



**Utopia West Residential
Development
5103 Greenlane, Town of
Beamsville, Lincoln
Transportation Impact Study**

Paradigm Transportation Solutions Limited

October 2021
210236



Project Summary



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Utopia West Residential Development 5103 Greenlane, Town of Beamsville, Transportation Impact Study

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Executive Summary

Content

New Horizon developments retained Paradigm Transportation Solutions Limited (Paradigm) to conduct this Transportation Impact Assessment for a proposed Utopia West residential development located at 5103 Greenlane.

The purpose of this study is to determine the net impacts of the proposed development on the surrounding road network. The findings, conclusions and recommendations of this study are summarized below and outlined in detail in the body of the report.

Development Concept

The applicant proposes to develop the site to include:

- ▶ 302.4 m² (3255 sq.ft.) of ground-floor commercial space
- ▶ Up to 387 apartment condominium units.

Vehicle access is proposed via one all-turns site driveway connection to Greenlane.

Conclusions

Based on the investigations carried out, it is concluded that:

- ▶ **Existing Traffic Operations:** The study area intersections are operating with overall acceptable levels of service and within capacity.

The 95th percentile queue length in meters seems to be within the available storage limit for all the movements except for the eastbound left turn movement which exceeds the storage lane length by around 45m during the AM peak hour.

- ▶ **Site Generated Traffic:** The site is forecast to generate a total of 142 AM peak hour trips and 182 PM peak hour trips.
- ▶ **2026 Background Traffic Operations:** The study area intersections are forecast to operate at overall acceptable levels of service and within capacity except for the critical movement-eastbound left turn at Greenlane and Ontario Street intersection which is forecast to operate at LOS E with a v/c ratio of 0.92 during the AM peak hour.

The 95th percentile queue length in meters seems to be within the available storage limit for all the movements except for the



eastbound left turn movement which exceeds the storage lane length by around 60m during the AM peak hour.

- ▶ **2031 Background Traffic Operations:** The study area intersections are forecast to operate at overall acceptable levels of service and within capacity except for the critical movement-eastbound left turn at Greenlane and Ontario Street intersection which is forecast to operate at LOS F with a v/c ratio of greater than 1.00 during the AM peak hour.

The 95th percentile queue length in meters seems to be within the available storage limit for all the movements except for the eastbound left turn movement which exceeds the storage lane length by around 70m during the AM peak hour.

- ▶ **2026 Future Total Traffic Operations:** The study area intersections are forecast to operate at overall acceptable levels of service and within capacity except for the critical movement-eastbound left turn at Greenlane and Ontario Street intersection which is forecast to operate at LOS F with a v/c ratio of greater than 1.00 during the AM peak hour.

The 95th percentile queue length in meters seems to be within the available storage limit for all the movements except for the eastbound left turn movement which exceeds the storage lane length by around 80m during the AM peak hour. Additionally, the 95th percentile queues for the outbound traffic from the site are observed to be very low.

- ▶ **2031 Future Total Traffic Operations:** The study area intersections are forecast to operate at overall acceptable levels of service and within capacity except for the critical movement-eastbound left turn at Greenlane and Ontario Street intersection which is forecast to operate at LOS F with a v/c ratio of greater than 1.00 during the AM peak hour.

The 95th percentile queue length in meters seems to be within the available storage limit for all the movements except for the eastbound left turn movement which exceeds the storage lane length by around 90m during the AM peak hour. Additionally, the 95th percentile queues for the outbound traffic from the site are observed to be very low.

- ▶ **Remedial Measures:** All study area intersection under 2031 future total traffic conditions are generally forecast to operate at acceptable levels of service and within capacity with signal timing optimization and increase in cycle length to 120s. It is noted that 95th percentile queue length exceeds storage lane by 90m. The extension of available storage space may not be possible due to spatial constraint.



- ▶ **Left Turn Warrant:** A left turn auxiliary lane with 15 meters storage is warranted on Greenlane at the site driveway under the 2026 horizon.

Recommendations

Based on the findings of this study, it is recommended that:

- ▶ The site be permitted to develop as planned;
- ▶ Increase cycle length of Greenlane and Ontario Street intersection to 120s and optimize the signal timing splits and phases to ensure the best operations for all movements; and
- ▶ An eastbound left turn lane on Greenlane at the site driveway with at least 15 metres of storage be provided.



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1 Introduction

1.1 Overview

New Horizon developments retained Paradigm Transportation Solutions Limited (Paradigm) to conduct this Transportation Impact Assessment for a residential development located at 5103 Greenlane.

Figure 1.1 illustrates the subject site location and study area limits.

The applicant proposes to develop the site to include:

- ▶ 302.4 m² (3255 sq.ft.) of ground-floor commercial space; and
- ▶ Up to 387 apartment condominium units.

Vehicle access is proposed via one all-turns site driveway connection to Greenlane.

1.2 Purpose and Scope

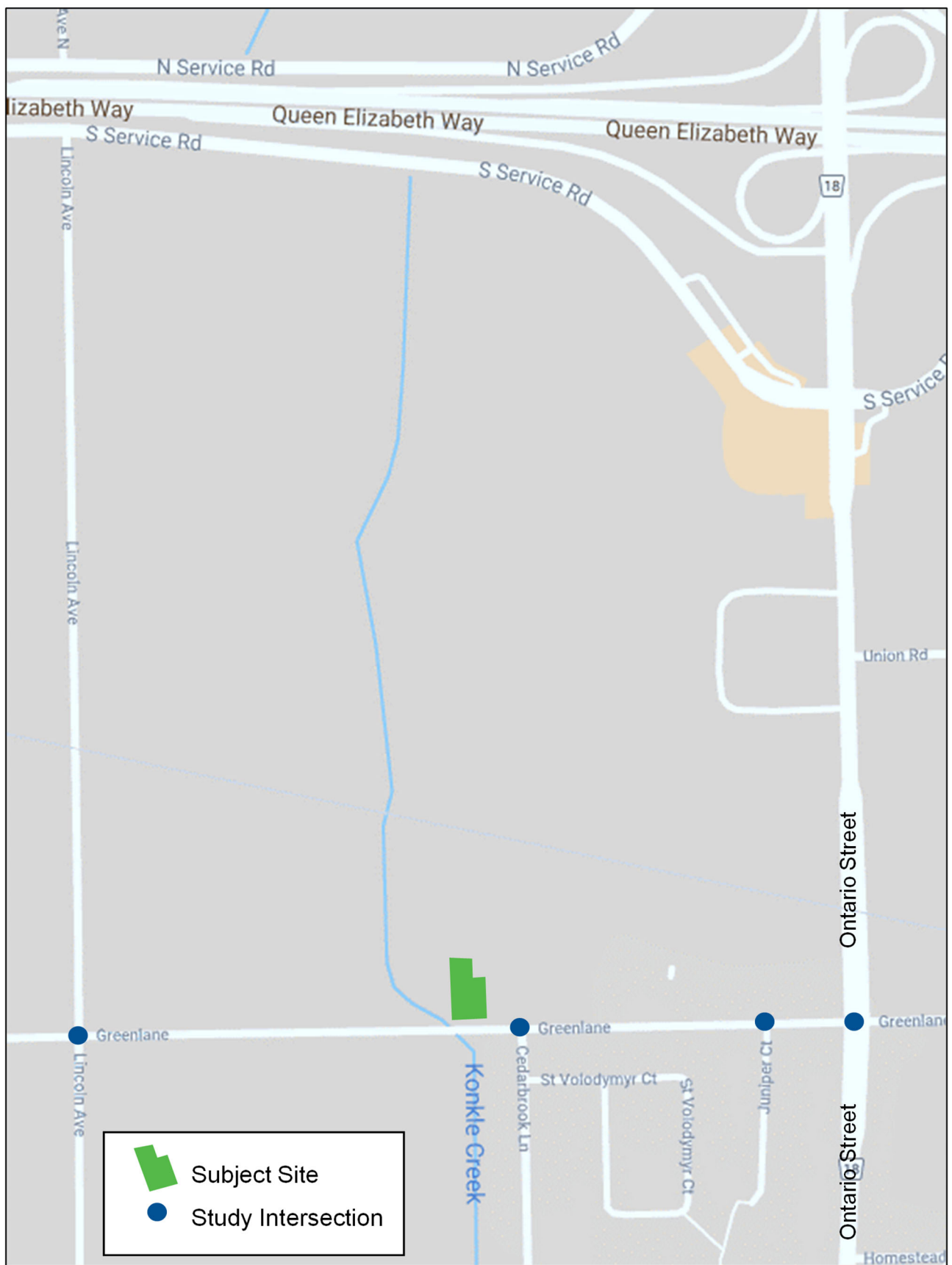
The purpose of the study is to:

- ▶ determine and assess the current study area traffic conditions;
- ▶ estimate background traffic growth in the area;
- ▶ estimate the traffic generated by the development;
- ▶ assess the AM and PM peak hour future background and total traffic within the study area; and
- ▶ recommend any necessary remedial measures required to mitigate the impacts of the additional site traffic.

A pre-study consultation was undertaken with Town of Lincoln staff in May 2021. The consultation established the work plan, general assumptions and requirements for the study.

Appendix A contains the pre-study consultation materials.





1.3 Study Area

The intersections that are assessed in this study, and confirmed by Town staff, include:

- ▶ Greenlane Street and Lincoln Avenue;
- ▶ Greenlane Street and Cedarbrook lane;
- ▶ Greenlane Street and Juniper Court;
- ▶ Greenlane Street and Ontario Street; and
- ▶ The site driveway connection to Greenlane.



2 Existing Conditions

This section documents current traffic conditions, operational deficiencies and constraints experienced by the public travelling at the intersections within the study area. The operational deficiencies and constraints identified at this stage will be fundamental to the process of defining the required remedial measures.

2.1 Roadway Characteristics

Details of the study area roadways are as follows:

► Greenlane Street-east of Cedarbrook Lane

- Direction: east-west
- Beamsville GO Transit Station Secondary Plan¹ (BGTSSP) Designation: Collector Road
- Cross-Section: 3-lane urban cross-section. One travel lane in each direction plus a central two-way left-turn lane.
- Stopping/Parking Restrictions: Not posted on either side of the road. Therefore, parking is subject to Town of Lincoln By-law 89-2000 Section 205.01.10 which limits parking to a maximum of 12 hours at any given time.
- Posted Speed Limit: 50 km/h
- Surrounding Land Use: mix of residential (south side) and commercial (north side)

► Greenlane Street-west of Cedarbrook Lane

- Direction: east-west
- BGTSSP Designation: Collector Road
- Cross-Section: 2-lane urban cross-section from west curb line of Cedarbrook Lane to about 60 metres west. Then it changes to a 2-lane rural cross-section.
- Stopping/Parking Restrictions: Not posted on either side of the road. Therefore, parking is subject to Town of Lincoln By-law 89-2000 Section 205.01.10 which limits parking to a maximum of 12 hours at any given time.
- Posted Speed Limit: Posted as 50 km/h
- Surrounding Land Use: Mix of residential and agricultural

¹ Schedule B5, Beamsville GO Transit Station Secondary Plan, Town of Lincoln, May 2018



► **Greenlane Street-west of Lincoln Avenue**

- Direction: east-west
- BGTSSP Designation: Collector Road
- Cross-Section: 2-lane rural
- Stopping/Parking Restrictions: Not posted on either side of the road. Therefore, parking is subject to Town of Lincoln By-law 89-2000 Section 205.01.10 which limits parking to a maximum of 12 hours at any given time
- Posted Speed Limit: 50 km/h
- Surrounding Land Use: Mix of residential and agricultural

► **Lincoln Avenue- north and south of Greenlane**

- Direction: north-south
- BGTSSP Designation: Collector Road
- Cross-Section: Two-lane rural
- Stopping/Parking Restrictions: prohibited on both sides of the road (both north and south of Greenlane)
- Posted Speed Limit: 50 km/h
- Surrounding Land Use: Mix of residential and agricultural

► **Cedarbrook Lane**

- Direction: north-south
- BGTSSP Designation: Local Road
- Cross-Section: Two-lane urban cross-section
- Stopping/Parking Restrictions: No parking on both sides north of St. Volodymyr Crescent. Parking permitted on west side south of St. Volodymyr Crescent (parking is prohibited on east side).
- Speed Limit: Not Posted, assumed to be 50 km/hr
- Surrounding Land Use: Residential

► **Juniper Court**

- Direction: north-south
- BGTSSP Designation: Local Road
- Cross-Section: Two-lane urban cross-section
- Stopping/Parking Restrictions: Parking is prohibited on the east side of the road north of the bulb. Parking is permitted



on the west side of the road north of the bulb. Parking is prohibited within the bulb from 15 November to 15 April

- Posted Speed Limit: Not Posted, assumed to be 50 km/hr
- Surrounding Land Use: Residential

► **Ontario Street**

- Direction: north-south
- BGTSSP Designation: Arterial Road
- Cross-Section: Two-lane urban cross-section
- Stopping/Parking Restrictions: No parking on both sides of the road.
- Speed Limit: Not Posted, assumed to be 50 km/hr
- Surrounding Land Use: Mix of Residential and Commercial.

Figure 2.1 details the existing lane configurations and traffic control at the study area intersections. Town is working on urbanizing Greenlane Road from King Street to Ontario Street. As part of the upgrading, a sidewalk will be provided on the north side of the roadway and a multi-use trail will be provided on the south side of the roadway throughout the study area.

2.2 Active Transportation Facilities

2.2.1 Walking

Sidewalks are provided in the study area as follows:

- Both sides of Greenlane- east of Cedarbrook Lane;
- On west side of Juniper Court; and
- On east side of Cedarbrook Lane

Walk Score is an online tool that assigns a numerical walkability score between 0 and 100 for addresses in Australia, Canada, United States, and New Zealand. Walk Score ranks communities nationwide based on how many businesses, parks, theatres, schools and other common destinations are within walking distance of any given address. The subject site has a Walk Score of 39 and is considered “Car-Dependent” which means almost all errands require a car².

To improve the pedestrian facility, a 1.8m wide concrete sidewalk is proposed by Town of Lincoln, on the north side of Greenlane Road between the section just east of the intersection between Greenlane

² <https://www.walkscore.com/score/cedarbrook-ln-lincoln-on-canada>



Road and Lincoln Avenue up till west of Ontario Street intersection with Greenlane Road.

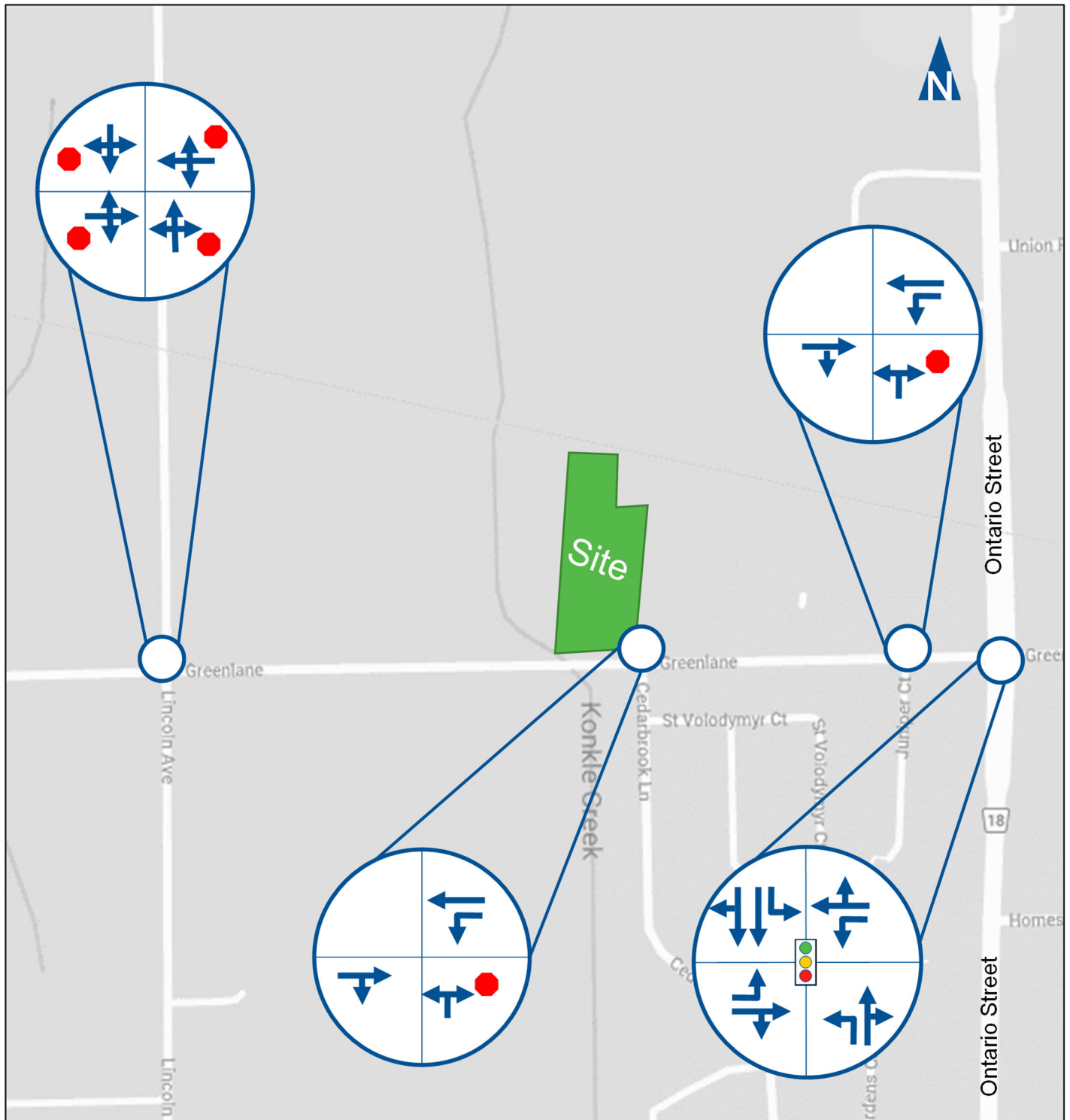
2.2.2 Cycling

The Town's cycling infrastructure consists of on street and off-street facilities. On-street facilities include bike lanes, paved shoulders and shared use lanes (sharrows). Off-road facilities include multi-use trails either in the boulevard or on a designated off-road route. At present, sharrows are provided in the study area as follows:

- ▶ On Greenlane- east of Cedarbrook Lane;
- ▶ Both directions on Greenlane-west of Cedarbrook Lane;
- ▶ Both directions on Greenlane-west of Lincoln Avenue; and
- ▶ Both directions on Lincoln Avenue-south of Greenlane

To accommodate the bicycle traffic, the Town of Lincoln is planning to provide a 3m wide multi-use trail along the south side of the Greenlane Road between the section just east of intersection between King Street and Greenlane Road till the west of Ontario Street intersection with Greenlane Road.





2.3 Transit Service

Town of Lincoln operates Niagara Region Transit (NRT) OnDemand that does not serve fixed routes like conventional transit service. It lets riders request trips in real-time through the app or over the phone by selecting a pickup point and destination. The service is provided year-round as follows:

- ▶ Monday to Saturday: 7 a.m. – 10 p.m.;
- ▶ Sunday: Closed; and
- ▶ Service in Niagara-on-the-Lake runs Monday to Saturday from 7 a.m. to 7 p.m.

The service takes riders anywhere across West Niagara, and to designated transit hubs in St. Catherine's, Welland, and Port Colborne. No transit service is observed to operate 400m within the site.

2.4 Traffic Volumes

Due to the COVID-19 impact on the travel pattern, the volume counts could not be collected at the study area intersections. Therefore, during pre-consultation, it was agreed with the Town to factor the most recent count data available which was year 2012 at the Lincoln Avenue and Greenlane intersection, year 2016 at the Cedarbrook lane and Greenlane intersection and year 2017 at the Greenlane and Ontario Street intersection. A growth rate of one percentage per annum was applied to bring the 2012 and 2016 counts up to 2021 volumes as it aligns with the population forecast of the Town of Lincoln Transportation Master Plan (TMP).³

Traffic count data was unavailable for the Juniper court and Greenlane intersection. Thus, AM and PM peak volumes were obtained from Institute of Transportation Engineers (ITE) Trip Generation Manual⁴ using the residential units count information on the Juniper Court obtained from the Google Street view and Aerial images. The traffic

The trips were then distributed based on existing trip distribution on Greenlane Road. Note that traffic volumes at Juniper Court intersection with Greenlane have not been smoothed to match the volumes at Greenlane and Ontario Street because of presence of a grocery store between Ontario and Juniper Court side street.

³ Transportation Master Plan, Town of Lincoln, October 2019.

⁴ Trip Generation Tenth Edition, Institute of Transportation Engineers, 2017



Figure 2.2 illustrates the existing AM and PM peak hour traffic.

Appendix B contains the detailed traffic count data.

2.5 Traffic Operations

Intersection level of service (LOS) is a recognized method of quantifying the average delay experienced by drivers at intersections. It is based on the delay experienced by individual vehicles executing the various movements. The delay is related to the number of vehicles intending to make a particular movement, compared to the estimated capacity for that movement. The capacity is based on a number of criteria related to the opposing traffic flows and intersection geometry.

Table 2.1 summarizes the level of service criteria for signalized and unsignalized intersections. The highest possible rating is LOS A, where the average total delay is equal or less than 10.0 seconds per vehicle. When the average delay exceeds 80 seconds for signalized intersections, 50 seconds for unsignalized intersections or when the volume to capacity ratio is greater than 1.0, the movement is classed as LOS F and remedial measures are usually implemented, if feasible.

TABLE 2.1: VEHICLE LEVEL OF SERVICE DEFINITIONS

Level of Service	Signalized Intersections Average Total Delay (sec/veh)	Unsignalized Intersections Average Total Delay (sec/veh)
A	≤ 10	≤ 10
B	$> 10 \text{ \& } \leq 20$	$> 10 \text{ \& } \leq 15$
C	$> 20 \text{ \& } \leq 35$	$> 15 \text{ \& } \leq 25$
D	$> 35 \text{ \& } \leq 55$	$> 25 \text{ \& } \leq 35$
E	$> 55 \text{ \& } \leq 80$	$> 35 \text{ \& } \leq 50$
F	> 80	> 50

To assess the existing peak hour conditions, a level of service analysis was conducted using Synchro 10 software, which implements the methods of the Highway Capacity Manual. The intersection analysis considered the following measures of performance:

- ▶ LOS for each movement and the overall intersection;
- ▶ The v/c ratio for each movement and the overall intersection; and
- ▶ The estimated 95th percentile queue lengths for each movement.



The Niagara Region's TIS guidelines identify critical movement thresholds for intersections as follows:

Signalized Intersections

- ▶ Through, shared through/right-turn or right-turn movements with a v/c ratio greater than 0.85; and
- ▶ Left-turn movements with a v/c ratio greater than 0.90.

Unsignalized Intersections

- ▶ Level of service based on average delay per vehicle on individual movements is LOS D or worse; and
- ▶ The 95th percentile back of queue exceeds available storage for individual movements.

An operational analysis was conducted for the existing weekday AM and PM peak hour traffic volumes at the study area intersections using Synchro software, which implements the methods of the Highway Capacity Manual (HCM). The key parameters used in the analysis include:

- ▶ Existing lane configurations;
- ▶ Heavy vehicle percentages derived from existing traffic count data;
- ▶ Conflicting pedestrian volumes derived from existing traffic count data;
- ▶ Obtained signal timing plan data; and
- ▶ Synchro default values for all other inputs inclusive of peak hour factor (0.92).

Table 2.2 summarizes the existing intersection operations.

The analyses indicate that all study area intersections are operating with overall acceptable levels of service and within capacity during the peak hours. The 95th percentile queue length in meters seems to be within the available storage limit for all the movements except for the eastbound left turn movement which exceeds the storage lane length by around 45m.

Appendix C contains the detailed Synchro 10 reports.



The map shows a residential area with the following streets and features:

- Streets:** Lincoln Ave, Site Access, Utopia, Juniper Ct, C'brook Lane, Ontario St, Green-lane, Green-lane.
- Lot Numbers:**
 - Lincoln Ave: 60, 113, 9, 52, 52, 7, 127, 9, 143, 153.
 - Site Access: 49, 55, 104, 38.
 - Utopia: 20, 4, 34, 76, 58.
 - Juniper Ct: 5, 16, 5, 11, 2, 138, 54, 60, 202, 1045.
 - C'brook Lane: 34, 67, 56, 11, 111, 306, 350, 143, 143, 190, 190, 227, 227, 171, 19.
 - Ontario St: 669, 481, 65, 599, 5, 78, 52, 244, 374, 368, 140, 202, 77, 389, 54, 1045.
 - Green-lane: 111, 14, 276.
 - Green-lane: 143, 153.
- Other Features:** A north arrow is located in the top right corner of the map.

[illegible]

TABLE 2.2: EXISTING PEAK HOUR TRAFFIC OPERATIONS

Analysis Period	Intersection	Control Type	MOE	Direction / Movement / Approach															
				Eastbound				Westbound				Northbound				Southbound			
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach
AM Peak Hour	1 - Greenlane & Lincoln Avenue	AWSC	LOS Delay V/C Q	< < <	A 8 >	> > >	A 8	< < <	A 8 >	> > >	A 8	< < <	A 8 >	> > >	A 8	< < <	A 8 >	> > >	A 8
	2 - Greenlane & Cedarbrook Lane	TWSC	LOS Delay V/C Q	- - -	- - -	- - -	A 0	A 8	- - -	- - -	A 1	B 10	- - -	- - -	B 10	- - -	- - -	- - -	A 4.0
	3 - Greenlane & Juniper Court	TWSC	LOS Delay V/C Q	- - -	- - -	- - -	A 0	A 8	- - -	- - -	A 0	B 10	- - -	- - -	B 10	- - -	- - -	- - -	A 0.5
	4-Greenlane & Ontario St.	TCS	LOS Delay V/C Q	D 51 0.74 70	C 25 0.23 18	> > >	D 42	C 27 0.04 7	C 29 0.54 32	> > >	C 28	B 12 0.13 10	C 28 0.76 147	> > >	C 26	B 16 0.19 9	B 17 0.31 40	> > >	B 17
PM Peak Hour	1 - Greenlane & Lincoln Avenue	AWSC	LOS Delay V/C Q	< < <	A 10 >	> > >	A 10	< < <	A 9 >	> > >	A 9	< < <	A 8 >	> > >	A 8	< < <	A 9 >	> > >	A 9
	2 - Greenlane & Cedarbrook Lane	TWSC	LOS Delay V/C Q	- - -	- - -	- - -	A 0	A 8	- - -	- - -	A 3	B 11	- - -	- - -	B 11	- - -	- - -	- - -	A 2.4
	3 - Greenlane & Juniper Court	TWSC	LOS Delay V/C Q	- - -	- - -	- - -	A 0	A 8	- - -	- - -	A 0	B 11	- - -	- - -	B 11	- - -	- - -	- - -	A 0.4
	4-Greenlane & Ontario St.	TCS	LOS Delay V/C Q	D 39 0.51 40	C 32 0.63 52	> > >	C 34	D 38 0.14 12	C 30 0.46 43	> > >	C 31	B 12 0.37 16	C 21 0.64 111	> > >	B 19	B 13 0.45 22	B 18 0.54 82	> > >	B 17

MOE - Measure of Effectiveness

LOS - Level of Service

Delay - Average Delay per Vehicle in Seconds

Q - 95th Percentile Queue Length

Ex - Existing Available Storage

Avail. - Available Storage

TWSC - Two-Way Stop Control

AWSC - All-Way Stop Control

< / > - Shared Lane



3 Development Concept

3.1 Development Description

The subject site will be located on the north side of Greenlane at municipal address 5103 Greenlane, west of Ontario Street (Regional Road 18).

The applicant proposes to redevelop the site to include:

- ▶ 302.4 m² (3255 sq.ft.) of ground-floor commercial space; and
- ▶ Up to 387 apartment condominium units.

Vehicle access is proposed via one all-turns site driveway connection to Greenlane located approximately 140 m to the west of Cedarbrook lane. Vehicle parking is accommodated through 456 parking spaces while bicycle parking will be provided through 160 long-term bicycle parking spaces and 8-short term spaces.

Figure 3.1 illustrates the proposed site plan.



3.2 Access Location

In general, it is desirable to minimize the number of conflict points created with existing and future driveways since more conflict points increase the risk of a collision. The number and types of conflict points at a driveway however can be managed by limiting both the amount of access allowed and the location of the driveway relative to other driveways in the area.

The property is noted to straddle the Urban Boundary and Greenbelt divisional line. Careful consideration to maintain the mobility along Greenlane and accommodate development traffic is essential which inspired review and consideration of the following:

- ▶ One-point of access is required to limit/reduce conflict points.
- ▶ All-direction access from Greenlane is needed to provide sufficient site circulation;
- ▶ Minimizing potential conflicts along Greenlane with adjacent connections be a priority.

As a result, the applicant has made efforts to ensure that these ideas were incorporated into the proposed development plan which has resulted in a single point of access located at the western limit of the property. Although the access would technically be located within the Greenbelt as opposed to the Urban Boundary, the location is noted to be beneficial from a safety and operational perspective based on the following:

- ▶ Sufficient spacing between adjacent intersections is good design practice in reducing conflict points. The increased spacing afforded by positing the driveway at the western limit of the property increasing the spacing between adjacent driveways and intersections which minimize the severity of potential conflicts between these connections along Greenlane.
- ▶ Inadequate corner clearance can create blocked accesses creating traffic backups, difficult turning movements and limited visibility. The proposed location meets the suggested corner clearances as stipulated by the Transportation Association of Canada (TAC) Geometric Design Guide for Canadian Roads⁵ for both an unsignalized intersection as well as a signalized intersection in the event Greenlane and Clearbrook Lane is ever signalized in the future.

⁵ Geometric Design Guide for Canadian Roads, Transportation Association of Canada, 2017



- ▶ If need be, separate left-turn lanes with appropriate storage are able to be accommodated for the development directly to the east (Utopia East) and the proposed development that will provide positive guidance for motorists along Greenlane.

As the planning and design of access has a number of criteria that need to be met to ensure that is designed appropriate from an operational and safety perspective, the location of the access as the western limit of the property maintains the overall intent and guidelines criteria as outlined by TAC.

The proposed driveway connection is noted to be adequately positioned, the number and type of conflict points are adequately managed, and the driveways are separated/located adequately relative to other driveways in the area. As the Town of Lincoln is committed to the design and development of a safe and efficient access for the proposed development, the provision of the access located at the western limit of the property will facilitate this given the significant spacing constraints in accommodating access within the urban boundary.

3.3 Parking Arrangement

3.3.1 Surface Parking Arrangement

The surface parking associated with the proposed development is technically provided within the Greenbelt lands. However, for clarification, the surface parking (i.e., 41 spaces) has been designed for visitors of the community orchard as well as for visitors of the residential households through a shared parking arrangement.

The concept of shared and/or managed parking reflects the variations in usage levels of different land uses by time of day, day of week and seasonal factors to derive efficiencies in overall parking supply requirements through a permissive sharing of a common pool of parking that support the range of planned uses at different times.

Each land use does not need its own dedicated supply of parking, yet that is exactly what standard analysis and zoning indicate is needed. In reality, throughout the day, different uses have different peak demand: for example, the community orchard will largely be driven by school/educational field trips that would likely have a high demand high demand until 3PM, while visitors of a residential building will have a high demand only after 7PM as outlined by inputs collected by the Urban Land Institute⁶ (ULI).

⁶ Shared Parking 2nd Edition, Urban Land Institute, 2005



Overall, the surface parking allows for accommodation of peak parking demand but shares a supply among the different uses. This is an important point as it reflects the notion that certain user groups can share the same parking spaces without requiring additional parking.

3.3.2 Residential and Retail Parking Arrangement

Parking for the retail/commercial uses and residents will be provided through the underground parking garage located within the Urban Boundary that provides for a total of 415 spaces, meeting the site-specific zoning requirements.

At this time, Paradigm understands the Applicant intends to install access control equipment on the first level of the garage to create a nested area for reserved residential parking. Reserved residential parking will be provided at 1.47 spaces per residential unit; 405 spaces. Parking that is not located interior to the nested area will be provided through 10 spaces that will be allocated for use by the retail component during the day and could also be used by visitors of the site during the evening hours.

Overall, the residential and retail requirements are accommodated through parking provided within the Urban Boundary whereas visitors to the community orchard and visitors of the residential building will be accommodated through the surface parking area. As the community orchard and visitors of the residential building will not have an overlap and peak parking demands, the proposed supply is able to accommodate through a shared parking arrangement that will limit the amount of on-site parking provided while still accommodating both uses adequately.

3.4 Swept Path Analysis

The site circulation has been assessed using a fire truck, waste garbage truck and moving truck

Appendix D contains reduced scale vehicle turning movement diagrams for the site's loading zones and main circulation drive aisles. The diagrams were produced using the site concept plan and AutoTURN swept path analysis software.

Based on the analysis the design vehicles can circulate the site without conflicting with the proposed building and other on-site objects (e.g., parking spaces, etc.). The inbound right-turn radius has been redesigned to reflect a 9.0 metre radius to avoid the vehicle crossing the roadway's centreline on entry. No other design issues are identified.



3.5 Development Trip Generation

Institute of Transportation Engineers (ITE) Trip Generation Manual⁷ land use code (LUC) 221 Multifamily Housing (Mid-Rise) and (LUC) 820 Shopping Center were used to estimate the trips generated by the proposed development. The average rates were used to estimate the trips since the criteria for fitted equation curve were not met. The site is estimated a total of 142 AM peak hour trips and 182 PM peak hour trips.

Table 3.1 summarizes the estimated site trip generation.

TABLE 3.1: SITE TRIP GENERATION

Land Use Code	Units	AM Peak Hour				PM Peak Hour			
		Rate	In	Out	Total	Rate	In	Out	Total
LUC 221 - Multifamily Housing (Mid-Rise)	387	0.36	36	103	139	0.44	104	66	170
LUC 820-Shopping Center	3.2	0.94	2	1	3	3.81	6	6	12
Total			38	104	142		110	72	182

3.6 Development Trip Distribution and Assignment

The site generated trips were assigned to the road network based on the existing distribution of traffic at the study area intersections as determined from the existing peak hour traffic volumes. The existing distribution was used since it reflects the current trip making characteristics for the surrounding neighbourhood, which is predominantly residential.

Table 3.2 summarizes the trip distribution.

⁷ Trip Generation Tenth Edition, Institute of Transportation Engineers, 2017



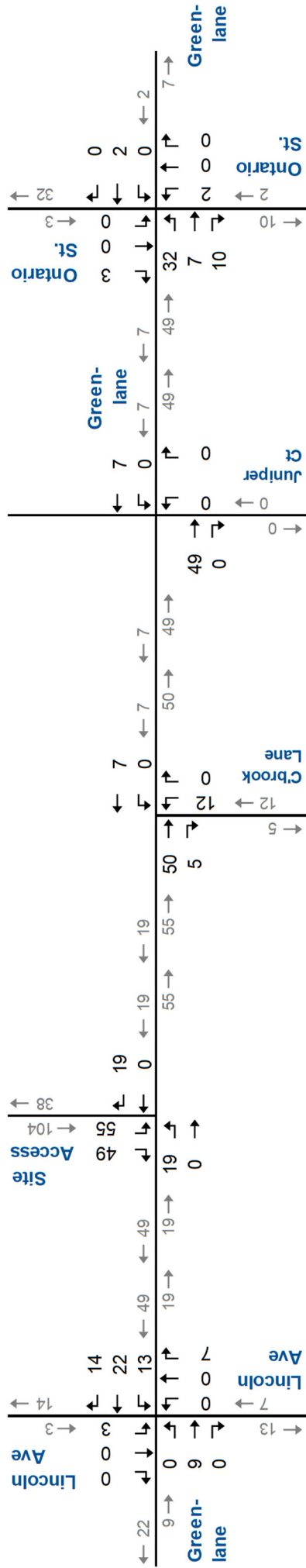
TABLE 3.2: ESTIMATED PEAK HOUR TRIP DISTRIBUTION

Origin / Destination	Direction	AM Peak Hour		PM Peak Hour	
		In	Out	In	Out
Greenlane St	East	22%	48%	30%	36%
	West	23%	20%	30%	21%
Lincoln Avenue	North	9%	14%	21%	7%
	South	19%	13%	11%	19%
Cedarbrook Lane	South	27%	5%	9%	17%
Juniper Ct. St	North	0%	0%	0%	0%
	South	0%	0%	0%	0%
Total		100%	100%	100%	100%

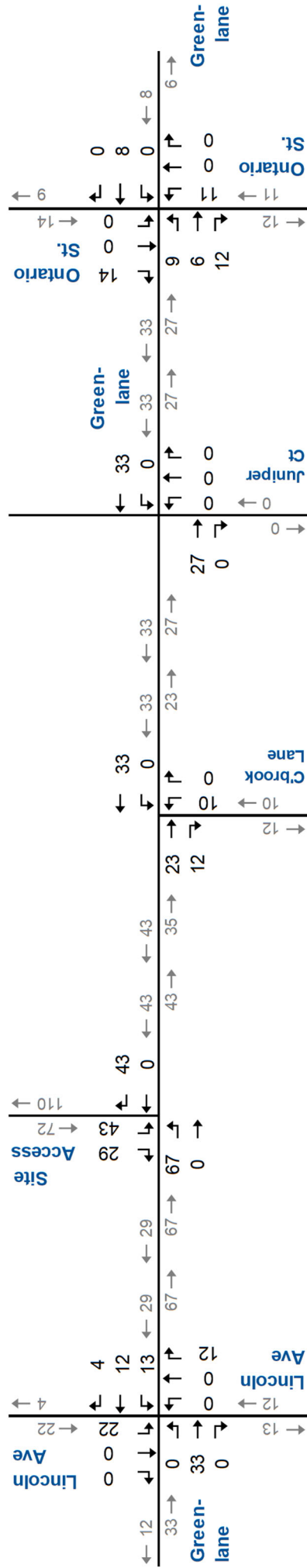
Figure 3.2 illustrates the AM and PM peak hour site generated trip assignment.



AM Peak



PM Peak



Site Generated Trip Assignment

4 Evaluation of Future Total Traffic

The assessment of future traffic conditions contained in this section includes estimates and analyses of future background and total traffic volumes at the 2026 and 2031 horizons. The future traffic volumes in the vicinity of the development will consist of increased non-site traffic volumes (background traffic), traffic generated by other area developments and the site generated traffic.

4.1 2026 Background Traffic Volumes

4.1.1 2026 General Background Traffic

A growth rate of 1% per annum compounded for five years (total growth of 5%) was applied to the existing traffic volumes to derive the 2026 background traffic volumes. The growth rate of 1% was used because it aligns with the Town of Lincoln TMP. **Figure 4.1** illustrates the 2026 AM and PM peak hour background traffic.

4.1.2 Other Area Developments

The traffic generated by the future 5055 Greenlane development⁸ to be located north of Cedarbrook lane and east of the subject site was added to the background traffic over and above general growth.

Figure 4.2 illustrates the 5055 Greenlane development location.

The development is planned as a six storeyed residential building with 276 units and 126 square meters of commercial space. A total of 325 parking spaces are also proposed to be provided as part of the development which is expected to be complete by 2026.

Figure 4.3 illustrates the 5055 Greenlane development assignment.

4.2 2026 Background Traffic Operations

The operations of the study area intersections under 2026 background traffic volumes were evaluated using the same analytical approach as used for existing traffic operations. The signal timings and cycle length have been maintained same as existing conditions.

⁸ 5055 Greenlane Beamsville – Transportation Impact Study Addendum Letter, Paradigm Transportation Solutions Limited, July 2018



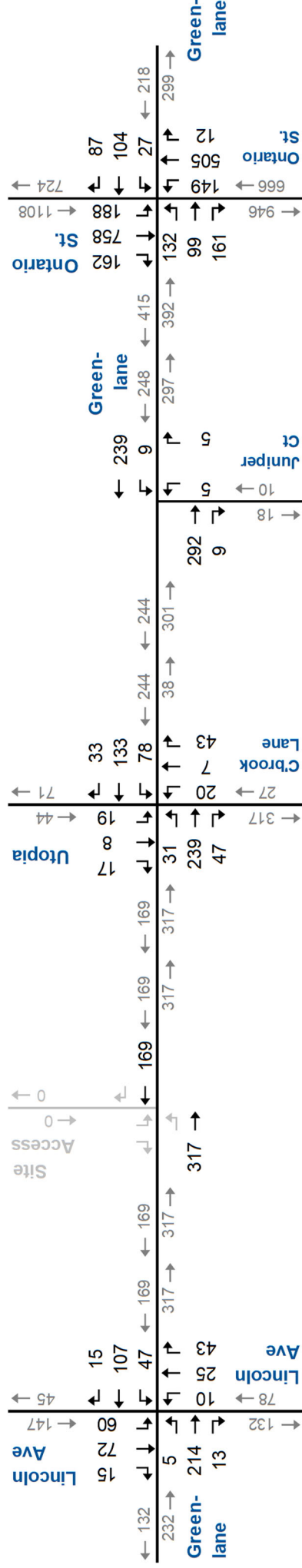
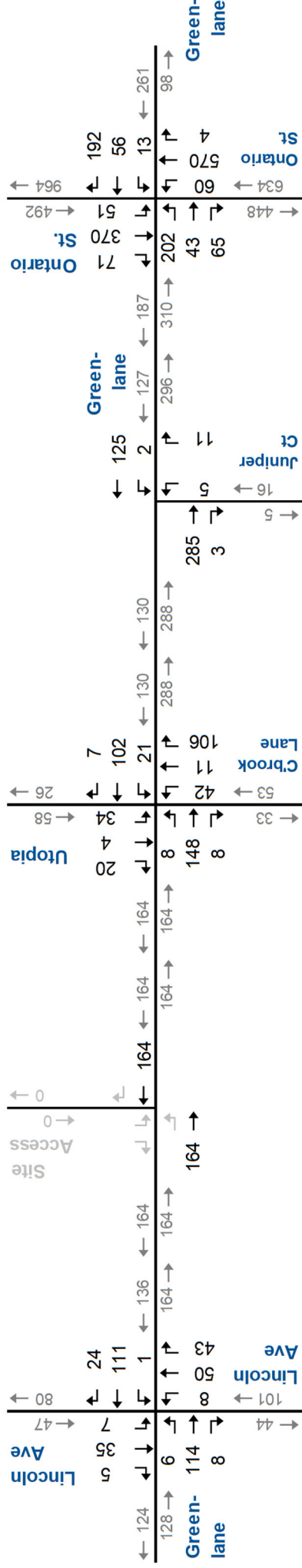
Table 4.1 summarizes the 2026 AM and PM peak hour background traffic operations. The entries in the table indicate the AM and PM peak hour level of service (LOS), volume to capacity ratios (v/c), and 95th percentile queue length estimates.

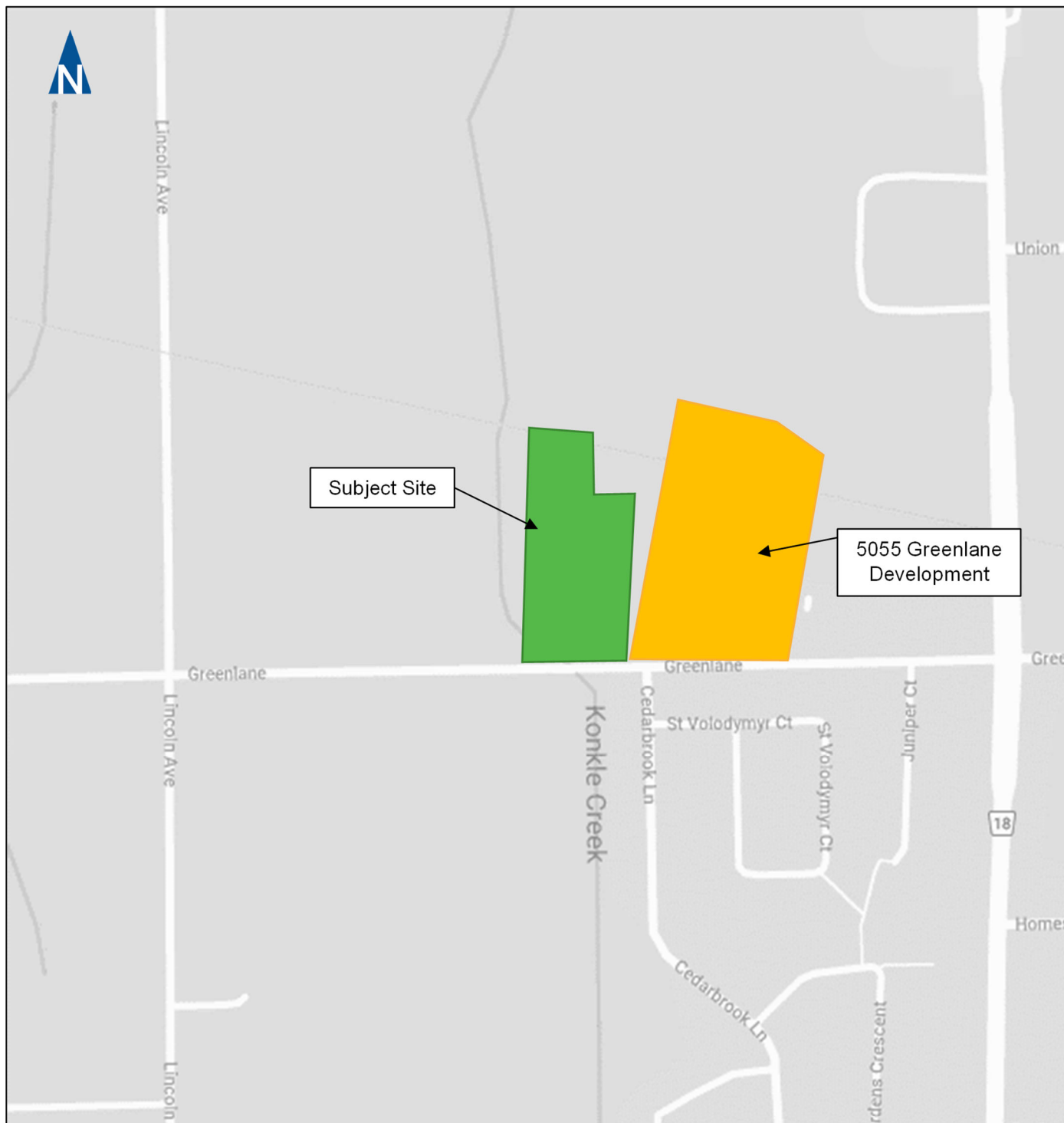
The results indicate the study area intersections are forecast to continue operating at acceptable levels of service and within capacity during the AM and PM peak hours except for the critical movement at the intersection of Greenlane and Ontario Street. The movement is as below:

- ▶ The eastbound left turn movement, forecast to operate at LOS E with a v/c ratio of 0.92 during the AM peak hour. The 95th percentile queue length in meters seems to be within the available storage limit for all the movements except for the eastbound left turn movement which exceeds the storage lane length by around 60m.

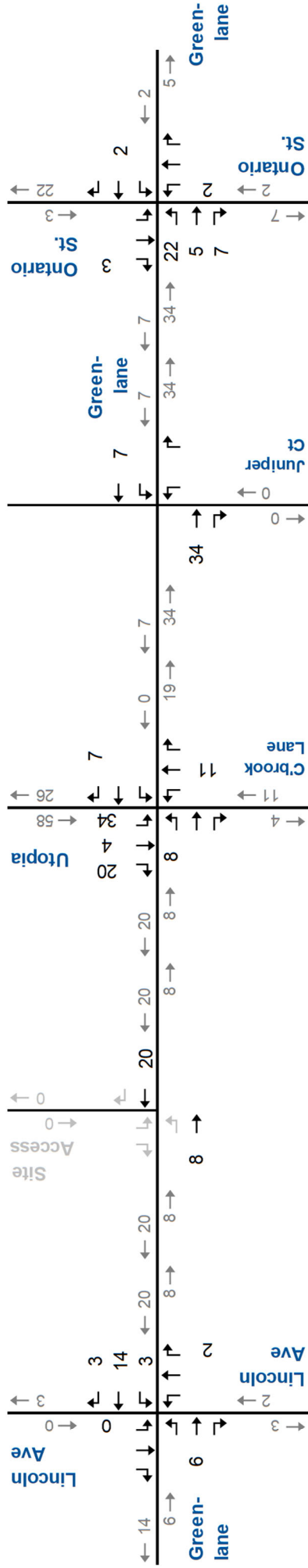
Appendix E contains the detailed Synchro 10 reports.



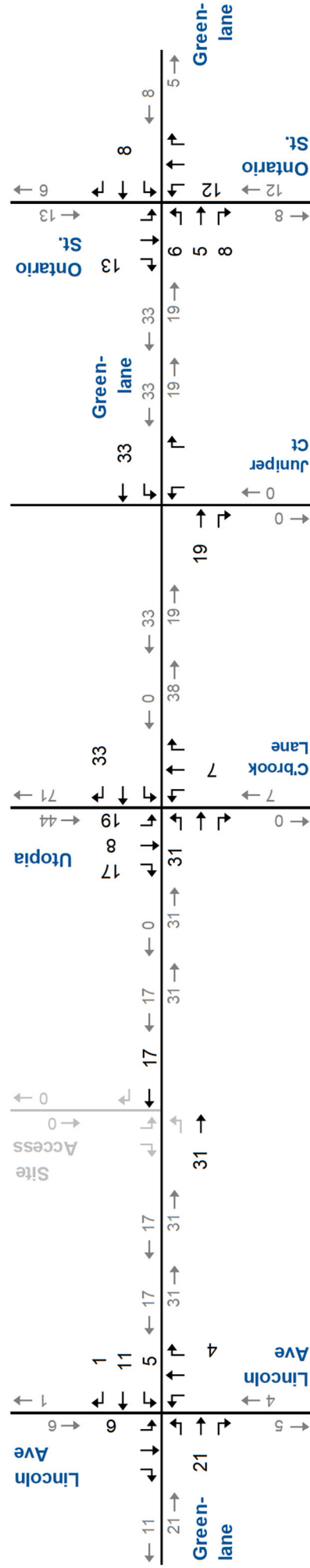




AM Peak



PM Peak



5055 Greenlane Development Trip Assignment

TABLE 4.1: 2026 BACKGROUND TRAFFIC OPERATIONS

Analysis Period	Intersection	Control Type	MOE	Direction / Movement / Approach																
				Eastbound				Westbound				Northbound				Southbound				Overall
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	
AM Peak Hour	1 - Greenlane & Lincoln Avenue	AWSC	LOS Delay V/C Q	< < < 0.17 1	A 8 > > > 0.18 1	> > > 0.18 1	A 8	< < < 0.18 1	A 8 > > > 0.18 1	> > > 0.18 1	A 8	< < < 0.14 1	A 8 > > > 0.14 1	> > > 0.14 1	A 8	< < < 0.07 0	A 8 > > > 0.07 0	> > > 0.07 0	A 8	A 8.2
	2 - Greenlane & Cedarbrook Lane & Utopia	TWSC	LOS Delay V/C Q	A 8 0.01 0	- - - > > > 0	A 8 > > > 0.02 0	- - - > > > 0	A 8 > > > 0.02 0	- - - > > > 0	A 1 > > > 0.23 1	B 11 > > > 0.23 1	- - - > > > 0	B 11 > > > 0.23 1	- - - > > > 0	B 11 > > > 0.23 1	< < < 0.11 0	B 12 > > > 0.11 0	> > > 0.11 0	B 12	A 5.3
	3 - Greenlane & Juniper Court	TWSC	LOS Delay V/C Q	- - - > > > 0	- - - > > > 0	A 8 > > > 0.00 0	- - - > > > 0	A 8 > > > 0.00 0	- - - > > > 0	A 0 > > > 0.03 0	B 11 > > > 0.03 0	- - - > > > 0	B 11 > > > 0.03 0	- - - > > > 0	B 11 > > > 0.03 0	- - - > > > 0	- - - > > > 0	- - - > > > 0	- - - > > > 0	A 0.4
	4-Greenlane & Ontario St.	TCS	LOS Delay V/C Q	E 80 0.92 87	C 25 0.27 21	> > > 0.27 21	E 61	C 28 0.04 7	C 29 0.57 38	> > > 0.57 38	C 29	B 12 0.14 11	C 30 0.79 173	> > > 0.79 173	C 28	B 17 0.21 9	B 18 0.32 43	> > > 0.32 43	B 18	C 31.3
PM Peak Hour	1 - Greenlane & Lincoln Avenue	AWSC	LOS Delay V/C Q	< < < 0.33 2	B 10 > > > 0.33 2	> > > 0.33 2	B 10	< < < 0.25 1	A 10 > > > 0.25 1	> > > 0.25 1	A 10	< < < 0.12 0	A 9 > > > 0.12 0	> > > 0.12 0	A 9	< < < 0.23 1	A 10 > > > 0.23 1	> > > 0.23 1	A 10	A 9.7
	2 - Greenlane & Cedarbrook Lane & Utopia	TWSC	LOS Delay V/C Q	A 8 0.02 0	- - - > > > 0	A 8 > > > 0.00 0	- - - > > > 0	A 8 > > > 0.00 0	- - - > > > 0	A 3 > > > 0.16 1	B 14 > > > 0.16 1	- - - > > > 0	B 14 > > > 0.16 1	- - - > > > 0	B 14 > > > 0.16 1	< < < 0.12 0	C 15 > > > 0.12 0	> > > 0.12 0	C 15	A 3.7
	3 - Greenlane & Juniper Court	TWSC	LOS Delay V/C Q	- - - > > > 0	- - - > > > 0	A 8 > > > 0.01 0	- - - > > > 0	A 8 > > > 0.01 0	- - - > > > 0	A 0 > > > 0.02 0	B 12 > > > 0.02 0	- - - > > > 0	B 12 > > > 0.02 0	- - - > > > 0	B 12 > > > 0.02 0	- - - > > > 0	- - - > > > 0	- - - > > > 0	- - - > > > 0	A 0.3
	4-Greenlane & Ontario St.	TCS	LOS Delay V/C Q	D 40 0.57 46	C 34 0.67 63	> > > 0.67 63	D 36	D 40 0.15 12	C 30 0.48 49	> > > 0.48 49	C 31	B 15 0.50 22	C 27 0.73 138	> > > 0.73 138	C 24	B 17 0.56 27	C 22 0.63 104	> > > 0.63 104	C 22	C 25.5

MOE - Measure of Effectiveness

LOS - Level of Service

Delay - Average Delay per Vehicle in Seconds

Q - 95th Percentile Queue Length

Ex - Existing Available Storage

Avail. - Available Storage

TWSC - Two-Way Stop Control

AWSC - All-Way Stop Control

< / > - Shared Lane



4.3 2026 Future Total Traffic Operations

The site generated traffic was added to the 2026 background traffic volumes to derive the future total traffic.

Figure 4.4 illustrates the AM and PM peak future total traffic.

The operations of the study area intersections under 2026 future total traffic were evaluated using the same analytical approach as used for background traffic operations. The signal timings and cycle length have been maintained same as existing conditions.

Table 4.2 summarizes the 2026 AM and PM peak hour future total traffic operations. The entries in the table indicate the AM and PM peak hour level of service (LOS), volume to capacity ratios (v/c), and 95th percentile queue length estimates.

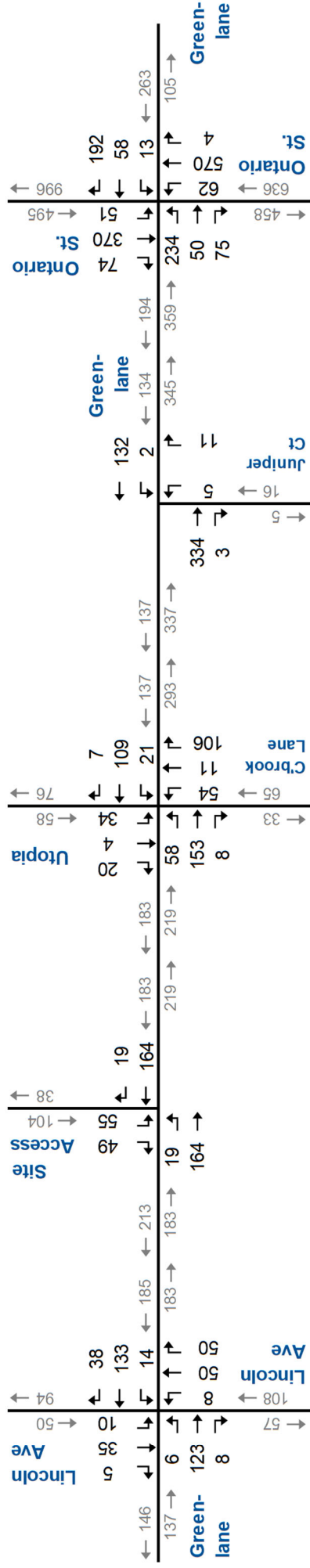
The results indicate the study area intersections are forecast to continue operating at acceptable levels of service and within capacity during the AM and PM peak hours except for the critical movement at the intersection of Greenlane and Ontario Street. The movement is as below:

- ▶ The eastbound left turn movement, forecast to operate at LOS F with a v/c ratio of greater than 1.00 during the AM peak hour which indicates that there is a heavy left turning traffic from Greenlane Road towards Ontario Street that exceed the capacity limit. With addition of site traffic, the operation of this movement appears to have exacerbated especially during the AM peak hour. The 95th percentile queue length in meters seems to be within the available storage limit for all the movements except for the eastbound left turn movement which exceeds the storage lane length by around 80m.
- ▶ The site access intersection with Greenlane is reported to operate at acceptable level of service and well within capacity. The 95th percentile queues are observed to be very low.

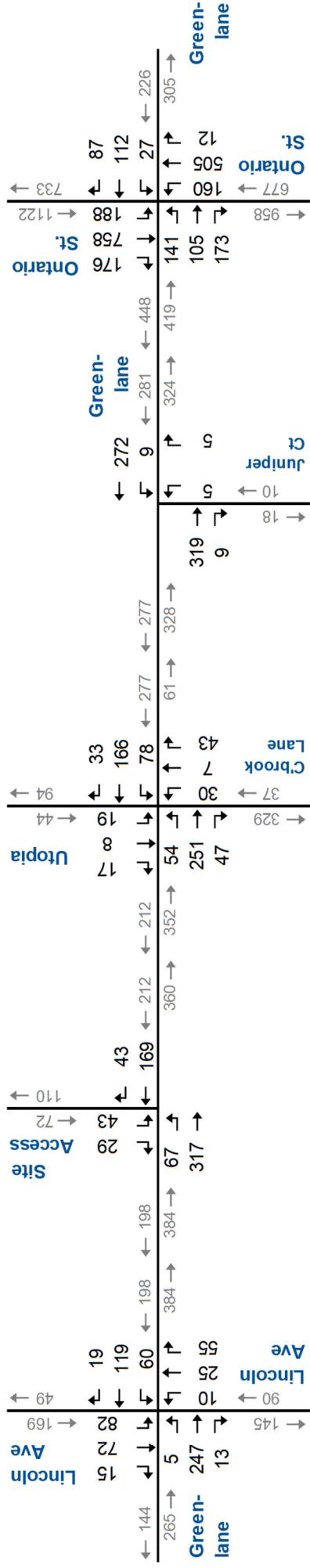
Appendix F contains the detailed Synchro 10 reports.



AM Peak



PM Peak



2026 Peak Hour Future Total Traffic

TABLE 4.2: 2026 FUTURE TOTAL TRAFFIC OPERATIONS

Analysis Period	Intersection	Control Type	MOE	Direction / Movement / Approach																
				Eastbound				Westbound				Northbound				Southbound				Overall
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	
AM Peak Hour	1 - Greenlane & Lincoln Avenue	AWSC	LOS Delay V/C Q	< < <	A 9 0.19	> > >	A 9	< < <	A 9 0.25	> > >	A 9	< < <	A 8 0.15	> > >	A 8	< < <	A 8 0.07	> > >	A 8	A 8.6
	2 - Greenlane & Cedarbrook Lane & Utopia	TWSC	LOS Delay V/C Q	A 8 0.04	- - -	> > >	A 2	A 8 0.02	- - -	> > >	A 1	< < <	B 13 0.29	> > >	B 13	< < <	B 14 0.13	> > >	B 14	A 6.1
	3 - Greenlane & Juniper Court	TWSC	LOS Delay V/C Q		- - -	> > >	A 0	A 8 0.00	- - -	> > >	A 0	B 11 0.03		> > >	B 11					A 0.4
	4 - Greenlane & Site Access	TWSC	LOS Delay V/C Q	A 8 0	- - -		A 1		- - -	> > >	A 0					B 11 0			B 11.2	A 2.8
	5-Greenlane & Ontario St.	TCS	LOS Delay V/C Q	F 122 1.07	C 26 0.31	> > >	F 88	C 29 0.05	C 30 0.57	> > >	C 30	B 12 0.14	C 30 0.79	> > >	C 28	B 17 0.21	B 18 0.33	> > >	B 18	D 37.7
PM Peak Hour	1 - Greenlane & Lincoln Avenue	AWSC	LOS Delay V/C Q	< < <	B 11 0.40	> > >	B 11	< < <	B 10 0.31	> > >	B 10	< < <	A 9 0.14	> > >	A 9	< < <	B 11 0.28	> > >	B 11	B 10.6
	2 - Greenlane & Cedarbrook Lane & Utopia	TWSC	LOS Delay V/C Q	A 8 0.04	- - -	> > >	A 1	A 8 0.07	- - -	> > >	A 1	< < <	C 16 0.21	> > >	C 16	< < <	C 17 0.14	> > >	C 17	A 4.1
	3 - Greenlane & Juniper Court	TWSC	LOS Delay V/C Q		- - -	> > >	A 0	A 8 0.01	- - -	> > >	A 0	B 12 0.02		> > >	B 12					A 0.3
	4 - Greenlane & Site Access	TWSC	LOS Delay V/C Q	A 8 0	- - -		A 1		- - -	> > >	A 0					B 14 0		> > >	B 14	A 2.3
	5 - Greenlane & Ontario St.	TCS	LOS Delay V/C Q	D 42 0.60	C 35 0.69	> > >	D 37	D 40 0.16	C 30 0.48	> > >	C 31	B 17 0.54	C 28 0.74	> > >	C 26	B 18 0.57	C 24 0.66	> > >	C 23	C 27.0

MOE - Measure of Effectiveness

LOS - Level of Service

Delay - Average Delay per Vehicle in Seconds

Q - 95th Percentile Queue Length

Ex - Existing Available Storage

Avail. - Available Storage

TWSC - Two-Way Stop Control

AWSC - All-Way Stop Control

< / > - Shared Lane



4.4 2031 Background Traffic Volumes

The approved growth rate of 1% per annum was compounded for ten years (total growth of 10%) and applied to the existing traffic to derive the 2031 background traffic. The growth rate of 1% was used because it aligns with the Town of Lincoln TMP.

No other area developments other than that outlined in sec 4.1.2 were added to the general background traffic estimates.

Figure 4.5 illustrates the AM and PM peak hour background traffic.

4.5 2031 Background Traffic Operations

The operations of the study area intersections under 2031 background traffic were evaluated using the same analytical approach as used for the 2026 traffic operations. The signal timings and cycle length have been maintained same as existing conditions.

Table 4.3 summarizes the 2031 AM and PM peak hour background traffic operations. The entries in the table indicate the AM and PM peak hour level of service (LOS), volume to capacity ratios (v/c), and 95th percentile queue length estimates.

The results indicate the study area intersections are forecast to continue operating at acceptable levels of service and within capacity during the AM and PM peak hours except for the critical movement at the intersection of Greenlane and Ontario Street. The movement is as below:

- ▶ The eastbound left turn movement, forecast to operate at LOS F with a v/c ratio of greater than 1.00 during the AM peak hour which indicates that there is a heavy left turning traffic from Greenlane Road towards Ontario Street that exceed the capacity limit. With the additional growth in background traffic in 2031 compared to 2026, the operation of this movement appears to have exacerbated especially during the AM peak hour. The 95th percentile queue length in meters seems to be within the available storage limit for all the movements except for the eastbound left turn movement which exceeds the storage lane length by around 70m.

Appendix G contains the detailed Synchro 10 reports.



The map shows a section of Lincoln Ave running vertically. At the top, Lincoln Ave intersects with Utopia. Below this is Site Access. Further down is Green-lane, which has a 'Green-lane' label on the left. At the bottom is Ontario St. The map includes various street names, lane directions, and various symbols for traffic lights and lane markings.

Streets and Intersections:

- Lincoln Ave** (top)
- Utopia** (left of Lincoln Ave)
- Site Access** (left of Lincoln Ave)
- Green-lane** (left of Lincoln Ave)
- Ontario St.** (bottom)

Other Labels:

- Lincoln Ave** (left of Lincoln Ave)
- Utopia** (left of Utopia)
- Site Access** (left of Site Access)
- Green-lane** (left of Green-lane)
- Ontario St.** (left of Ontario St.)

Map Details:

- The map shows a section of Lincoln Ave running vertically.
- At the top, Lincoln Ave intersects with Utopia.
- Below this is Site Access.
- Further down is Green-lane, which has a 'Green-lane' label on the left.
- At the bottom is Ontario St.
- The map includes various street names, lane directions, and various symbols for traffic lights and lane markings.

[illegible]

TABLE 4.3: 2031 BACKGROUND TRAFFIC OPERATIONS

Analysis Period	Intersection	Control Type	MOE	Direction / Movement / Approach																
				Eastbound				Westbound				Northbound				Southbound				Overall
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	
AM Peak Hour	1 - Greenlane & Lincoln Avenue	AWSC	LOS Delay V/C Q	< 9 < 0.18 < 1	A 9 >	< 9 < 0.23 < 1	A 9 >	< 8 < 0.15 < 1	A 8 >	< 8 < 0.07 < 0	A 8 >	A 8.6								
	2 - Greenlane & Cedarbrook Lane & Utopia	TWSC	LOS Delay V/C Q	A 8 0.01 0	- - - >	A 0	A 8 0.02 0	- - - >	A 1	B 12 0.25 1	- - - >	B 12	< B 12 < 0.11 < 0	> B 12 >	B 12	A 5.3				
	3 - Greenlane & Juniper Court	TWSC	LOS Delay V/C Q	- - - >	A 0	A 8 0.00 0	- - - >	A 0	B 11 0.03 0	- - - >	B 11	- - - >	- - - >	- - - >	- - - >	- - - >	A 0.4			
	4-Greenlane & Ontario St.	TCS	LOS Delay V/C Q	F 106 1.01 94	C 26 0.28 22	> > >	E 78	C 28 0.05 7	C 30 0.60 41	> > >	C 30	B 13 0.15 11	C 33 0.84 188	> > >	C 31	B 18 0.25 10	B 18 0.34 45	> > >	B 18	D 35.6
PM Peak Hour	1 - Greenlane & Lincoln Avenue	AWSC	LOS Delay V/C Q	< 11 < 0.36 < 2	B 11 >	< 10 < 0.27 < 1	A 10 >	< 9 < 0.13 < 0	A 9 >	< 10 < 0.24 < 1	> 10 >	A 10	A 10.0							
	2 - Greenlane & Cedarbrook Lane & Utopia	TWSC	LOS Delay V/C Q	A 8 0.02 0	- - - >	A 1	A 0 0.00 0	- - - >	A 3	B 14 0.17 1	- - - >	B 14	< C 16 < 0.12 < 0	> C 16 >	C 16	A 3.7				
	3 - Greenlane & Juniper Court	TWSC	LOS Delay V/C Q	- - - >	A 0	A 8 0.01 0	- - - >	A 0	B 12 0.02 0	- - - >	B 12	- - - >	- - - >	- - - >	- - - >	- - - >	- - - >	A 0.3		
	4-Greenlane & Ontario St.	TCS	LOS Delay V/C Q	D 42 0.60 49	C 35 0.68 66	> > >	D 37	D 40 0.17 13	C 30 0.49 52	> > >	C 31	B 17 0.55 24	C 31 0.78 166	> > >	C 28	C 21 0.64 30	C 25 0.67 115	> > >	C 24	C 27.8

MOE - Measure of Effectiveness

LOS - Level of Service

Delay - Average Delay per Vehicle in Seconds

Q - 95th Percentile Queue Length

Ex - Existing Available Storage

Avail. - Available Storage

TWSC - Two-Way Stop Control

AWSC - All-Way Stop Control

< / > - Shared Lane



4.6 2031 Future Total Traffic Operations

The site generated traffic was added to the 2031 background traffic to derive the future total traffic.

Figure 4.6 illustrates the AM and PM peak hour total traffic.

The operations of the study area intersections under 2031 future total traffic were evaluated using the same analytical approach as used for 2031 background traffic operations.

Table 4.4 summarizes the 2031 AM and PM peak hour future total traffic operations. The entries in the table indicate the AM and PM peak hour level of service (LOS), volume to capacity ratios (v/c), and 95th percentile queue length estimates. The signal timings and cycle length have been maintained same as existing conditions.

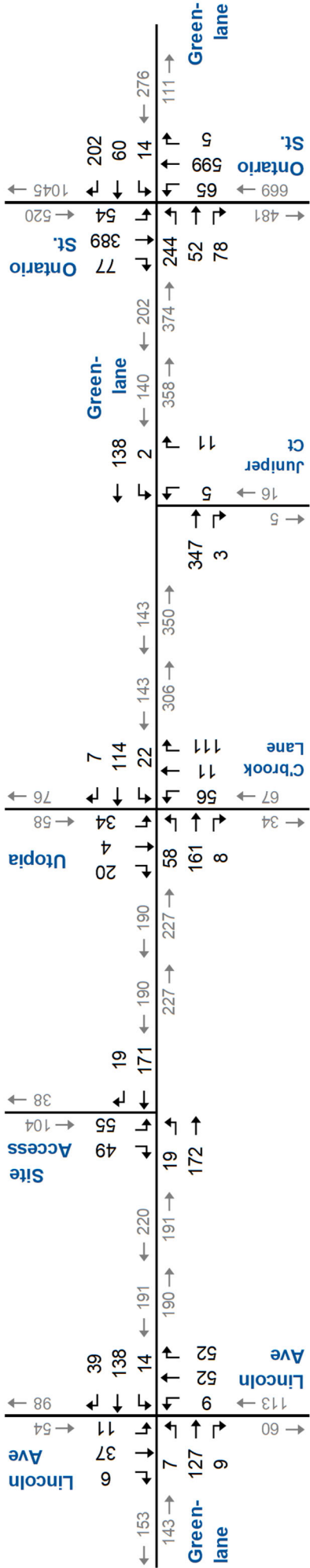
The results indicate the study area intersections are forecast to continue operating at acceptable levels of service and within capacity during the AM and PM peak hours except for the critical movement at the intersection of Greenlane and Ontario Street. The movement is as below:

- ▶ The eastbound left turn movement, forecast to operate at LOS F with a v/c ratio of greater than 1.00 during the AM peak hour which indicates that there is a heavy left turning traffic from Greenlane Road towards Ontario Street that exceed the capacity limit. With the addition of site traffic in 2031 compared to 2026, the operation of this movement appears to have exacerbated especially during the AM peak hour. The 95th percentile queue length in meters seems to be within the available storage limit for all the movements except for the eastbound left turn movement which exceeds the storage lane length by around 90m.
- ▶ The site access intersection with Greenlane is reported to operate at acceptable level of service and well within capacity. The 95th percentile queues are observed to be very low.

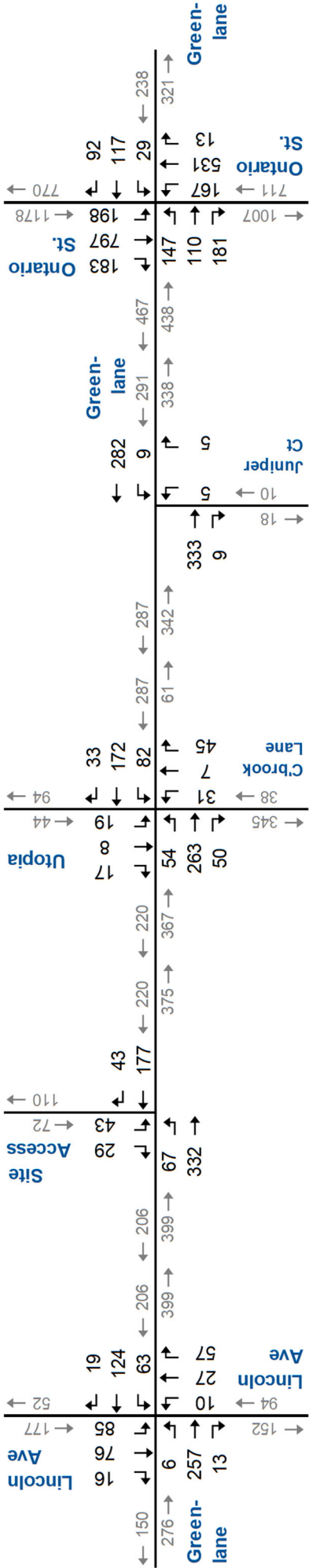
Appendix H contains the detailed Synchro 10 reports.



AM Peak



PM Peak



2031 Peak Hour Future Total Traffic

TABLE 4.4: 2031 FUTURE TOTAL TRAFFIC OPERATIONS

Analysis Period	Intersection	Control Type	MOE	Direction / Movement / Approach																
				Eastbound				Westbound				Northbound				Southbound				Overall
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	
AM Peak Hour	1 - Greenlane & Lincoln Avenue	AWSC	LOS Delay V/C Q	< 9 < 0.20 < 0.7 >	A 9 >	A 9	< 9 < 0.30 < 1.3 >	A 9	< 9 < 0.16 < 0.6 >	A 9	< 9 < 0.08 < 0.3 >	A 9	< 9 < 0.08 < 0.3 >	A 9	< 9 < 0.08 < 0.3 >	A 9	A 9.0			
	2 - Greenlane & Cedarbrook Lane & Utopia	TWSC	LOS Delay V/C Q	A 8 0.04 0.1 >	- >	A 2	A 8 0.02 0.1 >	A 1	< B 13 < 0.30 < 1.3 >	B 13	< B 14 < 0.14 < 0.5 >	B 14	A 6.2							
	3 - Greenlane & Juniper Court	TWSC	LOS Delay V/C Q	- >	- >	A 0	A 8 0.00 0 >	A 0	B 11 0.03 0 >	B 11			A 0.4							
	4 - Greenlane & Site Access	TWSC	LOS Delay V/C Q	A 8 0 0 >	- >	A 1	- >	A 0			B 11 0 1 >		B 11.4	A 2.8						
	5-Greenlane & Ontario St.	TCS	LOS Delay V/C Q	F 158 1.17 112 >	C 26 0.33 26 >	F 112	C 29 0.05 7 >	C 30 0.60 43 >	C 30	B 13 0.16 12 >	C 33 0.84 188 >	C 31	B 18 0.25 10 >	B 34 0.46 >	B 18	D 43.7				
PM Peak Hour	1 - Greenlane & Lincoln Avenue	AWSC	LOS Delay V/C Q	< 12 < 0.42 < 2 >	B >	B 12	< 11 < 0.32 < 1 >	B 11	< 9 < 0.15 < 1 >	A 9	< 11 < 0.29 < 1 >	B 11	B 11.0							
	2 - Greenlane & Cedarbrook Lane & Utopia	TWSC	LOS Delay V/C Q	A 8 0.04 0 >	- >	A 1	A 8 0.07 0 >	A 1	< C 17 < 0.23 < 1 >	C 17	< C 18 < 0.14 < 1 >	C 18	A 4.1							
	3 - Greenlane & Juniper Court	TWSC	LOS Delay V/C Q	- >	- >	A 0	A 8 0.01 0 >	A 0	B 12 0.02 0 >	B 12			A 0.3							
	4 - Greenlane & Site Access	TWSC	LOS Delay V/C Q	A 8 0 0 >	- >	A 1	- >	A 0			B 14 0 1 >		B 14	A 2.2						
	5 - Greenlane & Ontario St.	TCS	LOS Delay V/C Q	D 44 0.63 53 >	D 36 0.71 72 >	D 39	D 41 0.18 13 >	C 30 0.49 55 >	C 31	B 19 0.60 26 >	C 32 0.80 166 >	C 29	C 22 0.65 30 >	C 27 0.70 117 >	C 26	C 29.5				

MOE - Measure of Effectiveness

LOS - Level of Service

Delay - Average Delay per Vehicle in Seconds

Q - 95th Percentile Queue Length

Ex. - Existing Available Storage

Avail. - Available Storage

TWSC - Two-Way Stop Control

AWSC - All-Way Stop Control

< / > - Shared Lane



5 Remedial Measures

5.1 Intersection/Roadway Mitigation

5.1.1 Greenlane at Ontario Street

The eastbound left turn movement at the Greenlane and Ontario Street intersection has been identified as critical under 2026 and 2031 horizons (with or without the development) during AM peak hour. Signal timing optimization along with increasing the cycle length to 120 seconds could be considered to alleviate this issue.

Table 5.1 summarizes the AM peak hour 2031 future total traffic intersection operations with signal timing improvements. The analyses indicate that all study area intersections are operating with overall acceptable levels of service and within capacity during the AM peak hour.

The 95th percentile queue length in meters seems to be within the available storage limit for all the movements except for the eastbound left turn movement which exceeds the storage lane length by around 90m. Given the presence of left turning storage lane at Juniper Court located approximately 55 m to the west of the Greenlane and Ontario Street intersection there is not much scope to increase the available storage at the Greenlane Road for the eastbound left turning movement.

Appendix I contains the detailed Synchro 10 reports.



TABLE 5.1: 2031 SENSITIVITY ANALYSIS

Analysis Period	Intersection	Control Type	MOE	Direction / Movement / Approach															
				Eastbound				Westbound				Northbound				Southbound			
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach
AM Peak Hour	1-Greenlane & Ontario St.	TCS	LOS Delay V/C Q	E 61 0.83 112	C 25 0.25 25	> > > >	D 48	C 27 0.04 7	C 28 0.47 42	> > > >	C 28	B 19 0.18 16	D 39 0.84 214	> > > >	D 37	C 26 0.33 14	C 22 0.34 53	> > > >	C 22
																			C 33.6

MOE - Measure of Effectiveness

LOS - Level of Service

Delay - Average Delay per Vehicle in Seconds

Q - 95th Percentile Queue Length

Ex - Existing Available Storage

Avail. - Available Storage

TWSC - Two-Way Stop Control

AWSC - All-Way Stop Control

< / > - Shared Lane



5.2 Left-Turn Lane Warrants

The Ministry of Transportation Ontario (MTO) Design Supplement for the Transportation Association of Canada (TAC) Geometric Design Guide for Canadian Roads (GDGCR)⁹ provides procedures to assess the need for auxiliary left-turn lanes.

The need for eastbound left turn lane on the Greenlane at the at the site driveway was assessed for the 2026 and 2031 future total traffic volumes. The warrants were conducted using the Ministry of Transportation (MTO) left-turn lane warrant for an unsignalized intersection with a two-lane cross section for a 60 kilometre per hour design speed (10 kilometres per hour over the posted speed limit).

The warrants indicate the following:

- ▶ Forecast Year 2026: a left-turn lane with 15 metres storage is warranted on Greenlane at the site driveway; and
- ▶ Forecast Year 2031: the 15 metres storage warranted at the 2026 horizon is also warranted at the 2031 horizon.

The warrant can be found on **Appendix J**.

⁹ Ministry of Transportation Ontario. *Design Supplement for the TAC Geometric Design Guide for Canadian Roads, Section 9.17*. June 2017.



6 Conclusions and Recommendations

6.1 Conclusions

Based on the investigations carried out, it is concluded that:

- ▶ **Existing Traffic Operations:** The study area intersections are operating with overall acceptable levels of service and within capacity.

The 95th percentile queue length in meters seems to be within the available storage limit for all the movements except for the eastbound left turn movement which exceeds the storage lane length by around 45m during the AM peak hour.

- ▶ **Site Generated Traffic:** The site is forecast to generate a total of 142 AM peak hour trips and 182 PM peak hour trips.
- ▶ **2026 Background Traffic Operations:** The study area intersections are forecast to operate at overall acceptable levels of service and within capacity except for the critical movement-eastbound left turn at Greenlane and Ontario Street intersection which is forecast to operate at LOS E with a v/c ratio of 0.92 during the AM peak hour.

The 95th percentile queue length in meters seems to be within the available storage limit for all the movements except for the eastbound left turn movement which exceeds the storage lane length by around 60m during the AM peak hour.

- ▶ **2031 Background Traffic Operations:** The study area intersections are forecast to operate at overall acceptable levels of service and within capacity except for the critical movement-eastbound left turn at Greenlane and Ontario Street intersection which is forecast to operate at LOS F with a v/c ratio of greater than 1.00 during the AM peak hour.

The 95th percentile queue length in meters seems to be within the available storage limit for all the movements except for the eastbound left turn movement which exceeds the storage lane length by around 70m during the AM peak hour.

- ▶ **2026 Future Total Traffic Operations:** The study area intersections are forecast to operate at overall acceptable levels of service and within capacity except for the critical movement-eastbound left turn at Greenlane and Ontario Street intersection which is forecast to operate at LOS F with a v/c ratio of greater than 1.00 during the AM peak hour.

The 95th percentile queue length in meters seems to be within the available storage limit for all the movements except for the



eastbound left turn movement which exceeds the storage lane length by around 80m during the AM peak hour. Additionally, the 95th percentile queues for the outbound traffic from the site are observed to be very low.

- ▶ **2031 Future Total Traffic Operations:** The study area intersections are forecast to operate at overall acceptable levels of service and within capacity except for the critical movement-eastbound left turn at Greenlane and Ontario Street intersection which is forecast to operate at LOS F with a v/c ratio of greater than 1.00 during the AM peak hour.

The 95th percentile queue length in meters seems to be within the available storage limit for all the movements except for the eastbound left turn movement which exceeds the storage lane length by around 90m during the AM peak hour. Additionally, the 95th percentile queues for the outbound traffic from the site are observed to be very low.

- ▶ **Remedial Measures:** All study area intersection under 2031 future total traffic conditions are generally forecast to operate at acceptable levels of service and within capacity with signal timing optimization and increase in cycle length to 120s. It is noted that 95th percentile queue length exceeds storage lane by 90m. The extension of available storage space may not be possible due to spatial constraint.
- ▶ **Left Turn Warrant:** A left turn auxiliary lane with 15 meters storage is warranted on Greenlane at the site driveway under the 2026 horizon.

6.2 Recommendations

Based on the findings of this study, it is recommended that:

- ▶ The site be permitted to develop as planned;
- ▶ Increase cycle length of Greenlane and Ontario Street intersection to 120s and optimize the signal timing splits and phases to ensure the best operations for all movements; and
- ▶ An eastbound left turn lane on Greenlane at the site driveway with at least 15 metres of storage be provided.



Appendix A

Pre-Study Consultation Materials



From: [Walter Neubauer](#)
To: [Jill Juhlke](#); [Christine Kinahan](#)
Cc: [Eric Vonk](#); [Sarada Pulugurta](#)
Subject: RE: (210236) Utopia West Pre-Study Consultation
Date: May 11, 2021 10:35:38 AM
Attachments: [image003.png](#)
[image005.png](#)
[image006.png](#)

Factoring old traffic data is probably a more reliable indicator at this point.

**Walter Neubauer, C.E.T.
Manager, Engineering Services**

Town of Lincoln
Direct: 905-563-2799 ext. 278
Tel: 905-563-8205
wneubauer@lincoln.ca

lincoln.ca

 @TownofLincolnON

From: Jill Juhlke <jjuhlke@ptsl.com>
Sent: May 10, 2021 2:38 PM
To: Christine Kinahan <ckinahan@lincoln.ca>
Cc: Eric Vonk <evonk@lincoln.ca>; Walter Neubauer <wneubauer@lincoln.ca>; Sarada Pulugurta <spulugurta@ptsl.com>
Subject: RE: (210236) Utopia West Pre-Study Consultation

Thanks Christine,

Give the uncertainty around re-opening, will the Town will accept counts conducted during the current lockdown?

Thanks,

Jill Juhlke, C.E.T.
Senior Project Manager



Paradigm Transportation Solutions Limited

5A-150 Pinebush Road, Cambridge ON N1R 8J8
p: 905.381.2229 x301
e: jjuhlke@ptsl.com
w: www.ptsl.com

From: Christine Kinahan <ckinahan@lincoln.ca>
Sent: May 10, 2021 8:40 AM

To: Jill Juhlke <jjuhlke@ptsl.com>

Cc: Eric Vonk <evonk@lincoln.ca>; Walter Neubauer <wneubauer@lincoln.ca>

Subject: RE: (210236) Utopia West Pre-Study Consultation

Good morning Jill,

Just wanted to let you know we do not have any recent counts on hand for any of the identified locations.

Don't hesitate to reach out if you need any info or data, I will do my best to assist.

Thank you, and have a great day.

Christine Kinahan, Dipl.T
Engineering Technician, Engineering Services

Town of Lincoln

Direct: 905-563-2799 ext. 233

Tel: 905-563-8205

ckinahan@lincoln.ca

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@TownofLincolnON

From: Walter Neubauer <wneubauer@lincoln.ca>

Sent: May 7, 2021 10:27 AM

To: Jill Juhlke <jjuhlke@ptsl.com>; Christine Kinahan <ckinahan@lincoln.ca>

Cc: Eric Vonk <evonk@lincoln.ca>

Subject: RE: (210236) Utopia West Pre-Study Consultation

Hi Jill

Comments in red **below**. Please feel free to contact either Christine or myself if you have any questions. Also copying in Eric Vonk for comments.

Walter Neubauer, C.E.T.
Manager, Engineering Services

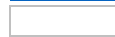
Town of Lincoln

Direct: 905-563-2799 ext. 278

Tel: 905-563-8205

wneubauer@lincoln.ca

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@TownofLincolnON

From: Jill Juhlke <jjuhlke@ptsl.com>

Sent: May 4, 2021 3:12 PM

To: Christine Kinahan <ckinahan@lincoln.ca>
Cc: Walter Neubauer <wneubauer@lincoln.ca>
Subject: (210236) Utopia West Pre-Study Consultation

Hi Christine,

We have been retained by New Horizon developments to prepare a transportation impact study in support of the proposed Utopia West residential development located at 5103 Greenlane.

The property owner is proposing to develop the site to include:

- ▶ 285 m² (3,070 sq. ft.) of ground-floor commercial space; and
- ▶ up to 400 apartment condominium units.

Vehicle access is proposed via one all-turns site driveway connection to Greenlane.

A total parking supply of about 500 parking spaces is proposed.

The Transportation Impact Study will follow the Niagara Region Guidelines for Transportation Impact Studies (2012). The following items supplement these guidelines:

1. The following study area intersections:
 - Greenlane and Cedarbrook lane (unsignalized)
 - **Greenlane and Lincoln Avenue**
 - **Greenlane and Juniper Court**
 - The site driveway connection to Greenlane
2. We will utilize the most recent count data from the Town. If The Town does not have data more recent than June 2016, we will utilize the traffic data collected as part of the transportation impact study completed by Paradigm for the Utopia East development currently under construction (immediately west of Sobey's). We will apply a Town-approved growth factor to the volumes to represent existing conditions.
 - **Town TMP**
 - **Niagara Region Go Hub Study**
 - **New data should be collected, there has been a lot of growth in Lincoln and this is a busy corridor. New data should be cross-referenced with older 2016 data given Covid impacts to driving patterns.**
3. Traffic forecasts will be completed for five (5) years from the date of the study and two analysis periods (AM and PM peak hours). **I'd like to see a 10 year forecast as well please.**
4. Trip generation will be based on ITE 10th Edition rates using the appropriate land use

codes (LUC). Tentatively those will include LUC 221 Multifamily Housing (Mid-Rise) and LUC 820 Shopping Center.

5. Trip distribution will be based on the existing travel patterns within the study area. The trips will be assigned based on the most logical routes to/from the site.
6. Unless otherwise directed, general background growth will be accounted for at a 2% per annum, compounded over the study years.
7. Traffic growth from nearby developments will be accounted for and as such, by way of this email we are requesting this information as applicable. **Please reference Town's TMP, Regional TMP and available TIS from surrounding developments**
8. All traffic analyses will be undertaken using Synchro 10.
9. All analyses results, assumptions and supporting documentation will be included within the report appendices.
10. We have assumed the Town will require an access and circulation review to ensure compliance of the proposed development plan with Town requirements, specifically refuse collection and fire vehicle circulation. Please confirm this will be required.

We kindly request your review and comment on the proposed work plan. Feel free to contact me if you have any questions or require additional information.

Thank you,

Jill Juhlke, C.E.T.
Senior Project Manager



Paradigm Transportation Solutions Limited

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presence of viruses. Paradigm Transportation Solutions Limited accepts no liability for any damage caused by any virus transmitted by this e-mail.

Appendix B

Detailed Traffic Count Data and Signal Timing Plan



Green Lane Rd @ Lincoln Ave

Morning Peak Diagram

Specified Period

From: 7:00:00

To: 9:00:00

One Hour Peak

From: 8:00:00

To: 9:00:00

Municipality: Beamsville

Site #: 0000000099

Intersection: Green Lane Rd & Lincoln Ave

TFR File #: 3

Count date: 27-Jun-2012

Weather conditions:

Sunny/Dry

Person(s) who counted:

Karin

**** Non-Signalized Intersection ****

Major Road: Green Lane Rd runs W/E

North Leg Total: 117

North Entering: 45

North Peds: 0

Peds Cross: $\nlessgtr$

Heavys	0	0	1	1
Trucks	0	1	1	2
Cars	5	32	5	42
Totals	5	33	7	



Heavys	0
Trucks	3
Cars	69
Totals	72

East Leg Total: 271

East Entering: 130

East Peds: 0

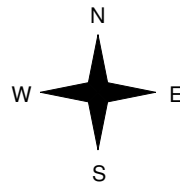
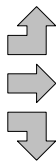
Peds Cross: $\nlessgtr$

Heavys	Trucks	Cars	Totals
0	3	98	101



Green Lane Rd

Heavys	Trucks	Cars	Totals
0	1	5	6
1	1	95	97
1	1	6	8
2	3	106	



Lincoln Ave

Cars	Trucks	Heavys	Totals
18	1	0	19
87	1	0	88
21	1	1	23
126	3	1	



Green Lane Rd



Cars	Trucks	Heavys	Totals
136	3	2	141

Peds Cross: $\nlessgtr$

West Peds: 0

West Entering: 111

West Leg Total: 212

Cars	59
Trucks	3
Heavys	2
Totals	64



Cars	6	46	36	88
Trucks	2	1	1	4
Heavys	0	0	0	0
Totals	8	47	37	

Peds Cross: $\nlessgtr$

South Peds: 1

South Entering: 92

South Leg Total: 156

Comments

Green Lane Rd @ Lincoln Ave

Mid-day Peak Diagram

Specified Period

From: 11:00:00

To: 14:00:00

One Hour Peak

From: 12:30:00

To: 13:30:00

Municipality: Beamsville

Site #: 0000000099

Intersection: Green Lane Rd & Lincoln Ave

TFR File #: 3

Count date: 27-Jun-2012

Weather conditions:

Sunny/Dry

Person(s) who counted:

Karin

** Non-Signalized Intersection **

Major Road: Green Lane Rd runs W/E

North Leg Total: 105

North Entering: 57

North Peds: 2

Peds Cross: $\times$

Heavys	0	0	0	0
Trucks	0	0	0	0
Cars	10	34	13	57
Totals	10	34	13	



Heavys	0
Trucks	0
Cars	48
Totals	48

East Leg Total: 364

East Entering: 184

East Peds: 2

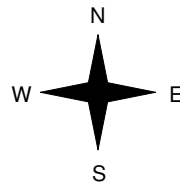
Peds Cross: $\times$

Heavys	Trucks	Cars	Totals
1	3	152	156



Green Lane Rd

Heavys	Trucks	Cars	Totals
0	0	5	5
1	3	121	125
0	0	8	8
1	3	134	



Lincoln Ave

Cars	Trucks	Heavys	Totals
17	0	0	17
134	3	1	138
29	0	0	29
180	3	1	

Green Lane Rd



Cars	Trucks	Heavys	Totals
176	3	1	180

Peds Cross: $\times$

West Peds: 0

West Entering: 138

West Leg Total: 294

Cars	71
Trucks	0
Heavys	0
Totals	71



Cars	8	26	42	76
Trucks	0	0	0	0
Heavys	0	0	0	0
Totals	8	26	42	

Peds Cross: $\times$

South Peds: 9

South Entering: 76

South Leg Total: 147

Comments

Green Lane Rd @ Lincoln Ave

Afternoon Peak Diagram

Specified Period

From: 15:00:00

To: 18:00:00

One Hour Peak

From: 15:45:00

To: 16:45:00

Municipality: Beamsville

Site #: 0000000099

Intersection: Green Lane Rd & Lincoln Ave

TFR File #: 3

Count date: 27-Jun-2012

Weather conditions:

Sunny/Dry

Person(s) who counted:

Karin

** Non-Signalized Intersection **

Major Road: Green Lane Rd runs W/E

North Leg Total: 177

North Entering: 131

North Peds: 2

Peds Cross: $\times$

Heavys	0	0	0	0
Trucks	1	2	2	5
Cars	13	66	47	126
Totals	14	68	49	



Heavys 1

Trucks 1

Cars 44

Totals 46

East Leg Total: 450

East Entering: 191

East Peds: 0

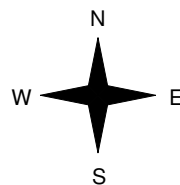
Peds Cross: $\times$

Heavys	Trucks	Cars	Totals
0	5	139	144



Green Lane Rd

Heavys	Trucks	Cars	Totals
1	0	4	5
1	7	167	175
0	0	12	12
2	7	183	



Lincoln Ave

Cars	Trucks	Heavys	Totals
16	1	0	17
118	3	0	121
52	1	0	53
186	5	0	

Green Lane Rd



Cars	Trucks	Heavys	Totals
249	9	1	259

Peds Cross: $\times$

West Peds: 2

West Entering: 192

West Leg Total: 336

Cars	130
Trucks	3
Heavys	0
Totals	133



Cars	8	24	35	67
Trucks	1	0	0	1
Heavys	0	0	0	0
Totals	9	24	35	

Peds Cross: $\times$

South Peds: 2

South Entering: 68

South Leg Total: 201

Comments

Green Lane Rd @ Lincoln Ave

Total Count Diagram

Municipality: Beamsville
Site #: 0000000099
Intersection: Green Lane Rd & Lincoln Ave
TFR File #: 3
Count date: 27-Jun-2012

Weather conditions:
 Sunny/Dry
Person(s) who counted:
 Karin

**** Non-Signalized Intersection ****

Major Road: Green Lane Rd runs W/E

North Leg Total: 1036
 North Entering: 553
 North Peds: 27
 Peds Cross: $\times$

	Heavys	Trucks	Cars	Totals
North	1	1	1	3
East	2	6	3	11
South	61	326	152	539
Totals	64	333	156	

	Heavys	Trucks	Cars	Totals
North	3	6	474	483
East	3	6	474	483
South	61	326	152	539
Totals	64	333	156	

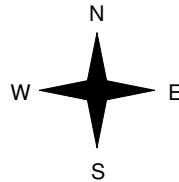
East Leg Total: 2668
 East Entering: 1228
 East Peds: 5
 Peds Cross: $\times$

Heavys	Trucks	Cars	Totals
7	18	903	928



Green Lane Rd

Heavys	Trucks	Cars	Totals
1	1	40	42
16	19	954	989
2	3	60	65
19	23	1054	



Lincoln Ave

Cars	Trucks	Heavys	Totals
144	2	1	147
789	13	5	807
268	5	1	274
1201	20	7	

Green Lane Rd

Cars	Trucks	Heavys	Totals
1394	28	18	1440

Peds Cross: $\times$
 West Peds: 6
 West Entering: 1096
 West Leg Total: 2024

	Cars	Trucks	Heavys	Totals
West	654	14	4	672
South	53	3	1	57
East	290	3	1	294
North	288	6	1	295
Totals	631	12	3	

Peds Cross: $\times$
 South Peds: 24
 South Entering: 646
 South Leg Total: 1318

Comments



Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada N2J 1N8
519-896-3163 cbowness@pts1.com

Count Name: Greenlane & Cedarbrook Lane
Site Code:
Start Date: 06/01/2016
Page No: 1

Turning Movement Data

Start Time	Greenlane Eastbound					Greenlane Westbound					Cedarbrook Lane Northbound					Int. Total
	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	U-Turn	Peds	App. Total	Left	Right	U-Turn	Peds	App. Total	
6:00 AM	11	0	0	0	11	1	9	0	0	10	2	9	0	0	11	32
6:15 AM	17	1	0	0	18	4	11	0	0	15	4	11	0	0	15	48
6:30 AM	20	0	0	0	20	0	16	0	0	16	4	17	0	0	21	57
6:45 AM	20	3	0	1	23	0	16	0	0	16	4	15	0	1	19	58
Hourly Total	68	4	0	1	72	5	52	0	0	57	14	52	0	1	66	195
7:00 AM	16	3	0	0	19	3	19	0	0	22	5	4	0	0	9	50
7:15 AM	18	0	0	0	18	6	19	0	0	25	8	21	0	0	29	72
7:30 AM	22	2	0	0	24	5	23	0	0	28	12	24	0	0	36	88
7:45 AM	38	0	0	0	38	5	20	0	0	25	10	31	0	1	41	104
Hourly Total	94	5	0	0	99	19	81	0	0	100	35	80	0	1	115	314
8:00 AM	26	1	0	1	27	3	15	0	0	18	9	19	0	1	28	73
8:15 AM	21	4	0	0	25	6	22	0	0	28	7	22	0	1	29	82
8:30 AM	23	1	0	0	24	3	22	1	0	26	9	25	0	1	34	84
8:45 AM	24	4	0	1	28	5	25	0	0	30	3	16	0	1	19	77
Hourly Total	94	10	0	2	104	17	84	1	0	102	28	82	0	4	110	316
9:00 AM	29	2	0	0	31	6	28	0	0	34	4	13	0	0	17	82
9:15 AM	21	4	0	0	25	8	10	0	0	18	4	7	0	0	11	54
9:30 AM	22	5	0	0	27	7	30	0	0	37	1	15	0	0	16	80
9:45 AM	37	3	0	0	40	5	25	0	1	30	2	6	0	0	8	78
Hourly Total	109	14	0	0	123	26	93	0	1	119	11	41	0	0	52	294
10:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3:00 PM	33	3	0	0	36	18	25	0	0	43	4	11	0	0	15	94
3:15 PM	37	11	0	0	48	13	41	0	0	54	3	5	0	0	8	110
3:30 PM	37	5	0	0	42	15	37	0	0	52	6	8	0	1	14	108
3:45 PM	46	11	0	0	57	20	45	0	0	65	5	16	0	0	21	143
Hourly Total	153	30	0	0	183	66	148	0	0	214	18	40	0	1	58	455
4:00 PM	41	8	0	0	49	21	52	0	0	73	9	9	0	0	18	140
4:15 PM	37	8	0	0	45	18	36	0	0	54	8	16	0	0	24	123
4:30 PM	43	8	0	0	51	16	55	1	0	72	1	8	0	0	9	132
4:45 PM	50	8	0	0	58	16	37	0	0	53	6	6	0	0	12	123
Hourly Total	171	32	0	0	203	71	180	1	0	252	24	39	0	0	63	518
5:00 PM	56	15	0	0	71	24	54	0	0	78	7	11	0	0	18	167
5:15 PM	50	12	0	0	62	15	46	0	0	61	4	14	0	0	18	141
5:30 PM	34	8	0	0	42	20	45	0	0	65	7	11	0	1	18	125
5:45 PM	40	7	0	0	47	14	39	0	0	53	7	13	0	0	20	120
Hourly Total	180	42	0	0	222	73	184	0	0	257	25	49	0	1	74	553

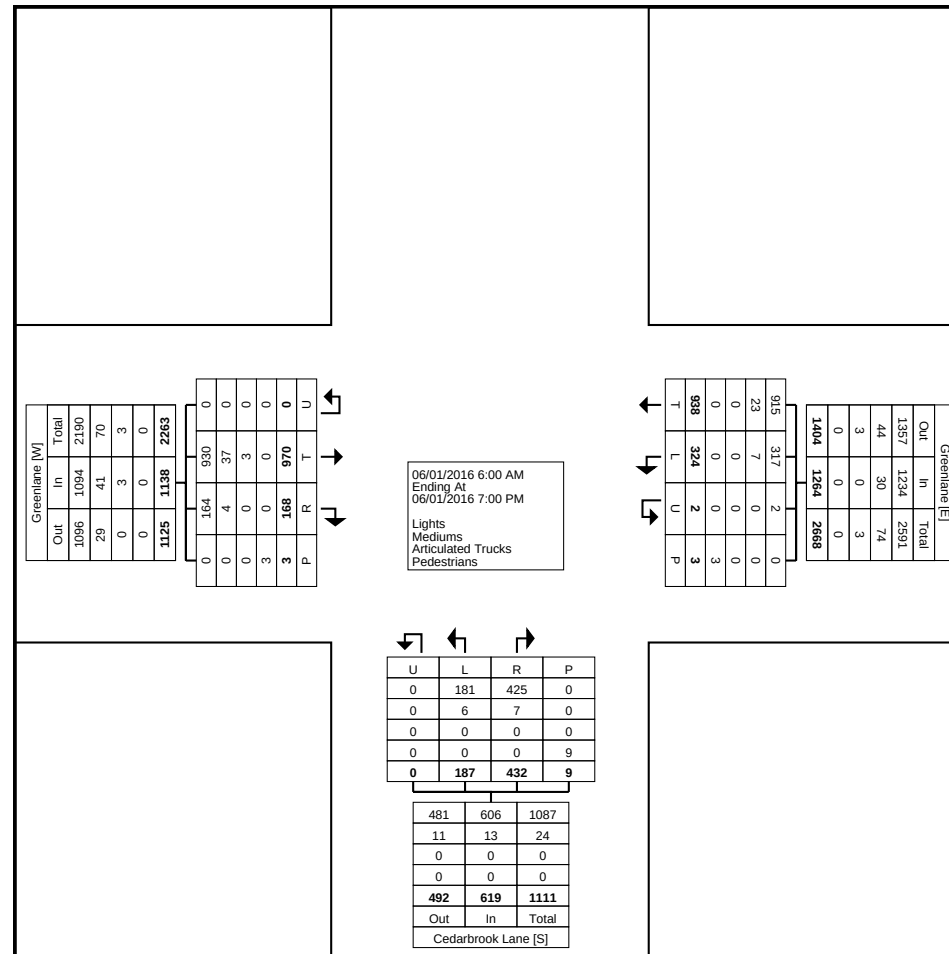
6:00 PM	29	6	0	0	35	11	36	0	0	47	7	15	0	0	22	104
6:15 PM	21	11	0	0	32	15	31	0	0	46	9	13	0	0	22	100
6:30 PM	18	8	0	0	26	14	21	0	0	35	8	12	0	1	20	81
6:45 PM	33	6	0	0	39	7	28	0	2	35	8	9	0	0	17	91
Hourly Total	101	31	0	0	132	47	116	0	2	163	32	49	0	1	81	376
Grand Total	970	168	0	3	1138	324	938	2	3	1264	187	432	0	9	619	3021
Approach %	85.2	14.8	0.0	-	-	25.6	74.2	0.2	-	-	30.2	69.8	0.0	-	-	-
Total %	32.1	5.6	0.0	-	37.7	10.7	31.0	0.1	-	41.8	6.2	14.3	0.0	-	20.5	-
Lights	930	164	0	-	1094	317	915	2	-	1234	181	425	0	-	606	2934
% Lights	95.9	97.6	-	-	96.1	97.8	97.5	100.0	-	97.6	96.8	98.4	-	-	97.9	97.1
Mediums	37	4	0	-	41	7	23	0	-	30	6	7	0	-	13	84
% Mediums	3.8	2.4	-	-	3.6	2.2	2.5	0.0	-	2.4	3.2	1.6	-	-	2.1	2.8
Articulated Trucks	3	0	0	-	3	0	0	0	-	0	0	0	0	-	0	3
% Articulated Trucks	0.3	0.0	-	-	0.3	0.0	0.0	0.0	-	0.0	0.0	0.0	-	-	0.0	0.1
Pedestrians	-	-	-	3	-	-	-	-	3	-	-	-	-	9	-	-
% Pedestrians	-	-	-	100.0	-	-	-	-	100.0	-	-	-	-	100.0	-	-



Paradigm Transportation Solutions Limited
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Waterloo, Ontario, Canada N2J 1N8
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Count Name: Greenlane & Cedarbrook Lane
Site Code:
Start Date: 06/01/2016
Page No: 3



Turning Movement Data Plot



Paradigm Transportation Solutions Limited
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Count Name: Greenlane & Cedarbrook Lane
Site Code:
Start Date: 06/01/2016
Page No: 4

Turning Movement Peak Hour Data (7:30 AM)

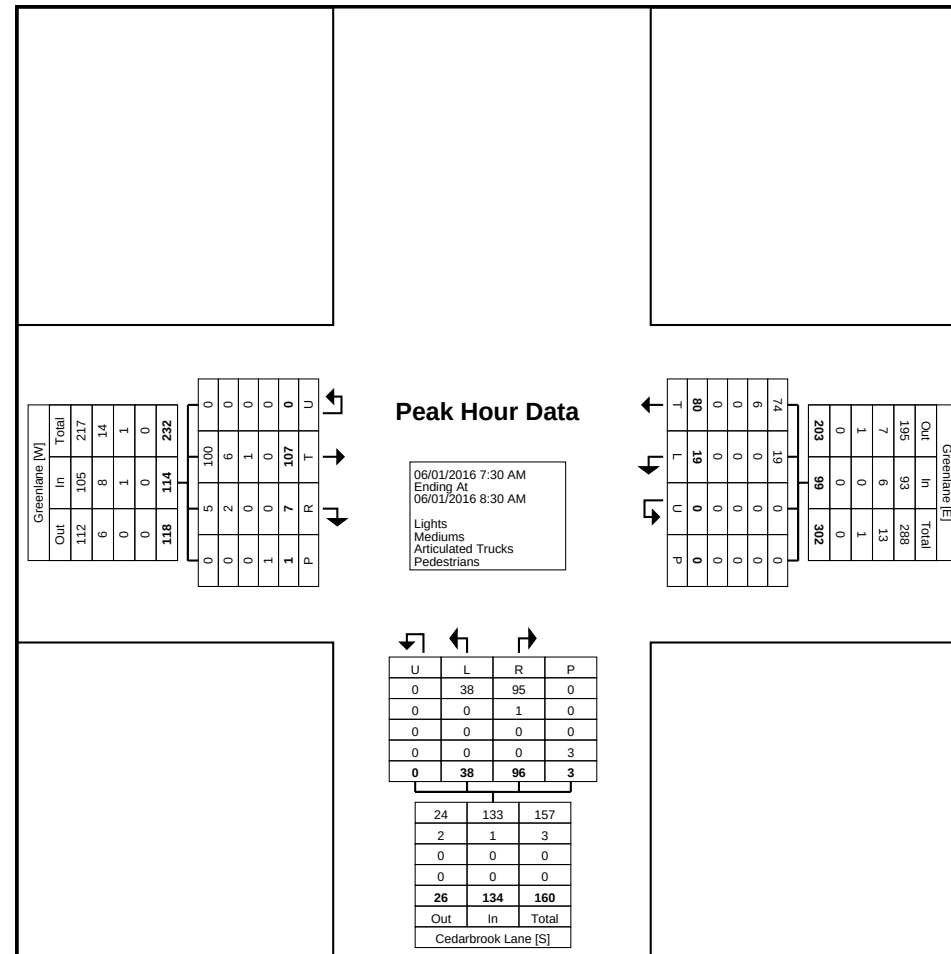
Start Time	Greenlane Eastbound					Greenlane Westbound					Cedarbrook Lane Northbound					Int. Total
	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	U-Turn	Peds	App. Total	Left	Right	U-Turn	Peds	App. Total	
7:30 AM	22	2	0	0	24	5	23	0	0	28	12	24	0	0	36	88
7:45 AM	38	0	0	0	38	5	20	0	0	25	10	31	0	1	41	104
8:00 AM	26	1	0	1	27	3	15	0	0	18	9	19	0	1	28	73
8:15 AM	21	4	0	0	25	6	22	0	0	28	7	22	0	1	29	82
Total	107	7	0	1	114	19	80	0	0	99	38	96	0	3	134	347
Approach %	93.9	6.1	0.0	-	-	19.2	80.8	0.0	-	-	28.4	71.6	0.0	-	-	-
Total %	30.8	2.0	0.0	-	32.9	5.5	23.1	0.0	-	28.5	11.0	27.7	0.0	-	38.6	-
PHF	0.704	0.438	0.000	-	0.750	0.792	0.870	0.000	-	0.884	0.792	0.774	0.000	-	0.817	0.834
Lights	100	5	0	-	105	19	74	0	-	93	38	95	0	-	133	331
% Lights	93.5	71.4	-	-	92.1	100.0	92.5	-	-	93.9	100.0	99.0	-	-	99.3	95.4
Mediums	6	2	0	-	8	0	6	0	-	6	0	1	0	-	1	15
% Mediums	5.6	28.6	-	-	7.0	0.0	7.5	-	-	6.1	0.0	1.0	-	-	0.7	4.3
Articulated Trucks	1	0	0	-	1	0	0	0	-	0	0	0	0	-	0	1
% Articulated Trucks	0.9	0.0	-	-	0.9	0.0	0.0	-	-	0.0	0.0	0.0	-	-	0.0	0.3
Pedestrians	-	-	-	1	-	-	-	-	0	-	-	-	-	3	-	-
% Pedestrians	-	-	-	100.0	-	-	-	-	-	-	-	-	-	100.0	-	-



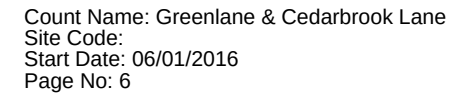
Paradigm Transportation Solutions Limited
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Count Name: Greenlane & Cedarbrook Lane
Site Code:
Start Date: 06/01/2016
Page No: 5



Turning Movement Peak Hour Data Plot (7:30 AM)

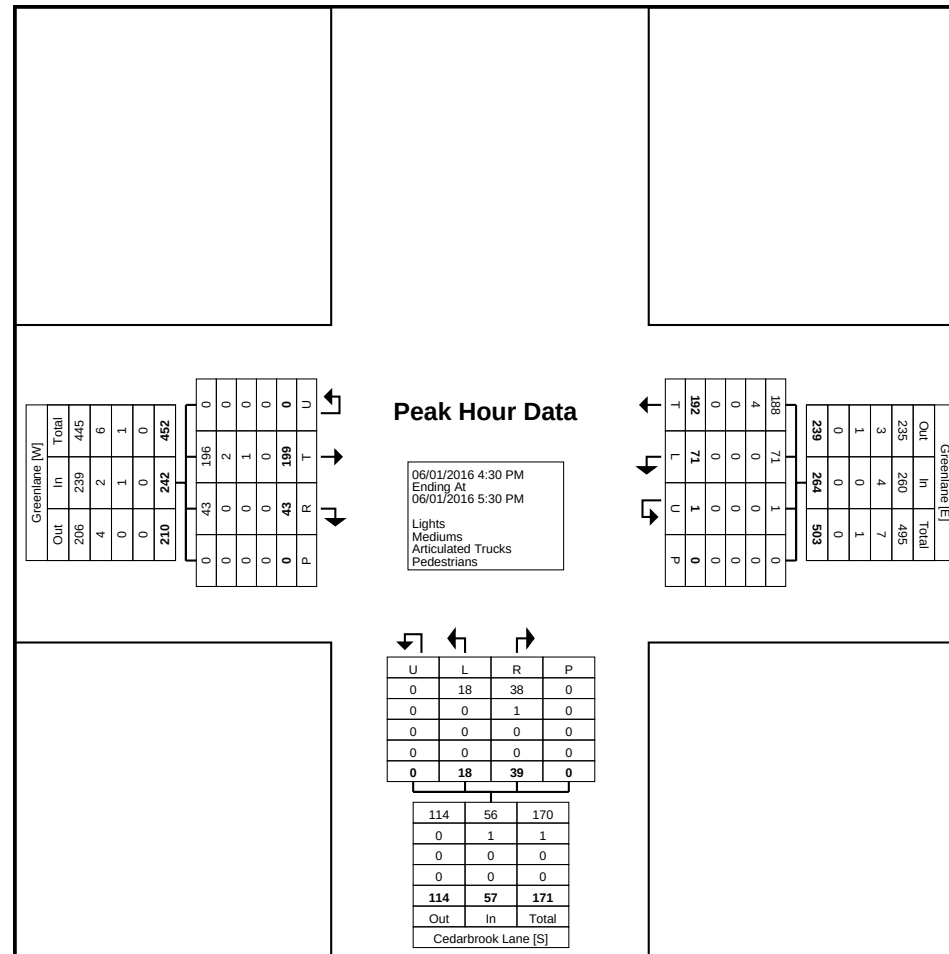




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Count Name: Greenlane & Cedarbrook Lane
Site Code:
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Count Name: Greenlane & Cedarbrook Lane
Site Code:
Start Date: 06/01/2016
Page No: 8

Trip Estimation for Juniper Court and Greenlane intersection

Land Use Code	Units	AM Peak Hour				PM Peak Hour			
		Rate	In	Out	Total	Rate	In	Out	Total
LUC 220- Multifamily Housing (Low-Rise)	43	FCE ¹	5	16	21	FCE ²	18	10	28
Total			5	16	21		18	10	28

$$^1 \ln(T) = 0.95 \ln(X) - 0.51 \quad ^2 \ln(T) = 0.89 \ln(X) - 0.02$$

Location..... Greenlane @ Ontario Street

GeoID..... 01200

Municipality. LINCOLN

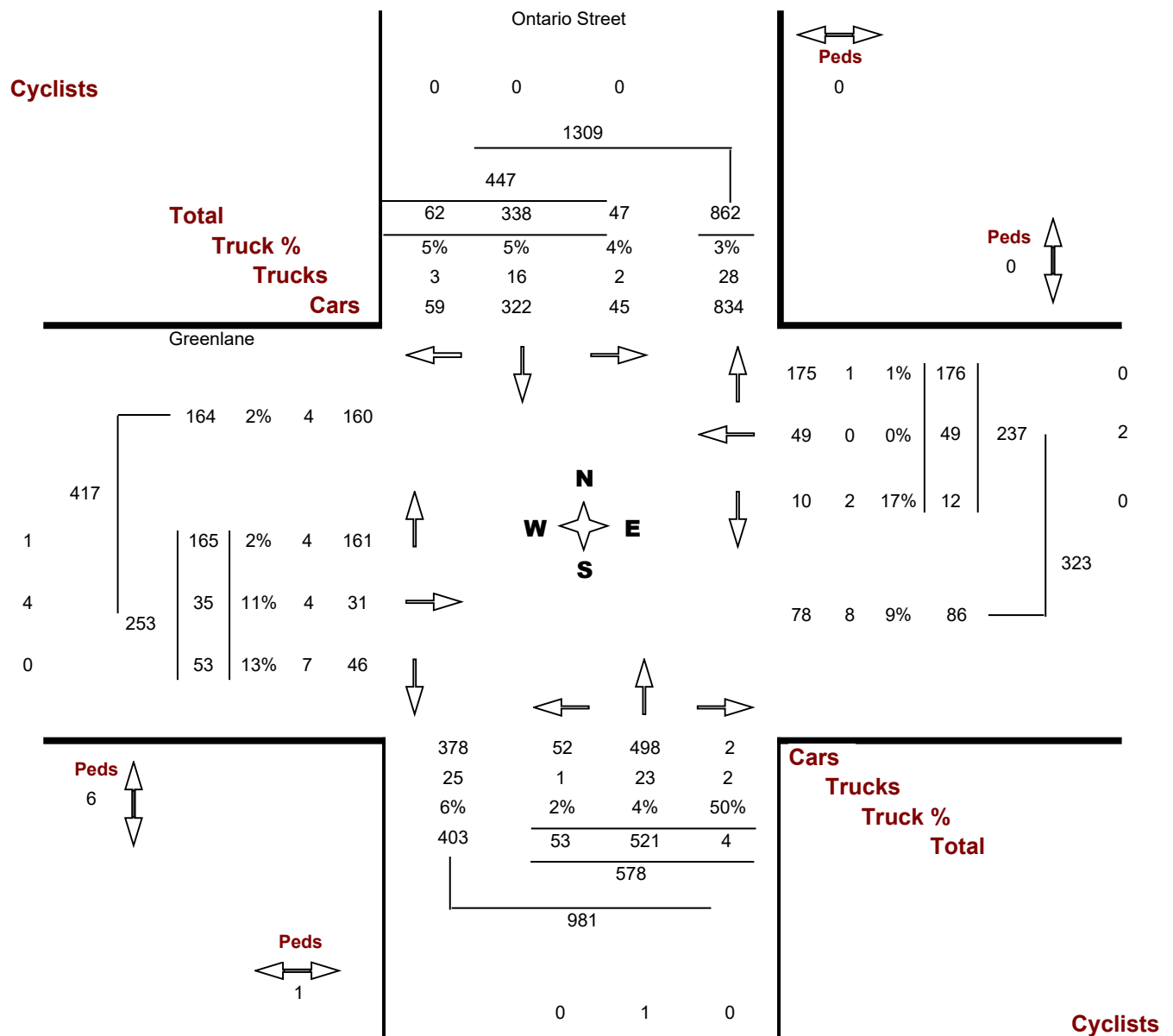
Count Date. Wednesday, 07 June, 2017

Traffic Cont.

Count Time. 07:00 AM — 09:00 AM

Major Dir..... North south

Peak Hour.. 08:00 AM — 09:00 AM



Turning Movements Report - PM Period

Location..... Greenlane @ Ontario Street

GeoID..... 01200

Municipality. LINCOLN

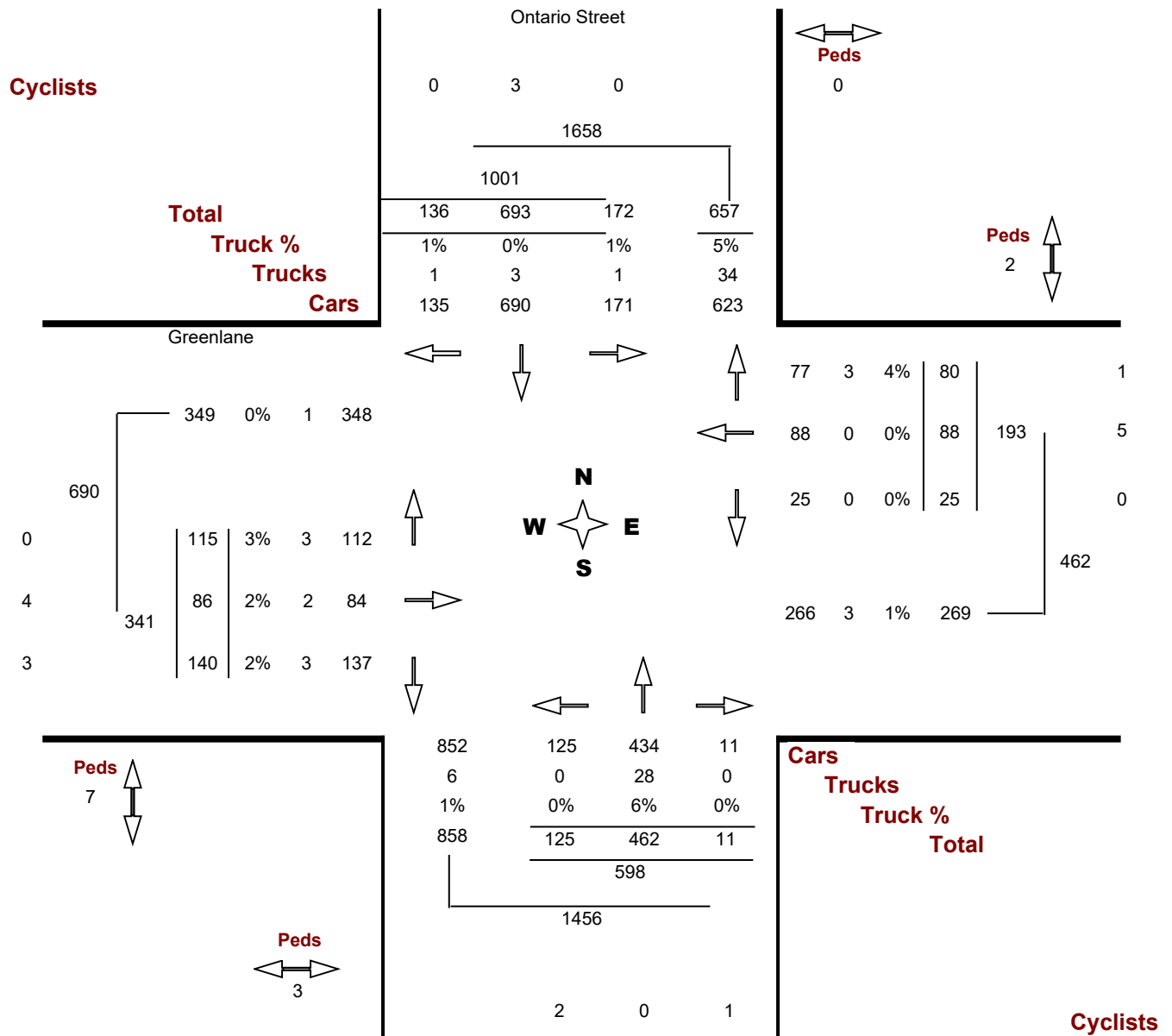
Count Date. Wednesday, 07 June, 2017

Traffic Cont.

Count Time. 03:00 PM — 06:00 PM

Major Dir..... North south

Peak Hour.. 04:30 PM — 05:30 PM

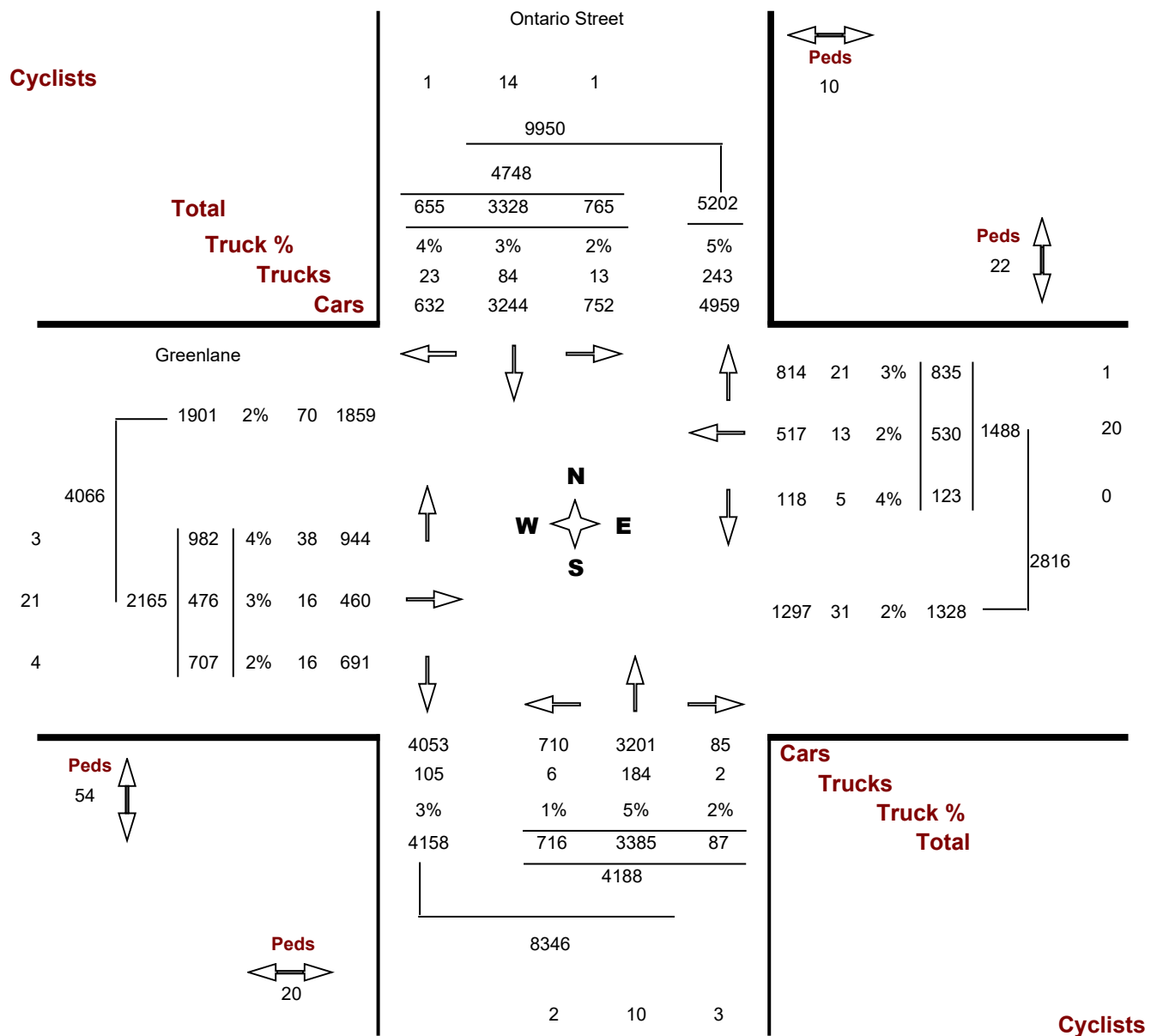


Location..... Greenlane @ Ontario Street

Municipality..... LINCOLN

GeolD..... 01200

Count Date..... Wednesday, 07 June, 2017



Turning Movement Count - Details Report (15 min)

Location..... Greenlane @ Ontario Street
Municipality..... LINCOLN
Count Date..... Wednesday, June 07, 2017

Ontario Street											Greenlane									
North Approach						South Approach					East Approach					West Approach				
Time Period	LT	TH	RT	U-Turn	TOT	LT	TH	RT	U-Turn	TOT	LT	TH	RT	U-Turn	TOT	LT	TH	RT	U-Turn	TOT
07:00 07:15	5	48	11	0	64	8	122	0	0	130	1	7	42	0	50	31	5	8	0	44
07:15 07:30	8	64	21	0	93	7	135	1	0	143	1	8	48	0	57	41	8	6	0	55
07:30 07:45	10	47	18	0	75	12	131	2	0	145	2	17	56	0	75	48	4	5	0	57
07:45 08:00	5	57	17	0	79	8	124	1	0	133	0	12	54	0	66	39	9	6	0	54
Hourly Total	28	216	67	0	311	35	512	4	0	551	4	44	200	0	248	159	26	25	0	210
08:00 08:15	15	82	16	0	113	8	169	0	0	177	3	10	51	0	64	47	11	12	0	70
08:15 08:30	8	81	20	0	109	14	95	3	0	112	3	9	50	0	62	52	10	20	0	82
08:30 08:45	9	83	10	0	102	14	151	0	0	165	3	12	48	0	63	30	7	11	0	48
08:45 09:00	15	92	16	0	123	17	106	1	0	124	3	18	27	0	48	36	7	10	0	53
Hourly Total	47	338	62	0	447	53	521	4	0	578	12	49	176	0	237	165	35	53	0	253
11:00 11:15	25	86	19	0	130	19	93	4	0	116	3	17	16	0	36	28	17	15	0	60
11:15 11:30	19	71	16	0	106	26	88	5	0	119	2	15	16	0	33	23	17	14	0	54
11:30 11:45	14	85	14	0	113	20	96	2	0	118	7	20	23	0	50	26	14	18	0	58
11:45 12:00	15	82	14	0	111	23	100	2	0	125	4	19	20	0	43	25	16	20	0	61
Hourly Total	73	324	63	0	460	88	377	13	0	478	16	71	75	0	162	102	64	67	0	233
12:00 12:15	12	78	23	0	113	19	99	1	0	119	9	18	11	0	38	37	19	27	0	83
12:15 12:30	27	82	16	0	125	22	88	4	0	114	7	11	17	0	35	29	15	23	0	67
12:30 12:45	18	72	18	0	108	24	86	3	0	113	6	13	18	0	37	27	13	22	0	62
12:45 13:00	16	72	27	0	115	21	105	5	0	131	6	16	15	0	37	31	11	18	0	60
Hourly Total	73	304	84	0	461	86	378	13	0	477	28	58	61	0	147	124	58	90	0	272
13:00 13:15	17	88	10	0	115	28	85	7	0	120	3	10	18	0	31	31	19	18	0	68
13:15 13:30	18	80	19	0	117	26	84	5	0	115	5	18	17	0	40	30	11	23	0	64
13:30 13:45	23	85	21	0	129	17	91	0	0	108	6	11	10	0	27	23	17	22	0	62
13:45 14:00	20	85	16	0	121	24	75	7	0	106	3	20	16	0	39	17	10	29	0	56
Hourly Total	78	338	66	0	482	95	335	19	0	449	17	59	61	0	137	101	57	92	0	250
15:00 15:15	31	125	14	0	170	29	102	6	0	137	3	26	22	0	51	28	19	21	0	68
15:15 15:30	35	139	9	0	183	31	98	3	0	132	3	14	22	0	39	29	10	30	0	69
15:30 15:45	41	121	28	0	190	28	105	2	0	135	2	17	29	0	48	24	22	36	0	82
15:45 16:00	28	139	27	0	194	38	114	4	0	156	1	21	22	0	44	20	20	25	0	65
Hourly Total	135	524	78	0	737	126	419	15	0	560	9	78	95	0	182	101	71	112	0	284
16:00 16:15	33	145	25	0	203	29	94	0	0	123	3	24	18	0	45	27	26	29	0	82

Ontario Street											Greenlane									
North Approach						South Approach					East Approach					West Approach				
Time Period	LT	TH	RT	U-Turn	TOT	LT	TH	RT	U-Turn	TOT	LT	TH	RT	U-Turn	TOT	LT	TH	RT	U-Turn	TOT
16:15 16:30	43	134	22	0	199	29	104	5	0	138	5	22	18	0	45	41	19	28	0	88
16:30 16:45	43	166	39	0	248	32	123	3	0	158	8	21	22	0	51	28	19	35	0	82
16:45 17:00	41	166	40	0	247	20	93	3	0	116	5	21	17	0	43	30	26	31	0	87
Hourly Total	160	611	126	0	897	110	414	11	0	535	21	88	75	0	184	126	90	123	0	339
17:00 17:15	45	148	20	0	213	26	128	4	0	158	8	29	15	0	52	27	15	42	0	84
17:15 17:30	43	213	37	0	293	47	118	1	0	166	4	17	26	0	47	30	26	32	0	88
17:30 17:45	46	152	22	0	220	28	82	0	0	110	3	16	22	0	41	27	20	32	0	79
17:45 18:00	37	160	30	0	227	22	101	3	0	126	1	21	29	0	51	20	14	39	0	73
Hourly Total	171	673	109	0	953	123	429	8	0	560	16	83	92	0	191	104	75	145	0	324
Grand Total	765	3328	655	0	4748	716	3385	87	0	4188	123	530	835	0	1488	982	476	707	0	2165
Truck %	2%	3%	4%	0%	3%	1%	5%	2%	0%	5%	4%	2%	3%	0%	3%	4%	3%	2%	0%	3%

Appendix C

Existing Traffic Operations Reports



HCM 2010 AWSC
1: Lincoln Avenue & Greenlane St.

210236 Utopia West
Existing AM peak

Intersection												
Intersection Delay, s/veh	8.2											
Intersection LOS	A											

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↔			↔	
Traffic Vol, veh/h	6	102	8	24	93	20	8	47	39	7	33	5
Future Vol, veh/h	6	102	8	24	93	20	8	47	39	7	33	5
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Free	Free	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None	-	None	-	None	-	None
Storage Length	-	-	150	-	0	-	-	-	0	-	-	-
Veh in Median Storage, #	0	-	-	-	0	0	-	-	-	-	-	-
Grade, %	0	-	-	-	0	0	-	-	-	-	-	-
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	7	111	9	26	101	22	9	51	42	8	36	5
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	8.2	8.4	8	8
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	9%	5%	18%	16%
Vol Thru, %	50%	88%	68%	73%
Vol Right, %	41%	7%	15%	11%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	94	116	137	45
LT Vol	8	6	24	7
Through Vol	47	102	93	33
RT Vol	39	8	20	5
Lane Flow Rate	102	126	149	49
Geometry Grp	1	1	1	1
Degree of Util (X)	0.124	0.154	0.181	0.063
Departure Headway (Hd)	4.381	4.411	4.367	4.636
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	819	815	823	773
Service Time	2.402	2.431	2.384	2.66
HCM Lane V/C Ratio	0.125	0.155	0.181	0.063
HCM Control Delay	8	8.2	8.4	8
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	0.4	0.5	0.7	0.2

HCM 2010 TWSC
2: Cedarbrook Lane

210236 Utopia West
Existing AM peak

Intersection						
Int Delay, s/veh	4					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↔		↔	↔	↔	
Traffic Vol, veh/h	141	7	20	97	40	101
Future Vol, veh/h	141	7	20	97	40	101
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	150	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	153	8	22	105	43	110

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	161
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	4.12
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	2.218
Pot Cap-1 Maneuver	-	-	1418
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	1418
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.3	10.4
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	816	-	-	1418	-
HCM Lane V/C Ratio	0.188	-	-	0.015	-
HCM Control Delay (s)	10.4	-	-	7.6	-
HCM Lane LOS	B	-	-	A	-
HCM 95th %tile Q(veh)	0.7	-	-	0	-

HCM 2010 TWSC
7: Juniper Ct.

210236 Utopia West
Existing AM peak

Intersection							
Int Delay, s/veh	0.5						
Movement	EBT	EBR	WBL	WBT	NBL	NBR	
Lane Configurations	↰		↰	↰	↰	↰	
Traffic Vol, veh/h	239	3	2	112	5	11	
Future Vol, veh/h	239	3	2	112	5	11	
Conflicting Peds, #/hr	0	0	0	0	0	0	
Sign Control	Free	Free	Free	Free	Stop	Stop	
RT Channelized	-	None	-	None	-	None	
Storage Length	-	-	150	-	0	-	
Veh in Median Storage, #	0	-	-	0	0	-	
Grade, %	0	-	-	0	0	-	
Peak Hour Factor	92	92	92	92	92	92	
Heavy Vehicles, %	2	2	2	2	2	2	
Mvmt Flow	260	3	2	122	5	12	

Major/Minor	Major1	Major2	Minor1		
Conflicting Flow All	0	0	263	0	388 262
Stage 1	-	-	-	-	262 -
Stage 2	-	-	-	-	126 -
Critical Hdwy	-	-	4.12	-	6.42 6.22
Critical Hdwy Stg 1	-	-	-	-	5.42 -
Critical Hdwy Stg 2	-	-	-	-	5.42 -
Follow-up Hdwy	-	-	2.218	-	3.518 3.318
Pot Cap-1 Maneuver	-	-	1301	-	616 777
Stage 1	-	-	-	-	782 -
Stage 2	-	-	-	-	900 -
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	1301	-	615 777
Mov Cap-2 Maneuver	-	-	-	-	615 -
Stage 1	-	-	-	-	782 -
Stage 2	-	-	-	-	898 -

Approach	EB	WB	NB
HCM Control Delay, s	0	0.1	10.1
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	718	-	-	1301	-
HCM Lane V/C Ratio	0.024	-	-	0.002	-
HCM Control Delay (s)	10.1	-	-	7.8	-
HCM Lane LOS	B	-	-	A	-
HCM 95th %tile Q(veh)	0.1	-	-	0	-

Queues
9: Ontario St. & Greenlane St.

210236 Utopia West
Existing AM peak

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	187	99	13	254	60	593	53	454
v/c Ratio	0.86	0.24	0.05	0.48	0.11	0.70	0.14	0.29
Control Delay	67.1	14.0	25.4	12.2	8.3	25.3	8.7	14.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	67.1	14.0	25.4	12.2	8.3	25.3	8.7	14.6
Queue Length 50th (m)	33.2	5.5	1.8	10.6	4.1	87.6	3.6	25.0
Queue Length 95th (m)	#69.5	18.1	6.5	32.2	9.9	147.1	9.2	40.3
Internal Link Dist (m)		76.1		136.0		151.0		75.7
Turn Bay Length (m)	25.0		20.0		70.0		30.0	
Base Capacity (vph)	284	513	348	635	615	848	435	1568
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.66	0.19	0.04	0.40	0.10	0.70	0.12	0.29

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

HCM 2010 Signalized Intersection Summary
9: Ontario St. & Greenlane St.

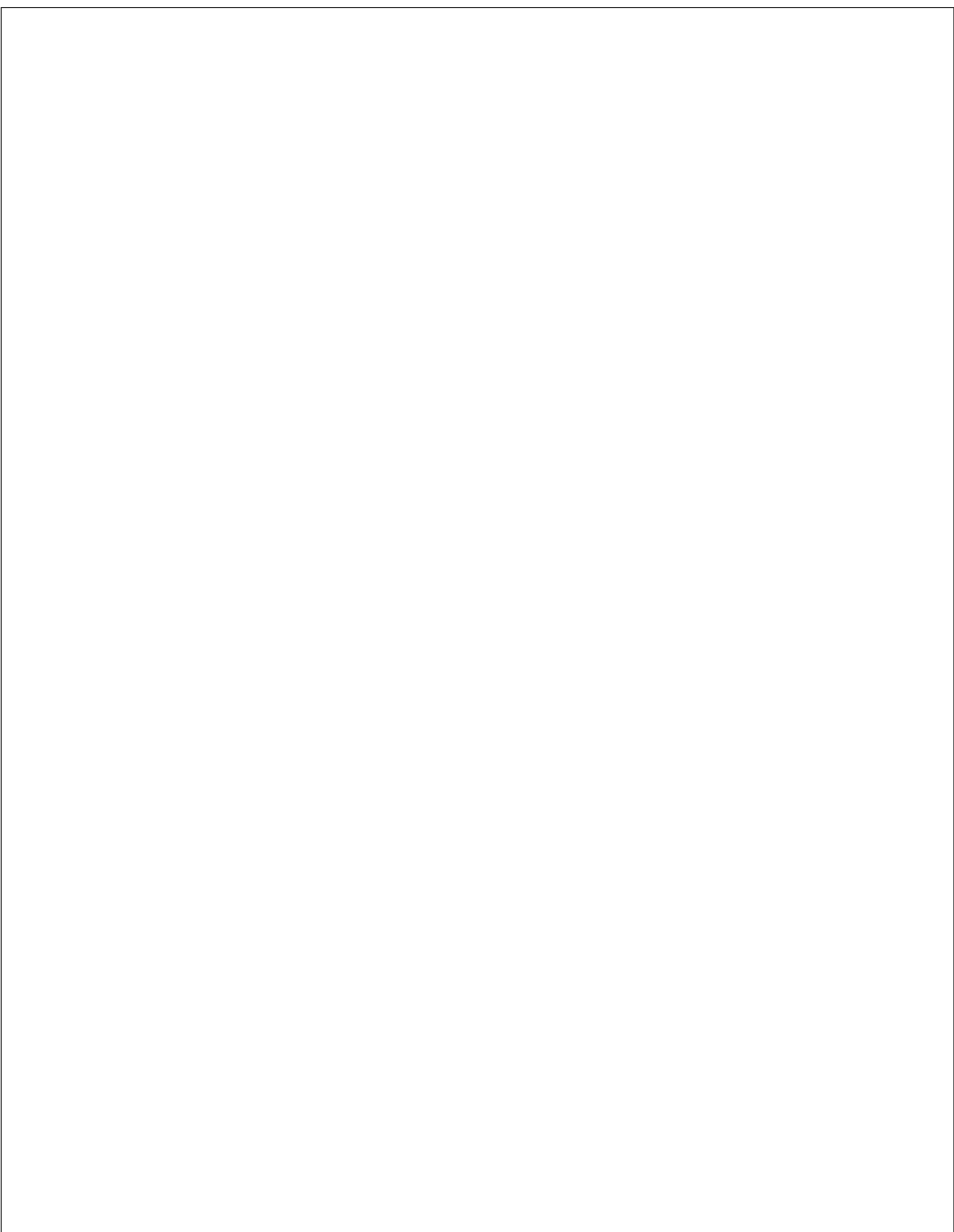
210236 Utopia West
Existing AM peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	172	36	55	12	51	183	55	542	4	49	352	65
Future Volume (veh/h)	172	36	55	12	51	183	55	542	4	49	352	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		0.99	1.00		0.99
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	1716	1560	1750	1496	1736	1750	1716	1678	1750	1683	1667	1750
Adj Flow Rate, veh/h	187	39	60	13	55	199	60	589	4	53	383	71
Adj No. of Lanes	1	1	0	1	1	0	1	1	0	1	2	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh. %	2	11	13	17	0	1	2	4	50	4	5	5
Cap, veh/h	253	172	265	342	102	371	478	780	5	281	1244	228
Arrive On Green	0.31	0.31	0.31	0.31	0.31	0.31	0.05	0.47	0.47	0.05	0.47	0.47
Sat Flow, veh/h	1032	555	853	1036	330	1194	1634	1664	11	1603	2669	490
Grp Volume(v), veh/h	187	0	99	13	0	254	60	0	593	53	226	228
Grp Sat Flow(s), veh/h/ln	1032	0	1408	1036	0	1523	1634	0	1676	1603	1583	1576
Q Serve(g_s), s	16.7	0.0	5.0	0.9	0.0	13.3	1.8	0.0	28.1	1.6	8.6	8.7
Cycle Q Clear(g_c), s	30.0	0.0	5.0	5.9	0.0	13.3	1.8	0.0	28.1	1.6	8.6	8.7
Prop In Lane	1.00		0.61	1.00		0.78	1.00		0.01	1.00		0.31
Lane Grp Cap(c), veh/h	253	0	437	342	0	473	478	0	785	281	738	734
V/C Ratio(X)	0.74	0.00	0.23	0.04	0.00	0.54	0.13	0.00	0.76	0.19	0.31	0.31
Avail Cap(c_a), veh/h	253	0	437	342	0	473	565	0	785	372	738	734
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	1.00	1.00
Uniform Delay (d), s/veh	40.4	0.0	24.7	26.9	0.0	27.6	12.2	0.0	21.1	16.2	16.1	16.1
Incr Delay (d2), s/veh	10.5	0.0	0.2	0.0	0.0	1.0	0.1	0.0	6.7	0.2	1.1	1.1
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	5.7	0.0	2.0	0.3	0.0	5.7	0.8	0.0	14.5	0.7	4.0	4.0
LnGrp Delay(d),s/veh	50.9	0.0	24.9	26.9	0.0	28.5	12.3	0.0	27.8	16.4	17.1	17.2
LnGrp LOS	D		C	C		C	B		C	B	B	B
Approach Vol, veh/h	286			267			653			507		
Approach Delay, s/veh	41.9			28.4			26.4			17.1		
Approach LOS	D			C			C			B		
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	7.6	52.1		36.9	7.8	51.9		36.9				
Change Period (Y+Rc), s	3.0	* 6.9		* 6.9	3.0	* 6.9		* 6.9				
Max Green Setting (Gmax), s	10.0	* 45		* 30	10.0	* 45		* 30				
Max Q Clear Time (g_c+I1), s	3.6	30.1		32.0	3.8	10.7		15.3				
Green Ext Time (p_c), s	0.0	3.5		0.0	0.1	2.9		1.4				
Intersection Summary												
HCM 2010 Ctrl Delay	26.5											
HCM 2010 LOS	C											
Notes												

HCM 2010 Signalized Intersection Summary
9: Ontario St. & Greenlane St.

210236 Utopia West
Existing AM peak

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.



HCM 2010 AWSC
1: Lincoln Avenue & Greenlane St.

210236 Utopia West
Existing PM peak

Intersection												
Intersection Delay, s/veh	9.1											
Intersection LOS	A											

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↔			↔	
Traffic Vol, veh/h	5	184	12	40	92	13	9	24	37	51	68	14
Future Vol, veh/h	5	184	12	40	92	13	9	24	37	51	68	14
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	5	200	13	43	100	14	10	26	40	55	74	15
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	9.5	9	8.3	9.2
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	13%	2%	28%	38%
Vol Thru, %	34%	92%	63%	51%
Vol Right, %	53%	6%	9%	11%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	70	201	145	133
LT Vol	9	5	40	51
Through Vol	24	184	92	68
RT Vol	37	12	13	14
Lane Flow Rate	76	218	158	145
Geometry Grp	1	1	1	1
Degree of Util (X)	0.1	0.281	0.207	0.198
Departure Headway (Hd)	4.718	4.631	4.733	4.924
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	756	773	755	726
Service Time	2.774	2.677	2.782	2.974
HCM Lane V/C Ratio	0.101	0.282	0.209	0.2
HCM Control Delay	8.3	9.5	9	9.2
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	0.3	1.2	0.8	0.7

HCM 2010 TWSC
2: Cedarbrook Lane

210236 Utopia West
Existing PM peak

Intersection						
Int Delay, s/veh	2.4					

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↔		↔	↔	↔	
Traffic Vol, veh/h	227	45	75	126	19	41
Future Vol, veh/h	227	45	75	126	19	41
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	150	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	247	49	82	137	21	45

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	296
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	4.12
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	2.218
Pot Cap-1 Maneuver	-	-	1265
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	1265
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	3	11.4
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	627	-	-	1265	-
HCM Lane V/C Ratio	0.104	-	-	0.064	-
HCM Control Delay (s)	11.4	-	-	8	-
HCM Lane LOS	B	-	-	A	-
HCM 95th %tile Q(veh)	0.3	-	-	0.2	-

HCM 2010 TWSC
7: Juniper Ct.

210236 Utopia West
Existing PM peak

Intersection							
Int Delay, s/veh	0.4						
Movement	EBT	EBR	WBL	WBT	NBL	NBR	
Lane Configurations	↰		↰	↰	↰	↰	
Traffic Vol, veh/h	259	9	9	196	5	5	
Future Vol, veh/h	259	9	9	196	5	5	
Conflicting Peds, #/hr	0	0	0	0	0	0	
Sign Control	Free	Free	Free	Free	Stop	Stop	
RT Channelized	-	None	-	None	-	None	
Storage Length	-	-	150	-	0	-	
Veh in Median Storage, #	0	-	-	0	0	-	
Grade, %	0	-	-	0	0	-	
Peak Hour Factor	92	92	92	92	92	92	
Heavy Vehicles, %	2	2	2	2	2	2	
Mvmt Flow	282	10	10	213	5	5	

Major/Minor	Major1	Major2	Minor1		
Conflicting Flow All	0	0	292	0	520 287
Stage 1	-	-	-	-	287 -
Stage 2	-	-	-	-	233 -
Critical Hdwy	-	-	4.12	-	6.42 6.22
Critical Hdwy Stg 1	-	-	-	-	5.42 -
Critical Hdwy Stg 2	-	-	-	-	5.42 -
Follow-up Hdwy	-	-	2.218	-	3.518 3.318
Pot Cap-1 Maneuver	-	-	1270	-	516 752
Stage 1	-	-	-	-	762 -
Stage 2	-	-	-	-	806 -
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	1270	-	512 752
Mov Cap-2 Maneuver	-	-	-	-	512 -
Stage 1	-	-	-	-	762 -
Stage 2	-	-	-	-	800 -

Approach	EB	WB	NB
HCM Control Delay, s	0	0.3	11
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	609	-	-	1270	-
HCM Lane V/C Ratio	0.018	-	-	0.008	-
HCM Control Delay (s)	11	-	-	7.9	-
HCM Lane LOS	B	-	-	A	-
HCM 95th %tile Q(veh)	0.1	-	-	0	-

Queues
9: Ontario St. & Greenlane St.

210236 Utopia West
Existing PM peak

	↰	→	↰	←	↰	↑	↰	↓
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	130	147	28	190	141	535	195	938
v/c Ratio	0.73	0.47	0.13	0.58	0.35	0.62	0.38	0.54
Control Delay	56.0	30.3	30.2	31.5	7.8	19.9	7.6	15.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	56.0	30.3	30.2	31.5	7.8	19.9	7.6	15.4
Queue Length 50th (m)	21.4	18.7	4.1	22.8	6.7	61.4	9.7	50.7
Queue Length 95th (m)	41.4	36.8	11.4	44.1	17.4	120.2	23.6	89.0
Internal Link Dist (m)		74.6		145.6		151.8		77.4
Turn Bay Length (m)	25.0		20.0		70.0		30.0	
Base Capacity (vph)	346	585	405	589	444	866	545	1729
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.38	0.25	0.07	0.32	0.32	0.62	0.36	0.54

Intersection Summary								
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HCM 2010 Signalized Intersection Summary
9: Ontario St. & Greenlane St.

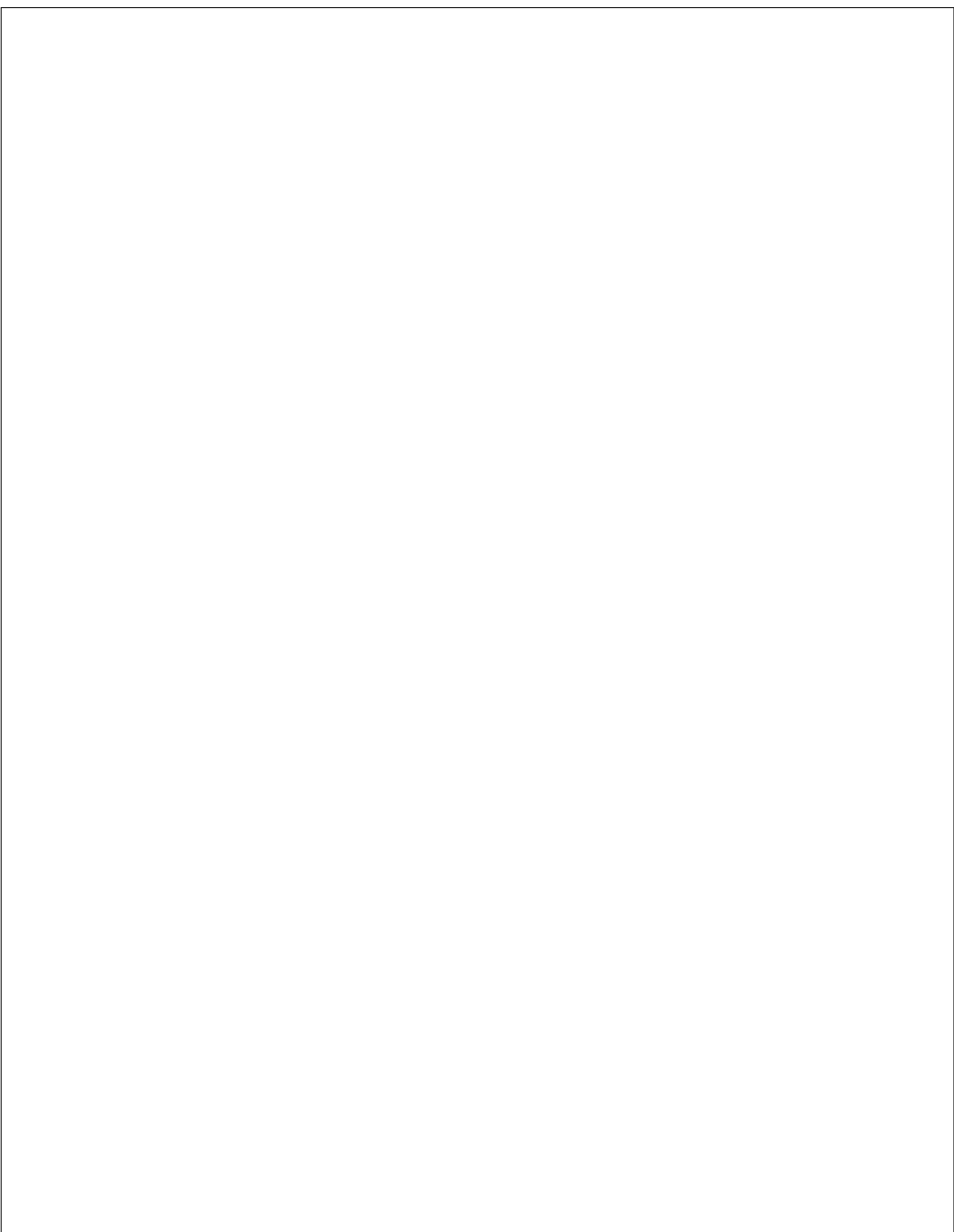
210236 Utopia West
Existing PM peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	120	89	46	26	92	83	130	481	11	179	721	142
Future Volume (veh/h)	120	89	46	26	92	83	130	481	11	179	721	142
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		0.99	1.00		0.99	1.00		0.99
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	1699	1716	1750	1750	1717	1750	1750	1653	1750	1733	1747	1750
Adj Flow Rate, veh/h	130	97	50	28	100	90	141	523	12	195	784	154
Adj No. of Lanes	1	1	0	1	1	0	1	1	0	1	2	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	3	2	2	0	0	4	0	6	0	1	0	1
Cap, veh/h	241	271	139	285	211	190	353	781	18	401	1388	273
Arrive On Green	0.25	0.25	0.25	0.25	0.25	0.25	0.06	0.49	0.49	0.08	0.50	0.50
Sat Flow, veh/h	1080	1067	550	1158	832	748	1667	1609	37	1650	2764	543
Grp Volume(v), veh/h	130	0	147	28	0	190	141	0	535	195	471	467
Grp Sat Flow(s), veh/h/ln	1080	0	1616	1158	0	1580	1667	0	1646	1650	1660	1647
Q Serve(g_s), s	10.8	0.0	6.9	1.9	0.0	9.5	3.9	0.0	23.0	5.3	18.3	18.3
Cycle Q Clear(g_c), s	20.2	0.0	6.9	8.8	0.0	9.5	3.9	0.0	23.0	5.3	18.3	18.3
Prop In Lane	1.00		0.34	1.00		0.47	1.00		0.02	1.00		0.33
Lane Grp Cap(c), veh/h	241	0	410	285	0	401	353	0	799	401	833	827
V/C Ratio(X)	0.54	0.00	0.36	0.10	0.00	0.47	0.40	0.00	0.67	0.49	0.56	0.56
Avail Cap(c_a), veh/h	317	0	523	366	0	511	428	0	799	446	833	827
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	1.00	1.00
Uniform Delay (d), s/veh	38.0	0.0	28.4	32.0	0.0	29.4	12.4	0.0	18.2	13.6	16.0	16.0
Incr Delay (d2), s/veh	1.4	0.0	0.4	0.1	0.0	0.6	0.5	0.0	4.4	0.7	2.8	2.8
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	3.3	0.0	3.1	0.6	0.0	4.2	1.8	0.0	11.4	2.5	9.0	8.9
LnGrp Delay(d),s/veh	39.3	0.0	28.8	32.2	0.0	30.0	12.9	0.0	22.7	14.3	18.8	18.8
LnGrp LOS	D		C	C		C	B		C	B	B	B
Approach Vol, veh/h	277			218			676			1133		
Approach Delay, s/veh	33.8			30.3			20.6			18.0		
Approach LOS	C			C			C			B		
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	10.4	51.9		30.4	8.9	53.5		30.4				
Change Period (Y+Rc), s	3.0	* 6.9		* 6.9	3.0	* 6.9		* 6.9				
Max Green Setting (Gmax), s	10.0	* 45		* 30	10.0	* 45		* 30				
Max Q Clear Time (g_c+I1), s	7.3	25.0		22.2	5.9	20.3		11.5				
Green Ext Time (p_c), s	0.2	3.4		0.8	0.1	6.7		1.1				
Intersection Summary												
HCM 2010 Ctrl Delay	21.8											
HCM 2010 LOS	C											
Notes												

HCM 2010 Signalized Intersection Summary
9: Ontario St. & Greenlane St.

210236 Utopia West
Existing PM peak

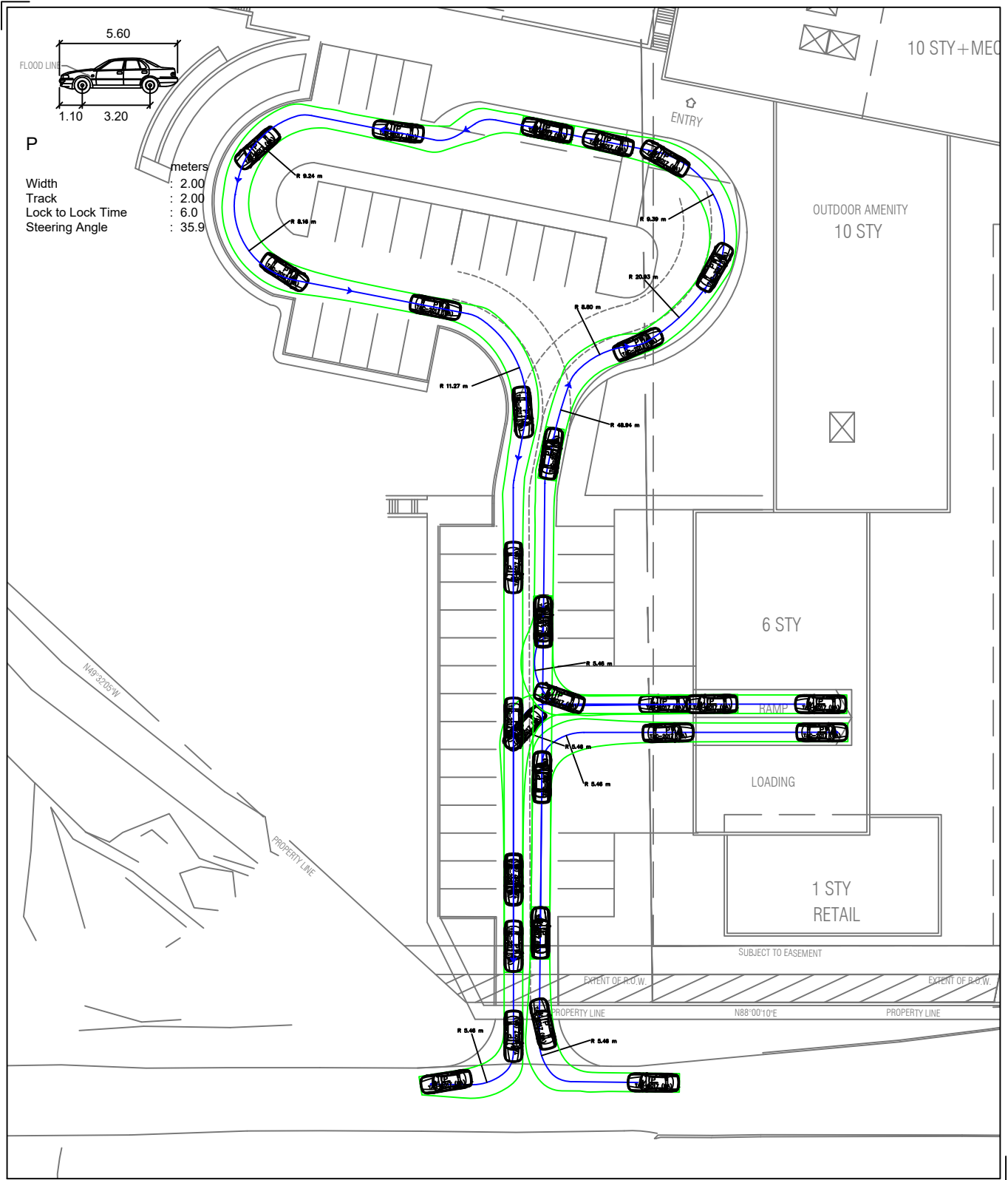
* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

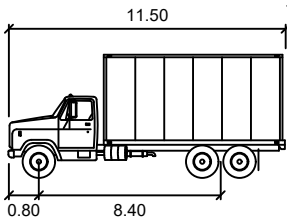


Appendix D

Swept Path Analysis







HSU

	meters
Width	: 2.60
Track	: 2.60
Lock to Lock Time	: 6.0
Steering Angle	: 40.0

6 STY

RAMP

1 STY
RETAIL

SUBJECT TO EASEMENT

PROPERTY LINE

EXTENT OF R.O.W.

PROPERTY LINE

N88°00'10"E

R9

R 266.03 m

R 10.02 m

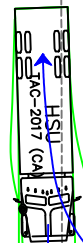
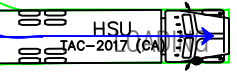
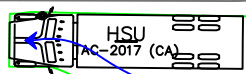
R 13.08 m

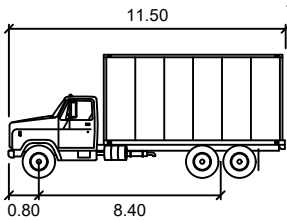
R 25.16 m

R 178.18 m

R 13.08 m

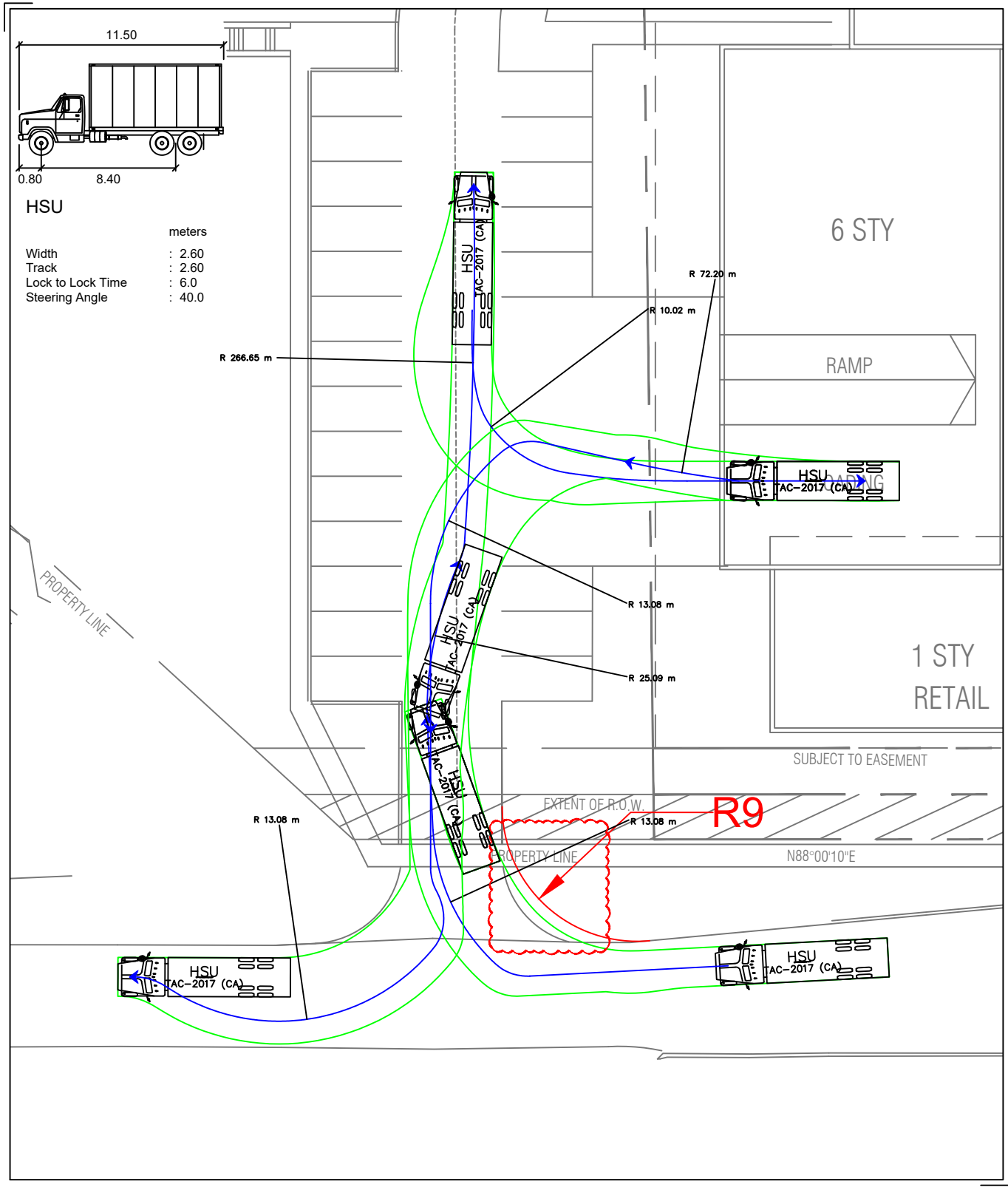
R 13.08 m

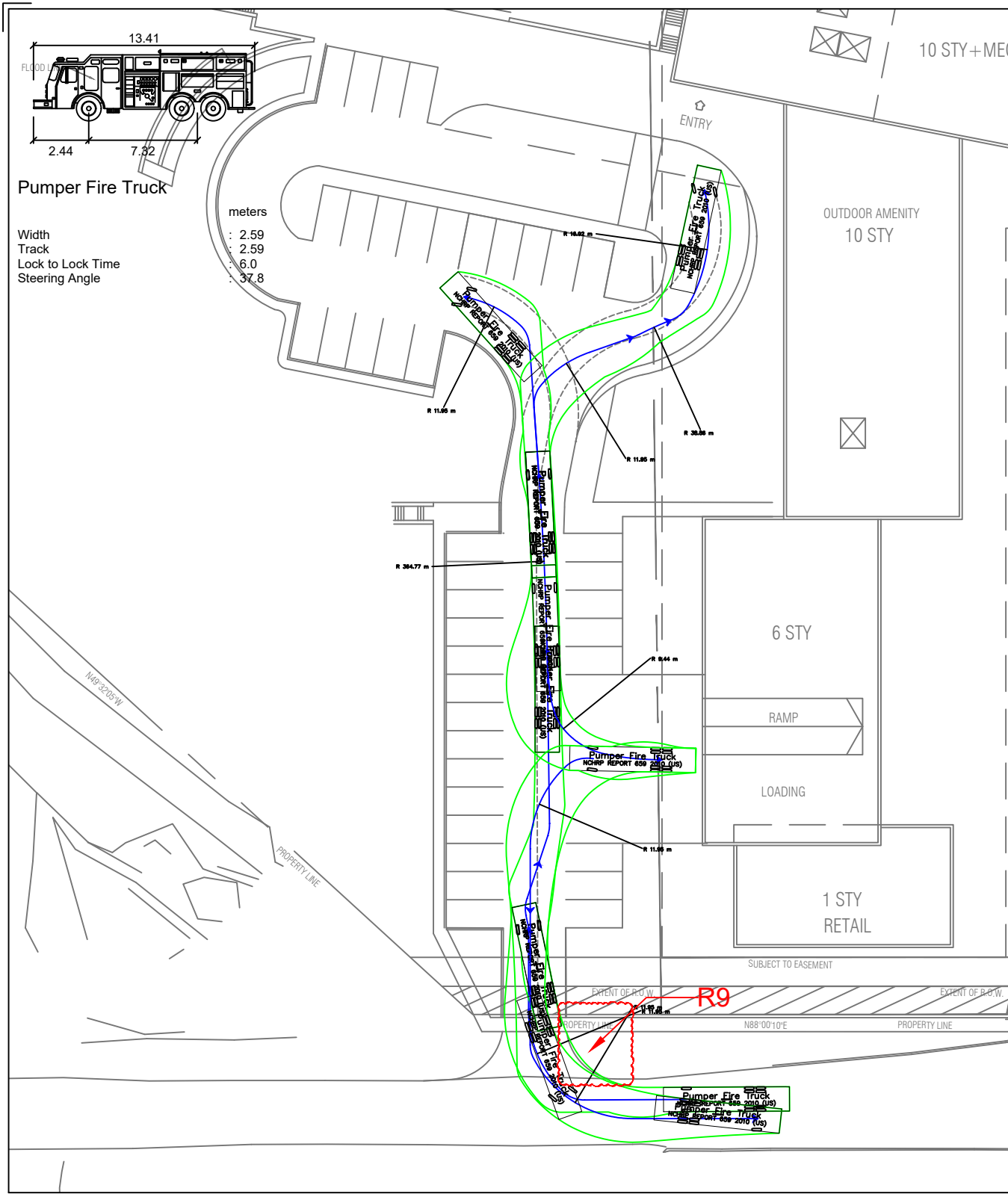




HSU

	meters
Width	: 2.60
Track	: 2.60
Lock to Lock Time	: 6.0
Steering Angle	: 40.0





Appendix E

2026 Background Traffic Operations Reports



HCM 2010 AWSC
1: Lincoln Avenue & Greenlane St.

210236 Utopia West
2026 Background AM peak

Intersection												
Intersection Delay, s/veh	8.2											
Intersection LOS	A											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	6	114	8	1	111	24	8	50	43	7	35	5
Future Vol, veh/h	6	114	8	1	111	24	8	50	43	7	35	5
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	7	124	9	1	121	26	9	54	47	8	38	5
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0
Approach	EB			WB			NB			SB		
Opposing Approach	WB			EB			SB			NB		
Opposing Lanes	1			1			1			1		
Conflicting Approach Left	SB			NB			EB			WB		
Conflicting Lanes Left	1			1			1			1		
Conflicting Approach Right	NB			SB			WB			EB		
Conflicting Lanes Right	1			1			1			1		
HCM Control Delay	8.4			8.3			8.1			8		
HCM LOS	A			A			A			A		
Lane	NBLn1	EBLn1	WBLn1	SBLn1								
Vol Left, %	8%	5%	1%	15%								
Vol Thru, %	50%	89%	82%	74%								
Vol Right, %	43%	6%	18%	11%								
Sign Control	Stop	Stop	Stop	Stop								
Traffic Vol by Lane	101	128	136	47								
LT Vol	8	6	1	7								
Through Vol	50	114	111	35								
RT Vol	43	8	24	5								
Lane Flow Rate	110	139	148	51								
Geometry Grp	1	1	1	1								
Degree of Util (X)	0.134	0.172	0.179	0.066								
Departure Headway (Hd)	4.402	4.438	4.355	4.675								
Convergence, Y/N	Yes	Yes	Yes	Yes								
Cap	815	810	825	766								
Service Time	2.427	2.458	2.375	2.703								
HCM Lane V/C Ratio	0.135	0.172	0.179	0.067								
HCM Control Delay	8.1	8.4	8.3	8								
HCM Lane LOS	A	A	A	A								
HCM 95th-tile Q	0.5	0.6	0.6	0.2								

HCM 2010 TWSC
2: Cedarbrook Lane /Utopia

210236 Utopia West
2026 Background AM peak

Intersection												
Int Delay, s/veh	5.3											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔		↔	↔			↔			↔	
Traffic Vol, veh/h	8	148	8	21	102	7	42	11	106	34	4	20
Future Vol, veh/h	8	148	8	21	102	7	42	11	106	34	4	20
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	150	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	9	161	9	23	111	8	46	12	115	37	4	22
Major/Minor	Major1		Major2		Minor1		Minor2					
Conflicting Flow All	119	0	0	170	0	0	358	349	166	408	349	115
Stage 1	-	-	-	-	-	-	184	184	-	161	161	-
Stage 2	-	-	-	-	-	-	174	165	-	247	188	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1469	-	-	1407	-	-	597	575	878	554	575	937
Stage 1	-	-	-	-	-	-	818	747	-	841	765	-
Stage 2	-	-	-	-	-	-	828	762	-	757	745	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1469	-	-	1407	-	-	570	562	878	465	562	937
Mov Cap-2 Maneuver	-	-	-	-	-	-	570	562	-	465	562	-
Stage 1	-	-	-	-	-	-	812	742	-	835	753	-
Stage 2	-	-	-	-	-	-	791	750	-	643	740	-
Approach	EB			WB			NB			SB		
HCM Control Delay, s	0.4			1.2			11.3			12.1		
HCM LOS							B			B		
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1				
Capacity (veh/h)	743	1469	-	-	1407	-	-	571				
HCM Lane V/C Ratio	0.233	0.006	-	-	0.016	-	-	0.11				
HCM Control Delay (s)	11.3	7.5	-	-	7.6	-	-	12.1				
HCM Lane LOS	B	A	-	-	A	-	-	B				
HCM 95th %tile Q(veh)	0.9	0	-	-	0	-	-	0.4				

HCM 2010 TWSC
3: Juniper Ct.

210236 Utopia West
2026 Background AM peak

Intersection							
Int Delay, s/veh	0.4						
Movement	EBT	EBR	WBL	WBT	NBL	NBR	
Lane Configurations	↰		↰	↱	↰	↱	
Traffic Vol, veh/h	285	3	2	125	5	11	
Future Vol, veh/h	285	3	2	125	5	11	
Conflicting Peds, #/hr	0	0	0	0	0	0	
Sign Control	Free	Free	Free	Free	Stop	Stop	
RT Channelized	-	None	-	None	-	None	
Storage Length	-	-	150	-	0	-	
Veh in Median Storage, #	0	-	-	0	0	-	
Grade, %	0	-	-	0	0	-	
Peak Hour Factor	92	92	92	92	92	92	
Heavy Vehicles, %	2	2	2	2	2	2	
Mvmt Flow	310	3	2	136	5	12	

Major/Minor	Major1	Major2	Minor1		
Conflicting Flow All	0	0	313	0	452 312
Stage 1	-	-	-	-	312 -
Stage 2	-	-	-	-	140 -
Critical Hdwy	-	-	4.12	-	6.42 6.22
Critical Hdwy Stg 1	-	-	-	-	5.42 -
Critical Hdwy Stg 2	-	-	-	-	5.42 -
Follow-up Hdwy	-	-	2.218	-	3.518 3.318
Pot Cap-1 Maneuver	-	-	1247	-	565 728
Stage 1	-	-	-	-	742 -
Stage 2	-	-	-	-	887 -
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	1247	-	564 728
Mov Cap-2 Maneuver	-	-	-	-	564 -
Stage 1	-	-	-	-	742 -
Stage 2	-	-	-	-	885 -

Approach	EB	WB	NB
HCM Control Delay, s	0	0.1	10.5
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	667	-	-	1247	-
HCM Lane V/C Ratio	0.026	-	-	0.002	-
HCM Control Delay (s)	10.5	-	-	7.9	-
HCM Lane LOS	B	-	-	A	-
HCM 95th %tile Q(veh)	0.1	-	-	0	-

Queues
4: Ontario St. & Greenlane St.

210236 Utopia West
2026 Background AM peak

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	220	118	14	270	65	624	55	479
v/c Ratio	0.89	0.25	0.05	0.47	0.13	0.78	0.17	0.32
Control Delay	70.3	13.5	25.3	13.4	9.1	30.5	9.7	16.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	70.3	13.5	25.3	13.4	9.1	30.5	9.7	16.2
Queue Length 50th (m)	41.4	6.7	2.0	14.5	5.1	104.4	4.3	29.3
Queue Length 95th (m)	#87.1	20.9	6.9	38.3	10.7	#172.6	9.3	42.8
Internal Link Dist (m)		76.1		136.0		151.0		75.7
Turn Bay Length (m)	25.0		20.0		70.0		30.0	
Base Capacity (vph)	266	496	324	605	562	802	370	1483
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.83	0.24	0.04	0.45	0.12	0.78	0.15	0.32

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

HCM 2010 Signalized Intersection Summary
4: Ontario St. & Greenlane St.

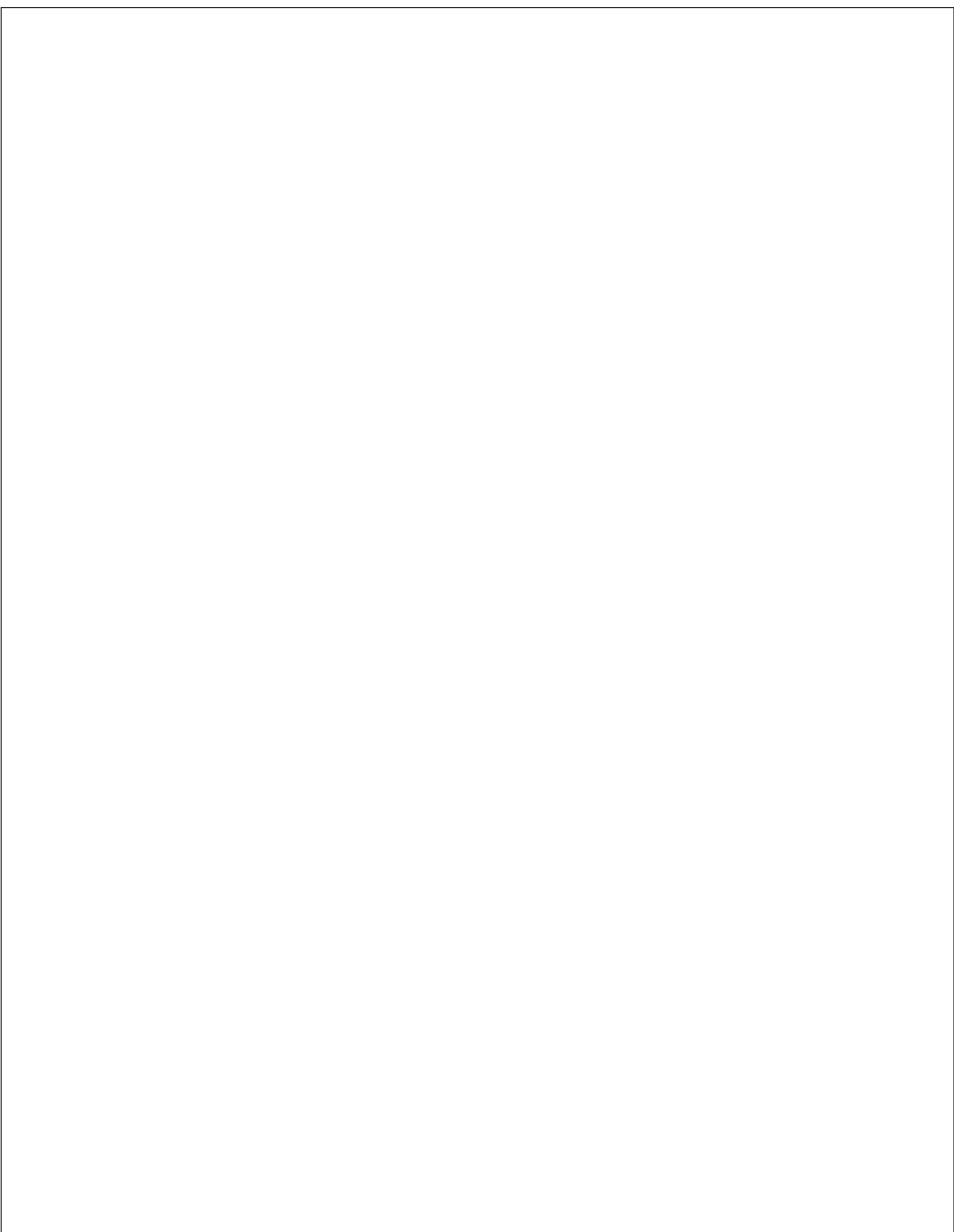
210236 Utopia West
2026 Background AM peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	202	43	65	13	56	192	60	570	4	51	370	71
Future Volume (veh/h)	202	43	65	13	56	192	60	570	4	51	370	71
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		0.99	1.00		0.99
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	1716	1560	1750	1496	1737	1750	1716	1678	1750	1683	1667	1750
Adj Flow Rate, veh/h	220	47	71	14	61	209	65	620	4	55	402	77
Adj No. of Lanes	1	1	0	1	1	0	1	1	0	1	2	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	11	13	17	0	1	2	4	50	4	5	5
Cap, veh/h	239	174	263	326	107	366	467	780	5	261	1234	234
Arrive On Green	0.31	0.31	0.31	0.31	0.31	0.31	0.05	0.47	0.47	0.05	0.47	0.47
Sat Flow, veh/h	1017	561	848	1018	345	1181	1634	1665	11	1603	2653	504
Grp Volume(v), veh/h	220	0	118	14	0	270	65	0	624	55	238	241
Grp Sat Flow(s), veh/h/ln	1017	0	1409	1018	0	1526	1634	0	1676	1603	1583	1574
Q Serve(g_s), s	15.6	0.0	6.1	1.0	0.0	14.4	1.9	0.0	30.5	1.7	9.2	9.3
Cycle Q Clear(g_c), s	30.0	0.0	6.1	7.1	0.0	14.4	1.9	0.0	30.5	1.7	9.2	9.3
Prop In Lane	1.00		0.60	1.00		0.77	1.00		0.01	1.00		0.32
Lane Grp Cap(c), veh/h	239	0	437	326	0	473	467	0	785	261	736	732
V/C Ratio(X)	0.92	0.00	0.27	0.04	0.00	0.57	0.14	0.00	0.79	0.21	0.32	0.33
Avail Cap(c_a), veh/h	239	0	437	326	0	473	552	0	785	350	736	732
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	1.00	1.00
Uniform Delay (d), s/veh	42.5	0.0	25.1	27.8	0.0	28.0	12.3	0.0	21.8	17.0	16.3	16.3
Incr Delay (d2), s/veh	37.2	0.0	0.2	0.0	0.0	1.4	0.1	0.0	8.2	0.3	1.2	1.2
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	8.3	0.0	2.4	0.3	0.0	6.2	0.9	0.0	15.8	0.7	4.2	4.3
LnGrp Delay(d),s/veh	79.8	0.0	25.4	27.9	0.0	29.4	12.4	0.0	29.9	17.3	17.5	17.5
LnGrp LOS	E		C	C		C	B		C	B	B	B
Approach Vol, veh/h	338			284			689			534		
Approach Delay, s/veh	60.8			29.3			28.3			17.5		
Approach LOS	E			C			C			B		
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	7.6	52.2		36.9	8.0	51.9		36.9				
Change Period (Y+Rc), s	3.0	* 6.9		* 6.9	3.0	* 6.9		* 6.9				
Max Green Setting (Gmax), s	10.0	* 45		* 30	10.0	* 45		* 30				
Max Q Clear Time (g_c+I1), s	3.7	32.5		32.0	3.9	11.3		16.4				
Green Ext Time (p_c), s	0.0	3.4		0.0	0.1	3.1		1.4				
Intersection Summary												
HCM 2010 Ctrl Delay	31.3											
HCM 2010 LOS	C											
Notes												

HCM 2010 Signalized Intersection Summary
4: Ontario St. & Greenlane St.

210236 Utopia West
2026 Background AM peak

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.



HCM 2010 AWSC
1: Lincoln Avenue & Greenlane St.

210236 Utopia West
2026 Background PM peak

Intersection												
Intersection Delay, s/veh	9.7											
Intersection LOS	A											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	5	214	13	47	107	15	10	25	43	60	72	15
Future Vol, veh/h	5	214	13	47	107	15	10	25	43	60	72	15
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	5	233	14	51	116	16	11	27	47	65	78	16
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0
Approach	EB			WB			NB			SB		
Opposing Approach	WB			EB			SB			NB		
Opposing Lanes	1			1			1			1		
Conflicting Approach Left	SB			NB			EB			WB		
Conflicting Lanes Left	1			1			1			1		
Conflicting Approach Right	NB			SB			WB			EB		
Conflicting Lanes Right	1			1			1			1		
HCM Control Delay	10.2			9.5			8.6			9.7		
HCM LOS	B			A			A			A		
Lane	NBLn1	EBLn1	WBLn1	SBLn1								
Vol Left, %	13%	2%	28%	41%								
Vol Thru, %	32%	92%	63%	49%								
Vol Right, %	55%	6%	9%	10%								
Sign Control	Stop	Stop	Stop	Stop								
Traffic Vol by Lane	78	232	169	147								
LT Vol	10	5	47	60								
Through Vol	25	214	107	72								
RT Vol	43	13	15	15								
Lane Flow Rate	85	252	184	160								
Geometry Grp	1	1	1	1								
Degree of Util (X)	0.115	0.332	0.248	0.226								
Departure Headway (Hd)	4.887	4.744	4.855	5.096								
Convergence, Y/N	Yes	Yes	Yes	Yes								
Cap	726	754	735	698								
Service Time	2.969	2.805	2.921	3.169								
HCM Lane V/C Ratio	0.117	0.334	0.25	0.229								
HCM Control Delay	8.6	10.2	9.5	9.7								
HCM Lane LOS	A	B	A	A								
HCM 95th-tile Q	0.4	1.5	1	0.9								

HCM 2010 TWSC
2: Cedarbrook Lane /Utopia

210236 Utopia West
2026 Background PM peak

Intersection												
Int Delay, s/veh	3.7											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔		↔	↔			↔			↔	
Traffic Vol, veh/h	31	239	47	78	133	33	20	7	43	19	8	17
Future Vol, veh/h	31	239	47	78	133	33	20	7	43	19	8	17
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	150	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	34	260	51	85	145	36	22	8	47	21	9	18
Major/Minor	Major1		Major2		Minor1		Minor2					
Conflicting Flow All	181	0	0	311	0	0	701	705	286	714	712	163
Stage 1	-	-	-	-	-	-	354	354	-	333	333	-
Stage 2	-	-	-	-	-	-	347	351	-	381	379	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1394	-	-	1249	-	-	353	361	753	346	358	882
Stage 1	-	-	-	-	-	-	663	630	-	681	644	-
Stage 2	-	-	-	-	-	-	669	632	-	641	615	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1394	-	-	1249	-	-	314	326	753	295	324	882
Mov Cap-2 Maneuver	-	-	-	-	-	-	314	326	-	295	324	-
Stage 1	-	-	-	-	-	-	643	611	-	661	600	-
Stage 2	-	-	-	-	-	-	602	589	-	576	597	-
Approach	EB			WB			NB			SB		
HCM Control Delay, s	0.7			2.6			13.7			15		
HCM LOS							B			C		
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1				
Capacity (veh/h)	492	1394	-	-	1249	-	-	406				
HCM Lane V/C Ratio	0.155	0.024	-	-	0.068	-	-	0.118				
HCM Control Delay (s)	13.7	7.6	0	-	8.1	-	-	15				
HCM Lane LOS	B	A	A	-	A	-	-	C				
HCM 95th %tile Q(veh)	0.5	0.1	-	-	0.2	-	-	0.4				

HCM 2010 TWSC
3: Juniper Ct.

210236 Utopia West
2026 Background PM peak

Intersection							
Int Delay, s/veh	0.3						
Movement	EBT	EBR	WBL	WBT	NBL	NBR	
Lane Configurations	↰		↰	↱	↰	↰	
Traffic Vol, veh/h	292	9	9	239	5	5	
Future Vol, veh/h	292	9	9	239	5	5	
Conflicting Peds, #/hr	0	0	0	0	0	0	
Sign Control	Free	Free	Free	Free	Stop	Stop	
RT Channelized	-	None	-	None	-	None	
Storage Length	-	-	150	-	0	-	
Veh in Median Storage, #	0	-	-	0	0	-	
Grade, %	0	-	-	0	0	-	
Peak Hour Factor	92	92	92	92	92	92	
Heavy Vehicles, %	2	2	2	2	2	2	
Mvmt Flow	317	10	10	260	5	5	

Major/Minor	Major1	Major2	Minor1		
Conflicting Flow All	0	0	327	0	602 322
Stage 1	-	-	-	-	322 -
Stage 2	-	-	-	-	280 -
Critical Hdwy	-	-	4.12	-	6.42 6.22
Critical Hdwy Stg 1	-	-	-	-	5.42 -
Critical Hdwy Stg 2	-	-	-	-	5.42 -
Follow-up Hdwy	-	-	2.218	-	3.518 3.318
Pot Cap-1 Maneuver	-	-	1233	-	463 719
Stage 1	-	-	-	-	735 -
Stage 2	-	-	-	-	767 -
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	1233	-	459 719
Mov Cap-2 Maneuver	-	-	-	-	459 -
Stage 1	-	-	-	-	735 -
Stage 2	-	-	-	-	761 -

Approach	EB	WB	NB
HCM Control Delay, s	0	0.3	11.6
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	560	-	-	1233	-
HCM Lane V/C Ratio	0.019	-	-	0.008	-
HCM Control Delay (s)	11.6	-	-	7.9	-
HCM Lane LOS	B	-	-	A	-
HCM 95th %tile Q(veh)	0.1	-	-	0	-

Queues
4: Ontario St. & Greenlane St.

210236 Utopia West
2026 Background PM peak

	↰	→	↰	←	↰	↑	↰	↓
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	143	283	29	208	162	562	204	1000
v/c Ratio	0.78	0.76	0.22	0.59	0.44	0.66	0.43	0.59
Control Delay	60.4	36.9	33.1	32.1	10.0	22.6	9.1	17.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	60.4	36.9	33.1	32.1	10.0	22.6	9.1	17.6
Queue Length 50th (m)	24.3	34.3	4.4	26.8	8.6	70.7	11.2	59.6
Queue Length 95th (m)	46.1	62.5	12.2	49.1	22.0	137.8	27.4	104.1
Internal Link Dist (m)		74.6		145.6		151.8		77.4
Turn Bay Length (m)	25.0		20.0		70.0		30.0	
Base Capacity (vph)	316	580	225	574	404	846	503	1681
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.45	0.49	0.13	0.36	0.40	0.66	0.41	0.59

Intersection Summary

HCM 2010 Signalized Intersection Summary
4: Ontario St. & Greenlane St.

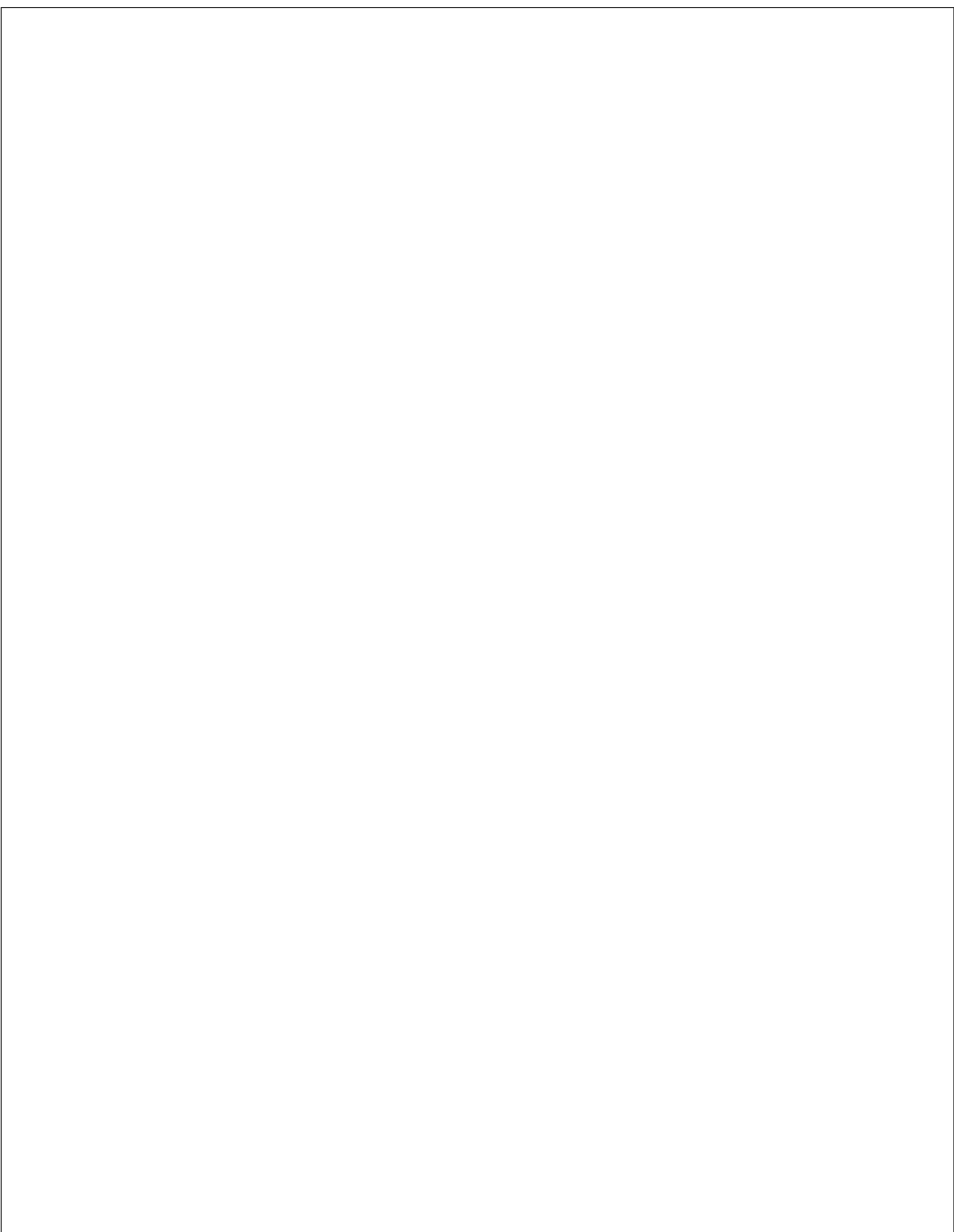
210236 Utopia West
2026 Background PM peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	132	99	161	27	104	87	149	505	12	188	758	162
Future Volume (veh/h)	132	99	161	27	104	87	149	505	12	188	758	162
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		0.99	1.00		0.99	1.00		0.99
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	1699	1716	1750	1750	1719	1750	1750	1653	1750	1733	1747	1750
Adj Flow Rate, veh/h	143	108	175	29	113	95	162	549	13	204	824	176
Adj No. of Lanes	1	1	0	1	1	0	1	1	0	1	2	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	3	2	2	0	0	4	0	6	0	1	0	1
Cap, veh/h	249	161	261	188	236	198	327	751	18	364	1307	279
Arrive On Green	0.27	0.27	0.27	0.27	0.27	0.27	0.07	0.47	0.47	0.08	0.48	0.48
Sat Flow, veh/h	1063	589	954	1024	862	724	1667	1608	38	1650	2718	581
Grp Volume(v), veh/h	143	0	283	29	0	208	162	0	562	204	503	497
Grp Sat Flow(s), veh/h/ln	1063	0	1544	1024	0	1586	1667	0	1646	1650	1660	1639
Q Serve(g_s), s	12.5	0.0	15.7	2.5	0.0	10.6	4.8	0.0	26.6	6.0	21.8	21.8
Cycle Q Clear(g_c), s	23.1	0.0	15.7	18.2	0.0	10.6	4.8	0.0	26.6	6.0	21.8	21.8
Prop In Lane	1.00		0.62	1.00		0.46	1.00		0.02	1.00		0.35
Lane Grp Cap(c), veh/h	249	0	423	188	0	434	327	0	769	364	798	788
V/C Ratio(X)	0.57	0.00	0.67	0.15	0.00	0.48	0.50	0.00	0.73	0.56	0.63	0.63
Avail Cap(c_a), veh/h	289	0	481	227	0	494	382	0	769	396	798	788
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	1.00	1.00
Uniform Delay (d), s/veh	38.9	0.0	31.1	39.2	0.0	29.2	14.5	0.0	20.8	16.0	18.6	18.6
Incr Delay (d2), s/veh	1.5	0.0	2.6	0.3	0.0	0.6	0.9	0.0	6.1	1.2	3.8	3.8
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	3.8	0.0	7.0	0.7	0.0	4.7	2.2	0.0	13.3	2.8	10.8	10.6
LnGrp Delay(d),s/veh	40.4	0.0	33.7	39.5	0.0	29.8	15.4	0.0	26.8	17.1	22.4	22.4
LnGrp LOS	D		C	D		C	B		C	B	C	C
Approach Vol, veh/h	426			237			724			1204		
Approach Delay, s/veh	36.0			31.0			24.3			21.5		
Approach LOS	D			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	11.1	51.9		33.3	9.8	53.2		33.3				
Change Period (Y+Rc), s	3.0	* 6.9		* 6.9	3.0	* 6.9		* 6.9				
Max Green Setting (Gmax), s	10.0	* 45		* 30	10.0	* 45		* 30				
Max Q Clear Time (g_c+I1), s	8.0	28.6		25.1	6.8	23.8		20.2				
Green Ext Time (p_c), s	0.1	3.4		1.1	0.1	6.9		0.9				
Intersection Summary												
HCM 2010 Ctrl Delay				25.5								
HCM 2010 LOS				C								
Notes												

HCM 2010 Signalized Intersection Summary
4: Ontario St. & Greenlane St.

210236 Utopia West
2026 Background PM peak

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.



Appendix F

2026 Future Total Traffic Operations Reports



HCM 2010 AWSC
1: Lincoln Avenue & Greenlane St.

210236 Utopia West
2026 Future Total AM peak

Intersection												
Intersection Delay, s/veh	8.6											
Intersection LOS	A											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	6	123	8	14	133	38	8	50	50	10	35	5
Future Vol, veh/h	6	123	8	14	133	38	8	50	50	10	35	5
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	7	134	9	15	145	41	9	54	54	11	38	5
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0
Approach	EB			WB			NB			SB		
Opposing Approach	WB			EB			SB			NB		
Opposing Lanes	1			1			1			1		
Conflicting Approach Left	SB			NB			EB			WB		
Conflicting Lanes Left	1			1			1			1		
Conflicting Approach Right	NB			SB			WB			EB		
Conflicting Lanes Right	1			1			1			1		
HCM Control Delay	8.6			8.9			8.4			8.3		
HCM LOS	A			A			A			A		
Lane	NBLn1	EBLn1	WBLn1	SBLn1								
Vol Left, %	7%	4%	8%	20%								
Vol Thru, %	46%	90%	72%	70%								
Vol Right, %	46%	6%	21%	10%								
Sign Control	Stop	Stop	Stop	Stop								
Traffic Vol by Lane	108	137	185	50								
LT Vol	8	6	14	10								
Through Vol	50	123	133	35								
RT Vol	50	8	38	5								
Lane Flow Rate	117	149	201	54								
Geometry Grp	1	1	1	1								
Degree of Util (X)	0.148	0.188	0.246	0.073								
Departure Headway (Hd)	4.533	4.536	4.401	4.853								
Convergence, Y/N	Yes	Yes	Yes	Yes								
Cap	790	791	816	737								
Service Time	2.566	2.565	2.428	2.891								
HCM Lane V/C Ratio	0.148	0.188	0.246	0.073								
HCM Control Delay	8.4	8.6	8.9	8.3								
HCM Lane LOS	A	A	A	A								
HCM 95th-tile Q	0.5	0.7	1	0.2								

HCM 2010 TWSC
2: Cedarbrook Lane /Utopia

210236 Utopia West
2026 Future Total AM peak

Intersection												
Int Delay, s/veh	6.1											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔		↔	↔			↔			↔	
Traffic Vol, veh/h	58	153	8	21	109	7	54	11	106	34	4	20
Future Vol, veh/h	58	153	8	21	109	7	54	11	106	34	4	20
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	150	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	63	166	9	23	118	8	59	12	115	37	4	22

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	126	0	0	175	0	0	478	469	171	528	469	122
Stage 1	-	-	-	-	-	-	297	297	-	168	168	-
Stage 2	-	-	-	-	-	-	181	172	-	360	301	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1460	-	-	1401	-	-	498	492	873	461	492	929
Stage 1	-	-	-	-	-	-	712	668	-	834	759	-
Stage 2	-	-	-	-	-	-	821	756	-	658	665	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1460	-	-	1401	-	-	459	461	873	373	461	929
Mov Cap-2 Maneuver	-	-	-	-	-	-	459	461	-	373	461	-
Stage 1	-	-	-	-	-	-	678	636	-	794	747	-
Stage 2	-	-	-	-	-	-	784	744	-	534	633	-

Approach	EB			WB			NB			SB		
HCM Control Delay, s	2			1.2			12.7			13.7		
HCM LOS							B			B		

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	650	1460	-	-	1401	-	-	478
HCM Lane V/C Ratio	0.286	0.043	-	-	0.016	-	-	0.132
HCM Control Delay (s)	12.7	7.6	-	-	7.6	-	-	13.7
HCM Lane LOS	B	A	-	-	A	-	-	B
HCM 95th %tile Q(veh)	1.2	0.1	-	-	0.1	-	-	0.5

HCM 2010 TWSC
3: Juniper Ct.

210236 Utopia West
2026 Future Total AM peak

Intersection							
Int Delay, s/veh	0.4						
Movement	EBT	EBR	WBL	WBT	NBL	NBR	
Lane Configurations	↰		↰	↱	↰	↰	
Traffic Vol, veh/h	334	3	2	132	5	11	
Future Vol, veh/h	334	3	2	132	5	11	
Conflicting Peds, #/hr	0	0	0	0	0	0	
Sign Control	Free	Free	Free	Free	Stop	Stop	
RT Channelized	-	None	-	None	-	None	
Storage Length	-	-	150	-	0	-	
Veh in Median Storage, #	0	-	-	0	0	-	
Grade, %	0	-	-	0	0	-	
Peak Hour Factor	92	92	92	92	92	92	
Heavy Vehicles, %	2	2	2	2	2	2	
Mvmt Flow	363	3	2	143	5	12	

Major/Minor	Major1	Major2	Minor1		
Conflicting Flow All	0	0	366	0	512 365
Stage 1	-	-	-	-	365 -
Stage 2	-	-	-	-	147 -
Critical Hdwy	-	-	4.12	-	6.42 6.22
Critical Hdwy Stg 1	-	-	-	-	5.42 -
Critical Hdwy Stg 2	-	-	-	-	5.42 -
Follow-up Hdwy	-	-	2.218	-	3.518 3.318
Pot Cap-1 Maneuver	-	-	1193	-	522 680
Stage 1	-	-	-	-	702 -
Stage 2	-	-	-	-	880 -
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	1193	-	521 680
Mov Cap-2 Maneuver	-	-	-	-	521 -
Stage 1	-	-	-	-	702 -
Stage 2	-	-	-	-	878 -

Approach	EB	WB	NB
HCM Control Delay, s	0	0.1	11
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	621	-	-	1193	-
HCM Lane V/C Ratio	0.028	-	-	0.002	-
HCM Control Delay (s)	11	-	-	8	-
HCM Lane LOS	B	-	-	A	-
HCM 95th %tile Q(veh)	0.1	-	-	0	-

Queues
4: Ontario St. & Greenlane St.

210236 Utopia West
2026 Future Total AM peak

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	254	136	14	272	67	624	55	482
v/c Ratio	0.97	0.28	0.05	0.46	0.13	0.80	0.18	0.33
Control Delay	85.8	14.3	25.4	13.9	9.1	32.0	9.8	16.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	85.8	14.3	25.4	13.9	9.1	32.0	9.8	16.6
Queue Length 50th (m)	50.6	8.7	2.0	15.8	5.3	104.4	4.3	29.6
Queue Length 95th (m)	#104.4	24.3	6.9	40.4	10.9	#172.5	9.3	43.1
Internal Link Dist (m)		76.1		136.0		151.0		75.7
Turn Bay Length (m)	25.0		20.0		70.0		30.0	
Base Capacity (vph)	261	489	310	591	544	783	352	1445
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.97	0.28	0.05	0.46	0.12	0.80	0.16	0.33

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

HCM 2010 Signalized Intersection Summary
4: Ontario St. & Greenlane St.

210236 Utopia West
2026 Future Total AM peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	234	50	75	13	58	192	62	570	4	51	370	74
Future Volume (veh/h)	234	50	75	13	58	192	62	570	4	51	370	74
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		0.99	1.00		0.99
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	1716	1560	1750	1496	1737	1750	1716	1678	1750	1683	1667	1750
Adj Flow Rate, veh/h	254	54	82	14	63	209	67	620	4	55	402	80
Adj No. of Lanes	1	1	0	1	1	0	1	1	0	1	2	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	11	13	17	0	1	2	4	50	4	5	5
Cap, veh/h	237	173	263	311	110	364	466	781	5	262	1225	242
Arrive On Green	0.31	0.31	0.31	0.31	0.31	0.31	0.05	0.47	0.47	0.05	0.46	0.46
Sat Flow, veh/h	1015	559	849	1002	354	1174	1634	1665	11	1603	2635	520
Grp Volume(v), veh/h	254	0	136	14	0	272	67	0	624	55	240	242
Grp Sat Flow(s), veh/h/ln	1015	0	1409	1002	0	1527	1634	0	1676	1603	1583	1571
Q Serve(g_s), s	15.5	0.0	7.1	1.0	0.0	14.5	2.0	0.0	30.5	1.7	9.3	9.4
Cycle Q Clear(g_c), s	30.0	0.0	7.1	8.2	0.0	14.5	2.0	0.0	30.5	1.7	9.3	9.4
Prop In Lane	1.00		0.60	1.00		0.77	1.00		0.01	1.00		0.33
Lane Grp Cap(c), veh/h	237	0	437	311	0	473	466	0	786	262	736	730
V/C Ratio(X)	1.07	0.00	0.31	0.05	0.00	0.57	0.14	0.00	0.79	0.21	0.33	0.33
Avail Cap(c_a), veh/h	237	0	437	311	0	473	550	0	786	351	736	730
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	1.00	1.00
Uniform Delay (d), s/veh	43.1	0.0	25.5	28.6	0.0	28.0	12.3	0.0	21.8	17.0	16.3	16.4
Incr Delay (d2), s/veh	78.6	0.0	0.3	0.0	0.0	1.5	0.1	0.0	8.1	0.3	1.2	1.2
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	11.4	0.0	2.8	0.3	0.0	6.3	0.9	0.0	15.8	0.7	4.3	4.3
LnGrp Delay(d),s/veh	121.7	0.0	25.8	28.7	0.0	29.5	12.4	0.0	29.9	17.3	17.5	17.6
LnGrp LOS	F		C	C		C	B		C	B	B	B
Approach Vol, veh/h	390			286			691			537		
Approach Delay, s/veh	88.3			29.5			28.2			17.5		
Approach LOS	F			C			C			B		
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	7.6	52.3		36.9	8.0	51.9		36.9				
Change Period (Y+Rc), s	3.0	* 6.9		* 6.9	3.0	* 6.9		* 6.9				
Max Green Setting (Gmax), s	10.0	* 45		* 30	10.0	* 45		* 30				
Max Q Clear Time (g_c+I1), s	3.7	32.5		32.0	4.0	11.4		16.5				
Green Ext Time (p_c), s	0.0	3.4		0.0	0.1	3.1		1.4				
Intersection Summary												
HCM 2010 Ctrl Delay	37.7											
HCM 2010 LOS	D											
Notes												

HCM 2010 Signalized Intersection Summary
4: Ontario St. & Greenlane St.

210236 Utopia West
2026 Future Total AM peak

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

HCM 2010 TWSC

5: Site Access

210236 Utopia West

2026 Future Total AM peak

Intersection						
Int Delay, s/veh	2.8					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	19	164	164	19	55	49
Future Vol, veh/h	19	164	164	19	55	49
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	21	178	178	21	60	53
Major/Minor						
	Major1	Major2	Minor2			
Conflicting Flow All	199	0	-	0	409	189
Stage 1	-	-	-	-	189	-
Stage 2	-	-	-	-	220	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1373	-	-	-	599	853
Stage 1	-	-	-	-	843	-
Stage 2	-	-	-	-	817	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1373	-	-	-	589	853
Mov Cap-2 Maneuver	-	-	-	-	589	-
Stage 1	-	-	-	-	829	-
Stage 2	-	-	-	-	817	-
Approach	EB	WB		SB		
HCM Control Delay, s	0.8	0		11.2		
HCM LOS	B					
Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	
Capacity (veh/h)	1373	-	-	-	690	
HCM Lane V/C Ratio	0.015	-	-	-	0.164	
HCM Control Delay (s)	7.7	0	-	-	11.2	
HCM Lane LOS	A	A	-	-	B	
HCM 95th %tile Q(veh)	0	-	-	-	0.6	

HCM 2010 AWSC
1: Lincoln Avenue & Greenlane St.

210236 Utopia West
2026 Future Total PM peak

Intersection												
Intersection Delay, s/veh	10.6											
Intersection LOS	B											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	5	247	13	60	119	19	10	25	55	82	72	15
Future Vol, veh/h	5	247	13	60	119	19	10	25	55	82	72	15
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	5	268	14	65	129	21	11	27	60	89	78	16
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0
Approach	EB			WB			NB			SB		
Opposing Approach	WB			EB			SB			NB		
Opposing Lanes	1			1			1			1		
Conflicting Approach Left	SB			NB			EB			WB		
Conflicting Lanes Left	1			1			1			1		
Conflicting Approach Right	NB			SB			WB			EB		
Conflicting Lanes Right	1			1			1			1		
HCM Control Delay	11.4			10.4			9.1			10.5		
HCM LOS	B			B			A			B		
Lane	NBLn1	EBLn1	WBLn1	SBLn1								
Vol Left, %	11%	2%	30%	49%								
Vol Thru, %	28%	93%	60%	43%								
Vol Right, %	61%	5%	10%	9%								
Sign Control	Stop	Stop	Stop	Stop								
Traffic Vol by Lane	90	265	198	169								
LT Vol	10	5	60	82								
Through Vol	25	247	119	72								
RT Vol	55	13	19	15								
Lane Flow Rate	98	288	215	184								
Geometry Grp	1	1	1	1								
Degree of Util (X)	0.141	0.402	0.307	0.277								
Departure Headway (Hd)	5.203	5.018	5.143	5.43								
Convergence, Y/N	Yes	Yes	Yes	Yes								
Cap	689	720	702	661								
Service Time	3.238	3.024	3.153	3.461								
HCM Lane V/C Ratio	0.142	0.4	0.306	0.278								
HCM Control Delay	9.1	11.4	10.4	10.5								
HCM Lane LOS	A	B	B	B								
HCM 95th-tile Q	0.5	1.9	1.3	1.1								

HCM 2010 TWSC
2: Cedarbrook Lane /Utopia

210236 Utopia West
2026 Future Total PM peak

Intersection												
Int Delay, s/veh	4.1											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔		↔	↔			↔			↔	
Traffic Vol, veh/h	54	251	47	78	166	33	30	7	43	19	8	17
Future Vol, veh/h	54	251	47	78	166	33	30	7	43	19	8	17
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	150	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	59	273	51	85	180	36	33	8	47	21	9	18
Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	216	0	0	324	0	0	799	803	299	812	810	198
Stage 1	-	-	-	-	-	-	417	417	-	368	368	-
Stage 2	-	-	-	-	-	-	382	386	-	444	442	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1354	-	-	1236	-	-	304	317	741	298	314	843
Stage 1	-	-	-	-	-	-	613	591	-	652	621	-
Stage 2	-	-	-	-	-	-	640	610	-	593	576	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1354	-	-	1236	-	-	264	279	741	249	277	843
Mov Cap-2 Maneuver	-	-	-	-	-	-	264	279	-	249	277	-
Stage 1	-	-	-	-	-	-	580	559	-	617	578	-
Stage 2	-	-	-	-	-	-	574	568	-	518	545	-
Approach	EB			WB			NB			SB		
HCM Control Delay, s	1.2			2.3			16.2			16.9		
HCM LOS							C			C		
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1				
Capacity (veh/h)	407	1354	-	-	1236	-	-	351				
HCM Lane V/C Ratio	0.214	0.043	-	-	0.069	-	-	0.136				
HCM Control Delay (s)	16.2	7.8	0	-	8.1	-	-	16.9				
HCM Lane LOS	C	A	A	-	A	-	-	C				
HCM 95th %tile Q(veh)	0.8	0.1	-	-	0.2	-	-	0.5				

HCM 2010 TWSC
3: Juniper Ct.

210236 Utopia West
2026 Future Total PM peak

Intersection							
Int Delay, s/veh	0.3						
Movement	EBT	EBR	WBL	WBT	NBL	NBR	
Lane Configurations	↰	↱	↰	↱	↰	↱	
Traffic Vol, veh/h	319	9	9	272	5	5	
Future Vol, veh/h	319	9	9	272	5	5	
Conflicting Peds, #/hr	0	0	0	0	0	0	
Sign Control	Free	Free	Free	Free	Stop	Stop	
RT Channelized	-	None	-	None	-	None	
Storage Length	-	-	150	-	0	-	
Veh in Median Storage, #	0	-	-	0	0	-	
Grade, %	0	-	-	0	0	-	
Peak Hour Factor	92	92	92	92	92	92	
Heavy Vehicles, %	2	2	2	2	2	2	
Mvmt Flow	347	10	10	296	5	5	

Major/Minor	Major1	Major2	Minor1		
Conflicting Flow All	0	0	357	0	668 352
Stage 1	-	-	-	-	352 -
Stage 2	-	-	-	-	316 -
Critical Hdwy	-	-	4.12	-	6.42 6.22
Critical Hdwy Stg 1	-	-	-	-	5.42 -
Critical Hdwy Stg 2	-	-	-	-	5.42 -
Follow-up Hdwy	-	-	2.218	-	3.518 3.318
Pot Cap-1 Maneuver	-	-	1202	-	423 692
Stage 1	-	-	-	-	712 -
Stage 2	-	-	-	-	739 -
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	1202	-	420 692
Mov Cap-2 Maneuver	-	-	-	-	420 -
Stage 1	-	-	-	-	712 -
Stage 2	-	-	-	-	733 -

Approach	EB	WB	NB
HCM Control Delay, s	0	0.3	12
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	523	-	-	1202	-
HCM Lane V/C Ratio	0.021	-	-	0.008	-
HCM Control Delay (s)	12	-	-	8	-
HCM Lane LOS	B	-	-	A	-
HCM 95th %tile Q(veh)	0.1	-	-	0	-

Queues
4: Ontario St. & Greenlane St.

210236 Utopia West
2026 Future Total PM peak

								
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	153	302	29	217	174	562	204	1015
v/c Ratio	0.81	0.77	0.22	0.59	0.49	0.67	0.44	0.62
Control Delay	63.1	37.5	32.8	32.2	11.5	23.8	9.8	18.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	63.1	37.5	32.8	32.2	11.5	23.8	9.8	18.8
Queue Length 50th (m)	26.6	38.0	4.4	29.1	10.0	73.8	12.0	64.2
Queue Length 95th (m)	49.8	67.5	12.3	51.8	24.6	142.2	28.8	109.3
Internal Link Dist (m)		74.6		145.6		151.8		77.4
Turn Bay Length (m)	25.0		20.0		70.0		30.0	
Base Capacity (vph)	303	574	207	566	388	833	488	1646
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.50	0.53	0.14	0.38	0.45	0.67	0.42	0.62

Intersection Summary								
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HCM 2010 Signalized Intersection Summary
4: Ontario St. & Greenlane St.

210236 Utopia West
2026 Future Total PM peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	141	105	173	27	112	87	160	505	12	188	758	176
Future Volume (veh/h)	141	105	173	27	112	87	160	505	12	188	758	176
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		0.99	1.00		0.99	1.00		0.99
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	1699	1716	1750	1750	1720	1750	1750	1653	1750	1733	1747	1750
Adj Flow Rate, veh/h	153	114	188	29	122	95	174	549	13	204	824	191
Adj No. of Lanes	1	1	0	1	1	0	1	1	0	1	2	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh. %	3	2	2	0	0	4	0	6	0	1	0	1
Cap, veh/h	253	165	272	183	254	198	320	739	17	355	1255	291
Arrive On Green	0.28	0.28	0.28	0.28	0.28	0.28	0.08	0.46	0.46	0.09	0.47	0.47
Sat Flow, veh/h	1054	582	960	1007	895	697	1667	1608	38	1650	2672	619
Grp Volume(v), veh/h	153	0	302	29	0	217	174	0	562	204	512	503
Grp Sat Flow(s), veh/h/ln	1054	0	1543	1007	0	1592	1667	0	1646	1650	1659	1632
Q Serve(g_s), s	13.8	0.0	17.1	2.6	0.0	11.1	5.3	0.0	27.5	6.3	23.2	23.2
Cycle Q Clear(g_c), s	24.9	0.0	17.1	19.7	0.0	11.1	5.3	0.0	27.5	6.3	23.2	23.2
Prop In Lane	1.00		0.62	1.00		0.44	1.00		0.02	1.00		0.38
Lane Grp Cap(c), veh/h	253	0	438	183	0	452	320	0	756	355	779	766
V/C Ratio(X)	0.60	0.00	0.69	0.16	0.00	0.48	0.54	0.00	0.74	0.57	0.66	0.66
Avail Cap(c_a), veh/h	277	0	472	206	0	488	365	0	756	383	779	766
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(l)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	39.4	0.0	31.3	40.0	0.0	29.1	15.6	0.0	21.7	16.8	19.9	19.9
Incr Delay (d2), s/veh	2.6	0.0	3.5	0.3	0.0	0.6	1.1	0.0	6.5	1.5	4.3	4.4
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	4.2	0.0	7.7	0.7	0.0	5.0	2.5	0.0	13.7	2.9	11.4	11.3
LnGrp Delay(d),s/veh	42.0	0.0	34.8	40.3	0.0	29.7	16.7	0.0	28.3	18.2	24.2	24.3
LnGrp LOS	D		C	D		C	B		C	B	C	C
Approach Vol, veh/h	455			246			736			1219		
Approach Delay, s/veh	37.2			30.9			25.5			23.3		
Approach LOS	D			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	11.4	51.9		34.7	10.4	52.9		34.7				
Change Period (Y+Rc), s	3.0	* 6.9		* 6.9	3.0	* 6.9		* 6.9				
Max Green Setting (Gmax), s	10.0	* 45		* 30	10.0	* 45		* 30				
Max Q Clear Time (g_c+I1), s	8.3	29.5		26.9	7.3	25.2		21.7				
Green Ext Time (p_c), s	0.1	3.3		0.8	0.1	6.9		0.8				
Intersection Summary												
HCM 2010 Ctrl Delay				27.0								
HCM 2010 LOS				C								
Notes												

HCM 2010 Signalized Intersection Summary
4: Ontario St. & Greenlane St.

210236 Utopia West
2026 Future Total PM peak

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

HCM 2010 TWSC

5: Site Access

210236 Utopia West

2026 Future Total PM peak

Intersection						
Int Delay, s/veh	2.3					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	67	317	169	43	43	29
Future Vol, veh/h	67	317	169	43	43	29
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	73	345	184	47	47	32
Major/Minor						
	Major1	Major2	Minor2			
Conflicting Flow All	231	0	-	0	699	208
Stage 1	-	-	-	-	208	-
Stage 2	-	-	-	-	491	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1337	-	-	-	406	832
Stage 1	-	-	-	-	827	-
Stage 2	-	-	-	-	615	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1337	-	-	-	378	832
Mov Cap-2 Maneuver	-	-	-	-	378	-
Stage 1	-	-	-	-	771	-
Stage 2	-	-	-	-	615	-
Approach	EB	WB		SB		
HCM Control Delay, s	1.4	0		13.9		
HCM LOS	B					
Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	
Capacity (veh/h)	1337	-	-	-	484	
HCM Lane V/C Ratio	0.054	-	-	-	0.162	
HCM Control Delay (s)	7.8	0	-	-	13.9	
HCM Lane LOS	A	A	-	-	B	
HCM 95th %tile Q(veh)	0.2	-	-	-	0.6	

Appendix G

2031 Background Traffic Operations Reports



HCM 2010 AWSC
1: Lincoln Avenue & Greenlane St.

210236 Utopia West
2031 Background AM peak

Intersection												
Intersection Delay, s/veh	8.3											
Intersection LOS	A											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	7	118	9	1	116	25	9	52	45	8	37	6
Future Vol, veh/h	7	118	9	1	116	25	9	52	45	8	37	6
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	8	128	10	1	126	27	10	57	49	9	40	7
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0
Approach	EB			WB			NB			SB		
Opposing Approach	WB			EB			SB			NB		
Opposing Lanes	1			1			1			1		
Conflicting Approach Left	SB			NB			EB			WB		
Conflicting Lanes Left	1			1			1			1		
Conflicting Approach Right	NB			SB			WB			EB		
Conflicting Lanes Right	1			1			1			1		
HCM Control Delay	8.5			8.4			8.2			8.1		
HCM LOS	A			A			A			A		
Lane	NBLn1	EBLn1	WBLn1	SBLn1								
Vol Left, %	8%	5%	1%	16%								
Vol Thru, %	49%	88%	82%	73%								
Vol Right, %	42%	7%	18%	12%								
Sign Control	Stop	Stop	Stop	Stop								
Traffic Vol by Lane	106	134	142	51								
LT Vol	9	7	1	8								
Through Vol	52	118	116	37								
RT Vol	45	9	25	6								
Lane Flow Rate	115	146	154	55								
Geometry Grp	1	1	1	1								
Degree of Util (X)	0.142	0.181	0.188	0.073								
Departure Headway (Hd)	4.443	4.469	4.388	4.711								
Convergence, Y/N	Yes	Yes	Yes	Yes								
Cap	808	803	818	761								
Service Time	2.469	2.494	2.413	2.74								
HCM Lane V/C Ratio	0.142	0.182	0.188	0.072								
HCM Control Delay	8.2	8.5	8.4	8.1								
HCM Lane LOS	A	A	A	A								
HCM 95th-tile Q	0.5	0.7	0.7	0.2								

HCM 2010 TWSC
2: Cedarbrook Lane /Utopia

210236 Utopia West
2031 Background AM peak

Intersection												
Int Delay, s/veh	5.3											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔		↔	↔			↔			↔	
Traffic Vol, veh/h	8	156	8	22	107	7	44	11	111	34	4	20
Future Vol, veh/h	8	156	8	22	107	7	44	11	111	34	4	20
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	150	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	9	170	9	24	116	8	48	12	121	37	4	22

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	124	0	0	179	0	0	374	365	175	427	365	120
Stage 1	-	-	-	-	-	-	193	193	-	168	168	-
Stage 2	-	-	-	-	-	-	181	172	-	259	197	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1463	-	-	1397	-	-	583	563	868	538	563	931
Stage 1	-	-	-	-	-	-	809	741	-	834	759	-
Stage 2	-	-	-	-	-	-	821	756	-	746	738	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1463	-	-	1397	-	-	556	549	868	447	549	931
Mov Cap-2 Maneuver	-	-	-	-	-	-	556	549	-	447	549	-
Stage 1	-	-	-	-	-	-	803	736	-	828	746	-
Stage 2	-	-	-	-	-	-	783	743	-	627	733	-

Approach	EB			WB			NB			SB		
HCM Control Delay, s	0.3			1.2			11.5			12.3		
HCM LOS							B			B		

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	731	1463	-	-	1397	-	-	553
HCM Lane V/C Ratio	0.247	0.006	-	-	0.017	-	-	0.114
HCM Control Delay (s)	11.5	7.5	-	-	7.6	-	-	12.3
HCM Lane LOS	B	A	-	-	A	-	-	B
HCM 95th %tile Q(veh)	1	0	-	-	0.1	-	-	0.4

HCM 2010 TWSC
3: Juniper Ct.

210236 Utopia West
2031 Background AM peak

Intersection							
Int Delay, s/veh	0.4						
Movement	EBT	EBR	WBL	WBT	NBL	NBR	
Lane Configurations	↻		↻	↻	↻		
Traffic Vol, veh/h	298	3	2	131	5	11	
Future Vol, veh/h	298	3	2	131	5	11	
Conflicting Peds, #/hr	0	0	0	0	0	0	
Sign Control	Free	Free	Free	Free	Stop	Stop	
RT Channelized	-	None	-	None	-	None	
Storage Length	-	-	150	-	0	-	
Veh in Median Storage, #	0	-	-	0	0	-	
Grade, %	0	-	-	0	0	-	
Peak Hour Factor	92	92	92	92	92	92	
Heavy Vehicles, %	2	2	2	2	2	2	
Mvmt Flow	324	3	2	142	5	12	

Major/Minor	Major1	Major2	Minor1		
Conflicting Flow All	0	0	327	0	472 326
Stage 1	-	-	-	-	326 -
Stage 2	-	-	-	-	146 -
Critical Hdwy	-	-	4.12	-	6.42 6.22
Critical Hdwy Stg 1	-	-	-	-	5.42 -
Critical Hdwy Stg 2	-	-	-	-	5.42 -
Follow-up Hdwy	-	-	2.218	-	3.518 3.318
Pot Cap-1 Maneuver	-	-	1233	-	551 715
Stage 1	-	-	-	-	731 -
Stage 2	-	-	-	-	881 -
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	1233	-	550 715
Mov Cap-2 Maneuver	-	-	-	-	550 -
Stage 1	-	-	-	-	731 -
Stage 2	-	-	-	-	879 -

Approach	EB	WB	NB
HCM Control Delay, s	0	0.1	10.7
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	654	-	-	1233	-
HCM Lane V/C Ratio	0.027	-	-	0.002	-
HCM Control Delay (s)	10.7	-	-	7.9	-
HCM Lane LOS	B	-	-	A	-
HCM 95th %tile Q(veh)	0.1	-	-	0	-

Queues
4: Ontario St. & Greenlane St.

210236 Utopia West
2031 Background AM peak

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	230	123	15	283	68	656	59	503
v/c Ratio	0.95	0.26	0.05	0.48	0.14	0.83	0.20	0.34
Control Delay	81.7	13.5	25.4	14.0	9.1	33.9	10.1	16.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	81.7	13.5	25.4	14.0	9.1	33.9	10.1	16.7
Queue Length 50th (m)	44.7	7.1	2.1	16.1	5.4	113.5	4.6	31.4
Queue Length 95th (m)	#94.4	21.5	7.2	41.3	11.0	#187.5	9.9	45.4
Internal Link Dist (m)		76.1		136.0		151.0		75.7
Turn Bay Length (m)	25.0		20.0		70.0		30.0	
Base Capacity (vph)	253	493	318	602	542	793	340	1465
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.91	0.25	0.05	0.47	0.13	0.83	0.17	0.34

Intersection Summary	
#	95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.	

HCM 2010 Signalized Intersection Summary
4: Ontario St. & Greenlane St.

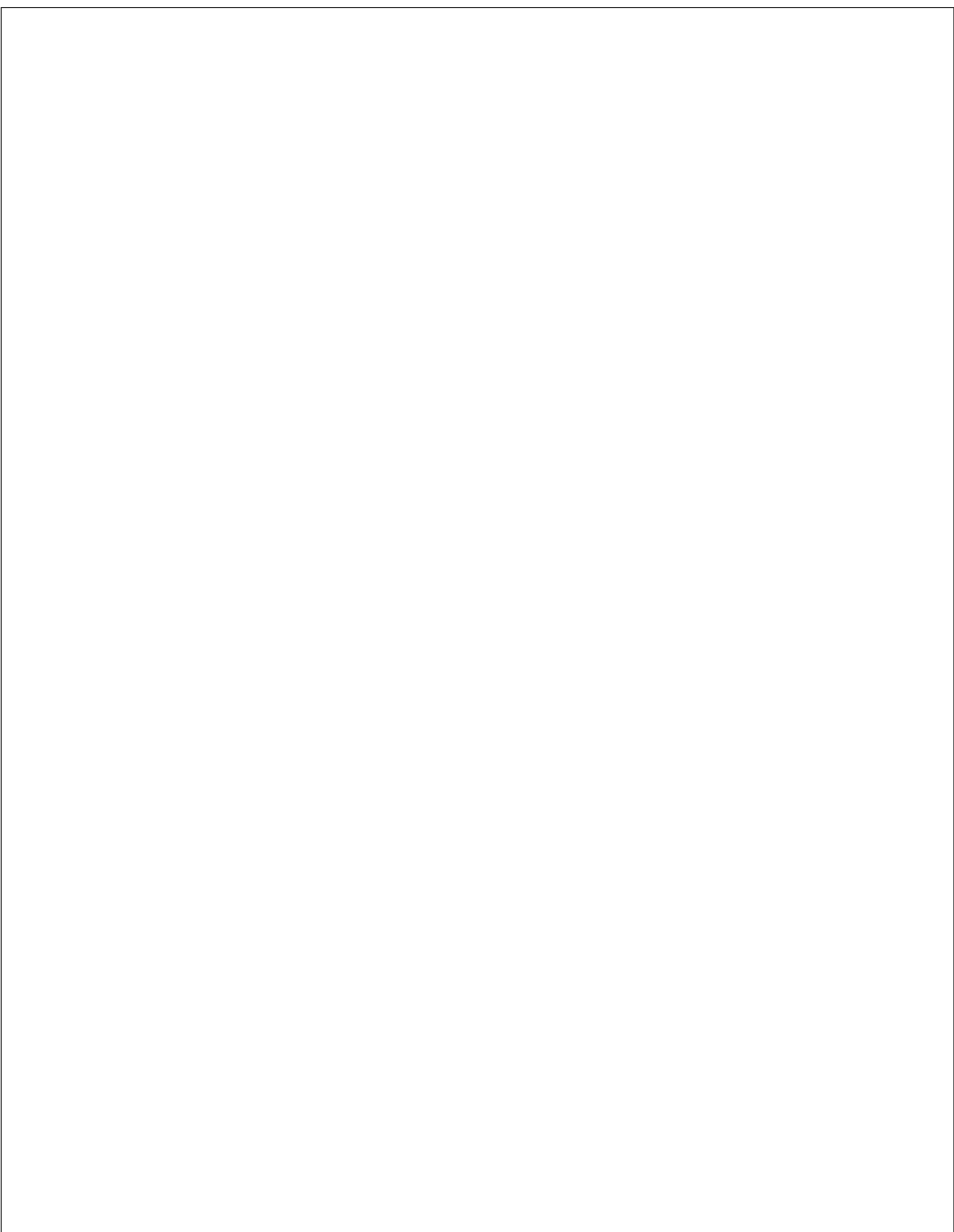
210236 Utopia West
2031 Background AM peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	212	45	68	14	58	202	63	599	5	54	389	74
Future Volume (veh/h)	212	45	68	14	58	202	63	599	5	54	389	74
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		0.99	1.00		0.99
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	1716	1560	1750	1496	1737	1750	1716	1677	1750	1683	1667	1750
Adj Flow Rate, veh/h	230	49	74	15	63	220	68	651	5	59	423	80
Adj No. of Lanes	1	1	0	1	1	0	1	1	0	1	2	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	11	13	17	0	1	2	4	50	4	5	5
Cap, veh/h	228	174	263	321	105	367	456	777	6	240	1236	232
Arrive On Green	0.31	0.31	0.31	0.31	0.31	0.31	0.05	0.47	0.47	0.05	0.46	0.46
Sat Flow, veh/h	1005	561	848	1013	339	1186	1634	1662	13	1603	2659	499
Grp Volume(v), veh/h	230	0	123	15	0	283	68	0	656	59	251	252
Grp Sat Flow(s), veh/h/ln	1005	0	1409	1013	0	1525	1634	0	1675	1603	1583	1575
Q Serve(g_s), s	14.8	0.0	6.4	1.1	0.0	15.2	2.0	0.0	33.2	1.8	9.7	9.9
Cycle Q Clear(g_c), s	30.0	0.0	6.4	7.5	0.0	15.2	2.0	0.0	33.2	1.8	9.7	9.9
Prop In Lane	1.00		0.60	1.00		0.78	1.00		0.01	1.00		0.32
Lane Grp Cap(c), veh/h	228	0	437	321	0	472	456	0	783	240	736	732
V/C Ratio(X)	1.01	0.00	0.28	0.05	0.00	0.60	0.15	0.00	0.84	0.25	0.34	0.34
Avail Cap(c_a), veh/h	228	0	437	321	0	472	540	0	783	327	736	732
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	1.00	1.00
Uniform Delay (d), s/veh	43.4	0.0	25.3	28.1	0.0	28.3	12.4	0.0	22.6	18.0	16.5	16.5
Incr Delay (d2), s/veh	62.4	0.0	0.3	0.0	0.0	1.8	0.1	0.0	10.4	0.4	1.3	1.3
Initial Q Delay(d3),s/veh	0.1	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	10.0	0.0	2.5	0.3	0.0	6.6	0.9	0.0	17.6	0.8	4.5	4.5
LnGrp Delay(d),s/veh	105.9	0.0	25.5	28.1	0.0	30.2	12.5	0.0	33.0	18.4	17.7	17.8
LnGrp LOS	F		C	C		C	B		C	B	B	B
Approach Vol, veh/h	353			298			724			562		
Approach Delay, s/veh	77.9			30.1			31.1			17.8		
Approach LOS	E			C			C			B		
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	7.8	52.2		36.9	8.0	51.9		36.9				
Change Period (Y+Rc), s	3.0	* 6.9		* 6.9	3.0	* 6.9		* 6.9				
Max Green Setting (Gmax), s	10.0	* 45		* 30	10.0	* 45		* 30				
Max Q Clear Time (g_c+I1), s	3.8	35.2		32.0	4.0	11.9		17.2				
Green Ext Time (p_c), s	0.1	3.1		0.0	0.1	3.3		1.5				
Intersection Summary												
HCM 2010 Ctrl Delay	35.6											
HCM 2010 LOS	D											
Notes												

HCM 2010 Signalized Intersection Summary
4: Ontario St. & Greenlane St.

210236 Utopia West
2031 Background AM peak

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.



HCM 2010 AWSC
1: Lincoln Avenue & Greenlane St.

210236 Utopia West
2031 Background PM peak

Intersection												
Intersection Delay, s/veh	10											
Intersection LOS	A											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	6	224	13	50	112	15	10	27	45	63	76	16
Future Vol, veh/h	6	224	13	50	112	15	10	27	45	63	76	16
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	7	243	14	54	122	16	11	29	49	68	83	17
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0
Approach	EB			WB			NB			SB		
Opposing Approach	WB			EB			SB			NB		
Opposing Lanes	1			1			1			1		
Conflicting Approach Left	SB			NB			EB			WB		
Conflicting Lanes Left	1			1			1			1		
Conflicting Approach Right	NB			SB			WB			EB		
Conflicting Lanes Right	1			1			1			1		
HCM Control Delay	10.5			9.8			8.8			9.9		
HCM LOS	B			A			A			A		
Lane	NBLn1	EBLn1	WBLn1	SBLn1								
Vol Left, %	12%	2%	28%	41%								
Vol Thru, %	33%	92%	63%	49%								
Vol Right, %	55%	5%	8%	10%								
Sign Control	Stop	Stop	Stop	Stop								
Traffic Vol by Lane	82	243	177	155								
LT Vol	10	6	50	63								
Through Vol	27	224	112	76								
RT Vol	45	13	15	16								
Lane Flow Rate	89	264	192	168								
Geometry Grp	1	1	1	1								
Degree of Util (X)	0.123	0.352	0.263	0.241								
Departure Headway (Hd)	4.962	4.799	4.917	5.16								
Convergence, Y/N	Yes	Yes	Yes	Yes								
Cap	714	742	723	689								
Service Time	3.054	2.868	2.992	3.242								
HCM Lane V/C Ratio	0.125	0.356	0.266	0.244								
HCM Control Delay	8.8	10.5	9.8	9.9								
HCM Lane LOS	A	B	A	A								
HCM 95th-tile Q	0.4	1.6	1.1	0.9								

HCM 2010 TWSC
2: Cedarbrook Lane /Utopia

210236 Utopia West
2031 Background PM peak

Intersection												
Int Delay, s/veh	3.7											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔		↔	↔			↔			↔	
Traffic Vol, veh/h	31	251	50	82	139	33	21	7	45	19	8	17
Future Vol, veh/h	31	251	50	82	139	33	21	7	45	19	8	17
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	150	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	34	273	54	89	151	36	23	8	49	21	9	18
Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	187	0	0	327	0	0	729	733	300	744	742	169
Stage 1	-	-	-	-	-	-	368	368	-	347	347	-
Stage 2	-	-	-	-	-	-	361	365	-	397	395	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1387	-	-	1233	-	-	338	348	740	331	344	875
Stage 1	-	-	-	-	-	-	652	621	-	669	635	-
Stage 2	-	-	-	-	-	-	657	623	-	629	605	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1387	-	-	1233	-	-	299	313	740	280	310	875
Mov Cap-2 Maneuver	-	-	-	-	-	-	299	313	-	280	310	-
Stage 1	-	-	-	-	-	-	632	602	-	649	589	-
Stage 2	-	-	-	-	-	-	588	578	-	563	587	-
Approach	EB			WB			NB			SB		
HCM Control Delay, s	0.7			2.6			14.1			15.5		
HCM LOS							B			C		
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1				
Capacity (veh/h)	476	1387	-	-	1233	-	-	389				
HCM Lane V/C Ratio	0.167	0.024	-	-	0.072	-	-	0.123				
HCM Control Delay (s)	14.1	7.7	0	-	8.1	-	-	15.5				
HCM Lane LOS	B	A	A	-	A	-	-	C				
HCM 95th %tile Q(veh)	0.6	0.1	-	-	0.2	-	-	0.4				

HCM 2010 TWSC
3: Juniper Ct.

210236 Utopia West
2031 Background PM peak

Intersection							
Int Delay, s/veh	0.3						
Movement	EBT	EBR	WBL	WBT	NBL	NBR	
Lane Configurations	↰		↰	↰	↰	↰	
Traffic Vol, veh/h	306	9	9	249	5	5	
Future Vol, veh/h	306	9	9	249	5	5	
Conflicting Peds, #/hr	0	0	0	0	0	0	
Sign Control	Free	Free	Free	Free	Stop	Stop	
RT Channelized	-	None	-	None	-	None	
Storage Length	-	-	150	-	0	-	
Veh in Median Storage, #	0	-	-	0	0	-	
Grade, %	0	-	-	0	0	-	
Peak Hour Factor	92	92	92	92	92	92	
Heavy Vehicles, %	2	2	2	2	2	2	
Mvmt Flow	333	10	10	271	5	5	

Major/Minor	Major1	Major2	Minor1		
Conflicting Flow All	0	0	343	0	629 338
Stage 1	-	-	-	-	338 -
Stage 2	-	-	-	-	291 -
Critical Hdwy	-	-	4.12	-	6.42 6.22
Critical Hdwy Stg 1	-	-	-	-	5.42 -
Critical Hdwy Stg 2	-	-	-	-	5.42 -
Follow-up Hdwy	-	-	2.218	-	3.518 3.318
Pot Cap-1 Maneuver	-	-	1216	-	446 704
Stage 1	-	-	-	-	722 -
Stage 2	-	-	-	-	759 -
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	1216	-	442 704
Mov Cap-2 Maneuver	-	-	-	-	442 -
Stage 1	-	-	-	-	722 -
Stage 2	-	-	-	-	753 -

Approach	EB	WB	NB
HCM Control Delay, s	0	0.3	11.8
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	543	-	-	1216	-
HCM Lane V/C Ratio	0.02	-	-	0.008	-
HCM Control Delay (s)	11.8	-	-	8	-
HCM Lane LOS	B	-	-	A	-
HCM 95th %tile Q(veh)	0.1	-	-	0	-

Queues
4: Ontario St. & Greenlane St.

210236 Utopia West
2031 Background PM peak

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	150	297	32	218	170	591	215	1050
v/c Ratio	0.80	0.77	0.24	0.59	0.50	0.71	0.49	0.63
Control Delay	63.4	37.2	33.5	32.0	11.7	25.2	10.5	19.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	63.4	37.2	33.5	32.0	11.7	25.2	10.5	19.1
Queue Length 50th (m)	26.1	37.2	4.9	28.9	9.6	79.7	12.5	66.8
Queue Length 95th (m)	48.8	66.2	13.0	51.5	24.1	#165.9	30.2	114.8
Internal Link Dist (m)		74.6		145.6		151.8		77.4
Turn Bay Length (m)	25.0		20.0		70.0		30.0	
Base Capacity (vph)	301	574	212	567	377	833	467	1656
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.50	0.52	0.15	0.38	0.45	0.71	0.46	0.63

Intersection Summary							
#	95th percentile volume exceeds capacity, queue may be longer. Queue shown is maximum after two cycles.						

HCM 2010 Signalized Intersection Summary
4: Ontario St. & Greenlane St.

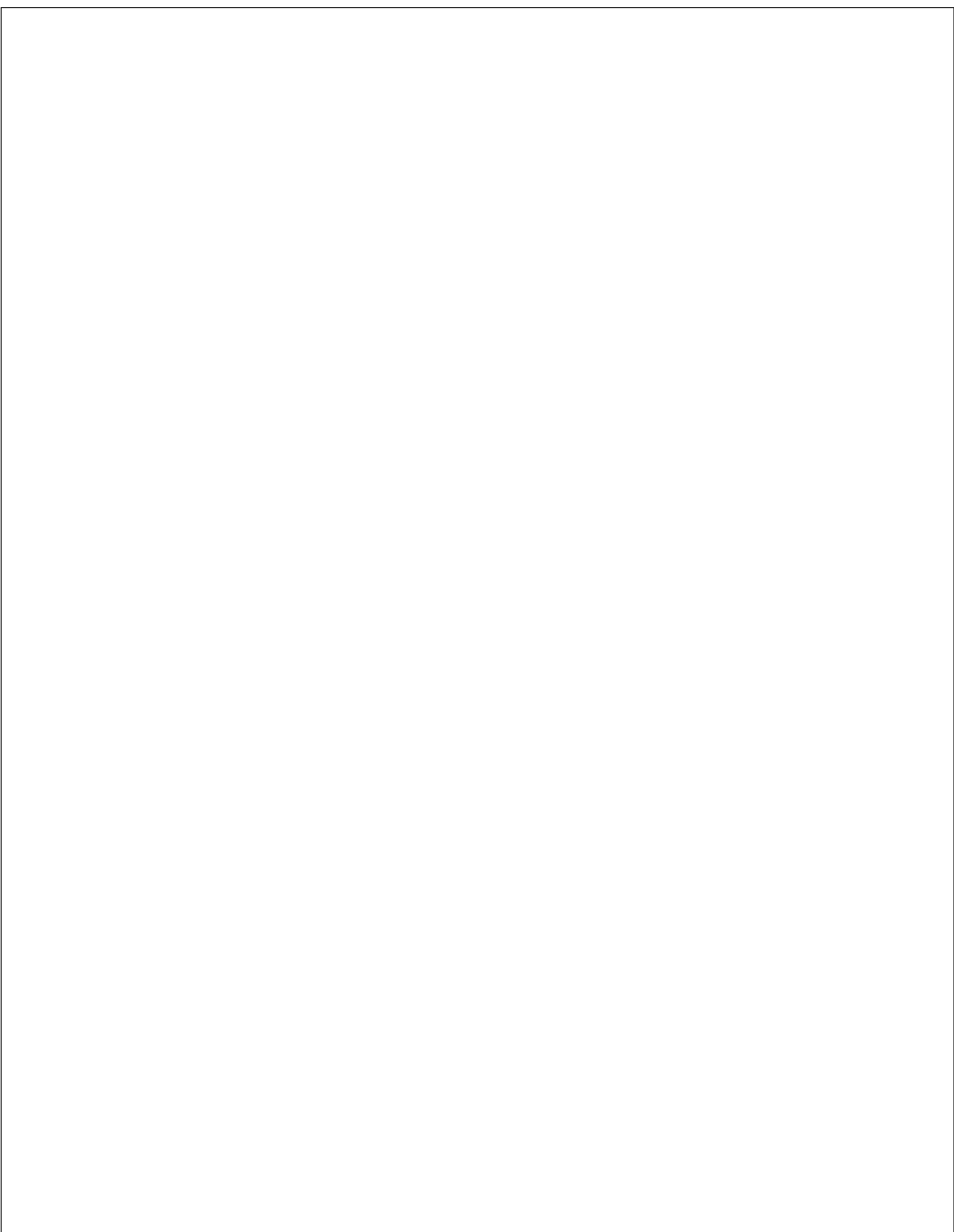
210236 Utopia West
2031 Background PM peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	138	104	169	29	109	92	156	531	13	198	797	169
Future Volume (veh/h)	138	104	169	29	109	92	156	531	13	198	797	169
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		0.99	1.00		0.99	1.00		0.99
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	1699	1716	1750	1750	1718	1750	1750	1653	1750	1733	1747	1750
Adj Flow Rate, veh/h	150	113	184	32	118	100	170	577	14	215	866	184
Adj No. of Lanes	1	1	0	1	1	0	1	1	0	1	2	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	3	2	2	0	0	4	0	6	0	1	0	1
Cap, veh/h	250	166	270	186	242	205	310	736	18	337	1286	273
Arrive On Green	0.28	0.28	0.28	0.28	0.28	0.28	0.07	0.46	0.46	0.09	0.47	0.47
Sat Flow, veh/h	1053	587	956	1011	858	727	1667	1607	39	1650	2721	578
Grp Volume(v), veh/h	150	0	297	32	0	218	170	0	591	215	528	522
Grp Sat Flow(s), veh/h/ln	1053	0	1543	1011	0	1586	1667	0	1646	1650	1660	1640
Q Serve(g_s), s	13.6	0.0	16.8	2.9	0.0	11.2	5.2	0.0	29.8	6.6	24.2	24.2
Cycle Q Clear(g_c), s	24.8	0.0	16.8	19.6	0.0	11.2	5.2	0.0	29.8	6.6	24.2	24.2
Prop In Lane	1.00		0.62	1.00		0.46	1.00		0.02	1.00		0.35
Lane Grp Cap(c), veh/h	250	0	436	186	0	448	310	0	754	337	784	775
V/C Ratio(X)	0.60	0.00	0.68	0.17	0.00	0.49	0.55	0.00	0.78	0.64	0.67	0.67
Avail Cap(c_a), veh/h	275	0	471	209	0	484	357	0	754	360	784	775
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	1.00	1.00
Uniform Delay (d), s/veh	39.6	0.0	31.3	40.0	0.0	29.3	16.0	0.0	22.5	17.9	20.0	20.0
Incr Delay (d2), s/veh	2.5	0.0	3.3	0.3	0.0	0.6	1.1	0.0	8.0	3.0	4.6	4.6
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	4.1	0.0	7.6	0.8	0.0	5.0	2.5	0.0	15.1	3.3	12.0	11.9
LnGrp Delay(d),s/veh	42.2	0.0	34.6	40.4	0.0	29.9	17.1	0.0	30.5	20.8	24.6	24.7
LnGrp LOS	D		C	D		C	B		C	C	C	C
Approach Vol, veh/h	447			250			761			1265		
Approach Delay, s/veh	37.1			31.3			27.5			24.0		
Approach LOS	D			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	11.7	51.9		34.6	10.3	53.3		34.6				
Change Period (Y+Rc), s	3.0	* 6.9		* 6.9	3.0	* 6.9		* 6.9				
Max Green Setting (Gmax), s	10.0	* 45		* 30	10.0	* 45		* 30				
Max Q Clear Time (g_c+I1), s	8.6	31.8		26.8	7.2	26.2		21.6				
Green Ext Time (p_c), s	0.1	3.3		0.8	0.1	7.0		0.9				
Intersection Summary												
HCM 2010 Ctrl Delay				27.8								
HCM 2010 LOS				C								
Notes												

HCM 2010 Signalized Intersection Summary
4: Ontario St. & Greenlane St.

210236 Utopia West
2031 Background PM peak

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.



Appendix H

2031 Future Total Traffic Operations Reports



HCM 2010 AWSC
1: Lincoln Avenue & Greenlane St.

210236 Utopia West
2031 Future Total AM peak

Intersection												
Intersection Delay, s/veh	8.7											
Intersection LOS	A											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	7	127	9	14	138	39	9	52	52	11	37	6
Future Vol, veh/h	7	127	9	14	138	39	9	52	52	11	37	6
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	8	138	10	15	150	42	10	57	57	12	40	7
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0
Approach	EB			WB			NB			SB		
Opposing Approach	WB			EB			SB			NB		
Opposing Lanes	1			1			1			1		
Conflicting Approach Left	SB			NB			EB			WB		
Conflicting Lanes Left	1			1			1			1		
Conflicting Approach Right	NB			SB			WB			EB		
Conflicting Lanes Right	1			1			1			1		
HCM Control Delay	8.7			9			8.5			8.4		
HCM LOS	A			A			A			A		
Lane	NBLn1	EBLn1	WBLn1	SBLn1								
Vol Left, %	8%	5%	7%	20%								
Vol Thru, %	46%	89%	72%	69%								
Vol Right, %	46%	6%	20%	11%								
Sign Control	Stop	Stop	Stop	Stop								
Traffic Vol by Lane	113	143	191	54								
LT Vol	9	7	14	11								
Through Vol	52	127	138	37								
RT Vol	52	9	39	6								
Lane Flow Rate	123	155	208	59								
Geometry Grp	1	1	1	1								
Degree of Util (X)	0.156	0.197	0.256	0.08								
Departure Headway (Hd)	4.574	4.569	4.435	4.887								
Convergence, Y/N	Yes	Yes	Yes	Yes								
Cap	782	785	810	731								
Service Time	2.611	2.603	2.466	2.929								
HCM Lane V/C Ratio	0.157	0.197	0.257	0.081								
HCM Control Delay	8.5	8.7	9	8.4								
HCM Lane LOS	A	A	A	A								
HCM 95th-tile Q	0.6	0.7	1	0.3								

HCM 2010 TWSC
2: Cedarbrook Lane /Utopia

210236 Utopia West
2031 Future Total AM peak

Intersection												
Int Delay, s/veh	6.2											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔		↔	↔			↔			↔	
Traffic Vol, veh/h	58	161	8	22	114	7	56	11	111	34	4	20
Future Vol, veh/h	58	161	8	22	114	7	56	11	111	34	4	20
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	150	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	63	175	9	24	124	8	61	12	121	37	4	22
Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	132	0	0	184	0	0	495	486	180	548	486	128
Stage 1	-	-	-	-	-	-	306	306	-	176	176	-
Stage 2	-	-	-	-	-	-	189	180	-	372	310	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1453	-	-	1391	-	-	485	481	863	447	481	922
Stage 1	-	-	-	-	-	-	704	662	-	826	753	-
Stage 2	-	-	-	-	-	-	813	750	-	648	659	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1453	-	-	1391	-	-	447	450	863	358	450	922
Mov Cap-2 Maneuver	-	-	-	-	-	-	447	450	-	358	450	-
Stage 1	-	-	-	-	-	-	670	630	-	786	740	-
Stage 2	-	-	-	-	-	-	776	737	-	521	627	-
Approach	EB			WB			NB			SB		
HCM Control Delay, s	1.9			1.2			13.1			14		
HCM LOS							B			B		
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1				
Capacity (veh/h)	639	1453	-	-	1391	-	-	462				
HCM Lane V/C Ratio	0.303	0.043	-	-	0.017	-	-	0.136				
HCM Control Delay (s)	13.1	7.6	-	-	7.6	-	-	14				
HCM Lane LOS	B	A	-	-	A	-	-	B				
HCM 95th %tile Q(veh)	1.3	0.1	-	-	0.1	-	-	0.5				

HCM 2010 TWSC
3: Juniper Ct.

210236 Utopia West
2031 Future Total AM peak

Intersection							
Int Delay, s/veh	0.4						
Movement	EBT	EBR	WBL	WBT	NBL	NBR	
Lane Configurations	↰		↰	↰	↰	↰	
Traffic Vol, veh/h	347	3	2	138	5	11	
Future Vol, veh/h	347	3	2	138	5	11	
Conflicting Peds, #/hr	0	0	0	0	0	0	
Sign Control	Free	Free	Free	Free	Stop	Stop	
RT Channelized	-	None	-	None	-	None	
Storage Length	-	-	150	-	0	-	
Veh in Median Storage, #	0	-	-	0	0	-	
Grade, %	0	-	-	0	0	-	
Peak Hour Factor	92	92	92	92	92	92	
Heavy Vehicles, %	2	2	2	2	2	2	
Mvmt Flow	377	3	2	150	5	12	

Major/Minor	Major1	Major2	Minor1		
Conflicting Flow All	0	0	380	0	533 379
Stage 1	-	-	-	-	379 -
Stage 2	-	-	-	-	154 -
Critical Hdwy	-	-	4.12	-	6.42 6.22
Critical Hdwy Stg 1	-	-	-	-	5.42 -
Critical Hdwy Stg 2	-	-	-	-	5.42 -
Follow-up Hdwy	-	-	2.218	-	3.518 3.318
Pot Cap-1 Maneuver	-	-	1178	-	507 668
Stage 1	-	-	-	-	692 -
Stage 2	-	-	-	-	874 -
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	1178	-	506 668
Mov Cap-2 Maneuver	-	-	-	-	506 -
Stage 1	-	-	-	-	692 -
Stage 2	-	-	-	-	872 -

Approach	EB	WB	NB
HCM Control Delay, s	0	0.1	11.1
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	607	-	-	1178	-
HCM Lane V/C Ratio	0.029	-	-	0.002	-
HCM Control Delay (s)	11.1	-	-	8.1	-
HCM Lane LOS	B	-	-	A	-
HCM 95th %tile Q(veh)	0.1	-	-	0	-

Queues
4: Ontario St. & Greenlane St.

210236 Utopia West
2031 Future Total AM peak

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	265	142	15	285	71	656	59	507
v/c Ratio	1.06	0.29	0.05	0.48	0.15	0.84	0.21	0.35
Control Delay	108.4	15.1	25.5	14.4	9.2	35.0	10.2	16.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	108.4	15.1	25.5	14.4	9.2	35.0	10.2	16.9
Queue Length 50th (m)	~59.6	9.8	2.1	17.3	5.6	113.5	4.6	31.5
Queue Length 95th (m)	#112.3	25.9	7.2	42.9	11.5	#187.5	9.9	45.7
Internal Link Dist (m)		76.1		136.0		151.0		75.7
Turn Bay Length (m)	25.0		20.0		70.0		30.0	
Base Capacity (vph)	251	488	308	593	530	782	331	1443
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	1.06	0.29	0.05	0.48	0.13	0.84	0.18	0.35

Intersection Summary	
~	Volume exceeds capacity, queue is theoretically infinite. Queue shown is maximum after two cycles.
#	95th percentile volume exceeds capacity, queue may be longer. Queue shown is maximum after two cycles.

HCM 2010 Signalized Intersection Summary
4: Ontario St. & Greenlane St.

210236 Utopia West
2031 Future Total AM peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	244	52	78	14	60	202	65	599	5	54	389	77
Future Volume (veh/h)	244	52	78	14	60	202	65	599	5	54	389	77
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		0.99	1.00		0.99
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	1716	1560	1750	1496	1737	1750	1716	1677	1750	1683	1667	1750
Adj Flow Rate, veh/h	265	57	85	15	65	220	71	651	5	59	423	84
Adj No. of Lanes	1	1	0	1	1	0	1	1	0	1	2	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh. %	2	11	13	17	0	1	2	4	50	4	5	5
Cap, veh/h	226	175	261	306	108	365	455	777	6	241	1224	241
Arrive On Green	0.31	0.31	0.31	0.31	0.31	0.31	0.05	0.47	0.47	0.05	0.46	0.46
Sat Flow, veh/h	1003	566	844	996	348	1178	1634	1662	13	1603	2635	519
Grp Volume(v), veh/h	265	0	142	15	0	285	71	0	656	59	253	254
Grp Sat Flow(s), veh/h/ln	1003	0	1410	996	0	1526	1634	0	1675	1603	1583	1571
Q Serve(g_s), s	14.6	0.0	7.5	1.1	0.0	15.4	2.1	0.0	33.2	1.8	9.9	10.0
Cycle Q Clear(g_c), s	30.0	0.0	7.5	8.6	0.0	15.4	2.1	0.0	33.2	1.8	9.9	10.0
Prop In Lane	1.00		0.60	1.00		0.77	1.00		0.01	1.00		0.33
Lane Grp Cap(c), veh/h	226	0	436	306	0	473	455	0	783	241	735	730
V/C Ratio(X)	1.17	0.00	0.33	0.05	0.00	0.60	0.16	0.00	0.84	0.25	0.34	0.35
Avail Cap(c_a), veh/h	226	0	436	306	0	473	538	0	783	327	735	730
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	1.00	1.00
Uniform Delay (d), s/veh	43.5	0.0	25.7	29.0	0.0	28.4	12.4	0.0	22.6	18.0	16.5	16.6
Incr Delay (d2), s/veh	114.8	0.0	0.3	0.0	0.0	1.9	0.1	0.0	10.4	0.4	1.3	1.3
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	13.2	0.0	3.0	0.3	0.0	6.7	0.9	0.0	17.6	0.8	4.5	4.6
LnGrp Delay(d),s/veh	158.4	0.0	26.0	29.0	0.0	30.3	12.5	0.0	32.9	18.4	17.8	17.9
LnGrp LOS	F		C	C		C	B		C	B	B	B
Approach Vol, veh/h	407			300			727			566		
Approach Delay, s/veh	112.2			30.3			30.9			17.9		
Approach LOS	F			C			C			B		
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	7.8	52.2		36.9	8.1	51.9		36.9				
Change Period (Y+Rc), s	3.0	* 6.9		* 6.9	3.0	* 6.9		* 6.9				
Max Green Setting (Gmax), s	10.0	* 45		* 30	10.0	* 45		* 30				
Max Q Clear Time (g_c+I1), s	3.8	35.2		32.0	4.1	12.0		17.4				
Green Ext Time (p_c), s	0.1	3.1		0.0	0.1	3.3		1.5				
Intersection Summary												
HCM 2010 Ctrl Delay	43.7											
HCM 2010 LOS	D											
Notes												

HCM 2010 Signalized Intersection Summary
4: Ontario St. & Greenlane St.

210236 Utopia West
2031 Future Total AM peak

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

HCM 2010 TWSC

5: Site Access

210236 Utopia West

2031 Future Total AM peak

Intersection						
Int Delay, s/veh	2.8					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	19	172	171	19	55	49
Future Vol, veh/h	19	172	171	19	55	49
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	21	187	186	21	60	53
Major/Minor						
	Major1	Major2		Minor2		
Conflicting Flow All	207	0	-	0	426	197
Stage 1	-	-	-	-	197	-
Stage 2	-	-	-	-	229	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1364	-	-	-	585	844
Stage 1	-	-	-	-	836	-
Stage 2	-	-	-	-	809	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1364	-	-	-	575	844
Mov Cap-2 Maneuver	-	-	-	-	575	-
Stage 1	-	-	-	-	822	-
Stage 2	-	-	-	-	809	-
Approach	EB	WB		SB		
HCM Control Delay, s	0.8	0		11.4		
HCM LOS	B					
Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	
Capacity (veh/h)	1364	-	-	-	677	
HCM Lane V/C Ratio	0.015	-	-	-	0.167	
HCM Control Delay (s)	7.7	0	-	-	11.4	
HCM Lane LOS	A	A	-	-	B	
HCM 95th %tile Q(veh)	0	-	-	-	0.6	

HCM 2010 AWSC
1: Lincoln Avenue & Greenlane St.

210236 Utopia West
2031 Future Total PM peak

Intersection												
Intersection Delay, s/veh	11											
Intersection LOS	B											

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↔			↔	
Traffic Vol, veh/h	6	257	13	63	124	19	10	27	57	85	76	16
Future Vol, veh/h	6	257	13	63	124	19	10	27	57	85	76	16
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	150	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	7	279	14	68	135	21	11	29	62	92	83	17
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	11.8	10.7	9.3	10.8
HCM LOS	B	B	A	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	11%	2%	31%	48%
Vol Thru, %	29%	93%	60%	43%
Vol Right, %	61%	5%	9%	9%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	94	276	206	177
LT Vol	10	6	63	85
Through Vol	27	257	124	76
RT Vol	57	13	19	16
Lane Flow Rate	102	300	224	192
Geometry Grp	1	1	1	1
Degree of Util (X)	0.15	0.423	0.324	0.294
Departure Headway (Hd)	5.297	5.071	5.204	5.507
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	676	711	692	652
Service Time	3.335	3.096	3.232	3.54
HCM Lane V/C Ratio	0.151	0.422	0.324	0.294
HCM Control Delay	9.3	11.8	10.7	10.8
HCM Lane LOS	A	B	B	B
HCM 95th-tile Q	0.5	2.1	1.4	1.2

HCM 2010 TWSC
2: Cedarbrook Lane /Utopia

210236 Utopia West
2031 Future Total PM peak

Intersection												
Int Delay, s/veh	4.1											

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔		↔	↔			↔			↔	
Traffic Vol, veh/h	54	263	50	82	172	33	31	7	45	19	8	17
Future Vol, veh/h	54	263	50	82	172	33	31	7	45	19	8	17
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	150	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	59	286	54	89	187	36	34	8	49	21	9	18

Major/Minor	Major1	Major2	Minor1	Minor2
Conflicting Flow All	223	0	0	340
Stage 1	-	-	-	-
Stage 2	-	-	-	-
Critical Hdwy	4.12	-	-	4.12
Critical Hdwy Stg 1	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-
Follow-up Hdwy	2.218	-	-	2.218
Pot Cap-1 Maneuver	1346	-	-	1219
Stage 1	-	-	-	-
Stage 2	-	-	-	-
Platoon blocked, %	-	-	-	-
Mov Cap-1 Maneuver	1346	-	-	1219
Mov Cap-2 Maneuver	-	-	-	-
Stage 1	-	-	-	-
Stage 2	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	1.1	2.3	16.9	17.5
HCM LOS			C	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	392	1346	-	-	1219	-	-	335
HCM Lane V/C Ratio	0.23	0.044	-	-	0.073	-	-	0.143
HCM Control Delay (s)	16.9	7.8	0	-	8.2	-	-	17.5
HCM Lane LOS	C	A	A	-	A	-	-	C
HCM 95th %tile Q(veh)	0.9	0.1	-	-	0.2	-	-	0.5

HCM 2010 TWSC
3: Juniper Ct.

210236 Utopia West
2031 Future Total PM peak

Intersection							
Int Delay, s/veh	0.3						
Movement	EBT	EBR	WBL	WBT	NBL	NBR	
Lane Configurations	↻		↻	↻	↻		
Traffic Vol, veh/h	333	9	9	282	5	5	
Future Vol, veh/h	333	9	9	282	5	5	
Conflicting Peds, #/hr	0	0	0	0	0	0	
Sign Control	Free	Free	Free	Free	Stop	Stop	
RT Channelized	-	None	-	None	-	None	
Storage Length	-	-	150	-	0	-	
Veh in Median Storage, #	0	-	-	0	0	-	
Grade, %	0	-	-	0	0	-	
Peak Hour Factor	92	92	92	92	92	92	
Heavy Vehicles, %	2	2	2	2	2	2	
Mvmt Flow	362	10	10	307	5	5	

Major/Minor	Major1	Major2	Minor1		
Conflicting Flow All	0	0	372	0	694 367
Stage 1	-	-	-	-	367 -
Stage 2	-	-	-	-	327 -
Critical Hdwy	-	-	4.12	-	6.42 6.22
Critical Hdwy Stg 1	-	-	-	-	5.42 -
Critical Hdwy Stg 2	-	-	-	-	5.42 -
Follow-up Hdwy	-	-	2.218	-	3.518 3.318
Pot Cap-1 Maneuver	-	-	1186	-	409 678
Stage 1	-	-	-	-	701 -
Stage 2	-	-	-	-	731 -
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	1186	-	406 678
Mov Cap-2 Maneuver	-	-	-	-	406 -
Stage 1	-	-	-	-	701 -
Stage 2	-	-	-	-	725 -

Approach	EB	WB	NB
HCM Control Delay, s	0	0.2	12.2
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	508	-	-	1186	-
HCM Lane V/C Ratio	0.021	-	-	0.008	-
HCM Control Delay (s)	12.2	-	-	8.1	-
HCM Lane LOS	B	-	-	A	-
HCM 95th %tile Q(veh)	0.1	-	-	0	-

Queues
4: Ontario St. & Greenlane St.

210236 Utopia West
2031 Future Total PM peak

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	160	317	32	227	182	591	215	1065
v/c Ratio	0.85	0.80	0.26	0.60	0.54	0.72	0.50	0.65
Control Delay	70.2	39.7	34.2	32.8	13.2	25.8	11.0	19.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	70.2	39.7	34.2	32.8	13.2	25.8	11.0	19.9
Queue Length 50th (m)	28.4	41.5	4.9	31.1	10.8	82.0	13.1	70.8
Queue Length 95th (m)	53.1	72.2	13.2	54.5	25.7	#165.9	30.2	117.2
Internal Link Dist (m)		74.6		145.6		151.8		77.4
Turn Bay Length (m)	25.0		20.0		70.0		30.0	
Base Capacity (vph)	290	569	191	562	365	825	458	1634
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.55	0.56	0.17	0.40	0.50	0.72	0.47	0.65

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis
4: Ontario St. & Greenlane St.

210236 Utopia West
2031 Future Total PM peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	147	110	181	29	117	92	167	531	13	198	797	183
Future Volume (vph)	147	110	181	29	117	92	167	531	13	198	797	183
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	6.9	6.9		6.9	6.9		3.0	6.9		3.0	6.9	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	0.95	
Flpb, ped/bikes	1.00	0.99		1.00	1.00		1.00	1.00		1.00	0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.91		1.00	0.93		1.00	1.00		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1614	1541		1660	1606		1662	1646		1646	3208	
Flt Permitted	0.51	1.00		0.33	1.00		0.19	1.00		0.29	1.00	
Satd. Flow (perm)	870	1541		575	1606		335	1646		506	3208	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	160	120	197	32	127	100	182	577	14	215	866	199
RTOR Reduction (vph)	0	64	0	0	31	0	0	1	0	0	17	0
Lane Group Flow (vph)	160	253	0	32	196	0	182	590	0	215	1048	0
Confl. Peds. (#/hr)			3	3			7		2	2		7
Heavy Vehicles (%)	3%	2%	2%	0%	0%	4%	0%	6%	0%	1%	0%	1%
Turn Type	Perm	NA		Perm	NA		pm+pt	NA		pm+pt	NA	
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	19.6	19.6		19.6	19.6		53.8	45.4		54.4	45.7	
Effective Green, g (s)	19.6	19.6		19.6	19.6		53.8	45.4		54.4	45.7	
Actuated g/C Ratio	0.22	0.22		0.22	0.22		0.59	0.50		0.60	0.50	
Clearance Time (s)	6.9	6.9		6.9	6.9		3.0	6.9		3.0	6.9	
Vehicle Extension (s)	2.5	2.5		2.5	2.5		2.5	2.5		2.5	2.5	
Lane Grp Cap (vph)	188	333		124	347		322	825		413	1619	
v/s Ratio Prot		0.16			0.12		c0.05	c0.36		0.05	0.33	
v/s Ratio Perm	c0.18			0.06			0.28			0.26		
v/c Ratio	0.85	0.76		0.26	0.57		0.57	0.72		0.52	0.65	
Uniform Delay, d1	34.0	33.2		29.4	31.7		9.9	17.5		10.1	16.5	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	28.7	9.1		0.8	1.7		1.8	5.3		0.9	2.0	
Delay (s)	62.8	42.3		30.2	33.4		11.7	22.8		11.0	18.5	
Level of Service	E	D		C	C		B	C		B	B	
Approach Delay (s)		49.2			33.0			20.2			17.2	
Approach LOS		D			C			C			B	

Intersection Summary			
HCM 2000 Control Delay	25.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	90.5	Sum of lost time (s)	16.8
Intersection Capacity Utilization	89.4%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM 2010 TWSC
5: Site Access

210236 Utopia West
2031 Future Total PM peak

Intersection						
Int Delay, s/veh	2.2					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	67	332	177	43	43	29
Future Vol, veh/h	67	332	177	43	43	29
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	73	361	192	47	47	32

Major/Minor	Major1	Major2	Minor2
Conflicting Flow All	239	0	0
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	4.12	-	-
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	2.218	-	-
Pot Cap-1 Maneuver	1328	-	-
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	1328	-	-
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	SB
HCM Control Delay, s	1.3	0	14.1
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1328	-	-	-	472
HCM Lane V/C Ratio	0.055	-	-	-	0.166
HCM Control Delay (s)	7.9	0	-	-	14.1
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0.2	-	-	-	0.6

Appendix I

2031 Total Traffic Operations Reports – Signal Optimization



HCM 2010 AWSC
1: Lincoln Avenue & Greenlane St.

210236 Utopia West
2031 Future Total Improvements AM peak

Intersection												
Intersection Delay, s/veh		8.7										
Intersection LOS		A										
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	7	127	9	14	138	39	9	52	52	11	37	6
Future Vol, veh/h	7	127	9	14	138	39	9	52	52	11	37	6
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	8	138	10	15	150	42	10	57	57	12	40	7
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0
Approach	EB			WB			NB			SB		
Opposing Approach	WB			EB			SB			NB		
Opposing Lanes	1			1			1			1		
Conflicting Approach Left	SB			NB			EB			WB		
Conflicting Lanes Left	1			1			1			1		
Conflicting Approach Right	NB			SB			WB			EB		
Conflicting Lanes Right	1			1			1			1		
HCM Control Delay	8.7			9			8.5			8.4		
HCM LOS	A			A			A			A		
Lane	NBLn1	EBLn1	WBLn1	SBLn1								
Vol Left, %	8%	5%	7%	20%								
Vol Thru, %	46%	89%	72%	69%								
Vol Right, %	46%	6%	20%	11%								
Sign Control	Stop	Stop	Stop	Stop								
Traffic Vol by Lane	113	143	191	54								
LT Vol	9	7	14	11								
Through Vol	52	127	138	37								
RT Vol	52	9	39	6								
Lane Flow Rate	123	155	208	59								
Geometry Grp	1	1	1	1								
Degree of Util (X)	0.156	0.197	0.256	0.08								
Departure Headway (Hd)	4.574	4.569	4.435	4.887								
Convergence, Y/N	Yes	Yes	Yes	Yes								
Cap	782	785	810	731								
Service Time	2.611	2.603	2.466	2.929								
HCM Lane V/C Ratio	0.157	0.197	0.257	0.081								
HCM Control Delay	8.5	8.7	9	8.4								
HCM Lane LOS	A	A	A	A								
HCM 95th-tile Q	0.6	0.7	1	0.3								

HCM 2010 TWSC
2: Cedarbrook Lane /Utopia

210236 Utopia West
2031 Future Total Improvements AM peak

Intersection												
Int Delay, s/veh		6.2										
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔		↔	↔			↔			↔	
Traffic Vol, veh/h	58	161	8	22	114	7	56	11	111	34	4	20
Future Vol, veh/h	58	161	8	22	114	7	56	11	111	34	4	20
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	150	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	63	175	9	24	124	8	61	12	121	37	4	22
Major/Minor	Major1		Major2		Minor1		Minor2					
Conflicting Flow All	132	0	0	184	0	0	495	486	180	548	486	128
Stage 1	-	-	-	-	-	-	306	306	-	176	176	-
Stage 2	-	-	-	-	-	-	189	180	-	372	310	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1453	-	-	1391	-	-	485	481	863	447	481	922
Stage 1	-	-	-	-	-	-	704	662	-	826	753	-
Stage 2	-	-	-	-	-	-	813	750	-	648	659	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1453	-	-	1391	-	-	447	450	863	358	450	922
Mov Cap-2 Maneuver	-	-	-	-	-	-	447	450	-	358	450	-
Stage 1	-	-	-	-	-	-	670	630	-	786	740	-
Stage 2	-	-	-	-	-	-	776	737	-	521	627	-
Approach	EB		WB		NB		SB					
HCM Control Delay, s	1.9		1.2		13.1		14					
HCM LOS					B		B					
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1				
Capacity (veh/h)	639	1453	-	-	1391	-	-	462				
HCM Lane V/C Ratio	0.303	0.043	-	-	0.017	-	-	0.136				
HCM Control Delay (s)	13.1	7.6	-	-	7.6	-	-	14				
HCM Lane LOS	B	A	-	-	A	-	-	B				
HCM 95th %tile Q(veh)	1.3	0.1	-	-	0.1	-	-	0.5				

HCM 2010 TWSC
3: Juniper Ct.

210236 Utopia West
2031 Future Total Improvements AM peak

Intersection							
Int Delay, s/veh	0.4						
Movement	EBT	EBR	WBL	WBT	NBL	NBR	
Lane Configurations	↰		↰	↱	↰	↱	
Traffic Vol, veh/h	347	3	2	138	5	11	
Future Vol, veh/h	347	3	2	138	5	11	
Conflicting Peds, #/hr	0	0	0	0	0	0	
Sign Control	Free	Free	Free	Free	Stop	Stop	
RT Channelized	-	None	-	None	-	None	
Storage Length	-	-	150	-	0	-	
Veh in Median Storage, #	0	-	-	0	0	-	
Grade, %	0	-	-	0	0	-	
Peak Hour Factor	92	92	92	92	92	92	
Heavy Vehicles, %	2	2	2	2	2	2	
Mvmt Flow	377	3	2	150	5	12	

Major/Minor	Major1	Major2	Minor1		
Conflicting Flow All	0	0	380	0	533 379
Stage 1	-	-	-	-	379 -
Stage 2	-	-	-	-	154 -
Critical Hdwy	-	-	4.12	-	6.42 6.22
Critical Hdwy Stg 1	-	-	-	-	5.42 -
Critical Hdwy Stg 2	-	-	-	-	5.42 -
Follow-up Hdwy	-	-	2.218	-	3.518 3.318
Pot Cap-1 Maneuver	-	-	1178	-	507 668
Stage 1	-	-	-	-	692 -
Stage 2	-	-	-	-	874 -
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	1178	-	506 668
Mov Cap-2 Maneuver	-	-	-	-	506 -
Stage 1	-	-	-	-	692 -
Stage 2	-	-	-	-	872 -

Approach	EB	WB	NB
HCM Control Delay, s	0	0.1	11.1
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	607	-	-	1178	-
HCM Lane V/C Ratio	0.029	-	-	0.002	-
HCM Control Delay (s)	11.1	-	-	8.1	-
HCM Lane LOS	B	-	-	A	-
HCM 95th %tile Q(veh)	0.1	-	-	0	-

Queues
4: Ontario St. & Greenlane St.

210236 Utopia West
2031 Future Total Improvements AM peak

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	265	142	15	285	71	656	59	507
v/c Ratio	0.93	0.25	0.04	0.42	0.17	0.79	0.26	0.33
Control Delay	72.5	13.3	23.0	12.5	14.2	34.9	16.1	18.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	72.5	13.3	23.0	12.5	14.2	34.9	16.1	18.8
Queue Length 50th (m)	59.6	10.6	2.3	18.7	8.2	141.5	6.7	39.6
Queue Length 95th (m)	#112.4	25.2	7.0	41.8	15.8	#213.6	13.6	53.3
Internal Link Dist (m)		76.1		136.0		151.0		75.7
Turn Bay Length (m)	25.0		20.0		70.0		30.0	
Base Capacity (vph)	329	641	401	749	418	827	228	1528
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.81	0.22	0.04	0.38	0.17	0.79	0.26	0.33

Intersection Summary	
#	95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.	

HCM 2010 Signalized Intersection Summary
4: Ontario St. & Greenlane St.

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	244	52	78	14	60	202	65	599	5	54	389	77
Future Volume (veh/h)	244	52	78	14	60	202	65	599	5	54	389	77
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		0.99	1.00		0.99
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	1716	1560	1750	1496	1737	1750	1716	1677	1750	1683	1667	1750
Adj Flow Rate, veh/h	265	57	85	15	65	220	71	651	5	59	423	84
Adj No. of Lanes	1	1	0	1	1	0	1	1	0	1	2	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	11	13	17	0	1	2	4	50	4	5	5
Cap, veh/h	320	226	337	390	139	470	387	773	6	178	1220	240
Arrive On Green	0.40	0.40	0.37	0.40	0.40	0.37	0.04	0.47	0.44	0.03	0.46	0.44
Sat Flow, veh/h	1003	566	844	996	348	1179	1634	1662	13	1603	2635	519
Grp Volume(v), veh/h	265	0	142	15	0	285	71	0	656	59	253	254
Grp Sat Flow(s), veh/h/ln	1003	0	1410	996	0	1527	1634	0	1675	1603	1583	1571
Q Serve(g_s), s	30.7	0.0	8.2	1.2	0.0	16.7	2.9	0.0	40.9	2.4	12.1	12.5
Cycle Q Clear(g_c), s	47.4	0.0	8.2	9.4	0.0	16.7	2.9	0.0	40.9	2.4	12.1	12.5
Prop In Lane	1.00		0.60	1.00		0.77	1.00		0.01	1.00		0.33
Lane Grp Cap(c), veh/h	320	0	562	390	0	609	387	0	779	178	733	727
V/C Ratio(X)	0.83	0.00	0.25	0.04	0.00	0.47	0.18	0.00	0.84	0.33	0.34	0.35
Avail Cap(c_a), veh/h	320	0	562	390	0	609	403	0	779	198	733	727
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	1.00	1.00
Uniform Delay (d), s/veh	44.4	0.0	24.5	27.1	0.0	27.3	18.3	0.0	27.9	25.3	20.4	20.8
Incr Delay (d2), s/veh	16.1	0.0	0.2	0.0	0.0	0.4	0.2	0.0	10.7	0.8	1.3	1.3
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	10.0	0.0	3.2	0.3	0.0	7.2	1.3	0.0	21.1	1.1	5.5	5.7
LnGrp Delay(d),s/veh	60.5	0.0	24.7	27.1	0.0	27.7	18.5	0.0	38.6	26.1	21.7	22.1
LnGrp LOS	E		C	C		C	B		D	C	C	C
Approach Vol, veh/h	407			300			727			566		
Approach Delay, s/veh	48.0			27.7			36.7			22.3		
Approach LOS	D			C			D			C		
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	8.1	59.3		51.4	8.4	59.0		51.4				
Change Period (Y+Rc), s	3.0	* 6.9		* 6.9	3.0	* 6.9		* 6.9				
Max Green Setting (Gmax), s	6.6	* 52		* 45	6.6	* 52		* 45				
Max Q Clear Time (g_c+I1), s	4.4	42.9		49.4	4.9	14.5		18.7				
Green Ext Time (p_c), s	0.0	3.0		0.0	0.0	3.4		2.0				
Intersection Summary												
HCM 2010 Ctrl Delay				33.6								
HCM 2010 LOS				C								
Notes												

HCM 2010 Signalized Intersection Summary
4: Ontario St. & Greenlane St.

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* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

HCM 2010 TWSC

5: Site Access

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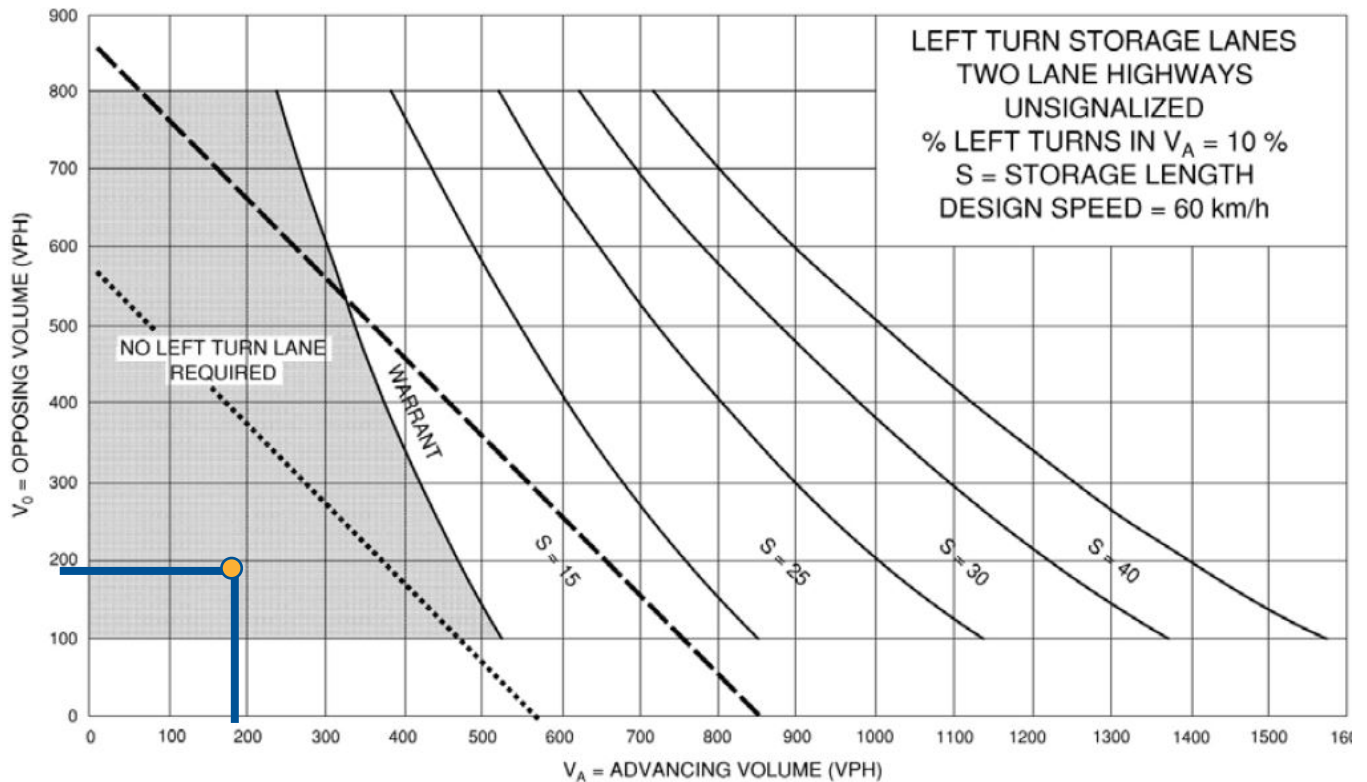
Intersection						
Int Delay, s/veh	2.8					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	19	172	171	19	55	49
Future Vol, veh/h	19	172	171	19	55	49
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	21	187	186	21	60	53
Major/Minor						
	Major1	Major2		Minor2		
Conflicting Flow All	207	0	-	0	426	197
Stage 1	-	-	-	-	197	-
Stage 2	-	-	-	-	229	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1364	-	-	-	585	844
Stage 1	-	-	-	-	836	-
Stage 2	-	-	-	-	809	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1364	-	-	-	575	844
Mov Cap-2 Maneuver	-	-	-	-	575	-
Stage 1	-	-	-	-	822	-
Stage 2	-	-	-	-	809	-
Approach	EB	WB		SB		
HCM Control Delay, s	0.8	0		11.4		
HCM LOS	B					
Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	
Capacity (veh/h)	1364	-	-	-	677	
HCM Lane V/C Ratio	0.015	-	-	-	0.167	
HCM Control Delay (s)	7.7	0	-	-	11.4	
HCM Lane LOS	A	A	-	-	B	
HCM 95th %tile Q(veh)	0	-	-	-	0.6	

Appendix J

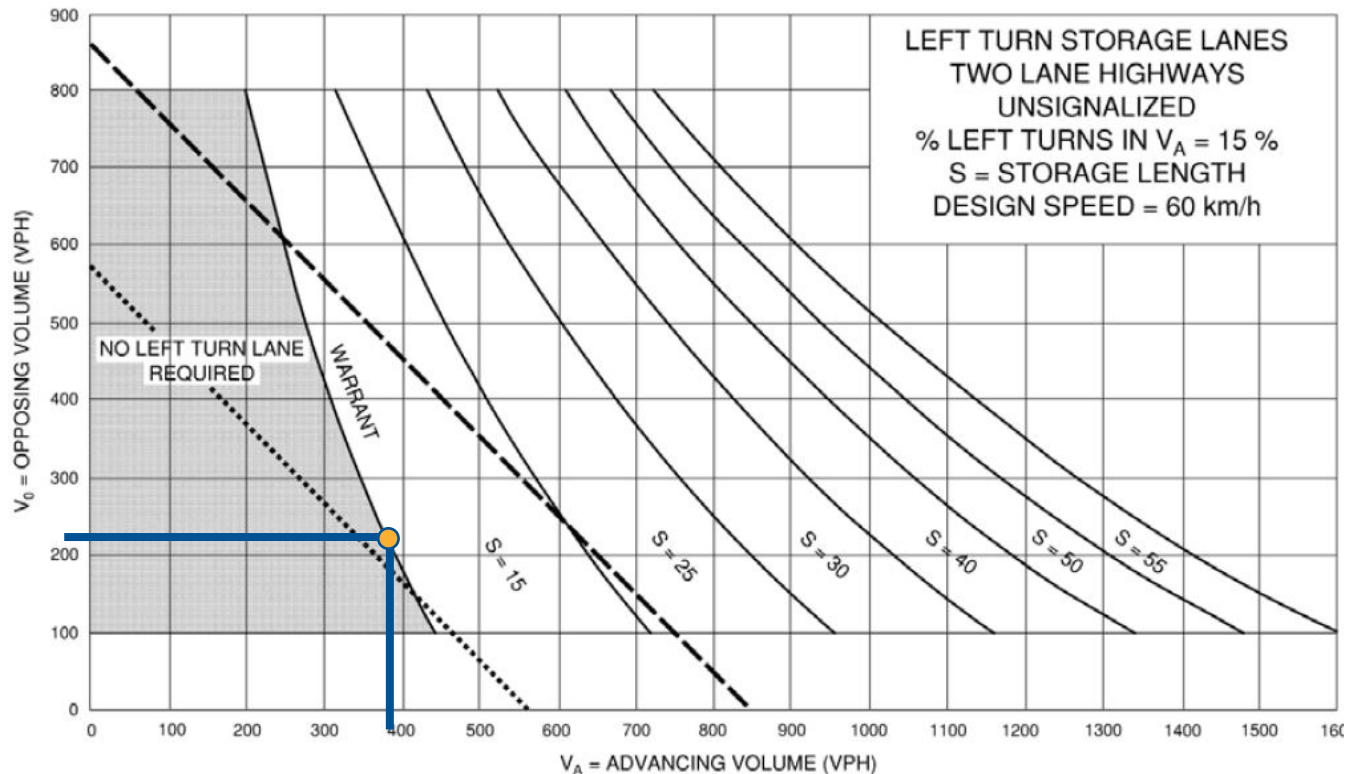
Left Turn Lane Warrants



AM Peak Hour

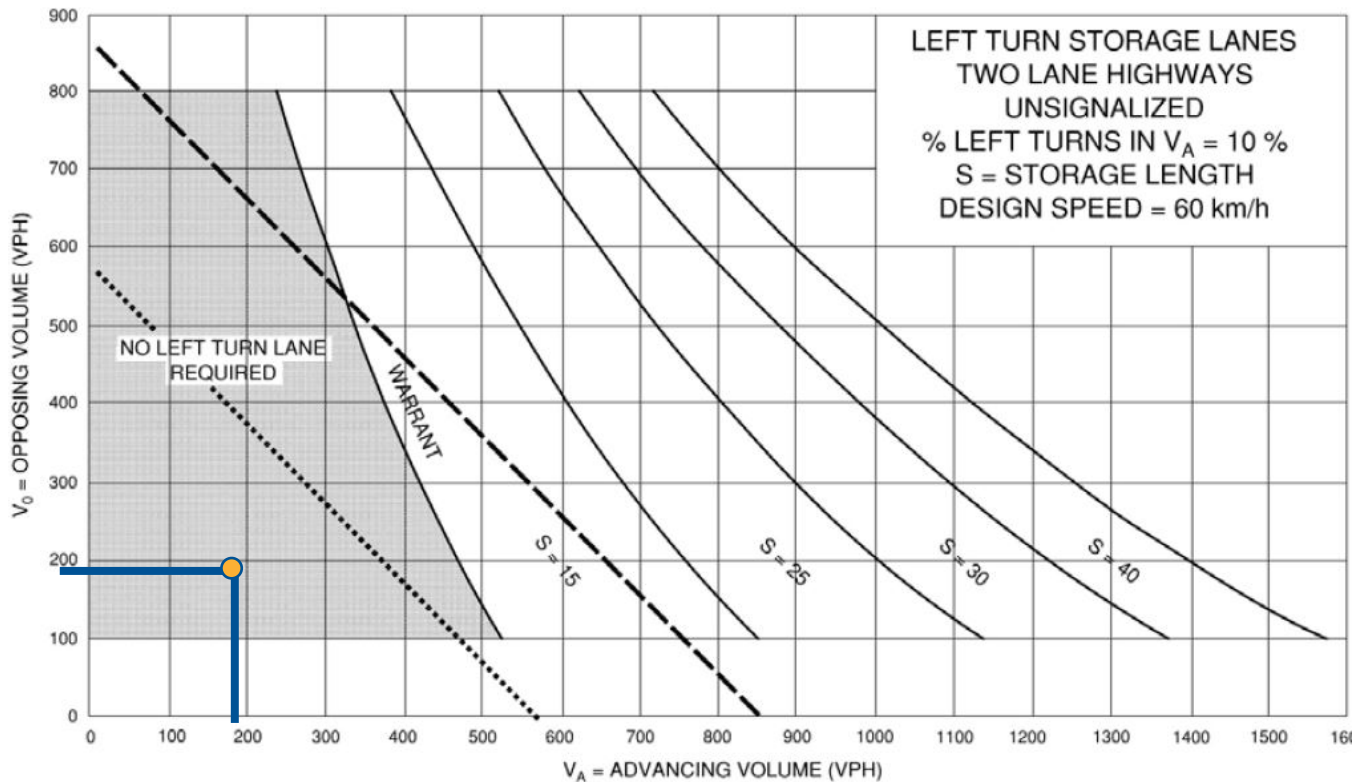


PM Peak Hour

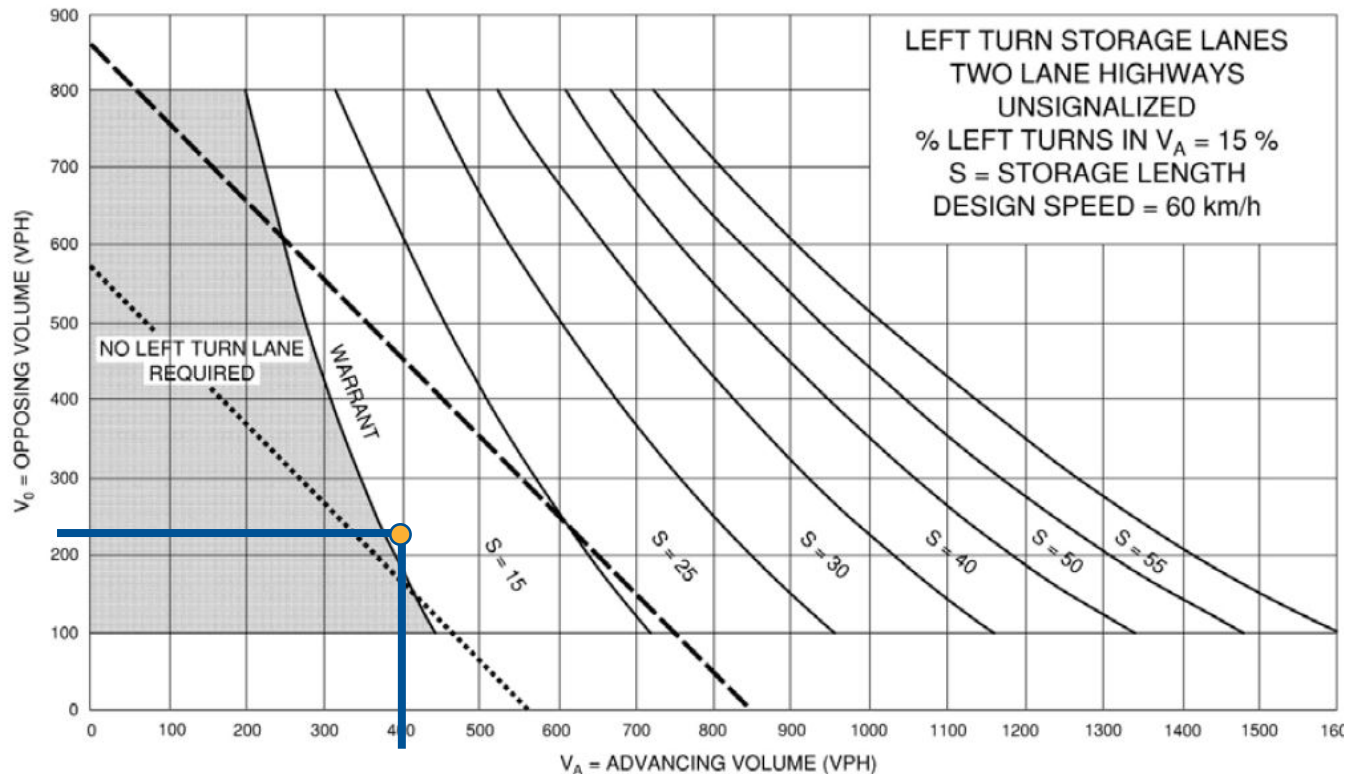


Left-Turn Warrants – Eastbound on Greenlane at Site Access 2026 Horizon

AM Peak Hour



PM Peak Hour



Left-Turn Warrants – Eastbound on Greenlane at Site Access 2031 Horizon

