



1 Dunbar Road North Waterloo, ON Transportation Impact Study

Paradigm Transportation Solutions Limited

2024-09
240414



Project Summary



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1 Dunbar Road North, Waterloo Transportation Impact Study



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Executive Summary

Content

Paradigm Transportation Solutions Limited has been retained to conduct this Transportation Impact Study (TIS) for a proposed residential development located at 1 Dunbar Road North in the City of Waterloo, Region of Waterloo.

This study includes an analysis of existing traffic conditions, a description of the proposed development, traffic forecasts for a five-year horizon from the date of TIS submission (2029), and assessment of traffic impacts with recommendations to accommodate the proposed development as appropriate.

Development Concept

The subject site is located on the north side of Erb Street West between Roslin Avenue North and Dunbar Road North. The proposed redevelopment consists of the removal of seven single-family houses and the construction of a new 10-storey building with 158 residential units.

Vehicular access is proposed via two all-moves driveway connections to Roslin Avenue and Dunbar Road.

Conclusions

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

- ▶ **Existing Traffic Conditions:** The study area intersections are operating with acceptable levels of service.
- ▶ **Development Trip Generation:** The development is forecast to generate 40 trips during the AM peak hour and 40 trips during the PM peak hour.
- ▶ **2029 Background and Total Traffic Conditions:** The study area intersections are forecast to operate within acceptable levels of service.
- ▶ **Remedial Measures:**
 - Left-Turn Lane: An eastbound left-turn lane with 15 metres of storage is warranted at Erb Street and Roslin Avenue under 2029 forecast total traffic volumes. The volumes meet the four-lane undivided warrant; however the left-turning volumes are less than 3% of the advancing volume.



- **Signal Warrant:** Traffic control signals at Erb Street and Roslin Avenue are not warranted under forecast total traffic conditions.
- ▶ **Sensitivity Analysis:** With a road diet on Erb Street, the study area intersections are forecast to operate with acceptable levels of service under 2029 background and total traffic conditions except for the following movements:
 - The northbound shared movement at Erb Street and Dunbar Road; and
 - The southbound shared movement at Erb Street and Roslin Avenue.

Additionally, eastbound left-turn lanes on Erb Street at Roslin Avenue and Dunbar Road are not warranted with a road diet on Erb Street under 2029 forecast total traffic volumes.

- ▶ **Transportation Demand Management:** The following measures are proposed on-site or are located nearby:
 - Internal sidewalks with connections to the existing municipal sidewalk network along Roslin Avenue, Dunbar Road and Erb Street which will be upgraded as part of build-out;
 - Access to bus transit route and LRT route that provide good connectivity to the broader network and access to major destinations; and
 - Parking unbundled from the sale/rent agreement of each unit.

In addition to the above measures, the following could be considered on-site to further encourage alternative modes of transportation:

- Car share vehicle/space in a priority location;
- The Region consider upgrades to the existing pedestrian crossing signal at Roslin Avenue including tactile strips at the curbs and repainting the crosswalk to meet municipal standards,
- Transit, car share, and active transportation information in a welcome package to new tenants and/or posting in a central location to further support all alternative modes; and
- Delegating a TDM coordinator, either an interested individual or property manager, to support all on-site TDM programs.



Recommendations

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

- ▶ the decision on whether to implement an eastbound left-turn lane on Erb Street at Roslin Avenue be deferred until the Region of Waterloo decides on whether to implement a road diet on Erb Street across the site frontage; and
- ▶ TDM measures noted above be considered to support alternative modes of transportation.



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1 Introduction

1.1 Overview

Paradigm Transportation Solutions Limited has been retained to conduct this Transportation Impact Study (TIS) for a proposed residential development located at 1 Dunbar Road North in the City of Waterloo, Region of Waterloo. **Figure 1.1** illustrates the subject development location.

1.2 Purpose and Scope

The purpose of this report is to identify and assess the potential traffic impact resulting from the proposed development. The scope of the study, developed in consultation with City of Waterloo and Region of Waterloo staff via e-mail in August 2024, includes:

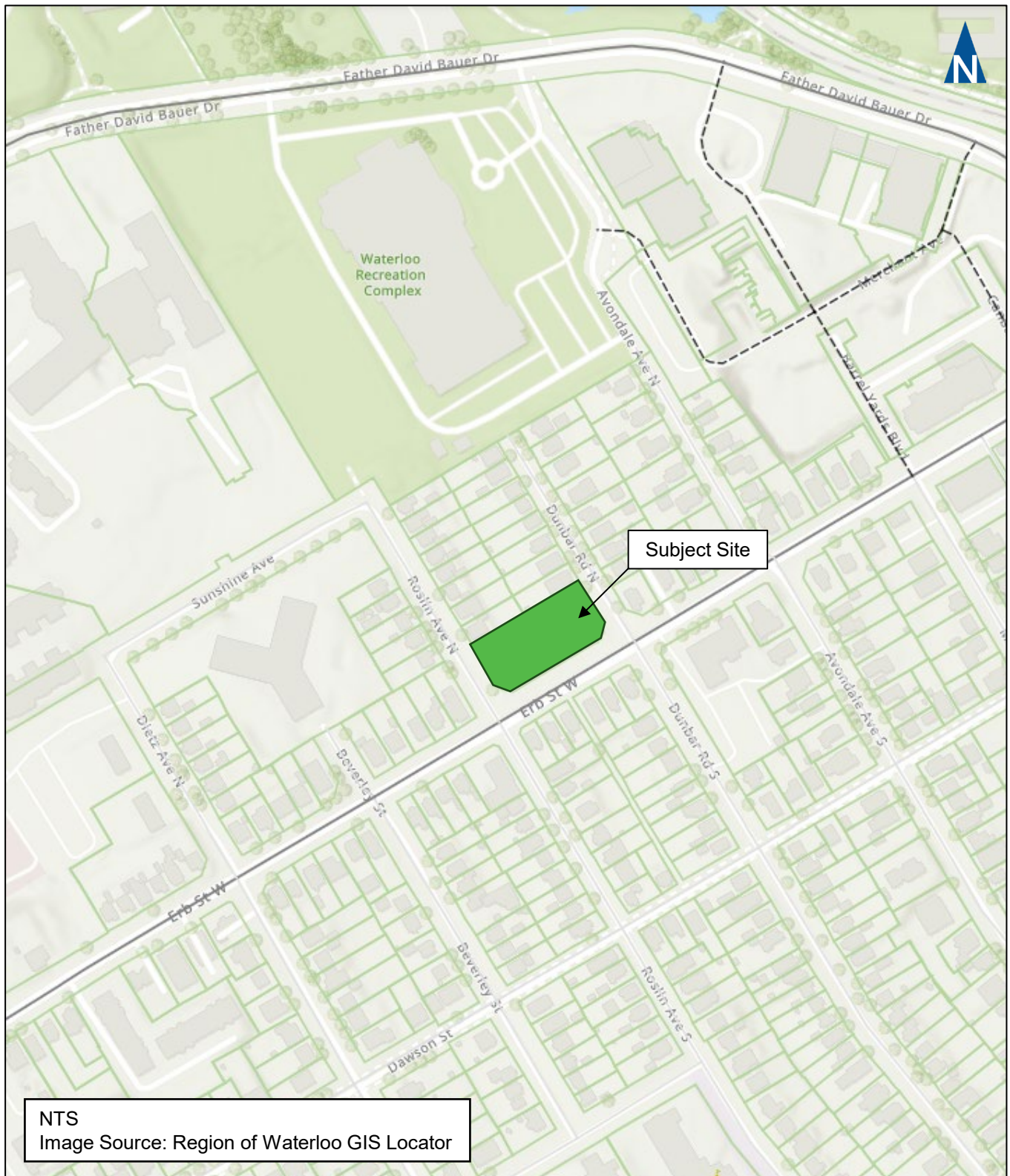
- ▶ Assessment of the current traffic and site conditions within the study area;
- ▶ Estimates of background traffic growth for a five-year horizon from TIS submission (2029);
- ▶ Estimates of additional traffic generated by the subject site;
- ▶ Analyses of the impact of future traffic on the surrounding road network, including the following study area intersections:
 - Erb Street West and Roslin Avenue North;
 - Erb Street West and Dunbar Road North; and
 - Proposed driveway connection to Roslin Avenue North.
- ▶ Recommendations necessary to mitigate the site generated traffic in a satisfactory manner;
- ▶ A sensitivity analysis on the study area intersections with Erb Street as a two-lane roadway; and
- ▶ Transportation Demand Management measures appropriate to the subject site.

Appendix A contains the pre-study consultation material and responses from the City and Region of Waterloo.

This study has been prepared in accordance with the requirements detailed by the Region of Waterloo Transportation Impact Study Guidelines¹.

¹ Region of Waterloo, Transportation Impact Study Guidelines, 2014.





Location of Subject Site

1 Dunbar Road North, Waterloo TIS
240414

Figure 1.1

2 Existing Conditions

2.1 Existing Roadways

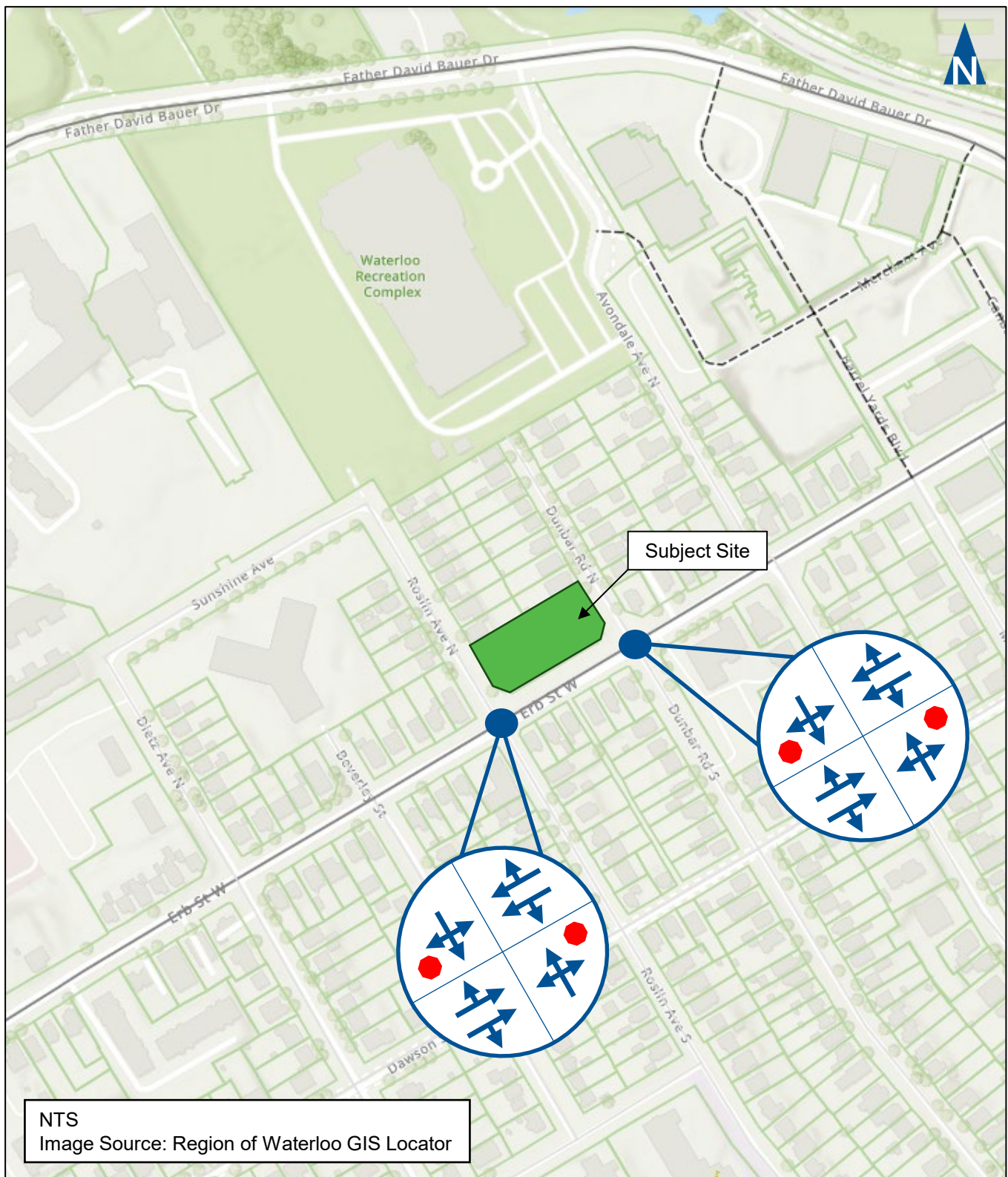
The main roadways near the subject site considered in assessing the traffic impacts of the development include:

- ▶ **Erb Street** is an east-west regional arterial road² with a four-lane cross section and a posted speed limit of 50 km/h.
- ▶ **Roslin Avenue** is a north-south local road with a two-lane cross section and a posted speed limit of 30 km/h.
- ▶ **Dunbar Road** is a north-south local road with a two-lane cross section and a posted speed limit of 30 km/h.

Figure 2.1 illustrates the existing lane configuration and traffic control at the study area intersections.

² City of Waterloo, *Official Plan Road Classification System Schedule 'E'*, February 2018.





2.2 Active Transportation

Sidewalks are provided on both sides of Erb Street and Roslin Avenue. On Dunbar Road, sidewalks are provided on both sides of the roadway north of Erb Street and on the west side to the south. An Intersection Pedestrian Signal is also provided on the west side of Erb Street and Roslin Avenue.

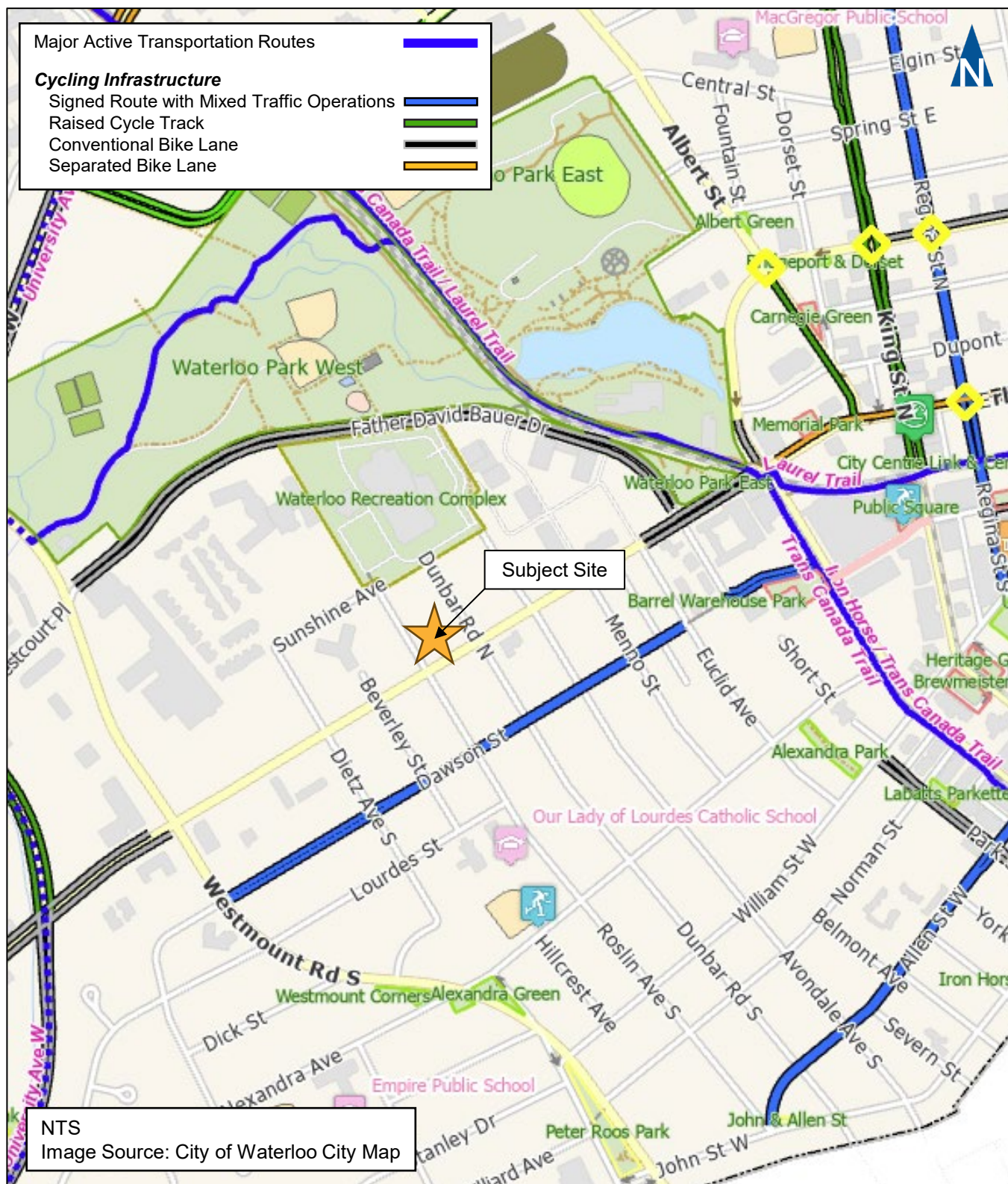
No dedicated cycling facilities are present within the immediate study area. The nearest cycling facility is located on Dawson Street.

The subject site has a Walk Score³ of 84 out of 100 (“Very Walkable”) which indicates most errands can be accomplished on foot and a Cycle Score of 98 out of 100 (“Biker’s Paradise”) which indicates daily errands can be accomplished on a bike.

Figure 2.2 illustrates the available cycling facilities near the subject site and major active transportation routes.

³ “Walk Score,” n.d., <https://www.walkscore.com/score/142-erb-st-w-waterloo-on-canada>





Existing Cycling Network and Major Active Transportation Routes

2.3 Transit Service

Grand River Transit operates **Route 5 Erb** within the study area. This route operates between The Boardwalk Station and Daniel/Bloomingdale with a stop at Waterloo Public Square Station. This route operates Monday to Friday (5:30 AM to 12:17 AM) with 30-minute headways, Saturday (6:05 AM to 11:57 PM) with 30 to 60-minute headways and Sunday (9:45 AM to 6:17 PM) with 45-minute headways. No holiday service is provided.

Figure 2.3 illustrates the existing transit service.





2.4 Traffic Volumes

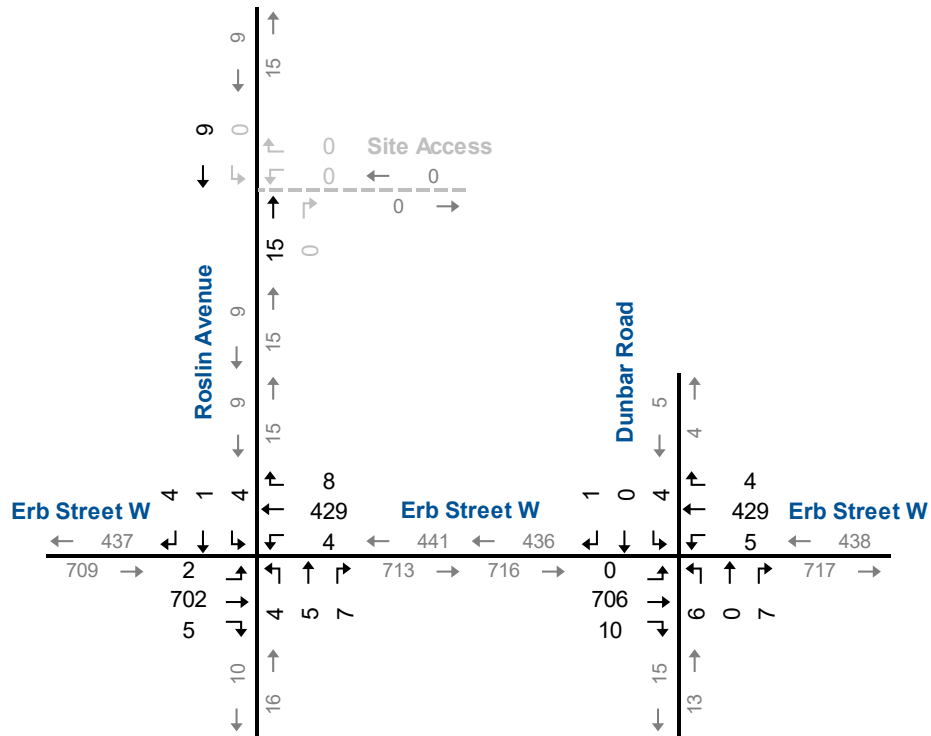
Turning movement counts were collected by Paradigm on 2024-07-30 at Erb Street and Roslin Avenue and Erb Street and Dunbar Road.

Figure 2.4 illustrates the existing AM (8:15 – 9:15 AM) and PM (4:15 – 5:15 PM) weekday peak hour traffic volumes.

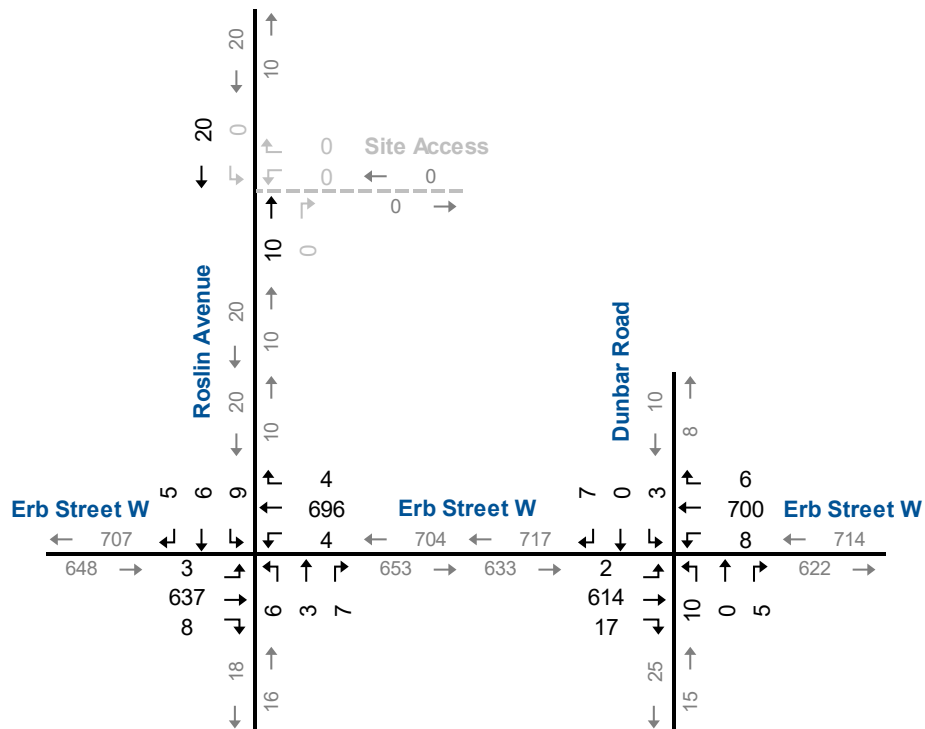
Appendix B contains the detailed traffic counts for the study area intersections.



AM Peak Hour



PM Peak Hour



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 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.

The highest possible rating is LOS A, under which the average total delay is equal to 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 they are feasible. LOS E is usually used as a guideline for the determination of road improvement needs on through lanes, while LOS F may be acceptable for left-turn movements at peak times, depending on delays.

The operations at the study area intersections have been assessed using Synchro 11. The criteria, as defined by the Region, for identifying “critical” intersections are:

- ▶ overall Level of Service E or F (i.e., average control delay per vehicle greater than 55 seconds) for signalized intersections; and
- ▶ overall Level of Service E or F (i.e., average control delay per vehicle greater than 35 seconds) for unsignalized intersections.
- ▶ As well, the criteria for identifying individual “critical” movements are:
 - the average control delay for individual movements is greater than 55 seconds;
 - estimated 95th percentile queue length for an exclusive movement exceeds the available storage space;
 - estimated 95th percentile queue length for an individual movement will block an existing access;
 - exclusive turning lanes are inaccessible because of queue lengths in adjacent through lanes; and
 - poor quality of service for non-auto modes.

Table 2.2 summarizes the results of the intersection operational analysis under existing conditions, including the AM and PM peak hour LOS, v/c ratios, and 95th percentile queues.



The results indicate that the study area intersections are operating with acceptable levels of service, and with no problem movements.

It is noted that the Synchro analysis does not capture the pedestrian crossing signal located on the west side of Erb Street and Roslin Avenue. This intersection has been analyzed as an unsignalized intersection. When a pedestrian presses on the push-button to cross, the eastbound and westbound vehicles are given a red signal which would allow southbound through/left-turning vehicles and northbound through/right-turning vehicles to complete their movement. These opportunities decrease the delay for the northbound and southbound vehicles. Therefore, the northbound and southbound operations at Erb Street and Roslin Avenue, as summarized in **Table 2.2**, can be considered on the upper end given that the Synchro analysis does not account for the pedestrian crossing signal.

Appendix C contains the detailed Synchro 11 reports.



TABLE 2.2: EXISTING TRAFFIC OPERATIONS

Analysis Period	Intersection	Control Type	MOE	Direction/Movement/Approach																Overall
				Eastbound				Westbound				Northbound				Southbound				
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	
AM Peak Hour	Roslin Avenue & Erb Street	TWSC	LOS Delay V/C Q	A 8 0.00 0	A 0 0.00 0	A 0 0.00 0	A 0	A 9 0.00 0	A 0 0.00 0	A 0 0.00 0	A 0	< 18 0.06 2	> 18	< 16 0.03 1	> 16	< 17 0.02 1	> 17	< 16		
	Dunbar Road & Erb Street	TWSC	LOS Delay V/C Q	A 0 0.00 0	A 0 0.00 0	A 0 0.00 0	A 0	A 9 0.01 0	A 0 0.00 0	A 0 0.00 0	A 0	< 16 0.04 1	> 16	< 17 0.02 1	> 17	< 17 0.02 1	> 17	< 17		
PM Peak Hour	Roslin Avenue & Erb Street	TWSC	LOS Delay V/C Q	A 9 0.00 0	A 0 0.00 0	A 0 0.00 0	A 0	A 9 0.00 0	A 0 0.00 0	A 0 0.00 0	A 0	< 21 0.07 2	> 21	< 25 0.10 2	> 25	< 25 0.10 2	> 25	< 25		
	Dunbar Road & Erb Street	TWSC	LOS Delay V/C Q	A 9 0.00 0	A 0 0.00 0	A 0 0.00 0	A 0	A 9 0.01 0	A 0 0.00 0	A 0 0.00 0	A 0	< 20 0.06 2	> 20	< 15 0.03 1	> 15	< 15 0.03 1	> 15	< 15		

MOE - Measure of Effectiveness

LOS - Level of Service

Delay - Average Delay per Vehicle in Seconds

V/C - Volume to Capacity Ratio

Q - 95th Percentile Queue Length (m)

TWSC - Two-Way Stop Control

</> - Shared with through movement



3 Development Concept

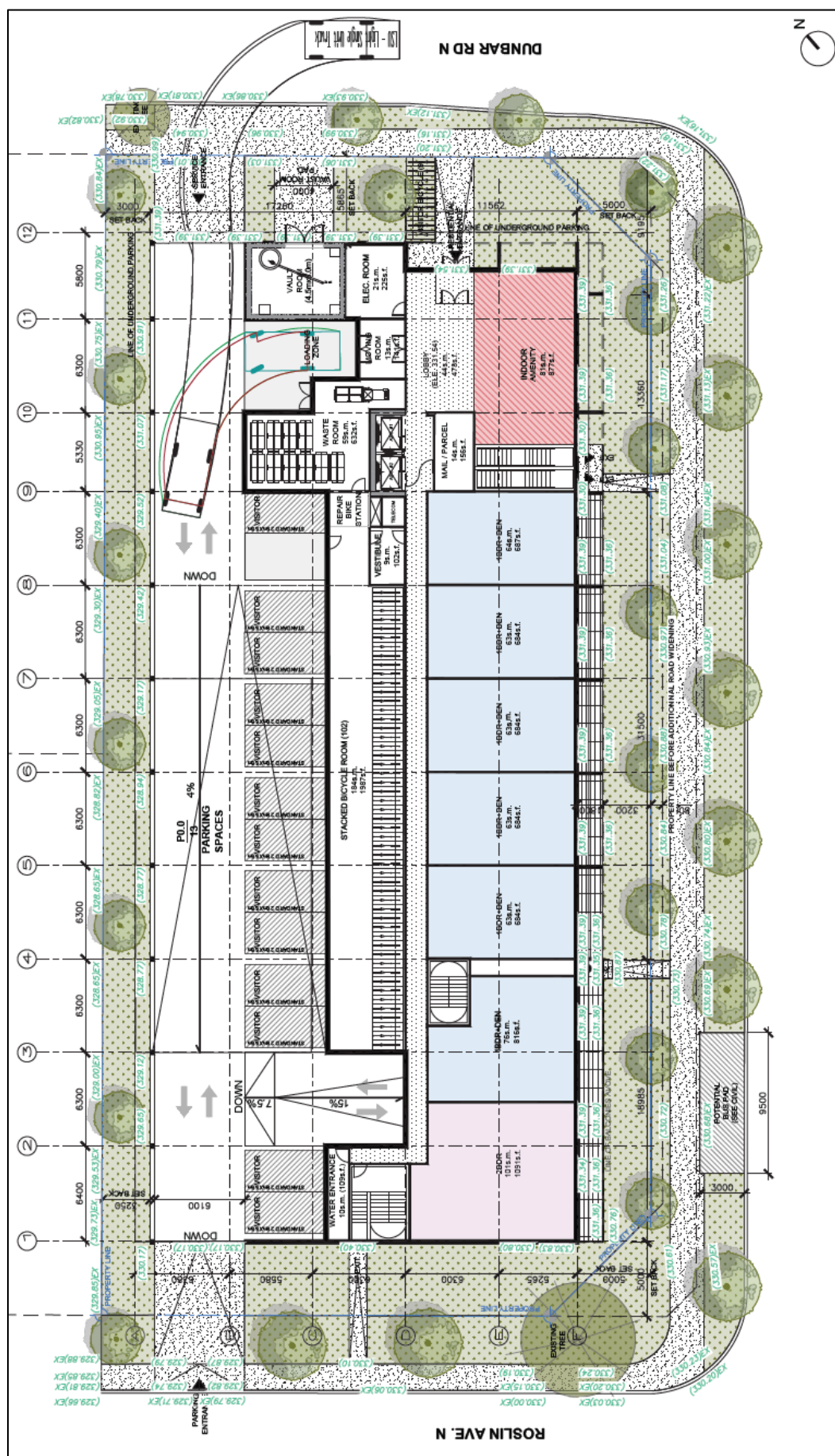
3.1 Development Description

The subject site is located on the north side of Erb Street West between Roslin Avenue North and Dunbar Road North. The proposed redevelopment consists of the removal of seven single-family houses and the construction of a new 10-storey building with 158 residential units.

Vehicular access is proposed via two all-moves driveway connections to Roslin Avenue and Dunbar Road. The driveway connection on Dunbar Road is primarily a service entrance while residents are expected to use the access on Roslin Avenue.

Figure 3.1 shows the proposed site plan.





3.2 Development Trip Generation

The Institute of Transportation Engineers (ITE) Trip Generation Manual⁴ provides rates and equations used to estimate the peak hour traffic volumes generated by the Land Use Code (LUC) 221 (Multifamily Housing (Mid-Rise)).

Given the location of the development near higher order transit, active transportation facilities and a variety of land uses, the location/setting of dense multi-use urban – close to rail transit has been used for LUC 221.

Table 3.1 summarizes the forecast number of net new trips generated by the proposed development.

TABLE 3.1: TRIP GENERATION

Land Use	Number of Units	AM Peak Hour				PM Peak Hour			
		Rate	In	Out	Total	Rate	In	Out	Total
LUC 221 - Multifamily Housing (Mid-Rise)*	158	0.25	6	34	40	Eqn ¹	30	10	40
Total Trip Generation			6	34	40		30	10	40

¹ LUC 221 - PM: $T = 0.24(X) + 2.00$

* Close to Rail Transit - Dense Multi-Use Urban

3.3 Development Trip Distribution and Assignment

The trip distribution was determined based on existing travel patterns within the study area and 2016 TTS Data. It is estimated that 60% of trips generated by the proposed development will travel to/from the east on Erb Street and 40% west.

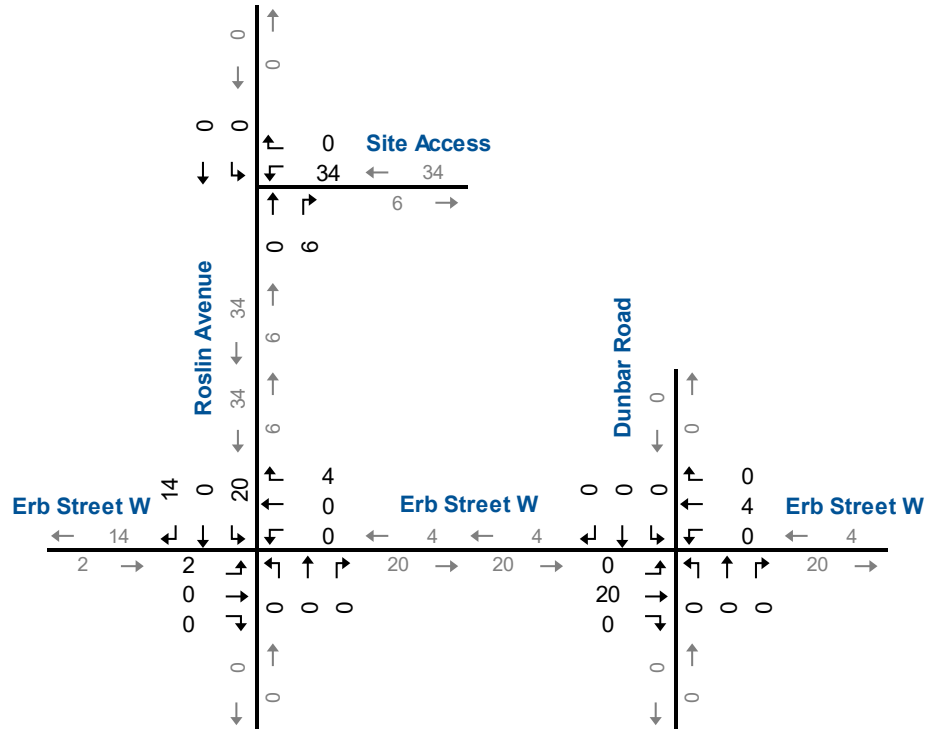
Trips have been assigned to the site access on Roslin Avenue. No trips were assigned to the second access on Dunbar Road as it primarily serves as a service entrance.

Figure 3.2 illustrates the site-generated traffic volumes for the AM and PM peak hours.

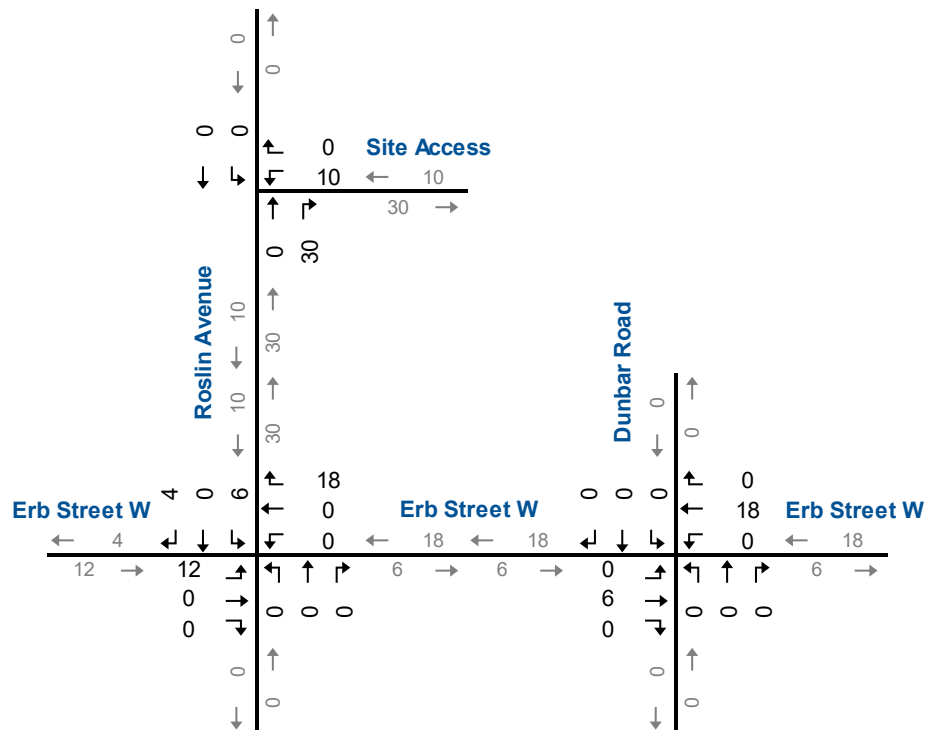
⁴ Institute of Transportation Engineers, *Trip Generation Manual*, 11th ed., (Washington, DC: ITE, 2021).



AM Peak Hour



PM Peak Hour



4 Evaluation of Future Traffic Conditions

The assessment of future traffic conditions in this section includes estimates of future background and total traffic volumes, and the analyses for the 2029 horizon.

4.1 Background Traffic Forecasts

To derive the 2029 generalized background traffic volumes, a growth rate of 1% was applied to the existing roadway traffic volumes on City roads and 0.50% on Regional roads. This growth rate was confirmed during the pre-study consultation.

4.1.1 Other Area Developments

As per the pre-study consultation, the following developments have been included in the background traffic volumes:

- ▶ **6-14 Dietz Avenue North:** A residential building located on the east side of Dietz Avenue North, north of Erb Street. The development is proposed to include 135 residential units. The trip generation letter and comment response⁵ completed in February 2024 indicates that the development is forecast to generate 37 AM peak hour trips and 43 PM peak hour trips.
- ▶ **70 King Street North:** A mixed-use 25-storey building located in the southeast corner of King Street North and Bridgeport Road. The development is proposed to include 243 units and 1,815 m² learning centre. The TIS Addendum⁶ completed in December 2021 indicates that the development is forecast to generate 109 AM peak hour trips and 135 PM peak hour trips. Applying the 15% mode share reduction that was applied in the original study results in a trip generation of 93 AM peak hour trips and 114 PM peak hour trips.
- ▶ **Westmount Place Phase 1 & 2:** A residential development located in the northwest corner of Erb Street and Dietz Avenue. Phase 1 of the development includes 139 units within a 12-storey building and Phase 2 includes 239 units within a 24-storey building. As outlined in the 6-14 Dietz Avenue North trip generation letter and comment response, Phases 1 and 2 are

⁵ Paradigm Transportation Solutions Limited, *6-14 Dietz Avenue North Waterloo ON Residential Development Trip Generation Letter and Parking Study Comment Response*, February 2024.

⁶ C.F. Crozier & Associates Inc., *Traffic Impact Brief 70 King Street North City of Waterloo*, December 2021.

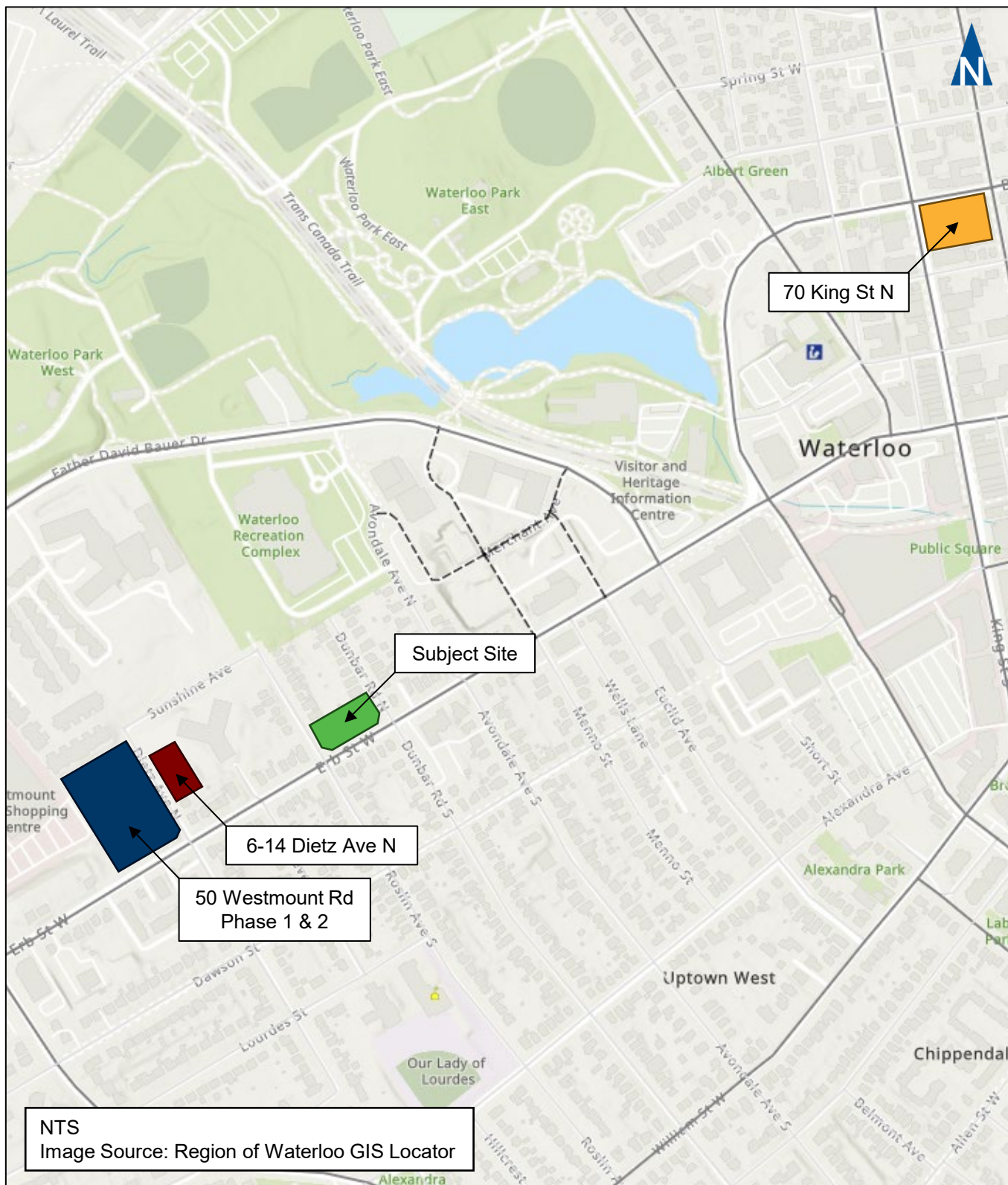


forecast to generate 89 AM peak hour trips and 106 PM peak hour trips.

Figure 4.1 illustrates the location of the other area developments.

Appendix D contains the other area development traffic volumes.





4.2 2029 Background Traffic Operations

Figure 4.2 illustrates the 2029 background traffic volumes, including road traffic growth and other area development traffic.

The 2029 background traffic volumes have been analyzed using the same methodology as under existing traffic conditions.

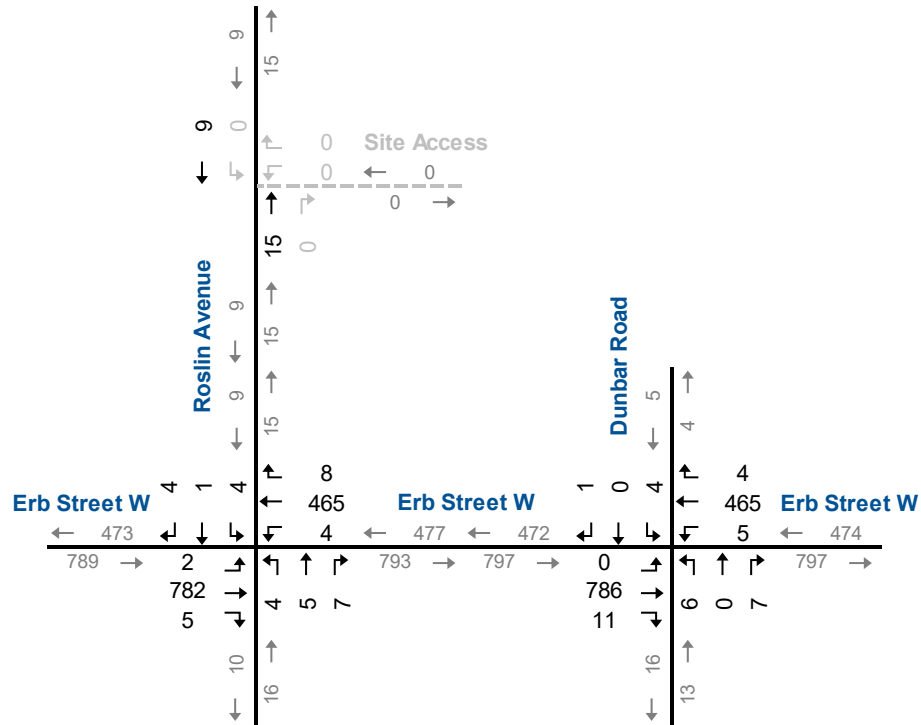
Table 4.1 summarizes the results of the 2029 background traffic operations. The results indicate that the study area intersections are forecast to operate with acceptable levels of service during the AM and PM peak hours.

As mentioned in **Section 2.5**, the northbound and southbound operations at Erb Street and Roslin Avenue can be considered on the upper end given that the Synchro analysis does not account for the pedestrian crossing signal on the west side of the intersection.

Appendix E contains the supporting detailed Synchro 11 reports.



AM Peak Hour



PM Peak Hour

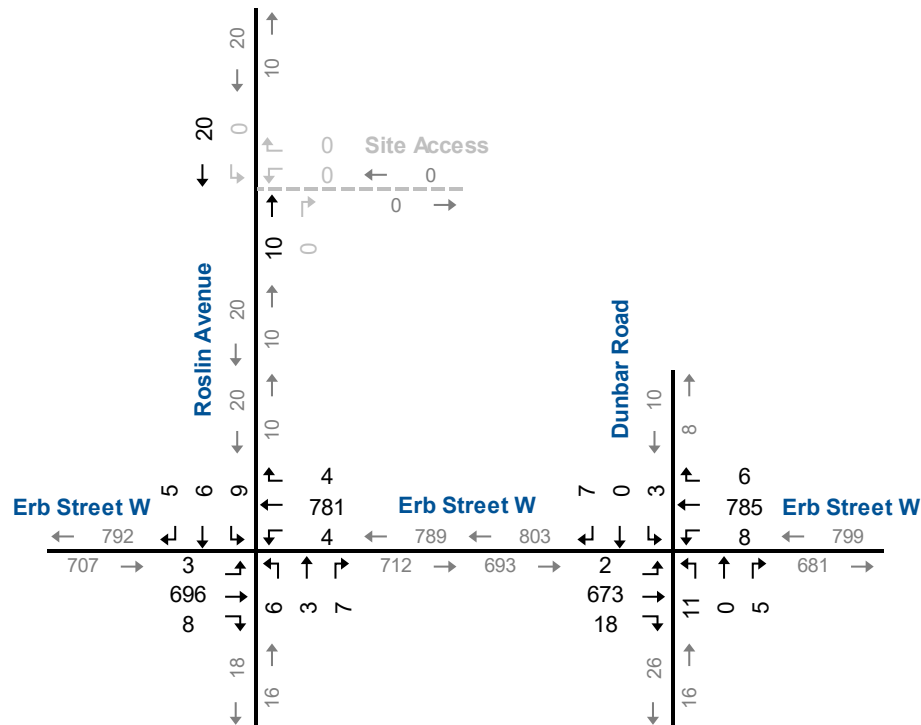


TABLE 4.1: 2029 BACKGROUND TRAFFIC OPERATIONS

Analysis Period	Intersection	Control Type	MOE	Direction/Movement/Approach																Overall
				Eastbound				Westbound				Northbound				Southbound				
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	
AM Peak Hour	Roslin Avenue & Erb Street	TWSC	LOS Delay V/C Q	A 8 0.00 0	A 0 0.00 0	A 0 0.00 0	A 0	A 9 0.01 0	A 0 0.00 0	A 0 0.00 0	A 0	< 21 0.07 2	> 21	C 21	< 17 0.03 1	> 17	C 17			
	Dunbar Road & Erb Street	TWSC	LOS Delay V/C Q	A 0 0.00 0	A 0 0.00 0	A 0 0.00 0	A 0	A 9 0.01 0	A 0 0.00 0	A 0 0.00 0	A 0	< 18 0.05 1	> 18	C 18	< 19 0.02 1	> 19	C 19			
PM Peak Hour	Roslin Avenue & Erb Street	TWSC	LOS Delay V/C Q	A 9 0.00 0	A 0 0.00 0	A 0 0.00 0	A 0	A 9 0.01 0	A 0 0.00 0	A 0 0.00 0	A 0	< 24 0.08 2	> 24	C 24	< 30 0.12 3	> 30	D 30			
	Dunbar Road & Erb Street	TWSC	LOS Delay V/C Q	A 9 0.00 0	A 0 0.00 0	A 0 0.00 0	A 0	A 9 0.01 0	A 0 0.00 0	A 0 0.00 0	A 0	< 24 0.08 2	> 24	C 24	< 17 0.03 1	> 17	C 17			

MOE - Measure of Effectiveness

Q - 95th Percentile Queue Length (m)

LOS - Level of Service

TWSC - Two-Way Stop Control

Delay - Average Delay per Vehicle in Seconds

</> - Shared with through movement

V/C - Volume to Capacity Ratio



4.3 2029 Total Traffic Operations

Figure 4.3 illustrates the 2029 total traffic volumes, including trips generated by the proposed development.

The 2029 total traffic volumes have been analyzed using the same methodology as under existing and background traffic conditions.

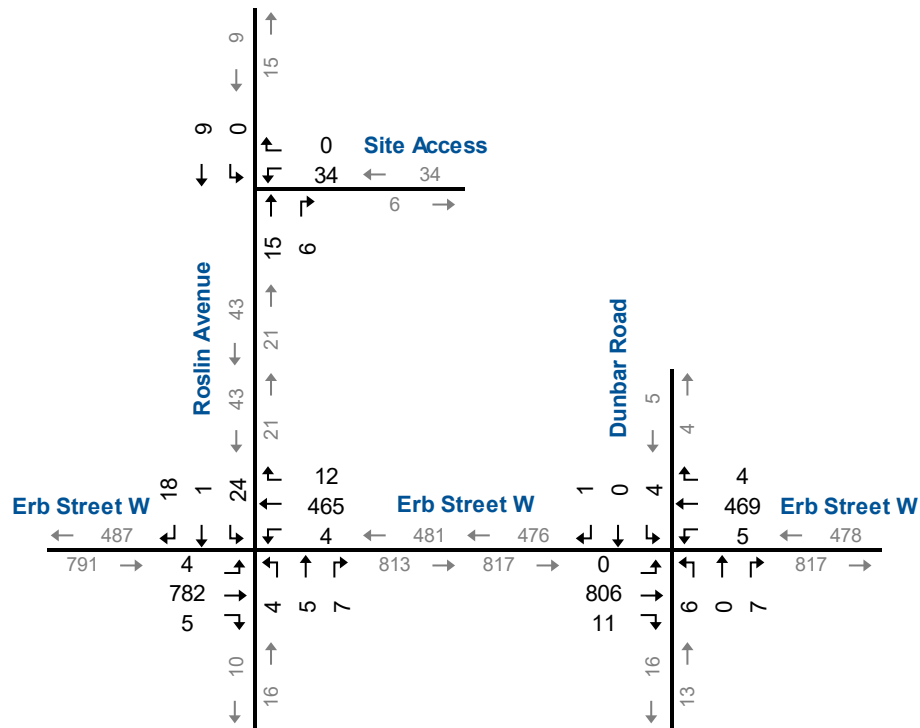
Table 4.2 summarizes the results of the 2029 total traffic operations. The results indicate that the study area intersections are forecast to operate with acceptable levels of service during the AM and PM peak hours. The site access intersection on Roslin Avenue is forecast to operate with LOS A during both peak hours.

As mentioned in **Section 2.5**, the northbound and southbound operations at Erb Street and Roslin Avenue can be considered on the upper end given that the Synchro analysis does not account for the pedestrian crossing signal on the west side of the intersection.

Appendix F contains the supporting detailed Synchro 11 reports.



AM Peak Hour



PM Peak Hour

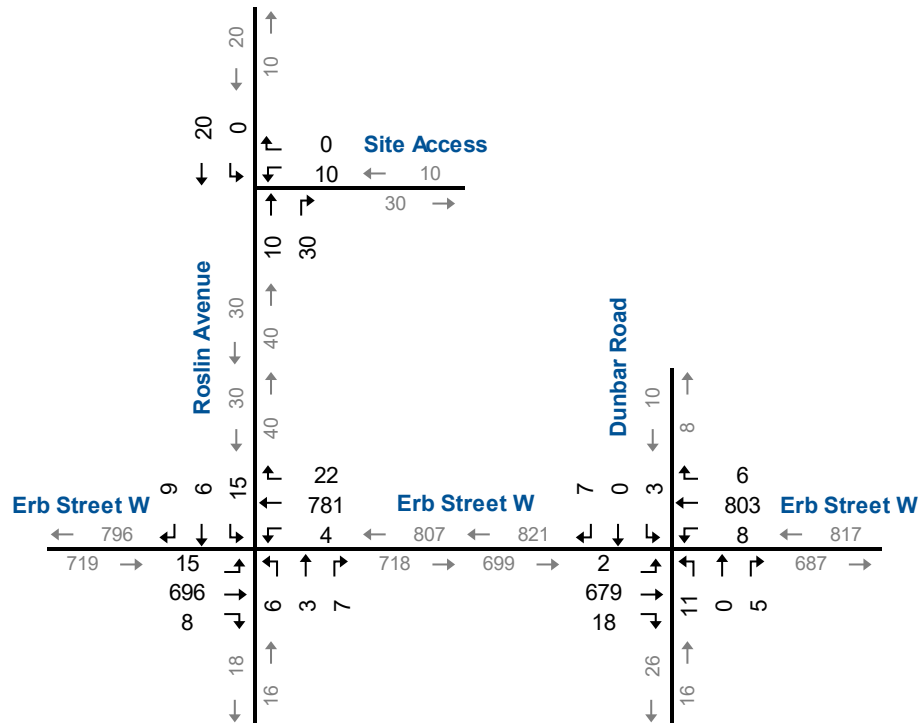


TABLE 4.2: 2029 TOTAL TRAFFIC OPERATIONS

Analysis Period	Intersection	Control Type	MOE	Direction/Movement/Approach																	Overall
				Eastbound				Westbound				Northbound				Southbound					
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach		
AM Peak Hour	Roslin Avenue & Erb Street	TWSC	LOS Delay V/C Q	A 8 0.00 0	A 0 0.00 0	A 0 0.00 0	A 0	A 9 0.01 0	A 0 0.00 0	A 0 0.00 0	A 0	< < < <	C 21 0.07 2	> > > >	C 21	< < < <	C 19 0.14 4	> > > >	C 19		
	Dunbar Road & Erb Street	TWSC	LOS Delay V/C Q	A 0 0.00 0	A 0 0.00 0	A 0 0.00 0	A 0	A 10 0.01 0	A 0 0.00 0	A 0 0.00 0	A 0	< < < <	C 19 0.05 1	> > > >	C 19	< < < <	C 19 0.02 1	> > > >	C 19		
	Roslin Avenue & Site Access	TWSC	LOS Delay V/C Q					A 9 0.03 1		> > > >	A 9		A 0 0.00 0	A 0 0.00 0	A 0	A 0 0.00 0	A 0 0.00 0		A 0		
PM Peak Hour	Roslin Avenue & Erb Street	TWSC	LOS Delay V/C Q	A 10 0.02 1	A 0 0.00 0	A 0 0.00 0	A 0	A 9 0.01 0	A 0 0.00 0	A 0 0.00 0	A 0	< < < <	D 25 0.08 2	> > > >	D 25	< < < <	D 32 0.18 4	> > > >	D 32		
	Dunbar Road & Erb Street	TWSC	LOS Delay V/C Q	A 9 0.00 0	A 0 0.00 0	A 0 0.00 0	A 0	A 9 0.01 0	A 0 0.00 0	A 0 0.00 0	A 0	< < < <	C 24 0.08 2	> > > >	C 24	< < < <	C 17 0.03 1	> > > >	C 17		
	Roslin Avenue & Site Access	TWSC	LOS Delay V/C Q					A 9 0.01 0		> > > >	A 9		A 0 0.00 0	A 0 0.00 0	A 0	A 0 0.00 0	A 0 0.00 0		A 0		

MOE - Measure of Effectiveness

LOS - Level of Service

Delay - Average Delay per Vehicle in Seconds

V/C - Volume to Capacity Ratio

Q - 95th Percentile Queue Length (m)

TWSC - Two-Way Stop Control

</> - Shared with through movement



5 Remedial Measures

5.1 Left-Turn Lanes

The Ministry of Transportation Design Supplement for the Transportation Association of Canada (TAC) Geometric Design Guide for Canadian Roads⁷ provides guidance on the assessment and/or need for auxiliary left-turn lanes.

Warrants have been calculated for eastbound left-turns on Erb Street at Roslin Avenue and Dunbar Road. The warrant was calculated using the nomographs for left-turn lanes on a four-lane undivided highway at an unsignalized intersection. Based on this criterion:

- ▶ At the intersection of Erb Street and Roslin Avenue, the volumes at the PM peak hour at the 2029 total horizon are just above the threshold to warrant an eastbound left-turn lane with 15 metres of storage. Given that the warrant is met by only a small number of trips, and that this stretch of Erb Street West does not have left-turn lanes at any of the other intersections, it is recommended that the Region of Waterloo consider whether an eastbound left-turn be implemented at this intersection.

Additionally, the Region should also take into account that the percentage of advancing left-turning vehicles is forecast to be minimal in the PM peak hour at 2.1%. While the warrant nomographs for a four-lane undivided highway are based on the left-turning volumes, the nomographs for a two-lane undivided highway are based on the percentage of advancing left-turning vehicles. Since the Region considers a minimum threshold of 5% of left-turning vehicles to assess the requirement of a left-turn lane, albeit for a two-lane cross-section, it is still worth considering whether constructing an eastbound left-turn lane is necessary given that the percentage of advancing left-turning vehicles is so low.

- ▶ An eastbound left-turn lane is not warranted on Erb Street at Dunbar Road.

Figure 5.1a and **Figure 5.1b** contain the warrant nomographs.

5.2 Traffic Control

The intersection of Erb Street and Roslin Avenue currently operates as an unsignalized intersection with a pedestrian crossing signal. To

⁷ MTO Design Supplement for TAC Geometric Design Guide for Canadian Roads, June 2017.

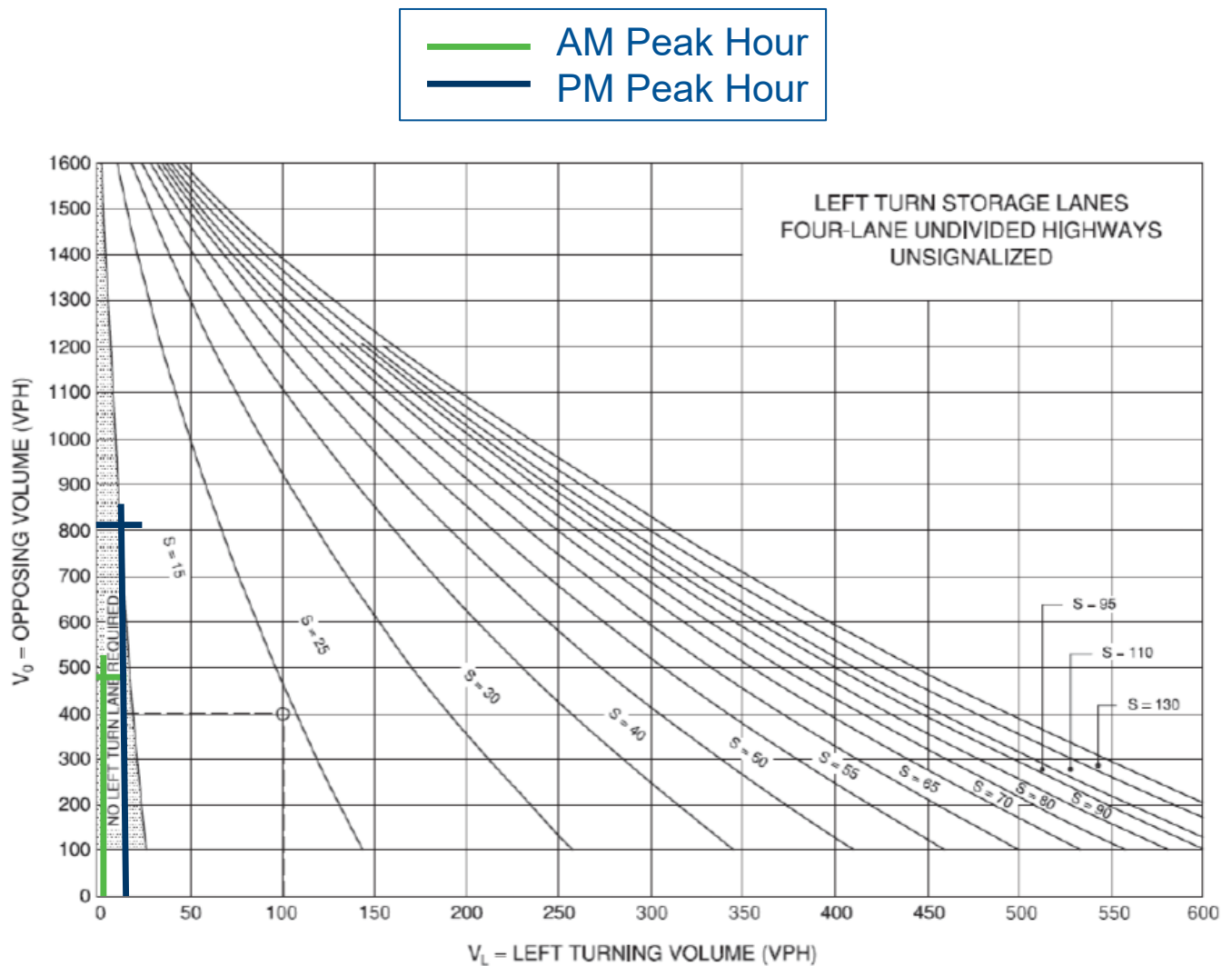


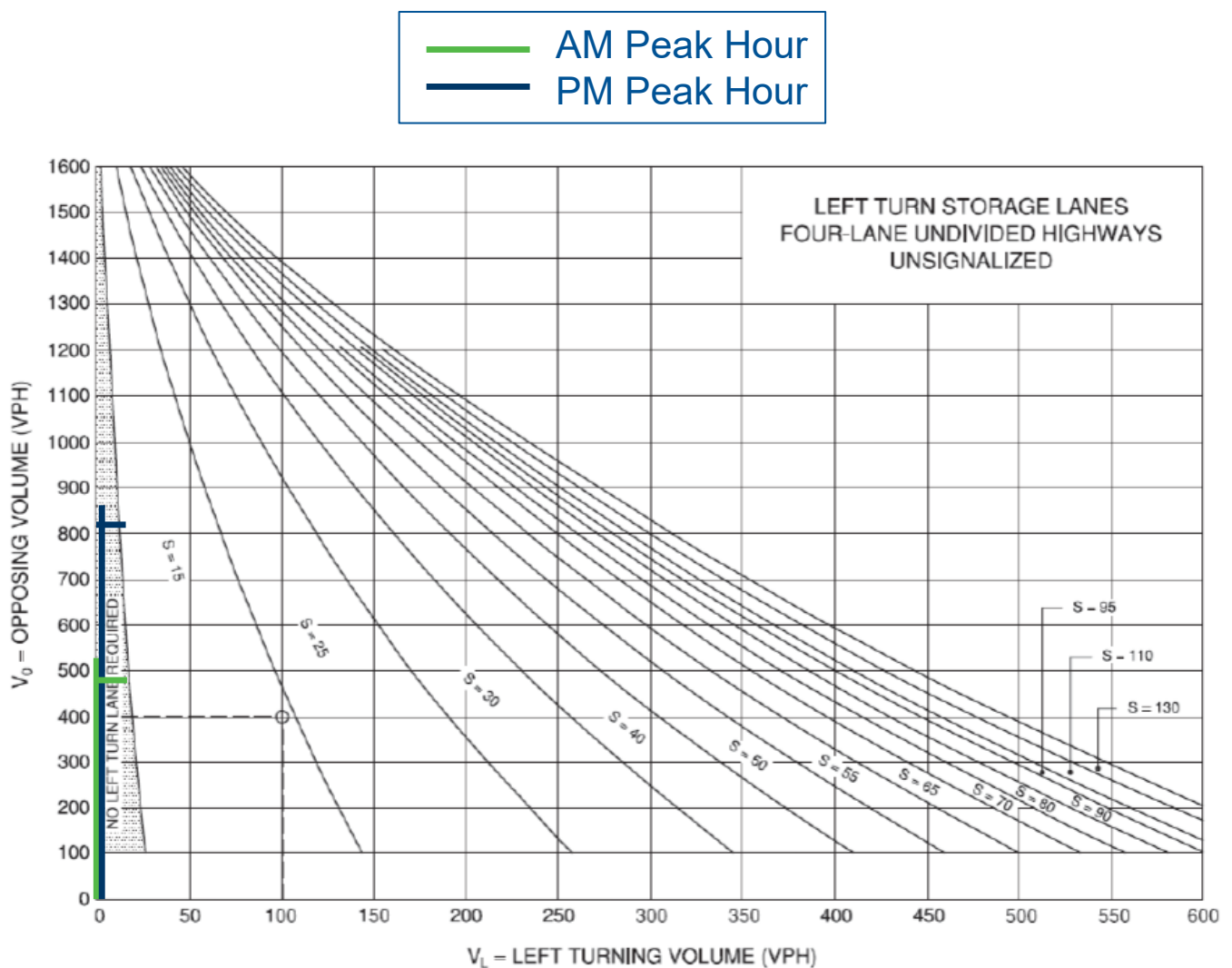
determine whether Erb Street and Roslin Avenue warrants a full signal, this intersection was assessed for signal warrant requirements using Ontario Traffic Manual (OTM) Book 12 Justification 7⁸. The analysis was completed under 2029 total traffic conditions. It was found that a signal is not justified at Erb Street and Roslin Avenue with Warrants 1 and 2 achieving below the 120% requirement.

Appendix G contains the warrant worksheet.

⁸ Ontario Ministry of Transportation, *Ontario Traffic Manual Book 12: Traffic Signals*, (Toronto: Queen's Printer for Ontario, 2012).







6 Sensitivity Analysis

During pre-study consultation, the Region requested that an analysis be completed with a road diet on Erb Street. The following section evaluates the traffic operations of the study area intersections with Erb Street as a two-lane roadway as opposed to a four-lane and identifies whether left-turn lanes would be needed at Roslin Avenue and Dunbar Road to facilitate access to the development.

6.1 Background Traffic

The background traffic volumes, with a road diet on Erb Street, have been analyzed using the same methodology as in **Section 4**.

Table 6.1 summarizes the results of the intersection operations. The results indicate that the study area intersections are forecast to operate with acceptable levels of service, except for the following movements during the PM peak hour:

- ▶ The northbound shared movement at Erb Street and Dunbar Road is forecast to operate with LOS E; and
- ▶ The southbound shared movement at Erb Street and Roslin Avenue is forecast to operate with LOS E.

As mentioned in **Section 2.5**, the northbound and southbound operations at Erb Street and Roslin Avenue can be considered on the upper end given that the Synchro analysis does not account for the pedestrian crossing signal on the west side of the intersection.

Appendix H contains the detailed Synchro 11 results.



TABLE 6.1: 2029 BACKGROUND TRAFFIC OPERATIONS – WITH ROAD DIET

Analysis Period	Intersection	Control Type	MOE	Direction/Movement/Approach																	Overall
				Eastbound				Westbound				Northbound				Southbound					
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach		
AM Peak Hour	Roslin Avenue & Erb Street	TWSC	LOS Delay V/C Q	A 8 0.00 0	A 0 0.00 0	A 0 0.00 0	A 0 0.00 0	A 9 0.01 0	A 0 0.00 0	A 0 0.00 0	A 0 0.00 0	< < < <	C 24 0.08 2	> > > >	C 24 0.04 1	< < < <	C 23 0.04 1	> > > >	C 23 0.04 1		
	Dunbar Road & Erb Street	TWSC	LOS Delay V/C Q	A 0 0.00 0	A 0 0.00 0	A 0 0.00 0	A 0 0.00 0	A 9 0.01 0	A 0 0.00 0	A 0 0.00 0	A 0 0.00 0	< < < <	C 23 0.06 2	> > > >	C 23 0.03 1	< < < <	D 28 0.03 1	> > > >	D 28 0.03 1		
PM Peak Hour	Roslin Avenue & Erb Street	TWSC	LOS Delay V/C Q	A 9 0.00 0	A 0 0.00 0	A 0 0.00 0	A 0 0.00 0	A 9 0.01 0	A 0 0.00 0	A 0 0.00 0	A 0 0.00 0	< < < <	D 32 0.11 3	> > > >	D 32 0.16 4	< < < <	E 39 0.16 4	> > > >	E 39 0.16 4		
	Dunbar Road & Erb Street	TWSC	LOS Delay V/C Q	A 9 0.00 0	A 0 0.00 0	A 0 0.00 0	A 0 0.00 0	A 9 0.01 0	A 0 0.00 0	A 0 0.00 0	A 0 0.00 0	< < < <	E 37 0.12 3	> > > >	E 37 0.05 2	< < < <	C 24 0.05 2	> > > >	C 24 0.05 2		

MOE - Measure of Effectiveness

LOS - Level of Service

Delay - Average Delay per Vehicle in Seconds

V/C - Volume to Capacity Ratio

Q - 95th Percentile Queue Length (m)

TWSC - Two-Way Stop Control

</> - Shared with through movement



6.2 Total Traffic

The total traffic volumes, with a road diet on Erb Street, have been analyzed using the same methodology as in **Section 4**.

Table 6.2 summarizes the results of the intersection operations. The results indicate that the study area intersections are forecast to operate with acceptable levels of service, except for the same critical movements noted under background traffic conditions.

The northbound shared movement at Erb Street and Dunbar Road and the southbound shared movement at Erb Street and Roslin Avenue are forecast to operate with high delay and low v/c ratios. This indicates that the number of gaps available for side street traffic is limited due to the high through traffic on Erb Street and reduced capacity of the roadway.

As mentioned in **Section 2.5**, it is also noted that the northbound and southbound operations at Erb Street and Roslin Avenue can be considered on the upper end given that the Synchro analysis does not account for the pedestrian crossing signal on the west side of the intersection.

Appendix I contains the detailed Synchro 11 results.



TABLE 6.2: 2029 TOTAL TRAFFIC OPERATIONS – WITH ROAD DIET

Analysis Period	Intersection	Control Type	MOE	Direction/Movement/Approach																Overall
				Eastbound				Westbound				Northbound				Southbound				
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	
AM Peak Hour	Roslin Avenue & Erb Street	TWSC	LOS Delay V/C Q	A 8 0.00 0	A 0 0.00 0	A 0 0.00 0	A 0	A 9 0.01 0	A 0 0.00 0	A 0 0.00 0	A 0	< < C 24 0.08 2	> > > > > >	C 24	< < D 29 0.22 6	> > > > > >	D 29			
	Dunbar Road & Erb Street	TWSC	LOS Delay V/C Q	A 0 0.00 0	A 0 0.00 0	A 0 0.00 0	A 0	A 10 0.01 0	A 0 0.00 0	A 0 0.00 0	A 0	< < C 24 0.06 2	> > > > > >	C 24	< < D 29 0.03 1	> > > > > >	D 29			
	Roslin Avenue & Site Access	TWSC	LOS Delay V/C Q					A 9 0.03 1		> > > > > >	A 9	A 0 0.00 0	A 0 0.00 0	A 0	A 0 0.00 0	A 0 0.00 0		A 0		
PM Peak Hour	Roslin Avenue & Erb Street	TWSC	LOS Delay V/C Q	A 10 0.02 1	A 0 0.00 0	A 0 0.00 0	A 0	A 9 0.01 0	A 0 0.00 0	A 0 0.00 0	A 0	< < D 35 0.12 3	> > > > > >	D 35	< < E 45 0.25 7	> > > > > >	E 45			
	Dunbar Road & Erb Street	TWSC	LOS Delay V/C Q	A 9 0.00 0	A 0 0.00 0	A 0 0.00 0	A 0	A 9 0.01 0	A 0 0.00 0	A 0 0.00 0	A 0	< < E 39 0.13 3	> > > > > >	E 39	< < C 24 0.05 2	> > > > > >	C 24			
	Roslin Avenue & Site Access	TWSC	LOS Delay V/C Q					A 9 0.01 0		> > > > > >	A 9	A 0 0.00 0	A 0 0.00 0	A 0	A 0 0.00 0	A 0 0.00 0		A 0		

MOE - Measure of Effectiveness

LOS - Level of Service

Delay - Average Delay per Vehicle in Seconds

V/C - Volume to Capacity Ratio

Q - 95th Percentile Queue Length (m)

TWSC - Two-Way Stop Control

</> - Shared with through movement



6.3 Left-Turn Lanes

The need for eastbound left-turn lanes on Erb Street at Roslin Avenue and Dunbar Road have been assessed following the methodology discussed in **Section 5.1**, except using the warrant nomographs for a two-lane undivided highway instead of a four-lane undivided highway.

The nomographs for a two-lane undivided highway are based on design speed, advancing volume, opposing volume and percent of advancing vehicles performing a left-turn maneuver. As nomographs are only provided for 5% increments, a minimum threshold of greater than 5% of advancing vehicles performing a left-turn maneuver is used in assessing the requirement of a left-turn lane.

Based on the above noted threshold, an eastbound left-turn lane on Erb Street at Roslin Avenue and Dunbar Road are not warranted under 2029 total traffic volumes as the percentage of advancing vehicles performing a left-turn maneuver is less than 5%.

Given the left-turn lane at Roslin Avenue is not warranted under a road diet condition and that one is only warranted by a small amount in the four-lane condition, decision on whether to implement an eastbound left-turn lane should be deferred until a decision on the road diet is made by the Region of Waterloo.



7 Transportation Demand Management

Transportation Demand Management (TDM) refers to ways of making the capacity of our roads more efficient by reducing vehicle demand. TDM approaches consider how people's choices of travel mode are affected by land use patterns, development design, parking availability, parking cost, and the relative cost, convenience, and availability of alternative modes of travel. Various TDM strategies are used to influence those factors so that the alternatives are more competitive with driving alone and potentially reduce reliance on motor vehicles. TDM strategies at a development can be divided into two basic categories:

- ▶ **Pre-occupancy:** things that need to be done while a development is being designed and built; and
- ▶ **Post-occupancy:** things that can be done once people are using the development.

The pre-occupancy actions are critical as they are most likely to determine how attractive, convenient, and safe alternative travel will be once the site is occupied. Before a site is occupied, it can be designed to be convenient and safe for pedestrians and cyclists, and vehicle parking can be provided to meet but not exceed demand.

After the development is built, incentives can be offered, but those incentives will not work as well if the site and its surroundings are oriented to cars. The incentives generally include subsidies to use transit, access to rideshare programs, and information about where and how to use alternatives.

7.1.1 Walking

The pedestrian accessibility of a development is essential in helping to ensure that those that can walk, have access to pedestrian connections.

As mentioned in **Section 2.2**, sidewalks are provided on all studied roadways. Sidewalks fronting the development at Dunbar Road, Erb Street and Roslin Avenue are to be widened with the development of the site.

A signalized pedestrian crossing is also provided on the west side of Erb Street and Roslin Avenue to facilitate crossing. To make the crossing more attractive to pedestrians and apparent to drivers, the Region should consider cosmetic upgrades such as repainting the



crosswalk to include high-visibility markings and adding tactile strips at the curbs.

The proposed site plan indicates pedestrian connections between the main building entrance and the existing municipal sidewalk along Dunbar Road. Pedestrian walkways are also provided from the development to Erb Street and Roslin Avenue.

The subject site is located approximately 130 metres (or a 2-minute walk) from the Urban Growth Centre boundary at Avondale Avenue North and 500 metres (8-minute walk) from the commercial core of which there are numerous restaurants, commercial and employment establishments.

Other key destinations within walkable distance from the subject site include the nearby schools at Our Lady of Lourdes School and Empire Public School. The pedestrian crossing signal at Erb Street and Roslin Avenue allow pedestrians to safely cross the roadway where they can continue travelling south on Roslin Avenue to access Our Lady of Lourdes School. To access Empire Public School, pedestrians can travel south on Roslin Avenue, turn right onto Lourdes Street and turn left onto Dietz Avenue to use the pedestrian crossing signal available at Westmount Road and Dietz Avenue. Pedestrians would then have to travel south on Westmount Road before turning right onto Alexandra Avenue which fronts onto the school property.

Another key destination includes the Waterloo Memorial Recreation Complex which is located approximately 150 metres from the subject site. The recreation facility is easily accessible given the existing sidewalk on Roslin Avenue and the pedestrian entrance at the southwest corner of the facility's parking lot.

7.1.2 Cycling

Bicycle Parking Requirements

The City of Waterloo Zoning By-law 2018-050⁹ indicates the following minimum bicycle parking requirements:

- ▶ Where a lot contains more than 20 dwelling units:
 - Type A: 0.30 spaces per unit (48 spaces);
 - Type B: 0.30 spaces per unit (48 spaces).

Therefore, 96 bicycle parking spaces are required under the Zoning By-Law. The Zoning By-law defines Type A bicycle parking as secure

⁹ City of Waterloo Zoning bylaw 2018-050, § Section 6.



bicycle parking located indoors or within a bike locker and Type B as any bicycle parking other than Type A.

It is noted that the By-Law indicates a Type B space may be satisfied by a Type A space. The site plan indicates a stacked bicycle room containing 102 bicycle parking spaces on the ground floor and 9 visitor bicycle parking spaces next to the main entrance which exceeds the minimum requirements.

Cyclists will be able to access the bicycle room internally as well as externally with another access at the rear of the building.

Existing Cycling Network

As mentioned in **Section 2.2**, while there are no cycling facilities within the study area, residents of the development can access the cycling network via the nearest cycling facility on Dawson Street. Dawson Street has a signed route and connects to the Iron Horse/Trans Canada Trail at Caroline Street. The Laurel Trail can also be accessed by turning left from Dawson Street onto Caroline Street and travelling north past Erb Street.

Bike lanes are provided on Erb Street west of Westmount Road and east of Euclid Avenue; however, no bike lanes are provided fronting the development.

7.1.3 Transit

The availability of convenient and desirable transit options can reduce the number of person automobile trips. As noted in **Section 2.3**, public transit is provided via Route 5.

The nearest bus stop travelling westbound is located at the northwest corner of Erb Street and Roslin Avenue and the nearest bus stop travelling eastbound is located at the southeast corner. Both stops are located 100 metres (1-minute walk) from the proposed development. This route is easily accessible given the existing sidewalks along Erb Street, Roslin Avenue and Dunbar Road. The pedestrian crossing signal at Erb Street and Roslin Avenue also facilitates crossing.

The proposed development is also located within a Major Transit Station Area. This indicates the development is within walkable distance from a higher-order transit station (i.e., ION LRT station). The two nearest stations are Waterloo Public Square Station and Willis Way Station which are both within 800 metres (10-minute walk) from the subject site. To access both stations, pedestrians would have to travel eastbound on Erb Street before turning right onto Caroline Street South. These stations are easily accessible given the sidewalks along



Erb Street and Caroline Street. Along this route are two signalized intersections: Erb Street and Father David Bauer Drive and Erb Street and Caroline Street. Both intersections operate with crosswalks and pedestrian activated push buttons to facilitate crossing.

While the Waterloo Public Square Station can be accessed by foot, this station can also be accessed via Bus Route 5.

7.1.4 Parking Management

Most apartment buildings and condominium complexes include the price of parking in the rent or purchase price of the unit, a practice known as bundled parking. This practice assumes that all residents have the same demand for parking, and they all bear the cost through their rent or purchase. This practice fails to reward those who do not own a car and who provide social benefits by their non-auto travel choice. When parking is unbundled, the price of the parking space(s) is separated from the rent or purchase price and allows residents to pay only for parking that they need. Unbundling means that parking is rented or sold separately, rather than automatically included with building space.

7.1.5 Car Share Program

Car sharing refers to automobile rental services intended to substitute for private vehicle ownership. It makes occasional use of a vehicle affordable while providing an incentive to minimize driving. It also enables reliance on alternative travel options as much as possible.

By providing this type of mode share on site, lower automobile ownership rates and parking requirements can be further obtained. Residents of the building could choose to use walking, transit or cycling as their primary mode of travel and utilize the car share as a secondary mode of travel.

Communauto (VRTUCAR)¹⁰ has a total of 33 locations across the Region of Waterloo. The closest vehicle/space can be found at Westmount Place which is 700 metres (10-minute walk) from the subject site. The second nearest vehicle/space is located at the Waterloo Public Library which is 750 metres (11-minute walk) from the subject site.

Availability of a shared vehicle will allow residents who normally would not need a vehicle for their daily activities to be comfortable with the decision to not own a vehicle. The owner should consider providing a

¹⁰ "How It Works," Communauto Ontario, n.d.,
<https://ontario.communauto.com/waterloo/how-it-works/>.



parking space as a designated car-share space, pending demand. The owner should liaise with the “CarShare Anywhere” program, to determine the feasibility of providing a vehicle stored on site in a surface lot space.

7.1.6 Travel Planning / Education / Promotion

Increasing awareness of sustainable transportation opportunities for residents and visitors of the subject site should be considered by the developer. Residents should be provided with a welcome package that outlines the available transit routes and active transportation options such as the development’s proximity to the existing cycling network. A travel plan will engage and educate residents on the available sustainable modes of travel and how to overcome obstacles that maybe perceived.

General education of all modes of transportation, including their benefits and how to make the best use of them, are a key component to TDM success. The strategies require cooperation and coordination with several partners, including transit providers, building owners, area municipalities as well as residents.

By educating about sustainable modes of travel as well as providing travel demand management tools and incentives, TDM can be further integrated within the development to promote all modes of transportation.

7.1.7 TDM Checklist

The Region of Waterloo developed a TDM Checklist to assist in assessing whether developments are planned in such a manner to increase transit use and to reduce single occupant vehicle (SOV) travel. It is noted that the TDM checklist is not designed for residential properties but can provide general guidance on TDM strategies.

Based on the following TDM measures, the development is considered TDM supportive with a score of 38 points:

- ▶ Functional building entrances that are oriented to public space;
- ▶ Sidewalks provided on both sides of all adjacent streets and on-site;
- ▶ Transit information provided on-site and in adjacent stops;
- ▶ Located within 800 metres from an LRT station;
- ▶ Provides no more than the minimum required parking spaces;
- ▶ Parking is not located on a major street frontage;



- ▶ 75% or more of parking is located underground; and
- ▶ Unbundled parking.

Appendix J contains the TDM Checklist.



8 Conclusions and Recommendations

8.1 Conclusions

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

- ▶ **Existing Traffic Conditions:** The study area intersections are operating with acceptable levels of service.
- ▶ **Development Trip Generation:** The development is forecast to generate 40 trips during the AM peak hour and 40 trips during the PM peak hour.
- ▶ **2029 Background and Total Traffic Conditions:** The study area intersections are forecast to operate within acceptable levels of service.
- ▶ **Remedial Measures:**
 - Left-Turn Lane: An eastbound left-turn lane with 15 metres of storage is warranted at Erb Street and Roslin Avenue under 2029 forecast total traffic volumes. The volumes meet the four-lane undivided warrant; however the left-turning volumes are less than 3% of the advancing volume.
 - Signal Warrant: Traffic control signals at Erb Street and Roslin Avenue are not warranted under forecast total traffic conditions.
- ▶ **Sensitivity Analysis:** With a road diet on Erb Street, the study area intersections are forecast to operate with acceptable levels of service under 2029 background and total traffic conditions except for the following movements:
 - The northbound shared movement at Erb Street and Dunbar Road; and
 - The southbound shared movement at Erb Street and Roslin Avenue.

Additionally, eastbound left-turn lanes on Erb Street at Roslin Avenue and Dunbar Road are not warranted with a road diet on Erb Street under 2029 forecast total traffic volumes.
- ▶ **Transportation Demand Management:** The following measures are proposed on-site or are located nearby:
 - Internal sidewalks with connections to the existing municipal sidewalk network along Roslin Avenue, Dunbar Road and Erb Street which will be upgraded as part of build-out;



- Access to bus transit route and LRT route that provide good connectivity to the broader network and access to major destinations; and
- Parking unbundled from the sale/rent agreement of each unit.

In addition to the above measures, the following could be considered on-site to further encourage alternative modes of transportation:

- Car share vehicle/space in a priority location;
- The Region consider upgrades to the existing pedestrian crossing signal at Roslin Avenue including tactile strips at the curbs and repainting the crosswalk to meet municipal standards,
- Transit, car share, and active transportation information in a welcome package to new tenants and/or posting in a central location to further support all alternative modes; and
- Delegating a TDM coordinator, either an interested individual or property manager, to support all on-site TDM programs.

8.2 Recommendations

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

- ▶ the decision on whether to implement an eastbound left-turn lane on Erb Street at Roslin Avenue be deferred until the Region of Waterloo decides on whether to implement a road diet on Erb Street across the site frontage; and
- ▶ TDM measures noted above be considered to support alternative modes of transportation.



Appendix A

Pre-Study Consultation Material



From: [Tanikia Kinear](#)
To: [Erica Bayley](#); [Kelly Ngo](#); [Ainsley Rego](#)
Subject: RE: (240414) 142-154 Erb Street W, Waterloo TIS Pre-Study Consultation
Date: August 13, 2024 9:26:51 AM
Attachments: [image001.png](#)

Good morning Erica,

Please see the below comments:

- Background growth rate 0.5%/year
- Proposed development is in a station area and minimum parking rates do not apply
- TIS should recommend improvements to walking and biking, particularly for how to cross Erb Street to/from nearby transit stops and to access bike network
- Recommendations to improve the pedestrian experience (i.e. supplemental pedestrian crossing locations) would be appreciated.

As the 2018 TMP identified a road diet for Erb Street immediately east of this development, it would be ideal for this TIS to explore a two-lane cross-section for Erb Street fronting this development, and identify whether left turn lanes would be needed at Roslin and Dunbar intersections to facilitate access.

Thanks,
Tanikia

From: Erica Bayley <ebayley@ptsl.com>
Sent: Monday, August 12, 2024 2:57 PM
To: Kelly Ngo <kngo@ptsl.com>; Ainsley Rego <Ainsley.Rego@waterloo.ca>; Tanikia Kinear <TKinear@regionofwaterloo.ca>
Subject: RE: (240414) 142-154 Erb Street W, Waterloo TIS Pre-Study Consultation

CAUTION! EXTERNAL SENDER

Were you expecting this email? TAKE A CLOSER LOOK. Is the sender legitimate?
DO NOT click links or open attachments unless you are 100% sure that the email is safe.

Hi Tanikia – can you advise when we may receive comments?

Thx,

Erica Bayley, P.Eng.
Senior Project Manager, Associate
(She/Her)

Paradigm Transportation Solutions Limited
p: 519.896.3163 x202
m: 519.635.5349

From: Kelly Ngo <kngo@ptsl.com>

Sent: Thursday, August 8, 2024 4:11 PM

To: Ainsley Rego <Ainsley.Rego@waterloo.ca>; TKinear@regionofwaterloo.ca

Cc: Erica Bayley <ebayley@ptsl.com>

Subject: RE: (240414) 142-154 Erb Street W, Waterloo TIS Pre-Study Consultation

Thanks for your comments, Ainsley. We'll review pedestrian crossing opportunities in the area.

Tanikia, did you have any comments regarding our scope?

Thanks,

Kelly Ngo

Transportation Consultant
(She/Her)



5A-150 Pinebush Road, Cambridge ON, N1R 8J8

p: 519.896.3163 x203

m: 416.400.8496

From: Ainsley Rego <Ainsley.Rego@waterloo.ca>

Sent: Tuesday, July 23, 2024 10:04 AM

To: Kelly Ngo <kngo@ptsl.com>; TKinear@regionofwaterloo.ca

Cc: Erica Bayley <ebayley@ptsl.com>

Subject: RE: (240414) 142-154 Erb Street W, Waterloo TIS Pre-Study Consultation

Hi Kelly,

Thank you for providing the attached scope of work. I have added some information in red.

The City will accept summertime counts.

In addition to the proposed scope of work can you also review pedestrian crossing opportunities in this area?

Please let me know if you have any questions or concerns.

Best,



Ainsley Rego, BES, RSP1 (she/her)

Engineering Technologist – Traffic

Transportation Engineering, Integrated Planning & Public Works, City of Waterloo

265 Lexington Court PO Box 337 Station Waterloo Waterloo, ON N2J 4A8

P: 1.519.886.2310 ext. 30336 **F:** 1.519.886.5788 **TTY:** 1.866.786.3941 **E:**

ainsley.rego@waterloo.ca

From: Kelly Ngo <kngo@ptsl.com>

Sent: Thursday, July 18, 2024 3:50 PM

To: Ainsley Rego <Ainsley.Rego@waterloo.ca>; TKinear@regionofwaterloo.ca

Cc: Erica Bayley <ebayley@ptsl.com>

Subject: [EXTERNAL] (240414) 142-154 Erb Street W, Waterloo TIS Pre-Study Consultation

Hi Ainsley and Tanikia,

We have been retained to complete the Transportation Impact Study for the proposed redevelopment located at 142-154 Erb Street West in Waterloo. The proposed redevelopment includes 158 residential units. Vehicular access is proposed via driveway connections to Roslin Avenue (parking) and Dunbar Road (loading). I've attached the preliminary site plan and the Region's PSC form for your review. Please let us know if you have anything to add or if the attached scope is acceptable.

We're also planning to collect traffic counts in the coming weeks. Can you confirm if summertime counts are acceptable?

Thank you,

Kelly Ngo

Transportation Consultant
(She/Her)



5A-150 Pinebush Road, Cambridge ON, N1R 8J8

p: 519.896.3163 x203

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e: kngo@ptsl.com

w: www.ptsl.com

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142-154 Erb Street West, Waterloo

PRE-STUDY CONFERENCE FORM

Item	Description	Details
ISSUES		
1	List any issues expected that may impact the content or recommendations of the subject Transportation Impact Study.	To be determined
INTRODUCTION		
2	Nature of application (Attach a drawing)	- Official Plan Amendment - Zoning Amendment
3	TIS process, and relevant policies, procedures and approvals	- Guidelines for the preparation of Transportation Impact Studies in Support of Development Applications - Transportation Impact Studies Requirements for Capacity Analysis, Roundabouts, Turn Lanes
4	Public Meeting	To be determined
CONTEXT		
5	Study intersections (Intersections to be analyzed) Note: the consultant is responsible to identify any further intersections impacted as the study progresses.	Dunbar Road & Erb Street West
		Roslin Avenue & Erb Street West
		Driveway connection to Roslin Avenue
6	Size and number of phases of development	158 residential units within a 10-storey building
7	Approved and pending approval development applications	Please confirm 6-14 Dietz Avenue North 70 King Street 50 Westmount Rd
8	Planned transportation system improvements	Please confirm – Region to confirm
TRAVEL DEMAND		
9	Horizon years	5 years from date of TIS (2029)

Item	Description	Details
10	Peak hour determination	○ AM weekday peak hour of adjacent roadway ○ PM weekday peak hour of adjacent roadway
11	Background	○ ROW travel demand forecasts ○ Approved and pending approval development applications ○ Please confirm background growth rate – City Streets 1%
12	Trip generation	○ ITE average rates, ○ ITE fitted equation
13	Trip reductions (TDM, internal, pass-by)	○ Please confirm mode share reduction
14	Trip distribution	○ ITE trip distribution IN/OUT split
15	Trip assignment	○ Local traffic pattern ○ Site layout and access design ○ Existing turning movements ○ 2016 Transportation Tomorrow Survey (TTS) Data
EVALUATION OF IMPACTS		
16	Traffic impact analysis (Use approved software)	○ Unsignalized intersections ○ left turn warrant analysis ○ signal warrant analysis ○ LOS, v/c, delay, queuing ○ ROW saturation flow rates

Item	Description	Details
17	Roundabout feasibility (Use approved software)	○ Not applicable
18	Transit assessment	○ Frequency and hours of service ○ Presence of bus stops
19	Pedestrian assessment	○ Existing network ○ Future network connectivity
20	Cycling assessment	○ Existing network ○ Future network connectivity
21	Safety analysis	○ Not required
22	Site access and circulation	○ Not applicable
23	Submission format	○ Three hard copies of main report including appendices (other than analysis results/output e.g. Synchro reports) ○ Minimum one original hard copy must be sealed by a professional engineer ○ Electronic copy of complete report and all appendices ○ Electronic copy of operational analysis files (e.g. Synchro, Arcady) ○ Electronic copy of all signal warrant calculation files ○ Other

Appendix B

Existing Traffic Data





Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Dunbar Road & Erb Street W
Site Code: 240414
Start Date: 07/30/2024
Page No: 1

Turning Movement Data

Start Time	Erb Street W Eastbound						Erb Street W Westbound						Dunbar Road Northbound						Dunbar Road Southbound						Int. Total
	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	
7:00 AM	0	83	2	0	1	85	1	42	1	0	0	44	1	0	1	0	1	2	1	0	1	0	3	2	133
7:15 AM	0	106	1	0	0	107	2	61	0	0	0	63	0	0	1	0	1	1	0	0	0	0	6	0	171
7:30 AM	0	112	0	0	0	112	1	66	0	0	0	67	1	0	2	0	0	3	0	0	0	0	0	0	182
7:45 AM	0	130	3	0	0	133	1	76	0	0	0	77	0	0	3	0	3	3	2	0	0	0	3	2	215
Hourly Total	0	431	6	0	1	437	5	245	1	0	0	251	2	0	7	0	5	9	3	0	1	0	12	4	701
8:00 AM	0	159	1	0	1	160	0	67	0	0	0	67	0	0	1	0	3	1	0	0	0	0	4	0	228
8:15 AM	0	182	4	0	0	186	1	90	1	0	0	92	2	0	0	0	0	2	0	0	1	0	3	1	281
8:30 AM	0	170	1	0	0	171	0	107	0	0	0	107	1	0	2	0	3	3	0	0	0	0	2	0	281
8:45 AM	0	204	1	0	0	205	3	123	1	0	0	127	2	0	4	0	6	6	2	0	0	0	4	2	340
Hourly Total	0	715	7	0	1	722	4	387	2	0	0	393	5	0	7	0	12	12	2	0	1	0	13	3	1130
9:00 AM	0	150	4	0	0	154	1	109	2	0	1	112	1	0	1	0	2	2	2	0	0	0	1	2	270
9:15 AM	0	141	3	0	0	144	3	115	0	0	0	118	3	0	2	0	2	5	1	0	1	0	3	2	269
9:30 AM	0	126	4	0	0	130	1	99	0	0	0	100	1	0	3	0	0	4	1	0	0	0	4	1	235
9:45 AM	0	131	3	0	0	134	0	105	0	0	0	105	5	0	0	0	1	5	0	0	0	0	1	0	244
Hourly Total	0	548	14	0	0	562	5	428	2	0	1	435	10	0	6	0	5	16	4	0	1	0	9	5	1018
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12:00 PM	0	126	3	0	1	129	2	119	1	0	0	122	1	0	4	0	0	5	0	0	1	0	6	1	257
12:15 PM	0	142	0	0	0	142	1	99	1	0	0	101	3	0	2	0	2	5	1	0	0	0	1	1	249
12:30 PM	0	130	1	0	0	131	4	109	0	0	0	113	2	0	2	0	4	4	0	0	1	0	1	1	249
12:45 PM	0	142	3	0	0	145	3	116	2	0	0	121	0	0	6	0	2	6	0	0	1	0	0	1	273
Hourly Total	0	540	7	0	1	547	10	443	4	0	0	457	6	0	14	0	8	20	1	0	3	0	8	4	1028
1:00 PM	4	136	3	0	0	143	1	94	1	0	0	96	0	0	0	0	3	0	0	0	0	0	1	0	239
1:15 PM	0	101	1	0	0	102	0	116	1	0	0	117	1	0	3	0	1	4	0	0	0	0	0	0	223
1:30 PM	1	138	1	0	0	140	2	103	0	0	0	105	2	0	2	0	1	4	0	0	1	0	2	1	250
1:45 PM	0	137	2	0	0	139	3	162	1	0	0	166	1	0	1	0	1	2	2	0	1	0	0	3	310
Hourly Total	5	512	7	0	0	524	6	475	3	0	0	484	4	0	6	0	6	10	2	0	2	0	3	4	1022
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3:00 PM	2	129	0	0	0	131	3	119	1	0	1	123	2	0	3	0	1	5	0	0	1	0	3	1	260
3:15 PM	1	137	3	0	0	141	3	127	1	0	0	131	0	0	0	0	0	0	1	0	1	0	0	2	274
3:30 PM	0	129	2	0	0	131	4	148	1	0	0	153	0	0	2	0	1	2	1	0	0	0	4	1	287
3:45 PM	1	143	1	0	0	145	2	151	0	0	0	153	3	0	3	0	3	6	1	0	1	0	3	2	306
Hourly Total	4	538	6	0	0	548	12	545	3	0	1	560	5	0	8	0	5	13	3	0	3	0	10	6	1127
4:00 PM	0	167	4	0	0	171	1	135	0	0	0	136	4	0	2	0	1	6	0	0	0	0	3	0	313
4:15 PM	1	161	4	0	0	166	3	167	2	0	0	172	2	0	2	0	1	4	1	0	2	0	3	3	345
4:30 PM	0	163	5	0	0	168	3	165	1	0	0	169	5	0	1	0	4	6	1	0	1	0	2	2	345

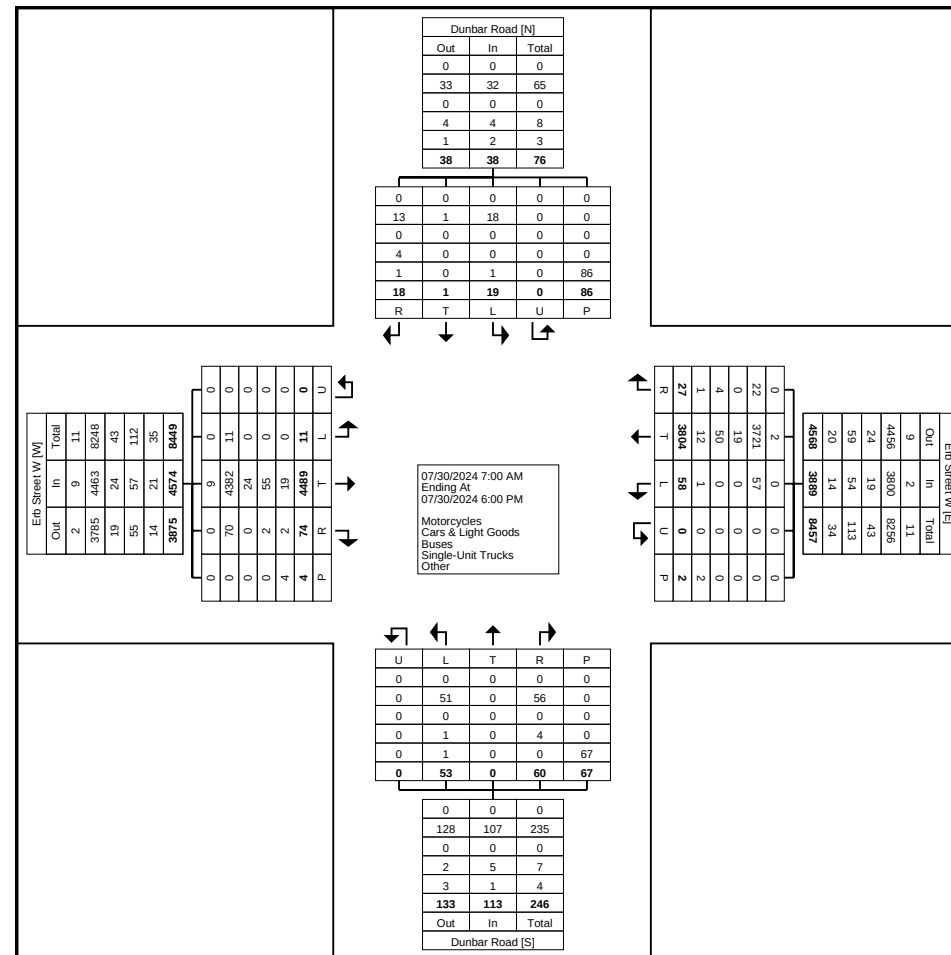
4:45 PM	1	130	3	0	1	134	2	162	3	0	0	167	3	0	1	0	3	4	0	0	1	0	2	1	306
Hourly Total	2	621	16	0	1	639	9	629	6	0	0	644	14	0	6	0	9	20	2	0	4	0	10	6	1309
5:00 PM	0	160	5	0	0	165	0	206	0	0	0	206	0	0	1	0	2	1	1	0	3	0	3	4	376
5:15 PM	0	133	2	0	0	135	3	144	4	0	0	151	3	0	2	0	4	5	0	1	0	0	3	1	292
5:30 PM	0	135	3	0	0	138	3	145	0	0	0	148	2	0	2	0	5	4	1	0	0	0	11	1	291
5:45 PM	0	156	1	0	0	157	1	157	2	0	0	160	2	0	1	0	6	3	0	0	0	0	4	0	320
Hourly Total	0	584	11	0	0	595	7	652	6	0	0	665	7	0	6	0	17	13	2	1	3	0	21	6	1279
Grand Total	11	4489	74	0	4	4574	58	3804	27	0	2	3889	53	0	60	0	67	113	19	1	18	0	86	38	8614
Approach %	0.2	98.1	1.6	0.0	-	-	1.5	97.8	0.7	0.0	-	-	46.9	0.0	53.1	0.0	-	-	50.0	2.6	47.4	0.0	-	-	-
Total %	0.1	52.1	0.9	0.0	-	53.1	0.7	44.2	0.3	0.0	-	45.1	0.6	0.0	0.7	0.0	-	1.3	0.2	0.0	0.2	0.0	-	0.4	-
Motorcycles	0	9	0	0	-	9	0	2	0	0	-	2	0	0	0	0	-	0	0	0	0	0	-	0	11
% Motorcycles	0.0	0.2	0.0	-	-	0.2	0.0	0.1	0.0	-	-	0.1	0.0	-	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.1
Cars & Light Goods	11	4382	70	0	-	4463	57	3721	22	0	-	3800	51	0	56	0	-	107	18	1	13	0	-	32	8402
% Cars & Light Goods	100.0	97.6	94.6	-	-	97.6	98.3	97.8	81.5	-	-	97.7	96.2	-	93.3	-	-	94.7	94.7	100.0	72.2	-	-	84.2	97.5
Buses	0	24	0	0	-	24	0	19	0	0	-	19	0	0	0	0	-	0	0	0	0	0	-	0	43
% Buses	0.0	0.5	0.0	-	-	0.5	0.0	0.5	0.0	-	-	0.5	0.0	-	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.5
Single-Unit Trucks	0	55	2	0	-	57	0	50	4	0	-	54	1	0	4	0	-	5	0	0	4	0	-	4	120
% Single-Unit Trucks	0.0	1.2	2.7	-	-	1.2	0.0	1.3	14.8	-	-	1.4	1.9	-	6.7	-	-	4.4	0.0	0.0	22.2	-	-	10.5	1.4
Articulated Trucks	0	9	1	0	-	10	1	6	0	0	-	7	0	0	0	0	-	0	0	0	0	0	-	0	17
% Articulated Trucks	0.0	0.2	1.4	-	-	0.2	1.7	0.2	0.0	-	-	0.2	0.0	-	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.2
Bicycles on Road	0	10	1	0	-	11	0	6	1	0	-	7	1	0	0	0	-	1	1	0	1	0	-	2	21
% Bicycles on Road	0.0	0.2	1.4	-	-	0.2	0.0	0.2	3.7	-	-	0.2	1.9	-	0.0	-	-	0.9	5.3	0.0	5.6	-	-	5.3	0.2
Bicycles on Crosswalk	-	-	-	-	0	-	-	-	-	-	1	-	-	-	-	-	3	-	-	-	-	-	9	-	-
% Bicycles on Crosswalk	-	-	-	-	0.0	-	-	-	-	-	50.0	-	-	-	-	-	4.5	-	-	-	-	-	10.5	-	-
Pedestrians	-	-	-	-	4	-	-	-	-	-	1	-	-	-	-	-	64	-	-	-	-	-	77	-	-
% Pedestrians	-	-	-	-	100.0	-	-	-	-	-	50.0	-	-	-	-	-	95.5	-	-	-	-	-	89.5	-	-



Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Dunbar Road & Erb Street W
Site Code: 240414
Start Date: 07/30/2024
Page No: 3



Turning Movement Data Plot



Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada N1R 8J8
519-896-3163 cbowness@ptsll.com

Count Name: Dunbar Road & Erb Street W
Site Code: 240414
Start Date: 07/30/2024
Page No: 4

Turning Movement Peak Hour Data (8:15 AM)

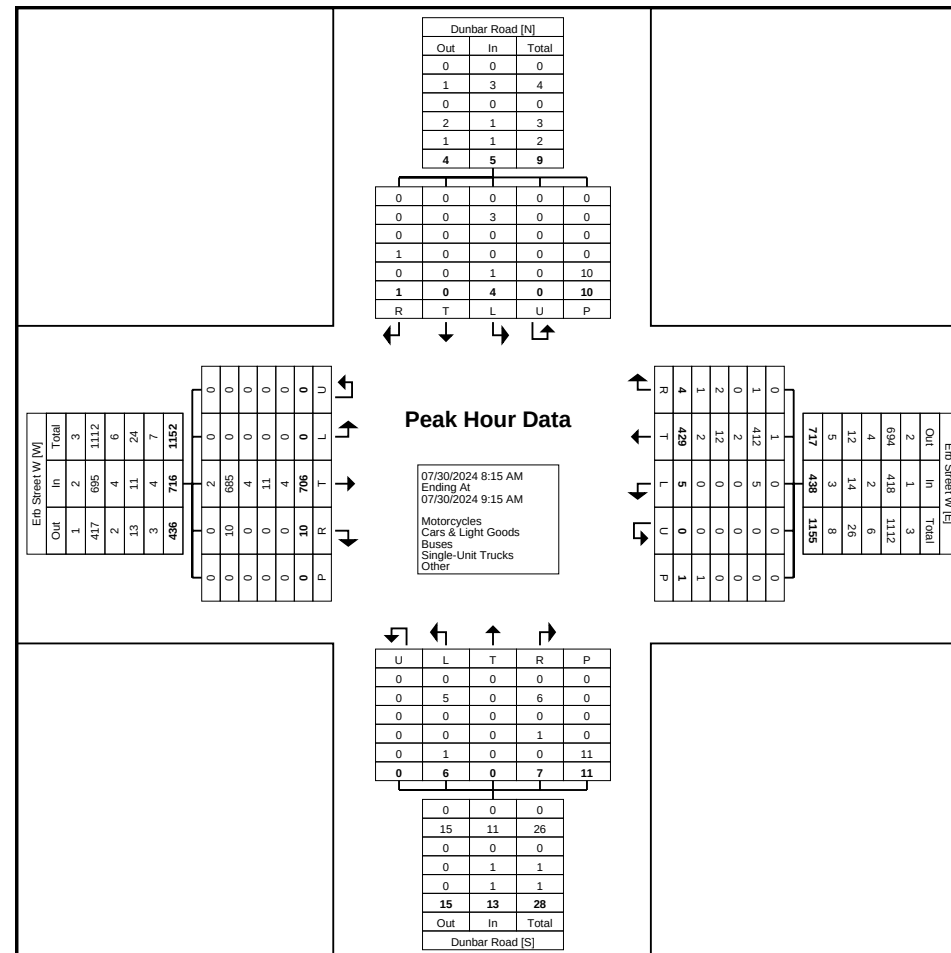
Start Time	Erb Street W Eastbound						Erb Street W Westbound						Dunbar Road Northbound						Dunbar Road Southbound						Int. Total
	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	
8:15 AM	0	182	4	0	0	186	1	90	1	0	0	92	2	0	0	0	0	2	0	0	1	0	3	1	281
8:30 AM	0	170	1	0	0	171	0	107	0	0	0	107	1	0	2	0	3	3	0	0	0	0	2	0	281
8:45 AM	0	204	1	0	0	205	3	123	1	0	0	127	2	0	4	0	6	6	2	0	0	0	4	2	340
9:00 AM	0	150	4	0	0	154	1	109	2	0	1	112	1	0	1	0	2	2	2	0	0	0	1	2	270
Total	0	706	10	0	0	716	5	429	4	0	1	438	6	0	7	0	11	13	4	0	1	0	10	5	1172
Approach %	0.0	98.6	1.4	0.0	-	-	1.1	97.9	0.9	0.0	-	-	46.2	0.0	53.8	0.0	-	-	80.0	0.0	20.0	0.0	-	-	-
Total %	0.0	60.2	0.9	0.0	-	61.1	0.4	36.6	0.3	0.0	-	37.4	0.5	0.0	0.6	0.0	-	1.1	0.3	0.0	0.1	0.0	-	0.4	-
PHF	0.000	0.865	0.625	0.000	-	0.873	0.417	0.872	0.500	0.000	-	0.862	0.750	0.000	0.438	0.000	-	0.542	0.500	0.000	0.250	0.000	-	0.625	0.862
Motorcycles	0	2	0	0	-	2	0	1	0	0	-	1	0	0	0	0	-	0	0	0	0	0	-	0	3
% Motorcycles	-	0.3	0.0	-	-	0.3	0.0	0.2	0.0	-	-	0.2	0.0	-	0.0	-	-	0.0	0.0	-	0.0	-	-	0.0	0.3
Cars & Light Goods	0	685	10	0	-	695	5	412	1	0	-	418	5	0	6	0	-	11	3	0	0	0	-	3	1127
% Cars & Light Goods	-	97.0	100.0	-	-	97.1	100.0	96.0	25.0	-	-	95.4	83.3	-	85.7	-	-	84.6	75.0	-	0.0	-	-	60.0	96.2
Buses	0	4	0	0	-	4	0	2	0	0	-	2	0	0	0	0	-	0	0	0	0	0	-	0	6
% Buses	-	0.6	0.0	-	-	0.6	0.0	0.5	0.0	-	-	0.5	0.0	-	0.0	-	-	0.0	0.0	-	0.0	-	-	0.0	0.5
Single-Unit Trucks	0	11	0	0	-	11	0	12	2	0	-	14	0	0	1	0	-	1	0	0	1	0	-	1	27
% Single-Unit Trucks	-	1.6	0.0	-	-	1.5	0.0	2.8	50.0	-	-	3.2	0.0	-	14.3	-	-	7.7	0.0	-	100.0	-	-	20.0	2.3
Articulated Trucks	0	2	0	0	-	2	0	2	0	0	-	2	0	0	0	0	-	0	0	0	0	0	-	0	4
% Articulated Trucks	-	0.3	0.0	-	-	0.3	0.0	0.5	0.0	-	-	0.5	0.0	-	0.0	-	-	0.0	0.0	-	0.0	-	-	0.0	0.3
Bicycles on Road	0	2	0	0	-	2	0	0	1	0	-	1	1	0	0	0	-	1	1	0	0	0	-	1	5
% Bicycles on Road	-	0.3	0.0	-	-	0.3	0.0	0.0	25.0	-	-	0.2	16.7	-	0.0	-	-	7.7	25.0	-	0.0	-	-	20.0	0.4
Bicycles on Crosswalk	-	-	-	-	0	-	-	-	-	-	1	-	-	-	-	-	1	-	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	-	-	-	-	-	-	-	100.0	-	-	-	-	-	9.1	-	-	-	-	-	0.0	-	-
Pedestrians	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	10	-	-	-	-	-	10	-	-
% Pedestrians	-	-	-	-	-	-	-	-	-	-	0.0	-	-	-	-	-	90.9	-	-	-	-	-	100.0	-	-



Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada N1R 8J8
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Count Name: Dunbar Road & Erb Street W
Site Code: 240414
Start Date: 07/30/2024
Page No: 5



Turning Movement Peak Hour Data Plot (8:15 AM)



Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada N1R 8J8
519-896-3163 cbowness@pts1.com

Count Name: Dunbar Road & Erb Street W
Site Code: 240414
Start Date: 07/30/2024
Page No: 6

Turning Movement Peak Hour Data (12:00 PM)

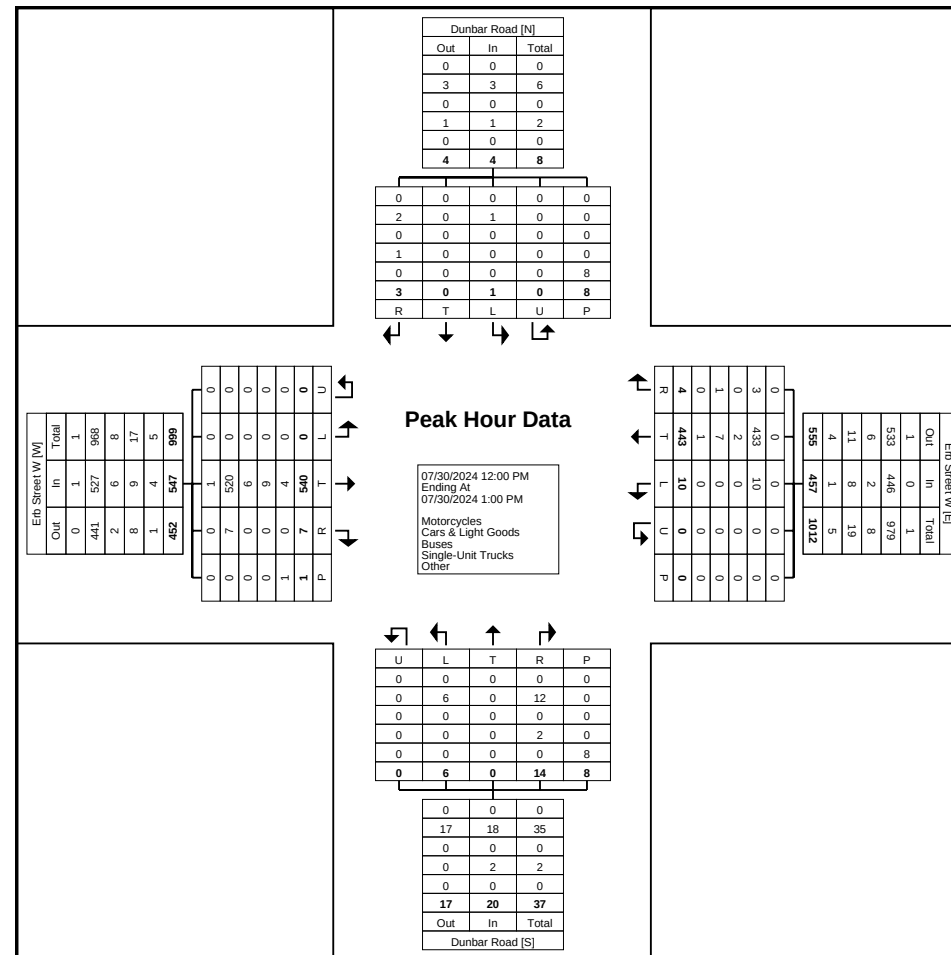
Start Time	Erb Street W Eastbound						Erb Street W Westbound						Dunbar Road Northbound						Dunbar Road Southbound						Int. Total
	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	
12:00 PM	0	126	3	0	1	129	2	119	1	0	0	122	1	0	4	0	0	5	0	0	1	0	6	1	257
12:15 PM	0	142	0	0	0	142	1	99	1	0	0	101	3	0	2	0	2	5	1	0	0	0	1	1	249
12:30 PM	0	130	1	0	0	131	4	109	0	0	0	113	2	0	2	0	4	4	0	0	1	0	1	1	249
12:45 PM	0	142	3	0	0	145	3	116	2	0	0	121	0	0	6	0	2	6	0	0	1	0	0	1	273
Total	0	540	7	0	1	547	10	443	4	0	0	457	6	0	14	0	8	20	1	0	3	0	8	4	1028
Approach %	0.0	98.7	1.3	0.0	-	-	2.2	96.9	0.9	0.0	-	-	30.0	0.0	70.0	0.0	-	-	25.0	0.0	75.0	0.0	-	-	-
Total %	0.0	52.5	0.7	0.0	-	53.2	1.0	43.1	0.4	0.0	-	44.5	0.6	0.0	1.4	0.0	-	1.9	0.1	0.0	0.3	0.0	-	0.4	-
PHF	0.000	0.951	0.583	0.000	-	0.943	0.625	0.931	0.500	0.000	-	0.936	0.500	0.000	0.583	0.000	-	0.833	0.250	0.000	0.750	0.000	-	1.000	0.941
Motorcycles	0	1	0	0	-	1	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	1
% Motorcycles	-	0.2	0.0	-	-	0.2	0.0	0.0	0.0	-	-	0.0	0.0	-	0.0	-	-	0.0	0.0	-	0.0	-	-	0.0	0.1
Cars & Light Goods	0	520	7	0	-	527	10	433	3	0	-	446	6	0	12	0	-	18	1	0	2	0	-	3	994
% Cars & Light Goods	-	96.3	100.0	-	-	96.3	100.0	97.7	75.0	-	-	97.6	100.0	-	85.7	-	-	90.0	100.0	-	66.7	-	-	75.0	96.7
Buses	0	6	0	0	-	6	0	2	0	0	-	2	0	0	0	0	-	0	0	0	0	0	-	0	8
% Buses	-	1.1	0.0	-	-	1.1	0.0	0.5	0.0	-	-	0.4	0.0	-	0.0	-	-	0.0	0.0	-	0.0	-	-	0.0	0.8
Single-Unit Trucks	0	9	0	0	-	9	0	7	1	0	-	8	0	0	2	0	-	2	0	0	1	0	-	1	20
% Single-Unit Trucks	-	1.7	0.0	-	-	1.6	0.0	1.6	25.0	-	-	1.8	0.0	-	14.3	-	-	10.0	0.0	-	33.3	-	-	25.0	1.9
Articulated Trucks	0	3	0	0	-	3	0	1	0	0	-	1	0	0	0	0	-	0	0	0	0	0	-	0	4
% Articulated Trucks	-	0.6	0.0	-	-	0.5	0.0	0.2	0.0	-	-	0.2	0.0	-	0.0	-	-	0.0	0.0	-	0.0	-	-	0.0	0.4
Bicycles on Road	0	1	0	0	-	1	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	1
% Bicycles on Road	-	0.2	0.0	-	-	0.2	0.0	0.0	0.0	-	-	0.0	0.0	-	0.0	-	-	0.0	0.0	-	0.0	-	-	0.0	0.1
Bicycles on Crosswalk	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	-	0.0	-	-	-	-	-	-	-	-	-	-	-	0.0	-	-	-	-	-	0.0	-	-
Pedestrians	-	-	-	-	1	-	-	-	-	-	0	-	-	-	-	-	8	-	-	-	-	-	8	-	-
% Pedestrians	-	-	-	-	100.0	-	-	-	-	-	-	-	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-



Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada N1R 8J8
519-896-3163 cbowness@pts1.com

Count Name: Dunbar Road & Erb Street W
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Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Dunbar Road & Erb Street W
Site Code: 240414
Start Date: 07/30/2024
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Turning Movement Peak Hour Data (4:15 PM)

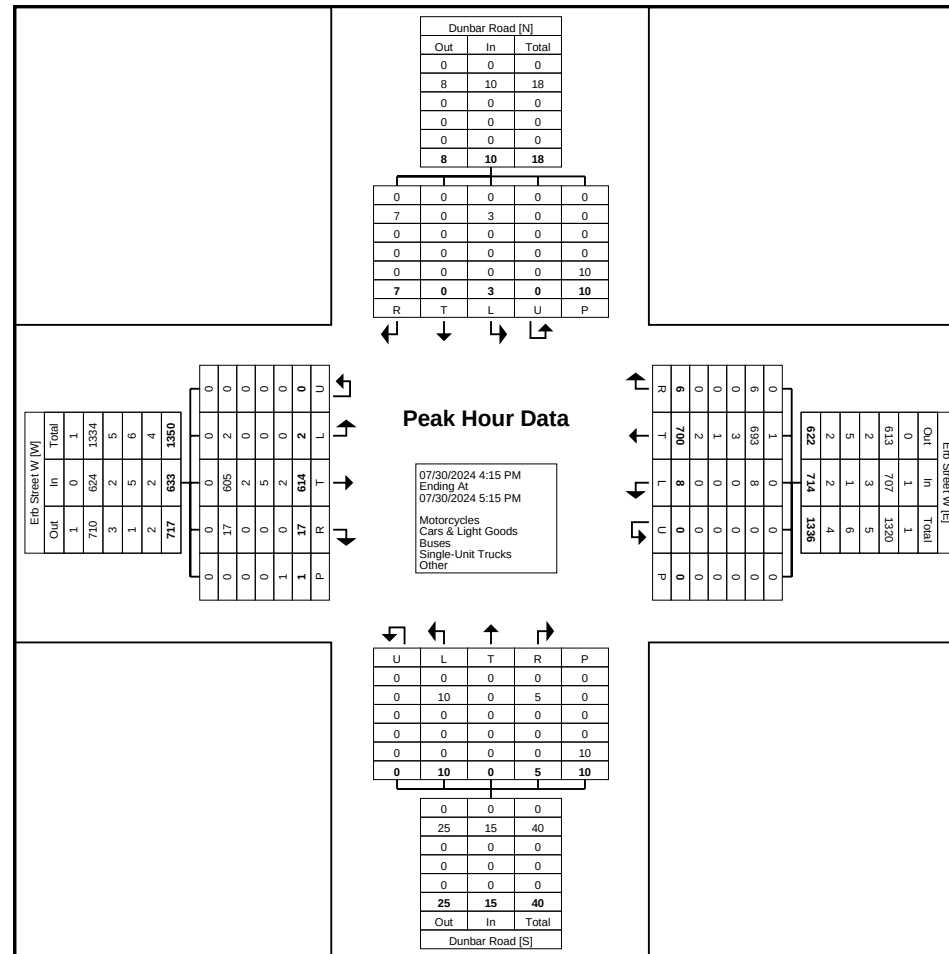
Start Time	Erb Street W Eastbound						Erb Street W Westbound						Dunbar Road Northbound						Dunbar Road Southbound						Int. Total
	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	
4:15 PM	1	161	4	0	0	166	3	167	2	0	0	172	2	0	2	0	1	4	1	0	2	0	3	3	345
4:30 PM	0	163	5	0	0	168	3	165	1	0	0	169	5	0	1	0	4	6	1	0	1	0	2	2	345
4:45 PM	1	130	3	0	1	134	2	162	3	0	0	167	3	0	1	0	3	4	0	0	1	0	2	1	306
5:00 PM	0	160	5	0	0	165	0	206	0	0	0	206	0	0	1	0	2	1	1	0	3	0	3	4	376
Total	2	614	17	0	1	633	8	700	6	0	0	714	10	0	5	0	10	15	3	0	7	0	10	10	1372
Approach %	0.3	97.0	2.7	0.0	-	-	1.1	98.0	0.8	0.0	-	-	66.7	0.0	33.3	0.0	-	-	30.0	0.0	70.0	0.0	-	-	-
Total %	0.1	44.8	1.2	0.0	-	46.1	0.6	51.0	0.4	0.0	-	52.0	0.7	0.0	0.4	0.0	-	1.1	0.2	0.0	0.5	0.0	-	0.7	-
PHF	0.500	0.942	0.850	0.000	-	0.942	0.667	0.850	0.500	0.000	-	0.867	0.500	0.000	0.625	0.000	-	0.625	0.750	0.000	0.583	0.000	-	0.625	0.912
Motorcycles	0	0	0	0	-	0	0	1	0	0	-	1	0	0	0	0	-	0	0	0	0	0	-	0	1
% Motorcycles	0.0	0.0	0.0	-	-	0.0	0.0	0.1	0.0	-	-	0.1	0.0	-	0.0	-	-	0.0	0.0	-	0.0	-	-	0.0	0.1
Cars & Light Goods	2	605	17	0	-	624	8	693	6	0	-	707	10	0	5	0	-	15	3	0	7	0	-	10	1356
% Cars & Light Goods	100.0	98.5	100.0	-	-	98.6	100.0	99.0	100.0	-	-	99.0	100.0	-	100.0	-	-	100.0	100.0	-	100.0	-	-	100.0	98.8
Buses	0	2	0	0	-	2	0	3	0	0	-	3	0	0	0	0	-	0	0	0	0	0	-	0	5
% Buses	0.0	0.3	0.0	-	-	0.3	0.0	0.4	0.0	-	-	0.4	0.0	-	0.0	-	-	0.0	0.0	-	0.0	-	-	0.0	0.4
Single-Unit Trucks	0	5	0	0	-	5	0	1	0	0	-	1	0	0	0	0	-	0	0	0	0	0	-	0	6
% Single-Unit Trucks	0.0	0.8	0.0	-	-	0.8	0.0	0.1	0.0	-	-	0.1	0.0	-	0.0	-	-	0.0	0.0	-	0.0	-	-	0.0	0.4
Articulated Trucks	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0
% Articulated Trucks	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	-	0.0	-	-	0.0	0.0	-	0.0	-	-	0.0	0.0
Bicycles on Road	0	2	0	0	-	2	0	2	0	0	-	2	0	0	0	0	-	0	0	0	0	0	-	0	4
% Bicycles on Road	0.0	0.3	0.0	-	-	0.3	0.0	0.3	0.0	-	-	0.3	0.0	-	0.0	-	-	0.0	0.0	-	0.0	-	-	0.0	0.3
Bicycles on Crosswalk	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	3	-	-
% Bicycles on Crosswalk	-	-	-	-	0.0	-	-	-	-	-	-	-	-	-	-	-	0.0	-	-	-	-	-	30.0	-	-
Pedestrians	-	-	-	-	1	-	-	-	-	-	0	-	-	-	-	-	10	-	-	-	-	-	7	-	-
% Pedestrians	-	-	-	-	100.0	-	-	-	-	-	-	-	-	-	-	-	100.0	-	-	-	-	-	70.0	-	-



Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada N1R 8J8
519-896-3163 cbowness@ptsI.com

Count Name: Dunbar Road & Erb Street W
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Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Roslin Avenue & Erb Street W
Site Code: 240414
Start Date: 07/30/2024
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Turning Movement Data

Start Time	Erb Street W Eastbound						Erb Street W Westbound						Roslin Avenue Northbound						Roslin Avenue Southbound						Int. Total
	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	
7:00 AM	0	81	0	0	1	81	0	39	3	0	0	42	2	0	3	0	2	5	1	0	0	0	1	1	129
7:15 AM	0	105	1	0	1	106	1	60	1	0	0	62	0	0	2	0	1	2	0	0	0	0	6	0	170
7:30 AM	0	117	2	0	0	119	0	66	0	0	1	66	1	0	1	0	1	2	1	0	1	0	0	2	189
7:45 AM	1	129	2	0	1	132	2	73	1	0	0	76	2	0	3	0	4	5	2	0	0	0	4	2	215
Hourly Total	1	432	5	0	3	438	3	238	5	0	1	246	5	0	9	0	8	14	4	0	1	0	11	5	703
8:00 AM	1	157	0	0	1	158	0	66	0	0	0	66	0	0	2	0	3	2	0	1	1	0	1	2	228
8:15 AM	0	184	2	0	2	186	0	89	4	0	0	93	2	2	1	0	0	5	2	0	3	0	3	5	289
8:30 AM	1	170	0	0	3	171	2	107	0	0	0	109	0	0	1	0	1	1	1	1	1	0	0	3	284
8:45 AM	1	199	2	0	3	202	2	123	2	0	0	127	2	2	4	0	7	8	1	0	0	0	2	1	338
Hourly Total	3	710	4	0	9	717	4	385	6	0	0	395	4	4	8	0	11	16	4	2	5	0	6	11	1139
9:00 AM	0	149	1	0	1	150	0	110	2	0	0	112	0	1	1	0	0	2	0	0	0	0	2	0	264
9:15 AM	2	134	3	0	6	139	1	117	1	0	0	119	0	1	5	0	0	6	4	1	0	0	4	5	269
9:30 AM	0	122	1	0	6	123	5	96	0	0	0	101	3	1	6	0	1	10	3	0	0	0	2	3	237
9:45 AM	3	130	2	0	2	135	0	109	1	0	0	110	1	0	5	0	2	6	3	1	1	0	0	5	256
Hourly Total	5	535	7	0	15	547	6	432	4	0	0	442	4	3	17	0	3	24	10	2	1	0	8	13	1026
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12:00 PM	0	124	1	0	1	125	2	118	2	0	0	122	1	0	4	0	2	5	2	0	0	0	2	2	254
12:15 PM	2	136	3	0	1	141	1	102	2	0	0	105	3	0	1	0	2	4	2	0	2	0	0	4	254
12:30 PM	1	126	1	0	3	128	2	106	1	0	0	109	2	0	1	0	2	3	4	0	3	0	1	7	247
12:45 PM	2	141	2	0	0	145	1	117	1	0	0	119	1	1	0	0	1	2	1	2	0	0	0	3	269
Hourly Total	5	527	7	0	5	539	6	443	6	0	0	455	7	1	6	0	7	14	9	2	5	0	3	16	1024
1:00 PM	1	155	1	0	0	157	1	91	2	0	0	94	0	0	1	0	1	1	0	1	0	0	1	1	253
1:15 PM	1	107	3	0	3	111	4	106	3	0	0	113	1	0	0	0	0	1	2	1	1	0	0	4	229
1:30 PM	2	137	0	0	0	139	0	105	2	0	0	107	3	1	2	0	0	6	2	1	1	0	1	4	256
1:45 PM	2	131	1	0	2	134	2	157	0	0	1	159	4	0	5	0	1	9	1	0	0	0	1	1	303
Hourly Total	6	530	5	0	5	541	7	459	7	0	1	473	8	1	8	0	2	17	5	3	2	0	3	10	1041
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3:00 PM	0	137	4	0	1	141	0	118	2	0	0	120	0	1	0	0	2	1	0	0	0	0	1	0	262
3:15 PM	0	139	1	0	4	140	0	125	2	0	0	127	3	0	2	0	4	5	1	1	0	0	0	2	274
3:30 PM	1	131	3	0	0	135	1	141	1	0	0	143	0	0	2	0	1	2	3	0	1	0	4	4	284
3:45 PM	1	150	4	0	1	155	0	149	3	0	0	152	3	0	4	0	3	7	0	0	1	0	1	1	315
Hourly Total	2	557	12	0	6	571	1	533	8	0	0	542	6	1	8	0	10	15	4	1	2	0	6	7	1135
4:00 PM	0	178	0	0	2	178	2	138	2	0	0	142	1	1	0	0	0	2	2	2	0	0	3	4	326
4:15 PM	0	167	0	0	3	167	1	168	1	0	0	170	2	0	1	0	3	3	1	1	2	0	3	4	344
4:30 PM	1	168	3	0	3	172	0	168	1	0	0	169	0	2	2	0	5	4	5	1	2	0	1	8	353

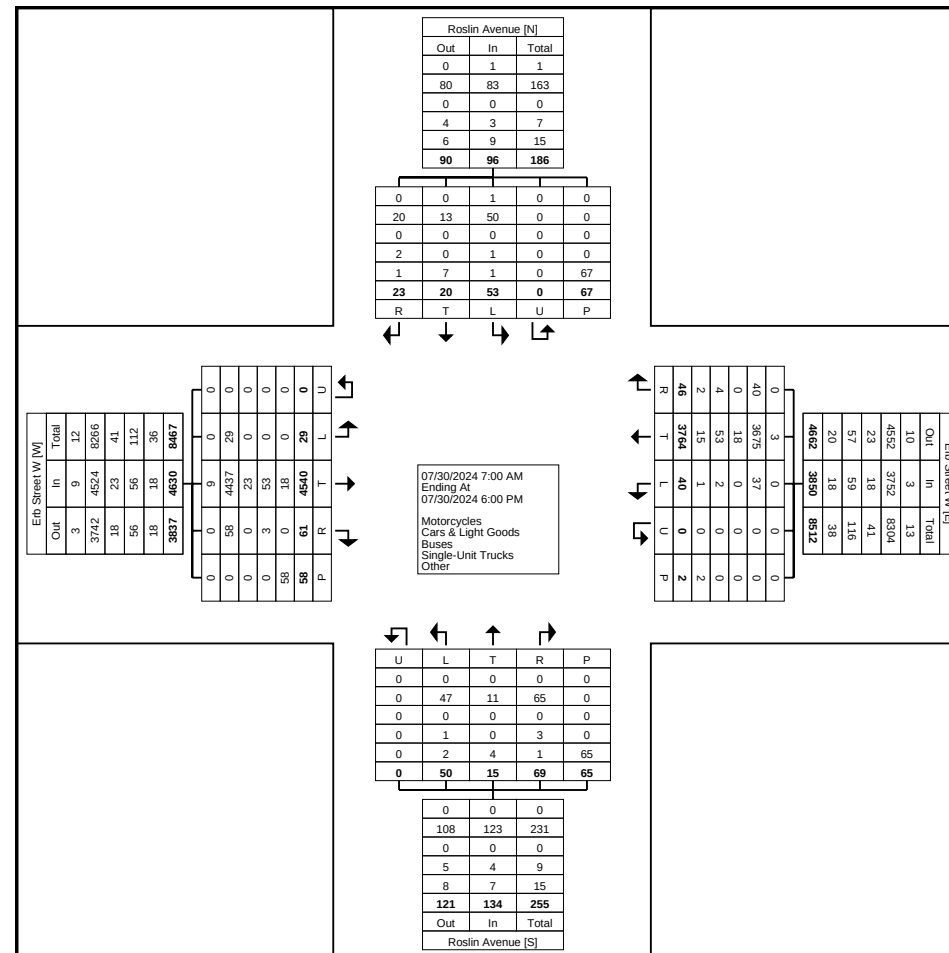
4:45 PM	1	133	3	0	1	137	0	160	2	0	0	162	1	1	1	0	2	3	1	3	1	0	0	5	307
Hourly Total	2	646	6	0	9	654	3	634	6	0	0	643	4	4	4	0	10	12	9	7	5	0	7	21	1330
5:00 PM	1	169	2	0	0	172	3	200	0	0	0	203	3	0	3	0	2	6	2	1	0	0	4	3	384
5:15 PM	0	147	3	0	2	150	2	141	1	0	0	144	3	0	1	0	4	4	0	0	2	0	3	2	300
5:30 PM	3	138	7	0	3	148	3	145	2	0	0	150	3	0	3	0	3	6	3	1	0	0	12	4	308
5:45 PM	1	149	3	0	1	153	2	154	1	0	0	157	3	1	2	0	5	6	3	1	0	0	4	4	320
Hourly Total	5	603	15	0	6	623	10	640	4	0	0	654	12	1	9	0	14	22	8	3	2	0	23	13	1312
Grand Total	29	4540	61	0	58	4630	40	3764	46	0	2	3850	50	15	69	0	65	134	53	20	23	0	67	96	8710
Approach %	0.6	98.1	1.3	0.0	-	-	1.0	97.8	1.2	0.0	-	-	37.3	11.2	51.5	0.0	-	-	55.2	20.8	24.0	0.0	-	-	-
Total %	0.3	52.1	0.7	0.0	-	53.2	0.5	43.2	0.5	0.0	-	44.2	0.6	0.2	0.8	0.0	-	1.5	0.6	0.2	0.3	0.0	-	1.1	-
Motorcycles	0	9	0	0	-	9	0	3	0	0	-	3	0	0	0	0	-	0	1	0	0	0	-	1	13
% Motorcycles	0.0	0.2	0.0	-	-	0.2	0.0	0.1	0.0	-	-	0.1	0.0	0.0	0.0	-	-	0.0	1.9	0.0	0.0	-	-	1.0	0.1
Cars & Light Goods	29	4437	58	0	-	4524	37	3675	40	0	-	3752	47	11	65	0	-	123	50	13	20	0	-	83	8482
% Cars & Light Goods	100.0	97.7	95.1	-	-	97.7	92.5	97.6	87.0	-	-	97.5	94.0	73.3	94.2	-	-	91.8	94.3	65.0	87.0	-	-	86.5	97.4
Buses	0	23	0	0	-	23	0	18	0	0	-	18	0	0	0	0	-	0	0	0	0	0	-	0	41
% Buses	0.0	0.5	0.0	-	-	0.5	0.0	0.5	0.0	-	-	0.5	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.5
Single-Unit Trucks	0	53	3	0	-	56	2	53	4	0	-	59	1	0	3	0	-	4	1	0	2	0	-	3	122
% Single-Unit Trucks	0.0	1.2	4.9	-	-	1.2	5.0	1.4	8.7	-	-	1.5	2.0	0.0	4.3	-	-	3.0	1.9	0.0	8.7	-	-	3.1	1.4
Articulated Trucks	0	9	0	0	-	9	0	6	1	0	-	7	0	0	1	0	-	1	0	0	1	0	-	1	18
% Articulated Trucks	0.0	0.2	0.0	-	-	0.2	0.0	0.2	2.2	-	-	0.2	0.0	0.0	1.4	-	-	0.7	0.0	0.0	4.3	-	-	1.0	0.2
Bicycles on Road	0	9	0	0	-	9	1	9	1	0	-	11	2	4	0	0	-	6	1	7	0	0	-	8	34
% Bicycles on Road	0.0	0.2	0.0	-	-	0.2	2.5	0.2	2.2	-	-	0.3	4.0	26.7	0.0	-	-	4.5	1.9	35.0	0.0	-	-	8.3	0.4
Bicycles on Crosswalk	-	-	-	-	4	-	-	-	-	0	-	-	-	-	-	-	4	-	-	-	-	-	6	-	-
% Bicycles on Crosswalk	-	-	-	-	6.9	-	-	-	-	0.0	-	-	-	-	-	-	6.2	-	-	-	-	-	9.0	-	-
Pedestrians	-	-	-	-	54	-	-	-	-	2	-	-	-	-	-	-	61	-	-	-	-	-	61	-	-
% Pedestrians	-	-	-	-	93.1	-	-	-	-	100.0	-	-	-	-	-	-	93.8	-	-	-	-	-	91.0	-	-



Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

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Count Name: Roslin Avenue & Erb Street W
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Turning Movement Data Plot



Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada N1R 8J8
519-896-3163 cbowness@pts1.com

Count Name: Roslin Avenue & Erb Street W
Site Code: 240414
Start Date: 07/30/2024
Page No: 4

Turning Movement Peak Hour Data (8:15 AM)

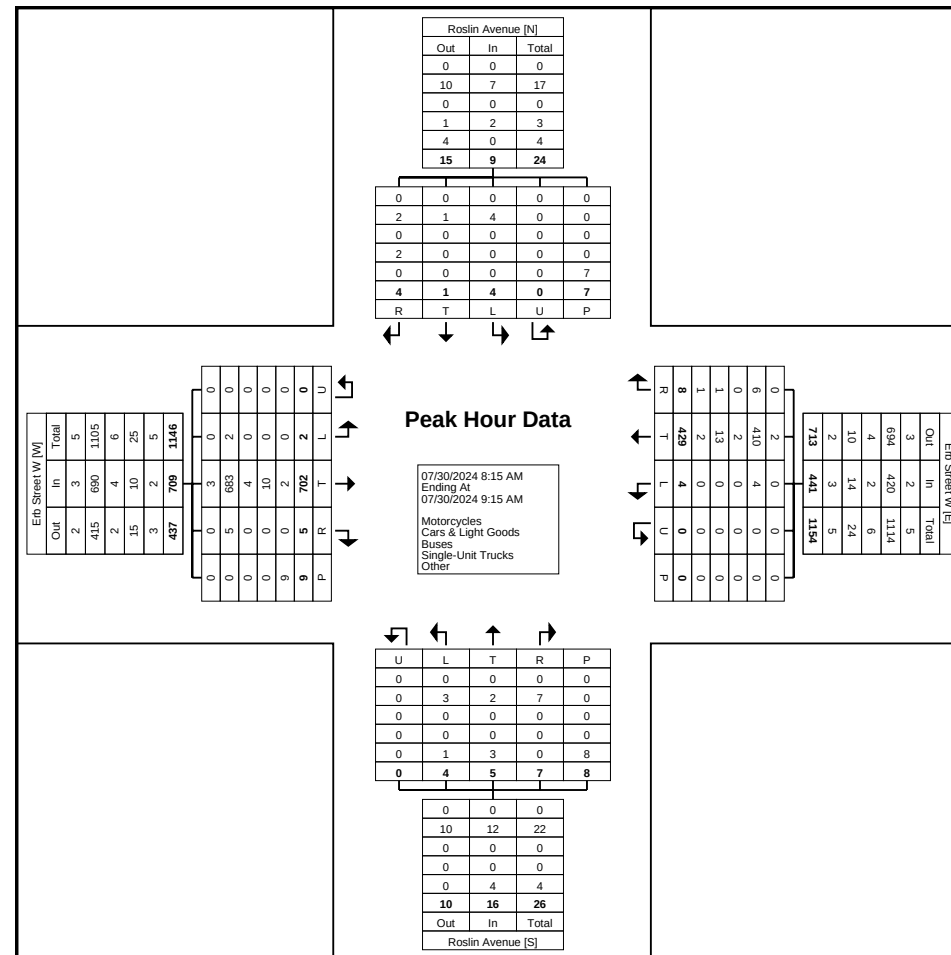
Start Time	Erb Street W Eastbound						Erb Street W Westbound						Roslin Avenue Northbound						Roslin Avenue Southbound						Int. Total
	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	
8:15 AM	0	184	2	0	2	186	0	89	4	0	0	93	2	2	1	0	0	5	2	0	3	0	3	5	289
8:30 AM	1	170	0	0	3	171	2	107	0	0	0	109	0	0	1	0	1	1	1	1	1	0	0	3	284
8:45 AM	1	199	2	0	3	202	2	123	2	0	0	127	2	2	4	0	7	8	1	0	0	0	2	1	338
9:00 AM	0	149	1	0	1	150	0	110	2	0	0	112	0	1	1	0	0	2	0	0	0	0	2	0	264
Total	2	702	5	0	9	709	4	429	8	0	0	441	4	5	7	0	8	16	4	1	4	0	7	9	1175
Approach %	0.3	99.0	0.7	0.0	-	-	0.9	97.3	1.8	0.0	-	-	25.0	31.3	43.8	0.0	-	-	44.4	11.1	44.4	0.0	-	-	-
Total %	0.2	59.7	0.4	0.0	-	60.3	0.3	36.5	0.7	0.0	-	37.5	0.3	0.4	0.6	0.0	-	1.4	0.3	0.1	0.3	0.0	-	0.8	-
PHF	0.500	0.882	0.625	0.000	-	0.877	0.500	0.872	0.500	0.000	-	0.868	0.500	0.625	0.438	0.000	-	0.500	0.500	0.250	0.333	0.000	-	0.450	0.869
Motorcycles	0	3	0	0	-	3	0	2	0	0	-	2	0	0	0	0	-	0	0	0	0	0	-	0	5
% Motorcycles	0.0	0.4	0.0	-	-	0.4	0.0	0.5	0.0	-	-	0.5	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.4
Cars & Light Goods	2	683	5	0	-	690	4	410	6	0	-	420	3	2	7	0	-	12	4	1	2	0	-	7	1129
% Cars & Light Goods	100.0	97.3	100.0	-	-	97.3	100.0	95.6	75.0	-	-	95.2	75.0	40.0	100.0	-	-	75.0	100.0	100.0	50.0	-	-	77.8	96.1
Buses	0	4	0	0	-	4	0	2	0	0	-	2	0	0	0	0	-	0	0	0	0	0	-	0	6
% Buses	0.0	0.6	0.0	-	-	0.6	0.0	0.5	0.0	-	-	0.5	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.5
Single-Unit Trucks	0	10	0	0	-	10	0	13	1	0	-	14	0	0	0	0	-	0	0	0	2	0	-	2	26
% Single-Unit Trucks	0.0	1.4	0.0	-	-	1.4	0.0	3.0	12.5	-	-	3.2	0.0	0.0	0.0	-	-	0.0	0.0	0.0	50.0	-	-	22.2	2.2
Articulated Trucks	0	1	0	0	-	1	0	1	0	0	-	1	0	0	0	0	-	0	0	0	0	0	-	0	2
% Articulated Trucks	0.0	0.1	0.0	-	-	0.1	0.0	0.2	0.0	-	-	0.2	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.2
Bicycles on Road	0	1	0	0	-	1	0	1	1	0	-	2	1	3	0	0	-	4	0	0	0	0	-	0	7
% Bicycles on Road	0.0	0.1	0.0	-	-	0.1	0.0	0.2	12.5	-	-	0.5	25.0	60.0	0.0	-	-	25.0	0.0	0.0	0.0	-	-	0.0	0.6
Bicycles on Crosswalk	-	-	-	-	1	-	-	-	-	-	0	-	-	-	-	-	1	-	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	-	11.1	-	-	-	-	-	-	-	-	-	-	-	12.5	-	-	-	-	-	0.0	-	-
Pedestrians	-	-	-	-	8	-	-	-	-	-	0	-	-	-	-	-	7	-	-	-	-	-	7	-	-
% Pedestrians	-	-	-	-	88.9	-	-	-	-	-	-	-	-	-	-	-	87.5	-	-	-	-	-	100.0	-	-



Paradigm Transportation Solutions Limited
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5A-150 Pinebush Rd

Cambridge, Ontario, Canada N1R 8J8
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Turning Movement Peak Hour Data (1:00 PM)

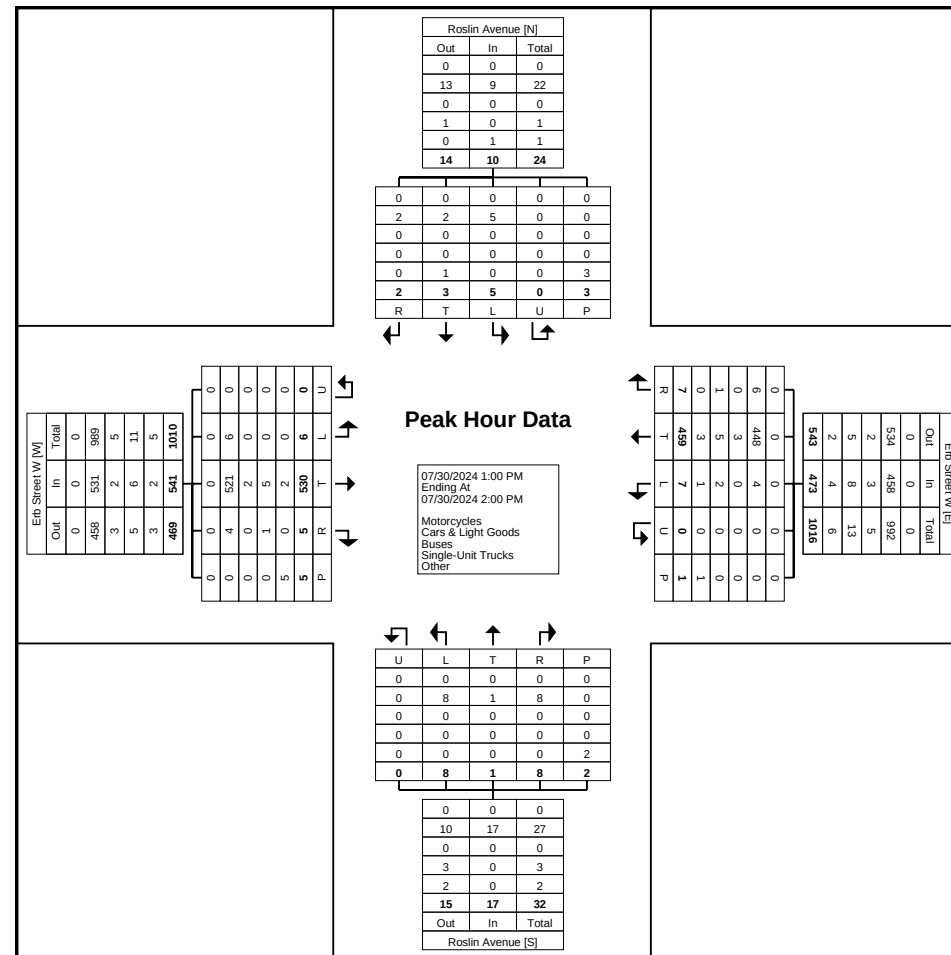
Start Time	Erb Street W Eastbound						Erb Street W Westbound						Roslin Avenue Northbound						Roslin Avenue Southbound						Int. Total
	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	
1:00 PM	1	155	1	0	0	157	1	91	2	0	0	94	0	0	1	0	1	1	0	1	0	0	1	1	253
1:15 PM	1	107	3	0	3	111	4	106	3	0	0	113	1	0	0	0	0	1	2	1	1	0	0	4	229
1:30 PM	2	137	0	0	0	139	0	105	2	0	0	107	3	1	2	0	0	6	2	1	1	0	1	4	256
1:45 PM	2	131	1	0	2	134	2	157	0	0	1	159	4	0	5	0	1	9	1	0	0	0	1	1	303
Total	6	530	5	0	5	541	7	459	7	0	1	473	8	1	8	0	2	17	5	3	2	0	3	10	1041
Approach %	1.1	98.0	0.9	0.0	-	-	1.5	97.0	1.5	0.0	-	-	47.1	5.9	47.1	0.0	-	-	50.0	30.0	20.0	0.0	-	-	-
Total %	0.6	50.9	0.5	0.0	-	52.0	0.7	44.1	0.7	0.0	-	45.4	0.8	0.1	0.8	0.0	-	1.6	0.5	0.3	0.2	0.0	-	1.0	-
PHF	0.750	0.855	0.417	0.000	-	0.861	0.438	0.731	0.583	0.000	-	0.744	0.500	0.250	0.400	0.000	-	0.472	0.625	0.750	0.500	0.000	-	0.625	0.859
Motorcycles	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0
% Motorcycles	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0
Cars & Light Goods	6	521	4	0	-	531	4	448	6	0	-	458	8	1	8	0	-	17	5	2	2	0	-	9	1015
% Cars & Light Goods	100.0	98.3	80.0	-	-	98.2	57.1	97.6	85.7	-	-	96.8	100.0	100.0	100.0	-	-	100.0	100.0	66.7	100.0	-	-	90.0	97.5
Buses	0	2	0	0	-	2	0	3	0	0	-	3	0	0	0	0	-	0	0	0	0	0	-	0	5
% Buses	0.0	0.4	0.0	-	-	0.4	0.0	0.7	0.0	-	-	0.6	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.5
Single-Unit Trucks	0	5	1	0	-	6	2	5	1	0	-	8	0	0	0	0	-	0	0	0	0	0	-	0	14
% Single-Unit Trucks	0.0	0.9	20.0	-	-	1.1	28.6	1.1	14.3	-	-	1.7	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	1.3
Articulated Trucks	0	1	0	0	-	1	0	1	0	0	-	1	0	0	0	0	-	0	0	0	0	0	-	0	2
% Articulated Trucks	0.0	0.2	0.0	-	-	0.2	0.0	0.2	0.0	-	-	0.2	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.2
Bicycles on Road	0	1	0	0	-	1	1	2	0	0	-	3	0	0	0	0	-	0	0	1	0	0	-	1	5
% Bicycles on Road	0.0	0.2	0.0	-	-	0.2	14.3	0.4	0.0	-	-	0.6	0.0	0.0	0.0	-	-	0.0	0.0	33.3	0.0	-	-	10.0	0.5
Bicycles on Crosswalk	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	-	0.0	-	-	-	-	-	0.0	-	-	-	-	-	0.0	-	-	-	-	-	0.0	-	-
Pedestrians	-	-	-	-	5	-	-	-	-	-	1	-	-	-	-	-	2	-	-	-	-	-	3	-	-
% Pedestrians	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-



Paradigm Transportation Solutions Limited
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Turning Movement Peak Hour Data (4:15 PM)

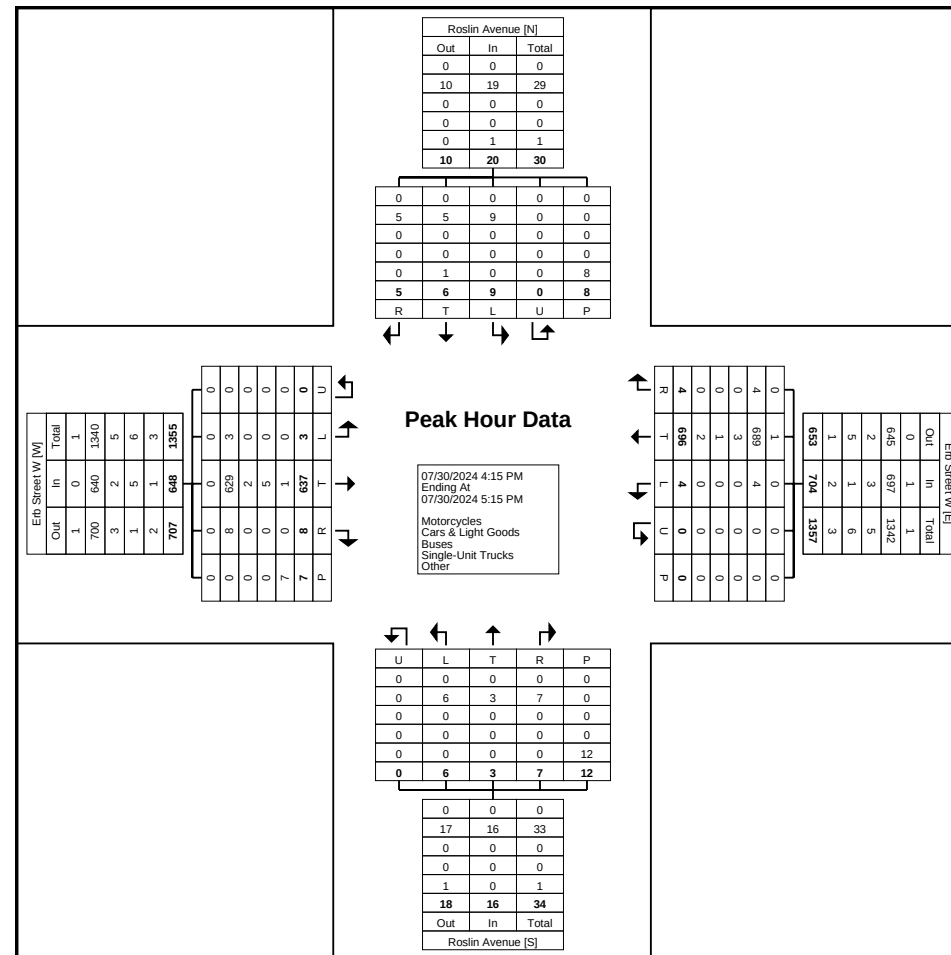
Start Time	Erb Street W Eastbound						Erb Street W Westbound						Roslin Avenue Northbound						Roslin Avenue Southbound						Int. Total
	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	
4:15 PM	0	167	0	0	3	167	1	168	1	0	0	170	2	0	1	0	3	3	1	1	2	0	3	4	344
4:30 PM	1	168	3	0	3	172	0	168	1	0	0	169	0	2	2	0	5	4	5	1	2	0	1	8	353
4:45 PM	1	133	3	0	1	137	0	160	2	0	0	162	1	1	1	0	2	3	1	3	1	0	0	5	307
5:00 PM	1	169	2	0	0	172	3	200	0	0	0	203	3	0	3	0	2	6	2	1	0	0	4	3	384
Total	3	637	8	0	7	648	4	696	4	0	0	704	6	3	7	0	12	16	9	6	5	0	8	20	1388
Approach %	0.5	98.3	1.2	0.0	-	-	0.6	98.9	0.6	0.0	-	-	37.5	18.8	43.8	0.0	-	-	45.0	30.0	25.0	0.0	-	-	-
Total %	0.2	45.9	0.6	0.0	-	46.7	0.3	50.1	0.3	0.0	-	50.7	0.4	0.2	0.5	0.0	-	1.2	0.6	0.4	0.4	0.0	-	1.4	-
PHF	0.750	0.942	0.667	0.000	-	0.942	0.333	0.870	0.500	0.000	-	0.867	0.500	0.375	0.583	0.000	-	0.667	0.450	0.500	0.625	0.000	-	0.625	0.904
Motorcycles	0	0	0	0	-	0	0	1	0	0	-	1	0	0	0	0	-	0	0	0	0	0	-	0	1
% Motorcycles	0.0	0.0	0.0	-	-	0.0	0.0	0.1	0.0	-	-	0.1	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.1
Cars & Light Goods	3	629	8	0	-	640	4	689	4	0	-	697	6	3	7	0	-	16	9	5	5	0	-	19	1372
% Cars & Light Goods	100.0	98.7	100.0	-	-	98.8	100.0	99.0	100.0	-	-	99.0	100.0	100.0	100.0	-	-	100.0	100.0	83.3	100.0	-	-	95.0	98.8
Buses	0	2	0	0	-	2	0	3	0	0	-	3	0	0	0	0	-	0	0	0	0	0	-	0	5
% Buses	0.0	0.3	0.0	-	-	0.3	0.0	0.4	0.0	-	-	0.4	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.4
Single-Unit Trucks	0	5	0	0	-	5	0	1	0	0	-	1	0	0	0	0	-	0	0	0	0	0	-	0	6
% Single-Unit Trucks	0.0	0.8	0.0	-	-	0.8	0.0	0.1	0.0	-	-	0.1	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.4
Articulated Trucks	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0
% Articulated Trucks	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0
Bicycles on Road	0	1	0	0	-	1	0	2	0	0	-	2	0	0	0	0	-	0	0	1	0	0	-	1	4
% Bicycles on Road	0.0	0.2	0.0	-	-	0.2	0.0	0.3	0.0	-	-	0.3	0.0	0.0	0.0	-	-	0.0	0.0	16.7	0.0	-	-	5.0	0.3
Bicycles on Crosswalk	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	2	-	-
% Bicycles on Crosswalk	-	-	-	-	0.0	-	-	-	-	-	-	-	-	-	-	-	0.0	-	-	-	-	-	25.0	-	-
Pedestrians	-	-	-	-	7	-	-	-	-	-	0	-	-	-	-	-	12	-	-	-	-	-	6	-	-
% Pedestrians	-	-	-	-	100.0	-	-	-	-	-	-	-	-	-	-	-	100.0	-	-	-	-	-	75.0	-	-



Paradigm Transportation Solutions Limited
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Appendix C

Existing Traffic Operations Reports



Lanes, Volumes, Timings

1: Roslin Avenue & Erb Street

Existing AM Peak Hour
(240414) 142-154 Erb Street West, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	2	702	5	4	423	8	4	4	5	7	4	4
Traffic Volume (vph)	2	702	5	4	423	8	4	4	5	7	4	1
Future Volume (vph)	1650	1650	1650	1650	1650	1650	1550	1550	1550	1550	1550	1550
Ideal Flow (vphpl)	0.95	0.95	0.95	0.95	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Lane Util. Factor	0.999											
Ped Bike Factor												
Frt					0.997			0.941				0.940
Flt Protected								0.988				0.978
Satd. Flow (prot)	0	3037	0	0	2968	0	0	1425	0	0	1153	0
Flt Permitted								0.988				0.978
Satd. Flow (perm)	0	3037	0	0	2968	0	0	1425	0	0	1153	0
Link Speed (k/h)					50			30				50
Link Distance (m)					96.9			113.5				113.2
Travel Time (s)					7.0			13.6				8.2
Conf. Peds. (#/hr)	7		8	8		7	9					9
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	2%	0%	0%	4%	13%	0%	0%	0%	0%	0%	50%
Adj. Flow (vph)	2	702	5	4	423	8	4	5	7	4	1	4
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	709	0	0	441	0	0	16	0	0	9	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Right	Left	Left	Right	Left	Left	Right	Right
Median Width(m)		0.0			0.0		0.0				0.0	
Link Offset(m)		0.0		0.0	0.0		0.0		4.8		0.0	
Crosswalk Width(m)		4.8		4.8			4.8				4.8	
Two way Left Turn Lane	1.21	1.21	1.21	1.21	1.21	1.21	1.31	1.31	1.31	1.31	1.31	1.31
Headway Factor	25	15	25	15	25	15	25	15	25	25	15	15
Turning Speed (k/h)		Free		Free		Free	Stop	Stop	Stop	Stop	Stop	Stop
Sign Control												
Intersection Summary												
Area Type:	Other											
Control Type:	Unsignalized											
Intersection Capacity Utilization	36.7%											
Analysis Period (min)	15											
ICU Level of Service A												

HCM 6th TWSC

1: Roslin Avenue & Erb Street

Existing AM Peak Hour
(240414) 142-154 Erb Street West, Waterloo TIS

Intersection	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Int Delay, s/veh	0.4											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	2	702	5	4	423	8	4	4	5	7	4	4
Traffic Vol. veh/h	2	702	5	4	423	8	4	4	5	7	4	1
Future Vol. veh/h	2	702	5	4	423	8	4	4	5	7	4	4
Conflicting Peds. #/hr	7	0	8	8	0	7	9	0	0	0	0	9
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage. #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	0	2	0	0	4	13	0	0	0	0	0	50
Mvmt Flow	2	702	5	4	423	8	4	5	7	4	1	4
Major/Minor	Major1	Major2	Minor1	Minor2	Minor1	Minor2	Minor1	Minor2	Minor1	Minor2	Minor1	Minor2
Conflicting Flow All	444	0	0	715	0	0	949	1169	362	806	1167	235
Stage 1	-	-	-	-	-	-	-	717	717	-	448	448
Stage 2	-	-	-	-	-	-	-	232	452	-	358	719
Critical Hwy	4.1	-	-	4.1	-	-	-	7.5	6.5	6.9	7.5	6.5
Critical Hwy Stg 1	-	-	-	-	-	-	-	6.5	5.5	-	6.5	5.5
Critical Hwy Stg 2	-	-	-	-	-	-	-	6.5	5.5	-	6.5	5.5
Follow-up Hwy	2.2	-	-	2.2	-	-	-	3.5	4	3.3	3.5	4
Pot Cap-1 Maneuver	1127	-	-	895	-	-	-	218	195	641	277	195
Stage 1	-	-	-	-	-	-	-	391	437	-	565	576
Stage 2	-	-	-	-	-	-	-	756	574	-	638	436
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1121	-	-	889	-	-	-	211	191	637	265	191
Mov Cap-2 Maneuver	-	-	-	-	-	-	-	211	191	-	265	191
Stage 1	-	-	-	-	-	-	-	387	433	-	560	570
Stage 2	-	-	-	-	-	-	-	740	568	-	622	432
Approach	EB	WB	NB	SB	EB	WB	NB	SB	EB	WB	NB	SB
HCM Control Delay, s	0	0.1	18.4	16	0	0.1	18.4	16	0	0.1	18.4	16
HCM LOS	C	C	C	C	C	C	C	C	C	C	C	C
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	WBR	SBLn1	WBR	SBLn1
Capacity (veh/h)	285	1121	-	-	889	-	-	-	-	337	-	-
HCM Lane V/C Ratio	0.056	0.002	-	-	0.004	-	-	-	-	0.027	-	-
HCM Control Delay (s)	18.4	8.2	0	-	9.1	0	-	16	-	16	-	-
HCM Lane LOS	C	A	A	A	A	A	A	A	A	A	A	A
HCM 95th %tile Q(veh)	0.2	0	-	-	0	-	-	0	-	0.1	-	-

Lanes, Volumes, Timings
 2: Dunbar Road & Erb Street

HCM 6th TWSC
 2: Dunbar Road & Erb Street

Existing AM Peak Hour
 (240414) 142-154 Erb Street West, Waterloo TIS

Existing AM Peak Hour
 (240414) 142-154 Erb Street West, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		4P	4P	4P	4P	4P	4P	4P	4P	4P	4P	4P
Traffic Volume (vph)	0	706	10	5	429	4	6	0	7	4	0	1
Future Volume (vph)	0	706	10	5	429	4	6	0	7	4	0	1
Ideal Flow (vphpl)	1650	1650	1650	1650	1650	1650	1550	1550	1550	1550	1550	1550
Lane Util. Factor	0.95	0.95	0.95	0.95	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		0.998			0.999		0.927				0.973	
FRT					0.999		0.977				0.962	
Flt Protected					0.999		0.977				0.962	
Satd. Flow (prot)	0	3005	0	0	2964	0	0	1291	0	0	1196	0
Flt Permitted					0.999		0.977				0.962	
Satd. Flow (perm)	0	3005	0	0	2964	0	0	1291	0	0	1196	0
Link Speed (k/h)					50		30				50	
Link Distance (m)					86.9		119.8				105.6	
Travel Time (s)					6.3		14.4				7.6	
Conf. Peds. (#/hr)	10	11	11	11	10				1			
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	3%	0%	0%	4%	50%	0%	0%	14%	0%	0%	100%
Adj. Flow (vph)	0	706	10	5	429	4	6	0	7	4	0	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	716	0	0	438	0	0	13	0	0	5	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Right	Left	Left	Right	Left	Left	Right	Right
Median Width(m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Link Offset(m)	0.0	0.0	0.0	0.0	0.0	0.0	4.8	0.0	0.0	0.0	4.8	0.0
Crosswalk Width(m)	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8
Two way Left Turn Lane	1.21	1.21	1.21	1.21	1.21	1.21	1.31	1.31	1.31	1.31	1.31	1.31
Headway Factor	25	15	25	15	25	15	25	15	25	25	15	15
Turning Speed (k/h)												
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
Intersection Summary												
Area Type:	Other											
Control Type:	Unsignalized											
Intersection Capacity Utilization	33.2%											
Analysis Period (min)	15											
ICU Level of Service A												

Intersection	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Int Delay, s/veh	0.3											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	4P	4P	4P	4P	4P	4P	4P	4P	4P	4P	4P	4P
Traffic Vol. veh/h	0	706	10	5	429	4	6	0	7	4	0	1
Future Vol. veh/h	0	706	10	5	429	4	6	0	7	4	0	1
Conflicting Peds. #/hr	10	0	11	11	0	10	0	0	1	1	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage. #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	0	3	0	0	4	50	0	0	14	0	0	100
Mvmt Flow	0	706	10	5	429	4	6	0	7	4	0	1
Major/Minor	Major1	Major2	Minor1	Minor2	Minor1	Minor2	Minor1	Minor2	Minor1	Minor2	Minor1	Minor2
Conflicting Flow All	443	0	0	727	0	0	947	1175	370	805	1178	227
Stage 1	-	-	-	-	-	-	-	722	722	-	451	451
Stage 2	-	-	-	-	-	-	-	225	453	-	354	727
Critical Hdwy	4.1	-	-	4.1	-	-	7.5	6.5	7.18	7.5	6.5	8.9
Critical Hdwy Stg 1	-	-	-	-	-	-	6.5	5.5	-	6.5	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.5	5.5	-	6.5	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.44	3.5	4	4.3
Pot Cap-1 Maneuver	1128	-	-	886	-	-	219	193	594	277	192	545
Stage 1	-	-	-	-	-	-	389	434	-	563	574	-
Stage 2	-	-	-	-	-	-	763	573	-	642	432	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1119	-	-	878	-	-	215	188	588	270	187	541
Mov Cap-2 Maneuver	-	-	-	-	-	-	215	188	-	270	187	-
Stage 1	-	-	-	-	-	-	385	430	-	558	565	-
Stage 2	-	-	-	-	-	-	755	564	-	634	428	-
Approach	EB	WB	NB	SB	EB	WB	NB	SB	EB	WB	NB	SB
HCM Control Delay, s	0	0.1	16.5	17.2	0	0.1	16.5	17.2	0	0.1	16.5	17.2
HCM LOS	C	C	C	C	C	C	C	C	C	C	C	C
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	WBR	SBLn1	WBR	SBLn1
Capacity (veh/h)	327	1119	-	-	878	-	-	300	-	-	300	-
HCM Lane V/C Ratio	0.04	-	-	-	0.006	-	-	0.017	-	-	0.017	-
HCM Control Delay (s)	16.5	0	-	-	9.1	0	-	17.2	-	-	17.2	-
HCM Lane LOS	C	A	-	-	A	-	-	C	-	-	C	-
HCM 95th %tile Q(veh)	0.1	0	-	-	0	-	-	0.1	-	-	0.1	-

Lanes, Volumes, Timings

1: Roslin Avenue & Erb Street

(240414) 142-154 Erb Street West, Waterloo TIS

Lanes, Volumes, Timings

1: Roslin Avenue & Erb Street

(240414) 142-154 Erb Street West, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↵↵	↵↵		↵↵	↵↵			↵↵			↵↵	
Traffic Volume (vph)	3	637	8	4	696	4	6	3	7	9	6	5
Future Volume (vph)	3	637	8	4	696	4	6	3	7	9	6	5
Ideal Flow (vphpl)	1650	1650	1650	1650	1650	1650	1550	1550	1550	1550	1550	1550
Lane Util. Factor	0.95	0.95	0.95	0.95	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor												
Frt		0.998			0.999			0.941			0.966	
Flt Protected								0.982			0.978	
Satd. Flow (prot)	0	3064	0	0	3067	0	0	1416	0	0	1448	0
Flt Permitted								0.982			0.978	
Satd. Flow (perm)	0	3064	0	0	3067	0	0	1416	0	0	1448	0
Link Speed (k/h)		50		50			30				50	
Link Distance (m)		82.1		96.9			113.5				113.2	
Travel Time (s)		5.9		7.0			13.6				8.2	
Conf. Peds. (#/hr)	8	12	12	8	7							7
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	1%	0%	0%	1%	0%	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	3	637	8	4	696	4	6	3	7	9	6	5
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	648	0	0	704	0	0	16	0	0	20	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Right	Left	Left	Right	Left	Left	Right	Right
Median Width(m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Link Offset(m)	0.0	0.0	0.0	0.0	0.0	0.0	4.8	0.0	0.0	0.0	4.8	0.0
Crosswalk Width(m)	4.8			4.8								
Two way Left Turn Lane												
Headway Factor	1.21	1.21	1.21	1.21	1.21	1.21	1.31	1.31	1.31	1.31	1.31	1.31
Turning Speed (k/h)	25	15	25	15	25	15	25	15	25	15	25	15
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
Intersection Summary												
Area Type:	Other											
Control Type:	Unsignalized											
Intersection Capacity Utilization	37.6%											
Analysis Period (min)	15											
ICU Level of Service A												

Intersection												
Int Delay, s/veh 0.6												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	4L	4T		4L	4T			4L	4T		4L	4T
Traffic Vol. veh/h	3 637	8 4	696	4 6	3 7	9 6	5					
Future Vol. veh/h	3 637	8 4	696	4 6	3 7	9 6	5					
Conflicting Peds. #/hr	8 0	12 12	0 8	7 0	0 0	0 0	7					
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	0	1	0	0	1	0	0	0	0	0	0	0
Mvmt Flow	3 637	8 4	696	4 6	3 7	9 6	5					
Major/Minor												
Conflicting Flow All	708	0	0	657	0	0	1025	1375	335	1040	1377	365
Stage 1	-	-	-	-	-	-	-	659	659	-	714	714
Stage 2	-	-	-	-	-	-	-	366	716	-	326	663
Critical Hwy	4.1	-	-	4.1	-	-	-	7.5	6.5	6.9	7.5	6.5
Critical Hwy Stg 1	-	-	-	-	-	-	-	6.5	5.5	-	6.5	5.5
Critical Hwy Stg 2	-	-	-	-	-	-	-	6.5	5.5	-	6.5	5.5
Follow-up Hwy	2.2	-	-	2.2	-	-	-	3.5	4	3.3	3.5	4
Pot Cap-1 Maneuver	900	-	-	940	-	-	-	192	147	667	187	146
Stage 1	-	-	-	-	-	-	-	424	464	-	393	438
Stage 2	-	-	-	-	-	-	-	631	437	-	666	462
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	894	-	-	931	-	-	-	180	143	661	179	142
Mov Cap-2 Maneuver	-	-	-	-	-	-	-	180	143	-	179	142
Stage 1	-	-	-	-	-	-	-	418	458	-	389	432
Stage 2	-	-	-	-	-	-	-	610	431	-	651	456
Approach												
EB	EB	WB	NB	SB								
HCM Control Delay, s	0	0.1	20.6	25.1								
HCM LOS	C	C	D	D								
Minor Lane/Major Mvmt												
NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	WBR	WBR	WBR	WBR	WBR	WBR
Capacity (veh/h)	247	894	-	-	931	-	-	-	-	199	-	-
HCM Lane V/C Ratio	0.065	0.003	-	-	0.004	-	-	-	-	0.101	-	-
HCM Control Delay (s)	20.6	9	0	-	8.9	0	-	-	-	25.1	-	-
HCM Lane LOS	C	A	A	A	A	A	-	-	-	D	-	-
HCM 95th %tile Q(veh)	0.2	0	-	-	0	-	-	-	-	0.3	-	-

Lanes, Volumes, Timings
 2: Dunbar Road & Erb Street

Existing PM Peak Hour
 (240414) 142-154 Erb Street West, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↔			↔	
Traffic Volume (vph)	2	614	17	8	700	6	10	0	5	3	0	7
Future Volume (vph)	2	614	17	8	700	6	10	0	5	3	0	7
Ideal Flow (vphpl)	1650	1650	1650	1650	1650	1650	1550	1550	1550	1550	1550	1550
Lane Util. Factor	0.95	0.95	0.95	0.95	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor												
Frt		0.996			0.999			0.955			0.905	
Flt Protected					0.999			0.968			0.985	
Sat'd. Flow (prot)	0	3058	0	0	3064	0	0	1417	0	0	1366	0
Flt Permitted					0.999			0.968			0.985	
Sat'd. Flow (perm)	0	3058	0	0	3064	0	0	1417	0	0	1366	0
Link Speed (k/h)		50			50			30			50	
Link Distance (m)		96.9			86.9			119.8			105.6	
Travel Time (s)		7.0			6.3			14.4			7.6	
Confl. Peds. (#/hr)	10		10	10		10		1				1
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	1%	0%	0%	1%	0%	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	2	614	17	8	700	6	10	0	5	3	0	7
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	633	0	0	714	0	0	15	0	0	10	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Link Offset(m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.21	1.21	1.21	1.21	1.21	1.21	1.31	1.31	1.31	1.31	1.31	1.31
Turning Speed (k/h)	25	15	25	15	25	15	25	15	25	15	25	15
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
Intersection Summary												
Area Type: Other												
Control Type: Unsignalized												
Intersection Capacity Utilization 39.3%												
Analysis Period (min) 15												
ICU Level of Service A												

HCM 6th TWSC
 2: Dunbar Road & Erb Street

Existing PM Peak Hour
 (240414) 142-154 Erb Street West, Waterloo TIS

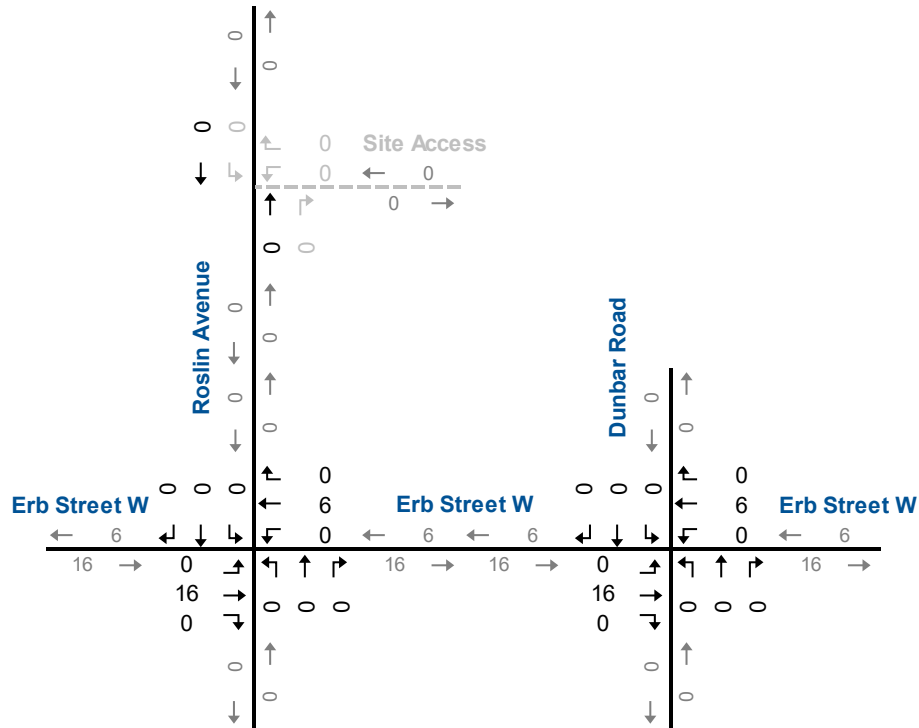
Intersection												
In Delay, s/veh												
0.4												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔↔	↔↔↔		↔↔↔				↔↔		↔↔	↔↔	
Traffic Vol. veh/h	2 614	17	8	700	6	10	0	5	3	0	7	
Future Vol. veh/h	2 614	17	8	700	6	10	0	5	3	0	7	
Conflicting Peds. #/hr	10	0	10	10	0	10	1	0	0	0	0	1
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage. #	-	0	-	-	0	-	0	-	0	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	0	1	0	0	1	0	0	0	0	0	0	0
Mvmt Flow	2 614	17	8	700	6	10	0	5	3	0	7	
Major/Minor												
Conflicting Flow All	716	0	0	641	0	0	1004	1369	326	1040	1374	364
Stage 1	-	-	-	-	-	-	-	637	637	-	729	729
Stage 2	-	-	-	-	-	-	-	367	732	-	311	645
Critical Hdwy	4.1	-	-	4.1	-	-	-	7.5	6.5	6.9	7.5	6.5
Critical Hdwy Stg 1	-	-	-	-	-	-	-	6.5	5.5	-	6.5	5.5
Critical Hdwy Stg 2	-	-	-	-	-	-	-	6.5	5.5	-	6.5	5.5
Follow-up Hdwy	2.2	-	-	2.2	-	-	-	3.5	4	3.3	3.5	4
Pot Cap-1 Maneuver	894	-	-	953	-	-	-	199	148	676	187	147
Stage 1	-	-	-	-	-	-	-	437	475	-	385	431
Stage 2	-	-	-	-	-	-	-	630	430	-	680	471
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	887	-	-	946	-	-	-	193	143	671	182	142
Mov Cap-2 Maneuver	-	-	-	-	-	-	-	193	143	-	182	142
Stage 1	-	-	-	-	-	-	-	432	470	-	381	422
Stage 2	-	-	-	-	-	-	-	614	421	-	673	466
Approach												
EB	EB	WB	NB	SB								
HCM Control Delay, s	0	0.2	20.1	15.2								
HCM LOS			C	C								
Minor Lane/Major Mvmt												
NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1					
Capacity (veh/h)	253	887	-	-	946	-	-	363				
HCM Lane V/C Ratio	0.059	0.002	-	-	0.008	-	-	0.028				
HCM Control Delay (s)	20.1	9.1	0	-	8.8	0.1	-	15.2				
HCM Lane LOS	C	A	A	-	A	A	-	C				
HCM 95th %tile Q(veh)	0.2	0	-	-	0	-	-	0.1				

Appendix D

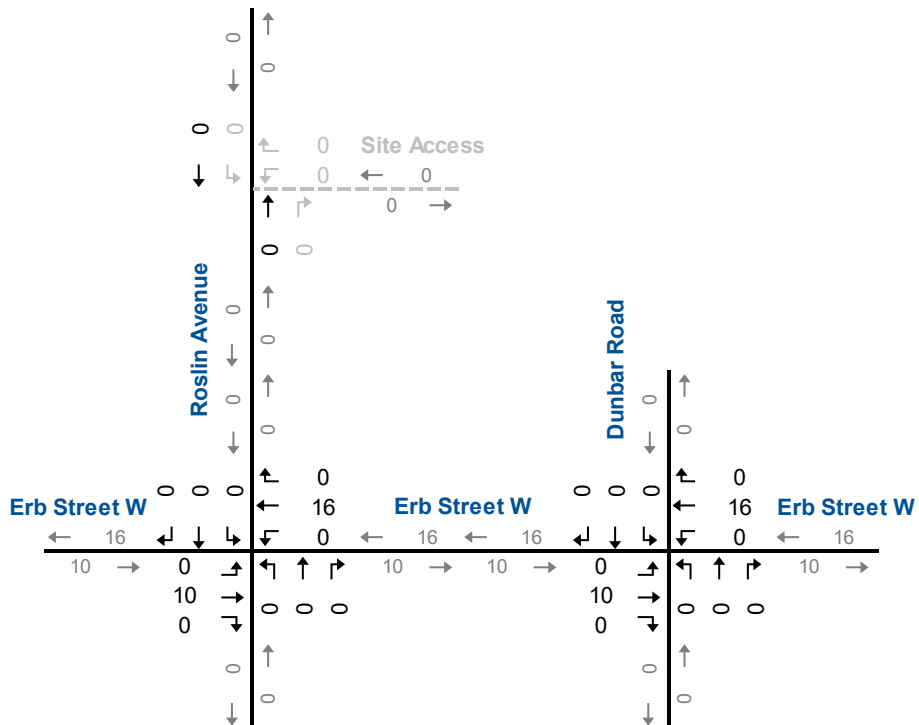
Other Area Development Traffic Volumes



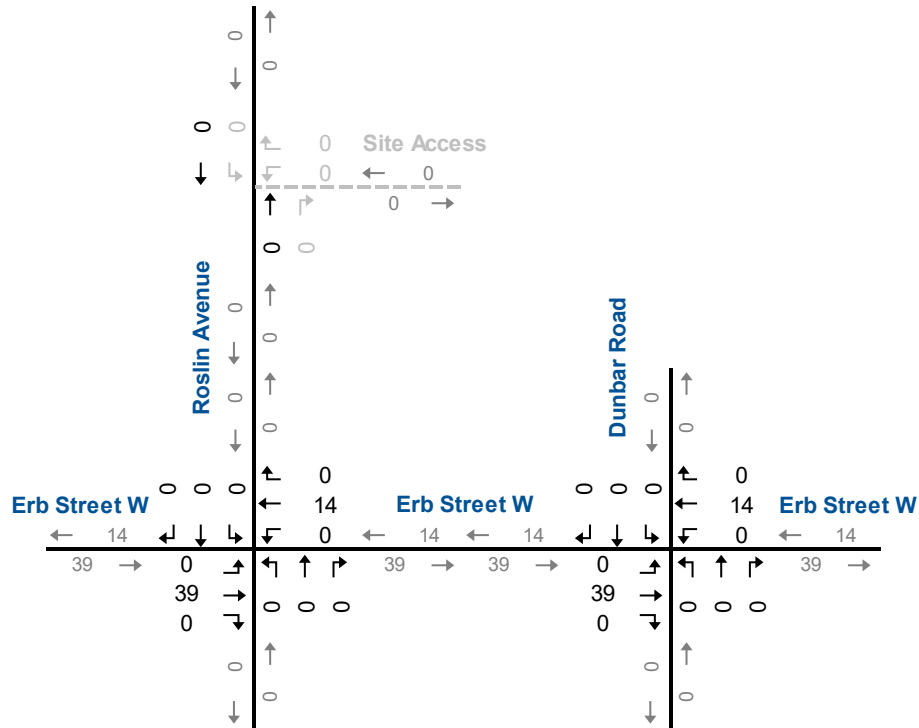
AM Peak Hour



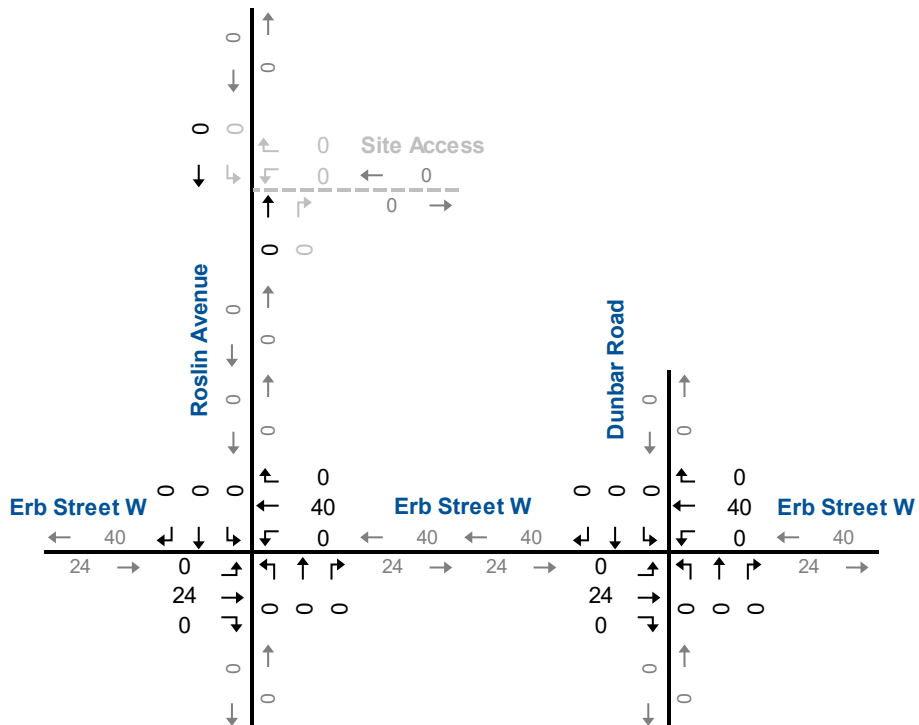
PM Peak Hour



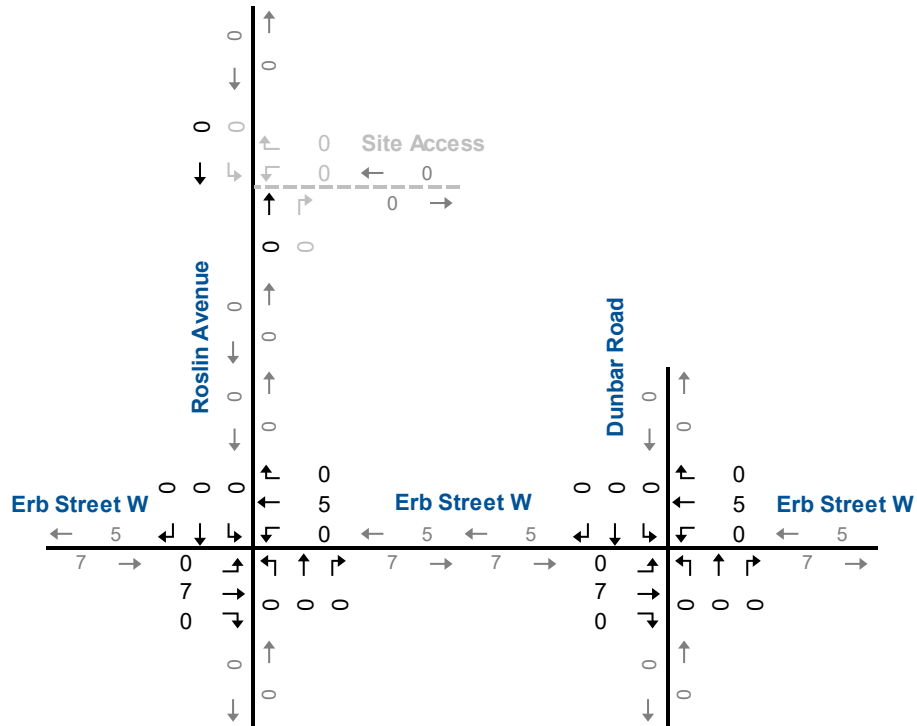
AM Peak Hour



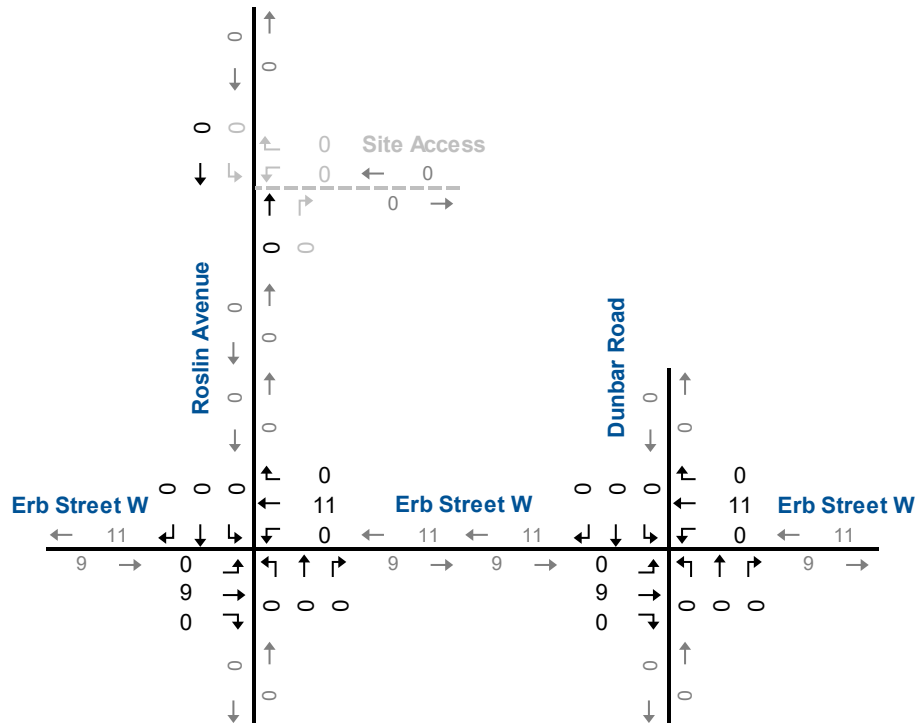
PM Peak Hour



AM Peak Hour



PM Peak Hour



Appendix E

2029 Background Traffic Operations Reports



Lanes, Volumes, Timings

1: Roslin Avenue & Erb Street

Future Background AM Peak Hour
(240414) 142-154 Erb Street West, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		4P		4P	4P			4P			4P	
Traffic Volume (vph)	2	782	5	4	465	8	4	5	7	4	1	4
Future Volume (vph)	2	782	5	4	465	8	4	5	7	4	1	4
Ideal Flow (vphpl)	1650	1650	1650	1650	1650	1650	1550	1550	1550	1550	1550	1550
Lane Util. Factor	0.95	0.95	0.95	0.95	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor												
Frt		0.999			0.997			0.941			0.940	
Flt Protected								0.988			0.978	
Satd. Flow (prot)	0	3037	0	0	2969	0	0	1425	0	0	1153	0
Flt Permitted								0.988			0.978	
Satd. Flow (perm)	0	3037	0	0	2969	0	0	1425	0	0	1153	0
Link Speed (k/h)		50			50			30			50	
Link Distance (m)		82.1			96.9			113.5			113.2	
Travel Time (s)		5.9			7.0			13.6			8.2	
Confl. Peds. (#/hr)	7		8	8		7	9					9
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	2%	0%	0%	4%	13%	0%	0%	0%	0%	0%	50%
Adj. Flow (vph)	2	782	5	4	465	8	4	5	7	4	1	4
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	789	0	0	477	0	0	16	0	0	9	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Right	Left	Left	Right	Left	Left	Right	Right
Median Width(m)		0.0			0.0			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.21	1.21	1.21	1.21	1.21	1.21	1.31	1.31	1.31	1.31	1.31	1.31
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Sign Control		Free			Free			Stop			Stop	
Intersection Summary												
Area Type: Other												
Control Type: Unsignalized												
Intersection Capacity Utilization 39.3%												
Analysis Period (min) 15												
ICU Level of Service A												

HCM 6th TWSC

1: Roslin Avenue & Erb Street

Future Background AM Peak Hour
(240414) 142-154 Erb Street West, Waterloo TIS

Intersection	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Int Delay, s/veh	0.4											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	4P	4P	4P	4P	4P	4P	4P	4P	4P	4P	4P	4P
Traffic Vol. veh/h	2	782	5	4	465	8	4	5	7	4	1	4
Future Vol. veh/h	2	782	5	4	465	8	4	5	7	4	1	4
Conflicting Peds. #/hr	7	0	8	8	0	7	9	0	0	0	0	9
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage. #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	0	2	0	0	4	13	0	0	0	0	0	50
Mvmt Flow	2	782	5	4	465	8	4	5	7	4	1	4
Major/Minor												
Conflicting Flow All	480	0	0	795	0	0	1047	1285	402	882	1283	253
Stage 1	-	-	-	-	-	-	-	797	797	-	484	484
Stage 2	-	-	-	-	-	-	-	250	488	-	398	799
Critical Hwy	4.1	-	-	4.1	-	-	-	7.5	6.5	6.9	7.5	6.5
Critical Hwy Stg 1	-	-	-	-	-	-	-	6.5	5.5	-	6.5	5.5
Critical Hwy Stg 2	-	-	-	-	-	-	-	6.5	5.5	-	6.5	5.5
Follow-up Hwy	2.2	-	-	2.2	-	-	-	3.5	4	3.3	3.5	4
Pot Cap-1 Maneuver	1093	-	-	835	-	-	-	185	166	604	244	167
Stage 1	-	-	-	-	-	-	-	351	401	-	538	555
Stage 2	-	-	-	-	-	-	-	738	553	-	605	401
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1087	-	-	830	-	-	-	179	163	600	233	163
Mov Cap-2 Maneuver	-	-	-	-	-	-	-	179	163	-	233	163
Stage 1	-	-	-	-	-	-	-	348	397	-	534	548
Stage 2	-	-	-	-	-	-	-	722	546	-	589	397
Approach												
EB	EB	WB	WB	EB	EB	WB	NB	NB	SB	SB	EB	EB
HCM Control Delay, s	0	0.1	0.1	0.1	0.1	0.1	20.6	17.3	17.3	17.3	17.3	17.3
HCM LOS	C	C	C	C	C	C	C	C	C	C	C	C
Minor Lane/Major Mvmt												
NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	WBR	SBLn1				
Capacity (veh/h)	247	1087	-	-	830	-	-	302				
HCM Lane V/C Ratio	0.065	0.002	-	-	0.005	-	-	0.03				
HCM Control Delay (s)	20.6	8.3	0	-	9.4	0	-	17.3				
HCM Lane LOS	C	A	A	A	A	A	A	C				
HCM 95th %tile Q(veh)	0.2	0	-	-	0	-	-	0.1				

Lanes, Volumes, Timings
2: Dunbar Road & Erb Street

HCM 6th TWSC
2: Dunbar Road & Erb Street

Future Background AM Peak Hour
(240414) 142-154 Erb Street West, Waterloo TIS

Future Background AM Peak Hour
(240414) 142-154 Erb Street West, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	786	11	5	465	4	6	0	7	4	4	0
Future Volume (vph)	0	786	11	5	465	4	6	0	7	4	4	0
Ideal Flow (vphpl)	1650	1650	1650	1650	1650	1650	1550	1550	1550	1550	1550	1550
Lane Util. Factor	0.95	0.95	0.95	0.95	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		0.998			0.999		0.927				0.973	
Frt					0.999		0.977				0.962	
Flt Protected					0.999		0.977				0.962	
Satd. Flow (prot)	0	3005	0	0	2965	0	0	1291	0	0	1196	0
Flt Permitted					0.999		0.977				0.962	
Satd. Flow (perm)	0	3005	0	0	2965	0	0	1291	0	0	1196	0
Link Speed (k/h)		50			50		30				50	
Link Distance (m)		96.9			86.9		119.8				105.6	
Travel Time (s)		7.0			6.3		14.4				7.6	
Conf. Peds. (#/hr)	10	11	11	11	10				1			
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	3%	0%	0%	4%	50%	0%	0%	14%	0%	0%	100%
Adj. Flow (vph)	0	786	11	5	465	4	6	0	7	4	4	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	797	0	0	474	0	0	13	0	0	5	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Right	Left	Left	Right	Left	Left	Right	Right
Median Width(m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Link Offset(m)	0.0	0.0	0.0	0.0	0.0	0.0	4.8	0.0	0.0	0.0	4.8	0.0
Crosswalk Width(m)	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8
Two way Left Turn Lane	1.21	1.21	1.21	1.21	1.21	1.21	1.31	1.31	1.31	1.31	1.31	1.31
Headway Factor	25	25	15	25	15	25	25	15	25	25	15	15
Turning Speed (k/h)	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
Sign Control												
Intersection Summary												
Area Type:	Other											
Control Type:	Unsignalized											
Intersection Capacity Utilization	35.8%											
Analysis Period (min)	15											
ICU Level of Service A												

Intersection	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Int Delay, s/veh	0.3											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol. veh/h	0	786	11	5	465	4	6	0	7	4	4	0
Future Vol. veh/h	0	786	11	5	465	4	6	0	7	4	4	0
Conflicting Peds. #/hr	10	0	11	11	0	10	0	0	1	1	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage. #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	0	3	0	0	4	50	0	0	14	0	0	100
Mvmt Flow	0	786	11	5	465	4	6	0	7	4	4	0
Major/Minor	Major1	Major2	Major3	Minor1	Minor2	Minor3	Major1	Major2	Major3	Minor1	Minor2	Minor3
Conflicting Flow All	479	0	0	808	0	0	1046	1292	411	881	1295	245
Stage 1	-	-	-	-	-	-	-	803	803	-	487	487
Stage 2	-	-	-	-	-	-	-	243	489	-	394	808
Critical Hwy	4.1	-	-	4.1	-	-	-	7.5	6.5	7.18	7.5	6.5
Critical Hwy Stg 1	-	-	-	-	-	-	-	6.5	5.5	-	6.5	5.5
Critical Hwy Stg 2	-	-	-	-	-	-	-	6.5	5.5	-	6.5	5.5
Follow-up Hwy	2.2	-	-	2.2	-	-	-	3.5	4	3.44	3.5	4
Pot Cap-1 Maneuver	1094	-	-	826	-	-	-	185	165	557	244	164
Stage 1	-	-	-	-	-	-	-	348	399	-	536	554
Stage 2	-	-	-	-	-	-	-	745	553	-	608	397
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1086	-	-	819	-	-	-	182	161	552	237	160
Mov Cap-2 Maneuver	-	-	-	-	-	-	-	182	161	-	237	160
Stage 1	-	-	-	-	-	-	-	345	395	-	532	545
Stage 2	-	-	-	-	-	-	-	738	544	-	600	393
Approach	EB	WB	NB	SB	EB	WB	NB	SB	EB	WB	NB	SB
HCM Control Delay, s	0	0.1	18.2	18.8	0	0.1	18.2	18.8	0	0.1	18.2	18.8
HCM LOS	C	C	C	C	C	C	C	C	C	C	C	C
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	WBR	SBLn1	WBR	SBLn1
Capacity (veh/h)	285	1086	-	-	819	-	-	266	-	-	266	-
HCM Lane V/C Ratio	0.046	-	-	-	0.006	-	-	0.019	-	-	0.019	-
HCM Control Delay (s)	18.2	0	-	-	9.4	0	-	18.8	-	-	18.8	-
HCM Lane LOS	C	A	-	-	A	-	-	C	-	-	C	-
HCM 95th %tile Q(veh)	0.1	0	-	-	0	-	-	0.1	-	-	0.1	-

Lanes, Volumes, Timings

1: Roslin Avenue & Erb Street

HCM 6th TWSC

Future Background PM Peak Hour
(240414) 142-154 Erb Street West, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔↔		↔↔	↔↔			↔↔			↔↔	
Traffic Volume (vph)	3	696	8	4	781	4	6	3	7	9	6	5
Future Volume (vph)	3	696	8	4	781	4	6	3	7	9	6	5
Ideal Flow (vphpl)	1650	1650	1650	1650	1650	1650	1550	1550	1550	1550	1550	1550
Lane Util. Factor	0.95	0.95	0.95	0.95	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor												
Frt		0.998			0.999			0.941			0.966	
Flt Protected								0.982			0.978	
Satd. Flow (prot)	0	3064	0	0	3067	0	0	1416	0	0	1448	0
Flt Permitted								0.982			0.978	
Satd. Flow (perm)	0	3064	0	0	3067	0	0	1416	0	0	1448	0
Link Speed (k/h)		50			50			30			50	
Link Distance (m)		82.1			96.9			113.5			113.2	
Travel Time (s)		5.9			7.0			13.6			8.2	
Confl. Peds. (#/hr)	8	12	12	12	7.0	8	7					7
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	1%	0%	0%	1%	0%	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	3	696	8	4	781	4	6	3	7	9	6	5
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	707	0	0	789	0	0	16	0	0	20	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right	Right
Median Width(m)		0.0			0.0		0.0	0.0			0.0	
Link Offset(m)		0.0			0.0		0.0	0.0			0.0	
Crosswalk Width(m)		4.8			4.8		4.8				4.8	
Two way Left Turn Lane												
Headway Factor	1.21	1.21	1.21	1.21	1.21	1.21	1.31	1.31	1.31	1.31	1.31	1.31
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Sign Control		Free			Free			Stop			Stop	
Intersection Summary												
Area Type: Other												
Control Type: Unsignalized												
Intersection Capacity Utilization 40.3%												
Analysis Period (min) 15												
ICU Level of Service A												

Paradigm Transportation Solutions Limited

Synchro 11 Report
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Intersection	0.6											
Int Delay, s/veh												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	4L			4L			4L			4L		
Traffic Vol. veh/h	3 696	8	4	781	4	6	3	7	9	6	5	
Future Vol. veh/h	3 696	8	4	781	4	6	3	7	9	6	5	
Conflicting Peds. #/hr	8	0	12	0	8	7	0	0	0	0	7	
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	0	1	0	0	1	0	0	0	0	0	0	0
Mvmt Flow	3 696	8	4	781	4	6	3	7	9	6	5	
Major/Minor												
Conflicting Flow All	793	0	0	716	0	0	1127	1519	364	1155	1521	408
Stage 1	-	-	-	-	-	-	718	718	-	799	799	-
Stage 2	-	-	-	-	-	-	409	801	-	356	722	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.5	6.5	6.9	7.5	6.5	6.9
Critical Hdwy Stg 1	-	-	-	-	-	-	6.5	5.5	-	6.5	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.5	5.5	-	6.5	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	837	-	-	894	-	-	162	120	639	154	120	598
Stage 1	-	-	-	-	-	-	391	436	-	350	401	-
Stage 2	-	-	-	-	-	-	596	400	-	640	434	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	832	-	-	886	-	-	150	117	633	147	117	591
Mov Cap-2 Maneuver	-	-	-	-	-	-	150	117	-	147	117	-
Stage 1	-	-	-	-	-	-	385	429	-	346	395	-
Stage 2	-	-	-	-	-	-	574	394	-	625	427	-
Approach												
EB	EB	WB	NB	SB								
HCM Control Delay, s	0	0	23.6	29.8								
HCM LOS	C D											
Minor Lane/Major Mvmt												
NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	WBR	WBR	WBR	WBR	WBR	WBR
Capacity (veh/h)	209	832	-	-	886	-	-	-	-	165	-	-
HCM Lane V/C Ratio	0.077	0.004	-	-	0.005	-	-	-	-	0.121	-	-
HCM Control Delay (s)	23.6	9.3	0	-	9.1	0	-	-	-	29.8	-	-
HCM Lane LOS	C	A	A	A	A	A	A	A	-	D	-	-
HCM 95th %tile Q(veh)	0.2	0	-	-	0	-	-	-	-	0.4	-	-

Paradigm Transportation Solutions Limited

Synchro 11 Report
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Lanes, Volumes, Timings
2: Dunbar Road & Erb Street

HCM 6th TWSC
2: Dunbar Road & Erb Street

Future Background PM Peak Hour
(240414) 142-154 Erb Street West, Waterloo TIS

Future Background PM Peak Hour
(240414) 142-154 Erb Street West, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		4P		4P			4P			4P		
Traffic Volume (vph)	2	673	18	8	785	6	11	0	5	3	0	7
Future Volume (vph)	2	673	18	8	785	6	11	0	5	3	0	7
Ideal Flow (vphpl)	1650	1650	1650	1650	1650	1650	1550	1550	1550	1550	1550	1550
Lane Util. Factor	0.95	0.95	0.95	0.95	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		0.996			0.999			0.958			0.905	
Frt Protected					0.999			0.967			0.985	
Satd. Flow (prot)	0	3058	0	0	3064	0	0	1420	0	0	1366	0
Flt Permitted					0.999			0.967			0.985	
Satd. Flow (perm)	0	3058	0	0	3064	0	0	1420	0	0	1366	0
Link Speed (k/h)		50			50			30			50	
Link Distance (m)		96.9			86.9			119.8			105.6	
Travel Time (s)		7.0			6.3			14.4			7.6	
Confl. Peds. (#/hr)	10		10	10		10		1				1
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	1%	0%	0%	1%	0%	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	2	673	18	8	785	6	11	0	5	3	0	7
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	693	0	0	799	0	0	16	0	0	10	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Right	Left	Left	Right	Left	Left	Right	Right
Median Width(m)		0.0			0.0			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.21	1.21	1.21	1.21	1.21	1.21	1.31	1.31	1.31	1.31	1.31	1.31
Turning Speed (k/h)	25	15	25	15	25	15	25	15	25	25	15	15
Sign Control		Free			Free			Stop			Stop	
Intersection Summary												
Area Type:	Other											
Control Type:	Unsignalized											
Intersection Capacity Utilization	42.0%											
Analysis Period (min)	15											
ICU Level of Service A												

Intersection												
In Delay, s/veh												
0.5												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	4P			4P			4P			4P		
Traffic Vol. veh/h	2	673	18	8	785	6	11	0	5	3	0	7
Future Vol. veh/h	2	673	18	8	785	6	11	0	5	3	0	7
Conflicting Peds. #/hr	10	0	10	10	0	10	1	0	0	0	0	1
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage. #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	0	1	0	0	1	0	0	0	0	0	0	0
Mvmt Flow	2	673	18	8	785	6	11	0	5	3	0	7
Major/Minor												
Conflicting Flow All	801	0	0	701	0	0	1106	1513	356	1155	1519	407
Stage 1	-	-	-	-	-	-	-	696	696	-	814	814
Stage 2	-	-	-	-	-	-	-	410	817	-	341	705
Critical Hwy	4.1	-	-	4.1	-	-	-	7.5	6.5	6.9	7.5	6.5
Critical Hwy Stg 1	-	-	-	-	-	-	-	6.5	5.5	-	6.5	5.5
Critical Hwy Stg 2	-	-	-	-	-	-	-	6.5	5.5	-	6.5	5.5
Follow-up Hwy	2.2	-	-	2.2	-	-	-	3.5	4	3.3	3.5	4
Pot Cap-1 Maneuver	831	-	-	905	-	-	-	168	121	646	154	120
Stage 1	-	-	-	-	-	-	-	403	446	-	342	394
Stage 2	-	-	-	-	-	-	-	595	393	-	653	442
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	825	-	-	898	-	-	-	162	117	641	149	116
Mov Cap-2 Maneuver	-	-	-	-	-	-	-	162	117	-	149	116
Stage 1	-	-	-	-	-	-	-	398	441	-	338	385
Stage 2	-	-	-	-	-	-	-	578	384	-	645	437
Approach												
EB	EB	WB	NB	SB								
Control Delay, s	0	0.2	23.5	16.9								
Control LOS	C	C	C	C								
Minor Lane/Major Mvmt												
NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1					
Capacity (veh/h)	211	825	-	-	898	-	-	313				
HCM Lane V/C Ratio	0.076	0.002	-	-	0.009	-	-	0.032				
HCM Control Delay (s)	23.5	9.4	0	-	9	0.1	-	16.9				
HCM Lane LOS	C	A	-	-	A	-	-	C				
HCM 95th %tile Q(veh)	0.2	0	-	-	0	-	-	0.1				

Appendix F

2029 Total Traffic Operations Reports



Lanes, Volumes, Timings

1: Roslin Avenue & Erb Street

Future Total AM Peak Hour
(240414) 142-154 Erb Street West, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	4	4	4	4	4	4	4	4	4	4	4	4
Traffic Volume (vph)	4	782	5	4	465	12	4	5	7	24	1	18
Future Volume (vph)	4	782	5	4	465	12	4	5	7	24	1	18
Ideal Flow (vphpl)	1650	1650	1650	1650	1650	1650	1550	1550	1550	1550	1550	1550
Lane Util. Factor	0.95	0.95	0.95	0.95	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor	0.999											
Frt					0.996		0.941					0.943
Flt Protected									0.988			0.973
Satd. Flow (prot)	0	3037	0	0	2964	0	0	1425	0	0	1163	0
Flt Permitted									0.988			0.973
Satd. Flow (perm)	0	3037	0	0	2964	0	0	1425	0	0	1163	0
Link Speed (k/h)					50		30					50
Link Distance (m)					96.9		113.5					34.5
Travel Time (s)					7.0		13.6					2.5
Confl. Peds. (#/hr)	7	5.9	8	8	7	9						9
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	2%	0%	0%	4%	13%	0%	0%	0%	0%	0%	50%
Adj. Flow (vph)	4	782	5	4	465	12	4	5	7	24	1	18
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	791	0	0	481	0	0	16	0	0	43	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Right	Left	Left	Right	Left	Left	Right	Right
Median Width(m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Link Offset(m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Crosswalk Width(m)	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8
Two way Left Turn Lane	1.21	1.21	1.21	1.21	1.21	1.21	1.31	1.31	1.31	1.31	1.31	1.31
Headway Factor	25	15	25	15	25	15	25	15	25	15	25	15
Turning Speed (k/h)	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
Sign Control												
Intersection Summary												
Area Type:	Other											
Control Type:	Unsignalized											
Intersection Capacity Utilization	43.3%											
Analysis Period (min)	15											
	ICU Level of Service A											

HCM 6th TWSC

1: Roslin Avenue & Erb Street

Future Total AM Peak Hour
(240414) 142-154 Erb Street West, Waterloo TIS

Intersection	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
In Delay, s/veh	0.9											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	4	4	4	4	4	4	4	4	4	4	4	4
Traffic Vol. veh/h	4	782	5	4	465	12	4	5	7	24	1	18
Future Vol. veh/h	4	782	5	4	465	12	4	5	7	24	1	18
Conflicting Peds. #/hr	7	0	8	8	0	7	9	0	0	0	0	9
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage. #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	0	2	0	0	4	13	0	0	0	0	0	50
Mvmt Flow	4	782	5	4	465	12	4	5	7	24	1	18
Major/Minor	Major1	Major2	Minor1	Minor2	Minor1	Minor2	Minor1	Minor2	Minor1	Minor2	Minor1	Minor2
Conflicting Flow All	484	0	0	795	0	0	1051	1293	402	888	1289	255
Stage 1	-	-	-	-	-	-	-	801	801	-	486	486
Stage 2	-	-	-	-	-	-	-	250	492	-	402	803
Critical Hwy	4.1	-	-	4.1	-	-	-	7.5	6.5	6.9	7.5	6.5
Critical Hwy Stg 1	-	-	-	-	-	-	-	6.5	5.5	-	6.5	5.5
Critical Hwy Stg 2	-	-	-	-	-	-	-	6.5	5.5	-	6.5	5.5
Follow-up Hwy	2.2	-	-	2.2	-	-	-	3.5	4	3.3	3.5	4
Pot Cap-1 Maneuver	1089	-	-	835	-	-	-	184	164	604	241	165
Stage 1	-	-	-	-	-	-	-	349	400	-	537	554
Stage 2	-	-	-	-	-	-	-	738	551	-	601	399
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1083	-	-	830	-	-	-	174	160	600	229	161
Mov Cap-2 Maneuver	-	-	-	-	-	-	-	174	160	-	229	161
Stage 1	-	-	-	-	-	-	-	344	395	-	531	547
Stage 2	-	-	-	-	-	-	-	705	544	-	582	394
Approach	EB	WB	NB	SB	EB	WB	NB	SB	EB	WB	NB	SB
HCM Control Delay, s	0	0.1	0.1	0.1	0.1	0.1	20.9	18.7	0.1	0.1	0.1	0.1
HCM LOS	C	C	C	C	C	C	C	C	C	C	C	C
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	WBR	SBLn1	WBR	SBLn1
Capacity (veh/h)	243	1083	-	-	830	-	-	-	-	-	306	-
HCM Lane V/C Ratio	0.066	0.004	-	-	0.005	-	-	-	-	-	0.141	-
HCM Control Delay (s)	20.9	8.3	0	-	9.4	0	-	-	-	-	18.7	-
HCM Lane LOS	C	A	A	A	A	A	A	A	A	A	C	C
HCM 95th %tile Q(veh)	0.2	0	-	-	0	-	-	-	-	-	0.5	-

Lanes, Volumes, Timings
2: Dunbar Road & Erb Street

HCM 6th TWSC
2: Dunbar Road & Erb Street

Future Total AM Peak Hour
(240414) 142-154 Erb Street West, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		4P		4P			4P			4P		
Traffic Volume (vph)	0	806	11	5	469	4	6	0	7	4	0	1
Future Volume (vph)	0	806	11	5	469	4	6	0	7	4	0	1
Ideal Flow (vphpl)	1650	1650	1650	1650	1650	1650	1550	1550	1550	1550	1550	1550
Lane Util. Factor	0.95	0.95	0.95	0.95	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		0.998			0.999			0.927			0.973	
Frt					0.999			0.977			0.962	
Flt Protected					0.999			0.977			0.962	
Satd. Flow (prot)	0	3005	0	0	2965	0	0	1291	0	0	1196	0
Flt Permitted					0.999			0.977			0.962	
Satd. Flow (perm)	0	3005	0	0	2965	0	0	1291	0	0	1196	0
Link Speed (k/h)					50			30			50	
Link Distance (m)					86.9			119.8			105.6	
Travel Time (s)					6.3			14.4			7.6	
Conf. Peds. (#/hr)	10	11	11	11	10			1			1	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	3%	0%	0%	4%	50%	0%	0%	14%	0%	0%	100%
Adj. Flow (vph)	0	806	11	5	469	4	6	0	7	4	0	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	817	0	0	478	0	0	13	0	0	5	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right
Median Width(m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Link Offset(m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Crosswalk Width(m)	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8
Two way Left Turn Lane	1.21	1.21	1.21	1.21	1.21	1.21	1.31	1.31	1.31	1.31	1.31	1.31
Headway Factor	25	15	25	15	25	15	25	15	25	25	15	15
Turning Speed (k/h)		Free			Free			Stop			Stop	
Sign Control												
Intersection Summary												
Area Type:	Other											
Control Type:	Unsignalized											
Intersection Capacity Utilization	36.4%											
Analysis Period (min)	15											
	ICU Level of Service A											

Intersection	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Int Delay, s/veh	0.3											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		4P		4P			4P			4P		
Traffic Vol. veh/h	0	806	11	5	469	4	6	0	7	4	0	1
Future Vol. veh/h	0	806	11	5	469	4	6	0	7	4	0	1
Conflicting Peds. #/hr	10	0	11	11	0	10	0	0	1	1	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage. #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	0	3	0	0	4	50	0	0	14	0	0	100
Mvmt Flow	0	806	11	5	469	4	6	0	7	4	0	1
Major/Minor	Major1	Major2	Major2	Minor1	Minor1	Minor2						
Conflicting Flow All	483	0	0	828	0	0	1068	1316	421	895	1319	247
Stage 1	-	-	-	-	-	-	823	823	-	491	491	-
Stage 2	-	-	-	-	-	-	245	493	-	404	828	-
Critical Hwy	4.1	-	-	4.1	-	-	7.5	6.5	7.18	7.5	6.5	8.9
Critical Hwy Stg 1	-	-	-	-	-	-	6.5	5.5	-	6.5	5.5	-
Critical Hwy Stg 2	-	-	-	-	-	-	6.5	5.5	-	6.5	5.5	-
Follow-up Hwy	2.2	-	-	2.2	-	-	3.5	4	3.44	3.5	4	4.3
Pot Cap-1 Maneuver	1090	-	-	812	-	-	179	159	549	239	158	525
Stage 1	-	-	-	-	-	-	338	391	-	533	552	-
Stage 2	-	-	-	-	-	-	743	550	-	600	389	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1082	-	-	805	-	-	176	155	544	233	154	521
Mov Cap-2 Maneuver	-	-	-	-	-	-	176	155	-	233	154	-
Stage 1	-	-	-	-	-	-	335	387	-	529	543	-
Stage 2	-	-	-	-	-	-	736	541	-	592	385	-
Approach	EB	WB	NB	SB								
HCM Control Delay, s	0	0.1					18.6			19		
HCM LOS			C						C			
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1				
Capacity (veh/h)	277	1082	-	-	-	805	-	-	262			
HCM Lane V/C Ratio	0.047	-	-	-	-	0.006	-	-	0.019			
HCM Control Delay (s)	18.6	0	-	-	-	9.5	0	-	19			
HCM Lane LOS	C	A	-	-	-	A	-	-	C			
HCM 95th %tile Q(veh)	0.1	0	-	-	-	0	-	-	0.1			

Lanes, Volumes, Timings
 3: Roslin Avenue & Site Access

Future Total AM Peak Hour
 (240414) 142-154 Erb Street West, Waterloo TIS

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	W		P			4
Traffic Volume (vph)	34	0	15	6	0	9
Future Volume (vph)	34	0	15	6	0	9
Ideal Flow (vphpl)	1765	1765	1650	1650	1650	1650
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Friction	0.961					
Flt Protected	0.950					
Satd. Flow (prot)	1658					
Flt Permitted	0.950					
Satd. Flow (perm)	1658					
Link Speed (k/h)	50					
Link Distance (m)	56.8					
Travel Time (s)	4.1					
Peak Hour Factor	1.00					
Heavy Vehicles (%)	0%					
Adj. Flow (vph)	34					
Shared Lane Traffic (%)	0					
Lane Group Flow (vph)	34					
Enter Blocked Intersection	No					
Lane Alignment	Left					
Median Width(m)	3.5					
Link Offset(m)	0.0					
Crosswalk Width(m)	4.8					
Two way Left Turn Lane	1.12					
Headway Factor	25					
Turning Speed (k/h)	15					
Sign Control	Stop					
Intersection Summary	Other					
Area Type:	Unsignalized					
Control Type:	ICU Level of Service A					
Intersection Capacity Utilization	13.3%					
Analysis Period (min)	15					

HCM 6th TWSC
 3: Roslin Avenue & Site Access

Future Total AM Peak Hour
 (240414) 142-154 Erb Street West, Waterloo TIS

Intersection	WBL	WBR	NBT	NBR	SBL	SBT
Int Delay, s/veh	4.7					
Movement	W		P			4
Lane Configurations	W		P			4
Traffic Vol. veh/h	34	0	15	6	0	9
Future Vol. veh/h	34	0	15	6	0	9
Conflicting Peds. #/hr	0					
Sign Control	Stop					
RT Channelized	- None -					
Storage Length	0					
Veh in Median Storage. #	0					
Grade, %	0					
Peak Hour Factor	100					
Heavy Vehicles, %	0					
Mvmt Flow	34					
Major/Minor	Minor1	Major1	Major2			
Conflicting Flow All	27	18	0	0	21	0
Stage 1	18	-	-	-	-	-
Stage 2	9	-	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	993	1066	-	-	1608	-
Stage 1	1010	-	-	-	-	-
Stage 2	1019	-	-	-	-	-
Platoon blocked, %	-					
Mov Cap-1 Maneuver	993	1066	-	-	1608	-
Mov Cap-2 Maneuver	993	-	-	-	-	-
Stage 1	1010	-	-	-	-	-
Stage 2	1019	-	-	-	-	-
Approach	WB	NB	SB			
HCM Control Delay, s	8.8	0	0			
HCM LOS	A					
Minor Lane/Major Mvmt	NBT	NBR/WBLn1	SBL	SBT		
Capacity (veh/h)	-	-	993	1608	-	-
HCM Lane V/C Ratio	-	-	0.034	-	-	-
HCM Control Delay (s)	-	-	8.8	0	-	-
HCM Lane LOS	-	-	A	A	-	-
HCM 95th %tile Q(veh)	-	-	0.1	0	-	-

Lanes, Volumes, Timings

1: Roslin Avenue & Erb Street

Future Total PM Peak Hour
(240414) 142-154 Erb Street West, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔↔↔			↔↔↔			↔↔			↔↔	
Traffic Volume (vph)	15	696	8	4	781	22	6	3	7	15	6	9
Future Volume (vph)	15	696	8	4	781	22	6	3	7	15	6	9
Ideal Flow (vphpl)	1650	1650	1650	1650	1650	1650	1550	1550	1550	1550	1550	1550
Lane Util. Factor	0.95	0.95	0.95	0.95	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor												
Frt	0.998				0.996			0.941			0.959	
Flt Protected	0.999							0.982			0.976	
Satd. Flow (prot)	0	3061	0	0	3058	0	0	1416	0	0	1435	0
Flt Permitted	0.999							0.982			0.976	
Satd. Flow (perm)	0	3061	0	0	3058	0	0	1416	0	0	1435	0
Link Speed (k/h)	50				50			30			50	
Link Distance (m)	82.1				96.9			113.5			34.5	
Travel Time (s)	5.9				7.0			13.6			2.5	
Confit. Peds. (#/hr)	8		12	12		8	7					7
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	1%	0%	0%	1%	0%	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	15	696	8	4	781	22	6	3	7	15	6	9
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	719	0	0	807	0	0	16	0	0	30	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)	0.0				0.0			0.0			0.0	
Link Offset(m)	0.0				0.0			0.0			0.0	
Crosswalk Width(m)	4.8				4.8			4.8			4.8	
Two way Left Turn Lane	1.21	1.21	1.21	1.21	1.21	1.21	1.31	1.31	1.31	1.31	1.31	1.31
Headway Factor	25											
Turning Speed (k/h)	Free	15	25	15	25	15	25	15	25	15	25	15
Sign Control	Free				Free			Stop			Stop	
Intersection Summary												
Area Type: Other												
Control Type: Unsignalized												
Intersection Capacity Utilization 46.9%												
Analysis Period (min) 15												
ICU Level of Service A												

HCM 6th TWSC

1: Roslin Avenue & Erb Street

Future Total PM Peak Hour
(240414) 142-154 Erb Street West, Waterloo TIS

Intersection												
Int Delay, s/veh												
1												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰↱	↰↱		↰↱	↰↱			↰↱	↰↱		↰↱	
Traffic Vol, veh/h	15	696	8	4	781	22	6	3	7	15	6	9
Future Vol, veh/h	15	696	8	4	781	22	6	3	7	15	6	9
Conflicting Peds, #/hr	8	0	12	12	0	8	7	0	0	0	0	7
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	0	1	0	0	1	0	0	0	0	0	0	0
Mvmt Flow	15	696	8	4	781	22	6	3	7	15	6	9
Major/Minor												
Conflicting Flow All	811	0	0	716	0	0	1151	1561	364	1188	1554	417
Stage 1	-	-	-	-	-	-	-	742	742	-	808	808
Stage 2	-	-	-	-	-	-	-	409	819	-	380	746
Critical Hdwy	4.1	-	-	4.1	-	-	-	7.5	6.5	6.9	7.5	6.5
Critical Hdwy Stg 1	-	-	-	-	-	-	-	6.5	5.5	-	6.5	5.5
Critical Hdwy Stg 2	-	-	-	-	-	-	-	6.5	5.5	-	6.5	5.5
Follow-up Hdwy	2.2	-	-	2.2	-	-	-	3.5	4	3.3	3.5	4
Pot Cap-1 Maneuver	824	-	-	894	-	-	-	155	113	639	146	114
Stage 1	-	-	-	-	-	-	-	378	425	-	345	397
Stage 2	-	-	-	-	-	-	-	596	392	-	619	424
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	819	-	-	886	-	-	-	140	107	633	136	108
Mov Cap-2 Maneuver	-	-	-	-	-	-	-	140	107	-	136	108
Stage 1	-	-	-	-	-	-	-	363	408	-	333	391
Stage 2	-	-	-	-	-	-	-	570	387	-	589	407
Approach												
EB	EB	WB	NB	SB								
HCM Control Delay, s	0.3	0	25.1	31.6								
HCM LOS	D	D	D	D								
Minor Lane/Major Mvmt												
NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	NBLn1	WBR	WBR	WBR	WBR	WBR
Capacity (veh/h)	195	819	-	-	886	-	-	-	-	165	-	-
HCM Lane V/C Ratio	0.082	0.018	-	-	0.005	-	-	-	-	0.182	-	-
HCM Control Delay (s)	25.1	9.5	0.1	-	9.1	0	-	-	-	31.6	-	-
HCM Lane LOS	D	A	-	-	A	-	-	-	-	D	-	-
HCM 95th %tile Q(veh)	0.3	0.1	-	-	0	-	-	-	-	0.6	-	-

Lanes, Volumes, Timings

2: Dunbar Road & Erb Street

Future Total PM Peak Hour
(240414) 142-154 Erb Street West, Waterloo TIS

[illegible]

HCM 6th TWSC
2: Dunbar Road & Erb Street

Future Total PM Peak Hour
(240414) 142-154 Erb Street West, Waterloo TIS

Intersection												
Int Delay, s/veh												
0.5												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	2 	2 	2 	8	8	8	6	11	0	5	3	0 7 
Traffic Vol, veh/h	2	679	18	8	803	6	11	0	5	3	0	7
Future Vol, veh/h	2	679	18	8	803	6	11	0	5	3	0	7
Conflicting Peds, #/hr	10	0	10	10	0	10	0	10	0	0	0	1
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	0	1	0	0	1	0	0	0	0	0	0	0
Mvmt Flow	2	679	18	8	803	6	11	0	5	3	0	7
Major/Minor	Major1		Major2		Minor1		Minor2					
Conflicting Flow All	819	0	0	707	0	0	1121	1537	359	1176	1543	416
Stage 1	-	-	-	-	-	-	-	702	702	-	832	832
Stage 2	-	-	-	-	-	-	-	419	835	-	344	711
Critical Hdwy	4.1	-	4.1	-	-	7.5	6.5	6.9	7.5	6.5	6.5	6.9
Critical Hdwy Stg 1	-	-	-	-	-	-	-	6.5	5.5	-	6.5	5.5
Critical Hdwy Stg 2	-	-	-	-	-	-	-	6.5	5.5	-	6.5	5.5
Follow-up Hdwy	2.2	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3	
Pot Cap-1 Maneuver	818	-	901	-	-	163	117	643	149	116	591	
Stage 1	-	-	-	-	-	400	443	-	334	387	-	
Stage 2	-	-	-	-	-	588	386	-	650	439	-	
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	812	-	894	-	-	157	113	638	144	112	586	
Mov Cap-2 Maneuver	-	-	-	-	-	157	113	-	144	112	-	
Stage 1	-	-	-	-	-	395	438	-	330	378	-	
Stage 2	-	-	-	-	-	571	377	-	642	434	-	
Approach	EB		WB		NB		SB					
HCM Control Delay, s	0	0.2		24		17.2						
HCM LOS			C		C		C					
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1				
Capacity (veh/h)	205	812	-	-	894	-	-	305				
HCM Lane V/C Ratio	0.078	0.002	-	-	0.009	-	-	0.033				
HCM Control Delay (s)	24	9.4	0	-	9.1	0.1	-	17.2				
HCM Lane LOS	C	A	A	-	A	A	-	C				
HCM 95th %ile Pl (veh)	0.3	0	-	-	0	-	-	0.1				

Lanes, Volumes, Timings

Future Total PM Peak Hour
(240414) 142-154 Erb Street West, Waterloo TIS

3: Roslin Avenue & Site Access

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	W		P			4
Traffic Volume (vph)	10	0	10	30	0	20
Future Volume (vph)	10	0	10	30	0	20
Ideal Flow (vphpl)	1765	1765	1650	1650	1650	1650
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Flt Protected	0.950		0.899			
Satd. Flow (prot)	1658	0	1467	0	0	1632
Flt Permitted	0.950					
Satd. Flow (perm)	1658	0	1467	0	0	1632
Link Speed (k/h)	50		50			50
Link Distance (m)	56.8		34.5			73.7
Travel Time (s)	4.1		2.5			5.3
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	10	0	10	30	0	20
Shared Lane Traffic (%)						
Lane Group Flow (vph)	10	0	40	0	0	20
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	3.5		0.0			0.0
Link Offset(m)	0.0		0.0			0.0
Crosswalk Width(m)	4.8		4.8			4.8
Two way Left Turn Lane						
Headway Factor	1.12	1.12	1.21	1.21	1.21	1.21
Turning Speed (k/h)	100	100	Free	100	100	Free
Sign Control	Stop		Free			Free
Intersection Summary	Other					
Area Type:	Other					
Control Type:	Unsignalized					
Intersection Capacity Utilization	13.3%					
Analysis Period (min)	15					
	ICU Level of Service A					

HCM 6th TWSC

Future Total PM Peak Hour
(240414) 142-154 Erb Street West, Waterloo TIS

3: Roslin Avenue & Site Access

Intersection	WBL	WBR	NBT	NBR	SBL	SBT
Int Delay, s/veh	1.3					
Movement	W		P			4
Lane Configurations	W		P			4
Traffic Vol. veh/h	10	0	10	30	0	20
Future Vol. veh/h	10	0	10	30	0	20
Conflicting Peds. #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage. #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles %	0	0	0	0	0	0
Mvmt Flow	10	0	10	30	0	20
Major/Minor	Minor1	Major1	Major2			
Conflicting Flow All	45	25	0	0	40	0
Stage 1	25	-	-	-	-	-
Stage 2	20	-	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	970	1057	-	-	1583	-
Stage 1	1003	-	-	-	-	-
Stage 2	1008	-	-	-	-	-
Platoon blocked, %	-	-	-	-	-	-
Mov Cap-1 Maneuver	970	1057	-	-	1583	-
Mov Cap-2 Maneuver	970	-	-	-	-	-
Stage 1	1003	-	-	-	-	-
Stage 2	1008	-	-	-	-	-
Approach	WB	NB	SB			
HCM Control Delay, s	8.8	0	0			
HCM LOS	A					
Minor Lane/Major Mvmt	NBT	NBR/WBLn1	SBL	SBT		
Capacity (veh/h)	-	-	970	1583	-	-
HCM Lane V/C Ratio	-	-	0.01	-	-	-
HCM Control Delay (s)	-	-	8.8	0	-	-
HCM Lane LOS	-	-	A	A	-	-
HCM 95th %tile Q(veh)	-	-	0	0	-	-

Appendix G

Signal Warrants



Signal Justification Calculation for Forecast Volumes (OTM Book 12 - Justification 7)



Horizon Year: 2029
Region/City/Township: City of Waterloo/Region of Waterloo

Major Street: Erb Street West
Minor Street: Roslin Avenue

North/South?: N

Number of Approach Lanes: 2 or more
Tee Intersection?: N
Flow Conditions: Restricted

PM Forecast Only? N

Warrant Results		
150% Satisfied	No	Justification for new intersections with forecast traffic
120% Satisfied	No	Justification for existing intersections with forecast traffic

Time Period	Major Street						Minor Street						Peds Crossing
	Erb Street West						Roslin Avenue						
	Eastbound			Westbound			Northbound			Southbound			
	Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right	
AM Peak Hour	4	782	5	4	465	12	4	5	7	24	1	18	24
PM Peak Hour	15	696	8	4	781	22	6	3	7	15	6	9	27
verage Hourly Volum	5	370	3	2	312	9	3	2	4	10	2	7	13

Warrant	AHV
1A - All	726
1B - Minor	26
2A - Major	700
2B - Cross	27

Warrant 1 - Minimum Vehicular Volume

1A	Approach Lanes	1		2 or more		Average Hourly Volume
	Flow Conditions	Free	Restricted	Free	Restricted	
					X	
	All Approaches	480	720	600	900	726
% Fulfilled						80.6%

1B	Approach Lanes	1		2 or more		Average Hourly Volume
	Flow Conditions	Free	Restricted	Free	Restricted	
					X	
	Minor Street Approaches	120	170	120	170	26
% Fulfilled						15.4%

Warrant 2 - Delay To Cross Traffic

2A	Approach Lanes	1		2 or more		Average Hourly Volume
	Flow Conditions	Free	Restricted	Free	Restricted	
					X	
	Major Street Approaches	480	720	600	900	700
% Fulfilled						77.7%

2B	Approach Lanes	1		2 or more		Average Hourly Volume
	Flow Conditions	Free	Restricted	Free	Restricted	
					X	
	Traffic Crossing Major Street	50	75	50	75	27
% Fulfilled						36.0%

Appendix H

2029 Background Traffic Operations Reports (Sensitivity Analysis)



Lanes, Volumes, Timings
 1: Roslin Avenue & Erb Street

HCM 6th TWSC
 1: Roslin Avenue & Erb Street

Future Background AM Peak Hour - Road Diet
 (240414) 142-154 Erb Street West, Waterloo TIS

Future Background AM Peak Hour - Road Diet
 (240414) 142-154 Erb Street West, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	2	782	5	4	465	8	4	4	5	7	4	4
Traffic Volume (vph)	2	782	5	4	465	8	4	4	5	7	4	1
Future Volume (vph)	1550	1550	1550	1550	1550	1550	1550	1550	1550	1550	1550	1550
Ideal Flow (vphpl)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Lane Util. Factor	0.999											
Ped Bike Factor												
Frt												
Flt Protected												
Satd. Flow (prot)	0	1501	0	0	1469	0	0	1425	0	0	1153	0
Flt Permitted												
Satd. Flow (perm)	0	1501	0	0	1469	0	0	1425	0	0	1153	0
Link Speed (k/h)												
Link Distance (m)												
Travel Time (s)												
Confl. Peds. (#/hr)	7	5.9	8	8	7.0	7	9					9
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	2%	0%	0%	4%	13%	0%	0%	0%	0%	0%	50%
Adj. Flow (vph)	2	782	5	4	465	8	4	5	7	4	1	4
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	789	0	0	477	0	0	16	0	0	9	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Right	Left	Left	Right	Left	Left	Right	Right
Median Width(m)												
Link Offset(m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Crosswalk Width(m)	4.8				4.8		4.8				4.8	
Two way Left Turn Lane	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31
Headway Factor	25	15	25	15	25	15	25	15	25	15	25	15
Turning Speed (k/h)												
Sign Control	Free	Free	Free	Free	Free	Free	Free	Free	Free	Free	Free	Free
Intersection Summary												
Area Type:	Other											
Control Type:	Unsignalized											
Intersection Capacity Utilization	65.0%											
Analysis Period (min)	15											
ICU Level of Service	C											

Intersection	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
In Delay, s/veh	0.5											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	2	782	5	4	465	8	4	4	5	7	4	4
Traffic Vol. veh/h	2	782	5	4	465	8	4	4	5	7	4	1
Future Vol. veh/h	2	782	5	4	465	8	4	4	5	7	4	1
Conflicting Peds. #/hr	7	0	8	8	0	7	9	0	0	0	0	9
Sign Control	Free	Free	Free	Free	Free	Free	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage. #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	0	2	0	0	4	13	0	0	0	0	0	50
Mvmt Flow	2	782	5	4	465	8	4	5	7	4	1	4
Major/Minor	Major1	Major2	Minor1	Minor2	Minor1	Minor2	Minor1	Minor2	Minor1	Minor2	Minor1	Minor2
Conflicting Flow All	480	0	0	795	0	0	1286	1285	793	1279	1283	485
Stage 1	-	-	-	-	-	-	-	797	797	-	484	484
Stage 2	-	-	-	-	-	-	-	489	488	-	795	799
Critical Hwy	4.1	-	-	4.1	-	-	-	7.1	6.5	6.2	7.1	6.5
Critical Hwy Stg 1	-	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5
Critical Hwy Stg 2	-	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5
Follow-up Hwy	2.2	-	-	2.2	-	-	-	3.5	4	3.3	3.5	4
Pot Cap-1 Maneuver	1093	-	-	835	-	-	-	143	166	392	144	167
Stage 1	-	-	-	-	-	-	-	383	401	-	568	555
Stage 2	-	-	-	-	-	-	-	564	553	-	384	401
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1087	-	-	830	-	-	-	138	163	390	136	163
Mov Cap-2 Maneuver	-	-	-	-	-	-	-	138	163	-	136	163
Stage 1	-	-	-	-	-	-	-	380	397	-	563	548
Stage 2	-	-	-	-	-	-	-	551	546	-	371	397
Approach	EB	WB	NB	SB	EB	WB	NB	SB	EB	WB	NB	SB
HCM Control Delay, s	0	0.1	23.9	23.3	0	0.1	23.9	23.3	0	0.1	23.9	23.3
HCM LOS	C	C	C	C	C	C	C	C	C	C	C	C
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	WBR	SBLn1	WBR	SBLn1
Capacity (veh/h)	206	1087	-	-	830	-	-	-	-	206	-	-
HCM Lane V/C Ratio	0.078	0.002	-	-	0.005	-	-	-	-	0.044	-	-
HCM Control Delay (s)	23.9	8.3	0	-	9.4	0	-	23.3	-	23.3	-	-
HCM Lane LOS	C	A	A	A	A	A	A	C	A	A	A	C
HCM 95th %tile Q(veh)	0.2	0	-	-	0	-	-	0.1	-	0.1	-	-

Lanes, Volumes, Timings
 2: Dunbar Road & Erb Street

HCM 6th TWSC
 2: Dunbar Road & Erb Street

Future Background AM Peak Hour - Road Diet
 (240414) 142-154 Erb Street West, Waterloo TIS

Future Background AM Peak Hour - Road Diet
 (240414) 142-154 Erb Street West, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔		↔	↔			↔			↔	
Traffic Volume (vph)	0	786	11	5	465	4	6	0	7	4	0	1
Future Volume (vph)	0	786	11	5	465	4	6	0	7	4	0	1
Ideal Flow (vphpl)	1550	1550	1550	1550	1550	1550	1550	1550	1550	1550	1550	1550
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		0.998			0.999			0.927			0.973	
Frt Protected					0.999			0.977			0.962	
Satd. Flow (prot)	0	1486	0	0	1466	0	0	1291	0	0	1196	0
Flt Permitted					0.999			0.977			0.962	
Satd. Flow (perm)	0	1486	0	0	1466	0	0	1291	0	0	1196	0
Link Speed (k/h)		50			50			30			50	
Link Distance (m)		96.9			86.9			119.8			105.6	
Travel Time (s)		7.0			6.3			14.4			7.6	
Conf. Peds. (#/hr)	10	11			10			1			1	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	3%	0%	0%	4%	50%	0%	0%	14%	0%	0%	100%
Adj. Flow (vph)	0	786	11	5	465	4	6	0	7	4	0	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	797	0	0	474	0	0	13	0	0	5	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Right	Left	Left	Right	Left	Left	Right	Right
Median Width(m)		0.0			0.0		0.0				0.0	
Link Offset(m)		0.0			0.0		0.0				0.0	
Crosswalk Width(m)		4.8			4.8		4.8				4.8	
Two way Left Turn Lane												
Headway Factor	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31
Turning Speed (k/h)	25	15	25	15	25	15	25	15	25	15	25	15
Sign Control		Free			Free		Stop		Stop		Stop	
Intersection Summary												
Area Type: Other												
Control Type: Unsignalized												
Intersection Capacity Utilization 61.9%												
Analysis Period (min) 15												
ICU Level of Service B												

Intersection	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
In Delay, s/veh	0.4											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol. veh/h	0	786	11	5	465	4	6	0	7	4	0	1
Future Vol. veh/h	0	786	11	5	465	4	6	0	7	4	0	1
Conflicting Peds. #/hr	10	0	11	11	0	10	0	0	1	1	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage. #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	0	3	0	0	4	50	0	0	14	0	0	100
Mvmt Flow	0	786	11	5	465	4	6	0	7	4	0	1
Major/Minor												
Conflicting Flow All	479	0	0	808	0	0	1281	1292	804	1283	1295	477
Stage 1	-	-	-	-	-	-	-	803	803	-	487	487
Stage 2	-	-	-	-	-	-	-	478	489	-	796	808
Critical Hwy	4.1	-	-	4.1	-	-	-	7.1	6.5	6.34	7.1	6.5
Critical Hwy Stg 1	-	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5
Critical Hwy Stg 2	-	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5
Follow-up Hwy	2.2	-	-	2.2	-	-	-	3.5	4	3.426	3.5	4
Pot Cap-1 Maneuver	1094	-	-	826	-	-	-	144	165	365	143	164
Stage 1	-	-	-	-	-	-	-	380	399	-	566	554
Stage 2	-	-	-	-	-	-	-	572	553	-	383	397
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1086	-	-	819	-	-	-	142	161	362	138	160
Mov Cap-2 Maneuver	-	-	-	-	-	-	-	142	161	-	138	160
Stage 1	-	-	-	-	-	-	-	377	395	-	561	545
Stage 2	-	-	-	-	-	-	-	566	544	-	375	393
Approach												
EB	EB	WB	EB	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SB
Control Delay, s	0	0.1	0.1	23.2	23.2	28.2	28.2	28.2	28.2	28.2	28.2	28.2
HCM LOS												
C												
D												
Minor Lane/Major Mvmt												
NBLn1	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	NBLn1	NBLn1	NBLn1	NBLn1	NBLn1
Capacity (veh/h)	211	1086	-	-	819	-	-	160	-	-	160	-
HCM Lane V/C Ratio	0.062	-	-	-	0.006	-	-	0.031	-	-	0.031	-
HCM Control Delay (s)	23.2	0	-	-	9.4	0	-	28.2	-	-	28.2	-
HCM Lane LOS	C	A	-	-	A	-	-	D	-	-	D	-
HCM 95th %tile Q(veh)	0.2	0	-	-	0	-	-	0.1	-	-	0.1	-

Lanes, Volumes, Timings

1: Roslin Avenue & Erb Street

Future Background PM Peak Hour - Road Diet

(240414) 142-154 Erb Street West, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	3	696	8	4	781	4	6	3	7	9	6	5
Future Volume (vph)	3	696	8	4	781	4	6	3	7	9	6	5
Ideal Flow (vphpl)	1550	1550	1550	1550	1550	1550	1550	1550	1550	1550	1550	1550
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		0.998			0.999			0.941			0.966	
Pd								0.982			0.978	
Flt Protected								0.982			0.978	
Satd. Flow (prot)	0	1515	0	0	1516	0	0	1416	0	0	1448	0
Flt Permitted								0.982			0.978	
Satd. Flow (perm)	0	1515	0	0	1516	0	0	1416	0	0	1448	0
Link Speed (k/h)		50			50			30			50	
Link Distance (m)		82.1			96.9			113.5			113.2	
Travel Time (s)		5.9			7.0			13.6			8.2	
Conf. Peds. (#/hr)	8	12	12	12	8	7						7
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	1%	0%	0%	1%	0%	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	3	696	8	4	781	4	6	3	7	9	6	5
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	707	0	0	789	0	0	16	0	0	20	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Right	Left	Left	Right	Left	Left	Right	Right
Median Width(m)		0.0			0.0			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31
Turning Speed (k/h)	25	15	25	15	25	15	25	15	25	15	25	15
Sign Control		Free			Free			Stop			Stop	
Intersection Summary												
Area Type:	Other											
Control Type:	Unsignalized											
Intersection Capacity Utilization	66.2%											
Analysis Period (min)	15											
	ICU Level of Service C											

HCM 6th TWSC

1: Roslin Avenue & Erb Street

Future Background PM Peak Hour - Road Diet

(240414) 142-154 Erb Street West, Waterloo TIS

Intersection	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Int Delay, s/veh	0.8											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol. veh/h	3	696	8	4	781	4	6	3	7	9	6	5
Future Vol. veh/h	3	696	8	4	781	4	6	3	7	9	6	5
Conflicting Peds. #/hr	8	0	12	12	0	8	7	0	0	0	0	7
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage. #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	0	1	0	0	1	0	0	0	0	0	0	0
Mvmt Flow	3	696	8	4	781	4	6	3	7	9	6	5
Major/Minor	Major1	Major2	Minor1	Minor2	Minor1	Minor2	Minor1	Minor2	Minor1	Minor2	Minor1	Minor2
Conflicting Flow All	793	0	0	716	0	0	1522	1519	712	1510	1521	798
Stage 1	-	-	-	-	-	-	718	718	-	799	799	-
Stage 2	-	-	-	-	-	-	804	801	-	711	722	-
Critical Hwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	837	-	-	894	-	-	98	120	436	100	120	389
Stage 1	-	-	-	-	-	-	423	436	-	382	401	-
Stage 2	-	-	-	-	-	-	380	400	-	427	434	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	832	-	-	886	-	-	91	117	432	95	117	384
Mov Cap-2 Maneuver	-	-	-	-	-	-	91	117	-	95	117	-
Stage 1	-	-	-	-	-	-	417	429	-	377	395	-
Stage 2	-	-	-	-	-	-	364	394	-	415	427	-
Approach	EB	WB	NB	SB	EB	WB	NB	SB	EB	WB	NB	SB
HCM Control Delay, s	0	0	32.3	38.9	0	0	32.3	38.9	0	0	32.3	38.9
HCM LOS	D											
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	EBL	EBT	EBR	WBR
Capacity (veh/h)	148	832	-	-	886	-	-	126	148	832	-	-
HCM Lane V/C Ratio	0.108	0.004	-	-	0.005	-	-	0.159	0.108	0.004	-	-
HCM Control Delay (s)	32.3	9.3	0	-	9.1	0	-	38.9	32.3	9.3	0	-
HCM Lane LOS	D	A	-	-	A	-	-	E	D	A	-	-
HCM 95th %tile Q(veh)	0.4	0	-	-	0	-	-	0.5	0.4	0	-	-

Lanes, Volumes, Timings
 2: Dunbar Road & Erb Street

HCM 6th TWSC
 2: Dunbar Road & Erb Street

Future Background PM Peak Hour - Road Diet
 (240414) 142-154 Erb Street West, Waterloo TIS

Future Background PM Peak Hour - Road Diet
 (240414) 142-154 Erb Street West, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	2	673	18	8	785	6	11	0	5	3	0	7
Future Volume (vph)	2	673	18	8	785	6	11	0	5	3	0	7
Ideal Flow (vphpl)	1550	1550	1550	1550	1550	1550	1550	1550	1550	1550	1550	1550
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		0.996			0.999		0.958				0.905	
Frt					0.999		0.967				0.985	
Flt Protected	0	1512	0	0	1515	0	0	1420	0	0	1366	0
Satd. Flow (prot)					0.999		0.967				0.985	
Flt Permitted	0	1512	0	0	1515	0	0	1420	0	0	1366	0
Satd. Flow (perm)					0.999		0.967				0.985	
Link Speed (k/h)		50			50		30				50	
Link Distance (m)		96.9			86.9		119.8				105.6	
Travel Time (s)		7.0			6.3		14.4				7.6	
Confl. Peds. (#/hr)	10		10	10		10		1				1
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	1%	0%	0%	1%	0%	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	2	673	18	8	785	6	11	0	5	3	0	7
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	693	0	0	799	0	0	16	0	0	10	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Right	Left	Left	Right	Left	Left	Right	Right
Median Width(m)		0.0			0.0		0.0				0.0	
Link Offset(m)		0.0			0.0		0.0				0.0	
Crosswalk Width(m)		4.8			4.8		4.8				4.8	
Two way Left Turn Lane												
Headway Factor	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31
Turning Speed (k/h)	25	15	25	15	25	15	25	15	25	25	15	15
Sign Control		Free			Free		Stop				Stop	
Intersection Summary												
Area Type: Other												
Control Type: Unsignalized												
Intersection Capacity Utilization 68.6%												
Analysis Period (min) 15												
ICU Level of Service C												

Intersection												
Int Delay, s/veh												
0.6												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔		↔	↔				↔	↔		↔	
Traffic Vol. veh/h	2	673	18	8	785	6	11	0	5	3	0	7
Future Vol. veh/h	2	673	18	8	785	6	11	0	5	3	0	7
Conflicting Peds. #/hr	10	0	10	10	0	10	1	0	0	0	0	1
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage. #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	0	1	0	0	1	0	0	0	0	0	0	0
Mvmt Flow	2	673	18	8	785	6	11	0	5	3	0	7
Major/Minor												
Conflicting Flow All	801	0	0	701	0	1505	1513	692	1503	1519	799	
Stage 1	-	-	-	-	-	-	696	696	-	814	814	-
Stage 2	-	-	-	-	-	-	809	817	-	689	705	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	831	-	-	905	-	-	101	121	447	101	120	389
Stage 1	-	-	-	-	-	-	435	446	-	375	394	-
Stage 2	-	-	-	-	-	-	377	393	-	439	442	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	825	-	-	898	-	-	97	117	444	98	116	386
Mov Cap-2 Maneuver	-	-	-	-	-	-	97	117	-	98	116	-
Stage 1	-	-	-	-	-	-	430	441	-	371	385	-
Stage 2	-	-	-	-	-	-	364	384	-	432	437	-
Approach												
EB	EB	WB	NB	SB								
HCM Control Delay, s	0	0.1	37.1	23.5								
HCM LOS	E C											
Minor Lane/Major Mvmt												
NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1					
Capacity (veh/h)	128	825	-	-	898	-	-	-	205			
HCM Lane V/C Ratio	0.125	0.002	-	-	0.009	-	-	-	0.049			
HCM Control Delay (s)	37.1	9.4	0	-	9	0	-	-	23.5			
HCM Lane LOS	E	A	A	-	A	A	-	C	C			
HCM 95th %tile Q(veh)	0.4	0	-	-	0	-	-	-	0.2			

Appendix I

2029 Total Traffic Operations Reports (Sensitivity Analysis)



Lanes, Volumes, Timings

1: Roslin Avenue & Erb Street

Future Total AM Peak Hour - Road Diet
(240414) 142-154 Erb Street West, Waterloo TIS

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations	4	782	5	4	465	12	4	5	7	24	1	18	
Traffic Volume (vph)	4	782	5	4	465	12	4	5	7	24	1	18	
Future Volume (vph)	1550	1550	1550	1550	1550	1550	1550	1550	1550	1550	1550	1550	
Ideal Flow (vphpl)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Lane Util. Factor	0.999												
Ped Bike Factor													
Frt													
Flt Protected													
Satd. Flow (prot)	0	1502	0	0	1467	0	0	1425	0	0	1163	0	
Flt Permitted													
Satd. Flow (perm)	0	1502	0	0	1467	0	0	1425	0	0	1163	0	
Link Speed (k/h)													
Link Distance (m)													
Travel Time (s)													
Confl. Peds. (#/hr)	7	5.9	8	8	7.0	7	9						
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Heavy Vehicles (%)	0%	2%	0%	0%	4%	13%	0%	0%	0%	0%	0%	50%	
Adj. Flow (vph)	4	782	5	4	465	12	4	5	7	24	1	18	
Shared Lane Traffic (%)													
Lane Group Flow (vph)	0	791	0	0	481	0	0	16	0	0	43	0	
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No	
Lane Alignment	Left	Left	Right	Left	Right	Right	Left	Right	Left	Left	Right	Right	
Median Width(m)		0.0			0.0		0.0				0.0		
Link Offset(m)		0.0			0.0		0.0				0.0		
Crosswalk Width(m)		4.8			4.8		4.8				4.8		
Two way Left Turn Lane	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	
Headway Factor	25	15	25	15	25	15	25	15	25	15	25	15	
Turning Speed (k/h)													
Sign Control	Free	Free	Free	Free	Free	Free	Free	Free	Free	Free	Free	Free	
Intersection Summary													
Area Type:	Other												
Control Type:	Unsignalized												
Intersection Capacity Utilization	68.9%												
Analysis Period (min)	15												
ICU Level of Service C													

HCM 6th TWSC

1: Roslin Avenue & Erb Street

Future Total AM Peak Hour - Road Diet
(240414) 142-154 Erb Street West, Waterloo TIS

Intersection	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
In Delay, s/veh	1.3												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations	4	782	5	4	465	12	4	5	7	24	1	18	
Traffic Vol. veh/h	4	782	5	4	465	12	4	5	7	24	1	18	
Future Vol. veh/h	4	782	5	4	465	12	4	5	7	24	1	18	
Conflicting Peds. #/hr	7	0	8	8	0	7	9	0	0	0	0	9	
Sign Control	Free	Free	Free	Free	Free	Free	Free	Free	Free	Free	Free	Free	
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None	
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-	
Veh in Median Storage. #	-	0	-	-	0	-	-	0	-	-	0	-	
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-	
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100	
Heavy Vehicles, %	0	2	0	0	4	13	0	0	0	0	0	50	
Mvmt Flow	4	782	5	4	465	12	4	5	7	24	1	18	
Major/Minor	Major1	Major2	Minor1	Minor2	Minor1	Minor2	Minor1	Minor2	Minor1	Minor2	Minor1	Minor2	
Conflicting Flow All	484	0	0	795	0	0	1299	1293	793	1285	1289	487	
Stage 1	-	-	-	-	-	-	-	801	801	-	486	486	
Stage 2	-	-	-	-	-	-	-	498	492	-	799	803	
Critical Hwy	4.1	-	-	4.1	-	-	-	7.1	6.5	6.2	7.1	6.5	
Critical Hwy Stg 1	-	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	
Critical Hwy Stg 2	-	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	
Follow-up Hwy	2.2	-	-	2.2	-	-	-	3.5	4	3.3	3.5	4	
Pot Cap-1 Maneuver	1089	-	-	835	-	-	-	140	164	392	143	165	
Stage 1	-	-	-	-	-	-	-	381	400	-	566	554	
Stage 2	-	-	-	-	-	-	-	558	551	-	382	399	
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-	
Mov Cap-1 Maneuver	1083	-	-	830	-	-	-	131	160	390	135	161	
Mov Cap-2 Maneuver	-	-	-	-	-	-	-	131	160	-	135	161	
Stage 1	-	-	-	-	-	-	-	376	395	-	559	547	
Stage 2	-	-	-	-	-	-	-	529	544	-	368	394	
Approach	EB	WB	NB	SB	EB	WB	NB	SB	EB	WB	NB	SB	
HCM Control Delay, s	0	0.1	24.5	28.6	0	0.1	24.5	28.6	0	0.1	24.5	28.6	
HCM LOS	C	C	D	D	C	C	D	D	C	C	D	D	
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	NBLn1	EBL	EBT	EBR	
Capacity (veh/h)	201	1083	-	-	830	-	-	195	201	1083	-	-	
HCM Lane V/C Ratio	0.08	0.004	-	-	0.005	-	-	0.221	0.08	0.004	-	-	
HCM Control Delay (s)	24.5	8.3	0	-	9.4	0	-	28.6	24.5	8.3	0	-	
HCM Lane LOS	C	A	A	A	A	A	A	D	C	A	A	A	
HCM 95th %tile Q(veh)	0.3	0	-	-	0	-	-	0.8	0.3	0	-	-	

Lanes, Volumes, Timings
 2: Dunbar Road & Erb Street

HCM 6th TWSC
 2: Dunbar Road & Erb Street

Future Total AM Peak Hour - Road Diet
 (240414) 142-154 Erb Street West, Waterloo TIS

Future Total AM Peak Hour - Road Diet
 (240414) 142-154 Erb Street West, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔		↔	↔			↔			↔	
Traffic Volume (vph)	0	806	11	5	469	4	6	0	7	4	0	1
Future Volume (vph)	0	806	11	5	469	4	6	0	7	4	0	1
Ideal Flow (vphpl)	1550	1550	1550	1550	1550	1550	1550	1550	1550	1550	1550	1550
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		0.998			0.999			0.927			0.973	
Frt Protected					0.999			0.977			0.962	
Satd. Flow (prot)	0	1486	0	0	1466	0	0	1291	0	0	1196	0
Flt Permitted					0.999			0.977			0.962	
Satd. Flow (perm)	0	1486	0	0	1466	0	0	1291	0	0	1196	0
Link Speed (k/h)		50			50			30			50	
Link Distance (m)		96.9			86.9			119.8			105.6	
Travel Time (s)		7.0			6.3			14.4			7.6	
Conf. Peds. (#/hr)	10	11			10			1			1	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	3%	0%	0%	4%	50%	0%	0%	14%	0%	0%	100%
Adj. Flow (vph)	0	806	11	5	469	4	6	0	7	4	0	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	817	0	0	478	0	0	13	0	0	5	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right
Median Width(m)	0.0	0.0			0.0		0.0			0.0		0.0
Link Offset(m)	0.0	0.0			0.0		0.0			0.0		0.0
Crosswalk Width(m)	4.8				4.8		4.8			4.8		4.8
Two way Left Turn Lane												
Headway Factor	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31
Turning Speed (k/h)	25	15	25	15	25	15	25	15	25	15	25	15
Sign Control	Free	Free			Free		Stop		Stop		Stop	
Intersection Summary												
Area Type:	Other											
Control Type:	Unsignalized											
Intersection Capacity Utilization	63.2%											
Analysis Period (min)	15											
ICU Level of Service B												

Intersection	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Int Delay, s/veh	0.4											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol. veh/h	0	806	11	5	469	4	6	0	7	4	0	1
Future Vol. veh/h	0	806	11	5	469	4	6	0	7	4	0	1
Conflicting Peds. #/hr	10	0	11	11	0	10	0	0	1	1	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage. #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	0	3	0	0	4	50	0	0	14	0	0	100
Mvmt Flow	0	806	11	5	469	4	6	0	7	4	0	1
Major/Minor	Major1	Major2	Minor1	Minor2								
Conflicting Flow All	483	0	0	828	0	0	1305	1316	824	1307	1319	481
Stage 1	-	-	-	-	-	-	-	823	823	-	491	-
Stage 2	-	-	-	-	-	-	-	482	483	-	816	828
Critical Hwy	4.1	-	-	4.1	-	-	-	7.1	6.5	6.34	7.1	6.5
Critical Hwy Stg 1	-	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5
Critical Hwy Stg 2	-	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5
Follow-up Hwy	2.2	-	-	2.2	-	-	-	3.5	4	3.426	3.5	4
Pot Cap-1 Maneuver	1090	-	-	812	-	-	-	138	159	355	138	158
Stage 1	-	-	-	-	-	-	-	371	391	-	563	552
Stage 2	-	-	-	-	-	-	-	569	550	-	374	389
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1082	-	-	805	-	-	-	136	155	352	133	154
Mov Cap-2 Maneuver	-	-	-	-	-	-	-	136	155	-	133	154
Stage 1	-	-	-	-	-	-	-	368	387	-	558	543
Stage 2	-	-	-	-	-	-	-	563	541	-	366	385
Approach	EB	WB	NB	SB								
HCM Control Delay, s	0	0.1	23.9	29.2								
HCM LOS			C	D								
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1				
Capacity (veh/h)	203	1082	-	-	805	-	-	154				
HCM Lane V/C Ratio	0.064	-	-	-	0.006	-	-	0.032				
HCM Control Delay (s)	23.9	0	-	-	9.5	0	-	29.2				
HCM Lane LOS	C	A	-	-	A	-	-	D				
HCM 95th %tile Q(veh)	0.2	0	-	-	0	-	-	0.1				

Lanes, Volumes, Timings

3: Roslin Avenue & Site Access

Future Total AM Peak Hour - Road Diet
(240414) 142-154 Erb Street West, Waterloo TIS

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	34	0	15	6	0	9
Future Volume (vph)	34	0	15	6	0	9
Ideal Flow (vphpl)	1765	1765	1650	1650	1650	1650
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Fit	0.961					
Fit Protected	0.950					
Satd. Flow (prot)	1658	0	1493	0	0	1337
Fit Permitted	0.950					
Satd. Flow (perm)	1658	0	1493	0	0	1337
Link Speed (k/h)	50		50			50
Link Distance (m)	56.8		34.5			73.7
Travel Time (s)	4.1		2.5			5.3
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	0%	7%	0%	0%	22%
Adj. Flow (vph)	34	0	15	6	0	9
Shared Lane Traffic (%)						
Lane Group Flow (vph)	34	0	21	0	0	9
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	3.5		0.0			0.0
Link Offset(m)	0.0		0.0			0.0
Crosswalk Width(m)	4.8		4.8			4.8
Two way Left Turn Lane						
Headway Factor	1.12	1.12	1.21	1.21	1.21	1.21
Turning Speed (k/h)	25	15		15	25	
Sign Control	Stop	Free	Free		Free	Free
Intersection Summary						
Area Type:	Other					
Control Type:	Unsignalized					
Intersection Capacity Utilization	13.3%					
Analysis Period (min)	15					
ICU Level of Service A						

HCM 6th TWSC

3: Roslin Avenue & Site Access

Future Total AM Peak Hour - Road Diet
(240414) 142-154 Erb Street West, Waterloo TIS

Intersection						
Int Delay, s/veh 4.7						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol. veh/h	34	0	15	6	0	9
Future Vol. veh/h	34	0	15	6	0	9
Conflicting Peds. #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage. #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	0	0	7	0	0	22
Mvmt Flow	34	0	15	6	0	9
Major/Minor	Minor1	Major1	Major2			
Conflicting Flow All	27	18	0	0	21	0
Stage 1	18	-	-	-	-	-
Stage 2	9	-	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	993	1066	-	-	1608	-
Stage 1	1010	-	-	-	-	-
Stage 2	1019	-	-	-	-	-
Platoon blocked, %						
Mov Cap-1 Maneuver	993	1066	-	-	1608	-
Mov Cap-2 Maneuver	993	-	-	-	-	-
Stage 1	1010	-	-	-	-	-
Stage 2	1019	-	-	-	-	-
Approach	WB	NB	SB			
HCM Control Delay, s	8.8	0	0			
HCM LOS	A					
Minor Lane/Major Mvmt	NBT	NBR/WBLn1	SBL	SBT		
Capacity (veh/h)	-	-	993	1608	-	-
HCM Lane V/C Ratio	-	-	0.034	-	-	-
HCM Control Delay (s)	-	-	8.8	0	-	-
HCM Lane LOS	-	-	A	-	-	-
HCM 95th %tile Q(veh)	-	-	0.1	0	-	-

Lanes, Volumes, Timings

1: Roslin Avenue & Erb Street

Future Total PM Peak Hour - Road Diet

(240414) 142-154 Erb Street West, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	15	696	8	4	781	22	6	3	7	15	6	9
Future Volume (vph)	15	696	8	4	781	22	6	3	7	15	6	9
Ideal Flow (vphpl)	1550	1550	1550	1550	1550	1550	1550	1550	1550	1550	1550	1550
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor												
Ft	0.998				0.996			0.941				0.959
Flt Protected	0.999							0.982				0.976
Satd. Flow (prot)	0	1514	0	0	1512	0	0	1416	0	0	1435	0
Flt Permitted	0.999							0.982				0.976
Satd. Flow (perm)	0	1514	0	0	1512	0	0	1416	0	0	1435	0
Link Speed (k/h)	50				50			30				50
Link Distance (m)	82.1				96.9			113.5				34.5
Travel Time (s)	5.9				7.0			13.6				2.5
Conf. Peds. (#/hr)	8				12			7				7
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	1%	0%	0%	1%	0%	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	15	696	8	4	781	22	6	3	7	15	6	9
Shared Lane Traffic (%)	0	719	0	0	807	0	0	16	0	0	30	0
Lane Group Flow (vph)	No	No	No	No	No	No	No	No	No	No	No	No
Enter Blocked Intersection	Left	Left	Right	Left	Right	Left	Left	Right	Left	Left	Right	Right
Lane Alignment	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Median Width(m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Link Offset(m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Crosswalk Width(m)	4.8				4.8			4.8				4.8
Two way Left Turn Lane	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31
Headway Factor	25	15	25	15	25	15	25	15	25	15	25	15
Turning Speed (k/h)	Free			Free			Stop			Stop		Stop
Sign Control												
Intersection Summary												
Area Type:	Other											
Control Type:	Unsignalized											
Intersection Capacity Utilization	70.5%											
Analysis Period (min)	15											
ICU Level of Service C												

HCM 6th TWSC

1: Roslin Avenue & Erb Street

Future Total PM Peak Hour - Road Diet

(240414) 142-154 Erb Street West, Waterloo TIS

Intersection	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Int Delay, s/veh	1.3											
Movement												
Lane Configurations												
Traffic Vol. veh/h	15	696	8	4	781	22	6	3	7	15	6	9
Future Vol. veh/h	15	696	8	4	781	22	6	3	7	15	6	9
Conflicting Peds. #/hr	8	0	12	12	0	8	7	0	0	0	0	7
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	-	-	None	-	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage. #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	0	1	0	0	1	0	0	0	0	0	0	0
Mvmt Flow	15	696	8	4	781	22	6	3	7	15	6	9
Major/Minor	Major1	Major2	Minor1	Minor2	Minor1	Minor2	Minor1	Minor2	Minor1	Minor2	Minor1	Minor2
Conflicting Flow All	811	0	0	716	0	0	1557	1561	712	1543	1554	807
Stage 1	-	-	-	-	-	-	742	742	-	808	808	-
Stage 2	-	-	-	-	-	-	815	819	-	735	746	-
Critical Hwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	824	-	-	894	-	-	93	113	436	95	114	386
Stage 1	-	-	-	-	-	-	411	425	-	378	397	-
Stage 2	-	-	-	-	-	-	374	392	-	414	424	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	819	-	-	886	-	-	83	107	432	88	108	381
Mov Cap-2 Maneuver	-	-	-	-	-	-	83	107	-	88	108	-
Stage 1	-	-	-	-	-	-	395	408	-	364	391	-
Stage 2	-	-	-	-	-	-	355	387	-	392	407	-
Approach	EB	WB	NB	SB	EB	WB	NB	SB	EB	WB	NB	SB
HCM Control Delay, s	0.2	0	34.7	44.7	0.2	0	34.7	44.7	0.2	0	34.7	44.7
HCM LOS	D	E	D	E	D	E	D	E	D	E	D	E
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	NBLn1	EBL	EBT	EBR
Capacity (veh/h)	137	819	-	-	886	-	-	120	137	819	-	-
HCM Lane V/C Ratio	0.117	0.018	-	-	0.005	-	-	0.25	0.117	0.018	-	-
HCM Control Delay (s)	34.7	9.5	0	-	9.1	0	-	44.7	34.7	9.5	0	-
HCM Lane LOS	D	A	-	-	A	-	-	E	D	A	-	-
HCM 95th %tile Q(veh)	0.4	0.1	-	-	0	-	-	0.9	0.4	0.1	-	-

Lanes, Volumes, Timings
2: Dunbar Road & Erb Street

HCM 6th TWSC
2: Dunbar Road & Erb Street

Future Total PM Peak Hour - Road Diet
(240414) 142-154 Erb Street West, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	2	679	18	8	803	6	11	0	5	3	0	7
Future Volume (vph)	2	679	18	8	803	6	11	0	5	3	0	7
Ideal Flow (vphpl)	1550	1550	1550	1550	1550	1550	1550	1550	1550	1550	1550	1550
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor												
Frt		0.997			0.999			0.958				0.905
Flt Protected								0.967				0.985
Satd. Flow (prot)	0	1513	0	0	1516	0	0	1420	0	0	1366	0
Flt Permitted								0.967				0.985
Satd. Flow (perm)	0	1513	0	0	1516	0	0	1420	0	0	1366	0
Link Speed (k/h)		50			50			30				50
Link Distance (m)		96.9			86.9			119.8				105.6
Travel Time (s)		7.0			6.3			14.4				7.6
Confl. Peds. (#/hr)	10		10	10		10		1				1
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	1%	0%	0%	1%	0%	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	2	679	18	8	803	6	11	0	5	3	0	7
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	699	0	0	817	0	0	16	0	0	10	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Right	Left	Left	Right	Left	Left	Right	Right
Median Width(m)		0.0			0.0			0.0				0.0
Link Offset(m)		0.0			0.0			0.0				0.0
Crosswalk Width(m)		4.8			4.8			4.8				4.8
Two way Left Turn Lane												
Headway Factor	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31
Turning Speed (k/h)	25	15	25	15	25	15	25	15	25	15	25	15
Sign Control		Free			Free			Stop				Stop
Intersection Summary												
Area Type: Other												
Control Type: Unsignalized												
Intersection Capacity Utilization 69.8%												
Analysis Period (min) 15												
ICU Level of Service C												

Intersection	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
In Delay, s/veh	0.6											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol. veh/h	2	679	18	8	803	6	11	0	5	3	0	7
Future Vol. veh/h	2	679	18	8	803	6	11	0	5	3	0	7
Conflicting Peds. #/hr	10	0	10	10	0	10	1	0	0	0	0	1
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage. #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	0	1	0	0	1	0	0	0	0	0	0	0
Mvmt Flow	2	679	18	8	803	6	11	0	5	3	0	7
Major/Minor												
Conflicting Flow All	819	0	0	707	0	0	1529	1537	698	1527	1543	817
Stage 1	-	-	-	-	-	-	-	702	702	-	832	832
Stage 2	-	-	-	-	-	-	-	827	835	-	695	711
Critical Hwy	4.1	-	-	4.1	-	-	-	7.1	6.5	6.2	7.1	6.5
Critical Hwy Stg 1	-	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5
Critical Hwy Stg 2	-	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5
Follow-up Hwy	2.2	-	-	2.2	-	-	-	3.5	4	3.3	3.5	4
Pot Cap-1 Maneuver	818	-	-	901	-	-	-	97	117	444	97	116
Stage 1	-	-	-	-	-	-	-	432	443	-	366	387
Stage 2	-	-	-	-	-	-	-	369	386	-	436	439
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	812	-	-	894	-	-	-	93	113	441	94	112
Mov Cap-2 Maneuver	-	-	-	-	-	-	-	93	113	-	94	112
Stage 1	-	-	-	-	-	-	-	427	438	-	362	378
Stage 2	-	-	-	-	-	-	-	356	377	-	429	434
Approach												
EB	EB	WB	WB	EB	EB	WB	NB	NB	SB	SB	EB	EB
Control Delay, s	0	0.1	0.1	0.1	0.1	0.1	38.6	38.6	24.1	24.1	38.6	38.6
Control LOS	E	E	E	E	E	E	E	E	C	C	E	E
Minor Lane/Major Mvmt												
NBLn1	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	WBR	SBLn1	WBR	SBLn1
Capacity (veh/h)	123	812	-	-	894	-	-	-	-	198	-	-
HCM Lane V/C Ratio	0.13	0.002	-	-	0.009	-	-	-	-	0.051	-	-
HCM Control Delay (s)	38.6	9.4	0	0	9.1	0	0	0	0	24.1	0	0
HCM Lane LOS	E	A	A	A	A	A	A	A	A	C	A	C
HCM 95th %tile Q(veh)	0.4	0	0	0	0	0	0	0	0	0.2	0	0

Lanes, Volumes, Timings

3: Roslin Avenue & Site Access

Future Total PM Peak Hour - Road Diet
(240414) 142-154 Erb Street West, Waterloo TIS

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	W		P			4
Traffic Volume (vph)	10	0	10	30	0	20
Future Volume (vph)	10	0	10	30	0	20
Ideal Flow (vphpl)	1765	1765	1650	1650	1650	1650
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Flt Protected	0.950		0.899			
Satd. Flow (prot)	1658	0	1467	0	0	1632
Flt Permitted	0.950					
Satd. Flow (perm)	1658	0	1467	0	0	1632
Link Speed (k/h)	50		50			50
Link Distance (m)	56.8		34.5			73.7
Travel Time (s)	4.1		2.5			5.3
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	10	0	10	30	0	20
Shared Lane Traffic (%)						
Lane Group Flow (vph)	10	0	40	0	0	20
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	3.5		0.0			0.0
Link Offset(m)	0.0		0.0			0.0
Crosswalk Width(m)	4.8		4.8			4.8
Two way Left Turn Lane						
Headway Factor	1.12	1.12	1.21	1.21	1.21	1.21
Turning Speed (k/h)	100	100	Free	100	100	100
Sign Control	Stop		Free			Free
Intersection Summary	Other					
Area Type:	Other					
Control Type:	Unsignalized					
Intersection Capacity Utilization	13.3%					
Analysis Period (min)	15					
	ICU Level of Service A					

HCM 6th TWSC

3: Roslin Avenue & Site Access

Future Total PM Peak Hour - Road Diet
(240414) 142-154 Erb Street West, Waterloo TIS

Intersection	WBL	WBR	NBT	NBR	SBL	SBT
Int Delay, s/veh	1.3					
Movement	W		P			4
Lane Configurations	W		P			4
Traffic Vol. veh/h	10	0	10	30	0	20
Future Vol. veh/h	10	0	10	30	0	20
Conflicting Peds. #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage. #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles %	0	0	0	0	0	0
Mvmt Flow	10	0	10	30	0	20
Major/Minor	Minor1	Major1	Major2			
Conflicting Flow All	45	25	0	0	40	0
Stage 1	25	-	-	-	-	-
Stage 2	20	-	-	-	-	-
Critical Hwy	6.4	6.2	-	-	4.1	-
Critical Hwy Stg 1	5.4	-	-	-	-	-
Critical Hwy Stg 2	5.4	-	-	-	-	-
Follow-up Hwy	3.5	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	970	1057	-	-	1583	-
Stage 1	1003	-	-	-	-	-
Stage 2	1008	-	-	-	-	-
Platoon blocked, %	-	-	-	-	-	-
Mov Cap-1 Maneuver	970	1057	-	-	1583	-
Mov Cap-2 Maneuver	970	-	-	-	-	-
Stage 1	1003	-	-	-	-	-
Stage 2	1008	-	-	-	-	-
Approach	WB	NB	SB			
HCM Control Delay, s	8.8	0	0			
HCM LOS	A					
Minor Lane/Major Mvmt	NBT	NBR/WBLn1	SBL	SBT		
Capacity (veh/h)	-	-	970	1583	-	-
HCM Lane V/C Ratio	-	-	0.01	-	-	-
HCM Control Delay (s)	-	-	8.8	0	-	-
HCM Lane LOS	-	-	A	A	-	-
HCM 95th %tile Q(veh)	-	-	0	0	-	-

Appendix J

TDM Checklist





Travel Demand Management (TDM) Implementation Checklist

Version 9/18/2013

Appendix H

Case Study: 1 Dunbar Road North

Site Context:

TDM Checklist No:

ZBL Parking Requirement:

Date:

Applicable Parking Reduction:

The Transportation Demand Management (TDM) Checklist and Parking Management Worksheet are not designed for residential properties, but can be used to inform mixed-use developments.

TABLE A		Site Access					
In creating an environment that supports pedestrian and cycling activity, the public realm must be accessible, safe, and comfortable to encourage movement on the street and in the surrounding area(s). These facilities and features should encourage walking and cycling.							
Points		Features			Yes	N/A	
A1	2	Development incorporates functional building entrances that are oriented to public space or to locations where pedestrians and transit users arrive from such as a street, square, park or plaza.			X		
A2	1	External to site: Continuous sidewalks (consistent with AODA Accessible Built Environment Standard) are provided along both sides of all adjacent public streets (over and above requirement)			X		
		AND Internal to site: Pedestrian walkways (consistent with AODA Accessible Built Environment Standard e.g.1.8m min width) are provided through large parking areas to link the building with the public street sidewalk system					
A3	3	Non-residential: development provides secure bike storage for 5% of the building occupants. Consistent with LEED requirements.					
A4	4	Shower and change facilities for employees provided on-site consistent with LEED requirements.					
A5	2	Provision of active uses at-grade along street frontages (e.g. retail).					
Category Max =		10	Total Points Applicable =		10	Score =	3

TABLE B		Public Transportation Access					
The availability and proximity of convenient public transit service with direct pedestrian linkages to the building will provide viable travel options for employees, visitors and residents.							
Points		Features				Yes	N/A
B1	1	Bus shelters with seating are provided at the transit stop immediately adjacent to the development in consultation with Transportation Planning at the Region of Waterloo					
B2	1	Information regarding public transit routes, schedules and fares are provided in an accessible and visible location on site and in adjacent bus stops				X	
B3a	5	Located within 800m of a Rapid Transit Station				X	
B3b	3	Located within 600 m of a bus service with headways of 15 min or less or is located in a designated mixed use corridor or node. Note: Points are awarded for either B3a, B3b or B3c only. Please choose whichever represents the highest order of transit.					
B3c	1	Located within 400 m of a bus service with headways of 16 min to 30 min. Note: Points are awarded for either B3a, B3b or B3c only. Please choose whichever represents the highest order of transit.					
Category Max =		5	Total Points Applicable =		5	Score =	5

TABLE C		Parking		
Vehicle parking facilities can affect the character, travel mode and cost of a development. Reducing parking supply to match expected demand can have a positive influence on the selection of alternative travel modes.				
Points		Features	Yes	N/A
C1	24	Utilizes reduced parking supply consistent with the TDM Parking Management Worksheet. Contact your Area Municipal planning authority to determine whether the Worksheet is applicable to your development. Note: Points are awarded for either C1, C2, or C3 only. Please choose whichever applies with the highest value.		
C2	24	Includes allowances for shared parking in mixed-use zones. Note: Points are awarded for C1, C2, or C3 only. Please choose whichever applies after consulting with the Area Municipal planning authority.		
C3	15	Provides no more than the minimum number of parking spaces, as required by applicable Zoning By-Law. Note: Points are awarded for either C1, C2, or C3 only. Please choose whichever applies.	X	
C4	10	Implements paid parking on part or all of the site (e.g. parking permits, paid parking zones near main entrances)		
C5	3	Provides priority parking for carpooling/vanpooling participants equivalent to 5% of employee spaces		
C6	5	Commercial Uses: Provide car-share spaces equivalent to 2% of building occupants		
C7	3	Parking is not located on major street frontage or between a road right of way and the building facade.	X	
C8	5	25% to 50% of parking is located underground or in a structure		

C9	10	50% to 75% of parking is located underground or in a structure		
C10	15	75% of parking or more is located underground or in a structure	X	
C11	3	Parking spaces provided off-site on a lot within 300 metres of the lot containing such use.		
Category Max =		25	Total Points Applicable =	25
			Score =	25



Region of Waterloo TDM Checklist v2.0

FORM-1

Case Study:	1 Dunbar Road North	Checklist No:	0
Date:	January 0, 1900	Site Context:	0

TABLE D		Trip Reduction Incentives		
A formal TDM plan will identify specific initiatives that will be initiated in order to encourage reduced single occupant vehicle travel.				
Points		Features	Yes	N/A
D1	2	The building owner/occupant will make available a ride matching service for car/vanpooling		
D2	2	The building owner/occupant will make available emergency ride home options		
D3	5	The building owner/occupant will make available subsidized transit passes for all occupants for a period of two years		
D4	5	The building owner/occupant agrees to charge for parking as an unbundled cost to occupants	X	
D5	2	The building owner/occupant agrees to provide reduced cost parking for users of car/van pool, bicycle, moped/motorcycle spaces		
D6	10	The building owner/occupant has prepared a TDM plan to the satisfaction of the Region of Waterloo and the Area Municipality that targets a 10% reduction in peak hour trips using forecast trip generation with status quo travel characteristics		
D7	5	The employer has provided flexible working hours, telework or shift work arrangements.		
D8	14	The development agrees to join Travelwise (TMA) that provides the same services outlined under items D1, D2, D6		
D9	5	The building owner/occupant will make available car sharing services		
D10	2	The development includes mixed uses (i.e. retail, commercial or food services, daycares, or other complementary uses) on-site or located within 400 metres.		
Category Max =		25	Total Points Applicable =	25
			Score =	5

TABLE E		Checklist Summary		
For each item, a “Yes” answer is equivalent to the points as indicated in the section. N/A sections should be explained in an attachment to this table. The score for each section is reflected as a percentage and calculated by dividing the points by the “Total Applicable”.				
Category	Minimum Requirement	Total Applicable	Points Scored	Comments
Pedestrian & Cyclist Orientation	24	10	3	
Public Transit Access		5	5	
Parking		25	25	
SUB-TOTAL		40	33	
Trip Reduction Incentives		25	5	
OVERALL TOTAL		65	38	

TABLE F		Scoring Summary		
FINAL SCORE		RATING (check one)		
50 - 65		*****		TDM SUPPORTIVE DEVELOPMENT
40 - 49		***		
30 - 39		**	X	
24 - 29		*		
0 - 23				Non-TDM Supportive Development (Review and upgrade TDM elements to pass)

Comments:
