total Del/Veh (s)	22.9	16.3	23.8	18.5	5.7	16.2	20.9	16.3	17.2	18.4	15.4	17.3

10: Waddington Road & Dufferin Cres Performance by lane

Lane	EB	NB	SB	All
Movements Served	LR	LT	TR	
Denied Del/Veh (s)				0.3
Total Del/Veh (s)	2.7	1.2	1.3	1.7

17: Townsite Road & Boundary Cres Performance by lane

Lane	EB	WB	WB	SB	All
Movements Served	LT	T	R	LR	
Denied Del/Veh (s)					0.8
Total Del/Veh (s)	0.9	0.8	0.8	7.2	2.2

20: Boundary Ave & Meredith Road/Strathmore St Performance by lane

Lane	EB	EB	WB	WB	NB	NB	SB	SB	All
Movements Served	L	TR	L	TR	L	TR	L	TR	
Denied Del/Veh (s)									0.5
Total Del/Veh (s)	12.1	8.1	11.0	6.7	10.0	6.3	7.7	6.4	7.2

21: Boundary Cres/Boundary Ave & Dufferin Cres Performance by lane

Lane	EB	EB	WB	WB	NB	NB	SB	SB	All
Movements Served	LT	R	LT	R	L	TR	L	TR	
Denied Del/Veh (s)									0.2
Total Del/Veh (s)	9.3	3.1	5.5	2.8	8.9	5.5	9.5	7.3	6.7

Total Zone Performance

Denied Del/Veh (s)	0.7
Total Del/Veh (s)	165.9

Intersection: 6: Bowen Road & Dufferin Cres

Movement	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	TR	L	T	R	L	T	TR	L	T	TR
Maximum Queue (m)	38.2	55.7	30.5	32.8	28.0	42.8	66.5	59.8	46.9	66.0	68.9
Average Queue (m)	12.6	28.2	21.3	13.5	12.9	19.0	41.6	33.4	24.6	36.1	34.0
95th Queue (m)	27.8	48.9	32.9	27.9	23.1	34.1	62.8	53.3	40.7	58.1	57.3
Link Distance (m)		170.7									
Upstream Blk Time (%)											
Queuing Penalty (veh)											
Storage Bay Dist (m)	43.8		27.4			68.5			63.4		
Storage Blk Time (%)	0	2	6	1			0			0	
Queuing Penalty (veh)	0	1	5	1			0			1	

Intersection: 10: Waddington Road & Dufferin Cres

Movement	EB	B15	B15	NB	SB
Directions Served	LR	T		LT	TR
Maximum Queue (m)	29.6	0.9	1.1	15.9	6.4
Average Queue (m)	12.6	0.0	0.0	7.5	0.7
95th Queue (m)	23.5	0.7	0.9	12.4	4.0
Link Distance (m)	634.9	69.8	69.8		
Upstream Blk Time (%)				7	
Queuing Penalty (veh)				0	
Storage Bay Dist (m)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 17: Townsite Road & Boundary Cres

Movement	EB	WB	SB
Directions Served	LT	T	LR
Maximum Queue (m)	11.5	1.0	27.9
Average Queue (m)	0.7	0.0	13.4
95th Queue (m)	5.0	0.8	22.2
Link Distance (m)			
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (m)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 20: Boundary Ave & Meredith Road/Strathmore St

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (m)	14.4	27.6	13.8	29.4	19.9	22.9	17.3	42.2
Average Queue (m)	4.5	12.2	4.2	12.2	8.2	9.9	4.9	17.5
95th Queue (m)	12.7	23.6	11.9	22.7	16.8	20.4	13.6	31.9
Link Distance (m)						537.5		139.6
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (m)	56.9		38.8		47.5		31.2	
Storage Blk Time (%)				0				1
Queuing Penalty (veh)				0				0

Intersection: 21: Boundary Cres/Boundary Ave & Dufferin Cres

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	LT	R	LT	R	L	TR	L	TR
Maximum Queue (m)	29.6	13.9	30.9	18.1	12.3	28.4	29.8	35.7
Average Queue (m)	14.6	5.4	11.9	5.0	3.5	12.7	12.8	11.6
95th Queue (m)	26.3	12.6	21.8	13.9	10.4	23.5	23.9	25.8
Link Distance (m)			69.8					537.5
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (m)		24.0		50.0	35.6		35.7	
Storage Blk Time (%)	1	0					0	0
Queuing Penalty (veh)	1	0					0	0

Zone Summary

Zone wide Queuing Penalty: 10

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	140	135	255	114	157	218	245	841	83	165	699	179
Future Volume (veh/h)	140	135	255	114	157	218	245	841	83	165	699	179
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1881	1863	1900	1881	1845	1900	1881	1850	1900	1863	1852	1900
Adj Flow Rate, veh/h	165	153	283	131	178	242	263	867	102	188	842	206
Adj No. of Lanes	1	1	0	1	1	1	1	2	0	1	2	0
Peak Hour Factor	0.85	0.88	0.90	0.87	0.88	0.90	0.93	0.97	0.81	0.88	0.83	0.87
Percent Heavy Veh, %	1	2	2	1	3	0	1	3	3	2	3	3
Cap, veh/h	364	204	378	206	643	563	320	1036	122	310	837	205
Arrive On Green	0.35	0.35	0.35	0.35	0.35	0.35	0.13	0.33	0.33	0.10	0.30	0.30
Sat Flow, veh/h	972	586	1085	958	1845	1615	1792	3169	373	1774	2804	686
Grp Volume(v), veh/h	165	0	436	131	178	242	263	481	488	188	528	520
Grp Sat Flow(s),veh/h/ln	972	0	1671	958	1845	1615	1792	1758	1785	1774	1759	1731
Q Serve(g_s), s	11.5	0.0	17.9	9.3	5.4	9.0	7.7	19.8	19.8	5.6	23.3	23.3
Cycle Q Clear(g_c), s	16.9	0.0	17.9	27.2	5.4	9.0	7.7	19.8	19.8	5.6	23.3	23.3
Prop In Lane	1.00		0.65	1.00		1.00	1.00		0.21	1.00		0.40
Lane Grp Cap(c), veh/h	364	0	583	206	643	563	320	575	583	310	525	517
V/C Ratio(X)	0.45	0.00	0.75	0.64	0.28	0.43	0.82	0.84	0.84	0.61	1.01	1.01
Avail Cap(c_a), veh/h	364	0	583	206	643	563	368	575	583	407	525	517
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	24.4	0.0	22.4	35.0	18.3	19.5	18.6	24.3	24.3	18.7	27.4	27.4
Incr Delay (d2), s/veh	0.9	0.0	5.3	6.3	0.2	0.5	11.7	10.5	10.3	1.4	40.7	41.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.2	0.0	9.1	3.2	2.8	4.0	4.8	11.3	11.4	2.8	17.2	16.9
LnGrp Delay(d),s/veh	25.3	0.0	27.7	41.3	18.6	20.0	30.3	34.8	34.7	20.1	68.0	68.5
LnGrp LOS	C		C	D	B	B	C	C	C	C	F	F
Approach Vol, veh/h		601			551			1232			1236	
Approach Delay, s/veh		27.1			24.6			33.8			60.9	
Approach LOS		C			C			C			E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	13.7	31.2		33.1	15.9	29.0		33.1
Change Period (Y+Rc), s	6.0	* 5.7		5.9	6.0	* 5.7		* 5.9
Max Green Setting (Gmax), s	12.0	* 23		27.1	12.0	* 23		* 27
Max Q Clear Time (g_c+I1), s	7.6	21.8		19.9	9.7	25.3		29.2
Green Ext Time (p_c), s	0.3	1.3		3.9	0.3	0.0		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	40.5
HCM 2010 LOS	D

Notes

Intersection	
Int Delay, s/veh	7.9

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	81	202	83	141	231	61
Future Vol, veh/h	81	202	83	141	231	61
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	88	86	74	93	77	76
Heavy Vehicles, %	1	1	2	1	2	0
Mvmt Flow	92	235	112	152	300	80

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	716	340	380	0	-	0
Stage 1	340	-	-	-	-	-
Stage 2	376	-	-	-	-	-
Critical Hdwy	6.41	6.21	4.12	-	-	-
Critical Hdwy Stg 1	5.41	-	-	-	-	-
Critical Hdwy Stg 2	5.41	-	-	-	-	-
Follow-up Hdwy	3.509	3.309	2.218	-	-	-
Pot Cap-1 Maneuver	398	705	1178	-	-	-
Stage 1	723	-	-	-	-	-
Stage 2	696	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	357	705	1178	-	-	-
Mov Cap-2 Maneuver	357	-	-	-	-	-
Stage 1	648	-	-	-	-	-
Stage 2	696	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	20.5	3.6	0
HCM LOS	C		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1178	-	553	-	-
HCM Lane V/C Ratio	0.095	-	0.591	-	-
HCM Control Delay (s)	8.4	0	20.5	-	-
HCM Lane LOS	A	A	C	-	-
HCM 95th %tile Q(veh)	0.3	-	3.8	-	-

Intersection	
Int Delay, s/veh	4.8

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	21	209	240	114	163	19
Future Vol, veh/h	21	209	240	114	163	19
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	Yield	-	None
Storage Length	-	-	-	363	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	86	66	85	89	87	53
Heavy Vehicles, %	0	1	3	4	2	5
Mvmt Flow	24	317	282	128	187	36

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	282	0	-	0	647	282
Stage 1	-	-	-	-	282	-
Stage 2	-	-	-	-	365	-
Critical Hdwy	4.1	-	-	-	6.42	6.25
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.2	-	-	-	3.518	3.345
Pot Cap-1 Maneuver	1292	-	-	-	436	750
Stage 1	-	-	-	-	766	-
Stage 2	-	-	-	-	702	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1292	-	-	-	426	750
Mov Cap-2 Maneuver	-	-	-	-	426	-
Stage 1	-	-	-	-	748	-
Stage 2	-	-	-	-	702	-

Approach	EB	WB	SB
HCM Control Delay, s	0.6	0	20.1
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1292	-	-	-	458
HCM Lane V/C Ratio	0.019	-	-	-	0.487
HCM Control Delay (s)	7.8	0	-	-	20.1
HCM Lane LOS	A	A	-	-	C
HCM 95th %tile Q(veh)	0.1	-	-	-	2.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	16	49	59	11	78	19	129	276	10	22	153	15
Future Volume (veh/h)	16	49	59	11	78	19	129	276	10	22	153	15
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1883	1900	1900	1842	1900	1900	1900	1900	1900	1883	1900
Adj Flow Rate, veh/h	20	61	78	24	118	32	202	329	12	33	204	24
Adj No. of Lanes	1	1	0	1	1	0	1	1	0	1	1	0
Peak Hour Factor	0.80	0.80	0.76	0.46	0.66	0.59	0.64	0.84	0.83	0.66	0.75	0.63
Percent Heavy Veh, %	0	2	2	0	4	4	0	0	0	0	1	1
Cap, veh/h	416	162	208	422	301	82	681	831	30	591	755	89
Arrive On Green	0.22	0.22	0.22	0.22	0.22	0.22	0.46	0.46	0.46	0.46	0.46	0.46
Sat Flow, veh/h	1257	752	962	1270	1396	379	1171	1822	66	1056	1654	195
Grp Volume(v), veh/h	20	0	139	24	0	150	202	0	341	33	0	228
Grp Sat Flow(s),veh/h/ln	1257	0	1714	1270	0	1775	1171	0	1888	1056	0	1849
Q Serve(g_s), s	0.4	0.0	2.1	0.5	0.0	2.2	3.9	0.0	3.7	0.7	0.0	2.3
Cycle Q Clear(g_c), s	2.6	0.0	2.1	2.6	0.0	2.2	6.3	0.0	3.7	4.3	0.0	2.3
Prop In Lane	1.00		0.56	1.00		0.21	1.00		0.04	1.00		0.11
Lane Grp Cap(c), veh/h	416	0	370	422	0	383	681	0	862	591	0	844
V/C Ratio(X)	0.05	0.00	0.38	0.06	0.00	0.39	0.30	0.00	0.40	0.06	0.00	0.27
Avail Cap(c_a), veh/h	1052	0	1236	1064	0	1280	991	0	1362	871	0	1333
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	11.4	0.0	10.2	11.3	0.0	10.2	7.1	0.0	5.5	6.9	0.0	5.1
Incr Delay (d2), s/veh	0.0	0.0	0.6	0.1	0.0	0.7	0.3	0.0	0.4	0.0	0.0	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.1	0.0	1.1	0.2	0.0	1.2	1.3	0.0	2.0	0.2	0.0	1.2
LnGrp Delay(d),s/veh	11.4	0.0	10.8	11.4	0.0	10.9	7.4	0.0	5.9	7.0	0.0	5.3
LnGrp LOS	B		B	B		B	A		A	A		A
Approach Vol, veh/h		159			174			543			261	
Approach Delay, s/veh		10.9			11.0			6.4			5.6	
Approach LOS		B			B			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		18.9		11.6		18.9		11.6
Change Period (Y+Rc), s		5.0		5.0		5.0		5.0
Max Green Setting (Gmax), s		22.0		22.0		22.0		22.0
Max Q Clear Time (g_c+I1), s		8.3		4.6		6.3		4.6
Green Ext Time (p_c), s		5.6		1.8		3.3		1.9

Intersection Summary	
HCM 2010 Ctrl Delay	7.5
HCM 2010 LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	64	126	84	68	175	98	42	135	43	64	151	65
Future Volume (veh/h)	64	126	84	68	175	98	42	135	43	64	151	65
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1887	1881	1900	1872	1863	1900	1871	1900	1792	1851	1900
Adj Flow Rate, veh/h	68	140	100	80	224	108	60	173	52	88	180	96
Adj No. of Lanes	0	1	1	0	1	1	1	1	0	1	1	0
Peak Hour Factor	0.94	0.90	0.84	0.85	0.78	0.91	0.70	0.78	0.83	0.73	0.84	0.68
Percent Heavy Veh, %	1	1	1	2	2	2	0	2	2	6	3	3
Cap, veh/h	95	156	817	90	207	809	310	400	120	342	329	175
Arrive On Green	0.51	0.51	0.51	0.51	0.51	0.51	0.29	0.29	0.29	0.29	0.29	0.29
Sat Flow, veh/h	8	305	1599	7	404	1583	1121	1382	416	1108	1137	607
Grp Volume(v), veh/h	208	0	100	304	0	108	60	0	225	88	0	276
Grp Sat Flow(s),veh/h/ln	313	0	1599	411	0	1583	1121	0	1798	1108	0	1744
Q Serve(g_s), s	0.4	0.0	1.7	0.5	0.0	1.9	2.5	0.0	5.3	3.7	0.0	7.0
Cycle Q Clear(g_c), s	26.8	0.0	1.7	26.8	0.0	1.9	9.6	0.0	5.3	9.1	0.0	7.0
Prop In Lane	0.33		1.00	0.26		1.00	1.00		0.23	1.00		0.35
Lane Grp Cap(c), veh/h	251	0	817	297	0	809	310	0	520	342	0	504
V/C Ratio(X)	0.83	0.00	0.12	1.02	0.00	0.13	0.19	0.00	0.43	0.26	0.00	0.55
Avail Cap(c_a), veh/h	256	0	822	297	0	809	520	0	856	613	0	930
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	12.0	0.0	6.7	13.9	0.0	6.7	19.8	0.0	15.2	18.9	0.0	15.8
Incr Delay (d2), s/veh	19.6	0.0	0.1	58.6	0.0	0.1	0.3	0.0	0.6	0.4	0.0	0.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.0	0.0	0.8	7.7	0.0	0.8	0.8	0.0	2.7	1.2	0.0	3.5
LnGrp Delay(d),s/veh	31.6	0.0	6.8	72.5	0.0	6.8	20.1	0.0	15.7	19.3	0.0	16.7
LnGrp LOS	C		A	F		A	C		B	B		B
Approach Vol, veh/h		308			412			285			364	
Approach Delay, s/veh		23.5			55.3			16.7			17.3	
Approach LOS		C			E			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		20.4		32.3		20.4		32.3
Change Period (Y+Rc), s		* 5.1		5.4		* 5.1		5.4
Max Green Setting (Gmax), s		* 25		27.0		* 28		26.0
Max Q Clear Time (g_c+I1), s		11.6		28.8		11.1		28.8
Green Ext Time (p_c), s		2.9		0.0		4.3		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	30.0
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	180	178	328	150	206	286	316	1083	109	217	900	231
Future Volume (veh/h)	180	178	328	150	206	286	316	1083	109	217	900	231
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1881	1863	1900	1881	1845	1900	1881	1850	1900	1863	1852	1900
Adj Flow Rate, veh/h	212	202	364	172	234	318	340	1116	135	247	1084	266
Adj No. of Lanes	1	1	0	1	1	1	1	2	0	1	2	0
Peak Hour Factor	0.85	0.88	0.90	0.87	0.88	0.90	0.93	0.97	0.81	0.88	0.83	0.87
Percent Heavy Veh, %	1	2	2	1	3	0	1	3	3	2	3	3
Cap, veh/h	305	205	370	98	634	555	363	978	118	311	791	193
Arrive On Green	0.34	0.34	0.34	0.34	0.34	0.34	0.15	0.31	0.31	0.12	0.28	0.28
Sat Flow, veh/h	861	597	1076	850	1845	1615	1792	3160	382	1774	2806	684
Grp Volume(v), veh/h	212	0	566	172	234	318	340	620	631	247	677	673
Grp Sat Flow(s),veh/h/ln	861	0	1673	850	1845	1615	1792	1758	1783	1774	1759	1731
Q Serve(g_s), s	19.4	0.0	26.5	0.7	7.5	12.7	10.8	24.5	24.5	7.6	22.3	22.3
Cycle Q Clear(g_c), s	27.0	0.0	26.5	27.2	7.5	12.7	10.8	24.5	24.5	7.6	22.3	22.3
Prop In Lane	1.00		0.64	1.00		1.00	1.00		0.21	1.00		0.40
Lane Grp Cap(c), veh/h	305	0	575	98	634	555	363	544	552	311	496	488
V/C Ratio(X)	0.70	0.00	0.98	1.75	0.37	0.57	0.94	1.14	1.14	0.79	1.37	1.38
Avail Cap(c_a), veh/h	305	0	575	98	634	555	363	544	552	360	496	488
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	29.6	0.0	25.7	39.5	19.5	21.2	19.6	27.3	27.3	19.4	28.4	28.4
Incr Delay (d2), s/veh	6.7	0.0	33.3	377.1	0.4	1.4	31.4	83.1	84.1	9.6	177.0	183.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.2	0.0	17.4	12.4	3.9	5.9	10.4	24.4	24.9	4.5	35.1	35.4
LnGrp Delay(d),s/veh	36.3	0.0	59.0	416.6	19.9	22.6	50.9	110.4	111.5	28.9	205.4	211.4
LnGrp LOS	D		E	F	B	C	D	F	F	C	F	F
Approach Vol, veh/h		778			724			1591			1597	
Approach Delay, s/veh		52.9			115.3			98.1			180.6	
Approach LOS		D			F			F			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	15.8	30.2		33.1	18.0	28.0		33.1
Change Period (Y+Rc), s	6.0	* 5.7		5.9	6.0	* 5.7		* 5.9
Max Green Setting (Gmax), s	12.0	* 23		27.1	12.0	* 22		* 27
Max Q Clear Time (g_c+I1), s	9.6	26.5		29.0	12.8	24.3		29.2
Green Ext Time (p_c), s	0.3	0.0		0.0	0.0	0.0		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	121.4
HCM 2010 LOS	F

Notes

Intersection						
Int Delay, s/veh	28.5					

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	109	272	115	182	298	85
Future Vol, veh/h	109	272	115	182	298	85
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	88	86	74	93	77	76
Heavy Vehicles, %	1	1	2	1	2	0
Mvmt Flow	124	316	155	196	387	112

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	949	443	499	0	-	0
Stage 1	443	-	-	-	-	-
Stage 2	506	-	-	-	-	-
Critical Hdwy	6.41	6.21	4.12	-	-	-
Critical Hdwy Stg 1	5.41	-	-	-	-	-
Critical Hdwy Stg 2	5.41	-	-	-	-	-
Follow-up Hdwy	3.509	3.309	2.218	-	-	-
Pot Cap-1 Maneuver	290	617	1065	-	-	-
Stage 1	649	-	-	-	-	-
Stage 2	608	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	243	617	1065	-	-	-
Mov Cap-2 Maneuver	243	-	-	-	-	-
Stage 1	543	-	-	-	-	-
Stage 2	608	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	80.3	4	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1065	-	431	-	-
HCM Lane V/C Ratio	0.146	-	1.021	-	-
HCM Control Delay (s)	9	0	80.3	-	-
HCM Lane LOS	A	A	F	-	-
HCM 95th %tile Q(veh)	0.5	-	13.4	-	-

Intersection	
Int Delay, s/veh	11.2

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	27	269	309	149	213	25
Future Vol, veh/h	27	269	309	149	213	25
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	Yield	-	None
Storage Length	-	-	-	363	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	86	66	85	89	87	53
Heavy Vehicles, %	0	1	3	4	2	5
Mvmt Flow	31	408	364	167	245	47

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	364	0	-	0	834	364
Stage 1	-	-	-	-	364	-
Stage 2	-	-	-	-	470	-
Critical Hdwy	4.1	-	-	-	6.42	6.25
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.2	-	-	-	3.518	3.345
Pot Cap-1 Maneuver	1206	-	-	-	338	674
Stage 1	-	-	-	-	703	-
Stage 2	-	-	-	-	629	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1206	-	-	-	327	674
Mov Cap-2 Maneuver	-	-	-	-	327	-
Stage 1	-	-	-	-	680	-
Stage 2	-	-	-	-	629	-

Approach	EB	WB	SB
HCM Control Delay, s	0.6	0	47.5
HCM LOS			E

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1206	-	-	-	357
HCM Lane V/C Ratio	0.026	-	-	-	0.818
HCM Control Delay (s)	8.1	0	-	-	47.5
HCM Lane LOS	A	A	-	-	E
HCM 95th %tile Q(veh)	0.1	-	-	-	7.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	21	63	77	15	100	25	167	358	13	28	198	20
Future Volume (veh/h)	21	63	77	15	100	25	167	358	13	28	198	20
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1883	1900	1900	1842	1900	1900	1900	1900	1900	1883	1900
Adj Flow Rate, veh/h	26	79	101	33	152	42	261	426	16	42	264	32
Adj No. of Lanes	1	1	0	1	1	0	1	1	0	1	1	0
Peak Hour Factor	0.80	0.80	0.76	0.46	0.66	0.59	0.64	0.84	0.83	0.66	0.75	0.63
Percent Heavy Veh, %	0	2	2	0	4	4	0	0	0	0	1	1
Cap, veh/h	367	176	226	374	326	90	632	895	34	521	811	98
Arrive On Green	0.23	0.23	0.23	0.23	0.23	0.23	0.49	0.49	0.49	0.49	0.49	0.49
Sat Flow, veh/h	1208	752	962	1223	1390	384	1100	1820	68	962	1648	200
Grp Volume(v), veh/h	26	0	180	33	0	194	261	0	442	42	0	296
Grp Sat Flow(s),veh/h/ln	1208	0	1714	1223	0	1774	1100	0	1888	962	0	1848
Q Serve(g_s), s	0.7	0.0	3.3	0.9	0.0	3.4	6.9	0.0	5.7	1.1	0.0	3.5
Cycle Q Clear(g_c), s	4.1	0.0	3.3	4.2	0.0	3.4	10.4	0.0	5.7	6.8	0.0	3.5
Prop In Lane	1.00		0.56	1.00		0.22	1.00		0.04	1.00		0.11
Lane Grp Cap(c), veh/h	367	0	402	374	0	416	632	0	929	521	0	909
V/C Ratio(X)	0.07	0.00	0.45	0.09	0.00	0.47	0.41	0.00	0.48	0.08	0.00	0.33
Avail Cap(c_a), veh/h	810	0	1031	823	0	1068	752	0	1136	626	0	1112
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	13.8	0.0	12.0	13.7	0.0	12.0	8.8	0.0	6.2	8.4	0.0	5.6
Incr Delay (d2), s/veh	0.1	0.0	0.8	0.1	0.0	0.8	0.5	0.0	0.5	0.1	0.0	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	0.0	1.6	0.3	0.0	1.8	2.1	0.0	2.9	0.3	0.0	1.8
LnGrp Delay(d),s/veh	13.9	0.0	12.8	13.8	0.0	12.8	9.3	0.0	6.6	8.5	0.0	5.9
LnGrp LOS	B		B	B		B	A		A	A		A
Approach Vol, veh/h		206			227			703			338	
Approach Delay, s/veh		12.9			13.0			7.6			6.2	
Approach LOS		B			B			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		23.0		13.6		23.0		13.6
Change Period (Y+Rc), s		5.0		5.0		5.0		5.0
Max Green Setting (Gmax), s		22.0		22.0		22.0		22.0
Max Q Clear Time (g_c+I1), s		12.4		6.1		8.8		6.2
Green Ext Time (p_c), s		5.6		2.3		4.0		2.5

Intersection Summary	
HCM 2010 Ctrl Delay	8.9
HCM 2010 LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	83	169	109	90	237	130	55	174	57	85	194	85
Future Volume (veh/h)	83	169	109	90	237	130	55	174	57	85	194	85
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1887	1881	1900	1872	1863	1900	1871	1900	1792	1851	1900
Adj Flow Rate, veh/h	88	188	130	106	304	143	79	223	69	116	231	125
Adj No. of Lanes	0	1	1	0	1	1	1	1	0	1	1	0
Peak Hour Factor	0.94	0.90	0.84	0.85	0.78	0.91	0.70	0.78	0.83	0.73	0.84	0.68
Percent Heavy Veh, %	1	1	1	2	2	2	0	2	2	6	3	3
Cap, veh/h	83	140	754	79	179	746	310	474	147	353	391	211
Arrive On Green	0.47	0.47	0.47	0.47	0.47	0.47	0.35	0.35	0.35	0.35	0.35	0.35
Sat Flow, veh/h	0	297	1599	0	380	1583	1042	1372	425	1042	1131	612
Grp Volume(v), veh/h	276	0	130	410	0	143	79	0	292	116	0	356
Grp Sat Flow(s),veh/h/ln	297	0	1599	380	0	1583	1042	0	1797	1042	0	1743
Q Serve(g_s), s	0.0	0.0	2.7	0.0	0.0	3.0	3.9	0.0	7.3	5.6	0.0	9.6
Cycle Q Clear(g_c), s	27.0	0.0	2.7	27.0	0.0	3.0	13.5	0.0	7.3	12.9	0.0	9.6
Prop In Lane	0.32		1.00	0.26		1.00	1.00		0.24	1.00		0.35
Lane Grp Cap(c), veh/h	223	0	754	258	0	746	310	0	621	353	0	602
V/C Ratio(X)	1.24	0.00	0.17	1.59	0.00	0.19	0.25	0.00	0.47	0.33	0.00	0.59
Avail Cap(c_a), veh/h	223	0	754	258	0	746	405	0	784	503	0	852
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	14.5	0.0	8.7	15.8	0.0	8.8	21.0	0.0	14.7	19.7	0.0	15.4
Incr Delay (d2), s/veh	139.6	0.0	0.1	282.0	0.0	0.1	0.4	0.0	0.6	0.5	0.0	0.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	10.8	0.0	1.2	23.0	0.0	1.3	1.1	0.0	3.7	1.7	0.0	4.7
LnGrp Delay(d),s/veh	154.1	0.0	8.8	297.8	0.0	8.9	21.4	0.0	15.2	20.2	0.0	16.4
LnGrp LOS	F		A	F		A	C		B	C		B
Approach Vol, veh/h		406			553			371			472	
Approach Delay, s/veh		107.6			223.1			16.5			17.3	
Approach LOS		F			F			B			B	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		24.9		32.4		24.9		32.4				
Change Period (Y+Rc), s		* 5.1		5.4		* 5.1		5.4				
Max Green Setting (Gmax), s		* 25		27.0		* 28		26.0				
Max Q Clear Time (g_c+I1), s		15.5		29.0		14.9		29.0				
Green Ext Time (p_c), s		3.0		0.0		4.9		0.0				
Intersection Summary												
HCM 2010 Ctrl Delay			100.6									
HCM 2010 LOS			F									
Notes												

6: Bowen Road & Dufferin Cres Performance by lane

Lane	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB	SB	All
Movements Served	L	TR	L	T	R	L	T	TR	L	T	TR	
Denied Del/Veh (s)												1.2
Total Del/Veh (s)	29.1	21.0	27.8	21.3	9.0	25.0	31.2	29.3	22.2	29.4	28.6	26.0

10: Waddington Road & Dufferin Cres Performance by lane

Lane	EB	NB	SB	All
Movements Served	LR	LT	TR	
Denied Del/Veh (s)				0.2
Total Del/Veh (s)	7.5	0.9	0.9	3.3

17: Townsite Road & Boundary Cres Performance by lane

Lane	EB	WB	WB	SB	All
Movements Served	LT	T	R	LR	
Denied Del/Veh (s)					0.8
Total Del/Veh (s)	1.2	1.0	0.8	8.9	2.9

20: Boundary Ave & Meredith Road/Strathmore St Performance by lane

Lane	EB	EB	WB	WB	NB	NB	SB	SB	All
Movements Served	L	TR	L	TR	L	TR	L	TR	
Denied Del/Veh (s)									0.5
Total Del/Veh (s)	12.0	6.4	11.2	8.4	9.3	7.3	9.5	5.2	7.3

21: Boundary Cres/Boundary Ave & Dufferin Cres Performance by lane

Lane	EB	EB	WB	WB	NB	NB	SB	SB	All
Movements Served	LT	R	LT	R	L	TR	L	TR	
Denied Del/Veh (s)									0.4
Total Del/Veh (s)	10.9	2.9	10.5	3.0	13.5	7.8	12.0	10.0	9.0

Total Zone Performance

Denied Del/Veh (s)	1.0
Total Del/Veh (s)	2033.3

Intersection: 6: Bowen Road & Dufferin Cres

Movement	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	TR	L	T	R	L	T	TR	L	T	TR
Maximum Queue (m)	58.6	101.7	30.9	35.0	30.9	80.4	109.3	110.5	78.2	101.4	100.2
Average Queue (m)	25.2	44.0	18.9	20.8	18.5	36.9	65.8	61.1	29.0	57.7	56.3
95th Queue (m)	50.2	81.4	31.9	34.4	30.7	74.0	105.9	100.7	61.8	92.3	95.6
Link Distance (m)		170.7									
Upstream Blk Time (%)											
Queuing Penalty (veh)											
Storage Bay Dist (m)	43.8		27.4			68.5			63.4		
Storage Blk Time (%)	1	8	5	6		0	8		0	7	
Queuing Penalty (veh)	3	12	9	7		1	20		0	13	

Intersection: 10: Waddington Road & Dufferin Cres

Movement	EB	NB	SB
Directions Served	LR	LT	TR
Maximum Queue (m)	34.4	7.4	3.7
Average Queue (m)	17.6	5.3	0.2
95th Queue (m)	29.2	10.6	2.0
Link Distance (m)	634.9		
Upstream Blk Time (%)		3	
Queuing Penalty (veh)		0	
Storage Bay Dist (m)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 17: Townsite Road & Boundary Cres

Movement	EB	SB
Directions Served	LT	LR
Maximum Queue (m)	14.8	39.7
Average Queue (m)	1.8	15.6
95th Queue (m)	8.9	27.4
Link Distance (m)		
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 20: Boundary Ave & Meredith Road/Strathmore St

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (m)	11.4	22.9	9.5	23.5	29.6	34.4	12.3	27.2
Average Queue (m)	3.8	10.9	2.2	8.9	13.0	14.9	3.6	11.5
95th Queue (m)	11.4	19.3	8.3	18.6	24.9	28.2	11.3	23.6
Link Distance (m)						537.5		139.6
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (m)	56.9		38.8		47.5		31.2	
Storage Blk Time (%)					0			0
Queuing Penalty (veh)					0			0

Intersection: 21: Boundary Cres/Boundary Ave & Dufferin Cres

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	LT	R	LT	R	L	TR	L	TR
Maximum Queue (m)	27.8	16.5	46.2	19.4	18.4	33.0	36.0	49.2
Average Queue (m)	18.1	7.5	20.1	8.2	6.0	13.6	9.4	18.4
95th Queue (m)	29.6	15.3	37.3	16.3	14.4	26.5	23.3	33.9
Link Distance (m)			69.8					537.5
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (m)		24.0		50.0	35.6		35.7	
Storage Blk Time (%)	3	0	0			0	0	1
Queuing Penalty (veh)	3	0	0			0	0	0

Zone Summary

Zone wide Queuing Penalty: 68

APPENDIX B

Future (2041) Conditions Mobility Performance

URBAN systems

6: Bowen Road & Dufferin Cres Performance by lane

Lane	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB	SB	All
Movements Served	L	TR	L	T	R	L	T	TR	L	T	TR	
Denied Del/Veh (s)												1.3
Total Del/Veh (s)	28.4	22.9	36.9	22.6	8.8	24.1	29.8	26.5	34.4	28.5	29.6	27.2

10: Waddington Road & Dufferin Cres Performance by lane

Lane	EB	NB	SB	All
Movements Served	LR	LT	TR	
Denied Del/Veh (s)				0.6
Total Del/Veh (s)	4.8	1.6	1.7	2.7

17: Townsite Road & Boundary Cres Performance by lane

Lane	EB	WB	WB	SB	All
Movements Served	LT	T	R	LR	
Denied Del/Veh (s)					0.9
Total Del/Veh (s)	1.2	1.1	0.9	9.4	2.7

20: Boundary Ave & Meredith Road/Strathmore St Performance by lane

Lane	EB	EB	WB	WB	NB	NB	SB	SB	All
Movements Served	L	TR	L	TR	L	TR	L	TR	
Denied Del/Veh (s)									0.5
Total Del/Veh (s)	15.7	9.1	16.9	8.6	14.7	7.4	9.6	8.3	9.1

21: Boundary Cres/Boundary Ave & Dufferin Cres Performance by lane

Lane	EB	EB	WB	WB	NB	NB	SB	SB	All
Movements Served	LT	R	LT	R	L	TR	L	TR	
Denied Del/Veh (s)									0.3
Total Del/Veh (s)	11.4	3.4	6.8	2.7	11.7	6.8	12.8	9.2	8.5

Total Zone Performance

Denied Del/Veh (s)	1.1
Total Del/Veh (s)	235.0

Intersection: 6: Bowen Road & Dufferin Cres

Movement	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	TR	L	T	R	L	T	TR	L	T	TR
Maximum Queue (m)	52.4	100.3	42.0	60.3	45.0	83.2	109.5	98.6	78.3	108.8	102.6
Average Queue (m)	19.0	38.4	29.5	21.7	18.6	32.8	60.2	54.2	44.9	60.3	59.4
95th Queue (m)	40.1	73.7	44.2	49.6	34.2	67.5	96.3	87.8	78.7	100.4	97.6
Link Distance (m)		170.7		52.9	52.9						
Upstream Blk Time (%)				3	0						
Queuing Penalty (veh)				7	0						
Storage Bay Dist (m)	43.8		27.4			68.5			63.4		
Storage Blk Time (%)	0	7	22	2		0	5		5	6	
Queuing Penalty (veh)	0	7	27	4		0	13		19	18	

Intersection: 10: Waddington Road & Dufferin Cres

Movement	EB	NB	SB
Directions Served	LR	LT	TR
Maximum Queue (m)	45.5	17.8	7.8
Average Queue (m)	16.3	7.8	1.4
95th Queue (m)	32.7	12.8	5.9
Link Distance (m)	634.9		
Upstream Blk Time (%)		13	
Queuing Penalty (veh)		0	
Storage Bay Dist (m)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 17: Townsite Road & Boundary Cres

Movement	EB	WB	SB
Directions Served	LT	T	LR
Maximum Queue (m)	15.7	1.8	33.7
Average Queue (m)	1.2	0.1	15.6
95th Queue (m)	6.9	1.3	26.4
Link Distance (m)			
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (m)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 20: Boundary Ave & Meredith Road/Strathmore St

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (m)	21.6	38.1	17.5	38.4	25.0	28.2	21.6	64.4
Average Queue (m)	5.6	14.6	4.7	15.2	10.4	13.0	5.9	23.0
95th Queue (m)	15.5	28.7	13.5	30.0	20.1	25.0	16.4	41.9
Link Distance (m)						537.5		139.6
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (m)	56.9		38.8		47.5		31.2	
Storage Blk Time (%)				0				2
Queuing Penalty (veh)				0				1

Intersection: 21: Boundary Cres/Boundary Ave & Dufferin Cres

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	LT	R	LT	R	L	TR	L	TR
Maximum Queue (m)	32.6	19.0	38.0	20.8	15.6	38.9	42.1	39.2
Average Queue (m)	18.4	6.7	16.9	5.9	5.1	15.6	18.3	14.8
95th Queue (m)	30.6	14.7	30.0	15.9	12.9	30.3	33.4	29.9
Link Distance (m)			69.8					537.5
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (m)		24.0		50.0	35.6		35.7	
Storage Blk Time (%)	4	0	0			0	1	0
Queuing Penalty (veh)	3	0	0			0	2	0

Zone Summary

Zone wide Queuing Penalty: 101

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	91	143	185	190	116	215	220	777	73	280	720	148
Future Volume (veh/h)	91	143	185	190	116	215	220	777	73	280	720	148
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1861	1900	1900	1863	1863	1881	1845	1900	1863	1848	1900
Adj Flow Rate, veh/h	102	181	226	207	153	276	324	959	94	304	783	161
Adj No. of Lanes	1	1	0	1	1	1	1	2	0	1	2	0
Peak Hour Factor	0.89	0.79	0.82	0.92	0.76	0.78	0.68	0.81	0.78	0.92	0.92	0.92
Percent Heavy Veh, %	2	1	1	0	2	2	1	3	3	2	3	3
Cap, veh/h	358	256	320	220	633	538	363	1018	100	325	880	181
Arrive On Green	0.34	0.34	0.34	0.34	0.34	0.34	0.14	0.32	0.32	0.12	0.30	0.30
Sat Flow, veh/h	955	754	941	994	1863	1583	1792	3225	316	1774	2901	597
Grp Volume(v), veh/h	102	0	407	207	153	276	324	521	532	304	474	470
Grp Sat Flow(s),veh/h/ln	955	0	1695	994	1863	1583	1792	1752	1789	1774	1755	1742
Q Serve(g_s), s	6.9	0.0	16.7	10.5	4.7	11.2	9.9	23.2	23.2	9.5	20.6	20.6
Cycle Q Clear(g_c), s	11.6	0.0	16.7	27.2	4.7	11.2	9.9	23.2	23.2	9.5	20.6	20.6
Prop In Lane	1.00		0.56	1.00		1.00	1.00		0.18	1.00		0.34
Lane Grp Cap(c), veh/h	358	0	576	220	633	538	363	553	565	325	532	528
V/C Ratio(X)	0.29	0.00	0.71	0.94	0.24	0.51	0.89	0.94	0.94	0.93	0.89	0.89
Avail Cap(c_a), veh/h	358	0	576	220	633	538	363	554	565	325	533	529
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	23.2	0.0	23.0	36.8	19.0	21.2	18.8	26.7	26.7	19.4	26.6	26.6
Incr Delay (d2), s/veh	0.4	0.0	4.0	44.3	0.2	0.8	22.8	24.6	24.3	33.1	16.9	17.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.9	0.0	8.4	7.3	2.5	4.9	7.1	14.9	15.2	7.5	12.5	12.4
LnGrp Delay(d),s/veh	23.6	0.0	26.9	81.1	19.2	22.0	41.6	51.3	51.0	52.5	43.5	43.6
LnGrp LOS	C		C	F	B	C	D	D	D	D	D	D
Approach Vol, veh/h		509			636			1377			1248	
Approach Delay, s/veh		26.3			40.6			48.9			45.7	
Approach LOS		C			D			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	16.0	31.0		33.1	17.0	30.0		33.1
Change Period (Y+Rc), s	6.0	* 5.7		5.9	6.0	* 5.7		* 5.9
Max Green Setting (Gmax), s	10.0	* 25		27.1	11.0	* 24		* 27
Max Q Clear Time (g_c+I1), s	11.5	25.2		18.7	11.9	22.6		29.2
Green Ext Time (p_c), s	0.0	0.1		3.9	0.0	1.4		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	43.4
HCM 2010 LOS	D

Notes

Intersection						
Int Delay, s/veh	7.8					

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	48	114	174	193	282	173
Future Vol, veh/h	48	114	174	193	282	173
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	58	80	90	71	91	83
Heavy Vehicles, %	3	7	3	2	1	0
Mvmt Flow	83	143	193	272	310	208

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	1072	414	518	0	-	0
Stage 1	414	-	-	-	-	-
Stage 2	658	-	-	-	-	-
Critical Hdwy	6.43	6.27	4.13	-	-	-
Critical Hdwy Stg 1	5.43	-	-	-	-	-
Critical Hdwy Stg 2	5.43	-	-	-	-	-
Follow-up Hdwy	3.527	3.363	2.227	-	-	-
Pot Cap-1 Maneuver	243	628	1043	-	-	-
Stage 1	665	-	-	-	-	-
Stage 2	513	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	190	628	1043	-	-	-
Mov Cap-2 Maneuver	190	-	-	-	-	-
Stage 1	520	-	-	-	-	-
Stage 2	513	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	34.1	3.8	0
HCM LOS	D		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1043	-	340	-	-
HCM Lane V/C Ratio	0.185	-	0.663	-	-
HCM Control Delay (s)	9.2	0	34.1	-	-
HCM Lane LOS	A	A	D	-	-
HCM 95th %tile Q(veh)	0.7	-	4.5	-	-

Intersection	
Int Delay, s/veh	6.1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	16	245	278	142	166	24
Future Vol, veh/h	16	245	278	142	166	24
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	Yield	-	None
Storage Length	-	-	-	363	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	60	71	92	82	76	75
Heavy Vehicles, %	17	6	2	4	4	0
Mvmt Flow	27	345	302	173	218	32

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	302	0	-	0	701	302
Stage 1	-	-	-	-	302	-
Stage 2	-	-	-	-	399	-
Critical Hdwy	4.27	-	-	-	6.44	6.2
Critical Hdwy Stg 1	-	-	-	-	5.44	-
Critical Hdwy Stg 2	-	-	-	-	5.44	-
Follow-up Hdwy	2.353	-	-	-	3.536	3.3
Pot Cap-1 Maneuver	1178	-	-	-	402	742
Stage 1	-	-	-	-	745	-
Stage 2	-	-	-	-	673	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1178	-	-	-	391	742
Mov Cap-2 Maneuver	-	-	-	-	391	-
Stage 1	-	-	-	-	724	-
Stage 2	-	-	-	-	673	-

Approach	EB	WB	SB
HCM Control Delay, s	0.6	0	25.9
HCM LOS			D

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1178	-	-	-	416
HCM Lane V/C Ratio	0.023	-	-	-	0.602
HCM Control Delay (s)	8.1	0	-	-	25.9
HCM Lane LOS	A	A	-	-	D
HCM 95th %tile Q(veh)	0.1	-	-	-	3.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	33	109	29	28	92	89	72	175	16	37	362	29
Future Volume (veh/h)	33	109	29	28	92	89	72	175	16	37	362	29
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1750	1900	1900	1859	1900	1792	1866	1900	1900	1866	1900
Adj Flow Rate, veh/h	50	124	39	58	177	146	80	206	21	58	447	48
Adj No. of Lanes	1	1	0	1	1	0	1	1	0	1	1	0
Peak Hour Factor	0.66	0.88	0.74	0.48	0.52	0.61	0.90	0.85	0.75	0.64	0.81	0.61
Percent Heavy Veh, %	0	10	10	0	4	4	6	2	2	0	2	2
Cap, veh/h	354	404	127	486	299	246	371	713	73	591	709	76
Arrive On Green	0.32	0.32	0.32	0.32	0.32	0.32	0.43	0.43	0.43	0.43	0.43	0.43
Sat Flow, veh/h	1074	1277	402	1242	944	778	865	1666	170	1172	1657	178
Grp Volume(v), veh/h	50	0	163	58	0	323	80	0	227	58	0	495
Grp Sat Flow(s),veh/h/ln	1074	0	1679	1242	0	1722	865	0	1836	1172	0	1835
Q Serve(g_s), s	1.6	0.0	2.9	1.5	0.0	6.2	3.1	0.0	3.2	1.3	0.0	8.3
Cycle Q Clear(g_c), s	7.8	0.0	2.9	4.3	0.0	6.2	11.4	0.0	3.2	4.5	0.0	8.3
Prop In Lane	1.00		0.24	1.00		0.45	1.00		0.09	1.00		0.10
Lane Grp Cap(c), veh/h	354	0	532	486	0	545	371	0	786	591	0	785
V/C Ratio(X)	0.14	0.00	0.31	0.12	0.00	0.59	0.22	0.00	0.29	0.10	0.00	0.63
Avail Cap(c_a), veh/h	618	0	944	791	0	968	509	0	1079	778	0	1078
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	14.5	0.0	10.1	11.8	0.0	11.3	13.2	0.0	7.3	8.8	0.0	8.8
Incr Delay (d2), s/veh	0.2	0.0	0.3	0.1	0.0	1.0	0.3	0.0	0.2	0.1	0.0	1.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.5	0.0	1.4	0.5	0.0	3.0	0.8	0.0	1.6	0.4	0.0	4.3
LnGrp Delay(d),s/veh	14.7	0.0	10.4	11.9	0.0	12.3	13.6	0.0	7.6	8.9	0.0	9.8
LnGrp LOS	B		B	B		B	B		A	A		A
Approach Vol, veh/h		213			381			307			553	
Approach Delay, s/veh		11.4			12.2			9.1			9.7	
Approach LOS		B			B			A			A	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		21.8		17.4		21.8		17.4				
Change Period (Y+Rc), s		5.0		5.0		5.0		5.0				
Max Green Setting (Gmax), s		23.0		22.0		23.0		22.0				
Max Q Clear Time (g_c+I1), s		13.4		9.8		10.3		8.2				
Green Ext Time (p_c), s		2.7		1.9		6.5		4.2				
Intersection Summary												
HCM 2010 Ctrl Delay			10.5									
HCM 2010 LOS			B									

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	52	130	59	42	145	50	35	126	87	147	138	58
Future Volume (veh/h)	52	130	59	42	145	50	35	126	87	147	138	58
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1841	1900	1900	1845	1638	1900	1802	1900	1827	1876	1900
Adj Flow Rate, veh/h	69	210	81	58	181	74	47	143	107	177	175	67
Adj No. of Lanes	0	1	1	0	1	1	1	1	0	1	1	0
Peak Hour Factor	0.75	0.62	0.73	0.73	0.80	0.68	0.75	0.88	0.81	0.83	0.79	0.87
Percent Heavy Veh, %	1	1	0	3	3	16	0	5	5	4	1	1
Cap, veh/h	80	198	764	79	202	659	405	337	252	379	454	174
Arrive On Green	0.47	0.47	0.47	0.47	0.47	0.47	0.35	0.35	0.35	0.35	0.35	0.35
Sat Flow, veh/h	10	418	1615	9	427	1392	1156	958	717	1103	1293	495
Grp Volume(v), veh/h	279	0	81	239	0	74	47	0	250	177	0	242
Grp Sat Flow(s),veh/h/ln	428	0	1615	437	0	1392	1156	0	1676	1103	0	1789
Q Serve(g_s), s	0.7	0.0	1.7	0.7	0.0	1.8	1.9	0.0	6.8	8.7	0.0	6.1
Cycle Q Clear(g_c), s	28.3	0.0	1.7	28.3	0.0	1.8	8.2	0.0	6.8	15.7	0.0	6.1
Prop In Lane	0.25		1.00	0.24		1.00	1.00		0.43	1.00		0.28
Lane Grp Cap(c), veh/h	277	0	764	281	0	659	405	0	588	379	0	628
V/C Ratio(X)	1.01	0.00	0.11	0.85	0.00	0.11	0.12	0.00	0.42	0.47	0.00	0.39
Avail Cap(c_a), veh/h	286	0	773	290	0	666	596	0	866	562	0	925
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	15.3	0.0	8.7	13.6	0.0	8.8	17.7	0.0	14.8	20.9	0.0	14.6
Incr Delay (d2), s/veh	54.4	0.0	0.1	20.2	0.0	0.1	0.1	0.0	0.5	0.9	0.0	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	7.2	0.0	0.8	4.0	0.0	0.7	0.6	0.0	3.2	2.7	0.0	3.0
LnGrp Delay(d),s/veh	69.7	0.0	8.8	33.8	0.0	8.8	17.8	0.0	15.3	21.8	0.0	14.9
LnGrp LOS	F		A	C		A	B		B	C		B
Approach Vol, veh/h		360			313			297			419	
Approach Delay, s/veh		56.0			27.9			15.7			17.8	
Approach LOS		E			C			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		26.4		33.8		26.4		33.8
Change Period (Y+Rc), s		* 5.1		5.4		* 5.1		5.4
Max Green Setting (Gmax), s		* 31		28.6		* 31		28.6
Max Q Clear Time (g_c+I1), s		10.2		30.3		17.7		30.3
Green Ext Time (p_c), s		4.1		0.0		3.8		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	29.5
HCM 2010 LOS	C

Notes

6: Bowen Road & Dufferin Cres Performance by lane

Lane	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB	SB	All
Movements Served	L	TR	L	T	R	L	T	TR	L	T	TR	
Denied Del/Veh (s)												121.5
Total Del/Veh (s)	48.4	81.3	46.9	31.4	30.3	52.1	60.5	72.0	46.7	66.5	83.0	62.3

10: Waddington Road & Dufferin Cres Performance by lane

Lane	EB	NB	SB	All
Movements Served	LR	LT	TR	
Denied Del/Veh (s)				0.3
Total Del/Veh (s)	14.6	1.2	1.3	6.1

17: Townsite Road & Boundary Cres Performance by lane

Lane	EB	WB	WB	SB	All
Movements Served	LT	T	R	LR	
Denied Del/Veh (s)					0.8
Total Del/Veh (s)	1.4	1.2	0.9	19.6	5.7

20: Boundary Ave & Meredith Road/Strathmore St Performance by lane

Lane	EB	EB	WB	WB	NB	NB	SB	SB	All
Movements Served	L	TR	L	TR	L	TR	L	TR	
Denied Del/Veh (s)									0.6
Total Del/Veh (s)	14.1	7.1	13.7	8.9	12.1	9.2	13.1	6.4	9.0

21: Boundary Cres/Boundary Ave & Dufferin Cres Performance by lane

Lane	EB	EB	WB	WB	NB	NB	SB	SB	All
Movements Served	LT	R	LT	R	L	TR	L	TR	
Denied Del/Veh (s)									1.0
Total Del/Veh (s)	13.4	3.6	14.9	3.6	17.4	10.5	15.6	13.3	11.9

Total Zone Performance

Denied Del/Veh (s)	73.1
Total Del/Veh (s)	2278.2

Intersection: 6: Bowen Road & Dufferin Cres

Movement	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	TR	L	T	R	L	T	TR	L	T	TR
Maximum Queue (m)	58.7	180.1	42.3	63.6	59.6	83.4	128.9	125.5	78.3	110.3	109.4
Average Queue (m)	47.4	133.4	26.9	35.6	42.7	78.4	115.0	114.7	64.8	101.4	101.8
95th Queue (m)	72.9	214.5	46.9	61.8	62.9	98.7	131.9	132.4	99.2	108.2	107.6
Link Distance (m)		170.7		52.9	52.9						
Upstream Blk Time (%)		23		6	6						
Queuing Penalty (veh)		0		20	19						
Storage Bay Dist (m)	43.8		27.4			68.5			63.4		
Storage Blk Time (%)	8	47	23	17		16	46		3	58	
Queuing Penalty (veh)	41	86	48	26		84	146		15	125	

Intersection: 10: Waddington Road & Dufferin Cres

Movement	EB	NB	SB
Directions Served	LR	LT	TR
Maximum Queue (m)	73.5	16.6	11.4
Average Queue (m)	30.5	7.2	0.7
95th Queue (m)	59.1	12.3	5.0
Link Distance (m)	634.9		
Upstream Blk Time (%)		7	
Queuing Penalty (veh)		0	
Storage Bay Dist (m)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 17: Townsite Road & Boundary Cres

Movement	EB	SB
Directions Served	LT	LR
Maximum Queue (m)	14.9	74.2
Average Queue (m)	2.3	25.1
95th Queue (m)	10.0	56.4
Link Distance (m)		
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 20: Boundary Ave & Meredith Road/Strathmore St

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (m)	10.4	32.2	12.3	31.0	45.0	48.4	16.5	39.7
Average Queue (m)	4.0	12.7	3.3	11.8	16.2	20.8	5.0	14.2
95th Queue (m)	11.4	23.9	10.3	23.1	32.0	38.2	13.6	28.4
Link Distance (m)						537.5		139.6
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (m)	56.9		38.8		47.5		31.2	
Storage Blk Time (%)				0	0	0		0
Queuing Penalty (veh)				0	1	0		0

Intersection: 21: Boundary Cres/Boundary Ave & Dufferin Cres

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	LT	R	LT	R	L	TR	L	TR
Maximum Queue (m)	28.9	25.9	60.5	40.5	21.6	52.5	42.6	53.3
Average Queue (m)	21.9	10.1	30.3	11.2	8.2	19.6	14.2	24.0
95th Queue (m)	32.2	20.7	50.6	27.8	17.3	38.0	30.6	44.3
Link Distance (m)			69.8					537.5
Upstream Blk Time (%)			0	0				
Queuing Penalty (veh)			0	0				
Storage Bay Dist (m)		24.0		50.0	35.6		35.7	
Storage Blk Time (%)	9	0	1			1	1	2
Queuing Penalty (veh)	11	1	2			1	2	2

Zone Summary

Zone wide Queuing Penalty: 630

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	180	178	328	150	206	286	316	1083	109	217	900	231
Future Volume (veh/h)	180	178	328	150	206	286	316	1083	109	217	900	231
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1881	1863	1900	1881	1845	1900	1881	1850	1900	1863	1852	1900
Adj Flow Rate, veh/h	212	202	364	172	234	318	340	1116	135	247	1084	266
Adj No. of Lanes	1	1	0	1	1	1	1	2	0	1	2	0
Peak Hour Factor	0.85	0.88	0.90	0.87	0.88	0.90	0.93	0.97	0.81	0.88	0.83	0.87
Percent Heavy Veh, %	1	2	2	1	3	0	1	3	3	2	3	3
Cap, veh/h	308	225	406	111	696	609	373	1105	133	284	845	206
Arrive On Green	0.38	0.38	0.38	0.38	0.38	0.38	0.17	0.35	0.35	0.13	0.30	0.30
Sat Flow, veh/h	861	597	1076	850	1845	1615	1792	3160	382	1774	2806	684
Grp Volume(v), veh/h	212	0	566	172	234	318	340	620	631	247	677	673
Grp Sat Flow(s),veh/h/ln	861	0	1673	850	1845	1615	1792	1758	1783	1774	1759	1731
Q Serve(g_s), s	27.3	0.0	37.3	6.9	10.6	17.9	17.7	41.0	41.0	11.9	35.3	35.3
Cycle Q Clear(g_c), s	37.9	0.0	37.3	44.2	10.6	17.9	17.7	41.0	41.0	11.9	35.3	35.3
Prop In Lane	1.00		0.64	1.00		1.00	1.00		0.21	1.00		0.40
Lane Grp Cap(c), veh/h	308	0	631	111	696	609	373	615	624	284	530	522
V/C Ratio(X)	0.69	0.00	0.90	1.54	0.34	0.52	0.91	1.01	1.01	0.87	1.28	1.29
Avail Cap(c_a), veh/h	308	0	631	111	696	609	418	615	624	399	530	522
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	39.5	0.0	34.3	57.0	26.0	28.3	34.9	38.1	38.1	31.8	40.9	40.9
Incr Delay (d2), s/veh	6.3	0.0	15.6	284.0	0.3	0.8	22.6	38.4	38.9	13.9	138.9	144.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	7.0	0.0	19.9	12.4	5.4	8.1	13.1	26.4	26.8	8.9	37.5	37.7
LnGrp Delay(d),s/veh	45.8	0.0	49.9	341.0	26.3	29.1	57.5	76.5	77.0	45.7	179.9	185.4
LnGrp LOS	D		D	F	C	C	E	F	F	D	F	F
Approach Vol, veh/h		778			724			1591			1597	
Approach Delay, s/veh		48.8			102.3			72.7			161.4	
Approach LOS		D			F			E			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	20.4	46.7		50.1	26.1	41.0		50.1
Change Period (Y+Rc), s	* 5.7	* 5.7		5.9	* 5.7	* 5.7		* 5.9
Max Green Setting (Gmax), s	* 22	* 36		44.1	* 23	* 35		* 44
Max Q Clear Time (g_c+I1), s	13.9	43.0		39.9	19.7	37.3		46.2
Green Ext Time (p_c), s	0.8	0.0		3.0	0.6	0.0		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	103.5
HCM 2010 LOS	F

Notes

Intersection	
Int Delay, s/veh	28.5

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	109	272	115	182	298	85
Future Vol, veh/h	109	272	115	182	298	85
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	88	86	74	93	77	76
Heavy Vehicles, %	1	1	2	1	2	0
Mvmt Flow	124	316	155	196	387	112

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	949	443	499	0	-	0
Stage 1	443	-	-	-	-	-
Stage 2	506	-	-	-	-	-
Critical Hdwy	6.41	6.21	4.12	-	-	-
Critical Hdwy Stg 1	5.41	-	-	-	-	-
Critical Hdwy Stg 2	5.41	-	-	-	-	-
Follow-up Hdwy	3.509	3.309	2.218	-	-	-
Pot Cap-1 Maneuver	290	617	1065	-	-	-
Stage 1	649	-	-	-	-	-
Stage 2	608	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	243	617	1065	-	-	-
Mov Cap-2 Maneuver	243	-	-	-	-	-
Stage 1	543	-	-	-	-	-
Stage 2	608	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	80.3	4	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1065	-	431	-	-
HCM Lane V/C Ratio	0.146	-	1.021	-	-
HCM Control Delay (s)	9	0	80.3	-	-
HCM Lane LOS	A	A	F	-	-
HCM 95th %tile Q(veh)	0.5	-	13.4	-	-

Intersection	
Int Delay, s/veh	11.2

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	27	269	309	149	213	25
Future Vol, veh/h	27	269	309	149	213	25
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	Yield	-	None
Storage Length	-	-	-	363	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	86	66	85	89	87	53
Heavy Vehicles, %	0	1	3	4	2	5
Mvmt Flow	31	408	364	167	245	47

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	364	0	-	0	834	364
Stage 1	-	-	-	-	364	-
Stage 2	-	-	-	-	470	-
Critical Hdwy	4.1	-	-	-	6.42	6.25
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.2	-	-	-	3.518	3.345
Pot Cap-1 Maneuver	1206	-	-	-	338	674
Stage 1	-	-	-	-	703	-
Stage 2	-	-	-	-	629	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1206	-	-	-	327	674
Mov Cap-2 Maneuver	-	-	-	-	327	-
Stage 1	-	-	-	-	680	-
Stage 2	-	-	-	-	629	-

Approach	EB	WB	SB
HCM Control Delay, s	0.6	0	47.5
HCM LOS			E

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1206	-	-	-	357
HCM Lane V/C Ratio	0.026	-	-	-	0.818
HCM Control Delay (s)	8.1	0	-	-	47.5
HCM Lane LOS	A	A	-	-	E
HCM 95th %tile Q(veh)	0.1	-	-	-	7.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	21	63	77	15	100	25	167	358	13	28	198	20
Future Volume (veh/h)	21	63	77	15	100	25	167	358	13	28	198	20
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1883	1900	1900	1842	1900	1900	1900	1900	1900	1883	1900
Adj Flow Rate, veh/h	26	79	101	33	152	42	261	426	16	42	264	32
Adj No. of Lanes	1	1	0	1	1	0	1	1	0	1	1	0
Peak Hour Factor	0.80	0.80	0.76	0.46	0.66	0.59	0.64	0.84	0.83	0.66	0.75	0.63
Percent Heavy Veh, %	0	2	2	0	4	4	0	0	0	0	1	1
Cap, veh/h	367	176	226	374	326	90	632	895	34	521	811	98
Arrive On Green	0.23	0.23	0.23	0.23	0.23	0.23	0.49	0.49	0.49	0.49	0.49	0.49
Sat Flow, veh/h	1208	752	962	1223	1390	384	1100	1820	68	962	1648	200
Grp Volume(v), veh/h	26	0	180	33	0	194	261	0	442	42	0	296
Grp Sat Flow(s),veh/h/ln	1208	0	1714	1223	0	1774	1100	0	1888	962	0	1848
Q Serve(g_s), s	0.7	0.0	3.3	0.9	0.0	3.4	6.9	0.0	5.7	1.1	0.0	3.5
Cycle Q Clear(g_c), s	4.1	0.0	3.3	4.2	0.0	3.4	10.4	0.0	5.7	6.8	0.0	3.5
Prop In Lane	1.00		0.56	1.00		0.22	1.00		0.04	1.00		0.11
Lane Grp Cap(c), veh/h	367	0	402	374	0	416	632	0	929	521	0	909
V/C Ratio(X)	0.07	0.00	0.45	0.09	0.00	0.47	0.41	0.00	0.48	0.08	0.00	0.33
Avail Cap(c_a), veh/h	810	0	1031	823	0	1068	752	0	1136	626	0	1112
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	13.8	0.0	12.0	13.7	0.0	12.0	8.8	0.0	6.2	8.4	0.0	5.6
Incr Delay (d2), s/veh	0.1	0.0	0.8	0.1	0.0	0.8	0.5	0.0	0.5	0.1	0.0	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	0.0	1.6	0.3	0.0	1.8	2.1	0.0	2.9	0.3	0.0	1.8
LnGrp Delay(d),s/veh	13.9	0.0	12.8	13.8	0.0	12.8	9.3	0.0	6.6	8.5	0.0	5.9
LnGrp LOS	B		B	B		B	A		A	A		A
Approach Vol, veh/h		206			227			703			338	
Approach Delay, s/veh		12.9			13.0			7.6			6.2	
Approach LOS		B			B			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		23.0		13.6		23.0		13.6
Change Period (Y+Rc), s		5.0		5.0		5.0		5.0
Max Green Setting (Gmax), s		22.0		22.0		22.0		22.0
Max Q Clear Time (g_c+I1), s		12.4		6.1		8.8		6.2
Green Ext Time (p_c), s		5.6		2.3		4.0		2.5

Intersection Summary	
HCM 2010 Ctrl Delay	8.9
HCM 2010 LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	83	169	109	90	237	130	55	174	57	85	194	85
Future Volume (veh/h)	83	169	109	90	237	130	55	174	57	85	194	85
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1887	1881	1900	1872	1863	1900	1871	1900	1792	1851	1900
Adj Flow Rate, veh/h	88	188	130	106	304	143	79	223	69	116	231	125
Adj No. of Lanes	0	1	1	0	1	1	1	1	0	1	1	0
Peak Hour Factor	0.94	0.90	0.84	0.85	0.78	0.91	0.70	0.78	0.83	0.73	0.84	0.68
Percent Heavy Veh, %	1	1	1	2	2	2	0	2	2	6	3	3
Cap, veh/h	78	132	776	74	174	768	300	471	146	342	388	210
Arrive On Green	0.48	0.48	0.48	0.48	0.48	0.48	0.34	0.34	0.34	0.34	0.34	0.34
Sat Flow, veh/h	0	271	1599	0	358	1583	1042	1372	425	1042	1131	612
Grp Volume(v), veh/h	276	0	130	410	0	143	79	0	292	116	0	356
Grp Sat Flow(s),veh/h/ln	271	0	1599	358	0	1583	1042	0	1797	1042	0	1743
Q Serve(g_s), s	0.0	0.0	2.8	0.0	0.0	3.1	4.1	0.0	7.8	6.0	0.0	10.3
Cycle Q Clear(g_c), s	29.6	0.0	2.8	29.6	0.0	3.1	14.4	0.0	7.8	13.8	0.0	10.3
Prop In Lane	0.32		1.00	0.26		1.00	1.00		0.24	1.00		0.35
Lane Grp Cap(c), veh/h	209	0	776	248	0	768	300	0	616	342	0	598
V/C Ratio(X)	1.32	0.00	0.17	1.65	0.00	0.19	0.26	0.00	0.47	0.34	0.00	0.60
Avail Cap(c_a), veh/h	209	0	776	248	0	768	453	0	880	496	0	854
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	15.9	0.0	8.8	17.4	0.0	8.9	22.5	0.0	15.7	21.1	0.0	16.6
Incr Delay (d2), s/veh	172.5	0.0	0.1	311.0	0.0	0.1	0.5	0.0	0.6	0.6	0.0	1.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	12.2	0.0	1.2	26.0	0.0	1.4	1.2	0.0	3.9	1.8	0.0	5.1
LnGrp Delay(d),s/veh	188.4	0.0	8.9	328.5	0.0	9.0	23.0	0.0	16.3	21.7	0.0	17.5
LnGrp LOS	F		A	F		A	C		B	C		B
Approach Vol, veh/h		406			553			371			472	
Approach Delay, s/veh		130.9			245.9			17.7			18.5	
Approach LOS		F			F			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		26.0		35.0		26.0		35.0
Change Period (Y+Rc), s		* 5.1		5.4		* 5.1		5.4
Max Green Setting (Gmax), s		* 30		29.6		* 30		29.6
Max Q Clear Time (g_c+I1), s		16.4		31.6		15.8		31.6
Green Ext Time (p_c), s		3.9		0.0		5.2		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	113.5
HCM 2010 LOS	F

Notes

APPENDIX C

Summary of Online Survey Results

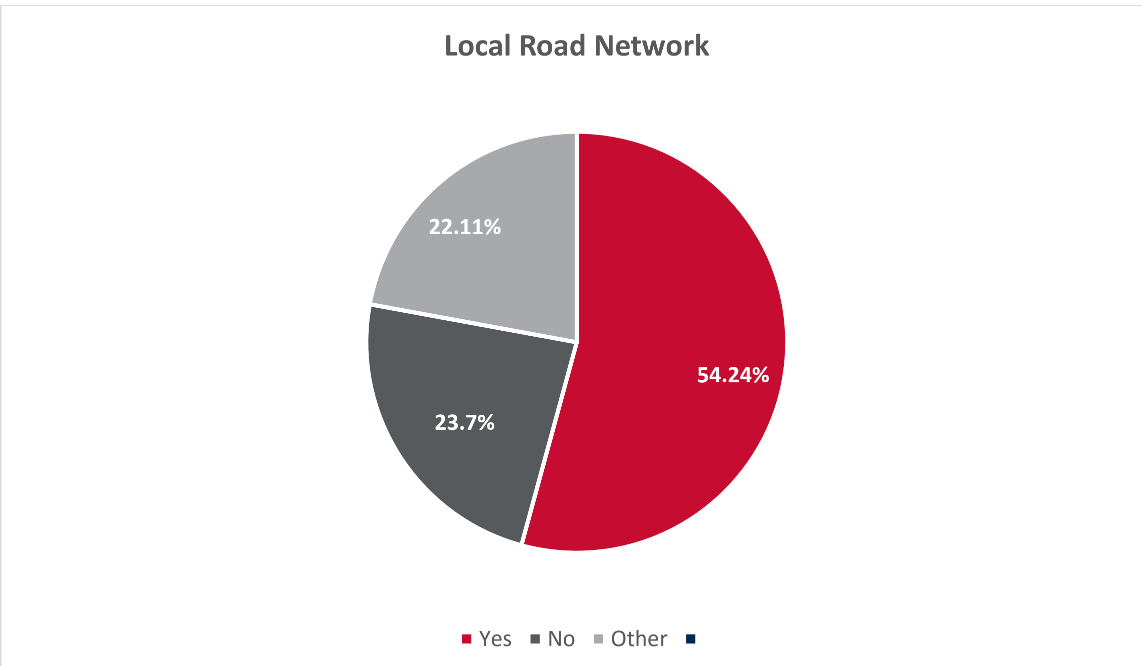
URBAN systems

ONLINE SURVEY RESULTS

An online survey was available to the public between June and August 2017 There were 504 participants. The survey had a total of 23 questions about Issues and Opportunities in the Hospital Area, out of which, 7 questions were directly related to transportation. The following section provides an summary of the responses. It should be noted that not all participants answered the questions. The total number of respondents is outlined in the summary of the corresponding questions.

Local Road Network
Q12: Does the local road network meet your needs for vehicle transportation?

Out of the 504 participants, 389 responded while 115 skipped the question. For 211 (54.2%) of the respondents, the local road network meets their needs for vehicle transportation while for 92 (23.7%) of the respondents, it does not. 86 (22.1%) answered “other” to this question.



How to Improve the Vehicle Transportation Network in the Hospital Area
Q13: What could be done to improve the vehicle transportation network in the hospital area?

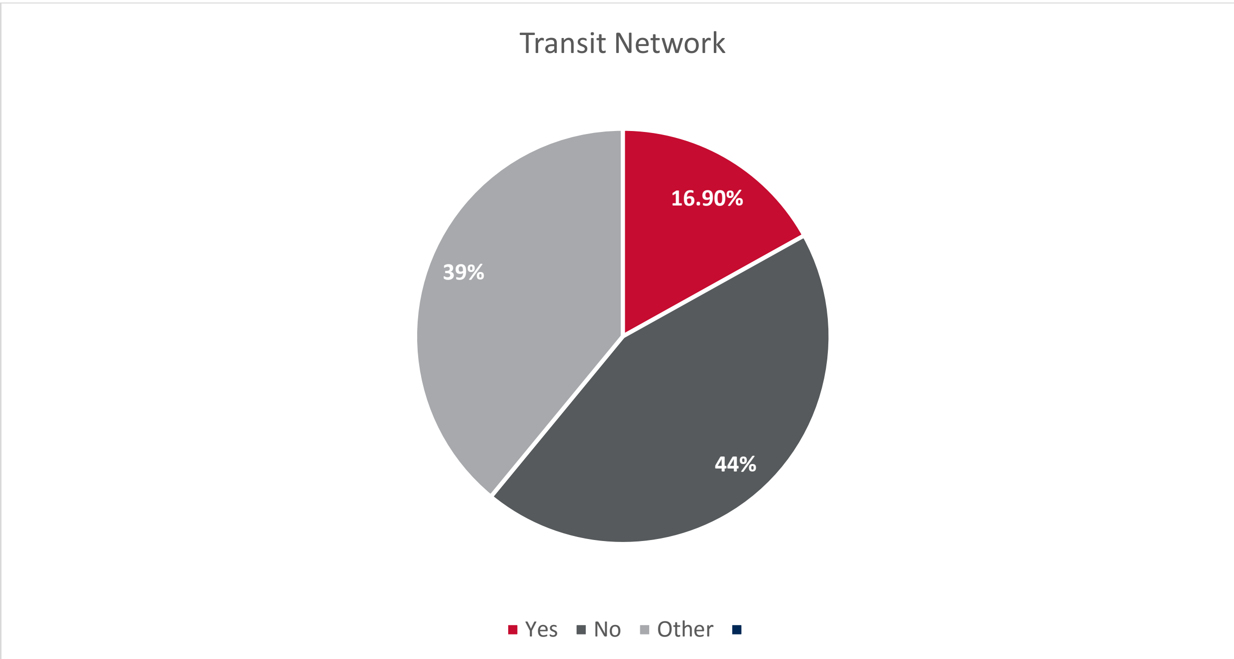
For the question “What could be done to improve the vehicle transportation network in the hospital area?”, the term “Island Highway-Northfield-Boundary intersection” was mentioned 67 times in the participants’ responses. “Transit improvements” had the third highest mentions and it appeared 30 times. The terms: road network, crosswalks, Island-Highway-Waddington intersection improvements and sidewalks had similar appearances and were mentioned between 9 and 17 times. The full summary is provided below.

Topic	Number of mentions
Island Highway-Northfield-Boundary intersection	67
Hospital parkade	31
Transit improvements	30
More parking	25
Road network	17
Crosswalks	16
Island Highway-Waddington intersection	14
Cycling lanes	12
Intersection improvements	10
Sidewalks	9
Don't know	9
Boundary-Dufferin intersection	9
Cycling network	8
Free parking	7
Nothing required	6
Traffic signs	5
Pedestrian safety	5
Park-and-ride	5
On-street parking	5
Bowen-Dufferin intersection	5
Traffic calming	4
Restrict parking	4
Residents' only parking	4
Reduce speed limits	4
Reduce Dufferin speed limits	4
Free hospital parking	4
Express bus	4
Dufferin volume	4
Bylaw enforcement	4
Boundary cycling lane dangerous	4
Turning lanes	3
Transit integration	3
Traffic enforcement	2
Road maintenance	2
Relocate hospital	2
Reduce on-street parking	2
Okay	2
Hospital entrance bus stop	2
Dufferin Safety	2
Crescent View	2
Congestion	2
Wider roads	1
Westhill-Dufferin intersection	1
Upset residents	1
Turning lights	1

Transit shelters	1
Traffic circle	1
Townsite volume	1
Townsite	1
Street lighting	1
Strathmore	1
Stephenson Point	1
Restrict parking at curves	1
Restrict on-street parking	1
Remove cycling lanes	1
Pedestrian network	1
Pedestrian intersections	1
Parkway access	1
New residential developments	1
Manage on-street parking	1
Light rail train	1
Improve cycling network	1
Hospital turning lanes	1
Hospital taxi stand	1
Hospital signage	1
Hospital drop-off parking	1
Hammond Bay	1
Enforce speed limits	1
Dufferin-Waddington intersection	1
Divert traffic	1
Departure Bay	1
Cycling safety	1
Car pools	1

Transit Network
Q19. Does the transit network meet your needs for travel to and from the hospital area?

Out of the 343 respondents, 151 (44.02%) answered that the transit network does not meet their needs for travel to and from hospital area. 58 (16.9%) answered yes while 134 (39%) responded "other"



How to Improve the Transit Network serving the Hospital Area
Q20. What could be done to improve the transit network serving the hospital area?

This question was answered by 214 respondents. The top three phrases with the highest number of mentions were "increase the frequency" at 58 times, "increase service hours" at 34 times and "match transit schedule to hospital staff schedules" at 30. The phrase "improve routes" appeared 21 times and is the fourth most mentioned phrase in the responses to this question. The comment "create a hospital express" was mentioned 20 times. Full summary is provided below.

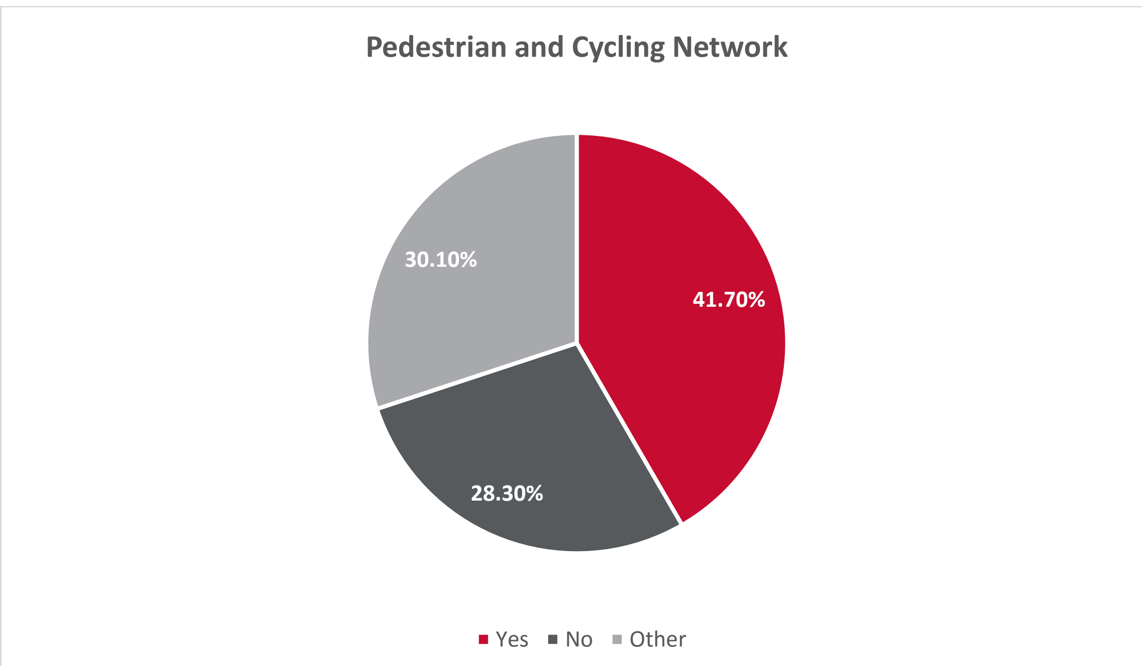
Topic	Number of mentions
Increase the frequency	58
Increase the service hours	34
Match transit schedule to hospital staff schedules	30
Improve routes	21
Create a hospital express	20
Improve the service	10
Expand network	8
Park-and-Ride	7
Hospital stop	6
Good as it is	4
Improve the road network	4
Train	5
Transit incentives	4
Improve cycling infrastructure	3
Smaller buses	3

Bus stops	2
Reliability	2
Bicycle parking	1
Make transit free	1
Hospital shifts	1
On time	1
Service	1

Pedestrian and Cycling Network in the Hospital Area

Q21. Does the pedestrian and cycling network meet your needs for active transportation in the hospital area?

Out of the 336 respondents, 140 (41.5%) feel the pedestrian and cycling network meet their needs for active transportation in the hospital area while 95 (28.3%) do not. 101 (30.1%) answered "other" to this question.



How to Improve Use and Safety of Pedestrian and Cycling Network in the Hospital Area

Q22. What could be done to improve the use and safety of the pedestrian and cycling network in the hospital area?

This question was answered by 232 survey participants. The phrase that had the highest number of mentions was "cycling lanes" and it appeared 62 times. "Crosswalks" was the word with the second highest number of mentions appearing 35 times while "sidewalks" appeared 31 times and stood third in number of mentions. The terms "Dufferin", "Intersection Safety" and boundary cycling dangerous" were mentioned 23, 20 and 13 times respectively. A full summary is provided below.

Topic	Number of mentions
Cycling lanes	62
Crosswalks	35
Sidewalks	31
Dufferin	23
Intersection safety	20
Boundary cycling dangerous	13
Street lighting	11
Bylaw enforcement	10
Good	8
Traffic enforcement	8
Bike parking	5
Bike storage	5
Reduce speeds	5
Education	4
Limit cycling	3
Meredith	3
Personal safety	3
Traffic calming	3
Traffic signs	3
Widen roads	5
Crescent View	2
Grant	2
Island Highway	8
Nelson	2
Northfield	2
Park trails	4
Pedestrian signs	2
Waddington	2
Beaufort Park	1
Bowen	1
Clean underpasses	1
Control traffic	1
Cycling infrastructure	1
Free hospital parking	1
Hammond Bay	1
Hospital parkade	1
Hospital paths	1
Hospital skywalk	1
Improve transit	2
Maintenance	1
New pedestrian underpass	1
Police	1
Residents' parking	1
Seafield	1
Slower speeds	1
Townsite	1

Issues or Opportunities in the Hospital Area

Q23. Are there any issues or opportunities in the Hospital Area that you would like to identify?

This question was answered by 215 respondents. The words with the highest number of mentions were "more parking" appearing 116 times. "Safety" was the second most mentioned word and it appeared 16 times. Respondents also mentioned "busy traffic" 11 times. "Intersection (Northfield/Boundary), others" "sidewalks" were mentioned 9 and 8 times respectively. A full summary is provided below.

Topic	Number of mentions
More parking	116
Safety	16
Hospital growth/ improvements	14
Use empty space in area	13
Busy traffic	11
Social problems (substance abuse/mental health)	10
Intersection (Northfield/Boundary), others	9
Sidewalks	8
No smoking/ Designated smoking areas	8
Crosswalks	7
Reduce crime	6
Speeding control	6
Healthcare services	6
Police/security presence	5
More greenspace	5
Establish a good plan	4
Roads	4
Walkability	4
Community police station	3
Retain community feel to neighbourhood	3
Signage	3
Restaurants	3
Food trucks	2
Wheelchair accessibility	2
Improve relationship between residents and hospital	2
More trees/protect trees	2
Improve visibility	2
Bike friendly	2
Parks/trails maintenance	2
Keep schools from closing	1
Rats	1
Limit density	1
Remove bike lanes	1
Condo development	1
Snow removal	1
Wellness services	1
Monitor scooter users	1
Public washrooms	1
Emergency services (fire/earthquake)	1

APPENDIX D

Network Improvements (2041) Mobility Performance

URBAN systems

6: Bowen Road & Dufferin Cres Performance by lane

Lane	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB	SB	All
Movements Served	L	TR	L	T	R	L	T	TR	L	T	TR	
Denied Del/Veh (s)												1.9
Total Del/Veh (s)	29.6	22.9	42.8	19.4	9.2	33.5	31.9	29.8	35.8	31.1	34.0	29.9

10: Waddington Road & Dufferin Cres Performance by lane

Lane	EB	NB	SB	All
Movements Served	LR	LT	TR	
Denied Del/Veh (s)				2.1
Total Del/Veh (s)	5.5	4.0	5.5	5.0

17: Townsite Road & Boundary Cres Performance by lane

Lane	EB	WB	WB	SB	All
Movements Served	LT	T	R	LR	
Denied Del/Veh (s)					0.9
Total Del/Veh (s)	6.3	6.6	0.9	7.5	5.8

20: Boundary Ave & Meredith Road/Strathmore St Performance by lane

Lane	EB	EB	WB	WB	NB	NB	SB	SB	All
Movements Served	L	TR	L	TR	L	TR	L	TR	
Denied Del/Veh (s)									0.5
Total Del/Veh (s)	15.1	9.6	14.3	9.2	16.8	7.5	9.8	8.3	9.4

21: Boundary Cres/Boundary Ave & Dufferin Cres Performance by lane

Lane	EB	EB	WB	WB	NB	NB	SB	SB	All
Movements Served	L	TR	L	TR	L	TR	L	TR	
Denied Del/Veh (s)									0.4
Total Del/Veh (s)	12.3	8.9	12.3	6.8	13.5	6.6	13.1	9.1	8.9

Total Zone Performance

Denied Del/Veh (s)	1.8
Total Del/Veh (s)	265.8

Intersection: 6: Bowen Road & Dufferin Cres

Movement	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	TR	L	T	R	L	T	TR	L	T	TR
Maximum Queue (m)	52.6	86.5	70.9	43.2	49.7	108.6	111.8	112.2	89.8	104.6	104.7
Average Queue (m)	17.3	40.4	34.1	17.2	19.7	36.9	64.5	58.6	48.5	62.1	66.2
95th Queue (m)	40.7	72.7	59.2	33.9	38.5	82.4	102.9	101.6	91.7	103.2	107.7
Link Distance (m)		170.7		137.5	137.5						
Upstream Blk Time (%)											
Queuing Penalty (veh)											
Storage Bay Dist (m)	67.0		80.0			110.0			75.0		
Storage Blk Time (%)		2	0			0	1		3	7	
Queuing Penalty (veh)		2	0			1	3		11	21	

Intersection: 10: Waddington Road & Dufferin Cres

Movement	EB	NB	SB
Directions Served	LR	LT	TR
Maximum Queue (m)	38.3	17.4	50.8
Average Queue (m)	17.2	7.8	20.4
95th Queue (m)	30.2	13.6	37.7
Link Distance (m)	714.0		
Upstream Blk Time (%)		40	
Queuing Penalty (veh)		0	
Storage Bay Dist (m)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 17: Townsite Road & Boundary Cres

Movement	EB	WB	WB	SB
Directions Served	LT	T	R	LR
Maximum Queue (m)	36.1	31.7	3.4	32.6
Average Queue (m)	16.2	15.7	0.2	15.5
95th Queue (m)	30.7	25.9	3.5	27.5
Link Distance (m)				
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (m)			36.3	
Storage Blk Time (%)		0		
Queuing Penalty (veh)		0		

Intersection: 20: Boundary Ave & Meredith Road/Strathmore St

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (m)	17.1	33.4	20.0	36.3	32.4	29.8	22.8	51.0
Average Queue (m)	5.6	15.4	5.3	14.3	11.4	12.8	5.7	23.9
95th Queue (m)	15.0	27.9	14.7	28.8	24.4	24.0	16.2	42.2
Link Distance (m)						539.7		139.6
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (m)	56.9		38.8		47.5		31.2	
Storage Blk Time (%)				0				2
Queuing Penalty (veh)				0				1

Intersection: 21: Boundary Cres/Boundary Ave & Dufferin Cres

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (m)	29.0	34.4	17.7	40.4	19.3	34.6	36.2	30.8
Average Queue (m)	9.0	15.7	6.6	17.2	6.3	15.1	16.9	14.8
95th Queue (m)	21.5	29.0	15.9	31.5	15.7	27.8	30.8	27.8
Link Distance (m)				714.0				539.7
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (m)	24.0		30.0		35.6		35.7	
Storage Blk Time (%)	1	1	0	1		0	1	0
Queuing Penalty (veh)	1	1	0	0		0	1	0

Zone Summary

Zone wide Queuing Penalty: 45

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	91	143	185	190	116	215	220	777	73	280	720	148
Future Volume (veh/h)	91	143	185	190	116	215	220	777	73	280	720	148
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1861	1900	1900	1863	1863	1881	1845	1900	1863	1848	1900
Adj Flow Rate, veh/h	102	181	226	207	153	276	324	959	94	304	783	161
Adj No. of Lanes	1	1	0	1	1	1	1	2	0	1	2	0
Peak Hour Factor	0.89	0.79	0.82	0.92	0.76	0.78	0.68	0.81	0.78	0.92	0.92	0.92
Percent Heavy Veh, %	2	1	1	0	2	2	1	3	3	2	3	3
Cap, veh/h	356	261	327	220	646	549	372	1044	102	337	914	188
Arrive On Green	0.35	0.35	0.35	0.35	0.35	0.35	0.14	0.32	0.32	0.13	0.31	0.31
Sat Flow, veh/h	955	754	941	994	1863	1583	1792	3225	316	1774	2901	597
Grp Volume(v), veh/h	102	0	407	207	153	276	324	521	532	304	474	470
Grp Sat Flow(s),veh/h/ln	955	0	1695	994	1863	1583	1792	1752	1789	1774	1755	1742
Q Serve(g_s), s	7.7	0.0	18.6	12.6	5.3	12.4	10.8	25.7	25.7	10.3	22.8	22.8
Cycle Q Clear(g_c), s	12.9	0.0	18.6	31.2	5.3	12.4	10.8	25.7	25.7	10.3	22.8	22.8
Prop In Lane	1.00		0.56	1.00		1.00	1.00		0.18	1.00		0.34
Lane Grp Cap(c), veh/h	356	0	588	220	646	549	372	568	579	337	553	549
V/C Ratio(X)	0.29	0.00	0.69	0.94	0.24	0.50	0.87	0.92	0.92	0.90	0.86	0.86
Avail Cap(c_a), veh/h	356	0	588	220	646	549	376	571	583	337	553	549
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	25.5	0.0	25.2	40.7	20.9	23.2	20.3	29.3	29.3	20.9	28.9	28.9
Incr Delay (d2), s/veh	0.4	0.0	3.5	44.6	0.2	0.7	18.9	19.9	19.6	25.9	12.7	12.8
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.1	0.0	9.3	7.8	2.7	5.5	7.2	15.6	15.9	7.4	13.0	12.9
LnGrp Delay(d),s/veh	25.9	0.0	28.7	85.3	21.1	23.9	39.2	49.2	48.9	46.8	41.6	41.7
LnGrp LOS	C		C	F	C	C	D	D	D	D	D	D
Approach Vol, veh/h		509			636			1377			1248	
Approach Delay, s/veh		28.1			43.2			46.7			42.9	
Approach LOS		C			D			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	18.0	34.8		37.1	18.8	34.0		37.1
Change Period (Y+Rc), s	6.0	* 5.7		5.9	6.0	* 5.7		* 5.9
Max Green Setting (Gmax), s	12.0	* 29		31.1	13.0	* 28		* 31
Max Q Clear Time (g_c+I1), s	12.3	27.7		20.6	12.8	24.8		33.2
Green Ext Time (p_c), s	0.0	1.4		4.7	0.0	2.9		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	42.3
HCM 2010 LOS	D

Notes

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	48	114	174	193	282	173
Future Volume (veh/h)	48	114	174	193	282	173
Number	7	14	5	2	6	16
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1800	1900	1900	1855	1889	1900
Adj Flow Rate, veh/h	83	142	193	272	310	208
Adj No. of Lanes	0	0	0	1	1	0
Peak Hour Factor	0.58	0.80	0.90	0.71	0.91	0.83
Percent Heavy Veh, %	0	0	2	2	1	1
Cap, veh/h	111	190	344	436	616	413
Arrive On Green	0.19	0.19	0.58	0.58	0.58	0.58
Sat Flow, veh/h	586	1002	370	746	1056	708
Grp Volume(v), veh/h	226	0	465	0	0	518
Grp Sat Flow(s),veh/h/ln	1594	0	1117	0	0	1764
Q Serve(g_s), s	5.3	0.0	7.1	0.0	0.0	6.9
Cycle Q Clear(g_c), s	5.3	0.0	13.9	0.0	0.0	6.9
Prop In Lane	0.37	0.63	0.42			0.40
Lane Grp Cap(c), veh/h	303	0	780	0	0	1030
V/C Ratio(X)	0.75	0.00	0.60	0.00	0.00	0.50
Avail Cap(c_a), veh/h	722	0	1092	0	0	1464
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.00	0.00	1.00
Uniform Delay (d), s/veh	15.2	0.0	6.4	0.0	0.0	4.9
Incr Delay (d2), s/veh	3.7	0.0	0.7	0.0	0.0	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.6	0.0	4.0	0.0	0.0	3.4
LnGrp Delay(d),s/veh	18.9	0.0	7.2	0.0	0.0	5.3
LnGrp LOS	B		A			A
Approach Vol, veh/h	226			465	518	
Approach Delay, s/veh	18.9			7.2	5.3	
Approach LOS	B			A	A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		
Phs Duration (G+Y+Rc), s		27.7		12.0		27.7		
Change Period (Y+Rc), s		4.5		4.5		4.5		
Max Green Setting (Gmax), s		33.0		18.0		33.0		
Max Q Clear Time (g_c+I1), s		15.9		7.3		8.9		
Green Ext Time (p_c), s		7.3		0.9		9.4		

Intersection Summary		
HCM 2010 Ctrl Delay		8.5
HCM 2010 LOS		A

Notes

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	16	245	278	142	166	24
Future Volume (veh/h)	16	245	278	142	166	24
Number	7	4	8	18	1	16
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1779	1863	1827	1836	1900
Adj Flow Rate, veh/h	27	345	302	0	218	32
Adj No. of Lanes	0	1	1	1	0	0
Peak Hour Factor	0.60	0.71	0.92	0.82	0.76	0.75
Percent Heavy Veh, %	6	6	2	4	0	0
Cap, veh/h	174	667	739	616	374	55
Arrive On Green	0.40	0.40	0.40	0.00	0.25	0.25
Sat Flow, veh/h	56	1681	1863	1553	1496	220
Grp Volume(v), veh/h	372	0	302	0	251	0
Grp Sat Flow(s),veh/h/ln	1738	0	1863	1553	1722	0
Q Serve(g_s), s	0.0	0.0	3.0	0.0	3.3	0.0
Cycle Q Clear(g_c), s	4.1	0.0	3.0	0.0	3.3	0.0
Prop In Lane	0.07			1.00	0.87	0.13
Lane Grp Cap(c), veh/h	841	0	739	616	430	0
V/C Ratio(X)	0.44	0.00	0.41	0.00	0.58	0.00
Avail Cap(c_a), veh/h	1366	0	1318	1099	1219	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.00	1.00	0.00
Uniform Delay (d), s/veh	5.9	0.0	5.5	0.0	8.4	0.0
Incr Delay (d2), s/veh	0.4	0.0	0.4	0.0	1.3	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.0	0.0	1.6	0.0	1.7	0.0
LnGrp Delay(d),s/veh	6.2	0.0	5.9	0.0	9.6	0.0
LnGrp LOS	A		A		A	
Approach Vol, veh/h		372	302		251	
Approach Delay, s/veh		6.2	5.9		9.6	
Approach LOS		A	A		A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4		6		8
Phs Duration (G+Y+Rc), s				14.6		10.9		14.6
Change Period (Y+Rc), s				4.5		4.5		4.5
Max Green Setting (Gmax), s				18.0		18.0		18.0
Max Q Clear Time (g_c+I1), s				6.1		5.3		5.0
Green Ext Time (p_c), s				4.1		1.1		3.4

Intersection Summary	
HCM 2010 Ctrl Delay	7.0
HCM 2010 LOS	A

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	33	109	29	28	92	89	72	175	16	37	362	29
Future Volume (veh/h)	33	109	29	28	92	89	72	175	16	37	362	29
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1750	1900	1900	1859	1900	1792	1866	1900	1900	1866	1900
Adj Flow Rate, veh/h	50	124	39	58	177	146	80	206	21	58	447	48
Adj No. of Lanes	1	1	0	1	1	0	1	1	0	1	1	0
Peak Hour Factor	0.66	0.88	0.74	0.48	0.52	0.61	0.90	0.85	0.75	0.64	0.81	0.61
Percent Heavy Veh, %	0	10	10	0	4	4	6	2	2	0	2	2
Cap, veh/h	354	411	129	486	304	251	370	721	74	590	717	77
Arrive On Green	0.32	0.32	0.32	0.32	0.32	0.32	0.43	0.43	0.43	0.43	0.43	0.43
Sat Flow, veh/h	1074	1277	402	1242	944	778	865	1666	170	1172	1657	178
Grp Volume(v), veh/h	50	0	163	58	0	323	80	0	227	58	0	495
Grp Sat Flow(s),veh/h/ln	1074	0	1679	1242	0	1722	865	0	1836	1172	0	1835
Q Serve(g_s), s	1.7	0.0	3.0	1.5	0.0	6.4	3.2	0.0	3.3	1.4	0.0	8.5
Cycle Q Clear(g_c), s	8.1	0.0	3.0	4.5	0.0	6.4	11.8	0.0	3.3	4.6	0.0	8.5
Prop In Lane	1.00		0.24	1.00		0.45	1.00		0.09	1.00		0.10
Lane Grp Cap(c), veh/h	354	0	541	486	0	554	370	0	795	590	0	794
V/C Ratio(X)	0.14	0.00	0.30	0.12	0.00	0.58	0.22	0.00	0.29	0.10	0.00	0.62
Avail Cap(c_a), veh/h	666	0	1029	847	0	1055	525	0	1125	801	0	1124
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	14.9	0.0	10.4	12.1	0.0	11.5	13.6	0.0	7.5	9.0	0.0	9.0
Incr Delay (d2), s/veh	0.2	0.0	0.3	0.1	0.0	1.0	0.4	0.0	0.2	0.1	0.0	1.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.5	0.0	1.4	0.5	0.0	3.1	0.8	0.0	1.7	0.4	0.0	4.5
LnGrp Delay(d),s/veh	15.1	0.0	10.7	12.2	0.0	12.5	13.9	0.0	7.7	9.1	0.0	10.0
LnGrp LOS	B		B	B		B	B		A	A		A
Approach Vol, veh/h		213			381			307			553	
Approach Delay, s/veh		11.7			12.5			9.3			9.9	
Approach LOS		B			B			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		22.7		18.1		22.7		18.1
Change Period (Y+Rc), s		5.0		5.0		5.0		5.0
Max Green Setting (Gmax), s		25.0		25.0		25.0		25.0
Max Q Clear Time (g_c+I1), s		13.8		10.1		10.5		8.4
Green Ext Time (p_c), s		3.0		2.2		7.1		4.8

Intersection Summary	
HCM 2010 Ctrl Delay	10.7
HCM 2010 LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	52	130	59	42	145	50	35	126	87	147	138	58
Future Volume (veh/h)	52	130	59	42	145	50	35	126	87	147	138	58
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1727	1886	1900	1845	1779	1900	1900	1802	1900	1827	1876	1900
Adj Flow Rate, veh/h	69	210	81	58	181	74	47	143	107	177	175	67
Adj No. of Lanes	1	1	0	1	1	0	1	1	0	1	1	0
Peak Hour Factor	0.75	0.62	0.73	0.73	0.80	0.68	0.75	0.88	0.81	0.83	0.79	0.87
Percent Heavy Veh, %	10	1	1	3	3	3	0	5	5	4	1	1
Cap, veh/h	407	440	170	404	408	167	535	386	289	506	521	200
Arrive On Green	0.34	0.34	0.34	0.34	0.34	0.34	0.40	0.40	0.40	0.40	0.40	0.40
Sat Flow, veh/h	1039	1298	500	1073	1202	491	1156	958	717	1103	1293	495
Grp Volume(v), veh/h	69	0	291	58	0	255	47	0	250	177	0	242
Grp Sat Flow(s),veh/h/ln	1039	0	1798	1073	0	1693	1156	0	1676	1103	0	1789
Q Serve(g_s), s	2.3	0.0	5.2	1.8	0.0	4.8	1.2	0.0	4.3	5.5	0.0	3.8
Cycle Q Clear(g_c), s	7.0	0.0	5.2	7.0	0.0	4.8	5.0	0.0	4.3	9.7	0.0	3.8
Prop In Lane	1.00		0.28	1.00		0.29	1.00		0.43	1.00		0.28
Lane Grp Cap(c), veh/h	407	0	610	404	0	574	535	0	675	506	0	721
V/C Ratio(X)	0.17	0.00	0.48	0.14	0.00	0.44	0.09	0.00	0.37	0.35	0.00	0.34
Avail Cap(c_a), veh/h	784	0	1262	793	0	1188	945	0	1271	898	0	1356
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	13.2	0.0	10.6	13.4	0.0	10.5	10.1	0.0	8.5	11.9	0.0	8.4
Incr Delay (d2), s/veh	0.2	0.0	0.6	0.2	0.0	0.5	0.1	0.0	0.3	0.4	0.0	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.7	0.0	2.7	0.5	0.0	2.3	0.4	0.0	2.0	1.7	0.0	1.9
LnGrp Delay(d),s/veh	13.4	0.0	11.2	13.5	0.0	11.0	10.2	0.0	8.9	12.4	0.0	8.7
LnGrp LOS	B		B	B		B	B		A	B		A
Approach Vol, veh/h		360			313			297			419	
Approach Delay, s/veh		11.6			11.5			9.1			10.2	
Approach LOS		B			B			A			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		21.5		19.2		21.5		19.2
Change Period (Y+Rc), s		* 5.1		5.4		* 5.1		5.4
Max Green Setting (Gmax), s		* 31		28.6		* 31		28.6
Max Q Clear Time (g_c+I1), s		7.0		9.0		11.7		9.0
Green Ext Time (p_c), s		4.4		4.8		4.7		4.1

Intersection Summary		
HCM 2010 Ctrl Delay		10.6
HCM 2010 LOS		B

Notes

6: Bowen Road & Dufferin Cres Performance by lane

Lane	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB	SB	All
Movements Served	L	TR	L	T	R	L	T	TR	L	T	TR	
Denied Del/Veh (s)												115.5
Total Del/Veh (s)	53.4	57.2	38.6	28.7	27.7	49.4	70.0	77.2	45.8	66.5	82.7	60.8

10: Waddington Road & Dufferin Cres Performance by lane

Lane	EB	NB	SB	All
Movements Served	LR	LT	TR	
Denied Del/Veh (s)				2.7
Total Del/Veh (s)	12.2	5.2	7.6	8.5

17: Townsite Road & Boundary Cres Performance by lane

Lane	EB	WB	WB	SB	All
Movements Served	LT	T	R	LR	
Denied Del/Veh (s)					0.9
Total Del/Veh (s)	8.1	7.1	0.9	8.9	6.9

20: Boundary Ave & Meredith Road/Strathmore St Performance by lane

Lane	EB	EB	WB	WB	NB	NB	SB	SB	All
Movements Served	L	TR	L	TR	L	TR	L	TR	
Denied Del/Veh (s)									0.5
Total Del/Veh (s)	13.0	7.7	14.6	9.4	11.2	9.3	11.3	5.9	8.9

21: Boundary Cres/Boundary Ave & Dufferin Cres Performance by lane

Lane	EB	EB	WB	WB	NB	NB	SB	SB	All
Movements Served	L	TR	L	TR	L	TR	L	TR	
Denied Del/Veh (s)									0.8
Total Del/Veh (s)	18.6	10.5	15.9	12.1	19.1	12.1	17.8	13.5	13.3

Total Zone Performance

Denied Del/Veh (s)	70.3
Total Del/Veh (s)	2201.2

Intersection: 6: Bowen Road & Dufferin Cres

Movement	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	TR	L	T	R	L	T	TR	L	T	TR
Maximum Queue (m)	81.9	177.4	62.6	74.9	78.1	116.6	124.4	125.2	89.9	107.4	111.1
Average Queue (m)	56.8	105.5	26.7	33.6	41.1	102.4	116.1	116.1	71.9	101.2	102.1
95th Queue (m)	98.8	188.3	48.4	59.4	67.8	148.5	125.0	125.1	114.7	107.0	105.5
Link Distance (m)		170.7		139.5	139.5						
Upstream Blk Time (%)		10									
Queuing Penalty (veh)		0									
Storage Bay Dist (m)	67.0		80.0			110.0			75.0		
Storage Blk Time (%)	1	31		0		2	47		2	55	
Queuing Penalty (veh)	7	56		0		12	150		11	119	

Intersection: 10: Waddington Road & Dufferin Cres

Movement	EB	NB	SB
Directions Served	LR	LT	TR
Maximum Queue (m)	60.9	17.0	60.2
Average Queue (m)	28.8	6.9	22.6
95th Queue (m)	49.3	11.1	40.3
Link Distance (m)	713.4		
Upstream Blk Time (%)		43	
Queuing Penalty (veh)		0	
Storage Bay Dist (m)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 17: Townsite Road & Boundary Cres

Movement	EB	WB	SB
Directions Served	LT	T	LR
Maximum Queue (m)	54.2	37.7	36.3
Average Queue (m)	19.6	17.5	19.3
95th Queue (m)	38.0	30.9	31.5
Link Distance (m)			
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (m)			
Storage Blk Time (%)		0	
Queuing Penalty (veh)		0	

Intersection: 20: Boundary Ave & Meredith Road/Strathmore St

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (m)	14.1	27.7	9.7	26.2	37.2	48.2	17.4	35.7
Average Queue (m)	4.5	13.3	2.6	11.7	16.6	20.9	4.6	14.2
95th Queue (m)	12.6	23.1	8.9	22.8	30.2	38.1	13.5	27.7
Link Distance (m)						539.3		139.6
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (m)	56.9		38.8		47.5		31.2	
Storage Blk Time (%)					0	0		0
Queuing Penalty (veh)					0	0		0

Intersection: 21: Boundary Cres/Boundary Ave & Dufferin Cres

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (m)	29.2	48.2	44.7	55.0	23.4	50.6	42.4	52.3
Average Queue (m)	13.0	21.6	13.9	27.5	9.0	21.4	14.9	25.3
95th Queue (m)	23.2	39.2	29.6	47.8	19.1	38.3	30.8	44.1
Link Distance (m)				713.4				539.3
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (m)	24.0		30.0		35.6		35.7	
Storage Blk Time (%)	0	5	0	5		1	0	2
Queuing Penalty (veh)	1	4	2	5		1	1	2

Zone Summary

Zone wide Queuing Penalty: 370

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	180	178	328	150	206	286	316	1083	109	217	900	231
Future Volume (veh/h)	180	178	328	150	206	286	316	1083	109	217	900	231
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1881	1863	1900	1881	1845	1900	1881	1850	1900	1863	1852	1900
Adj Flow Rate, veh/h	212	202	364	172	234	318	340	1116	135	247	1084	266
Adj No. of Lanes	1	1	0	1	1	1	1	2	0	1	2	0
Peak Hour Factor	0.85	0.88	0.90	0.87	0.88	0.90	0.93	0.97	0.81	0.88	0.83	0.87
Percent Heavy Veh, %	1	2	2	1	3	0	1	3	3	2	3	3
Cap, veh/h	311	226	407	114	697	611	379	1086	131	288	825	201
Arrive On Green	0.38	0.38	0.38	0.38	0.38	0.38	0.18	0.34	0.34	0.13	0.29	0.29
Sat Flow, veh/h	861	597	1076	850	1845	1615	1792	3160	382	1774	2806	684
Grp Volume(v), veh/h	212	0	566	172	234	318	340	620	631	247	677	673
Grp Sat Flow(s),veh/h/ln	861	0	1673	850	1845	1615	1792	1758	1783	1774	1759	1731
Q Serve(g_s), s	26.6	0.0	36.3	6.9	10.3	17.4	17.1	39.3	39.3	11.4	33.6	33.6
Cycle Q Clear(g_c), s	36.9	0.0	36.3	43.2	10.3	17.4	17.1	39.3	39.3	11.4	33.6	33.6
Prop In Lane	1.00		0.64	1.00		1.00	1.00		0.21	1.00		0.40
Lane Grp Cap(c), veh/h	311	0	632	114	697	611	379	604	613	288	517	509
V/C Ratio(X)	0.68	0.00	0.89	1.51	0.34	0.52	0.90	1.03	1.03	0.86	1.31	1.32
Avail Cap(c_a), veh/h	311	0	632	114	697	611	471	604	613	467	517	509
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	38.5	0.0	33.4	55.6	25.3	27.5	33.4	37.5	37.5	30.2	40.3	40.3
Incr Delay (d2), s/veh	6.0	0.0	15.3	268.5	0.3	0.8	17.0	43.4	44.0	8.7	152.5	158.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.8	0.0	19.4	12.1	5.3	7.9	12.2	26.3	26.7	8.3	38.1	38.3
LnGrp Delay(d),s/veh	44.4	0.0	48.7	324.1	25.6	28.3	50.4	80.9	81.5	39.0	192.8	198.5
LnGrp LOS	D		D	F	C	C	D	F	F	D	F	F
Approach Vol, veh/h		778			724			1591			1597	
Approach Delay, s/veh		47.5			97.7			74.6			171.4	
Approach LOS		D			F			E			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	20.2	45.0		49.1	25.9	39.3		49.1
Change Period (Y+Rc), s	* 5.7	* 5.7		5.9	* 5.7	* 5.7		* 5.9
Max Green Setting (Gmax), s	* 26	* 34		43.1	* 26	* 34		* 43
Max Q Clear Time (g_c+I1), s	13.4	41.3		38.9	19.1	35.6		45.2
Green Ext Time (p_c), s	1.1	0.0		3.0	1.1	0.0		0.0

Intersection Summary			
HCM 2010 Ctrl Delay			106.6
HCM 2010 LOS			F

Notes

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	109	272	115	182	298	85
Future Volume (veh/h)	109	272	115	182	298	85
Number	7	14	5	2	6	16
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1881	1900	1900	1873	1871	1900
Adj Flow Rate, veh/h	124	316	155	196	387	112
Adj No. of Lanes	0	0	0	1	1	0
Peak Hour Factor	0.88	0.86	0.74	0.93	0.77	0.76
Percent Heavy Veh, %	0	0	1	1	2	2
Cap, veh/h	148	376	274	306	673	195
Arrive On Green	0.32	0.32	0.48	0.48	0.48	0.48
Sat Flow, veh/h	464	1182	329	634	1396	404
Grp Volume(v), veh/h	441	0	351	0	0	499
Grp Sat Flow(s),veh/h/ln	1649	0	963	0	0	1800
Q Serve(g_s), s	11.2	0.0	7.2	0.0	0.0	9.0
Cycle Q Clear(g_c), s	11.2	0.0	16.2	0.0	0.0	9.0
Prop In Lane	0.28	0.72	0.44			0.22
Lane Grp Cap(c), veh/h	525	0	580	0	0	868
V/C Ratio(X)	0.84	0.00	0.61	0.00	0.00	0.57
Avail Cap(c_a), veh/h	657	0	754	0	0	1116
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.00	0.00	1.00
Uniform Delay (d), s/veh	14.3	0.0	10.8	0.0	0.0	8.4
Incr Delay (d2), s/veh	7.9	0.0	1.0	0.0	0.0	0.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.2	0.0	4.0	0.0	0.0	4.4
LnGrp Delay(d),s/veh	22.2	0.0	11.8	0.0	0.0	9.0
LnGrp LOS	C		B			A
Approach Vol, veh/h	441			351	499	
Approach Delay, s/veh	22.2			11.8	9.0	
Approach LOS	C			B	A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		
Phs Duration (G+Y+Rc), s		26.3		18.9		26.3		
Change Period (Y+Rc), s		4.5		4.5		4.5		
Max Green Setting (Gmax), s		28.0		18.0		28.0		
Max Q Clear Time (g_c+I1), s		18.2		13.2		11.0		
Green Ext Time (p_c), s		3.6		1.2		7.2		

Intersection Summary		
HCM 2010 Ctrl Delay		14.3
HCM 2010 LOS		B

Notes

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	27	269	309	149	213	25
Future Volume (veh/h)	27	269	309	149	213	25
Number	7	4	8	18	1	16
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1883	1845	1827	1854	1900
Adj Flow Rate, veh/h	31	408	364	0	245	47
Adj No. of Lanes	0	1	1	1	0	0
Peak Hour Factor	0.86	0.66	0.85	0.89	0.87	0.53
Percent Heavy Veh, %	1	1	3	4	0	0
Cap, veh/h	162	733	762	641	386	74
Arrive On Green	0.41	0.41	0.41	0.00	0.27	0.27
Sat Flow, veh/h	59	1774	1845	1553	1449	278
Grp Volume(v), veh/h	439	0	364	0	293	0
Grp Sat Flow(s),veh/h/ln	1833	0	1845	1553	1732	0
Q Serve(g_s), s	0.0	0.0	4.0	0.0	4.2	0.0
Cycle Q Clear(g_c), s	5.0	0.0	4.0	0.0	4.2	0.0
Prop In Lane	0.07			1.00	0.84	0.16
Lane Grp Cap(c), veh/h	895	0	762	641	461	0
V/C Ratio(X)	0.49	0.00	0.48	0.00	0.64	0.00
Avail Cap(c_a), veh/h	1301	0	1184	996	1112	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.00	1.00	0.00
Uniform Delay (d), s/veh	6.3	0.0	6.0	0.0	9.1	0.0
Incr Delay (d2), s/veh	0.4	0.0	0.5	0.0	1.5	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.7	0.0	2.1	0.0	2.1	0.0
LnGrp Delay(d),s/veh	6.7	0.0	6.5	0.0	10.5	0.0
LnGrp LOS	A		A		B	
Approach Vol, veh/h		439	364		293	
Approach Delay, s/veh		6.7	6.5		10.5	
Approach LOS		A	A		B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs				4		6		8
Phs Duration (G+Y+Rc), s				16.1		12.0		16.1
Change Period (Y+Rc), s				4.5		4.5		4.5
Max Green Setting (Gmax), s				18.0		18.0		18.0
Max Q Clear Time (g_c+I1), s				7.0		6.2		6.0
Green Ext Time (p_c), s				4.6		1.3		4.0

Intersection Summary	
HCM 2010 Ctrl Delay	7.7
HCM 2010 LOS	A

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	21	63	77	15	100	25	167	358	13	28	198	20
Future Volume (veh/h)	21	63	77	15	100	25	167	358	13	28	198	20
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1883	1900	1900	1842	1900	1900	1900	1900	1900	1883	1900
Adj Flow Rate, veh/h	26	79	101	33	152	42	261	426	16	42	264	32
Adj No. of Lanes	1	1	0	1	1	0	1	1	0	1	1	0
Peak Hour Factor	0.80	0.80	0.76	0.46	0.66	0.59	0.64	0.84	0.83	0.66	0.75	0.63
Percent Heavy Veh, %	0	2	2	0	4	4	0	0	0	0	1	1
Cap, veh/h	362	178	228	369	329	91	635	910	34	524	825	100
Arrive On Green	0.24	0.24	0.24	0.24	0.24	0.24	0.50	0.50	0.50	0.50	0.50	0.50
Sat Flow, veh/h	1208	752	962	1223	1390	384	1100	1820	68	962	1648	200
Grp Volume(v), veh/h	26	0	180	33	0	194	261	0	442	42	0	296
Grp Sat Flow(s),veh/h/ln	1208	0	1714	1223	0	1774	1100	0	1888	962	0	1848
Q Serve(g_s), s	0.7	0.0	3.4	0.9	0.0	3.6	7.0	0.0	5.8	1.1	0.0	3.6
Cycle Q Clear(g_c), s	4.3	0.0	3.4	4.3	0.0	3.6	10.7	0.0	5.8	6.9	0.0	3.6
Prop In Lane	1.00		0.56	1.00		0.22	1.00		0.04	1.00		0.11
Lane Grp Cap(c), veh/h	362	0	406	369	0	420	635	0	945	524	0	925
V/C Ratio(X)	0.07	0.00	0.44	0.09	0.00	0.46	0.41	0.00	0.47	0.08	0.00	0.32
Avail Cap(c_a), veh/h	870	0	1127	884	0	1167	779	0	1192	650	0	1167
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	14.3	0.0	12.4	14.2	0.0	12.4	8.8	0.0	6.2	8.5	0.0	5.7
Incr Delay (d2), s/veh	0.1	0.0	0.8	0.1	0.0	0.8	0.5	0.0	0.4	0.1	0.0	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	0.0	1.7	0.3	0.0	1.8	2.2	0.0	3.1	0.3	0.0	1.9
LnGrp Delay(d),s/veh	14.4	0.0	13.1	14.3	0.0	13.2	9.3	0.0	6.6	8.5	0.0	5.9
LnGrp LOS	B		B	B		B	A		A	A		A
Approach Vol, veh/h		206			227			703			338	
Approach Delay, s/veh		13.3			13.4			7.6			6.2	
Approach LOS		B			B			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		24.0		14.0		24.0		14.0
Change Period (Y+Rc), s		5.0		5.0		5.0		5.0
Max Green Setting (Gmax), s		24.0		25.0		24.0		25.0
Max Q Clear Time (g_c+I1), s		12.7		6.3		8.9		6.3
Green Ext Time (p_c), s		6.4		2.6		4.3		2.8

Intersection Summary	
HCM 2010 Ctrl Delay	9.0
HCM 2010 LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	83	169	109	90	237	130	55	174	57	85	194	85
Future Volume (veh/h)	83	169	109	90	237	130	55	174	57	85	194	85
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1881	1900	1900	1863	1900	1900	1871	1900	1792	1851	1900
Adj Flow Rate, veh/h	88	188	130	106	304	143	79	223	69	116	231	125
Adj No. of Lanes	1	1	0	1	1	0	1	1	0	1	1	0
Peak Hour Factor	0.94	0.90	0.84	0.85	0.78	0.91	0.70	0.78	0.83	0.73	0.84	0.68
Percent Heavy Veh, %	0	1	1	0	2	2	0	2	2	6	3	3
Cap, veh/h	349	427	295	450	493	232	370	514	159	411	424	229
Arrive On Green	0.41	0.41	0.41	0.41	0.41	0.41	0.37	0.37	0.37	0.37	0.37	0.37
Sat Flow, veh/h	958	1037	717	1078	1199	564	1042	1372	425	1042	1131	612
Grp Volume(v), veh/h	88	0	318	106	0	447	79	0	292	116	0	356
Grp Sat Flow(s),veh/h/ln	958	0	1755	1078	0	1763	1042	0	1797	1042	0	1743
Q Serve(g_s), s	3.9	0.0	6.4	3.8	0.0	9.8	3.2	0.0	6.0	4.6	0.0	7.9
Cycle Q Clear(g_c), s	13.7	0.0	6.4	10.2	0.0	9.8	11.0	0.0	6.0	10.5	0.0	7.9
Prop In Lane	1.00		0.41	1.00		0.32	1.00		0.24	1.00		0.35
Lane Grp Cap(c), veh/h	349	0	721	450	0	725	370	0	674	411	0	654
V/C Ratio(X)	0.25	0.00	0.44	0.24	0.00	0.62	0.21	0.00	0.43	0.28	0.00	0.54
Avail Cap(c_a), veh/h	533	0	1058	656	0	1063	614	0	1094	655	0	1062
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	16.8	0.0	10.4	14.1	0.0	11.4	16.4	0.0	11.5	15.4	0.0	12.1
Incr Delay (d2), s/veh	0.4	0.0	0.4	0.3	0.0	0.9	0.3	0.0	0.4	0.4	0.0	0.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.1	0.0	3.2	1.2	0.0	4.9	0.9	0.0	3.0	1.4	0.0	3.9
LnGrp Delay(d),s/veh	17.2	0.0	10.8	14.3	0.0	12.3	16.7	0.0	11.9	15.8	0.0	12.8
LnGrp LOS	B		B	B		B	B		B	B		B
Approach Vol, veh/h		406			553			371			472	
Approach Delay, s/veh		12.2			12.7			12.9			13.5	
Approach LOS		B			B			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		23.5		25.6		23.5		25.6
Change Period (Y+Rc), s		* 5.1		5.4		* 5.1		5.4
Max Green Setting (Gmax), s		* 30		29.6		* 30		29.6
Max Q Clear Time (g_c+I1), s		13.0		15.7		12.5		12.2
Green Ext Time (p_c), s		4.5		4.5		5.9		7.2

Intersection Summary	
HCM 2010 Ctrl Delay	12.8
HCM 2010 LOS	B

Notes