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167-171 King Street South Waterloo Transportation Impact Study

Paradigm Transportation Solutions Limited

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Project Summary

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Executive Summary

Content

VanMar Constructors ON Inc. retained Paradigm Transportation Solutions Limited to complete this Transportation Impact Study (TIS) for a proposed mixed-use redevelopment located at 167-171 King Street South 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 the build-out of Phase 1 (2027), build-out of Phase 2 (2028), and five years beyond full build-out (2033), and an assessment of traffic impacts with recommendations to accommodate the proposed development as appropriate.

Development Concept

The subject site is located southeast of the King Street South and William Street intersection. The proposed redevelopment consists of the removal of the existing funeral home and the construction of two towers: a 37-storey, 438-unit tower (Tower A), and a 33-storey, 396-unit tower with ground floor retail (1,810 sq.ft.) and restaurant (4,069 sq.ft.) space (Tower B).

Vehicular access is proposed via the existing two driveways to Caroline Street South and Kuntz Lane.

The proposed redevelopment will be built out in two phases with Tower A completed by 2027 and Tower B by 2028.

Conclusions

Based on the investigations conducted, 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 193 AM peak hour trips and 141 PM peak hour trips.
- ▶ **2027 Background and Total Traffic Conditions:** The study area intersections are operating with acceptable levels of service.
- ▶ **2028 Background and Total Traffic Conditions:** The study area intersections are forecast to operate with acceptable levels



of service, with the following movement noted at King Street South and William Street under total traffic conditions:

- The eastbound left-turn movement is forecast to operate with 95th percentile queues exceeding the marked storage length (15 metres) by one metre during the AM peak hour.
- ▶ **2033 Background and Total Traffic Conditions:** The study area intersections are forecast to operate with acceptable levels of service. Under total traffic conditions, the eastbound left-turn movement at King Street South and William Street is forecast to continue operating with 95th percentile queues exceeding the marked storage by two metres during the AM peak hour. This excess queue is minimal and is not anticipated to block access to Kuntz Lane.

Existing and Future Traffic Conditions with the ION LRT Signal Timing Plan:

- ▶ **Existing Traffic Conditions:** The results indicate the studied signalized intersections are operating at acceptable levels of service with the following critical movements noted at King Street South and William Street:
 - The eastbound left-turn movement is operating with 95th percentile queues exceeding the available storage during both peak hours; and
 - The eastbound through movement is operating at LOS F and E during the AM and PM peak hours, respectively.
- ▶ **Background Traffic Conditions:** The results indicate the studied signalized intersections are forecast to operate with acceptable levels of service, except for the same critical movements noted under existing traffic conditions and the addition of the following:

King Street South and William Street:

- The westbound left-turn movement is forecast to operate at LOS F and 95th percentile queues exceeding the available storage during the PM peak hour starting under the 2027 horizon year;
- The westbound through movement is forecast to operate at LOS E during the PM peak hour starting under the 2033 horizon year; and
- The overall intersection is forecast to operate at LOS E during the AM peak hour starting under the 2033 horizon year.



Caroline Street South and Allen Street West

- The southbound shared movement is forecast to operate at LOS E during the PM peak hour starting under the 2027 horizon year and at LOS F starting under the 2033 horizon year; and
 - The overall intersection is forecast to operate at LOS E during the PM peak hour starting under the 2033 horizon year.
- ▶ **Total Traffic Conditions:** The results indicate the studied signalized intersections are forecast to operate with acceptable levels of service, except for the same critical movements noted under background traffic conditions.
- ▶ **Left-Turn Lanes:**
- Site Access on Caroline Street South: A southbound left-turn lane is not warranted at the site access on Caroline Street South under 2027, 2028 and 2033 total traffic volumes.
 - King Street South and Kuntz Lane: A northbound left-turn lane is not warranted at King Street South and Kuntz Lane under 2027, 2028 and 2033 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 King Street West and Caroline Street South;
 - 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;
- 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 development be approved with no conditions related to off-site transportation improvements and that the TDM measures noted above be considered to support the alternative modes of transportation.



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1 Introduction

1.1 Overview

VanMar Constructors ON Inc. retained Paradigm Transportation Solutions Limited to complete this Transportation Impact Study (TIS) for a proposed mixed-use redevelopment located at 167-171 King Street South in the City of Waterloo, Region of Waterloo. **Figure 1.1** illustrates the subject development location.

1.2 Purpose and Scope

This report identifies and assesses the potential traffic impact resulting from the proposed redevelopment. The scope of the study, developed in consultation with City of Waterloo and Region of Waterloo staff via e-mail in May 2025, includes:

- ▶ assessing the current traffic and site conditions within the study area;
- ▶ estimating background traffic growth for the build-out of Phase 1 (2027), build-out of Phase 2 (2028) and five years beyond full build-out (2033);
- ▶ estimating additional traffic generated by the subject site;
- ▶ analyzing the impact of future traffic on the surrounding road network, including the following study area intersections:
 - King Street South and William Street (signalized);
 - Allen Street West and Caroline Street South (signalized);
 - William Street West and Kuntz Lane (unsignalized);
 - King Street South and Kuntz Lane (unsignalized); and
 - Site Access on Caroline Street South (unsignalized).
- ▶ recommending necessary measures to mitigate the site generated traffic in a satisfactory manner.

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.





NTS
Image Source: Region of Waterloo GIS Locator



Location of Subject Site

167-171 King Street South, Waterloo TIS
250137

Figure 1.1

2 Existing Conditions

2.1 Existing Roadways

The main roadways near the subject site under the jurisdiction of the Region of Waterloo include:

- ▶ **King Street** is a north-south arterial² road with a two-lane cross-section and a posted speed limit of 50 km/h. On-street parking is permitted on the west side of the roadway north of George Street.
- ▶ **Caroline Street** is a north-south minor collector road with a two-lane cross section and an assumed speed limit of 50 km/h.
- ▶ **Allen Street** is an east-west minor collector road with a two-lane cross-section and an assumed speed limit of 50 km/h.

The main roadways near the subject site under the jurisdiction of the City of Waterloo include:

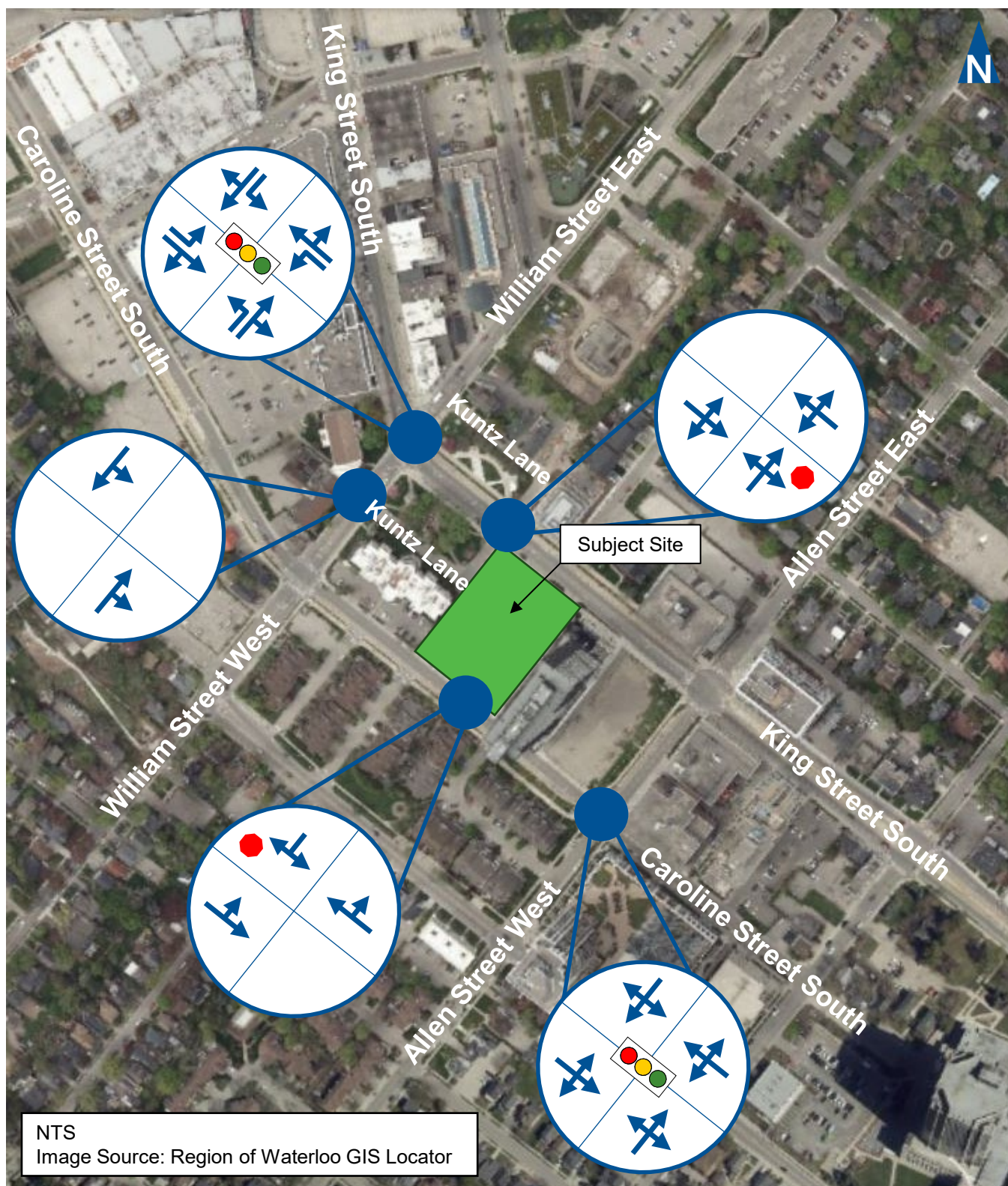
- ▶ **William Street** is an east-west minor collector road with a two-lane cross-section and a posted speed limit of 40 km/h.
- ▶ **Kuntz Lane** is a local road with a north-south orientation between William Street and the site access and an east-west orientation between the site access and King Street. The roadway has a one-lane cross section and an assumed speed limit of 50 km/h. On-street parking is permitted on the east side of the roadway between William Street and the site access.

The intersections of King Street South and William Street and Caroline Street South and Allen Street operate under traffic signal control. All other study area intersections operate under stop-control. At King Street South and William Street, westbound right-turn movements are prohibited on red. Similarly, at Caroline Street South and Allen Street West, southbound right-turn movements are prohibited on red.

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

2.2.1 Pedestrian

Pedestrian infrastructure is well developed within the study area, with sidewalks provided on all studied roadways. Notably, the sidewalk along King Street was reconstructed and widened to three metres during the construction of the ION LRT to support the anticipated increase in pedestrian traffic.

In addition to the existing sidewalks, the Iron Horse Trail runs along the west side of Caroline Street South, immediately west of the subject site. The Iron Horse Trail connects to the Laurel Trail at Erb Street to the north which runs through the University of Waterloo to Columbia Lake.

Pedestrian mobility is further supported within the study area by signalized intersections at King Street South and William Street and Caroline Street South and Allen Street. These intersections operate with pedestrian signals and marked crosswalks on all four approaches.

Collectively, these facilities contribute to an interconnected pedestrian network which facilitate convenient access to key destinations including those within uptown Waterloo and the nearby ION LRT stations.

The subject site has a Walk Score³ of 98 out of 100 (“Walker’s Paradise”) which means daily errands do not require a car.

2.2.2 Cycling

While no dedicated bike lanes are provided within the study area, an off-road multi-use trail is provided on the west side of Caroline Street South and a signed bike route is provided along Allen Street West. The nearest dedicated cycling facility is provided on Park Street which is approximately 150 metres from the subject site.

The subject site has a Bike Score of 97 out of 100 (“Biker’s Paradise”) which means daily errands can be accomplished on a bike.

Figure 2.2 illustrates the existing cycling facilities within the study area.

³ “Walk Score,” n.d., <https://www.walkscore.com/score/171-king-st-s-waterloo-on-canada>





Figure 2.2

2.3 Transit Service

Grand River Transit operates five routes within the study area:

- ▶ **Route 5 (Erb)** operates between the Boardwalk Station to Daniel Avenue and Bloomingdale Road. On weekdays, this route operates from 5:30 AM to 12:15 AM with 30-minute headways. On Saturdays, this route operates from 6:05 AM to 11:55 PM with 30 to 60-minute headways. On Sundays, this route operates from 9:45 AM to 6:15 PM with 45-minute headways.
- ▶ **Route 7 (King)** operates between Conestoga Station and Fairway Station. On weekdays, this route operates from 5:30 AM to 12:35 AM with 15-minute headways. On Saturdays, this route operates from 5:40 AM to 12:40 AM with 15-minute headways. On Sundays, this route operates from 8:00 AM to 12:40 AM with 15-minute headways.
- ▶ **Route 16 (Strasburg-Belmont)** operates between Conestoga College Doon Campus to Waterloo Public Square Station. On weekdays, this route operates from 5:20 AM to 11:45 PM with 15-minute headways. On Saturdays, this route operates from 6:25 AM to 12:15 AM with 30-minute headways. On Sundays, this route operates from 7:45 AM to 12:15 AM with 30-minute headways.
- ▶ **Route 301 (ION Light Rail)** operates between Conestoga Mall in Waterloo to Fairview Park Mall in Kitchener. On weekdays, this route operates from 4:45 AM to 12:25 AM with 10 to 30-minute headways. On Saturdays, this route operates from 5:25 AM to 12:25 AM with 15 to 30-minutes headways. On Sundays/Holidays, this route operates from 6:15 AM to 12:25 AM with 15 to 30-minutes headways.

Figure 2.3 illustrates the existing transit network.





2.4 Traffic Volumes

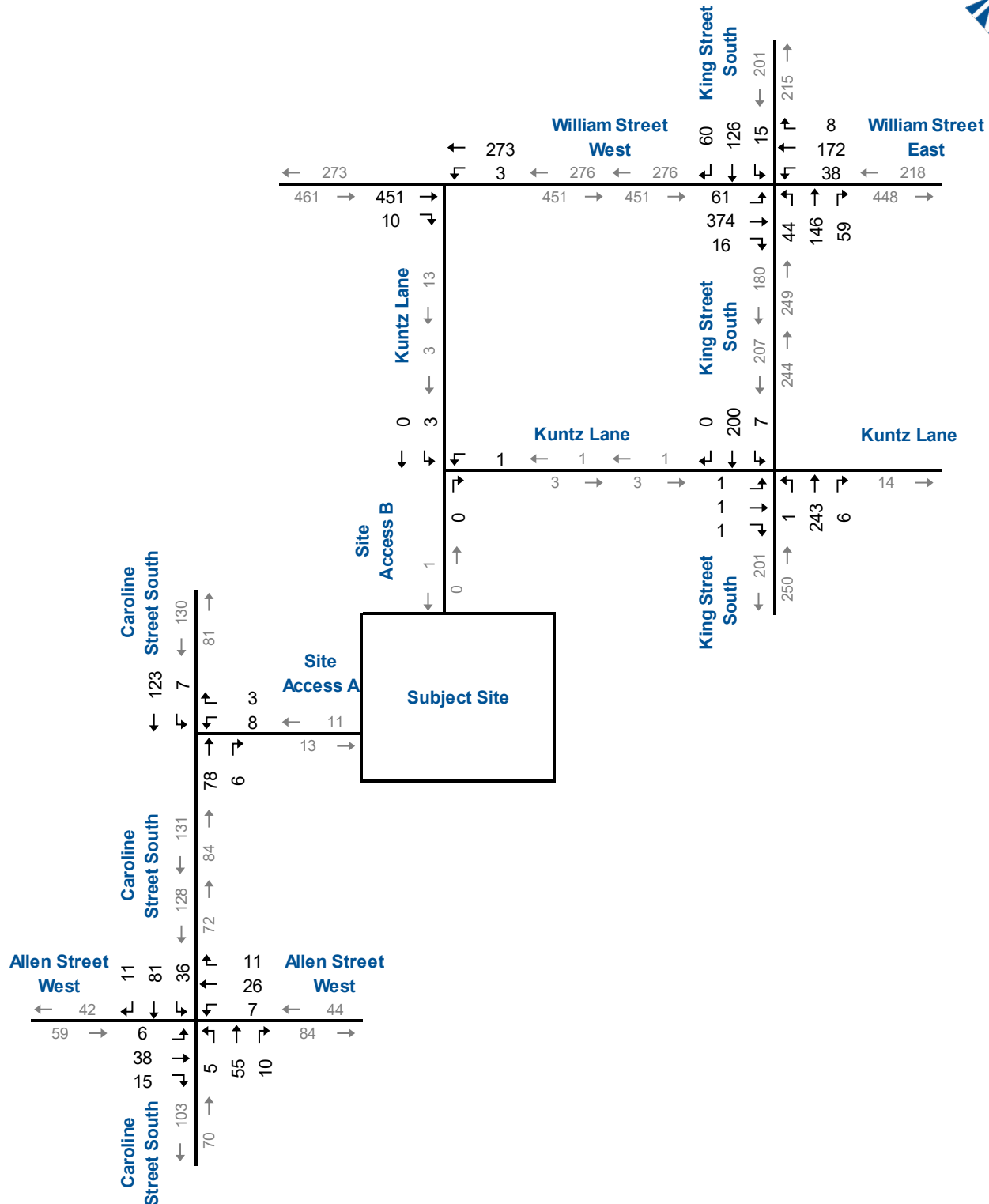
Paradigm collected turning movement counts at Caroline Street South and Allen Street West on 12 November 2024 and at all other study area intersections on 15 May 2025.

Traffic volumes were increased on William Street West between Kuntz Lane and King Street South to ensure balanced volumes since there are no midblock driveways, roadways, or on-street parking spaces.

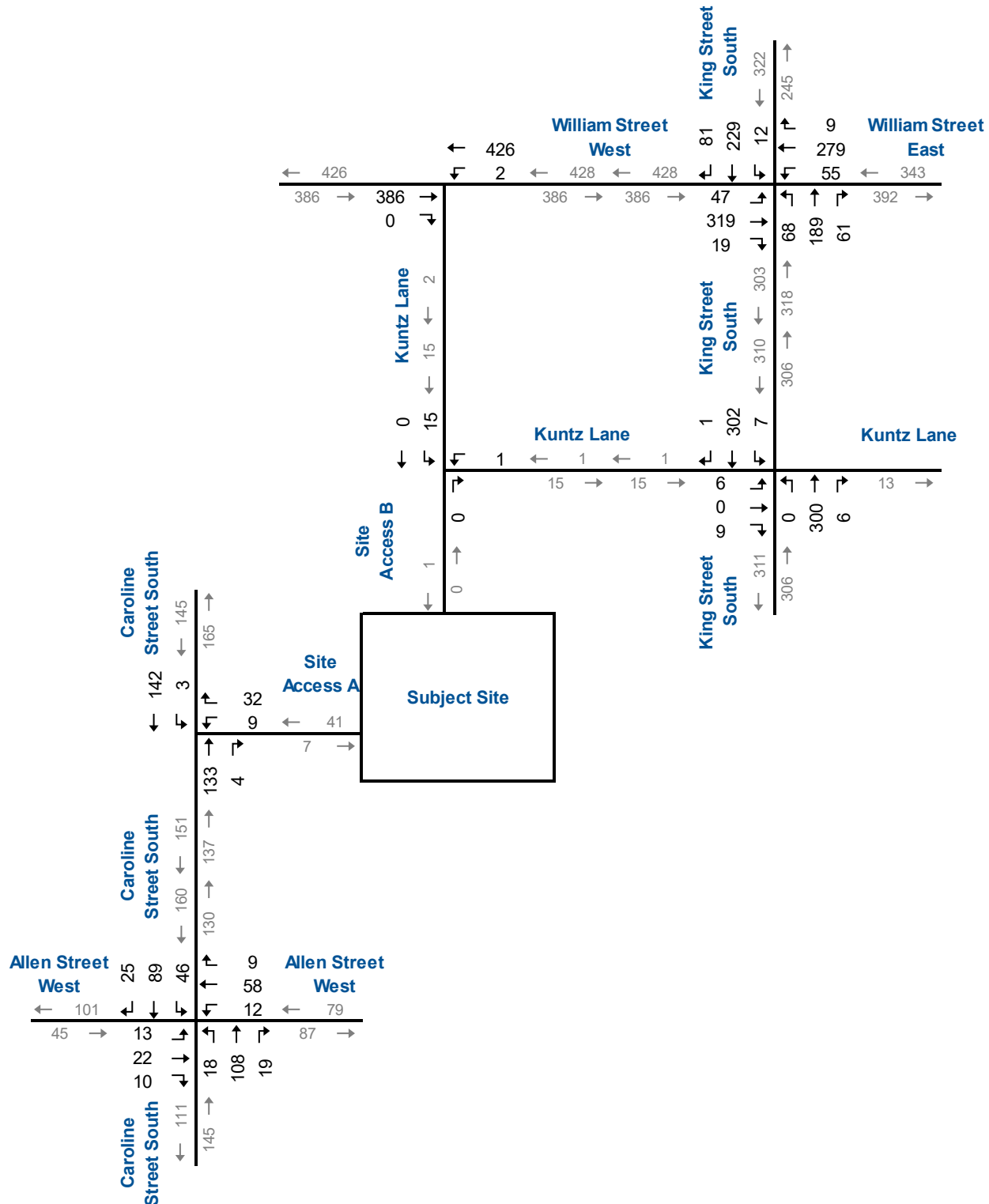
Figure 2.4a and **Figure 2.4b** illustrate the existing AM and PM weekday peak hour traffic volumes, respectively.

Appendix A contains the collected traffic counts and signal timings for the study area intersections.





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 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 12. The signal timing plans provided by the Region for the intersections of King Street South and William Street and Caroline Street South and Allen Street West include an LRT plan which reflect adjustments to the standard plan to accommodate the LRT's movement. The following analyses uses the standard signal timing plans as it runs more frequently given the cycle length for both signalized intersections is 80 seconds and the LRT has a headway of 10 minutes during both peak hours.

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 currently operating at acceptable overall levels of service with no problem movements.

Appendix B contains the detailed Synchro 12 reports. It is noted that HCM 2000 was used to determine the operations at William Street West and Kuntz Lane as HCM 7th Edition does not account for one-way intersections.



TABLE 2.2: EXISTING TRAFFIC OPERATIONS

Analysis Period	Intersection	Control Type	MOE	Direction/Movement/Approach																
				Eastbound				Westbound				Northbound				Southbound				Overall
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	
AM Peak Hour	King Street South & William Street	TCS	LOS Delay V/C Stor. Avail.	B 17 0.16 14 15 1	C 24 0.61 74 - -	> > > > >	C 23	B 17 0.15 10 25 15	B 18 0.28 32 - -	> > > > >	B 18	B 11 0.09 8 35 27	B 11 0.29 27 - -	> > > > >	B 11	B 16 0.03 5 25 20	B 15 0.30 31 - -	> > > > >	B 15	B 18
	King Street South & Kuntz Lane	TWSC	LOS Delay V/C Q	< < < < <	B 11 0.01 0	> > > > >	B 11					< < < < <	A 8 0.00 0	> > > > >	A 0	< < < < <	A 8 0.01 0	> > > > >	A 0	
	Caroline Street South & Allen Street West	TCS	LOS Delay V/C Q	< < < < <	B 11 0.09 10	> > > > >	B 11	< < < < <	B 10 0.07 8	> > > > >	B 10	< < < < <	B 11 0.07 12	> > > > >	B 11	< < < < <	B 12 0.15 22	> > > > >	B 12	B 11
	Caroline Street South & Site Access	TWSC	LOS Delay V/C Q					A 10 0.01 0		> > > > >	A 10		A 0 0.00 0	> > > > >	A 0	< < < < <	A 8 0.01 0		A 0	
	William Street & Kuntz Lane	TWSC	LOS Delay V/C Q		A 0 0.27 0	> > > > >	A 0	< < < < <	A 0 0.00 1			A 0								
PM Peak Hour	King Street South & William Street	TCS	LOS Delay V/C Stor. Avail.	B 17 0.15 11 15 4	C 22 0.53 62 - -	> > > > >	C 21	B 18 0.19 13 25 12	C 20 0.44 52 - -	> > > > >	B 20	B 12 0.17 11 35 24	B 12 0.34 34 - -	> > > > >	B 12	B 16 0.03 4 25 21	C 22 0.53 58 - -	> > > > >	C 22	B 19
	King Street South & Kuntz Lane	TWSC	LOS Delay V/C Q	< < < < <	B 13 0.03 1	> > > > >	B 13					< < < < <	A 0 0.00 0	> > > > >	A 0	< < < < <	A 8 0.01 0	> > > > >	A 0	
	Caroline Street South & Allen Street West	TCS	LOS Delay V/C Q	< < < < <	B 11 0.07 8	> > > > >	B 11	< < < < <	B 12 0.13 14	> > > > >	B 12	< < < < <	B 11 0.15 23	> > > > >	B 11	< < < < <	B 12 0.19 28	> > > > >	B 12	B 12
	Caroline Street South & Site Access	TWSC	LOS Delay V/C Q					A 10 0.05 2		> > > > >	A 10		A 0 0.00 0	> > > > >	A 0	< < < < <	A 8 0.00 0		A 0	
	William Street & Kuntz Lane	TWSC	LOS Delay V/C Q		A 0 0.23 0	> > > > >	A 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)

Stor. - Existing Storage (m)

Avail. - Available Storage (m)

TCS - Traffic Control Signal

TWSC - Two-Way Stop Control

< / > - Shared with through movement



3 Development Concept

3.1 Development Description

The subject site is located southeast of the King Street South and William Street intersection. The proposed redevelopment consists of the removal of the existing funeral home and the construction of two towers: a 37-storey, 438-unit tower (Tower A), and a 33-storey, 396-unit tower with ground floor retail (1,810 sq.ft.) and restaurant (4,069 sq.ft.) space (Tower B).

Vehicular access is proposed via the existing two driveways to Caroline Street South and Kuntz Lane.

The proposed redevelopment is to be built out in two phases with Tower A completed by 2027 and Tower B by 2028.

Figure 3.1 illustrates the proposed site plan.



3.2 Development Trip Generation

3.2.1 Vehicle Trip Generation

The Institute of Transportation Engineers (ITE) Trip Generation Manual⁴ provides rates and equations used to estimate the peak hour vehicular traffic volumes for various Land Use Codes (LUC) of this development:

- ▶ LUC 222 (Multifamily Housing (High-Rise));
- ▶ LUC 822 (Strip Retail Plaza <40k); and
- ▶ LUC 932 (High-Turnover (Sit-Down) Restaurant).

To reflect the location of the subject site and its proximity to an ION LRT station, the setting for LUC 222 was adjusted to Dense Multi-Use Urban, Close to Rail Transit. For LUCs 822 and 932, the setting General Urban/Suburban was used.

Given the mixed-use nature of the development, the trip generation estimates include trips internal to the site. These are trips completed between two different land uses but remain within the site. Estimates of internal trips have been completed using the National Cooperative Highway Research Program (NCHRP) 8-51 Internal Capture Estimation Tool. **Appendix C** contains the internal capture worksheets.

Lastly, the ITE Trip Generation Manual provides average pass-by rates for certain land use codes. It is noted that the pass-by rates for LUC 821 (Shopping Plaza (40-150k)) were applied to the estimated trips generated by the retail land use as pass-by rates are not provided for LUC 822. Pass-by trips were assigned to the intersection of King Street South and Kuntz Lane based on the existing volume distribution along the roadway.

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

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



TABLE 3.1: VEHICLE TRIP GENERATION

Land Use	Number of Units	AM Peak Hour				PM Peak Hour			
		Rate	In	Out	Total	Rate	In	Out	Total
LUC 222 - Multifamily Housing (High-Rise)	834	Egn ¹	18	144	162	Egn ¹	92	41	133
Internal Capture		4%	1	5	6	8%	6	4	10
LUC 822 - Strip Retail Plaza (<40k) (1,000 sq.ft.)	1.81	2.36	3	1	4	Egn ²	12	11	23
Internal Capture		25%	1	0	1	57%	7	6	13
Pass-by (LUC 821)	4.07	0%	0	0	0	40%	2	2	4
LUC 932 - High-Turnover (Sit-Down) Restaurant (1,000 sq.ft.)		9.57	21	18	39	9.05	22	15	37
Internal Capture		13%	4	1	5	41%	6	9	15
Pass-by (LUC 932)		0%	0	0	0	43%	5	5	10
Total Trip Generation			42	163	205		126	67	193
Total Internal Capture			6	6	12		19	19	38
Total Pass-By			0	0	0		7	7	14
Net Trip Generation			36	157	193		100	41	141

¹LUC 222 - AM: $\ln(T) = 0.93\ln(X) - 1.17$ | PM: $\ln(T) = 0.87\ln(X) - 0.96$

²LUC 822 - PM: $\ln(T) = 0.71\ln(X) + 2.72$

3.2.2 Pedestrian and Bicycle Trip Generation

In addition to vehicular trips, the ITE Trip Generation Manual provides rates to estimate the number of walking and cycling trips forecast to be generated by the proposed development. The same LUCs and settings used to determine the vehicle trip generation were used to determine the number of walking and cycling trips.

It is noted that walking and cycling trip rates have been studied less extensively compared to vehicle trip rates. Therefore, no walking trip rates were available for the AM peak hour for the retail land use and for the AM and PM peak hours for the restaurant land use. Additionally, cycling trip rates were not provided for any of the non-residential land uses.

Table 3.2 summarizes the forecast number of pedestrian and bicycle trips generated by the proposed development.

TABLE 3.2: PEDESTRIAN AND BICYCLE TRIP GENERATION

Land Use	Number of Units	Mode	AM Peak Hour		PM Peak Hour	
			Rate	Total	Rate	Total
LUC 222 - Multifamily Housing (High-Rise)	834	Walk	0.18	150	0.29	242
		Bicycle	0.02	17	0.01	8
LUC 822 - Strip Retail Plaza (<40k) (1,000 sq.ft.)	1.81	Walk	-	-	0.56	1
Total Pedestrian and Bicycle Trip Generation				167		251



3.3 Development Trip Distribution and Assignment

3.3.1 Vehicle Trip Distribution and Assignment

The vehicle trip distribution was determined based on existing travel patterns within the study area and 2022 TTS⁵ data for Zone 12035. Trips travelling north or west are likely to travel to/from the north or west areas of Waterloo, respectively. Trips travelling east are likely to travel to/from the Expressway and trips travelling south are likely to travel to/from downtown Kitchener. Site trips are likely to be dispersed throughout the study area given the interconnected nature of the grid network in the uptown area.

Trips generated by Phase 1 of the proposed development have been assigned to use the access on Caroline Street South. The build out of the full development will result in the use of both accesses.

Table 3.2 displays the breakdown of trip distributions used in this study.

TABLE 3.2: ESTIMATED TRIP DISTRIBUTION

Origin/Destination	Percentage
North	25%
South	20%
East	30%
West	25%
Total	100%

Figure 3.2a and **Figure 3.2b** illustrate the Phase 1 site generated traffic volumes for the AM and PM peak hours, respectively.

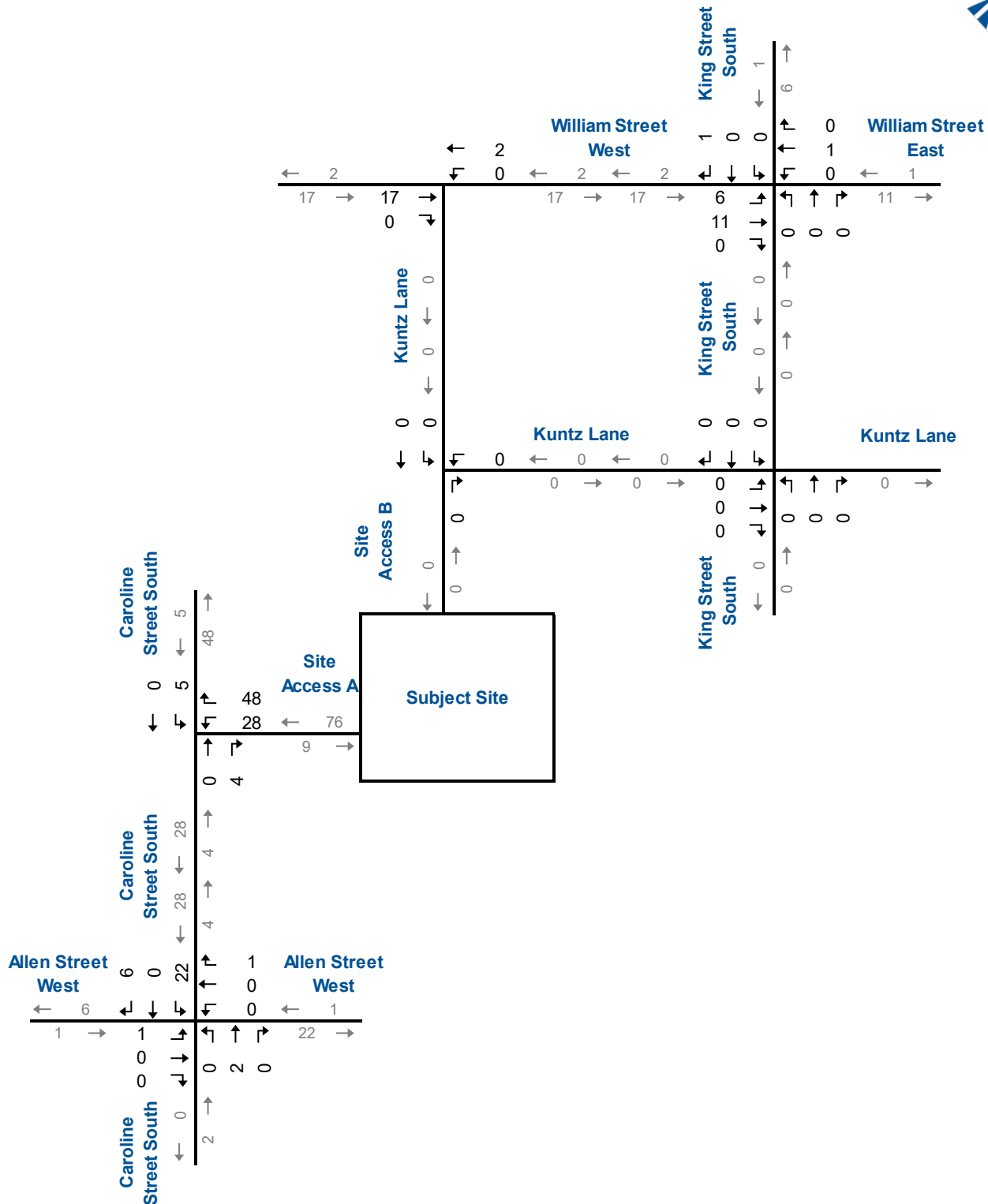
Figure 3.2c and **Figure 3.2d** illustrate the Phase 2 site generated traffic volumes for the AM and PM peak hours, respectively.

Figure 3.2e and **Figure 3.2f** illustrate the site generated traffic volumes at full build-out for the AM and PM peak hours, respectively.

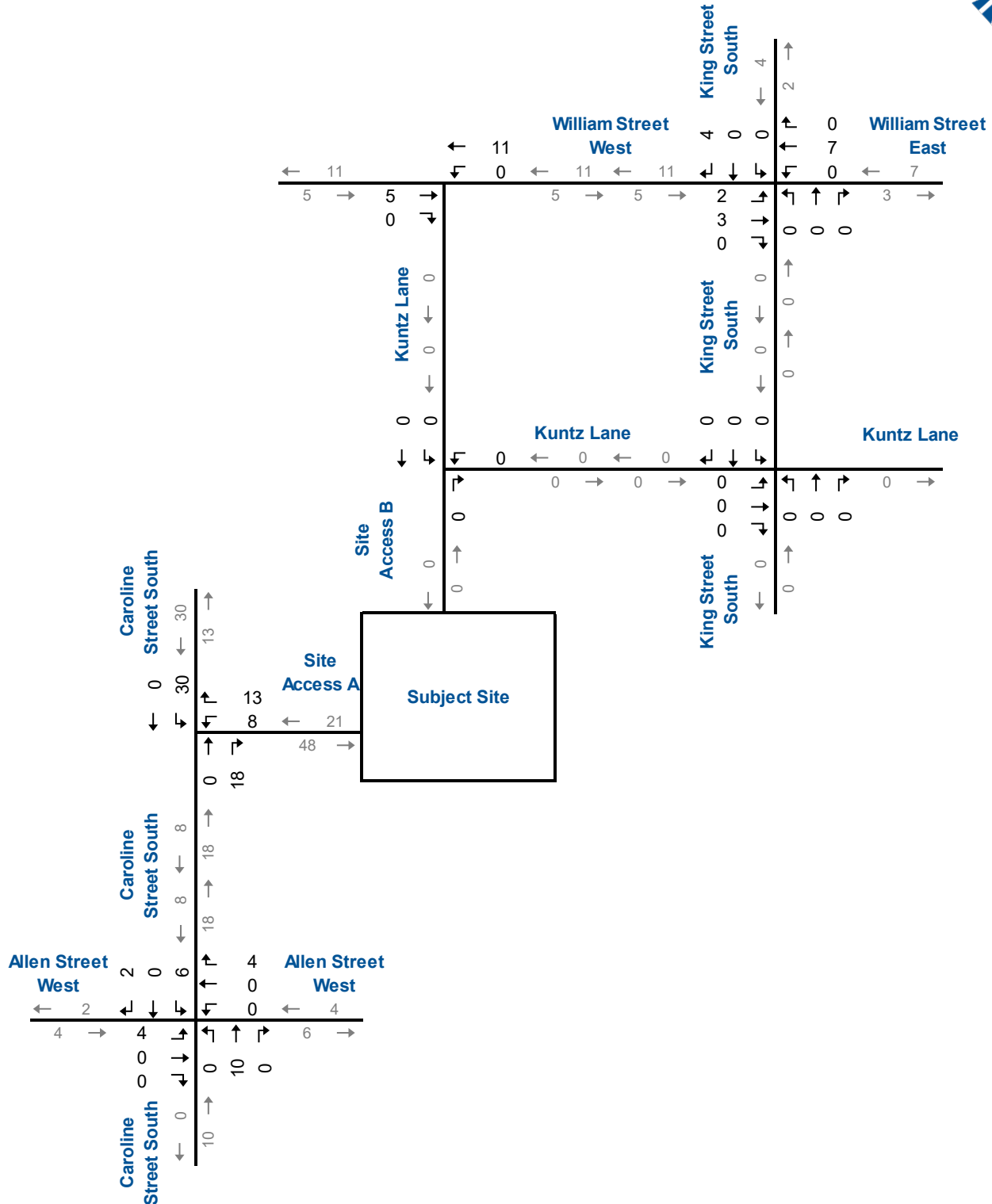
⁵ Data Management Group, Transportation Tomorrow Survey 2022, University of Toronto, 2022. <http://www.transportationtomorrow.on.ca/>



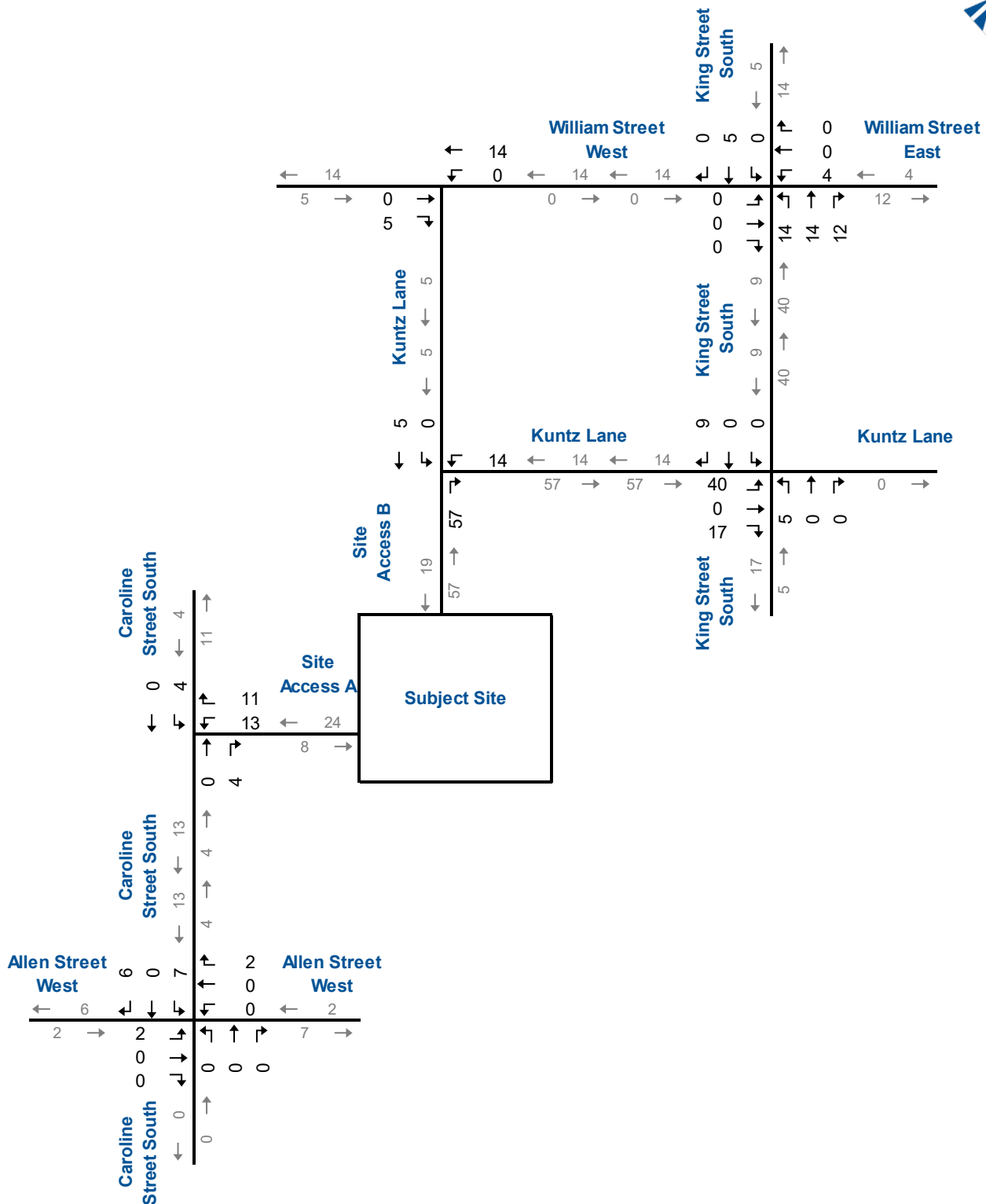
AM Peak Hour



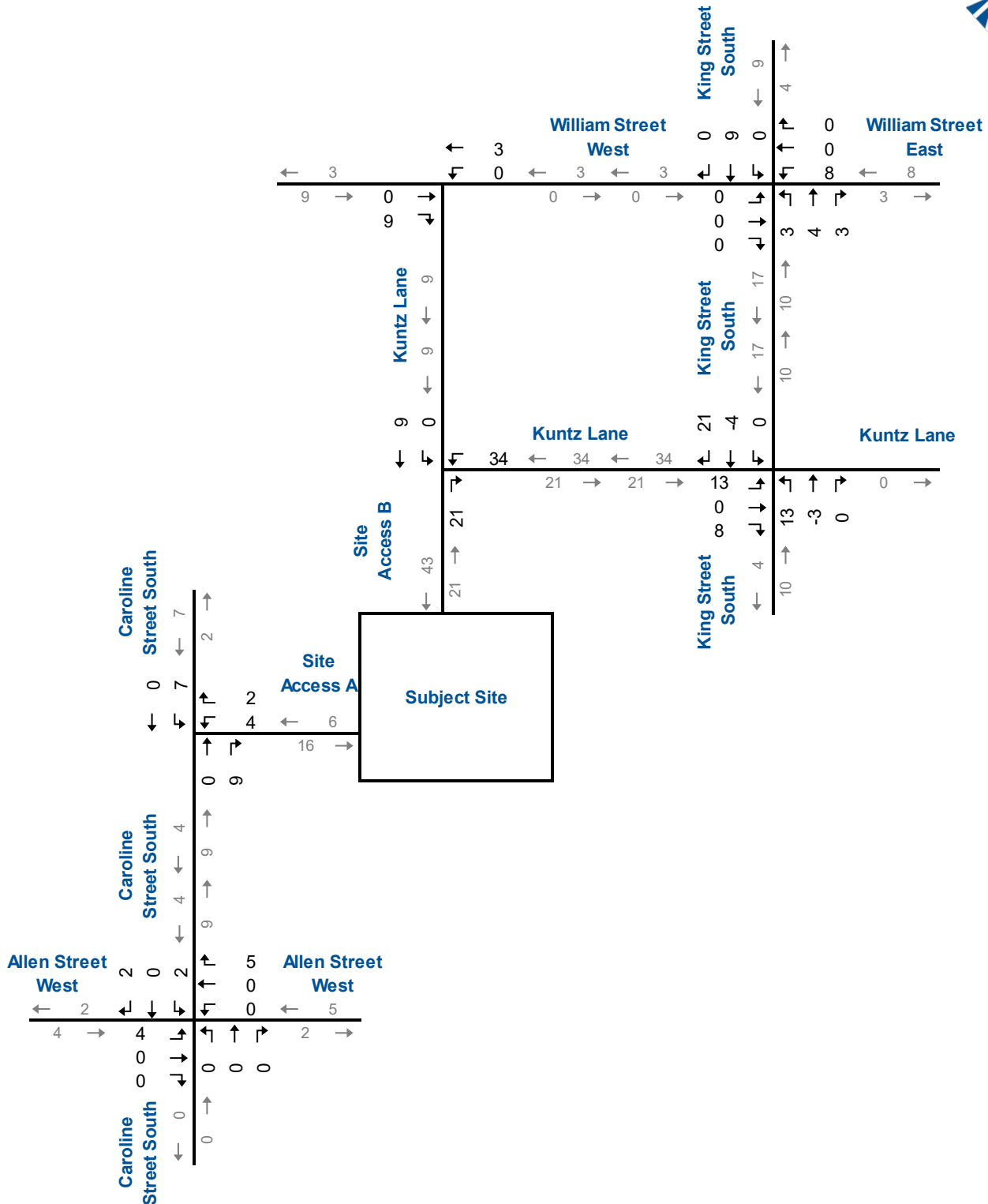
PM Peak Hour



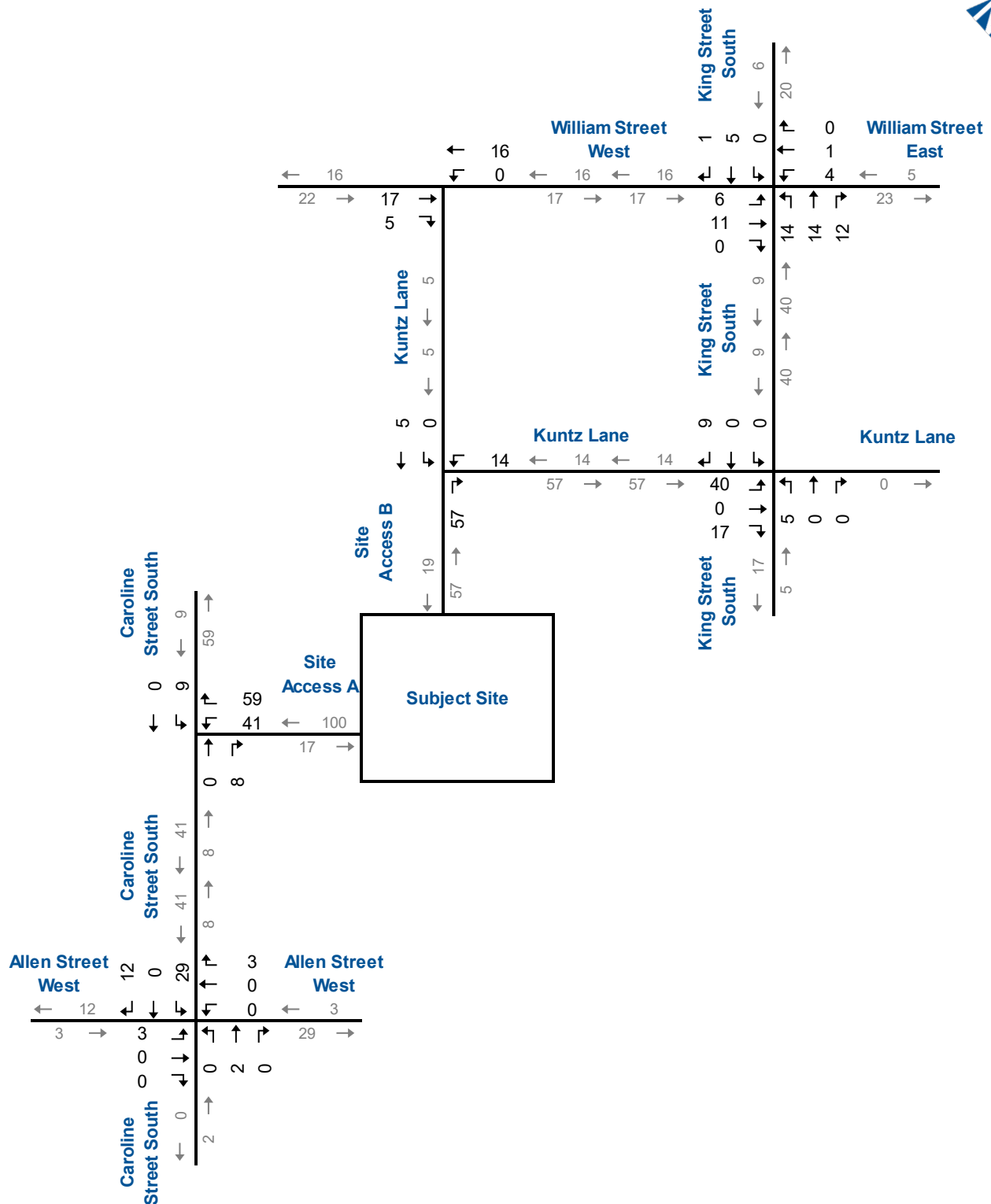
AM Peak Hour



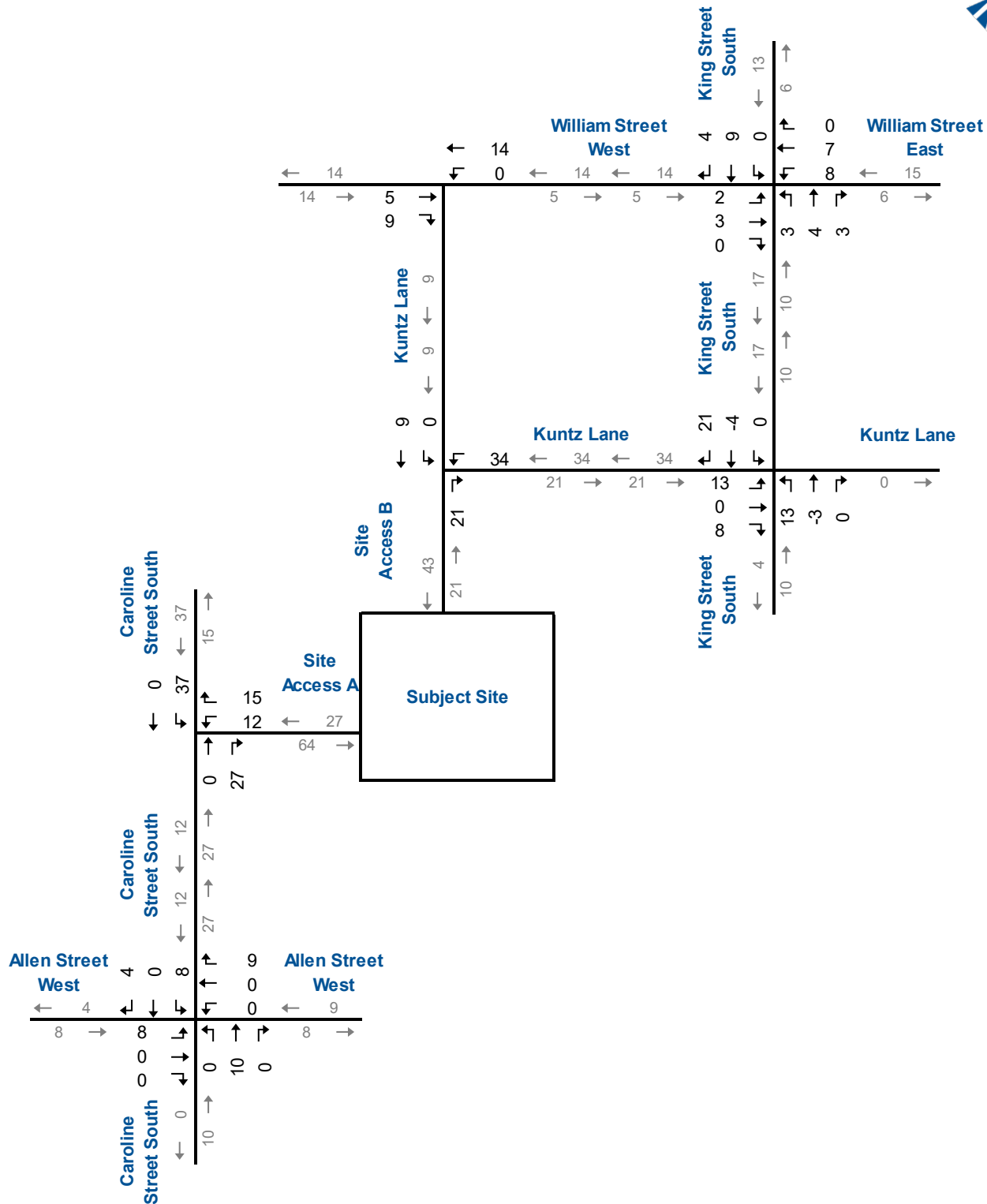
PM Peak Hour



AM Peak Hour



PM Peak Hour



3.3.2 Pedestrian and Cyclist Points of Interest

There exists many places of interest that are within walking or cycling distance from the subject site given its location within the Urban Growth Centre. These points of interest include, but are not limited to, the ION LRT Stations, the Shops at Waterloo Town Square, places of worship and neighbourhood parks. These points of interests are accessible via walking or cycling given the existing sidewalks along all studied roadways, the multi-use trail on Caroline Street and the cycling infrastructure on Allen Street.

Figure 3.3 illustrates common points of interest including the existing major active transportation routes near the subject site.



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 traffic conditions after the build out of Phase 1 (2027), build-out of Phase 2 (2028) and five years beyond full build-out (2033).

4.1 Background Traffic Forecasts

To derive the generalized background traffic volumes, a growth rate of 1.5% was applied to the existing roadway traffic volumes. This growth rate was confirmed with the City and Region during the pre-study consultation.

4.1.1 Other Area Developments

In addition to the generalized background traffic growth, the following developments have been included in the background traffic volumes:

- ▶ 203-207 King Street South and 10-16 John Street West⁶: This development consists of a 27-storey mixed-use building with 338 units, 2,467 sq.ft. of daycare space and 7,112 sq.ft. of commercial space. The TIS completed for this location indicates the development is forecast to generate 122 AM peak hour trips and 146 PM peak hour trips.
- ▶ 187-191 King Street⁷: The property owner of this existing development is proposing to reconfigure the existing King Street South driveway from a right-in/right-out to a right-in only driveway. All exiting vehicles will be directed to use the Caroline Street driveway. The Traffic Impact Statement completed for this location indicates 2 vehicles during the AM peak hour and 20 vehicles during the PM peak hour will be reassigned to the Caroline Street driveway.
- ▶ 115 Park Street and 47 Norman Street: This development consists of a six-storey, 60-unit, mixed-use apartment building with 1,959 sq.ft. of ground floor commercial space. The Traffic Impact Statement completed for this location indicates the development is forecast to generate 12 AM peak hour trips and 22 PM peak hour trips.

⁶ Nextrans Consulting Engineers, Transportation Impact Study Proposed Mixed-Use Development 203-207 King Street South City of Waterloo, ON, September 2023.

⁷ Paradigm Transportation Solutions Limited, *187-191 King Street South, Waterloo, ON Traffic Brief*, December 2024.



- ▶ 924-944 King Street West⁸: This development consists of 28-storey mixed-use building accommodating 341 residential units and 659 m² (7,093 sq.ft) of ground floor commercial space. The TIS completed for this location indicates the development is forecast to generate 87 AM peak hour trips and 90 PM peak hour trips.
- ▶ 864-872 King Street West⁹: This development consists of a 455-unit, 44-storey residential building. The TIS completed for this location indicates the development is forecast to generate 100 AM peak hour trips and 86 PM peak hour trips.

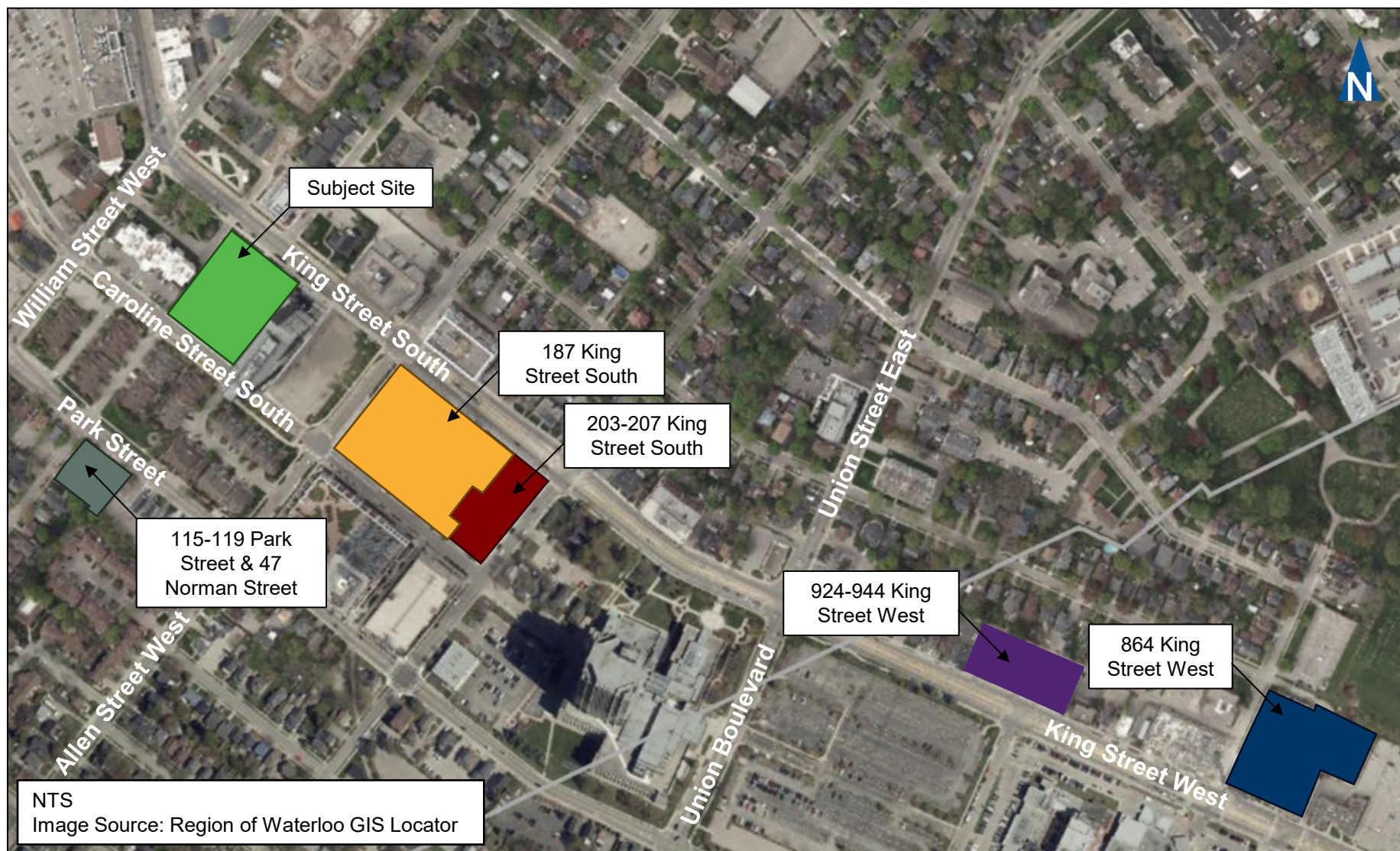
Figure 4.1 illustrates the location of the other area developments relative to the subject site.

Appendix D contains the traffic volumes generated by the other area developments.

⁸ Paradigm Transportation Solutions Limited, *924-944 King Street West, Kitchener, ON Transportation Impact Study*, December 2024.

⁹ Paradigm Transportation Solutions Limited, *864 King Street West, Kitchener, ON Transportation Impact Study*, June 2024.





4.2 Phase 1 (Tower A) Build-Out Horizon – Year 2027

4.2.1 Background Traffic Operations

Figure 4.2a and **Figure 4.2b** illustrate the 2027 background traffic volumes, including road traffic growth and other area development traffic.

The 2027 background traffic volumes have been analyzed using the same methodology as under existing traffic conditions. Signal timings have not been optimized to review the impacts from background traffic growth.

Table 4.1 summarizes the results of the 2027 background traffic operations. The results indicate that the study area intersections are forecast to operate at acceptable levels of service with no problem movements during the AM and PM peak hours.

Appendix E contains the supporting detailed Synchro 12 reports.



TABLE 4.1: 2027 BACKGROUND TRAFFIC OPERATIONS

Analysis Period	Intersection	Control Type	MOE	Direction/Movement/Approach																
				Eastbound				Westbound				Northbound				Southbound				Overall
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	
AM Peak Hour	King Street South & William Street	TCS	LOS Delay V/C Q Stor. Avail.	B 17 0.17 14 15 1	C 25 0.64 77 - -	> > > > >	C 24	B 18 0.16 11 25 14	B 18 0.29 33 - -	> > > > >	B 18	B 11 0.12 10 35 25	B 12 0.36 35 - -	> > > > >	B 12	B 16 0.03 5 25 20	B 16 0.32 35 - -	> > > > >	B 16	B 18
	King Street South & Kuntz Lane	TWSC	LOS Delay V/C Q	< < < < <	B 12 0.01 0	> > > > >	B 12					< < < < <	A 8 0.00 0	> > > > >	A 0	< < < < <	A 8 0.01 0	> > > > >	A 0	
	Caroline Street South & Allen Street West	TCS	LOS Delay V/C Q	< < < < <	B 11 0.10 10	> > > > >	B 11	< < < < <	B 11 0.07 8	> > > > >	B 11	< < < < <	B 10 0.08 13	> > > > >	B 10	< < < < <	B 12 0.16 23	> > > > >	B 12	B 11
	Caroline Street South & Site Access	TWSC	LOS Delay V/C Q					A 10 0.01 0		> > > > >	A 10		A 0 0.00 0	> > > > >	A 0	< < < < <	A 8 0.01 0		A 0	
	William Street & Kuntz Lane	TWSC	LOS Delay V/C Q		A 0 0.28 0	> > > > >	A 0	< < < < <	A 0 0.00 1		A 0									
PM Peak Hour	King Street South & William Street	TCS	LOS Delay V/C Q Stor. Avail.	B 17 0.16 12 15 3	C 23 0.56 66 - -	> > > > >	C 22	B 19 0.23 15 25 10	C 21 0.47 54 - -	> > > > >	C 20	B 12 0.20 12 35 23	B 13 0.37 38 - -	> > > > >	B 12	B 17 0.03 4 25 21	C 24 0.60 69 - -	> > > > >	C 24	B 20
	King Street South & Kuntz Lane	TWSC	LOS Delay V/C Q	< < < < <	B 14 0.04 1	> > > > >	B 14					< < < < <	A 0 0.00 0	> > > > >	A 0	< < < < <	A 8 0.01 0	> > > > >	A 0	
	Caroline Street South & Allen Street West	TCS	LOS Delay V/C Q	< < < < <	B 11 0.08 9	> > > > >	B 11	< < < < <	B 12 0.13 14	> > > > >	B 12	< < < < <	B 10 0.19 26	> > > > >	B 10	< < < < <	B 12 0.20 29	> > > > >	B 12	B 12
	Caroline Street South & Site Access	TWSC	LOS Delay V/C Q					A 10 0.05 2		> > > > >	A 10		A 0 0.00 0	> > > > >	A 0	< < < < <	A 8 0.00 0		A 0	
	William Street & Kuntz Lane	TWSC	LOS Delay V/C Q		A 0 0.24 0	> > > > >	A 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)

Stor. - Existing Storage (m)

Avail. - Available Storage (m)

TCS - Traffic Control Signal

TWSC - Two-Way Stop Control

</> - Shared with through movement



4.2.2 Total Traffic Operations

Figure 4.3a and **Figure 4.3b** illustrate the 2027 total traffic volumes, including trips generated by the proposed development. Traffic volumes at the existing accesses have been removed from the study area network.

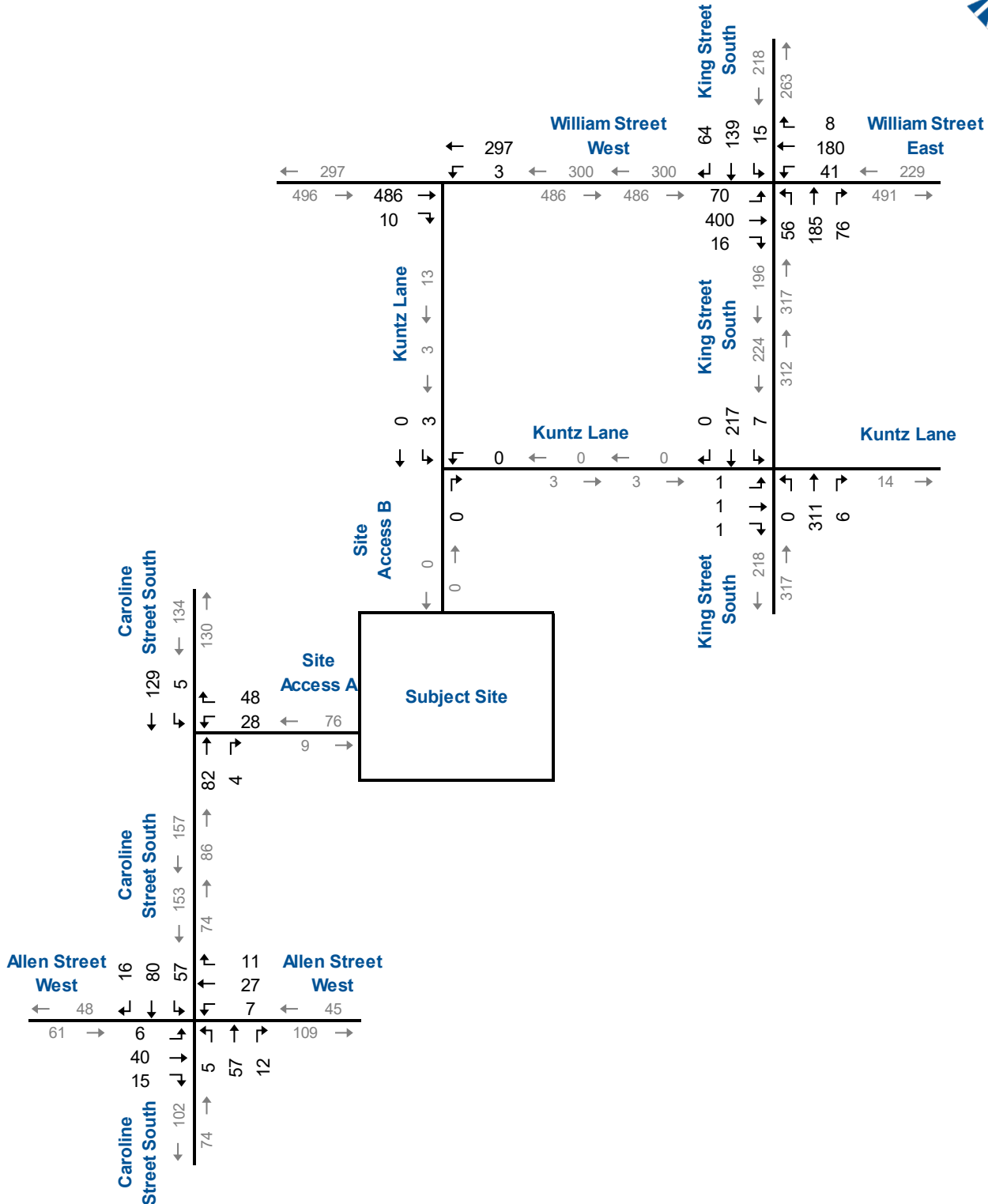
The 2027 total traffic volumes have been analyzed using the same methodology as under existing and background traffic conditions. Signal timings have not been optimized to review the impacts from the subject development.

Table 4.2 summarizes the results of the 2027 total traffic operations. The results indicate that the study area intersections are forecast to operate at acceptable levels of service with no problem movements during the AM and PM peak hours.

Appendix F contains the supporting detailed Synchro 12 reports.



AM Peak Hour



2027 Total Traffic Volumes AM Peak Hour

PM Peak Hour

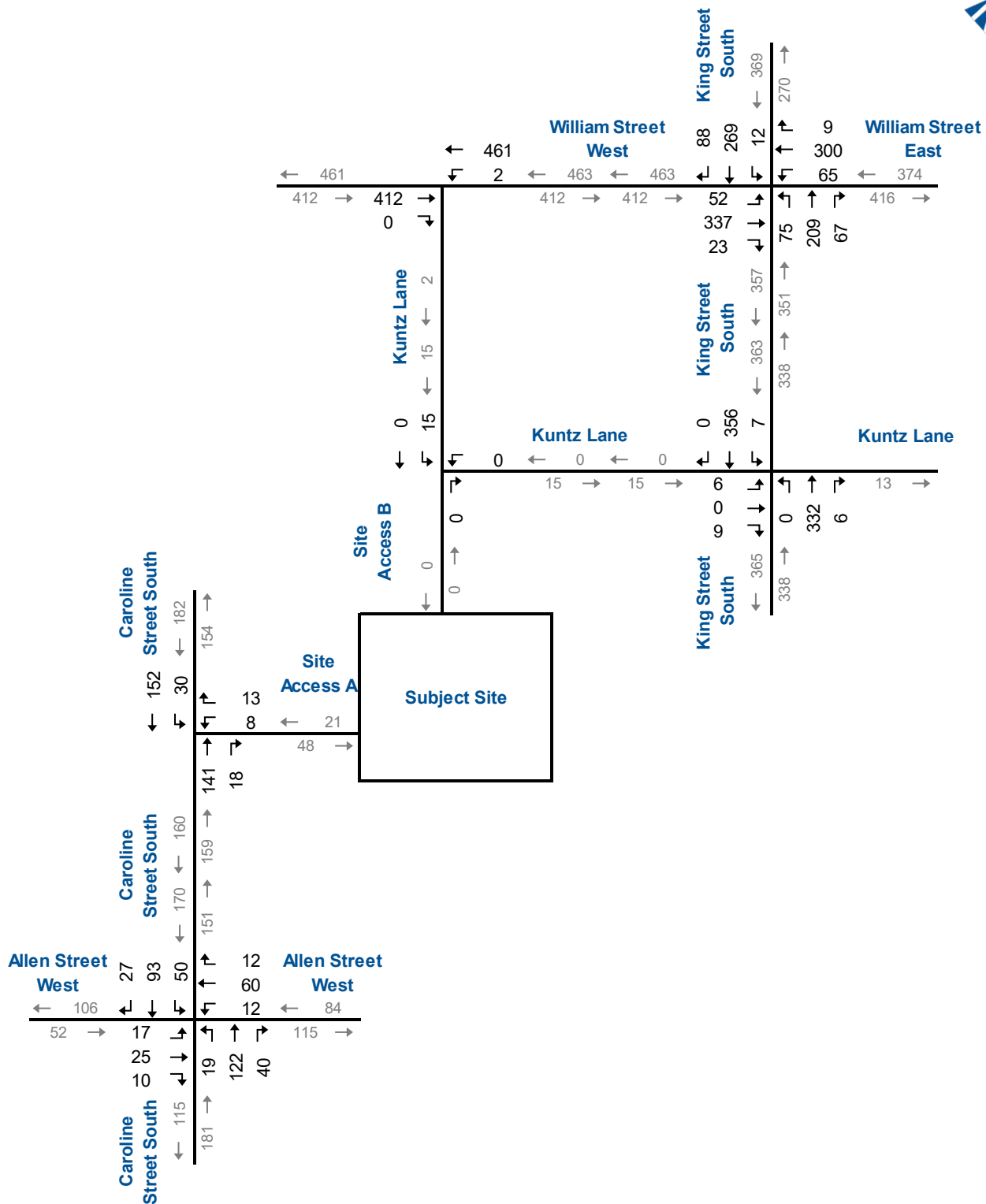


TABLE 4.2: 2027 TOTAL TRAFFIC OPERATIONS

Analysis Period	Intersection	Control Type	MOE	Direction/Movement/Approach																
				Eastbound				Westbound				Northbound				Southbound				Overall
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	
AM Peak Hour	King Street South & William Street	TCS	LOS Delay V/C Stor. Avail.	B 17 0.18 15 0	C 25 0.65 80 - -	> > > >	C 24	B 18 0.17 11 25 14	B 18 0.30 34 - -	> > > >	B 18	B 11 0.12 10 35 25	B 12 0.36 35 - -	> > > >	B 12	B 16 0.03 5 25 20	B 16 0.32 35 - -	> > > >	B 16	B 18
	King Street South & Kuntz Lane	TWSC	LOS Delay V/C Q	< < < <	B 12 0.01 0	> > > >	B 12					< < < <	A 0 0.00 0	> > > >	A 0	< < < <	A 8 0.01 0	> > > >	A 0	
	Caroline Street South & Allen Street West	TCS	LOS Delay V/C Q	< < < <	B 11 0.10 10	> > > >	B 11	< < < <	B 11 0.07 8	> > > >	B 11	< < < <	B 10 0.08 12	> > > >	B 10	< < < <	B 12 0.19 27	> > > >	B 12	B 11
	Caroline Street South & Site Access	TWSC	LOS Delay V/C Q					A 10 0.09 2		> > > >	A 10		A 0 0.00 0	> > > >	A 0	< < < <	A 8 0.00 0		A 0	
	William Street & Kuntz Lane	TWSC	LOS Delay V/C Q		A 0 0.29 0	> > > >	A 0	< < < <	A 0 0.00 0		A 0									
PM Peak Hour	King Street South & William Street	TCS	LOS Delay V/C Stor. Avail.	B 17 0.17 12 15 3	C 23 0.57 67 - -	> > > >	C 22	B 19 0.23 15 25 10	C 21 0.48 56 - -	> > > >	C 20	B 12 0.20 12 35 23	B 13 0.37 38 - -	> > > >	B 12	B 17 0.03 4 25 21	C 24 0.61 70 - -	> > > >	C 24	B 20
	King Street South & Kuntz Lane	TWSC	LOS Delay V/C Q	< < < <	B 14 0.04 1	> > > >	B 14					< < < <	A 0 0.00 0	> > > >	A 0	< < < <	A 8 0.01 0	> > > >	A 0	
	Caroline Street South & Allen Street West	TCS	LOS Delay V/C Q	< < < <	B 11 0.08 10	> > > >	B 11	< < < <	B 12 0.13 14	> > > >	B 12	< < < <	B 12 0.23 28	> > > >	B 12	< < < <	B 14 0.24 29	> > > >	B 14	B 13
	Caroline Street South & Site Access	TWSC	LOS Delay V/C Q					B 10 0.03 1		> > > >	B 10		A 0 0.00 0	> > > >	A 0	< < < <	A 8 0.02 1		A 1	
	William Street & Kuntz Lane	TWSC	LOS Delay V/C Q		A 0 0.24 0	> > > >	A 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)

Stor. - Existing Storage (m)

Avail. - Available Storage (m)

TCS - Traffic Control Signal

TWSC - Two-Way Stop Control

</> - Shared with through movement



4.3 Phase 2 (Tower B) Build-Out Horizon – Year 2028

4.3.1 Background Traffic Operations

Figure 4.4a and **Figure 4.4b** illustrate the 2028 background traffic volumes, including road traffic growth and other area development traffic.

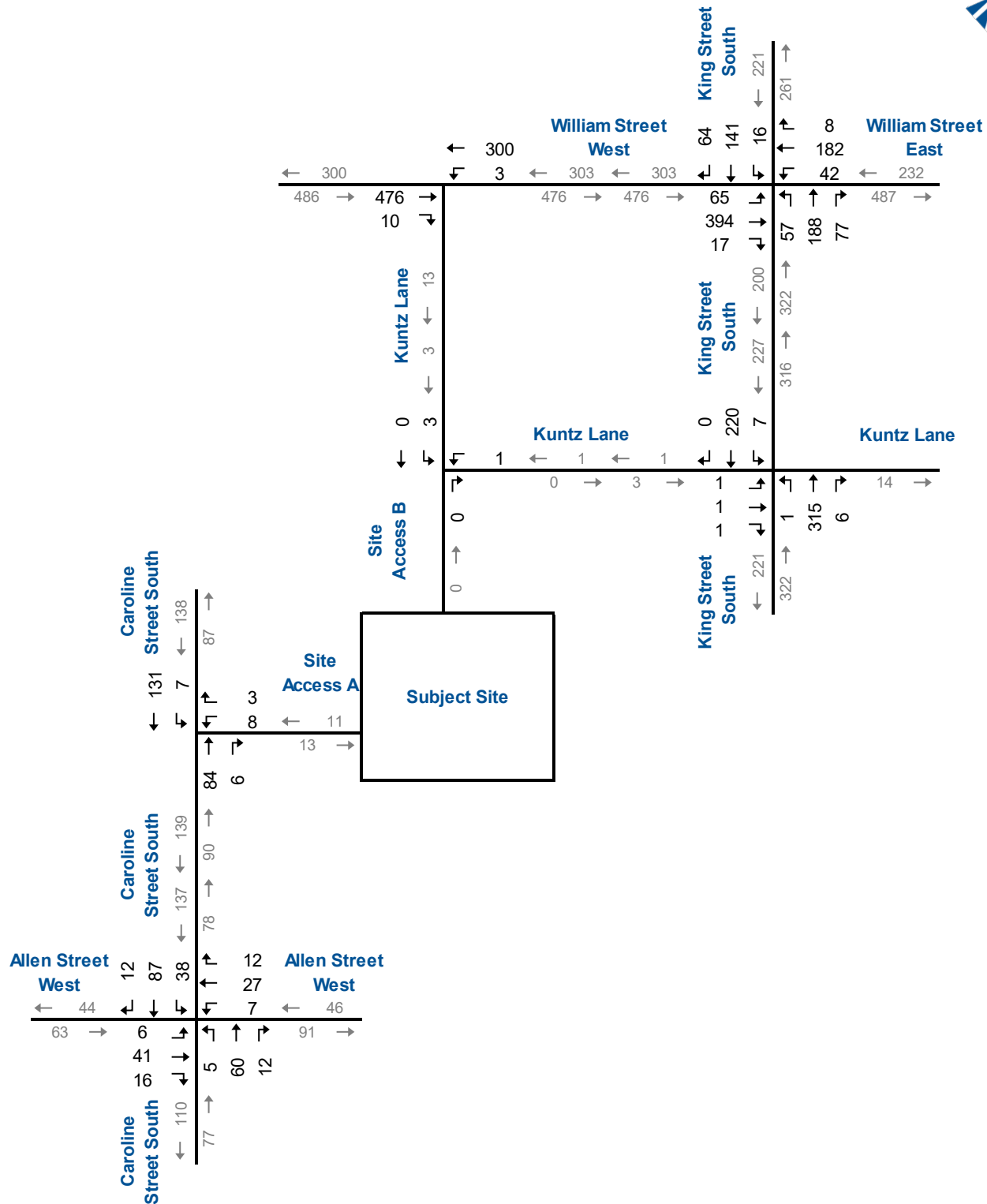
The 2028 background traffic volumes have been analyzed using the same methodology as under existing and 2027 traffic conditions. Signal timings have not been optimized to review the impacts from background traffic growth.

Table 4.3 summarizes the results of the 2028 background traffic operations. The results indicate that the study area intersections are forecast to operate at acceptable levels of service with no problem movements during the AM and PM peak hours.

Appendix G contains the supporting detailed Synchro 12 reports.



AM Peak Hour



PM Peak Hour

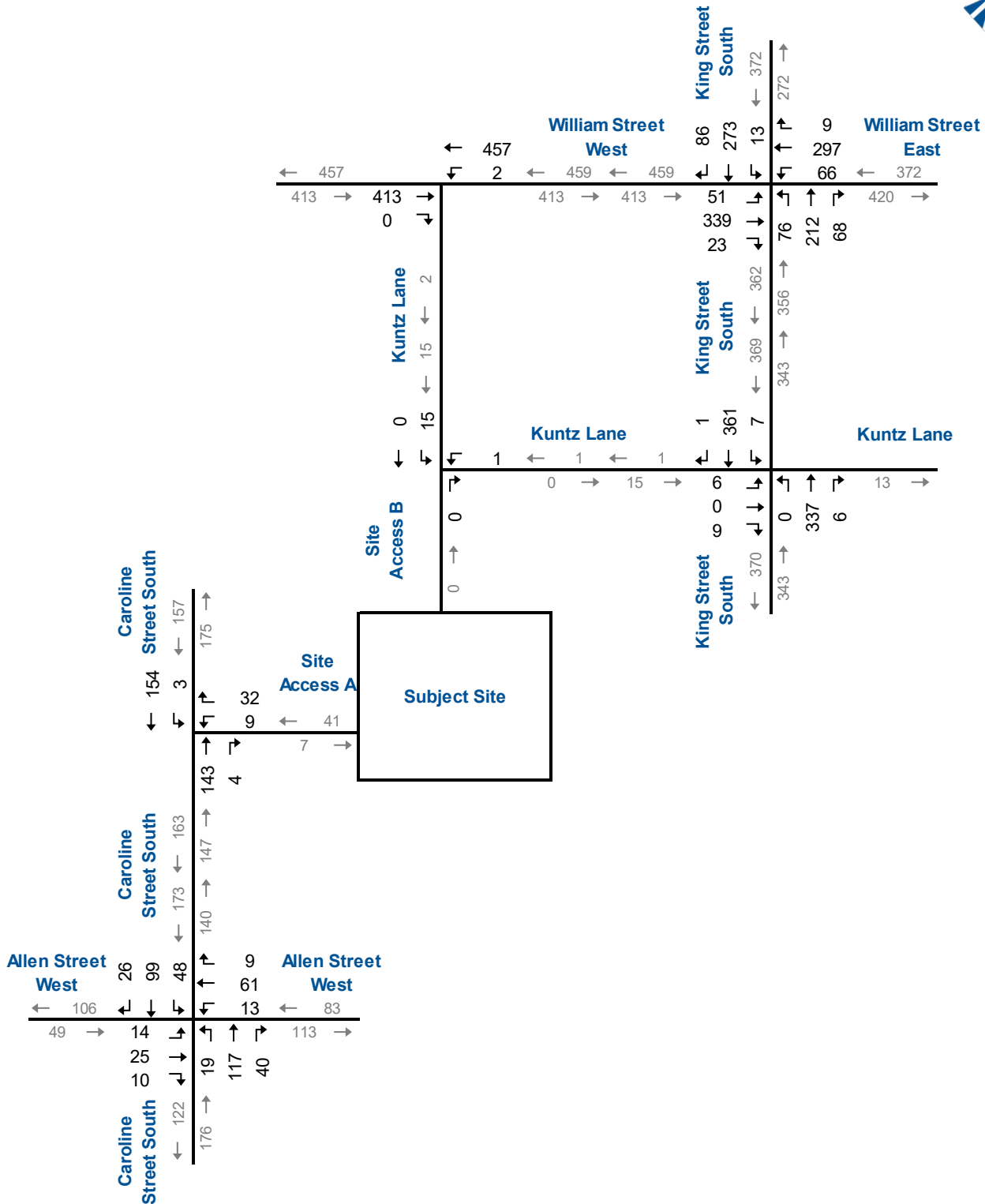


TABLE 4.3: 2028 BACKGROUND TRAFFIC OPERATIONS

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	King Street South & William Street	TCS	LOS Delay V/C Stor. Avail.	B 17 0.17 14 15 1	C 25 0.65 79 - -	> > > >	C 24	B 18 0.17 11 25 14	B 18 0.30 34 - -	> > > >	B 18	B 11 0.12 10 35 25	B 12 0.37 36 - -	> > > >	B 12	B 16 0.04 5 25 20	B 16 0.33 35 - -	> > > >	B 16	B 18
	King Street South & Kuntz Lane	TWSC	LOS Delay V/C Q	< < < <	B 12 0.01 0	> > > >	B 12					< < < <	A 8 0.00 0	> > > >	A 0	< < < <	A 8 0.01 0	> > > >	A 0	
	Caroline Street South & Allen Street West	TCS	LOS Delay V/C Q	< < < <	B 11 0.10 10	> > > >	B 11	< < < <	B 10 0.07 8	> > > >	B 10	< < < <	B 10 0.08 13	> > > >	B 10	< < < <	B 12 0.16 24	> > > >	B 12	B 11
	Caroline Street South & Site Access	TWSC	LOS Delay V/C Q					A 10 0.01 0		> > > >	A 10		A 0 0.00 0	> > > >	A 0	< < < <	A 8 0.01 0		A 0	
	William Street & Kuntz Lane	TWSC	LOS Delay V/C Q		A 0 0.29 0	> > > >	A 0	< < < <	A 0 0.00 1		A 0									
PM Peak Hour	King Street South & William Street	TCS	LOS Delay V/C Stor. Avail.	B 17 0.17 12 15 3	C 23 0.57 67 - -	> > > >	C 22	B 19 0.24 16 25 9	C 21 0.47 55 - -	> > > >	C 20	B 12 0.21 12 35 23	B 13 0.38 39 - -	> > > >	B 13	B 16 0.03 5 25 20	C 24 0.61 70 - -	> > > >	C 24	B 20
	King Street South & Kuntz Lane	TWSC	LOS Delay V/C Q	< < < <	B 14 0.04 1	> > > >	B 14					< < < <	A 0 0.00 0	> > > >	A 0	< < < <	A 8 0.01 0	> > > >	A 0	
	Caroline Street South & Allen Street West	TCS	LOS Delay V/C Q	< < < <	B 11 0.08 9	> > > >	B 11	< < < <	B 12 0.13 14	> > > >	B 12	< < < <	B 10 0.19 27	> > > >	B 10	< < < <	B 12 0.20 30	> > > >	B 12	B 12
	Caroline Street South & Site Access	TWSC	LOS Delay V/C Q					A 10 0.05 2		> > > >	A 10		A 0 0.00 0	> > > >	A 0	< < < <	A 8 0.00 0		A 0	
	William Street & Kuntz Lane	TWSC	LOS Delay V/C Q		A 0 0.24 0	> > > >	A 0	< < < <	A 0 0.00 0		A 0									

MOE - Measure of Effectiveness

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V/C - Volume to Capacity Ratio

Q - 95th Percentile Queue Length (m)

Stor. - Existing Storage (m)

Avail. - Available Storage (m)

TCS - Traffic Control Signal

TWSC - Two-Way Stop Control

</> - Shared with through movement



4.3.2 Total Traffic Operations

Figure 4.5a and **Figure 4.5b** illustrate the 2028 total traffic volumes, including trips generated by the proposed development. Traffic volumes at the existing accesses have been removed from the study area network.

The 2028 total traffic volumes have been analyzed using the same methodology as under existing and 2027 traffic conditions. Signal timings have not been optimized to review the impacts from the subject development.

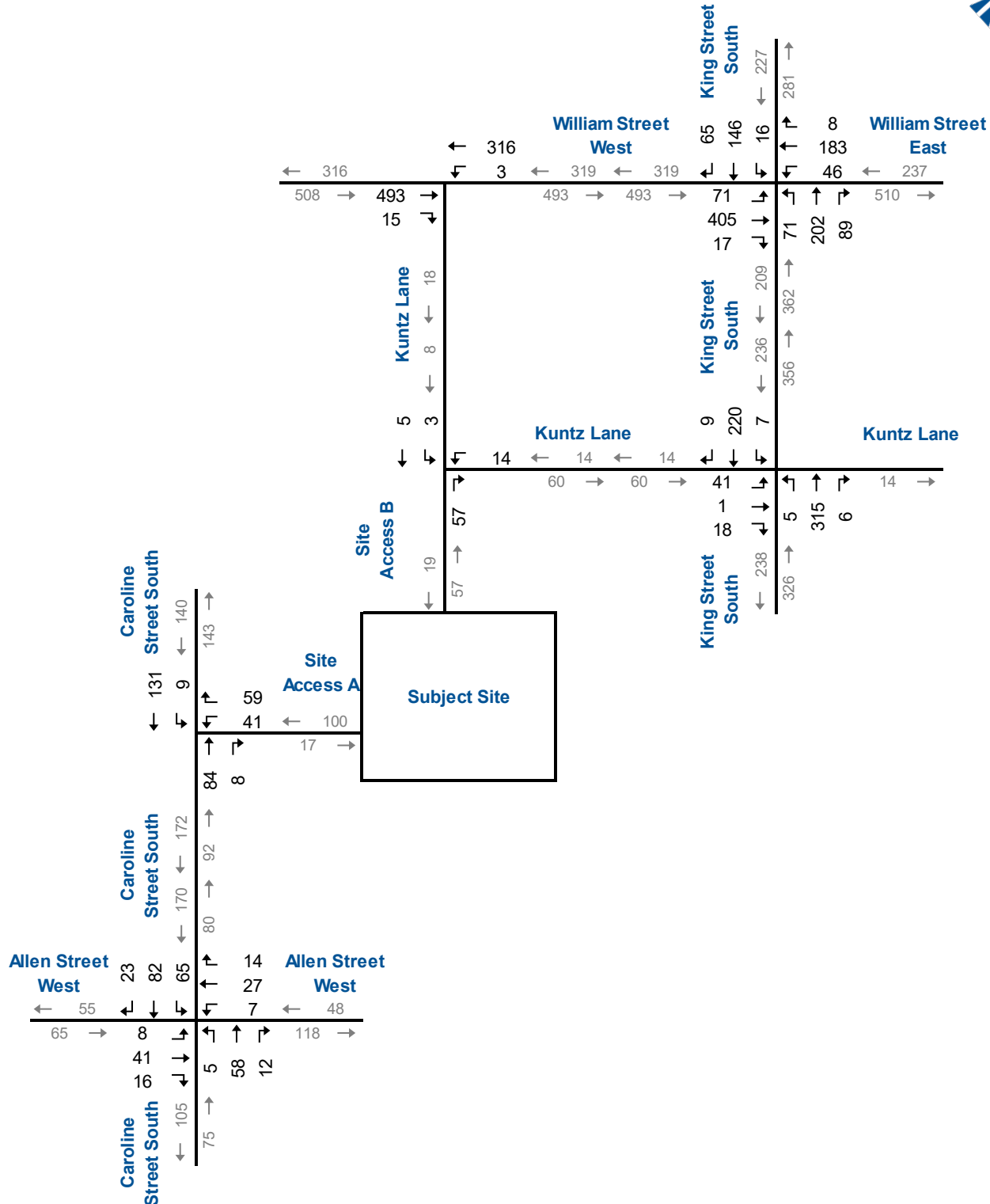
Table 4.2 summarizes the results of the 2028 total traffic operations. The results indicate that the study area intersections are forecast to operate at acceptable levels of service with no problem movements during the AM and PM peak hours.

It is noted that the eastbound left-turn movement at King Street South and William Street is forecast to operate with 95th percentile queues exceeding the marked storage length (15 metres) by 1 metre during the AM peak hour. This excess queue is minimal and is not anticipated to block access to Kuntz Lane.

Appendix H contains the supporting detailed Synchro 12 reports.



AM Peak Hour



PM Peak Hour

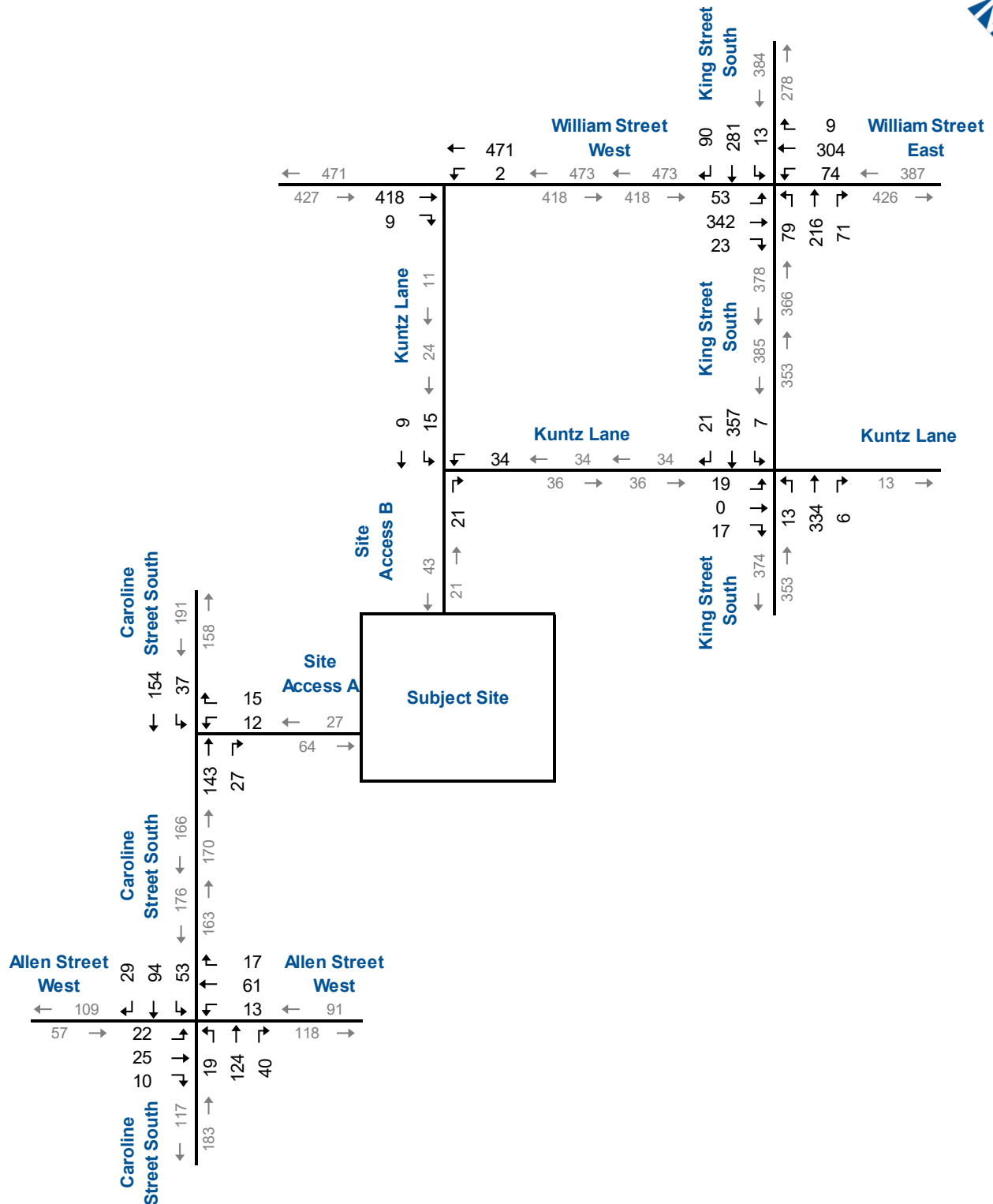


TABLE 4.4: 2028 TOTAL TRAFFIC OPERATIONS

Analysis Period	Intersection	Control Type	MOE	Direction/Movement/Approach																
				Eastbound				Westbound				Northbound				Southbound				Overall
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	
AM Peak Hour	King Street South & William Street	TCS	LOS Delay V/C Stor. Avail.	B 17 0.19 16 15 -1	C 26 0.66 81 - -	> > > >	C 24	B 18 0.19 12 25 13	B 18 0.30 34 - -	> > > >	B 18	B 11 0.16 12 35 23	B 13 0.41 40 - -	> > > >	B 12	B 17 0.04 5 25 20	B 17 0.36 36 - -	> > > >	B 17	B 19
	King Street South & Kuntz Lane	TWSC	LOS Delay V/C Q	< < < <	B 14 14 0.13 3	> > > >	B 14					< < < <	A 8 0.00 0	> > > >	A 0	< < < <	A 8 0.01 0	> > > >	A 0	
	Caroline Street South & Allen Street West	TCS	LOS Delay V/C Q	< < < <	B 11 11 0.10 11	> > > >	B 11	< < < <	B 10 10 0.08 8	> > > >	B 10	< < < <	B 10 10 0.08 13	> > > >	B 10	< < < <	B 12 12 0.22 30	> > > >	B 12	B 11
	Caroline Street South & Site Access	TWSC	LOS Delay V/C Q					A 10 0.12 3		> > > >	A 10		A 0 0.00 0	> > > >	A 0	< < < <	A 8 0.01 0		A 0	
	William Street & Kuntz Lane	TWSC	LOS Delay V/C Q		A 0 0.30 0	> > > >	A 0	< < < <	A 0 0.00 0		A 0									
PM Peak Hour	King Street South & William Street	TCS	LOS Delay V/C Stor. Avail.	B 18 0.18 13 15 2	C 23 0.58 68 - -	> > > >	C 22	B 20 0.27 17 25 8	C 21 0.48 56 - -	> > > >	C 21	B 12 0.22 13 35 22	B 13 0.38 40 - -	> > > >	B 13	B 16 0.03 5 25 20	C 25 0.63 73 - -	> > > >	C 24	C 20
	King Street South & Kuntz Lane	TWSC	LOS Delay V/C Q	< < < <	C 16 16 0.10 2	> > > >	C 16					< < < <	A 9 0.01 0	> > > >	A 0	< < < <	A 8 0.01 0	> > > >	A 0	
	Caroline Street South & Allen Street West	TCS	LOS Delay V/C Q	< < < <	B 11 11 0.09 10	> > > >	B 11	< < < <	B 11 11 0.14 14	> > > >	B 11	< < < <	B 12 12 0.23 28	> > > >	B 12	< < < <	B 15 15 0.25 30	> > > >	B 15	B 13
	Caroline Street South & Site Access	TWSC	LOS Delay V/C Q					B 10 0.04 1		> > > >	B 10		A 0 0.00 0	> > > >	A 0	< < < <	A 8 0.03 1		A 2	
	William Street & Kuntz Lane	TWSC	LOS Delay V/C Q		A 0 0.25 0	> > > >	A 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)

Stor. - Existing Storage (m)

Avail. - Available Storage (m)

TCS - Traffic Control Signal

TWSC - Two-Way Stop Control

</> - Shared with through movement



4.4 Five Years Post Full Build-Out Horizon – Year 2033

4.4.1 Background Traffic Operations

Figure 4.6a and **Figure 4.6b** illustrate the 2033 background traffic volumes, including road traffic growth and other area development traffic.

The 2033 background traffic volumes have been analyzed using the same methodology as under existing, 2027 and 2028 traffic conditions. Signal timings have not been optimized to review the impacts from background traffic growth.

Table 4.5 summarizes the results of the 2033 background traffic operations. The results indicate that the study area intersections are forecast to operate at acceptable levels of service with no problem movements during the AM and PM peak hours.

Appendix I contains the supporting detailed Synchro 12 reports.



PM Peak Hour

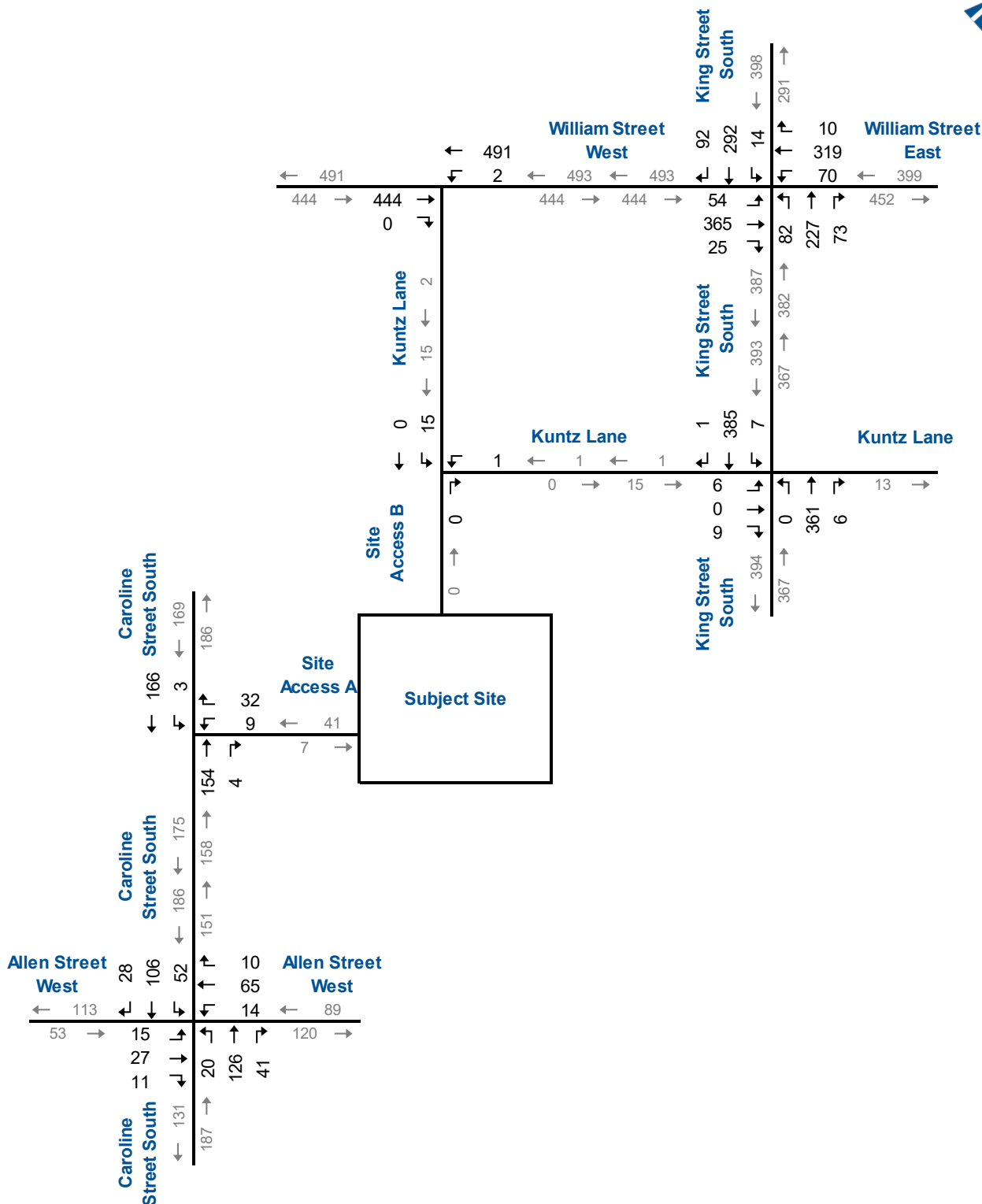


TABLE 4.5: 2033 BACKGROUND TRAFFIC OPERATIONS

Analysis Period	Intersection	Control Type	MOE	Direction/Movement/Approach																
				Eastbound				Westbound				Northbound				Southbound				Overall
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	
AM Peak Hour	King Street South & William Street	TCS	LOS Delay V/C Q Stor. Avail.	B 17 0.19 15 0	C 27 0.69 87 - -	> > > >	C 26	B 19 0.20 12 13	B 18 0.32 37 -	> > > >	B 18	B 11 0.13 10 25	B 13 0.39 39 -	> > > >	B 12	B 17 0.04 6 25 19	B 17 0.35 38 -	> > > >	B 17	B 19
	King Street South & Kuntz Lane	TWSC	LOS Delay V/C Q	< < < <	B 12 0.01 0	> > > >	B 12					< < < <	A 8 0.00 0	> > > >	A 0	< < < <	A 8 0.01 0	> > > >	A 0	
	Caroline Street South & Allen Street West	TCS	LOS Delay V/C Q	< < < <	B 11 0.11 11	> > > >	B 11	< < < <	B 11 0.08 9	> > > >	B 11	< < < <	B 10 0.09 14	> > > >	B 10	< < < <	B 12 0.17 25	> > > >	B 12	B 11
	Caroline Street South & Site Access	TWSC	LOS Delay V/C Q					A 10 0.01 0		> > > >	A 10		A 0 0.00 0	> > > >	A 0	< < < <	A 8 0.01 0		A 0	
	William Street & Kuntz Lane	TWSC	LOS Delay V/C Q		A 0 0.31 0	> > > >	A 0	< < < <	A 0 0.00 0		A 0									
PM Peak Hour	King Street South & William Street	TCS	LOS Delay V/C Q Stor. Avail.	B 18 0.19 13 2	C 24 0.62 74 - -	> > > >	C 23	B 20 0.27 17 8	C 22 0.51 60 -	> > > >	C 21	B 12 0.23 13 22	B 13 0.40 42 -	> > > >	B 13	B 17 0.04 5 25 20	C 26 0.65 76 -	> > > >	C 25	C 21
	King Street South & Kuntz Lane	TWSC	LOS Delay V/C Q	< < < <	B 14 0.04 1	> > > >	B 14					< < < <	A 0 0.00 0	> > > >	A 0	< < < <	A 8 0.01 0	> > > >	A 0	
	Caroline Street South & Allen Street West	TCS	LOS Delay V/C Q	< < < <	B 11 0.09 10	> > > >	B 11	< < < <	B 12 0.14 15	> > > >	B 12	< < < <	B 13 0.24 28	> > > >	B 13	< < < <	B 15 0.27 32	> > > >	B 15	B 13
	Caroline Street South & Site Access	TWSC	LOS Delay V/C Q					A 10 0.05 2		> > > >	A 10		A 0 0.00 0	> > > >	A 0	< < < <	A 8 0.00 0		A 0	
	William Street & Kuntz Lane	TWSC	LOS Delay V/C Q		A 0 0.26 0	> > > >	A 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)

Stor. - Existing Storage (m)

Avail. - Available Storage (m)

TCS - Traffic Control Signal

TWSC - Two-Way Stop Control

</> - Shared with through movement



4.4.2 Total Traffic Operations

Figure 4.7a and **Figure 4.7b** illustrate the 2033 total traffic volumes, including trips generated by the proposed development. Traffic volumes at the existing accesses have been removed from the study area network.

The 2033 total traffic volumes have been analyzed using the same methodology as under existing, 2027 and 2028 traffic conditions. Signal timings have not been optimized to review the impacts from the subject development.

Table 4.6 summarizes the results of the 2033 total traffic operations. The results indicate that the study area intersections are forecast to operate at acceptable levels of service with no problem movements during the AM and PM peak hours.

Under 2033 total traffic operations, the eastbound left-turn movement at King Street South and William Street is forecast to continue operating with 95th percentile queues exceeding the marked storage length (15 metres). This queue is forecast to exceed the marked storage by 2 metres during the AM peak hour which is considered minimal and is not anticipated to block access to Kuntz Lane.

Appendix J contains the supporting detailed Synchro 12 reports.



PM Peak Hour

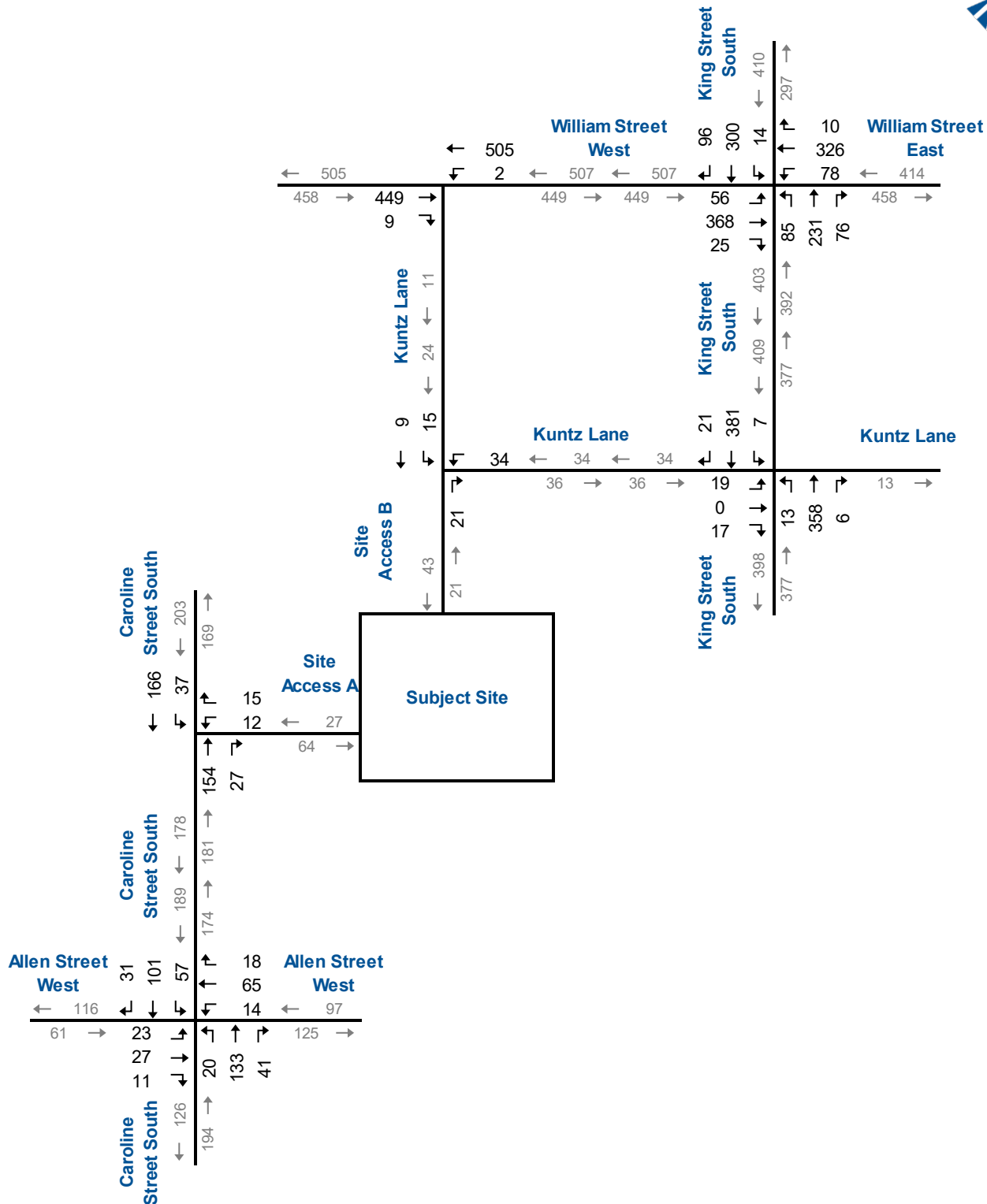


TABLE 4.6: 2033 TOTAL TRAFFIC OPERATIONS

Analysis Period	Intersection	Control Type	MOE	Direction/Movement/Approach																
				Eastbound				Westbound				Northbound				Southbound				Overall
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	
AM Peak Hour	King Street South & William Street	TCS	LOS Delay V/C Q Stor. Avail.	B 18 0.21 17 15 -2	C 28 0.71 90 -	> > > >	C 26	B 19 0.23 13 25 12	B 18 0.32 37 -	> > > >	B 19	B 12 0.17 12 35 23	B 13 0.43 43 -	> > > >	B 13	B 17 0.04 6 25 19	B 18 0.38 39 -	> > > >	B 18	B 20
	King Street South & Kuntz Lane	TWSC	LOS Delay V/C Q	< < < <	B 14 0.14 4	> > > >	B 14					< < < <	A 8 0.00 0	> > > >	A 0	< < < <	A 8 0.01 0	> > > >	A 0	
	Caroline Street South & Allen Street West	TCS	LOS Delay V/C Q	< < < <	B 11 0.11 11	> > > >	B 11	< < < <	B 10 0.08 9	> > > >	B 10	< < < <	B 10 0.09 13	> > > >	B 10	< < < <	B 13 0.23 32	> > > >	B 13	B 12
	Caroline Street South & Site Access	TWSC	LOS Delay V/C Q					B 10 0.12 3		> > > >	B 10		A 0 0.00 0	> > > >	A 0	< < < <	A 8 0.01 0		A 0	
	William Street & Kuntz Lane	TWSC	LOS Delay V/C Q		A 0 0.32 0	> > > >	A 0	< < < <	A 0 0.00 0		A 0									
PM Peak Hour	King Street South & William Street	TCS	LOS Delay V/C Q Stor. Avail.	B 18 0.20 14 15 1	C 24 0.62 74 -	> > > >	C 23	C 21 0.31 19 25 6	C 22 0.52 61 -	> > > >	C 22	B 12 0.25 13 35 22	B 13 0.41 43 -	> > > >	B 13	B 17 0.04 5 25 20	C 26 0.67 80 -	> > > >	C 26	C 21
	King Street South & Kuntz Lane	TWSC	LOS Delay V/C Q	< < < <	C 16 0.10 2	> > > >	C 16					< < < <	A 9 0.01 0	> > > >	A 0	< < < <	A 8 0.01 0	> > > >	A 0	
	Caroline Street South & Allen Street West	TCS	LOS Delay V/C Q	< < < <	B 11 0.10 11	> > > >	B 11	< < < <	B 12 0.15 15	> > > >	B 12	< < < <	B 13 0.25 30	> > > >	B 13	< < < <	B 15 0.28 33	> > > >	B 15	B 13
	Caroline Street South & Site Access	TWSC	LOS Delay V/C Q					B 11 0.04 1		> > > >	B 11		A 0 0.00 0	> > > >	A 0	< < < <	A 8 0.03 1		A 1	
	William Street & Kuntz Lane	TWSC	LOS Delay V/C Q		A 0 0.27 0	> > > >	A 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)

Stor. - Existing Storage (m)

Avail. - Available Storage (m)

TCS - Traffic Control Signal

TWSC - Two-Way Stop Control

</> - Shared with through movement



5 Evaluation of Existing and Future Traffic Conditions with the ION Light-Rail

As mentioned in **Section 2.5**, the signal timings used in the above analyses do not account for the LRT travelling through the study area. The following section summarizes the traffic operations at King Street South and William Street and Caroline Street South and Allen Street West when the LRT signal timing plan is used in the Synchro analyses.

It is noted that the results in the subsequent sections are considered conservative given the Synchro analyses assumes the LRT signal timing plan runs every cycle.

5.1 Existing Traffic Conditions

Table 5.1 summarizes the results of the existing traffic operations at the studied signalized intersections when the LRT signal timing plan is used. The results indicate the studied signalized intersections are operating at acceptable levels of service during the AM and PM peak hours, except for the following critical movements at King Street South and William Street:

- ▶ The eastbound left-turn movement is operating with 95th percentile queues exceeding the available storage by four and two metres during the AM and PM peak hours, respectively; and
- ▶ The eastbound through movement is operating with LOS F and E during the AM and PM peak hours, respectively.

Appendix K contains the detailed Synchro 12 reports.



TABLE 5.1: EXISTING TRAFFIC OPERATIONS – WITH LRT PLAN

Analysis Period	Intersection	Control Type	MOE	Direction/Movement/Approach																
				Eastbound				Westbound				Northbound				Southbound				Overall
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	
AM Peak Hour	King Street South & William Street	TCS	LOS	C	F	>	F	D	C	>	D	A	A	>	A	A	>	A	D	
			Delay	32	92	>	84	50	33	>	36	5	5	>	5	9	8	>	8	43
			V/C	0.32	1.04	>		0.47	0.48	>		0.07	0.22	>		0.02	0.21	>		
			Q	19	122	>		18	45	>		5	16	>		4	21	>		
			Stor.	15	-	>		25	-	>		35	-	>		25	-	>		
			Avail.	-4	-	>		7	-	>		30	-	>		21	-	>		
			LOS	<	C	>	C	<	C	>	C	<	C	>	C	<	D	>	D	C
			Delay	<	26	>	26	<	25	>	25	<	29	>	29	<	41	>	41	33
	Caroline Street South & Allen Street West	TCS	V/C	<	0.21	>		<	0.16	>		<	0.25	>		<	0.54	>		
			Q	<	16	>		<	13	>		<	20	>		<	37	>		
			LOS	D	E	>	E	D	D	>	D	A	A	>	A	A	B	>	B	C
			Delay	37	62	>	58	54	45	>	46	5	5	>	5	9	11	>	11	32
PM Peak Hour	King Street South & William Street	TCS	V/C	0.37	0.91	>		0.56	0.76	>		0.12	0.25	>		0.02	0.37	>		
			Q	17	102	>		25	80	>		7	20	>		3	40	>		
			Stor.	15	-	>		25	-	>		35	-	>		25	-	>		
			Avail.	-2	-	>		0	-	>		28	-	>		22	-	>		
	Caroline Street South & Allen Street West	TCS	LOS	<	C	>	C	<	C	>	C	<	D	>	D	<	D	>	D	D
			Delay	<	26	>	26	<	31	>	31	<	38	>	38	<	53	>	53	41
			V/C	<	0.17	>		<	0.29	>		<	0.53	>		<	0.72	>		
			Q	<	14	>		<	23	>		<	39	>		<	54	>		

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)

Stor. - Existing Storage (m)

Avail. - Available Storage (m)

TCS - Traffic Control Signal

< / > - Shared with through movement



5.2 Background Traffic Conditions

Table 5.2a and **Table 5.2b** summarize the results of the 2027, 2028 and 2033 background traffic operations at King Street South and William Street and Caroline Street South and Allen Street West, respectively, when the LRT signal timing plan is used. The results indicate the studied signalized intersections are forecast to operate with acceptable levels of service, except for the same critical movements noted under existing traffic conditions and the addition of the following:

King Street South and William Street

- ▶ The westbound left-turn movement is forecast to operate with LOS F and 95th percentile queues exceeding the available storage during the PM peak hour starting under the 2027 horizon year;
- ▶ The westbound through movement is forecast to operate with LOS E during the PM peak hour starting under the 2033 horizon year; and
- ▶ The overall intersection is forecast to operate at LOS E during the AM peak hour starting under the 2033 horizon year.

Caroline Street South and Allen Street West

- ▶ The southbound shared movement is forecast to operate at LOS E during the PM peak hour starting under the 2027 horizon year and LOS F starting under the 2033 horizon year; and
- ▶ The overall intersection is forecast to operate at LOS E during the PM peak hour starting under the 2033 horizon year.

Appendix L contains the detailed Synchro 12 reports.



TABLE 5.2A: BACKGROUND TRAFFIC OPERATIONS AT KING STREET SOUTH AND WILLIAM STREET – WITH LRT PLAN

Horizon Year	Analysis Period	Intersection	Control Type	MOE	Direction/Movement/Approach																
					Eastbound				Westbound				Northbound				Southbound				Overall
					Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	
2027	AM Peak Hour	King Street South & William Street	TCS	LOS	C	F	>	F	D	C	>	D	A	A	>	A	A	A	>	A	D
				Delay	33	103	>	94	53	34	>	37	5	5	>	5	9	8	>	8	45
				V/C	0.34	1.08	>		0.51	0.50	>		0.09	0.27	>		0.02	0.23	>		
				Q	20	128	>		20	46	>		6	21	>		4	23	>		
2027	PM Peak Hour	King Street South & William Street	TCS	Stor.	15	-	>		25	-	>		35	-	>		25	-	>		
				Avail.	-5	-	>		5	-	>		29	-	>		21	-	>		
				LOS	D	E	>	E	F	D	>	D	A	A	>	A	A	B	>	B	D
				Delay	40	72	>	68	84	48	>	54	5	6	>	6	9	12	>	12	36
2028	AM Peak Hour	King Street South & William Street	TCS	V/C	0.42	0.96	>		0.76	0.79	>		0.14	0.28	>		0.02	0.42	>		
				Q	18	109	>		32	85	>		8	23	>		3	48	>		
				Stor.	15	-	>		25	-	>		35	-	>		25	-	>		
				Avail.	-3	-	>		-7	-	>		27	-	>		22	-	>		
2028	PM Peak Hour	King Street South & William Street	TCS	LOS	C	F	>	F	D	C	>	D	A	A	>	A	A	A	>	A	D
				Delay	33	109	>	99	54	34	>	38	5	5	>	5	9	8	>	8	47
				V/C	0.35	1.10	>		0.52	0.51	>		0.09	0.28	>		0.03	0.23	>		
				Q	20	130	>		20	47	>		6	21	>		4	24	>		
2023	AM Peak Hour	King Street South & William Street	TCS	Stor.	15	-	>		25	-	>		35	-	>		25	-	>		
				Avail.	-5	-	>		5	-	>		29	-	>		21	-	>		
				LOS	D	E	>	E	F	D	>	E	A	A	>	A	A	B	>	B	D
				Delay	42	75	>	71	92	48	>	56	6	6	>	6	9	12	>	12	37
2023	PM Peak Hour	King Street South & William Street	TCS	V/C	0.44	0.97	>		0.80	0.80	>		0.14	0.28	>		0.02	0.42	>		
				Q	18	111	>		33	87	>		8	23	>		3	49	>		
				Stor.	15	-	>		25	-	>		35	-	>		25	-	>		
				Avail.	-3	-	>		-8	-	>		27	-	>		22	-	>		
2023	AM Peak Hour	King Street South & William Street	TCS	LOS	D	F	>	F	E	D	>	D	A	A	>	A	A	A	>	A	E
				Delay	35	138	>	124	58	35	>	39	5	6	>	5	9	9	>	9	58
				V/C	0.40	1.18	>		0.56	0.55	>		0.10	0.29	>		0.03	0.26	>		
				Q	22	143	>		22	50	>		7	23	>		4	26	>		
2023	PM Peak Hour	King Street South & William Street	TCS	Stor.	15	-	>		25	-	>		35	-	>		25	-	>		
				Avail.	-7	-	>		3	-	>		28	-	>		21	-	>		
				LOS	D	F	>	F	F	E	>	E	A	A	>	A	A	B	>	B	D
				Delay	51	94	>	89	111	55	>	65	6	6	>	6	9	12	>	12	45
2023	PM Peak Hour	King Street South & William Street	TCS	V/C	0.54	1.05	>		0.89	0.87	>		0.15	0.30	>		0.03	0.45	>		
				Q	24	122	>		36	96	>		8	26	>		4	54	>		
				Stor.	15	-	>		25	-	>		35	-	>		25	-	>		
				Avail.	-9	-	>		-11	-	>		27	-	>		21	-	>		

MOE - Measure of Effectiveness

Q - 95th Percentile Queue Length (m)

</> - Shared with through movement

LOS - Level of Service

Stor. - Existing Storage (m)

Delay - Average Delay per Vehicle in Seconds

Avail. - Available Storage (m)

V/C - Volume to Capacity Ratio

TCS - Traffic Control Signal



TABLE 5.2B: BACKGROUND TRAFFIC OPERATIONS AT CAROLINE STREET SOUTH AND ALLEN STREET WEST – WITH LRT PLAN

Horizon Year	Analysis Period	Intersection	Control Type	MOE	Direction/Movement/Approach																
					Eastbound				Westbound				Northbound				Southbound				Overall
					Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	
2027	AM Peak Hour	Caroline Street South & Allen Street West	TCS	LOS	<	C	>	C	<	C	>	C	<	C	>	C	<	D	>	D	C
				Delay	<	26	>	26	<	25	>	25	<	29	>	29	<	42	>	42	33
				V/C	<	0.22	>		<	0.16	>		<	0.28	>		<	0.56	>		
				Q	<	17	>		<	14	>		<	21	>		<	38	>		
2028	AM Peak Hour	Caroline Street South & Allen Street West	TCS	LOS	<	C	>	C	<	C	>	C	<	D	>	D	<	E	>	E	D
				Delay	<	26	>	26	<	31	>	31	<	42	>	42	<	64	>	64	46
				V/C	<	0.18	>		<	0.30	>		<	0.64	>		<	0.81	>		
				Q	<	14	>		<	23	>		<	49	>		<	60	>		
2028	PM Peak Hour	Caroline Street South & Allen Street West	TCS	LOS	<	C	>	C	<	C	>	C	<	C	>	C	<	D	>	D	C
				Delay	<	26	>	26	<	25	>	25	<	30	>	30	<	42	>	42	34
				V/C	<	0.22	>		<	0.16	>		<	0.28	>		<	0.58	>		
				Q	<	17	>		<	14	>		<	22	>		<	39	>		
2028	PM Peak Hour	Caroline Street South & Allen Street West	TCS	LOS	<	C	>	C	<	C	>	C	<	D	>	D	<	E	>	E	D
				Delay	<	27	>	27	<	31	>	31	<	42	>	42	<	66	>	66	47
				V/C	<	0.19	>		<	0.31	>		<	0.65	>		<	0.83	>		
				Q	<	15	>		<	24	>		<	50	>		<	62	>		
2033	AM Peak Hour	Caroline Street South & Allen Street West	TCS	LOS	<	C	>	C	<	C	>	C	<	C	>	C	<	D	>	D	C
				Delay	<	26	>	26	<	25	>	25	<	30	>	30	<	44	>	44	34
				V/C	<	0.24	>		<	0.18	>		<	0.30	>		<	0.61	>		
				Q	<	18	>		<	14	>		<	23	>		<	43	>		
2033	PM Peak Hour	Caroline Street South & Allen Street West	TCS	LOS	<	C	>	C	<	C	>	C	<	D	>	D	<	F	>	F	E
				Delay	<	27	>	27	<	32	>	32	<	45	>	45	<	85	>	85	55
				V/C	<	0.20	>		<	0.33	>		<	0.69	>		<	0.93	>		
				Q	<	16	>		<	25	>		<	56	>		<	69	>		

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)

Stor. - Existing Storage (m)

Avail. - Available Storage (m)

TCS - Traffic Control Signal

</> - Shared with through movement



5.3 Total Traffic Conditions

Table 5.3a and **Table 5.3b** summarize the results of the 2027, 2028 and 2033 total traffic operations at King Street South and William Street and Caroline Street South and Allen Street West, respectively, when the LRT signal timing plan is used. The results indicate the studied signalized intersections are forecast to operate at acceptable levels of service, except for the same critical movements noted under background traffic conditions.

Appendix M contains the detailed Synchro 12 reports.



TABLE 5.3A: TOTAL TRAFFIC OPERATIONS AT KING STREET SOUTH AND WILLIAM STREET – WITH LRT PLAN

Horizon Year	Analysis Period	Intersection	Control Type	MOE	Direction/Movement/Approach																
					Eastbound				Westbound				Northbound				Southbound				Overall
					Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	
2027	AM Peak Hour	King Street South & William Street	TCS	LOS	C	F	>	F	D	C	>	D	A	A	>	A	A	>	A	D	D
				Delay	34	112	>	101	53	34	>	37	5	5	>	5	9	8	>	8	49
				V/C	0.37	1.11	>		0.51	0.50	>		0.09	0.27	>		0.02	0.23	>		
				Q	22	133	>		20	46	>		6	21	>		4	23	>		
2027	PM Peak Hour	King Street South & William Street	TCS	Stor.	15	-	>		25	-	>		35	-	>		25	-	>		
				Avail.	-7	-	>		5	-	>		29	-	>		21	-	>		
				LOS	D	E	>	E	F	D	>	E	A	A	>	A	A	>	B	D	D
				Delay	43	74	>	70	88	49	>	56	6	6	>	6	9	12	>	12	37
2028	AM Peak Hour	King Street South & William Street	TCS	V/C	0.46	0.97	>		0.78	0.81	>		0.14	0.28	>		0.02	0.42	>		
				Q	20	110	>		32	88	>		8	23	>		3	48	>		
				Stor.	15	-	>		25	-	>		35	-	>		25	-	>		
				Avail.	-5	-	>		-7	-	>		27	-	>		22	-	>		
2028	PM Peak Hour	King Street South & William Street	TCS	LOS	C	F	>	F	E	C	>	D	A	A	>	A	A	>	A	D	D
				Delay	34	119	>	107	59	34	>	39	5	6	>	6	9	8	>	9	50
				V/C	0.38	1.13	>		0.57	0.51	>		0.11	0.31	>		0.03	0.25	>		
				Q	22	135	>		23	47	>		7	24	>		4	24	>		
2028	PM Peak Hour	King Street South & William Street	TCS	Stor.	15	-	>		25	-	>		35	-	>		25	-	>		
				Avail.	-7	-	>		2	-	>		28	-	>		21	-	>		
				LOS	D	E	>	E	F	D	>	E	A	A	>	A	A	>	B	D	D
				Delay	45	76	>	72	120	50	>	64	6	6	>	6	9	12	>	12	39
2023	AM Peak Hour	King Street South & William Street	TCS	V/C	0.48	0.98	>		0.93	0.82	>		0.15	0.29	>		0.02	0.44	>		
				Q	21	112	>		37	89	>		8	24	>		3	51	>		
				Stor.	15	-	>		25	-	>		35	-	>		25	-	>		
				Avail.	-6	-	>		-12	-	>		27	-	>		22	-	>		
2023	PM Peak Hour	King Street South & William Street	TCS	LOS	D	F	>	F	E	D	>	D	A	A	>	A	A	>	A	E	E
				Delay	37	148	>	132	63	35	>	40	5	6	>	6	9	9	>	9	60
				V/C	0.43	1.21	>		0.60	0.55	>		0.12	0.32	>		0.03	0.27	>		
				Q	24	147	>		24	51	>		8	25	>		4	26	>		
2023	PM Peak Hour	King Street South & William Street	TCS	Stor.	15	-	>		25	-	>		35	-	>		25	-	>		
				Avail.	-9	-	>		1	-	>		27	-	>		21	-	>		
				LOS	E	F	>	F	F	E	>	E	A	A	>	A	A	>	B	D	D
				Delay	56	96	>	91	137	58	>	73	6	6	>	6	9	12	>	12	47
2023	PM Peak Hour	King Street South & William Street	TCS	V/C	0.58	1.06	>		0.99	0.88	>		0.16	0.31	>		0.03	0.47	>		
				Q	25	124	>		40	99	>		9	26	>		4	56	>		
				Stor.	15	-	>		25	-	>		35	-	>		25	-	>		
				Avail.	-10	-	>		-15	-	>		26	-	>		21	-	>		

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)

Stor. - Existing Storage (m)

Avail. - Available Storage (m)

TCS - Traffic Control Signal

</> - Shared with through movement



TABLE 5.3B: TOTAL TRAFFIC OPERATIONS AT CAROLINE STREET SOUTH AND ALLEN STREET WEST – WITH LRT PLAN

Horizon Year	Analysis Period	Intersection	Control Type	MOE	Direction/Movement/Approach																
					Eastbound				Westbound				Northbound				Southbound				Overall
					Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	
2027	AM Peak Hour	Caroline Street South & Allen Street West	TCS	LOS	<	C	>	C	<	C	>	C	<	C	>	C	<	D	>	D	D
				Delay	<	26	>	26	<	25	>	25	<	29	>	29	<	50	>	50	37
				V/C	<	0.22	>		<	0.16	>		<	0.27	>		<	0.68	>		
				Q	<	17	>		<	14	>		<	21	>		<	50	>		
2027	PM Peak Hour	Caroline Street South & Allen Street West	TCS	LOS	<	C	>	C	<	C	>	C	<	D	>	D	<	E	>	E	D
				Delay	<	27	>	27	<	30	>	30	<	43	>	43	<	70	>	70	48
				V/C	<	0.20	>		<	0.31	>		<	0.66	>		<	0.85	>		
				Q	<	16	>		<	24	>		<	52	>		<	62	>		
2028	AM Peak Hour	Caroline Street South & Allen Street West	TCS	LOS	<	C	>	C	<	C	>	C	<	C	>	C	<	E	>	E	D
				Delay	<	26	>	26	<	24	>	24	<	29	>	29	<	59	>	59	42
				V/C	<	0.23	>		<	0.17	>		<	0.27	>		<	0.78	>		
				Q	<	18	>		<	14	>		<	21	>		<	59	>		
2028	PM Peak Hour	Caroline Street South & Allen Street West	TCS	LOS	<	C	>	C	<	C	>	C	<	D	>	D	<	E	>	E	D
				Delay	<	28	>	28	<	30	>	30	<	44	>	44	<	79	>	79	52
				V/C	<	0.22	>		<	0.33	>		<	0.67	>		<	0.90	>		
				Q	<	17	>		<	25	>		<	53	>		<	65	>		
2033	AM Peak Hour	Caroline Street South & Allen Street West	TCS	LOS	<	C	>	C	<	C	>	C	<	C	>	C	<	E	>	E	D
				Delay	<	27	>	27	<	25	>	25	<	30	>	30	<	65	>	65	45
				V/C	<	0.25	>		<	0.18	>		<	0.29	>		<	0.82	>		
				Q	<	19	>		<	15	>		<	22	>		<	63	>		
2033	PM Peak Hour	Caroline Street South & Allen Street West	TCS	LOS	<	C	>	C	<	C	>	C	<	D	>	D	<	F	>	F	E
				Delay	<	28	>	28	<	31	>	31	<	47	>	47	<	105	>	105	62
				V/C	<	0.23	>		<	0.36	>		<	0.72	>		<	1.01	>		
				Q	<	18	>		<	26	>		<	58	>		<	73	>		

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)

Stor. - Existing Storage (m)

Avail. - Available Storage (m)

TCS - Traffic Control Signal

</> - Shared with through movement



6 Remedial Measures

6.1 Left-Turn Lanes

The Ministry of Transportation Design Supplement for the Transportation Association of Canada (TAC) Geometric Design Guide for Canadian Roads¹⁰ provides guidance on the assessment and/or need for auxiliary left-turn lanes.

Warrant nomographs are used to determine if a left-turn lane is required based on a criterion such as design speed, advancing volume, opposing volume and percent of advancing left-turning vehicles. As nomographs are only provided for 5% increments, a minimum threshold of greater than 5% of advancing left-turning vehicles is used in assessing the requirement of a left-turn lane.

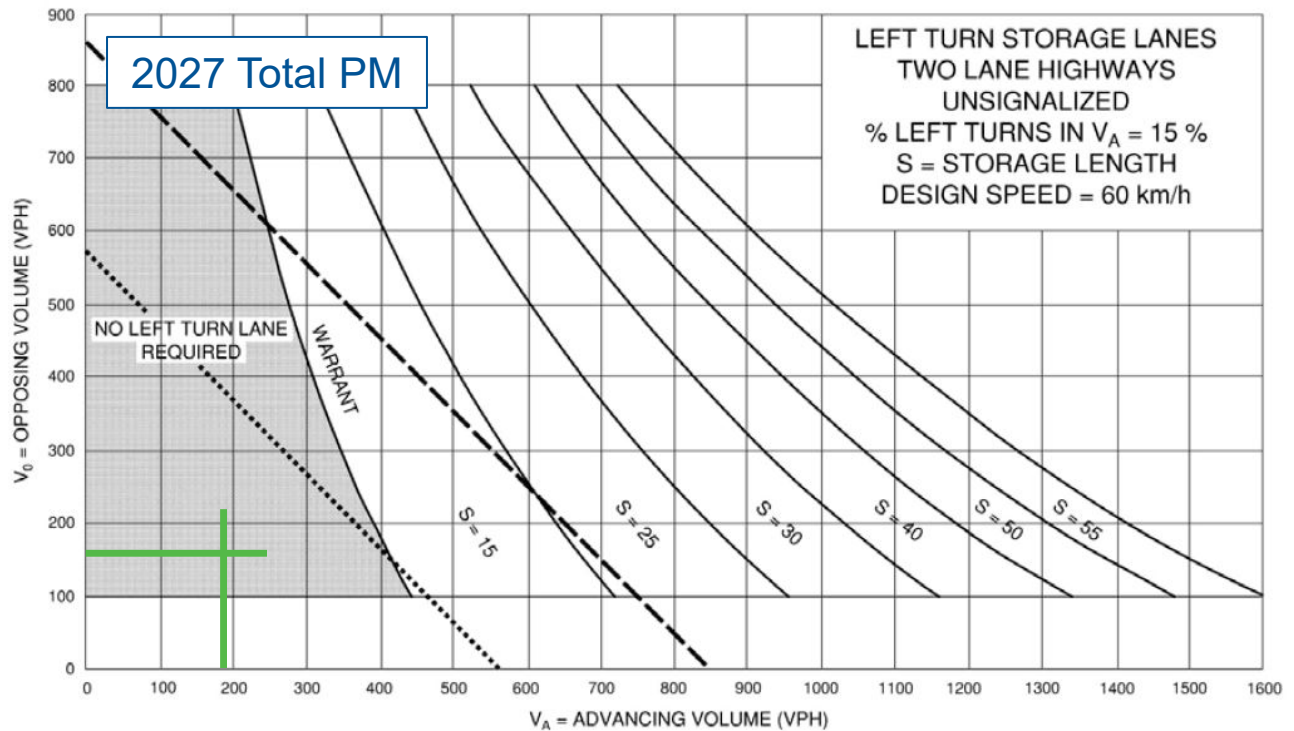
Warrants have been calculated for southbound left-turns at the site access intersection on Caroline Street South. The warrant was calculated using the nomographs for left-turn lanes on a two-lane undivided highway at an unsignalized intersection with a design speed of 60 km/h (10 km/h over the posted speed limit). Based on this criterion, a southbound left-turn lane is not warranted at the site access on Caroline Street South under 2027, 2028 and 2033 total traffic volumes.

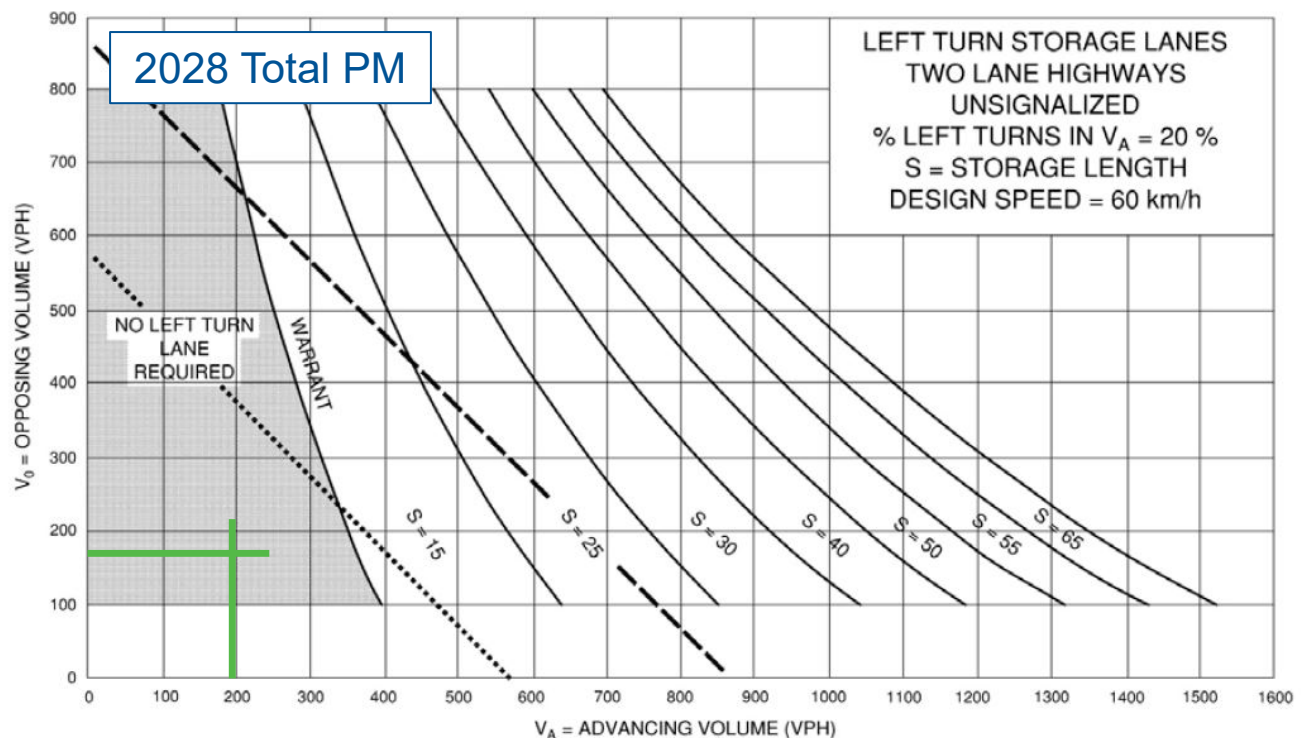
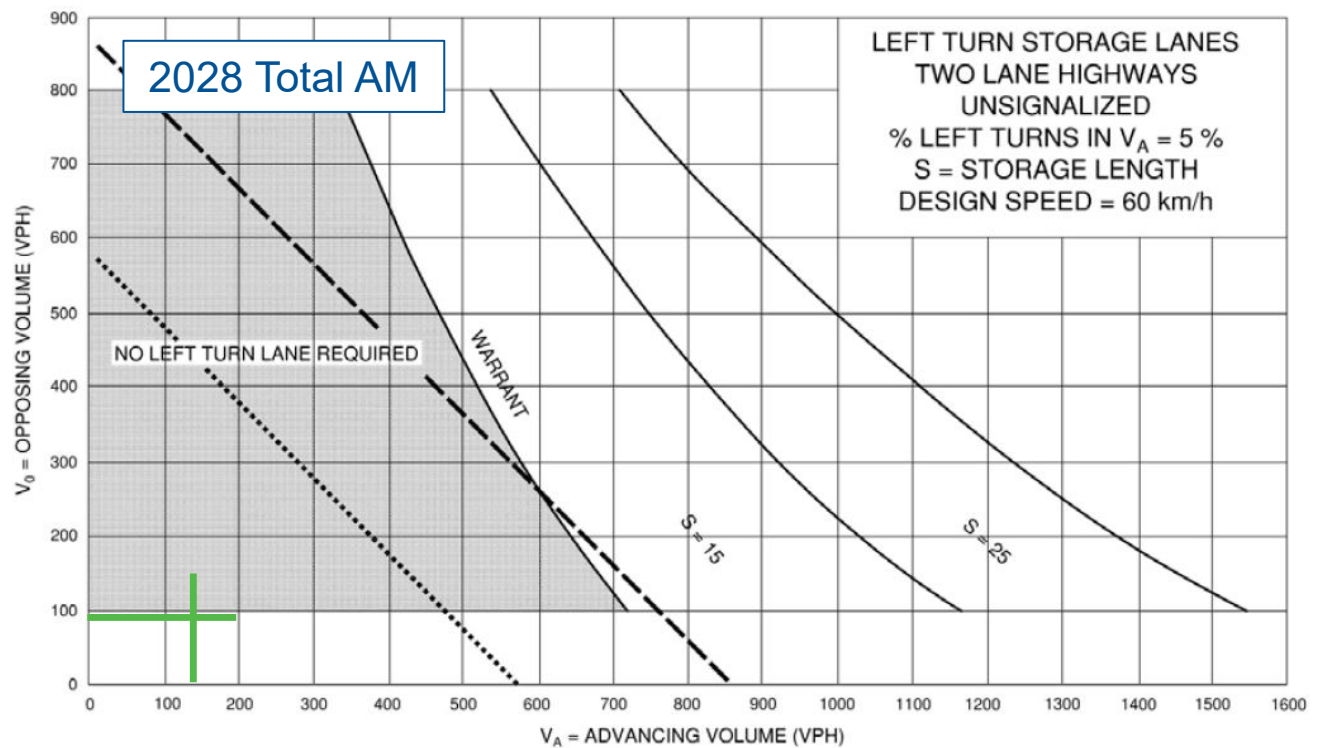
Warrants are not provided for the intersection of King Street South and Kuntz Lane as the percentage of advancing left-turning vehicles is forecast to be less than 5% during both peak hours under all horizon years.

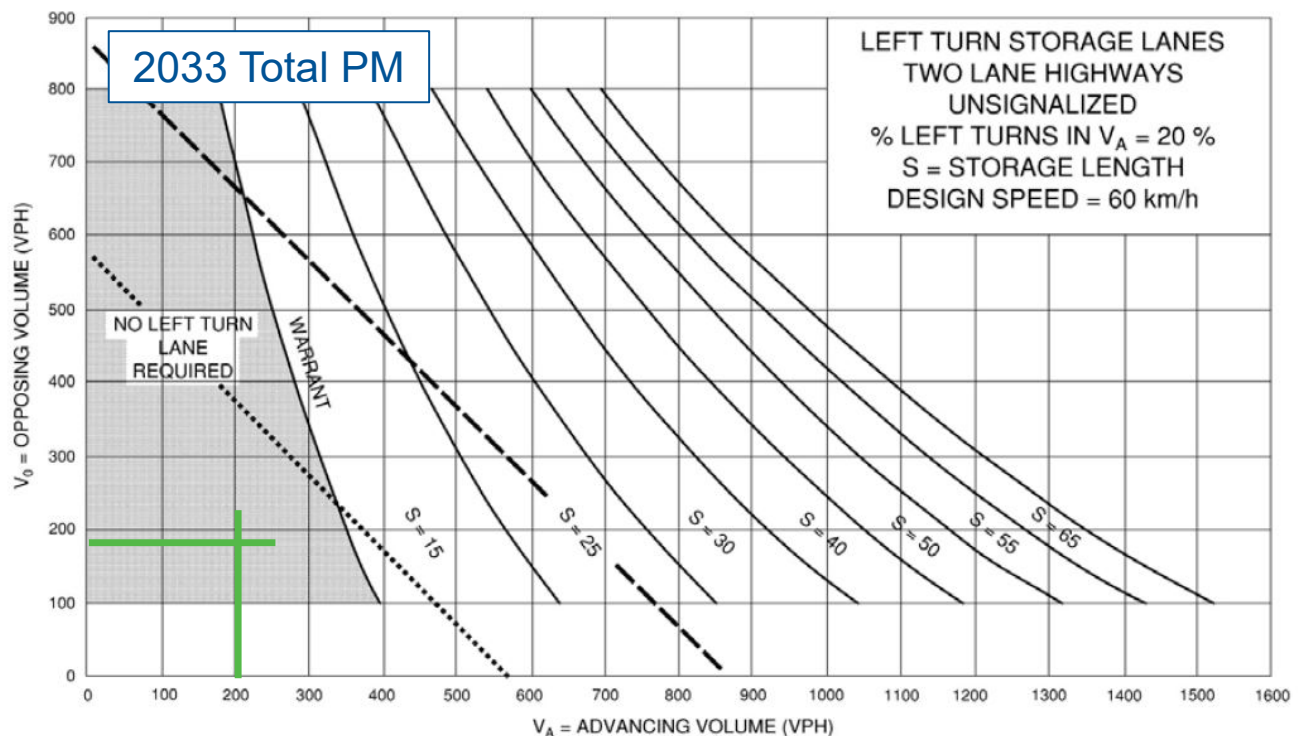
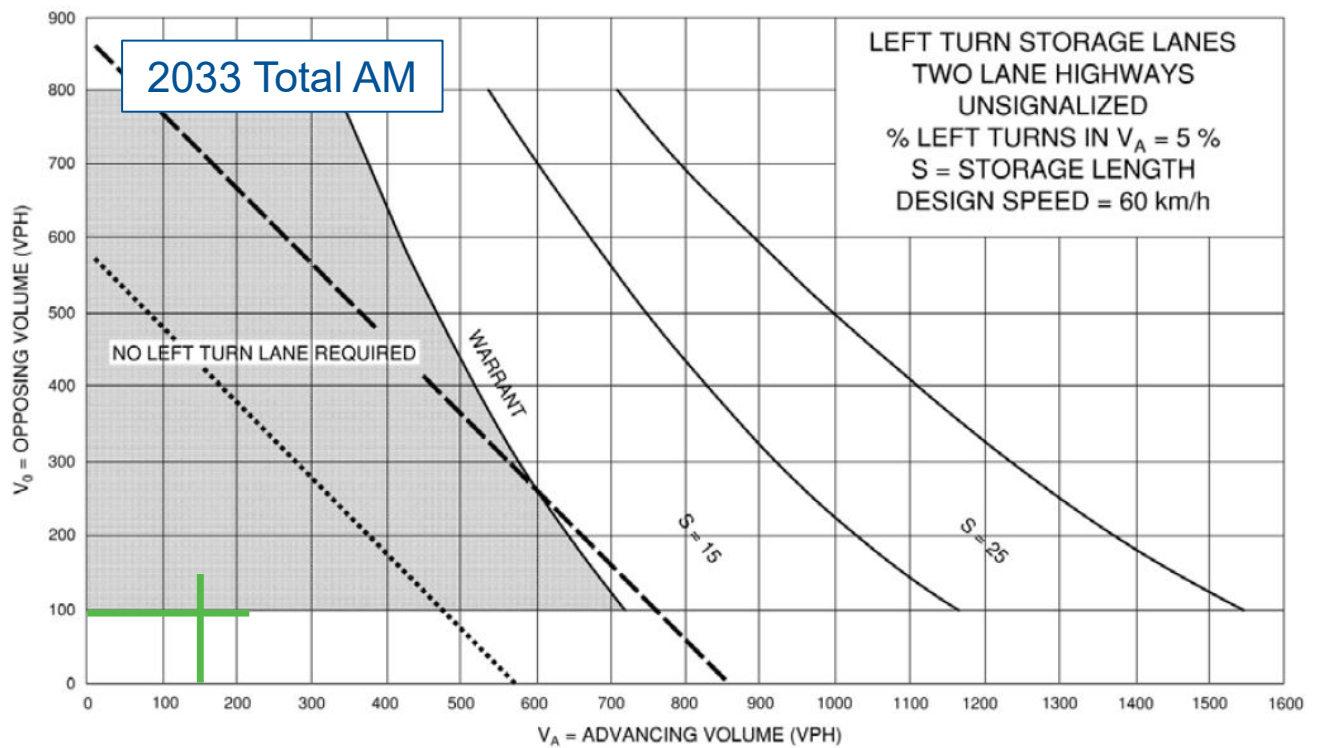
Figure 5.1a, Figure 5.1b and Figure 5.1c contain the warrant nomographs.

¹⁰ MTO Design Supplement for TAC Geometric Design Guide for Canadian Roads, October 2023.









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 and a multi-use trail (i.e., the Iron Horse Trail) runs along the west side of Caroline Street South, immediately west of the subject site. The proposed site plan indicates pedestrian connections between the main building entrances and the existing municipal sidewalk along Caroline Street South and King Street South.

The subject site is located within the Urban Growth Centre within which restaurants, commercial and employment establishments exist.



7.1.2 Cycling

Bicycle Parking Requirements

The City of Waterloo Zoning By-law 2018-050¹¹ indicates the following minimum bicycle parking requirements:

- ▶ Where a lot contains more than 20 dwelling units:
 - Type A: 0.30 spaces per unit (251 spaces);
 - Type B: 0.30 spaces per unit (251 spaces).
- ▶ For non-residential uses within Areas A:
 - Type A or B: 40% of the required motor vehicle parking spaces (4 spaces).

Therefore, 506 bicycle parking spaces are required under the Zoning By-Law. The Zoning By-law defines Type A bicycle parking as secure bicycle parking located indoors or within a bike locker and Type B as any bicycle parking other than Type A. It is recommended that the proposed supply meets the minimum bicycle parking requirements.

Existing Cycling Network

As previously mentioned, a multi-use trail is provided on the west side of Caroline Street South, and a signed bike route is provided along Allen Street West. The nearest dedicated cycling facility is provided on Park Street which is approximately 150 metres from the subject site.

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, 7, 16 and 301.

The nearest bus stops are located at the intersections of King Street South and William Street and King Street South and Allen Street. The nearest bus stops are within a 2-minute walk from the subject site.

The subject site is also located within a Protected Major Transit Station Area. This indicates the development is within walkable distance from a higher-order transit station (i.e., ION LRT station). The nearest station is Allen Station which is within 150 metres (or a 1-minute walk) from the subject site. Allen Station is easily accessible given the sidewalks along both side of King Street South as well as the

¹¹ City of Waterloo Zoning bylaw 2018-050, § Section 6.



pedestrian activated push buttons and crosswalks at King Street South and Allen Street which help facilitate crossing.

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)¹² has a total of 33 locations across the Region of Waterloo. The closest vehicle/space can be found at the parking lot directly across from Willis Way Station which is 400 metres (5-minute walk) from the subject site. The second nearest vehicle/space is located at the parking lot on the east side of Regina Street south of the Laurel Trail which is 500 metres (7-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 parking space as a designated car-share space, pending demand. The owner should liaise with the “CarShare Anywhere” program, to

¹² “How It Works,” Communauto Ontario, n.d.,
<https://ontario.communauto.com/waterloo/how-it-works/>.



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 34 points:

- ▶ Functional building entrances that are oriented to public space;
- ▶ Provision of active uses at-grade along street frontages;
- ▶ Located within 800m of a Rapid Transit Station;
- ▶ Parking is not located on a major street frontage;
- ▶ 75% or more of parking is located underground;
- ▶ Provision of unbundled parking; and
- ▶ The development includes mixed-uses.

Appendix N contains the TDM Checklist.



8 Conclusions and Recommendations

8.1 Conclusions

Based on the investigations conducted, 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 193 AM peak hour trips and 141 PM peak hour trips.
- ▶ **2027 Background and Total Traffic Conditions:** The study area intersections are operating with acceptable levels of service.
- ▶ **2028 Background and Total Traffic Conditions:** The study area intersections are forecast to operate with acceptable levels of service, with the following movement noted at King Street South and William Street under total traffic conditions:
 - The eastbound left-turn movement is forecast to operate with 95th percentile queues exceeding the marked storage length (15 metres) by 1 metre during the AM peak hour.
- ▶ **2033 Background and Total Traffic Conditions:** The study area intersections are forecast to operate with acceptable levels of service. Under total traffic conditions, the eastbound left-turn movement at King Street South and William Street is forecast to continue operating with 95th percentile queues exceeding the marked storage by 2 metres during the AM peak hour. This excess queue is minimal and is not anticipated to block access to Kuntz Lane.

Existing and Future Traffic Conditions with the ION LRT Signal Timing Plan:

- ▶ **Existing Traffic Conditions:** The results indicate the studied signalized intersections are operating at acceptable levels of service with the following critical movements noted at King Street South and William Street:
 - The eastbound left-turn movement is operating with 95th percentile queues exceeding the available storage during both peak hours; and
 - The eastbound through movement is operating with LOS F and E during the AM and PM peak hours, respectively.



- ▶ **Background Traffic Conditions:** The results indicate the studied signalized intersections are forecast to operate with acceptable levels of service, except for the same critical movements noted under existing traffic conditions and the addition of the following:

King Street South and William Street:

- The westbound left-turn movement is forecast to operate with LOS F and 95th percentile queues exceeding the available storage during the PM peak hour starting under the 2027 horizon year;
- The westbound through movement is forecast to operate with LOS E during the PM peak hour starting under the 2033 horizon year; and
- The overall intersection is forecast to operate with LOS E during the AM peak hour starting under the 2033 horizon year.

Caroline Street South and Allen Street West

- The southbound shared movement is forecast to operate with LOS E during the PM peak hour starting under the 2027 horizon year and LOS F starting under the 2033 horizon year; and
- The overall intersection is forecast to operate with LOS E during the PM peak hour starting under the 2033 horizon year.

- ▶ **Total Traffic Conditions:** The results indicate the studied signalized intersections are forecast to operate with acceptable levels of service, except for the same critical movements noted under background traffic conditions.

- ▶ **Left-Turn Lanes:**

- Site Access on Caroline Street South: A southbound left-turn lane is not warranted at the site access on Caroline Street South under 2027, 2028 and 2033 total traffic volumes.
- King Street South and Kuntz Lane: A northbound left-turn lane is not warranted at King Street South and Kuntz Lane under 2027, 2028 and 2033 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 King Street West and Caroline Street South;



- 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;
- 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 development be approved with no conditions related to off-site transportation improvements and that the TDM measures noted above be considered to support the alternative modes of transportation.



Appendix A

Existing Traffic Data and Signal Timings





Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

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

Count Name: Caroline Street & Allen Street
Site Code: 240616
Start Date: 11/12/2024
Page No: 1

Turning Movement Data

Start Time	Allen Street Eastbound						Allen Street Westbound						Caroline Street Northbound						Caroline Street 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	4	0	0	6	4	0	1	0	0	0	1	0	6	3	0	3	9	1	4	0	0	4	5	19
7:15 AM	1	4	2	0	8	7	0	1	0	0	2	1	1	3	1	0	2	5	5	7	1	0	3	13	26
7:30 AM	1	5	0	0	10	6	2	0	1	0	1	3	1	7	5	0	2	13	6	3	2	0	0	11	33
7:45 AM	0	9	3	0	12	12	2	3	0	0	1	5	0	11	2	0	4	13	10	16	5	0	5	31	61
Hourly Total	2	22	5	0	36	29	4	5	1	0	4	10	2	27	11	0	11	40	22	30	8	0	12	60	139
8:00 AM	1	10	4	0	18	15	3	8	1	0	2	12	2	12	3	0	6	17	8	30	1	0	3	39	83
8:15 AM	1	7	4	0	20	12	2	5	4	0	2	11	0	19	1	0	6	20	10	13	3	0	5	26	69
8:30 AM	3	10	1	0	10	14	1	6	2	0	9	9	0	12	3	0	4	15	7	22	4	0	0	33	71
8:45 AM	1	11	6	0	24	18	1	7	4	0	10	12	3	12	3	0	11	18	11	16	3	0	5	30	78
Hourly Total	6	38	15	0	72	59	7	26	11	0	23	44	5	55	10	0	27	70	36	81	11	0	13	128	301
9:00 AM	2	6	4	0	8	12	3	7	1	0	1	11	1	9	1	0	8	11	5	16	2	0	2	23	57
9:15 AM	1	8	4	0	7	13	1	7	0	0	2	8	2	12	5	0	11	19	5	6	5	0	1	16	56
9:30 AM	1	11	2	0	10	14	4	3	1	0	4	8	2	8	3	0	10	13	3	11	1	0	0	15	50
9:45 AM	2	1	4	0	15	7	4	3	1	0	5	8	4	11	5	0	2	20	13	24	3	0	3	40	75
Hourly Total	6	26	14	0	40	46	12	20	3	0	12	35	9	40	14	0	31	63	26	57	11	0	6	94	238
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12:00 PM	4	8	6	0	13	18	3	4	2	0	10	9	6	17	4	0	10	27	10	18	6	0	3	34	88
12:15 PM	2	5	4	0	11	11	6	4	4	0	18	14	6	20	8	0	8	34	11	23	3	0	2	37	96
12:30 PM	1	4	4	0	13	9	2	6	2	0	4	10	3	18	6	0	13	27	4	21	5	0	1	30	76
12:45 PM	0	5	5	0	12	10	4	2	3	0	10	9	5	16	5	0	19	26	10	17	2	0	2	29	74
Hourly Total	7	22	19	0	49	48	15	16	11	0	42	42	20	71	23	0	50	114	35	79	16	0	8	130	334
1:00 PM	3	3	2	0	11	8	3	7	0	0	10	10	3	20	8	0	6	31	19	16	3	0	2	38	87
1:15 PM	3	4	1	0	11	8	2	3	4	0	5	9	5	12	6	0	5	23	17	28	3	0	1	48	88
1:30 PM	1	4	3	0	15	8	3	2	0	0	7	5	1	19	4	0	6	24	16	19	4	0	4	39	76
1:45 PM	5	7	3	0	15	15	0	3	2	0	4	5	2	23	7	0	8	32	12	18	1	0	5	31	83
Hourly Total	12	18	9	0	52	39	8	15	6	0	26	29	11	74	25	0	25	110	64	81	11	0	12	156	334
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3:00 PM	4	5	3	0	14	12	1	7	2	0	7	10	4	14	3	0	8	21	10	10	6	0	5	26	69
3:15 PM	2	12	2	0	12	16	4	7	2	0	8	13	3	21	6	0	9	30	14	12	5	0	5	31	90
3:30 PM	2	9	5	0	13	16	3	5	1	0	11	9	8	19	5	0	4	32	7	19	5	0	3	31	88
3:45 PM	2	3	3	0	15	8	2	11	2	0	12	15	3	22	6	0	11	31	14	33	5	0	1	52	106
Hourly Total	10	29	13	0	54	52	10	30	7	0	38	47	18	76	20	0	32	114	45	74	21	0	14	140	353
4:00 PM	3	7	1	0	14	11	4	14	4	0	6	22	3	43	2	0	6	48	10	17	5	0	7	32	113
4:15 PM	7	5	3	0	25	15	1	14	2	0	8	17	8	21	5	0	9	34	11	19	9	0	3	39	105
4:30 PM	1	7	3	0	19	11	5	19	1	0	9	25	4	22	6	0	8	32	11	20	6	0	7	37	105

4:45 PM	1	7	2	0	18	10	5	10	2	0	2	17	5	21	10	0	12	36	12	21	3	0	5	36	99
Hourly Total	12	26	9	0	76	47	15	57	9	0	25	81	20	107	23	0	35	150	44	77	23	0	22	144	422
5:00 PM	7	6	5	0	12	18	5	13	1	0	7	19	4	30	4	0	11	38	9	19	4	0	0	32	107
5:15 PM	4	4	2	0	27	10	2	18	3	1	7	24	4	17	7	0	12	28	12	23	5	0	6	40	102
5:30 PM	5	1	5	0	15	11	2	9	2	0	10	13	6	23	6	0	4	35	7	21	7	0	7	35	94
5:45 PM	3	15	0	0	12	18	3	6	4	0	15	13	7	10	8	0	5	25	12	20	5	0	6	37	93
Hourly Total	19	26	12	0	66	57	12	46	10	1	39	69	21	80	25	0	32	126	40	83	21	0	19	144	396
Grand Total	74	207	96	0	445	377	83	215	58	1	209	357	106	530	151	0	243	787	312	562	122	0	106	996	2517
Approach %	19.6	54.9	25.5	0.0	-	-	23.2	60.2	16.2	0.3	-	-	13.5	67.3	19.2	0.0	-	-	31.3	56.4	12.2	0.0	-	-	-
Total %	2.9	8.2	3.8	0.0	-	15.0	3.3	8.5	2.3	0.0	-	14.2	4.2	21.1	6.0	0.0	-	31.3	12.4	22.3	4.8	0.0	-	39.6	-
Motorcycles	0	0	0	0	-	0	1	1	0	0	-	2	0	0	0	0	-	0	0	2	0	0	-	2	4
% Motorcycles	0.0	0.0	0.0	-	-	0.0	1.2	0.5	0.0	0.0	-	0.6	0.0	0.0	0.0	-	-	0.0	0.0	0.4	0.0	-	-	0.2	0.2
Cars & Light Goods	71	198	94	0	-	363	79	206	57	1	-	343	101	522	147	0	-	770	251	552	115	0	-	918	2394
% Cars & Light Goods	95.9	95.7	97.9	-	-	96.3	95.2	95.8	98.3	100.0	-	96.1	95.3	98.5	97.4	-	-	97.8	80.4	98.2	94.3	-	-	92.2	95.1
Buses	0	2	0	0	-	2	0	3	0	0	-	3	0	2	0	0	-	2	51	3	1	0	-	55	62
% Buses	0.0	1.0	0.0	-	-	0.5	0.0	1.4	0.0	0.0	-	0.8	0.0	0.4	0.0	-	-	0.3	16.3	0.5	0.8	-	-	5.5	2.5
Single-Unit Trucks	1	4	2	0	-	7	3	1	1	0	-	5	4	5	3	0	-	12	10	2	4	0	-	16	40
% Single-Unit Trucks	1.4	1.9	2.1	-	-	1.9	3.6	0.5	1.7	0.0	-	1.4	3.8	0.9	2.0	-	-	1.5	3.2	0.4	3.3	-	-	1.6	1.6
Articulated Trucks	0	1	0	0	-	1	0	1	0	0	-	1	0	1	0	0	-	1	0	1	0	0	-	1	4
% Articulated Trucks	0.0	0.5	0.0	-	-	0.3	0.0	0.5	0.0	0.0	-	0.3	0.0	0.2	0.0	-	-	0.1	0.0	0.2	0.0	-	-	0.1	0.2
Bicycles on Road	2	2	0	0	-	4	0	3	0	0	-	3	1	0	1	0	-	2	0	2	2	0	-	4	13
% Bicycles on Road	2.7	1.0	0.0	-	-	1.1	0.0	1.4	0.0	0.0	-	0.8	0.9	0.0	0.7	-	-	0.3	0.0	0.4	1.6	-	-	0.4	0.5
Bicycles on Crosswalk	-	-	-	-	151	-	-	-	-	-	2	-	-	-	-	-	7	-	-	-	-	-	6	-	-
% Bicycles on Crosswalk	-	-	-	-	33.9	-	-	-	-	-	1.0	-	-	-	-	-	2.9	-	-	-	-	-	5.7	-	-
Pedestrians	-	-	-	-	294	-	-	-	-	-	207	-	-	-	-	-	236	-	-	-	-	-	100	-	-
% Pedestrians	-	-	-	-	66.1	-	-	-	-	-	99.0	-	-	-	-	-	97.1	-	-	-	-	-	94.3	-	-

Turning Movement Data Plot



Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

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

Count Name: Caroline Street & Allen Street
Site Code: 240616
Start Date: 11/12/2024
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Turning Movement Peak Hour Data (8:00 AM)

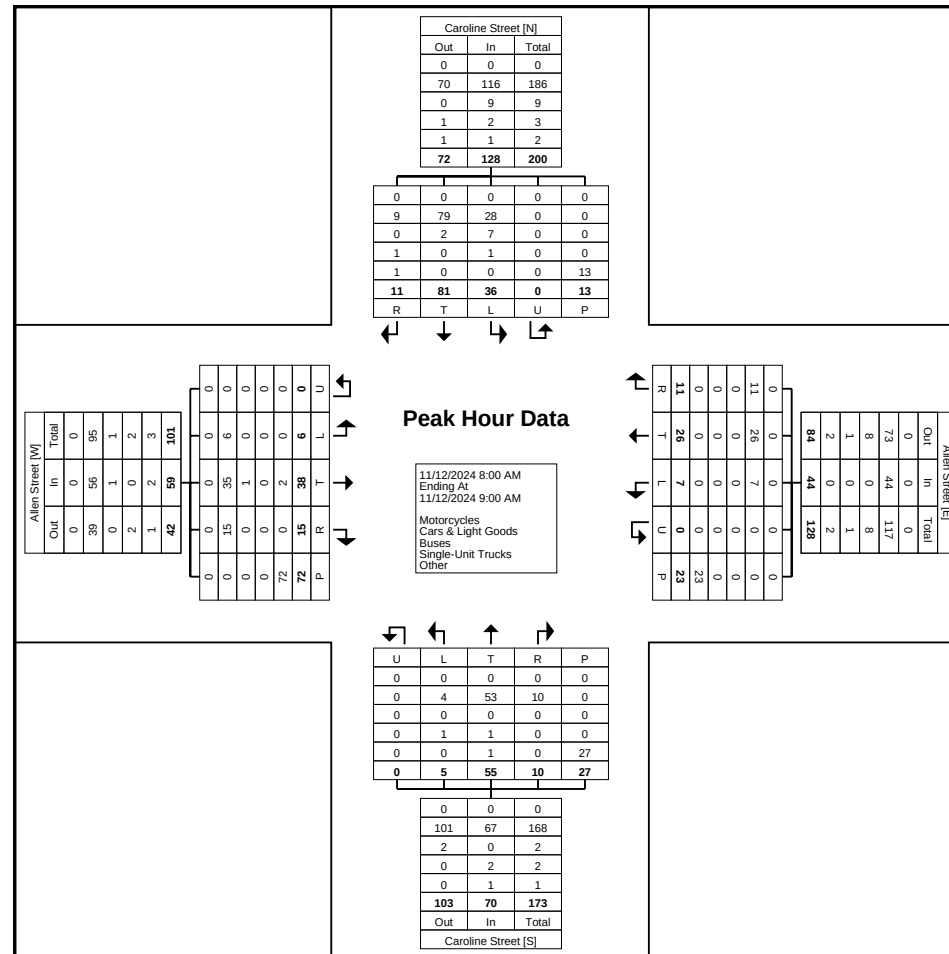
Start Time	Allen Street Eastbound						Allen Street Westbound						Caroline Street Northbound						Caroline Street Southbound						Int. Total
	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	
8:00 AM	1	10	4	0	18	15	3	8	1	0	2	12	2	12	3	0	6	17	8	30	1	0	3	39	83
8:15 AM	1	7	4	0	20	12	2	5	4	0	2	11	0	19	1	0	6	20	10	13	3	0	5	26	69
8:30 AM	3	10	1	0	10	14	1	6	2	0	9	9	0	12	3	0	4	15	7	22	4	0	0	33	71
8:45 AM	1	11	6	0	24	18	1	7	4	0	10	12	3	12	3	0	11	18	11	16	3	0	5	30	78
Total	6	38	15	0	72	59	7	26	11	0	23	44	5	55	10	0	27	70	36	81	11	0	13	128	301
Approach %	10.2	64.4	25.4	0.0	-	-	15.9	59.1	25.0	0.0	-	-	7.1	78.6	14.3	0.0	-	-	28.1	63.3	8.6	0.0	-	-	-
Total %	2.0	12.6	5.0	0.0	-	19.6	2.3	8.6	3.7	0.0	-	14.6	1.7	18.3	3.3	0.0	-	23.3	12.0	26.9	3.7	0.0	-	42.5	-
PHF	0.500	0.864	0.625	0.000	-	0.819	0.583	0.813	0.688	0.000	-	0.917	0.417	0.724	0.833	0.000	-	0.875	0.818	0.675	0.688	0.000	-	0.821	0.907
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	35	15	0	-	56	7	26	11	0	-	44	4	53	10	0	-	67	28	79	9	0	-	116	283
% Cars & Light Goods	100.0	92.1	100.0	-	-	94.9	100.0	100.0	100.0	-	-	100.0	80.0	96.4	100.0	-	-	95.7	77.8	97.5	81.8	-	-	90.6	94.0
Buses	0	1	0	0	-	1	0	0	0	0	-	0	0	0	0	0	-	0	7	2	0	0	-	9	10
% Buses	0.0	2.6	0.0	-	-	1.7	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	19.4	2.5	0.0	-	-	7.0	3.3
Single-Unit Trucks	0	0	0	0	-	0	0	0	0	0	-	0	1	1	0	0	-	2	1	0	1	0	-	2	4
% Single-Unit Trucks	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	20.0	1.8	0.0	-	-	2.9	2.8	0.0	9.1	-	-	1.6	1.3
Articulated Trucks	0	0	0	0	-	0	0	0	0	0	-	0	0	1	0	0	-	1	0	0	0	0	-	0	1
% Articulated Trucks	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	1.8	0.0	-	-	1.4	0.0	0.0	0.0	-	-	0.0	0.3
Bicycles on Road	0	2	0	0	-	2	0	0	0	0	-	0	0	0	0	0	-	0	0	0	1	0	-	1	3
% Bicycles on Road	0.0	5.3	0.0	-	-	3.4	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	9.1	-	-	0.8	1.0
Bicycles on Crosswalk	-	-	-	-	35	-	-	-	-	-	1	-	-	-	-	-	1	-	-	-	-	-	1	-	-
% Bicycles on Crosswalk	-	-	-	-	48.6	-	-	-	-	-	4.3	-	-	-	-	-	3.7	-	-	-	-	-	7.7	-	-
Pedestrians	-	-	-	-	37	-	-	-	-	-	22	-	-	-	-	-	26	-	-	-	-	-	12	-	-
% Pedestrians	-	-	-	-	51.4	-	-	-	-	-	95.7	-	-	-	-	-	96.3	-	-	-	-	-	92.3	-	-



Paradigm Transportation Solutions Limited
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Turning Movement Peak Hour Data (12:00 PM)

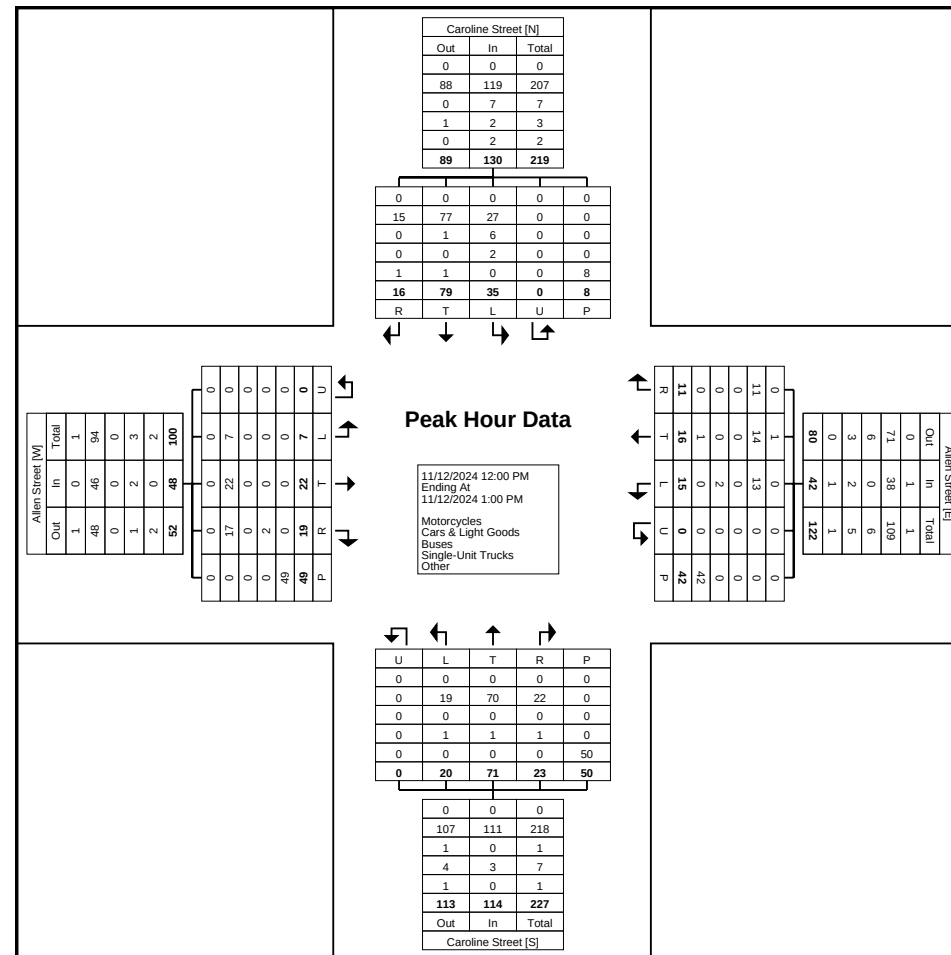
Start Time	Allen Street Eastbound						Allen Street Westbound						Caroline Street Northbound						Caroline Street Southbound						Int. Total
	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	
12:00 PM	4	8	6	0	13	18	3	4	2	0	10	9	6	17	4	0	10	27	10	18	6	0	3	34	88
12:15 PM	2	5	4	0	11	11	6	4	4	0	18	14	6	20	8	0	8	34	11	23	3	0	2	37	96
12:30 PM	1	4	4	0	13	9	2	6	2	0	4	10	3	18	6	0	13	27	4	21	5	0	1	30	76
12:45 PM	0	5	5	0	12	10	4	2	3	0	10	9	5	16	5	0	19	26	10	17	2	0	2	29	74
Total	7	22	19	0	49	48	15	16	11	0	42	42	20	71	23	0	50	114	35	79	16	0	8	130	334
Approach %	14.6	45.8	39.6	0.0	-	-	35.7	38.1	26.2	0.0	-	-	17.5	62.3	20.2	0.0	-	-	26.9	60.8	12.3	0.0	-	-	-
Total %	2.1	6.6	5.7	0.0	-	14.4	4.5	4.8	3.3	0.0	-	12.6	6.0	21.3	6.9	0.0	-	34.1	10.5	23.7	4.8	0.0	-	38.9	-
PHF	0.438	0.688	0.792	0.000	-	0.667	0.625	0.667	0.688	0.000	-	0.750	0.833	0.888	0.719	0.000	-	0.838	0.795	0.859	0.667	0.000	-	0.878	0.870
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	6.3	0.0	-	-	2.4	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.3
Cars & Light Goods	7	22	17	0	-	46	13	14	11	0	-	38	19	70	22	0	-	111	27	77	15	0	-	119	314
% Cars & Light Goods	100.0	100.0	89.5	-	-	95.8	86.7	87.5	100.0	-	-	90.5	95.0	98.6	95.7	-	-	97.4	77.1	97.5	93.8	-	-	91.5	94.0
Buses	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	6	1	0	0	-	7	7
% Buses	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	17.1	1.3	0.0	-	-	5.4	2.1
Single-Unit Trucks	0	0	2	0	-	2	2	0	0	0	-	2	1	1	1	0	-	3	2	0	0	0	-	2	9
% Single-Unit Trucks	0.0	0.0	10.5	-	-	4.2	13.3	0.0	0.0	-	-	4.8	5.0	1.4	4.3	-	-	2.6	5.7	0.0	0.0	-	-	1.5	2.7
Articulated Trucks	0	0	0	0	-	0	0	1	0	0	-	1	0	0	0	0	-	0	0	1	0	0	-	1	2
% Articulated Trucks	0.0	0.0	0.0	-	-	0.0	0.0	6.3	0.0	-	-	2.4	0.0	0.0	0.0	-	-	0.0	0.0	1.3	0.0	-	-	0.8	0.6
Bicycles on Road	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	1	0	-	1	1
% Bicycles on Road	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	6.3	-	-	0.8	0.3
Bicycles on Crosswalk	-	-	-	-	14	-	-	-	-	-	1	-	-	-	-	-	2	-	-	-	-	-	1	-	-
% Bicycles on Crosswalk	-	-	-	-	28.6	-	-	-	-	-	2.4	-	-	-	-	-	4.0	-	-	-	-	-	12.5	-	-
Pedestrians	-	-	-	-	35	-	-	-	-	-	41	-	-	-	-	-	48	-	-	-	-	-	7	-	-
% Pedestrians	-	-	-	-	71.4	-	-	-	-	-	97.6	-	-	-	-	-	96.0	-	-	-	-	-	87.5	-	-



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Count Name: Caroline Street & Allen Street
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Turning Movement Peak Hour Data Plot (12:00 PM)



Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada N1R 8J8
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Count Name: Caroline Street & Allen Street
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Turning Movement Peak Hour Data (3:45 PM)

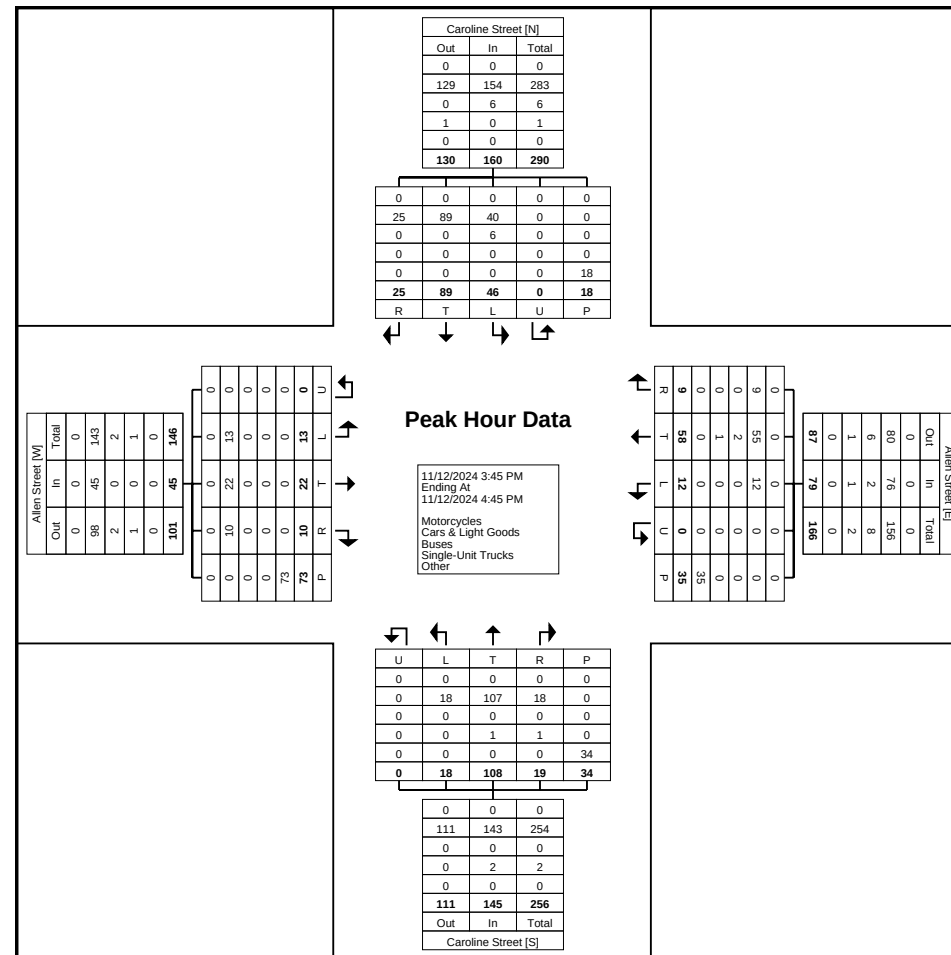
Start Time	Allen Street Eastbound						Allen Street Westbound						Caroline Street Northbound						Caroline Street Southbound						Int. Total
	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	
3:45 PM	2	3	3	0	15	8	2	11	2	0	12	15	3	22	6	0	11	31	14	33	5	0	1	52	106
4:00 PM	3	7	1	0	14	11	4	14	4	0	6	22	3	43	2	0	6	48	10	17	5	0	7	32	113
4:15 PM	7	5	3	0	25	15	1	14	2	0	8	17	8	21	5	0	9	34	11	19	9	0	3	39	105
4:30 PM	1	7	3	0	19	11	5	19	1	0	9	25	4	22	6	0	8	32	11	20	6	0	7	37	105
Total	13	22	10	0	73	45	12	58	9	0	35	79	18	108	19	0	34	145	46	89	25	0	18	160	429
Approach %	28.9	48.9	22.2	0.0	-	-	15.2	73.4	11.4	0.0	-	-	12.4	74.5	13.1	0.0	-	-	28.8	55.6	15.6	0.0	-	-	-
Total %	3.0	5.1	2.3	0.0	-	10.5	2.8	13.5	2.1	0.0	-	18.4	4.2	25.2	4.4	0.0	-	33.8	10.7	20.7	5.8	0.0	-	37.3	-
PHF	0.464	0.786	0.833	0.000	-	0.750	0.600	0.763	0.563	0.000	-	0.790	0.563	0.628	0.792	0.000	-	0.755	0.821	0.674	0.694	0.000	-	0.769	0.949
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	13	22	10	0	-	45	12	55	9	0	-	76	18	107	18	0	-	143	40	89	25	0	-	154	418
% Cars & Light Goods	100.0	100.0	100.0	-	-	100.0	100.0	94.8	100.0	-	-	96.2	100.0	99.1	94.7	-	-	98.6	87.0	100.0	100.0	-	-	96.3	97.4
Buses	0	0	0	0	-	0	0	2	0	0	-	2	0	0	0	0	-	0	6	0	0	0	-	6	8
% Buses	0.0	0.0	0.0	-	-	0.0	0.0	3.4	0.0	-	-	2.5	0.0	0.0	0.0	-	-	0.0	13.0	0.0	0.0	-	-	3.8	1.9
Single-Unit Trucks	0	0	0	0	-	0	0	1	0	0	-	1	0	1	1	0	-	2	0	0	0	0	-	0	3
% Single-Unit Trucks	0.0	0.0	0.0	-	-	0.0	0.0	1.7	0.0	-	-	1.3	0.0	0.9	5.3	-	-	1.4	0.0	0.0	0.0	-	-	0.0	0.7
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	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0
% Bicycles on Road	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 Crosswalk	-	-	-	-	20	-	-	-	-	-	0	-	-	-	-	-	1	-	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	-	27.4	-	-	-	-	-	0.0	-	-	-	-	-	2.9	-	-	-	-	-	0.0	-	-
Pedestrians	-	-	-	-	53	-	-	-	-	-	35	-	-	-	-	-	33	-	-	-	-	-	18	-	-
% Pedestrians	-	-	-	-	72.6	-	-	-	-	-	100.0	-	-	-	-	-	97.1	-	-	-	-	-	100.0	-	-



Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

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

Count Name: Caroline Street & Allen Street
Site Code: 240616
Start Date: 11/12/2024
Page No: 9





Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

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

Count Name: Caroline Street & Freemont Street
Site Code: 250137
Start Date: 05/15/2025
Page No: 1

Turning Movement Data

Start Time	Freemont Street Eastbound						Funeral Home Driveway Westbound						Caroline Street Northbound						Caroline Street 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	1	0	0	14	1	0	0	0	0	7	0	0	5	0	0	2	5	0	8	0	0	0	8	14
7:15 AM	0	0	0	0	6	0	1	0	0	0	3	1	0	6	0	0	4	6	0	15	0	0	0	15	22
7:30 AM	0	1	0	0	12	1	0	1	1	0	5	2	0	11	0	0	1	11	1	10	0	0	0	11	25
7:45 AM	0	0	0	0	8	0	1	0	0	0	7	1	0	11	0	0	0	11	1	21	1	0	0	23	35
Hourly Total	0	2	0	0	40	2	2	1	1	0	22	4	0	33	0	0	7	33	2	54	1	0	0	57	96
8:00 AM	1	0	0	0	14	1	0	0	1	0	2	1	0	12	0	0	0	12	3	25	0	0	0	28	42
8:15 AM	1	0	0	0	9	1	1	0	1	0	6	2	0	20	1	0	0	21	3	28	0	0	1	31	55
8:30 AM	1	0	0	0	24	1	2	1	0	0	5	3	0	15	1	0	0	16	1	37	0	0	1	38	58
8:45 AM	0	0	0	0	19	0	1	1	2	0	5	4	0	17	1	0	1	18	2	29	0	0	0	31	53
Hourly Total	3	0	0	0	66	3	4	2	4	0	18	10	0	64	3	0	1	67	9	119	0	0	2	128	208
9:00 AM	0	0	0	0	25	0	0	2	0	0	6	2	1	24	3	0	1	28	1	29	0	0	0	30	60
9:15 AM	1	0	0	0	19	1	0	1	0	0	3	1	0	15	1	0	0	16	0	31	1	0	1	32	50
9:30 AM	2	0	0	0	11	2	0	0	0	0	9	0	1	19	2	1	3	23	2	31	3	0	1	36	61
9:45 AM	1	1	1	0	19	3	0	0	1	0	5	1	0	19	1	0	1	20	0	27	0	0	0	27	51
Hourly Total	4	1	1	0	74	6	0	3	1	0	23	4	2	77	7	1	5	87	3	118	4	0	2	125	222
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11:30 AM	0	0	0	0	15	0	0	0	1	0	4	1	0	26	1	0	2	27	0	37	1	0	0	38	66
11:45 AM	0	0	1	0	19	1	1	0	0	0	9	1	0	22	1	0	2	23	1	43	0	0	0	44	69
Hourly Total	0	0	1	0	34	1	1	0	1	0	13	2	0	48	2	0	4	50	1	80	1	0	0	82	135
12:00 PM	1	0	2	0	17	3	0	0	3	0	6	3	0	32	1	0	0	33	3	34	0	0	0	37	76
12:15 PM	0	0	0	0	17	0	4	0	1	0	4	5	0	33	0	0	0	33	1	35	4	0	0	40	78
12:30 PM	2	0	0	0	27	2	1	1	0	0	12	2	0	24	1	0	0	25	3	34	0	0	0	37	66
12:45 PM	1	0	0	0	22	1	0	0	2	0	11	2	0	12	3	0	1	15	7	32	0	0	0	39	57
Hourly Total	4	0	2	0	83	6	5	1	6	0	33	12	0	101	5	0	1	106	14	135	4	0	0	153	277
1:00 PM	0	0	0	0	16	0	1	0	1	0	6	2	1	23	1	0	1	25	2	35	0	0	0	37	64
1:15 PM	1	0	0	0	23	1	3	0	0	0	6	3	0	27	0	0	1	27	2	40	0	0	0	42	73
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hourly Total	1	0	0	0	39	1	4	0	1	0	12	5	1	50	1	0	2	52	4	75	0	0	0	79	137
3:00 PM	0	2	0	0	17	2	3	1	3	0	7	7	0	25	1	0	2	26	4	32	0	0	1	36	71
3:15 PM	1	0	0	0	18	1	0	0	1	0	4	1	0	37	4	0	1	41	2	35	2	0	0	39	82
3:30 PM	0	2	0	0	18	2	5	0	4	0	4	9	0	29	0	1	0	30	3	24	0	0	0	27	68
3:45 PM	2	0	0	0	12	2	1	0	9	0	6	10	0	27	1	0	0	28	2	41	1	0	0	44	84
Hourly Total	3	4	0	0	65	7	9	1	17	0	21	27	0	118	6	1	3	125	11	132	3	0	1	146	305
4:00 PM	0	0	0	0	15	0	4	0	15	0	10	19	0	34	1	0	2	35	0	34	1	0	0	35	89
4:15 PM	0	0	1	0	25	1	2	0	6	0	7	8	0	39	0	0	0	39	0	28	1	0	0	29	77

4:30 PM	0	0	0	0	29	0	2	0	2	0	7	4	0	31	2	0	0	33	1	35	1	0	3	37	74
4:45 PM	1	0	0	0	27	1	2	0	0	0	13	2	0	33	0	0	4	33	0	43	0	0	2	43	79
Hourly Total	1	0	1	0	96	2	10	0	23	0	37	33	0	137	3	0	6	140	1	140	3	0	5	144	319
5:00 PM	0	0	0	0	26	0	0	0	0	0	12	0	0	38	0	0	0	38	3	36	1	2	1	42	80
5:15 PM	0	0	0	0	28	0	0	0	6	0	10	6	0	26	4	0	0	30	2	32	1	0	1	35	71
5:30 PM	0	0	1	0	30	1	0	0	4	0	10	4	0	26	1	0	0	27	8	33	0	0	0	41	73
5:45 PM	1	0	0	0	38	1	0	0	0	0	12	0	1	31	2	0	0	34	5	36	3	0	1	44	79
Hourly Total	1	0	1	0	122	2	0	0	10	0	44	10	1	121	7	0	0	129	18	137	5	2	3	162	303
Grand Total	17	7	6	0	619	30	35	8	64	0	223	107	4	749	34	2	29	789	63	990	21	2	13	1076	2002
Approach %	56.7	23.3	20.0	0.0	-	-	32.7	7.5	59.8	0.0	-	-	0.5	94.9	4.3	0.3	-	-	5.9	92.0	2.0	0.2	-	-	-
Total %	0.8	0.3	0.3	0.0	-	1.5	1.7	0.4	3.2	0.0	-	5.3	0.2	37.4	1.7	0.1	-	39.4	3.1	49.5	1.0	0.1	-	53.7	-
Motorcycles	0	0	0	0	-	0	0	0	0	0	-	0	0	3	0	0	-	3	0	4	0	0	-	4	7
% Motorcycles	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.4	0.0	0.0	-	0.4	0.0	0.4	0.0	0.0	-	0.4	0.3
Cars & Light Goods	17	2	5	0	-	24	33	4	62	0	-	99	4	725	31	2	-	762	63	911	20	2	-	996	1881
% Cars & Light Goods	100.0	28.6	83.3	-	-	80.0	94.3	50.0	96.9	-	-	92.5	100.0	96.8	91.2	100.0	-	96.6	100.0	92.0	95.2	100.0	-	92.6	94.0
Buses	0	0	0	0	-	0	0	0	0	0	-	0	0	2	0	0	-	2	0	48	0	0	-	48	50
% Buses	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.3	0.0	0.0	-	0.3	0.0	4.8	0.0	0.0	-	4.5	2.5
Single-Unit Trucks	0	0	1	0	-	1	1	0	1	0	-	2	0	8	2	0	-	10	0	22	1	0	-	23	36
% Single-Unit Trucks	0.0	0.0	16.7	-	-	3.3	2.9	0.0	1.6	-	-	1.9	0.0	1.1	5.9	0.0	-	1.3	0.0	2.2	4.8	0.0	-	2.1	1.8
Articulated Trucks	0	0	0	0	-	0	0	0	1	0	-	1	0	1	0	0	-	1	0	4	0	0	-	4	6
% Articulated Trucks	0.0	0.0	0.0	-	-	0.0	0.0	0.0	1.6	-	-	0.9	0.0	0.1	0.0	0.0	-	0.1	0.0	0.4	0.0	0.0	-	0.4	0.3
Bicycles on Road	0	5	0	0	-	5	1	4	0	0	-	5	0	10	1	0	-	11	0	1	0	0	-	1	22
% Bicycles on Road	0.0	71.4	0.0	-	-	16.7	2.9	50.0	0.0	-	-	4.7	0.0	1.3	2.9	0.0	-	1.4	0.0	0.1	0.0	0.0	-	0.1	1.1
Bicycles on Crosswalk	-	-	-	-	355	-	-	-	-	-	5	-	-	-	-	-	1	-	-	-	-	-	1	-	-
% Bicycles on Crosswalk	-	-	-	-	57.4	-	-	-	-	-	2.2	-	-	-	-	-	3.4	-	-	-	-	-	7.7	-	-
Pedestrians	-	-	-	-	264	-	-	-	-	-	218	-	-	-	-	-	28	-	-	-	-	-	12	-	-
% Pedestrians	-	-	-	-	42.6	-	-	-	-	-	97.8	-	-	-	-	-	96.6	-	-	-	-	-	92.3	-	-

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: Caroline Street & Freemont Street
Site Code: 250137
Start Date: 05/15/2025
Page No: 4

Turning Movement Peak Hour Data (8:15 AM)

Start Time	Freemont Street Eastbound						Funeral Home Driveway Westbound						Caroline Street Northbound						Caroline Street 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	1	0	0	0	9	1	1	0	1	0	6	2	0	20	1	0	0	21	3	28	0	0	1	31	55
8:30 AM	1	0	0	0	24	1	2	1	0	0	5	3	0	15	1	0	0	16	1	37	0	0	1	38	58
8:45 AM	0	0	0	0	19	0	1	1	2	0	5	4	0	17	1	0	1	18	2	29	0	0	0	31	53
9:00 AM	0	0	0	0	25	0	0	2	0	0	6	2	1	24	3	0	1	28	1	29	0	0	0	30	60
Total	2	0	0	0	77	2	4	4	3	0	22	11	1	76	6	0	2	83	7	123	0	0	2	130	226
Approach %	100.0	0.0	0.0	0.0	-	-	36.4	36.4	27.3	0.0	-	-	1.2	91.6	7.2	0.0	-	-	5.4	94.6	0.0	0.0	-	-	-
Total %	0.9	0.0	0.0	0.0	-	0.9	1.8	1.8	1.3	0.0	-	4.9	0.4	33.6	2.7	0.0	-	36.7	3.1	54.4	0.0	0.0	-	57.5	-
PHF	0.500	0.000	0.000	0.000	-	0.500	0.500	0.500	0.375	0.000	-	0.688	0.250	0.792	0.500	0.000	-	0.741	0.583	0.831	0.000	0.000	-	0.855	0.942
Motorcycles	0	0	0	0	-	0	0	0	0	0	-	0	0	1	0	0	-	1	0	1	0	0	-	1	2
% Motorcycles	0.0	-	-	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	1.3	0.0	-	-	1.2	0.0	0.8	-	-	-	0.8	0.9
Cars & Light Goods	2	0	0	0	-	2	4	4	2	0	-	10	1	73	6	0	-	80	7	111	0	0	-	118	210
% Cars & Light Goods	100.0	-	-	-	-	100.0	100.0	100.0	66.7	-	-	90.9	100.0	96.1	100.0	-	-	96.4	100.0	90.2	-	-	-	90.8	92.9
Buses	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0	7	0	0	-	7	7
% Buses	0.0	-	-	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	5.7	-	-	-	5.4	3.1
Single-Unit Trucks	0	0	0	0	-	0	0	0	0	0	-	0	0	2	0	0	-	2	0	4	0	0	-	4	6
% Single-Unit Trucks	0.0	-	-	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	2.6	0.0	-	-	2.4	0.0	3.3	-	-	-	3.1	2.7
Articulated Trucks	0	0	0	0	-	0	0	0	1	0	-	1	0	0	0	0	-	0	0	0	0	0	-	0	1
% Articulated Trucks	0.0	-	-	-	-	0.0	0.0	0.0	33.3	-	-	9.1	0.0	0.0	0.0	-	-	0.0	0.0	0.0	-	-	-	0.0	0.4
Bicycles on Road	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0
% Bicycles on Road	0.0	-	-	-	-	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 Crosswalk	-	-	-	-	42	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	-	54.5	-	-	-	-	-	0.0	-	-	-	-	-	0.0	-	-	-	-	-	0.0	-	-
Pedestrians	-	-	-	-	35	-	-	-	-	-	22	-	-	-	-	-	2	-	-	-	-	-	2	-	-
% Pedestrians	-	-	-	-	45.5	-	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-

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@ptsl.com

Count Name: Caroline Street & Freemont Street
Site Code: 250137
Start Date: 05/15/2025
Page No: 6

Turning Movement Peak Hour Data (11:30 AM)

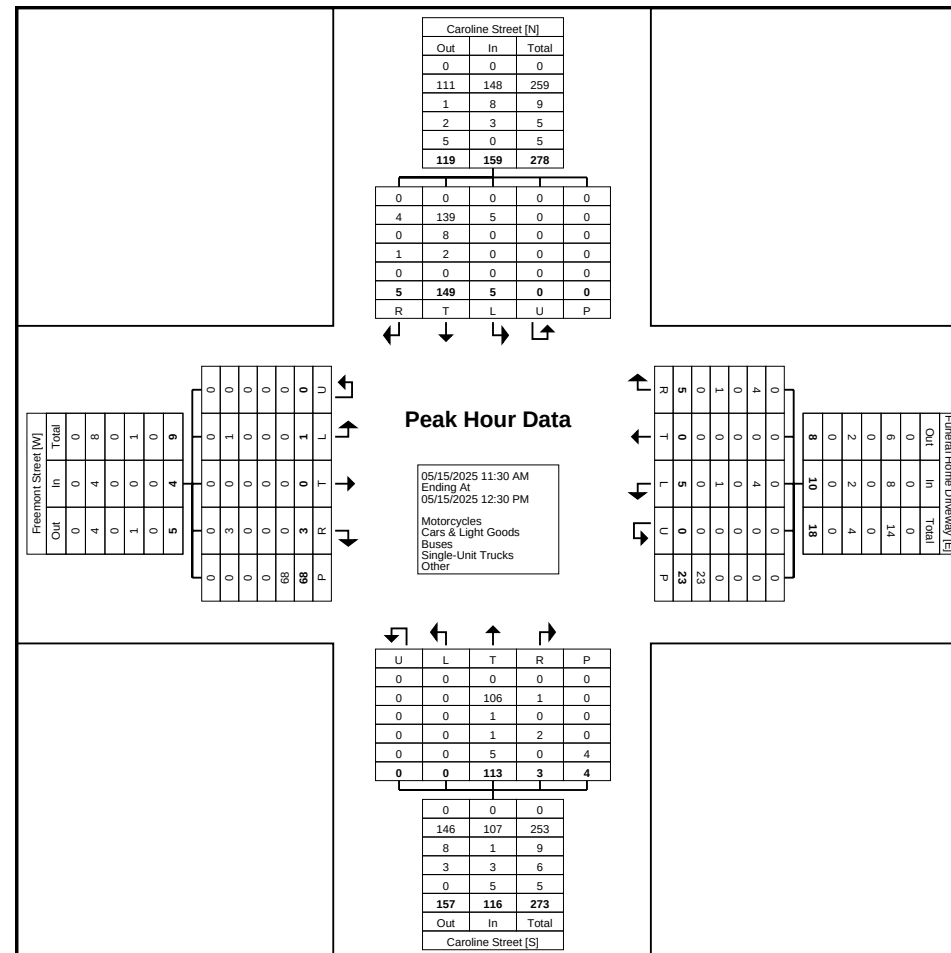
Start Time	Freemont Street Eastbound						Funeral Home Driveway Westbound						Caroline Street Northbound						Caroline Street Southbound						Int. Total
	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	
11:30 AM	0	0	0	0	15	0	0	0	1	0	4	1	0	26	1	0	2	27	0	37	1	0	0	38	66
11:45 AM	0	0	1	0	19	1	1	0	0	0	9	1	0	22	1	0	2	23	1	43	0	0	0	44	69
12:00 PM	1	0	2	0	17	3	0	0	3	0	6	3	0	32	1	0	0	33	3	34	0	0	0	37	76
12:15 PM	0	0	0	0	17	0	4	0	1	0	4	5	0	33	0	0	0	33	1	35	4	0	0	40	78
Total	1	0	3	0	68	4	5	0	5	0	23	10	0	113	3	0	4	116	5	149	5	0	0	159	289
Approach %	25.0	0.0	75.0	0.0	-	-	50.0	0.0	50.0	0.0	-	-	0.0	97.4	2.6	0.0	-	-	3.1	93.7	3.1	0.0	-	-	-
Total %	0.3	0.0	1.0	0.0	-	1.4	1.7	0.0	1.7	0.0	-	3.5	0.0	39.1	1.0	0.0	-	40.1	1.7	51.6	1.7	0.0	-	55.0	-
PHF	0.250	0.000	0.375	0.000	-	0.333	0.313	0.000	0.417	0.000	-	0.500	0.000	0.856	0.750	0.000	-	0.879	0.417	0.866	0.313	0.000	-	0.903	0.926
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
Cars & Light Goods	1	0	3	0	-	4	4	0	4	0	-	8	0	106	1	0	-	107	5	139	4	0	-	148	267
% Cars & Light Goods	100.0	-	100.0	-	-	100.0	80.0	-	80.0	-	-	80.0	-	93.8	33.3	-	-	92.2	100.0	93.3	80.0	-	-	93.1	92.4
Buses	0	0	0	0	-	0	0	0	0	0	-	0	0	1	0	0	-	1	0	8	0	0	-	8	9
% Buses	0.0	-	0.0	-	-	0.0	0.0	-	0.0	-	-	0.0	-	0.9	0.0	-	-	0.9	0.0	5.4	0.0	-	-	5.0	3.1
Single-Unit Trucks	0	0	0	0	-	0	1	0	1	0	-	2	0	1	2	0	-	3	0	2	1	0	-	3	8
% Single-Unit Trucks	0.0	-	0.0	-	-	0.0	20.0	-	20.0	-	-	20.0	-	0.9	66.7	-	-	2.6	0.0	1.3	20.0	-	-	1.9	2.8
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
Bicycles on Road	0	0	0	0	-	0	0	0	0	0	-	0	0	5	0	0	-	5	0	0	0	0	-	0	5
% Bicycles on Road	0.0	-	0.0	-	-	0.0	0.0	-	0.0	-	-	0.0	-	4.4	0.0	-	-	4.3	0.0	0.0	0.0	-	-	0.0	1.7
Bicycles on Crosswalk	-	-	-	-	39	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	0	-	-	-
% Bicycles on Crosswalk	-	-	-	-	57.4	-	-	-	-	-	0.0	-	-	-	-	-	0.0	-	-	-	-	-	-	-	-
Pedestrians	-	-	-	-	29	-	-	-	-	-	23	-	-	-	-	-	4	-	-	-	-	0	-	-	-
% Pedestrians	-	-	-	-	42.6	-	-	-	-	-	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: Caroline Street & Freemont Street
Site Code: 250137
Start Date: 05/15/2025
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Turning Movement Peak Hour Data Plot (11:30 AM)



Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

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

Count Name: Caroline Street & Freemont Street
Site Code: 250137
Start Date: 05/15/2025
Page No: 8

Turning Movement Peak Hour Data (3:45 PM)

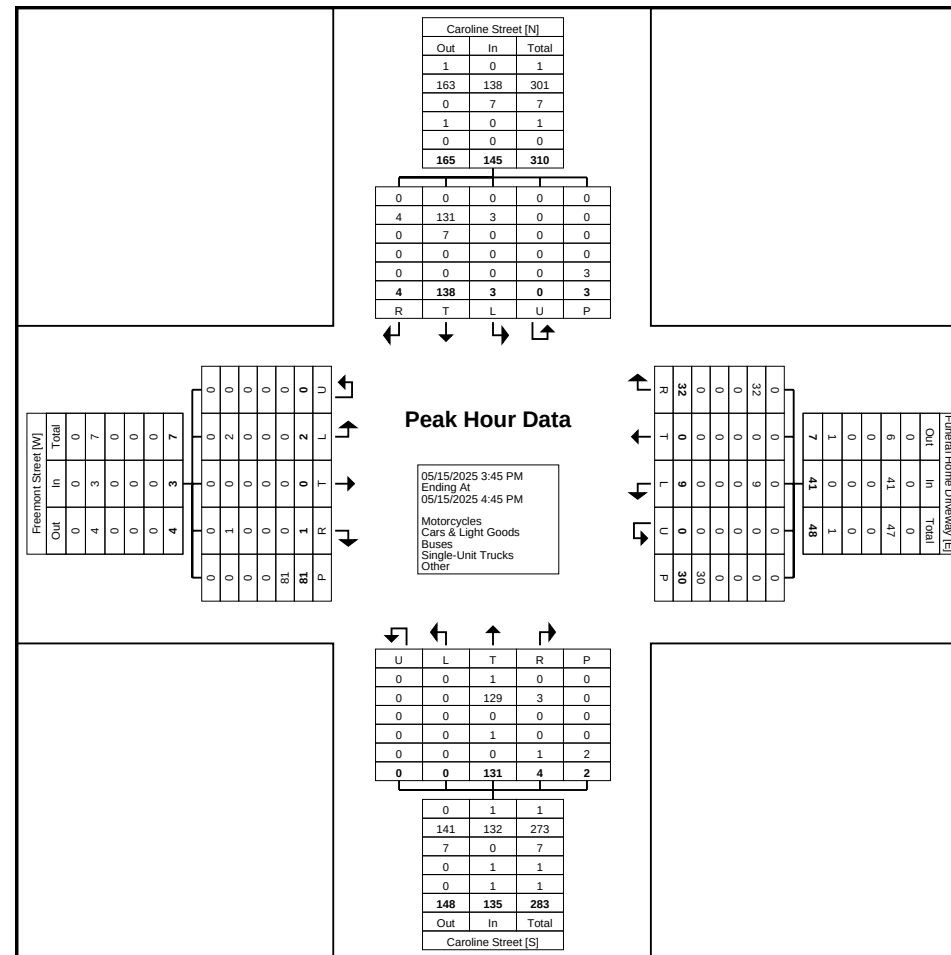
Start Time	Freemont Street Eastbound						Funeral Home Driveway Westbound						Caroline Street Northbound						Caroline Street Southbound						Int. Total
	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	
3:45 PM	2	0	0	0	12	2	1	0	9	0	6	10	0	27	1	0	0	28	2	41	1	0	0	44	84
4:00 PM	0	0	0	0	15	0	4	0	15	0	10	19	0	34	1	0	2	35	0	34	1	0	0	35	89
4:15 PM	0	0	1	0	25	1	2	0	6	0	7	8	0	39	0	0	0	39	0	28	1	0	0	29	77
4:30 PM	0	0	0	0	29	0	2	0	2	0	7	4	0	31	2	0	0	33	1	35	1	0	3	37	74
Total	2	0	1	0	81	3	9	0	32	0	30	41	0	131	4	0	2	135	3	138	4	0	3	145	324
Approach %	66.7	0.0	33.3	0.0	-	-	22.0	0.0	78.0	0.0	-	-	0.0	97.0	3.0	0.0	-	-	2.1	95.2	2.8	0.0	-	-	-
Total %	0.6	0.0	0.3	0.0	-	0.9	2.8	0.0	9.9	0.0	-	12.7	0.0	40.4	1.2	0.0	-	41.7	0.9	42.6	1.2	0.0	-	44.8	-
PHF	0.250	0.000	0.250	0.000	-	0.375	0.563	0.000	0.533	0.000	-	0.539	0.000	0.840	0.500	0.000	-	0.865	0.375	0.841	1.000	0.000	-	0.824	0.910
Motorcycles	0	0	0	0	-	0	0	0	0	0	-	0	0	1	0	0	-	1	0	0	0	0	-	0	1
% Motorcycles	0.0	-	0.0	-	-	0.0	0.0	-	0.0	-	-	0.0	-	0.8	0.0	-	-	0.7	0.0	0.0	0.0	-	-	0.0	0.3
Cars & Light Goods	2	0	1	0	-	3	9	0	32	0	-	41	0	129	3	0	-	132	3	131	4	0	-	138	314
% Cars & Light Goods	100.0	-	100.0	-	-	100.0	100.0	-	100.0	-	-	100.0	-	98.5	75.0	-	-	97.8	100.0	94.9	100.0	-	-	95.2	96.9
Buses	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0	7	0	0	-	7	7
% Buses	0.0	-	0.0	-	-	0.0	0.0	-	0.0	-	-	0.0	-	0.0	0.0	-	-	0.0	0.0	5.1	0.0	-	-	4.8	2.2
Single-Unit Trucks	0	0	0	0	-	0	0	0	0	0	-	0	0	1	0	0	-	1	0	0	0	0	-	0	1
% Single-Unit Trucks	0.0	-	0.0	-	-	0.0	0.0	-	0.0	-	-	0.0	-	0.8	0.0	-	-	0.7	0.0	0.0	0.0	-	-	0.0	0.3
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
Bicycles on Road	0	0	0	0	-	0	0	0	0	0	-	0	0	0	1	0	-	1	0	0	0	0	-	0	1
% Bicycles on Road	0.0	-	0.0	-	-	0.0	0.0	-	0.0	-	-	0.0	-	0.0	25.0	-	-	0.7	0.0	0.0	0.0	-	-	0.0	0.3
Bicycles on Crosswalk	-	-	-	-	53	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	-	65.4	-	-	-	-	-	0.0	-	-	-	-	-	0.0	-	-	-	-	-	0.0	-	-
Pedestrians	-	-	-	-	28	-	-	-	-	-	30	-	-	-	-	-	2	-	-	-	-	-	3	-	-
% Pedestrians	-	-	-	-	34.6	-	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-



Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

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Count Name: Caroline Street & Freemont Street
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Turning Movement Peak Hour Data Plot (3:45 PM)



Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

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

Count Name: King Street & William Street
Site Code: 250137
Start Date: 05/15/2025
Page No: 1

Turning Movement Data

Start Time	William Street Eastbound						William Street Westbound						King Street Northbound						King Street 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	4	18	4	0	4	26	3	7	0	0	4	10	2	17	5	0	0	24	1	19	6	0	2	26	86
7:15 AM	8	32	2	0	8	42	6	14	1	0	4	21	2	23	8	0	0	33	1	25	10	0	1	36	132
7:30 AM	10	47	2	0	7	59	4	21	1	0	5	26	7	24	3	0	1	34	1	24	9	0	2	34	153
7:45 AM	13	68	4	0	17	85	8	16	1	0	10	25	3	26	4	0	3	33	3	36	9	0	5	48	191
Hourly Total	35	165	12	0	36	212	21	58	3	0	23	82	14	90	20	0	4	124	6	104	34	0	10	144	562
8:00 AM	13	65	5	0	15	83	8	26	2	0	5	36	6	41	7	0	2	54	2	32	8	0	5	42	215
8:15 AM	17	87	6	0	11	110	9	44	0	0	5	53	16	39	19	0	2	74	4	27	19	0	8	50	287
8:30 AM	14	93	4	0	17	111	6	42	4	0	7	52	7	37	13	0	4	57	2	32	19	0	3	53	273
8:45 AM	10	93	1	0	9	104	11	49	1	0	8	61	6	37	11	0	2	54	5	34	9	0	6	48	267
Hourly Total	54	338	16	0	52	408	34	161	7	0	25	202	35	154	50	0	10	239	13	125	55	0	22	193	1042
9:00 AM	20	101	5	0	21	126	12	37	3	0	8	52	15	33	16	0	5	64	4	33	13	0	10	50	292
9:15 AM	14	59	4	0	17	77	10	44	2	0	10	56	12	38	14	0	8	64	6	32	8	0	6	46	243
9:30 AM	11	54	4	0	11	69	9	32	1	0	7	42	9	30	7	0	10	46	5	38	15	0	4	58	215
9:45 AM	10	55	6	0	13	71	14	34	0	0	8	48	16	40	13	0	5	69	6	40	7	0	6	53	241
Hourly Total	55	269	19	0	62	343	45	147	6	0	33	198	52	141	50	0	28	243	21	143	43	0	26	207	991
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11:30 AM	17	45	2	0	14	64	15	40	1	0	11	56	15	49	12	0	9	76	1	57	12	0	8	70	266
11:45 AM	15	57	5	0	22	77	11	51	2	0	14	64	10	53	13	0	11	76	1	39	15	0	17	55	272
Hourly Total	32	102	7	0	36	141	26	91	3	0	25	120	25	102	25	0	20	152	2	96	27	0	25	125	538
12:00 PM	13	60	4	0	24	77	10	66	5	0	14	81	15	57	14	0	9	86	1	40	19	0	10	60	304
12:15 PM	19	39	3	0	21	61	11	52	7	0	23	70	12	53	11	0	10	76	4	41	21	0	18	66	273
12:30 PM	11	51	4	0	18	66	7	34	3	0	13	44	8	58	21	0	4	87	2	41	12	0	7	55	252
12:45 PM	16	56	5	1	24	78	9	40	3	0	12	52	6	49	13	0	7	68	1	32	23	0	16	56	254
Hourly Total	59	206	16	1	87	282	37	192	18	0	62	247	41	217	59	0	30	317	8	154	75	0	51	237	1083
1:00 PM	17	68	4	0	23	89	11	39	5	0	12	55	15	50	18	0	5	83	3	41	17	0	18	61	288
1:15 PM	14	53	3	0	16	70	14	46	3	0	13	63	12	52	16	0	7	80	4	49	16	0	17	69	282
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hourly Total	31	121	7	0	39	159	25	85	8	0	25	118	27	102	34	0	12	163	7	90	33	0	35	130	570
3:00 PM	14	65	3	0	25	82	10	50	2	0	8	62	13	49	18	0	3	80	9	38	20	0	5	67	291
3:15 PM	17	64	5	0	13	86	7	50	3	0	14	60	11	56	12	0	3	79	7	37	16	0	11	60	285
3:30 PM	10	65	5	0	26	80	9	64	7	0	19	80	8	53	10	0	5	71	1	49	15	0	13	65	296
3:45 PM	14	77	4	0	17	95	11	56	5	0	29	72	6	55	13	0	12	74	3	47	17	0	5	67	308
Hourly Total	55	271	17	0	81	343	37	220	17	0	70	274	38	213	53	0	23	304	20	171	68	0	34	259	1180
4:00 PM	20	68	9	0	26	97	10	68	7	0	15	85	23	48	8	0	6	79	8	60	11	0	2	79	340
4:15 PM	10	85	3	0	34	98	11	63	2	0	13	76	18	39	15	0	6	72	3	56	19	0	11	78	324

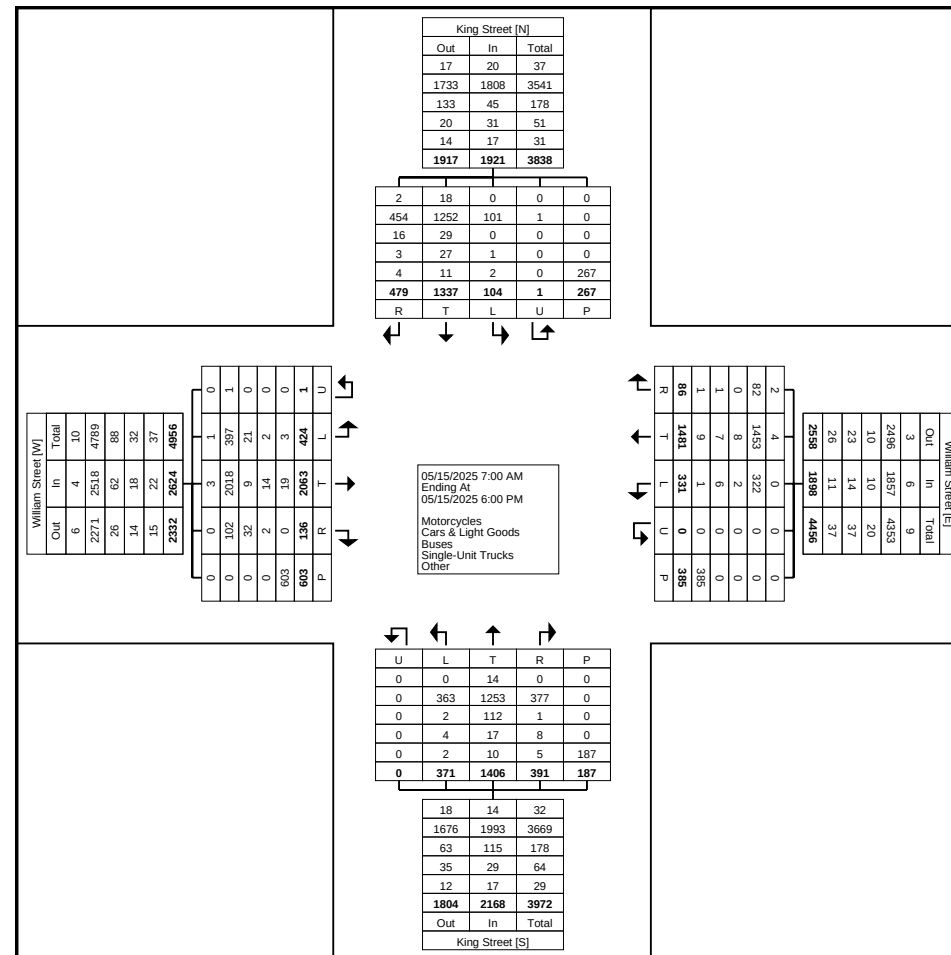
4:30 PM	12	68	6	0	31	86	17	73	3	0	11	93	19	54	14	0	5	87	4	66	22	0	5	92	358
4:45 PM	13	78	6	0	22	97	15	72	3	0	8	90	13	48	13	0	8	74	0	58	19	0	5	77	338
Hourly Total	55	299	24	0	113	378	53	276	15	0	47	344	73	189	50	0	25	312	15	240	71	0	23	326	1360
5:00 PM	12	86	4	0	17	102	12	71	1	0	12	84	18	48	19	0	7	85	5	49	21	0	7	75	346
5:15 PM	12	61	5	0	16	78	9	56	1	0	21	66	16	51	9	0	11	76	4	53	16	1	11	74	294
5:30 PM	11	62	3	0	27	76	16	66	3	0	23	85	21	50	14	0	7	85	2	66	21	0	11	89	335
5:45 PM	13	83	6	0	37	102	16	58	4	0	19	78	11	49	8	0	10	68	1	46	15	0	12	62	310
Hourly Total	48	292	18	0	97	358	53	251	9	0	75	313	66	198	50	0	35	314	12	214	73	1	41	300	1285
Grand Total	424	2063	136	1	603	2624	331	1481	86	0	385	1898	371	1406	391	0	187	2168	104	1337	479	1	267	1921	8611
Approach %	16.2	78.6	5.2	0.0	-	-	17.4	78.0	4.5	0.0	-	-	17.1	64.9	18.0	0.0	-	-	5.4	69.6	24.9	0.1	-	-	-
Total %	4.9	24.0	1.6	0.0	-	30.5	3.8	17.2	1.0	0.0	-	22.0	4.3	16.3	4.5	0.0	-	25.2	1.2	15.5	5.6	0.0	-	22.3	-
Motorcycles	1	3	0	0	-	4	0	4	2	0	-	6	0	14	0	0	-	14	0	18	2	0	-	20	44
% Motorcycles	0.2	0.1	0.0	0.0	-	0.2	0.0	0.3	2.3	-	-	0.3	0.0	1.0	0.0	-	-	0.6	0.0	1.3	0.4	0.0	-	1.0	0.5
Cars & Light Goods	397	2018	102	1	-	2518	322	1453	82	0	-	1857	363	1253	377	0	-	1993	101	1252	454	1	-	1808	8176
% Cars & Light Goods	93.6	97.8	75.0	100.0	-	96.0	97.3	98.1	95.3	-	-	97.8	97.8	89.1	96.4	-	-	91.9	97.1	93.6	94.8	100.0	-	94.1	94.9
Buses	21	9	32	0	-	62	2	8	0	0	-	10	2	112	1	0	-	115	0	29	16	0	-	45	232
% Buses	5.0	0.4	23.5	0.0	-	2.4	0.6	0.5	0.0	-	-	0.5	0.5	8.0	0.3	-	-	5.3	0.0	2.2	3.3	0.0	-	2.3	2.7
Single-Unit Trucks	2	14	2	0	-	18	6	7	1	0	-	14	4	17	8	0	-	29	1	27	3	0	-	31	92
% Single-Unit Trucks	0.5	0.7	1.5	0.0	-	0.7	1.8	0.5	1.2	-	-	0.7	1.1	1.2	2.0	-	-	1.3	1.0	2.0	0.6	0.0	-	1.6	1.1
Articulated Trucks	1	0	0	0	-	1	0	1	0	0	-	1	0	1	2	0	-	3	0	4	2	0	-	6	11
% Articulated Trucks	0.2	0.0	0.0	0.0	-	0.0	0.0	0.1	0.0	-	-	0.1	0.0	0.1	0.5	-	-	0.1	0.0	0.3	0.4	0.0	-	0.3	0.1
Bicycles on Road	2	19	0	0	-	21	1	8	1	0	-	10	2	9	3	0	-	14	2	7	2	0	-	11	56
% Bicycles on Road	0.5	0.9	0.0	0.0	-	0.8	0.3	0.5	1.2	-	-	0.5	0.5	0.6	0.8	-	-	0.6	1.9	0.5	0.4	0.0	-	0.6	0.7
Bicycles on Crosswalk	-	-	-	-	37	-	-	-	-	-	13	-	-	-	-	-	5	-	-	-	-	-	6	-	-
% Bicycles on Crosswalk	-	-	-	-	6.1	-	-	-	-	-	3.4	-	-	-	-	-	2.7	-	-	-	-	-	2.2	-	-
Pedestrians	-	-	-	-	566	-	-	-	-	-	372	-	-	-	-	-	182	-	-	-	-	-	261	-	-
% Pedestrians	-	-	-	-	93.9	-	-	-	-	-	96.6	-	-	-	-	-	97.3	-	-	-	-	-	97.8	-	-



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Count Name: King Street & William Street
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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@ptsl.com

Count Name: King Street & William Street
Site Code: 250137
Start Date: 05/15/2025
Page No: 4

Turning Movement Peak Hour Data (8:15 AM)

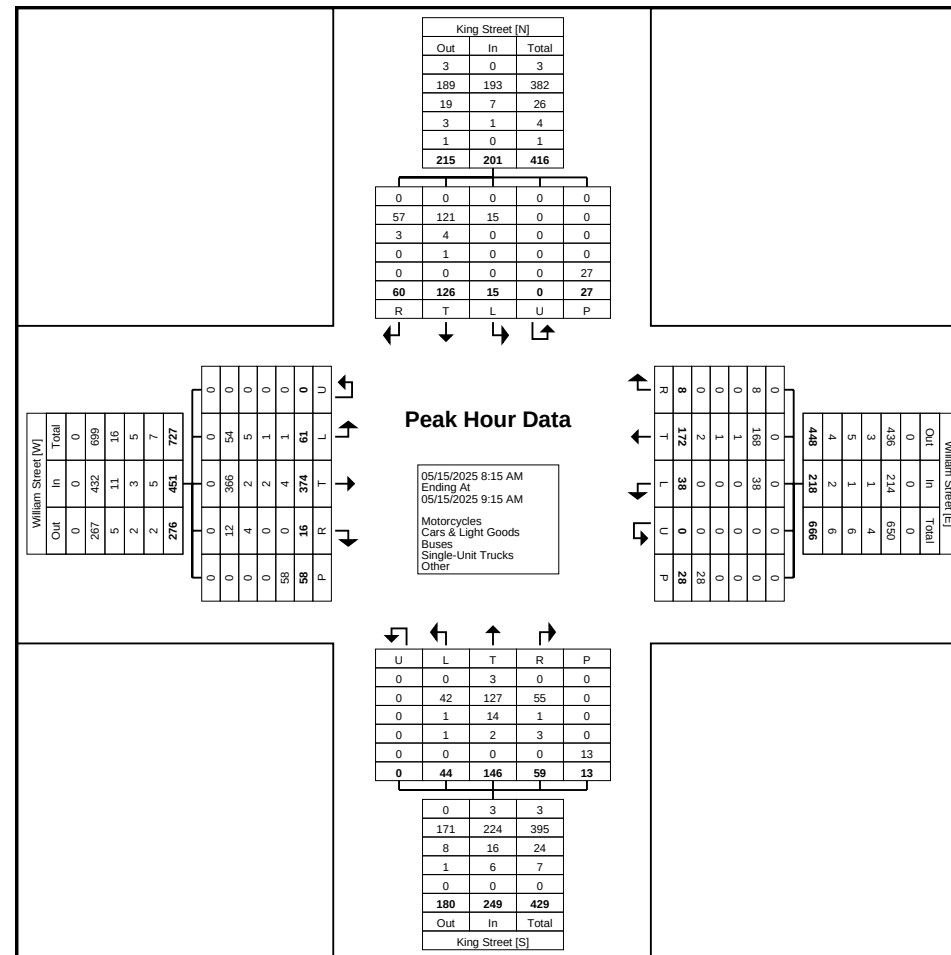
Start Time	William Street Eastbound						William Street Westbound						King Street Northbound						King Street Southbound						Int. Total
	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	
8:15 AM	17	87	6	0	11	110	9	44	0	0	5	53	16	39	19	0	2	74	4	27	19	0	8	50	287
8:30 AM	14	93	4	0	17	111	6	42	4	0	7	52	7	37	13	0	4	57	2	32	19	0	3	53	273
8:45 AM	10	93	1	0	9	104	11	49	1	0	8	61	6	37	11	0	2	54	5	34	9	0	6	48	267
9:00 AM	20	101	5	0	21	126	12	37	3	0	8	52	15	33	16	0	5	64	4	33	13	0	10	50	292
Total	61	374	16	0	58	451	38	172	8	0	28	218	44	146	59	0	13	249	15	126	60	0	27	201	1119
Approach %	13.5	82.9	3.5	0.0	-	-	17.4	78.9	3.7	0.0	-	-	17.7	58.6	23.7	0.0	-	-	7.5	62.7	29.9	0.0	-	-	-
Total %	5.5	33.4	1.4	0.0	-	40.3	3.4	15.4	0.7	0.0	-	19.5	3.9	13.0	5.3	0.0	-	22.3	1.3	11.3	5.4	0.0	-	18.0	-
PHF	0.763	0.926	0.667	0.000	-	0.895	0.792	0.878	0.500	0.000	-	0.893	0.688	0.936	0.776	0.000	-	0.841	0.750	0.926	0.789	0.000	-	0.948	0.958
Motorcycles	0	0	0	0	-	0	0	0	0	0	-	0	0	3	0	0	-	3	0	0	0	0	-	0	3
% Motorcycles	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	2.1	0.0	-	-	1.2	0.0	0.0	0.0	-	-	0.0	0.3
Cars & Light Goods	54	366	12	0	-	432	38	168	8	0	-	214	42	127	55	0	-	224	15	121	57	0	-	193	1063
% Cars & Light Goods	88.5	97.9	75.0	-	-	95.8	100.0	97.7	100.0	-	-	98.2	95.5	87.0	93.2	-	-	90.0	100.0	96.0	95.0	-	-	96.0	95.0
Buses	5	2	4	0	-	11	0	1	0	0	-	1	1	14	1	0	-	16	0	4	3	0	-	7	35
% Buses	8.2	0.5	25.0	-	-	2.4	0.0	0.6	0.0	-	-	0.5	2.3	9.6	1.7	-	-	6.4	0.0	3.2	5.0	-	-	3.5	3.1
Single-Unit Trucks	1	2	0	0	-	3	0	1	0	0	-	1	1	2	3	0	-	6	0	1	0	0	-	1	11
% Single-Unit Trucks	1.6	0.5	0.0	-	-	0.7	0.0	0.6	0.0	-	-	0.5	2.3	1.4	5.1	-	-	2.4	0.0	0.8	0.0	-	-	0.5	1.0
Articulated Trucks	0	0	0	0	-	0	0	1	0	0	-	1	0	0	0	0	-	0	0	0	0	0	-	0	1
% Articulated Trucks	0.0	0.0	0.0	-	-	0.0	0.0	0.6	0.0	-	-	0.5	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.1
Bicycles on Road	1	4	0	0	-	5	0	1	0	0	-	1	0	0	0	0	-	0	0	0	0	0	-	0	6
% Bicycles on Road	1.6	1.1	0.0	-	-	1.1	0.0	0.6	0.0	-	-	0.5	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.5
Bicycles on Crosswalk	-	-	-	-	4	-	-	-	-	-	2	-	-	-	-	-	0	-	-	-	-	-	1	-	-
% Bicycles on Crosswalk	-	-	-	-	6.9	-	-	-	-	-	7.1	-	-	-	-	-	0.0	-	-	-	-	-	3.7	-	-
Pedestrians	-	-	-	-	54	-	-	-	-	-	26	-	-	-	-	-	13	-	-	-	-	-	26	-	-
% Pedestrians	-	-	-	-	93.1	-	-	-	-	-	92.9	-	-	-	-	-	100.0	-	-	-	-	-	96.3	-	-



Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

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

Count Name: King Street & William Street
Site Code: 250137
Start Date: 05/15/2025
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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 cdowness@ptsil.com

Count Name: King Street & William Street
Site Code: 250137
Start Date: 05/15/2025
Page No: 6

Turning Movement Peak Hour Data (11:30 AM)

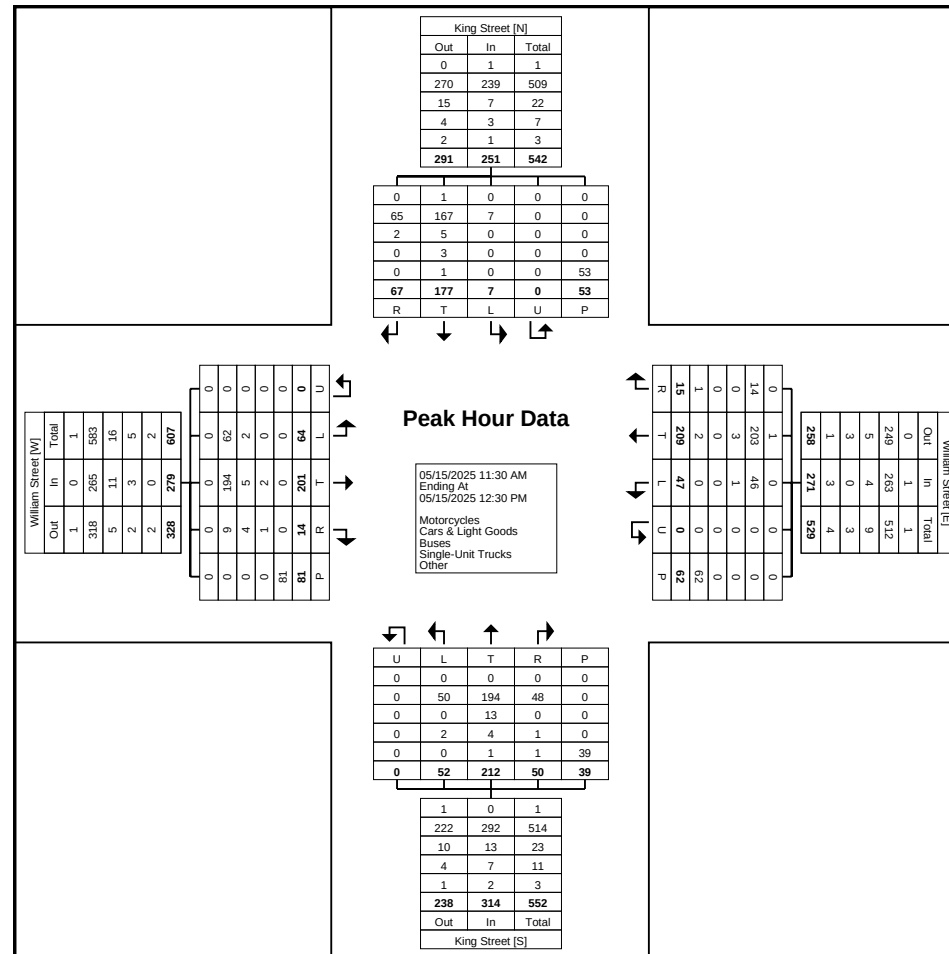
Start Time	William Street Eastbound						William Street Westbound						King Street Northbound						King Street Southbound						Int. Total
	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	
11:30 AM	17	45	2	0	14	64	15	40	1	0	11	56	15	49	12	0	9	76	1	57	12	0	8	70	266
11:45 AM	15	57	5	0	22	77	11	51	2	0	14	64	10	53	13	0	11	76	1	39	15	0	17	55	272
12:00 PM	13	60	4	0	24	77	10	66	5	0	14	81	15	57	14	0	9	86	1	40	19	0	10	60	304
12:15 PM	19	39	3	0	21	61	11	52	7	0	23	70	12	53	11	0	10	76	4	41	21	0	18	66	273
Total	64	201	14	0	81	279	47	209	15	0	62	271	52	212	50	0	39	314	7	177	67	0	53	251	1115
Approach %	22.9	72.0	5.0	0.0	-	-	17.3	77.1	5.5	0.0	-	-	16.6	67.5	15.9	0.0	-	-	2.8	70.5	26.7	0.0	-	-	-
Total %	5.7	18.0	1.3	0.0	-	25.0	4.2	18.7	1.3	0.0	-	24.3	4.7	19.0	4.5	0.0	-	28.2	0.6	15.9	6.0	0.0	-	22.5	-
PHF	0.842	0.838	0.700	0.000	-	0.906	0.783	0.792	0.536	0.000	-	0.836	0.867	0.930	0.893	0.000	-	0.913	0.438	0.776	0.798	0.000	-	0.896	0.917
Motorcycles	0	0	0	0	-	0	0	1	0	0	-	1	0	0	0	0	-	0	0	1	0	0	-	1	2
% Motorcycles	0.0	0.0	0.0	-	-	0.0	0.0	0.5	0.0	-	-	0.4	0.0	0.0	0.0	-	-	0.0	0.0	0.6	0.0	-	-	0.4	0.2
Cars & Light Goods	62	194	9	0	-	265	46	203	14	0	-	263	50	194	48	0	-	292	7	167	65	0	-	239	1059
% Cars & Light Goods	96.9	96.5	64.3	-	-	95.0	97.9	97.1	93.3	-	-	97.0	96.2	91.5	96.0	-	-	93.0	100.0	94.4	97.0	-	-	95.2	95.0
Buses	2	5	4	0	-	11	1	3	0	0	-	4	0	13	0	0	-	13	0	5	2	0	-	7	35
% Buses	3.1	2.5	28.6	-	-	3.9	2.1	1.4	0.0	-	-	1.5	0.0	6.1	0.0	-	-	4.1	0.0	2.8	3.0	-	-	2.8	3.1
Single-Unit Trucks	0	2	1	0	-	3	0	0	0	0	-	0	2	4	1	0	-	7	0	3	0	0	-	3	13
% Single-Unit Trucks	0.0	1.0	7.1	-	-	1.1	0.0	0.0	0.0	-	-	0.0	3.8	1.9	2.0	-	-	2.2	0.0	1.7	0.0	-	-	1.2	1.2
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	0	0	0	-	0	0	2	1	0	-	3	0	1	1	0	-	2	0	1	0	0	-	1	6
% Bicycles on Road	0.0	0.0	0.0	-	-	0.0	0.0	1.0	6.7	-	-	1.1	0.0	0.5	2.0	-	-	0.6	0.0	0.6	0.0	-	-	0.4	0.5
Bicycles on Crosswalk	-	-	-	-	7	-	-	-	-	-	4	-	-	-	-	-	1	-	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	-	8.6	-	-	-	-	-	6.5	-	-	-	-	-	2.6	-	-	-	-	-	0.0	-	-
Pedestrians	-	-	-	-	74	-	-	-	-	-	58	-	-	-	-	-	38	-	-	-	-	-	53	-	-
% Pedestrians	-	-	-	-	91.4	-	-	-	-	-	93.5	-	-	-	-	-	97.4	-	-	-	-	-	100.0	-	-



Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada N1R 8J8
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Count Name: King Street & William Street
Site Code: 250137
Start Date: 05/15/2025
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Turning Movement Peak Hour Data Plot (11:30 AM)



Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

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

Count Name: King Street & William Street
Site Code: 250137
Start Date: 05/15/2025
Page No: 8

Turning Movement Peak Hour Data (4:15 PM)

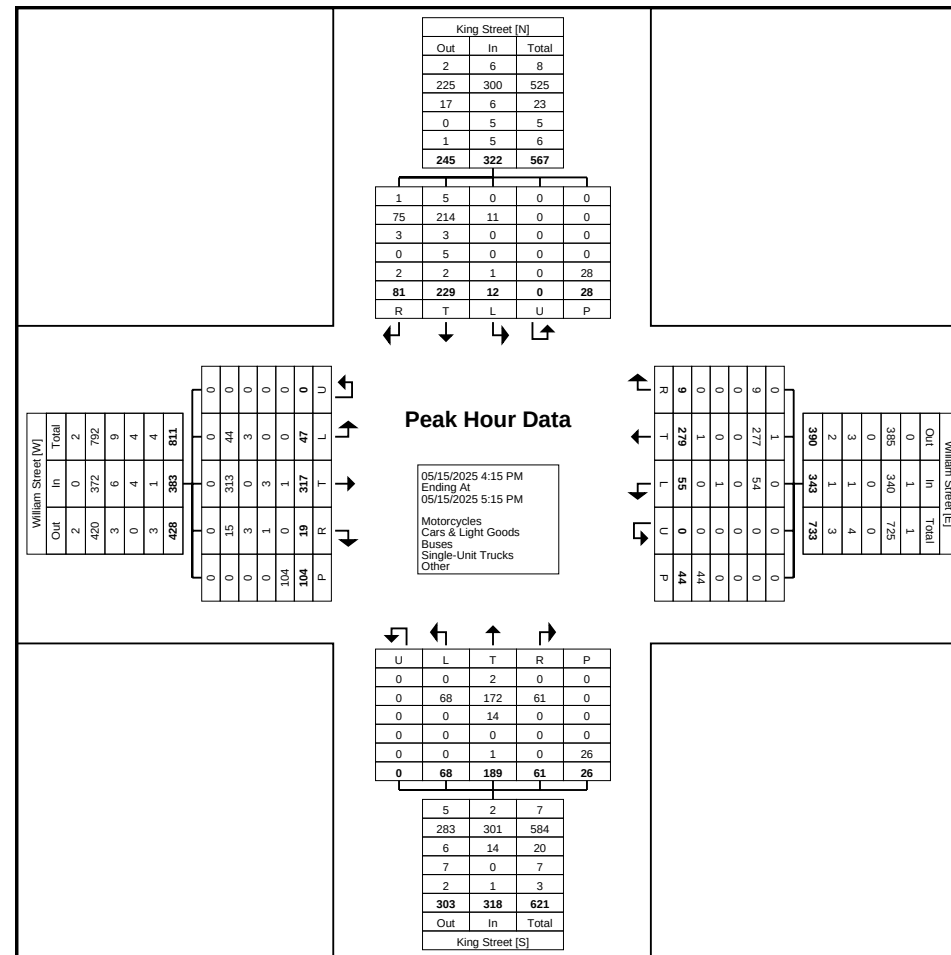
Start Time	William Street Eastbound						William Street Westbound						King Street Northbound						King Street Southbound						Int. Total
	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	
4:15 PM	10	85	3	0	34	98	11	63	2	0	13	76	18	39	15	0	6	72	3	56	19	0	11	78	324
4:30 PM	12	68	6	0	31	86	17	73	3	0	11	93	19	54	14	0	5	87	4	66	22	0	5	92	358
4:45 PM	13	78	6	0	22	97	15	72	3	0	8	90	13	48	13	0	8	74	0	58	19	0	5	77	338
5:00 PM	12	86	4	0	17	102	12	71	1	0	12	84	18	48	19	0	7	85	5	49	21	0	7	75	346
Total	47	317	19	0	104	383	55	279	9	0	44	343	68	189	61	0	26	318	12	229	81	0	28	322	1366
Approach %	12.3	82.8	5.0	0.0	-	-	16.0	81.3	2.6	0.0	-	-	21.4	59.4	19.2	0.0	-	-	3.7	71.1	25.2	0.0	-	-	-
Total %	3.4	23.2	1.4	0.0	-	28.0	4.0	20.4	0.7	0.0	-	25.1	5.0	13.8	4.5	0.0	-	23.3	0.9	16.8	5.9	0.0	-	23.6	-
PHF	0.904	0.922	0.792	0.000	-	0.939	0.809	0.955	0.750	0.000	-	0.922	0.895	0.875	0.803	0.000	-	0.914	0.600	0.867	0.920	0.000	-	0.875	0.954
Motorcycles	0	0	0	0	-	0	0	1	0	0	-	1	0	2	0	0	-	2	0	5	1	0	-	6	9
% Motorcycles	0.0	0.0	0.0	-	-	0.0	0.0	0.4	0.0	-	-	0.3	0.0	1.1	0.0	-	-	0.6	0.0	2.2	1.2	-	-	1.9	0.7
Cars & Light Goods	44	313	15	0	-	372	54	277	9	0	-	340	68	172	61	0	-	301	11	214	75	0	-	300	1313
% Cars & Light Goods	93.6	98.7	78.9	-	-	97.1	98.2	99.3	100.0	-	-	99.1	100.0	91.0	100.0	-	-	94.7	91.7	93.4	92.6	-	-	93.2	96.1
Buses	3	0	3	0	-	6	0	0	0	0	-	0	0	14	0	0	-	14	0	3	3	0	-	6	26
% Buses	6.4	0.0	15.8	-	-	1.6	0.0	0.0	0.0	-	-	0.0	0.0	7.4	0.0	-	-	4.4	0.0	1.3	3.7	-	-	1.9	1.9
Single-Unit Trucks	0	3	1	0	-	4	1	0	0	0	-	1	0	0	0	0	-	0	0	5	0	0	-	5	10
% Single-Unit Trucks	0.0	0.9	5.3	-	-	1.0	1.8	0.0	0.0	-	-	0.3	0.0	0.0	0.0	-	-	0.0	0.0	2.2	0.0	-	-	1.6	0.7
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	1	0	0	-	1	0	1	0	0	-	1	1	2	2	0	-	5	8
% Bicycles on Road	0.0	0.3	0.0	-	-	0.3	0.0	0.4	0.0	-	-	0.3	0.0	0.5	0.0	-	-	0.3	8.3	0.9	2.5	-	-	1.6	0.6
Bicycles on Crosswalk	-	-	-	-	4	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	-	3.8	-	-	-	-	-	0.0	-	-	-	-	-	0.0	-	-	-	-	-	0.0	-	-
Pedestrians	-	-	-	-	100	-	-	-	-	-	44	-	-	-	-	-	26	-	-	-	-	-	28	-	-
% Pedestrians	-	-	-	-	96.2	-	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-



Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada N1R 8J8
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Count Name: King Street & William Street
Site Code: 250137
Start Date: 05/15/2025
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Turning Movement Peak Hour Data Plot (4:15 PM)



Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

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

Count Name: Kuntz Lane & King Street
Site Code: 250137
Start Date: 05/15/2025
Page No: 1

Turning Movement Data

Start Time	Kuntz Lane Eastbound						Kuntz Lane Westbound						King Street Northbound						King Street 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	1	0	0	0	0	1	0	0	0	0	4	0	0	23	0	0	0	23	1	23	0	0	0	24	48
7:15 AM	0	0	0	0	6	0	0	0	0	0	3	0	0	32	0	0	0	32	1	32	0	0	0	33	65
7:30 AM	0	0	0	0	8	0	0	1	0	0	3	1	0	38	0	0	0	38	0	31	0	0	0	31	70
7:45 AM	0	0	0	0	7	0	0	0	0	0	10	0	0	33	1	0	0	34	0	47	1	0	1	48	82
Hourly Total	1	0	0	0	21	1	0	1	0	0	20	1	0	126	1	0	0	127	2	133	1	0	1	136	265
8:00 AM	0	0	0	0	13	0	0	0	0	0	4	0	0	54	0	0	0	54	0	44	1	0	0	45	99
8:15 AM	0	0	1	0	9	1	0	0	0	0	3	0	0	71	2	0	0	73	0	38	0	0	0	38	112
8:30 AM	0	1	1	0	14	2	0	0	0	0	6	0	1	62	1	0	2	64	0	45	0	0	0	45	111
8:45 AM	0	0	0	0	5	0	0	0	0	0	13	0	0	53	1	0	0	54	1	41	0	0	0	42	96
Hourly Total	0	1	2	0	41	3	0	0	0	0	26	0	1	240	4	0	2	245	1	168	1	0	0	170	418
9:00 AM	0	1	1	0	14	2	0	0	0	0	3	0	0	59	2	0	0	61	0	51	0	1	0	52	115
9:15 AM	0	0	0	0	17	0	0	0	0	0	7	0	1	66	0	0	0	67	3	43	0	0	0	46	113
9:30 AM	0	0	0	0	17	0	0	0	0	0	7	0	0	54	1	0	0	55	3	44	0	0	0	47	102
9:45 AM	1	0	0	0	10	1	0	1	0	0	2	1	0	64	3	0	0	67	1	62	0	0	1	63	132
Hourly Total	1	1	1	0	58	3	0	1	0	0	19	1	1	243	6	0	0	250	7	200	0	1	1	208	462
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
11:30 AM	0	0	0	0	10	0	0	0	0	0	6	0	1	76	0	0	0	77	0	66	0	0	0	66	143
11:45 AM	0	0	1	0	10	1	0	0	0	0	6	0	0	81	1	1	0	83	2	56	0	1	1	59	143
Hourly Total	0	0	1	0	20	1	0	0	0	0	12	0	1	157	1	1	0	160	2	122	0	1	1	125	286
12:00 PM	1	0	0	0	28	1	0	0	0	0	11	0	0	85	1	0	0	86	1	54	0	0	1	55	142
12:15 PM	1	0	0	0	22	1	0	0	0	0	12	0	0	73	0	0	0	73	0	61	0	0	0	61	135
12:30 PM	1	0	0	0	16	1	0	0	0	0	6	0	1	86	0	0	0	87	2	45	0	0	1	47	135
12:45 PM	0	0	0	0	21	0	0	0	0	0	7	0	0	69	2	0	0	71	3	41	0	0	0	44	115
Hourly Total	3	0	0	0	87	3	0	0	0	0	36	0	1	313	3	0	0	317	6	201	0	0	2	207	527
1:00 PM	1	1	0	0	21	2	0	0	0	0	10	0	0	81	1	0	0	82	4	51	1	0	0	56	140
1:15 PM	1	0	1	0	27	2	0	0	0	0	5	0	0	74	3	0	0	77	1	68	1	0	0	70	149
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Hourly Total	2	1	1	0	48	4	0	0	0	0	15	0	0	155	4	0	0	159	5	119	2	0	0	126	289
3:00 PM	4	0	3	0	15	7	0	0	0	0	9	0	0	80	1	0	0	81	1	51	0	0	0	52	140
3:15 PM	1	0	5	0	9	6	0	0	0	0	12	0	0	70	1	0	0	71	0	52	0	0	0	52	129
3:30 PM	3	0	2	0	19	5	0	0	0	0	10	0	0	73	3	1	0	77	0	63	0	0	1	63	145
3:45 PM	1	0	1	0	27	2	0	0	0	0	15	0	0	70	2	0	0	72	2	67	0	1	0	70	144
Hourly Total	9	0	11	0	70	20	0	0	0	0	46	0	0	293	7	1	0	301	3	233	0	1	1	237	558
4:00 PM	4	0	8	0	20	12	0	0	0	0	9	0	0	69	3	0	0	72	3	72	0	0	0	75	159
4:15 PM	1	0	0	0	19	1	0	0	0	0	18	0	0	73	0	0	0	73	0	75	0	1	0	76	150

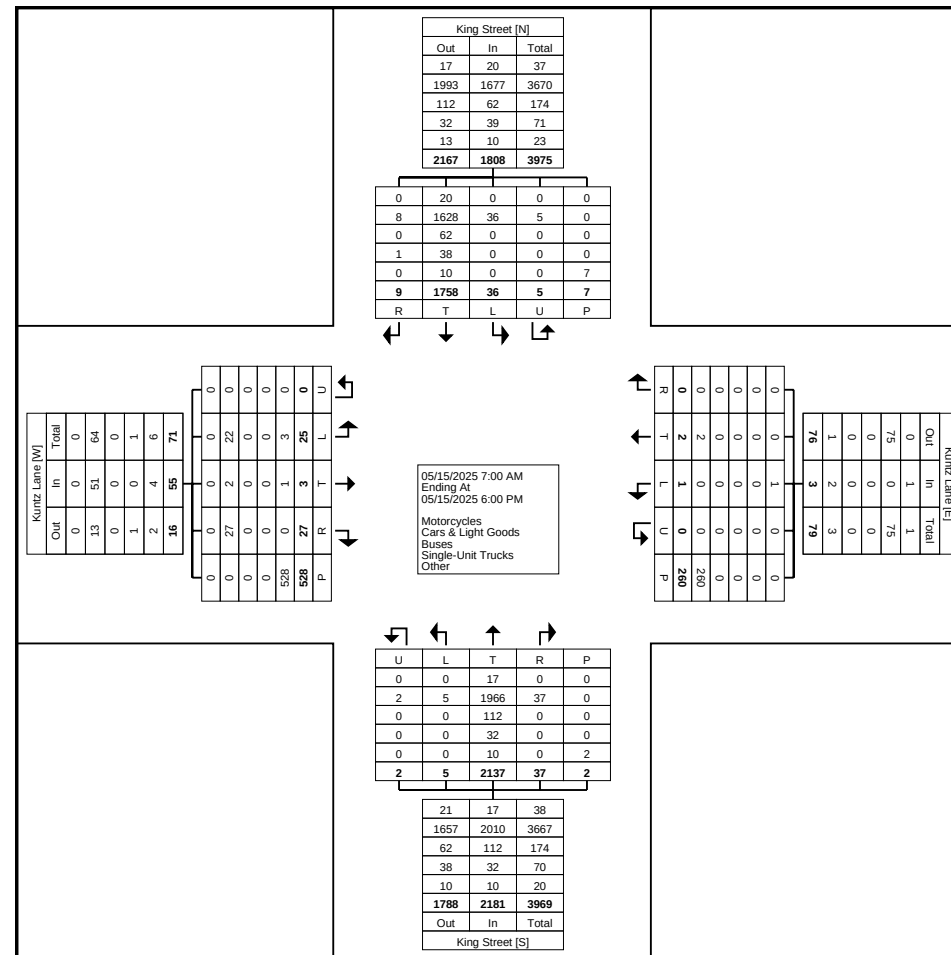
4:30 PM	1	0	1	0	25	2	0	0	0	0	5	0	0	85	0	0	0	85	2	82	1	0	1	85	172
4:45 PM	0	0	0	0	22	0	0	0	0	0	4	0	0	73	3	0	0	76	2	73	0	1	0	76	152
Hourly Total	6	0	9	0	86	15	0	0	0	0	36	0	0	300	6	0	0	306	7	302	1	2	1	312	633
5:00 PM	3	0	1	0	19	4	0	0	0	0	7	0	0	81	1	0	0	82	0	65	0	0	0	65	151
5:15 PM	0	0	1	0	19	1	0	0	0	0	10	0	0	85	1	0	0	86	1	67	3	0	0	71	158
5:30 PM	0	0	0	0	24	0	1	0	0	0	20	1	0	76	1	0	0	77	0	85	0	0	0	85	163
5:45 PM	0	0	0	0	35	0	0	0	0	0	13	0	1	68	2	0	0	71	2	63	1	0	0	66	137
Hourly Total	3	0	2	0	97	5	1	0	0	0	50	1	1	310	5	0	0	316	3	280	4	0	0	287	609
Grand Total	25	3	27	0	528	55	1	2	0	0	260	3	5	2137	37	2	2	2181	36	1758	9	5	7	1808	4047
Approach %	45.5	5.5	49.1	0.0	-	-	33.3	66.7	0.0	0.0	-	-	0.2	98.0	1.7	0.1	-	-	2.0	97.2	0.5	0.3	-	-	-
Total %	0.6	0.1	0.7	0.0	-	1.4	0.0	0.0	0.0	0.0	-	0.1	0.1	52.8	0.9	0.0	-	53.9	0.9	43.4	0.2	0.1	-	44.7	-
Motorcycles	0	0	0	0	-	0	1	0	0	0	-	1	0	17	0	0	-	17	0	20	0	0	-	20	38
% Motorcycles	0.0	0.0	0.0	-	-	0.0	100.0	0.0	-	-	-	33.3	0.0	0.8	0.0	0.0	-	0.8	0.0	1.1	0.0	0.0	-	1.1	0.9
Cars & Light Goods	22	2	27	0	-	51	0	0	0	0	-	0	5	1966	37	2	-	2010	36	1628	8	5	-	1677	3738
% Cars & Light Goods	88.0	66.7	100.0	-	-	92.7	0.0	0.0	-	-	-	0.0	100.0	92.0	100.0	100.0	-	92.2	100.0	92.6	88.9	100.0	-	92.8	92.4
Buses	0	0	0	0	-	0	0	0	0	0	-	0	0	112	0	0	-	112	0	62	0	0	-	62	174
% Buses	0.0	0.0	0.0	-	-	0.0	0.0	0.0	-	-	-	0.0	0.0	5.2	0.0	0.0	-	5.1	0.0	3.5	0.0	0.0	-	3.4	4.3
Single-Unit Trucks	0	0	0	0	-	0	0	0	0	0	-	0	0	32	0	0	-	32	0	38	1	0	-	39	71
% Single-Unit Trucks	0.0	0.0	0.0	-	-	0.0	0.0	0.0	-	-	-	0.0	0.0	1.5	0.0	0.0	-	1.5	0.0	2.2	11.1	0.0	-	2.2	1.8
Articulated Trucks	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0	1	0	0	-	1	1
% 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	0.1	0.0	0.0	-	0.1	0.0
Bicycles on Road	3	1	0	0	-	4	0	2	0	0	-	2	0	10	0	0	-	10	0	9	0	0	-	9	25
% Bicycles on Road	12.0	33.3	0.0	-	-	7.3	0.0	100.0	-	-	-	66.7	0.0	0.5	0.0	0.0	-	0.5	0.0	0.5	0.0	0.0	-	0.5	0.6
Bicycles on Crosswalk	-	-	-	-	33	-	-	-	-	-	16	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	-	6.3	-	-	-	-	-	6.2	-	-	-	-	-	0.0	-	-	-	-	-	0.0	-	-
Pedestrians	-	-	-	-	495	-	-	-	-	-	244	-	-	-	-	-	2	-	-	-	-	-	7	-	-
% Pedestrians	-	-	-	-	93.8	-	-	-	-	-	93.8	-	-	-	-	-	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: Kuntz Lane & King Street
Site Code: 250137
Start Date: 05/15/2025
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: Kuntz Lane & King Street
Site Code: 250137
Start Date: 05/15/2025
Page No: 4

Turning Movement Peak Hour Data (9:00 AM)

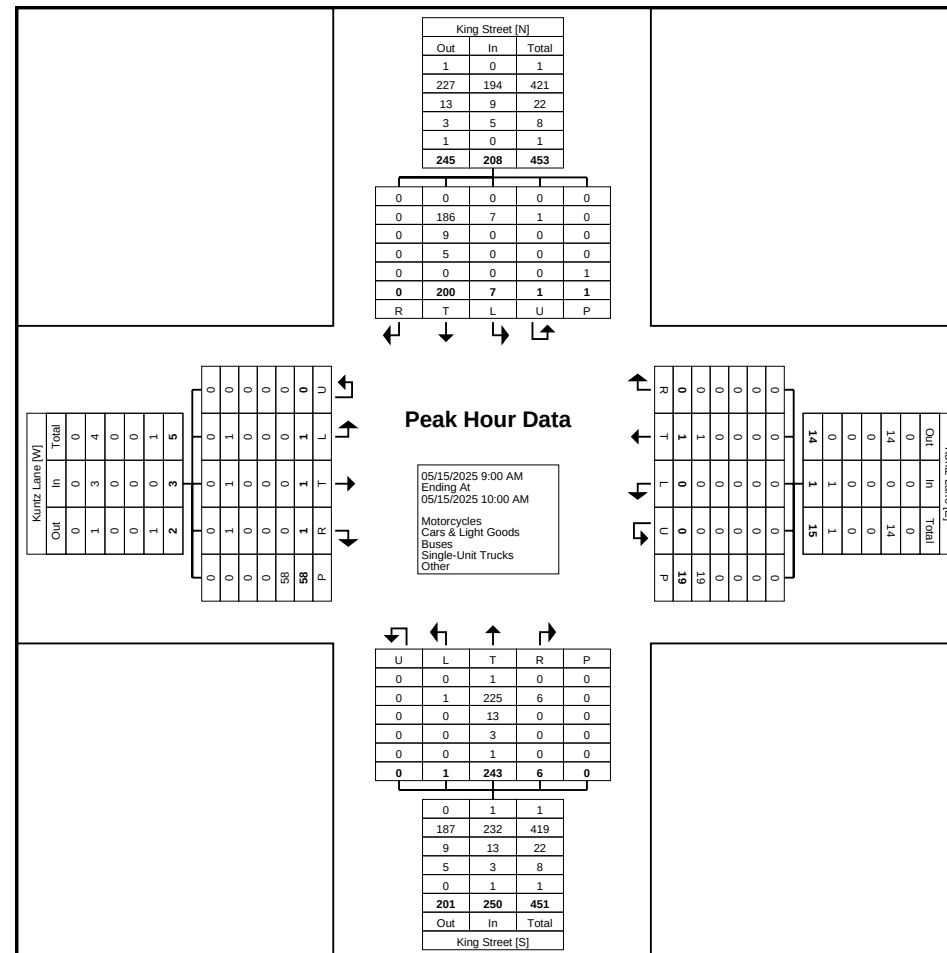
Start Time	Kuntz Lane Eastbound						Kuntz Lane Westbound						King Street Northbound						King Street Southbound						Int. Total
	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	
9:00 AM	0	1	1	0	14	2	0	0	0	0	3	0	0	59	2	0	0	61	0	51	0	1	0	52	115
9:15 AM	0	0	0	0	17	0	0	0	0	0	7	0	1	66	0	0	0	67	3	43	0	0	0	46	113
9:30 AM	0	0	0	0	17	0	0	0	0	0	7	0	0	54	1	0	0	55	3	44	0	0	0	47	102
9:45 AM	1	0	0	0	10	1	0	1	0	0	2	1	0	64	3	0	0	67	1	62	0	0	1	63	132
Total	1	1	1	0	58	3	0	1	0	0	19	1	1	243	6	0	0	250	7	200	0	1	1	208	462
Approach %	33.3	33.3	33.3	0.0	-	-	0.0	100.0	0.0	0.0	-	-	0.4	97.2	2.4	0.0	-	-	3.4	96.2	0.0	0.5	-	-	-
Total %	0.2	0.2	0.2	0.0	-	0.6	0.0	0.2	0.0	0.0	-	0.2	0.2	52.6	1.3	0.0	-	54.1	1.5	43.3	0.0	0.2	-	45.0	-
PHF	0.250	0.250	0.250	0.000	-	0.375	0.000	0.250	0.000	0.000	-	0.250	0.250	0.920	0.500	0.000	-	0.933	0.583	0.806	0.000	0.250	-	0.825	0.875
Motorcycles	0	0	0	0	-	0	0	0	0	0	-	0	0	1	0	0	-	1	0	0	0	0	-	0	1
% Motorcycles	0.0	0.0	0.0	-	-	0.0	-	0.0	-	-	-	0.0	0.0	0.4	0.0	-	-	0.4	0.0	0.0	-	0.0	-	0.0	0.2
Cars & Light Goods	1	1	1	0	-	3	0	0	0	0	-	0	1	225	6	0	-	232	7	186	0	1	-	194	429
% Cars & Light Goods	100.0	100.0	100.0	-	-	100.0	-	0.0	-	-	-	0.0	100.0	92.6	100.0	-	-	92.8	100.0	93.0	-	100.0	-	93.3	92.9
Buses	0	0	0	0	-	0	0	0	0	0	-	0	0	13	0	0	-	13	0	9	0	0	-	9	22
% Buses	0.0	0.0	0.0	-	-	0.0	-	0.0	-	-	-	0.0	0.0	5.3	0.0	-	-	5.2	0.0	4.5	-	0.0	-	4.3	4.8
Single-Unit Trucks	0	0	0	0	-	0	0	0	0	0	-	0	0	3	0	0	-	3	0	5	0	0	-	5	8
% Single-Unit Trucks	0.0	0.0	0.0	-	-	0.0	-	0.0	-	-	-	0.0	0.0	1.2	0.0	-	-	1.2	0.0	2.5	-	0.0	-	2.4	1.7
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	0	0	0	-	0	0	1	0	0	-	1	0	1	0	0	-	1	0	0	0	0	-	0	2
% Bicycles on Road	0.0	0.0	0.0	-	-	0.0	-	100.0	-	-	-	100.0	0.0	0.4	0.0	-	-	0.4	0.0	0.0	-	0.0	-	0.0	0.4
Bicycles on Crosswalk	-	-	-	-	4	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	-	6.9	-	-	-	-	-	0.0	-	-	-	-	-	-	-	-	-	-	-	0.0	-	-
Pedestrians	-	-	-	-	54	-	-	-	-	-	19	-	-	-	-	-	0	-	-	-	-	-	1	-	-
% Pedestrians	-	-	-	-	93.1	-	-	-	-	-	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: Kuntz Lane & King Street
Site Code: 250137
Start Date: 05/15/2025
Page No: 5



Turning Movement Peak Hour Data Plot (9:00 AM)



Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

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

Count Name: Kuntz Lane & King Street
Site Code: 250137
Start Date: 05/15/2025
Page No: 6

Turning Movement Peak Hour Data (11:30 AM)

Start Time	Kuntz Lane Eastbound						Kuntz Lane Westbound						King Street Northbound						King Street 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	
11:30 AM	0	0	0	0	10	0	0	0	0	0	6	0	1	76	0	0	0	77	0	66	0	0	0	66	143
11:45 AM	0	0	1	0	10	1	0	0	0	0	6	0	0	81	1	1	0	83	2	56	0	1	1	59	143
12:00 PM	1	0	0	0	28	1	0	0	0	0	11	0	0	85	1	0	0	86	1	54	0	0	1	55	142
12:15 PM	1	0	0	0	22	1	0	0	0	0	12	0	0	73	0	0	0	73	0	61	0	0	0	61	135
Total	2	0	1	0	70	3	0	0	0	0	35	0	1	315	2	1	0	319	3	237	0	1	2	241	563
Approach %	66.7	0.0	33.3	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.3	98.7	0.6	0.3	-	-	1.2	98.3	0.0	0.4	-	-	-
Total %	0.4	0.0	0.2	0.0	-	0.5	0.0	0.0	0.0	0.0	-	0.0	0.2	56.0	0.4	0.2	-	56.7	0.5	42.1	0.0	0.2	-	42.8	-
PHF	0.500	0.000	0.250	0.000	-	0.750	0.000	0.000	0.000	0.000	-	0.000	0.250	0.926	0.500	0.250	-	0.927	0.375	0.898	0.000	0.250	-	0.913	0.984
Motorcycles	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0	3	0	0	-	3	3
% Motorcycles	0.0	-	0.0	-	-	0.0	-	-	-	-	-	-	0.0	0.0	0.0	0.0	-	0.0	0.0	1.3	-	0.0	-	1.2	0.5
Cars & Light Goods	2	0	1	0	-	3	0	0	0	0	-	0	1	291	2	1	-	295	3	218	0	1	-	222	520
% Cars & Light Goods	100.0	-	100.0	-	-	100.0	-	-	-	-	-	-	100.0	92.4	100.0	100.0	-	92.5	100.0	92.0	-	100.0	-	92.1	92.4
Buses	0	0	0	0	-	0	0	0	0	0	-	0	0	14	0	0	-	14	0	9	0	0	-	9	23
% Buses	0.0	-	0.0	-	-	0.0	-	-	-	-	-	-	0.0	4.4	0.0	0.0	-	4.4	0.0	3.8	-	0.0	-	3.7	4.1
Single-Unit Trucks	0	0	0	0	-	0	0	0	0	0	-	0	0	8	0	0	-	8	0	5	0	0	-	5	13
% Single-Unit Trucks	0.0	-	0.0	-	-	0.0	-	-	-	-	-	-	0.0	2.5	0.0	0.0	-	2.5	0.0	2.1	-	0.0	-	2.1	2.3
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
Bicycles on Road	0	0	0	0	-	0	0	0	0	0	-	0	0	2	0	0	-	2	0	2	0	0	-	2	4
% Bicycles on Road	0.0	-	0.0	-	-	0.0	-	-	-	-	-	-	0.0	0.6	0.0	0.0	-	0.6	0.0	0.8	-	0.0	-	0.8	0.7
Bicycles on Crosswalk	-	-	-	-	6	-	-	-	-	-	1	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	-	8.6	-	-	-	-	-	2.9	-	-	-	-	-	-	-	-	-	-	-	0.0	-	-
Pedestrians	-	-	-	-	64	-	-	-	-	-	34	-	-	-	-	-	0	-	-	-	-	-	2	-	-
% Pedestrians	-	-	-	-	91.4	-	-	-	-	-	97.1	-	-	-	-	-	-	-	-	-	-	-	100.0	-	-

Turning Movement Peak Hour Data Plot (11:30 AM)



Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

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

Count Name: Kuntz Lane & King Street
Site Code: 250137
Start Date: 05/15/2025
Page No: 8

Turning Movement Peak Hour Data (4:00 PM)

Start Time	Kuntz Lane Eastbound						Kuntz Lane Westbound						King Street Northbound						King Street 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	
4:00 PM	4	0	8	0	20	12	0	0	0	0	9	0	0	69	3	0	0	72	3	72	0	0	0	75	159
4:15 PM	1	0	0	0	19	1	0	0	0	0	18	0	0	73	0	0	0	73	0	75	0	1	0	76	150
4:30 PM	1	0	1	0	25	2	0	0	0	0	5	0	0	85	0	0	0	85	2	82	1	0	1	85	172
4:45 PM	0	0	0	0	22	0	0	0	0	0	4	0	0	73	3	0	0	76	2	73	0	1	0	76	152
Total	6	0	9	0	86	15	0	0	0	0	36	0	0	300	6	0	0	306	7	302	1	2	1	312	633
Approach %	40.0	0.0	60.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	98.0	2.0	0.0	-	-	2.2	96.8	0.3	0.6	-	-	-
Total %	0.9	0.0	1.4	0.0	-	2.4	0.0	0.0	0.0	0.0	-	0.0	0.0	47.4	0.9	0.0	-	48.3	1.1	47.7	0.2	0.3	-	49.3	-
PHF	0.375	0.000	0.281	0.000	-	0.313	0.000	0.000	0.000	0.000	-	0.000	0.000	0.882	0.500	0.000	-	0.900	0.583	0.921	0.250	0.500	-	0.918	0.920
Motorcycles	0	0	0	0	-	0	0	0	0	0	-	0	0	2	0	0	-	2	0	6	0	0	-	6	8
% Motorcycles	0.0	-	0.0	-	-	0.0	-	-	-	-	-	-	-	0.7	0.0	-	-	0.7	0.0	2.0	0.0	0.0	-	1.9	1.3
Cars & Light Goods	6	0	9	0	-	15	0	0	0	0	-	0	0	280	6	0	-	286	7	281	1	2	-	291	592
% Cars & Light Goods	100.0	-	100.0	-	-	100.0	-	-	-	-	-	-	-	93.3	100.0	-	-	93.5	100.0	93.0	100.0	100.0	-	93.3	93.5
Buses	0	0	0	0	-	0	0	0	0	0	-	0	0	16	0	0	-	16	0	6	0	0	-	6	22
% Buses	0.0	-	0.0	-	-	0.0	-	-	-	-	-	-	-	5.3	0.0	-	-	5.2	0.0	2.0	0.0	0.0	-	1.9	3.5
Single-Unit Trucks	0	0	0	0	-	0	0	0	0	0	-	0	0	1	0	0	-	1	0	5	0	0	-	5	6
% Single-Unit Trucks	0.0	-	0.0	-	-	0.0	-	-	-	-	-	-	-	0.3	0.0	-	-	0.3	0.0	1.7	0.0	0.0	-	1.6	0.9
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
Bicycles on Road	0	0	0	0	-	0	0	0	0	0	-	0	0	1	0	0	-	1	0	4	0	0	-	4	5
% Bicycles on Road	0.0	-	0.0	-	-	0.0	-	-	-	-	-	-	-	0.3	0.0	-	-	0.3	0.0	1.3	0.0	0.0	-	1.3	0.8
Bicycles on Crosswalk	-	-	-	-	3	-	-	-	-	-	3	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	-	3.5	-	-	-	-	-	8.3	-	-	-	-	-	-	-	-	-	-	-	0.0	-	-
Pedestrians	-	-	-	-	83	-	-	-	-	-	33	-	-	-	-	-	0	-	-	-	-	-	1	-	-
% Pedestrians	-	-	-	-	96.5	-	-	-	-	-	91.7	-	-	-	-	-	-	-	-	-	-	-	100.0	-	-

Turning Movement Peak Hour Data Plot (4:00 PM)



Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

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

Count Name: Kuntz Lane & William Street
Site Code: 250137
Start Date: 05/15/2025
Page No: 1

Turning Movement Data

Start Time	William Street Eastbound					William Street Westbound					Kuntz Lane Northbound					Int. Total
	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	U-Turn	Peds	App. Total	Left	Right	U-Turn	Peds	App. Total	
7:00 AM	24	0	0	0	24	0	18	0	0	18	0	0	0	1	0	42
7:15 AM	48	0	0	0	48	0	24	0	0	24	0	0	0	1	0	72
7:30 AM	58	0	0	1	58	0	37	0	0	37	0	0	0	1	0	95
7:45 AM	86	0	0	0	86	0	30	0	0	30	0	0	0	7	0	116
Hourly Total	216	0	0	1	216	0	109	0	0	109	0	0	0	10	0	325
8:00 AM	85	0	0	0	85	0	47	0	0	47	0	0	0	2	0	132
8:15 AM	106	2	0	0	108	0	75	0	0	75	0	0	0	2	0	183
8:30 AM	108	3	0	0	111	1	66	0	0	67	0	0	0	3	0	178
8:45 AM	113	3	0	0	116	2	62	0	0	64	0	0	0	2	0	180
Hourly Total	412	8	0	0	420	3	250	0	0	253	0	0	0	9	0	673
9:00 AM	111	2	0	4	113	0	67	0	2	67	0	0	0	7	0	180
9:15 AM	80	0	0	0	80	0	64	0	2	64	0	0	0	1	0	144
9:30 AM	69	0	0	1	69	0	56	0	0	56	0	0	0	7	0	125
9:45 AM	73	0	0	0	73	0	50	0	0	50	0	0	0	2	0	123
Hourly Total	333	2	0	5	335	0	237	0	4	237	0	0	0	17	0	572
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11:30 AM	66	0	0	0	66	0	73	0	0	73	0	0	0	3	0	139
11:45 AM	78	6	0	6	84	0	70	0	0	70	0	0	0	6	0	154
Hourly Total	144	6	0	6	150	0	143	0	0	143	0	0	0	9	0	293
12:00 PM	78	0	0	8	78	3	96	0	0	99	0	0	0	6	0	177
12:15 PM	72	0	0	0	72	2	79	0	1	81	0	0	0	5	0	153
12:30 PM	62	1	0	0	63	0	59	0	0	59	0	0	0	6	0	122
12:45 PM	75	0	0	0	75	0	67	0	1	67	0	0	0	8	0	142
Hourly Total	287	1	0	8	288	5	301	0	2	306	0	0	0	25	0	594
1:00 PM	93	0	0	0	93	0	74	0	1	74	0	0	0	4	0	167
1:15 PM	67	1	0	0	68	0	70	0	0	70	0	0	0	5	0	138
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hourly Total	160	1	0	0	161	0	144	0	1	144	0	0	0	9	0	305
3:00 PM	84	1	0	0	85	0	88	0	0	88	0	0	0	8	0	173
3:15 PM	78	1	0	0	79	2	66	0	0	68	0	0	0	5	0	147
3:30 PM	88	0	0	0	88	0	88	0	0	88	0	0	0	6	0	176
3:45 PM	95	0	0	0	95	0	83	0	0	83	0	0	0	2	0	178
Hourly Total	345	2	0	0	347	2	325	0	0	327	0	0	0	21	0	674
4:00 PM	88	1	0	0	89	0	107	1	0	108	0	0	0	3	0	197
4:15 PM	106	0	0	0	106	0	98	0	0	98	0	1	0	3	1	205
4:30 PM	83	0	0	0	83	0	112	0	0	112	0	0	0	4	0	195

4:45 PM	100	0	0	0	100	1	106	0	0	107	0	0	0	1	0	207
Hourly Total	377	1	0	0	378	1	423	1	0	425	0	1	0	11	1	804
5:00 PM	97	0	0	0	97	1	106	0	0	107	0	0	0	5	0	204
5:15 PM	80	1	0	0	81	0	95	0	1	95	0	0	0	3	0	176
5:30 PM	82	0	0	0	82	1	100	0	0	101	0	0	0	5	0	183
5:45 PM	96	1	0	0	97	0	78	0	1	78	0	0	0	7	0	175
Hourly Total	355	2	0	0	357	2	379	0	2	381	0	0	0	20	0	738
Grand Total	2629	23	0	20	2652	13	2311	1	9	2325	0	1	0	131	1	4978
Approach %	99.1	0.9	0.0	-	-	0.6	99.4	0.0	-	-	0.0	100.0	0.0	-	-	-
Total %	52.8	0.5	0.0	-	53.3	0.3	46.4	0.0	-	46.7	0.0	0.0	0.0	-	0.0	-
Motorcycles	5	0	0	-	5	0	6	0	-	6	0	0	0	-	0	11
% Motorcycles	0.2	0.0	-	-	0.2	0.0	0.3	0.0	-	0.3	-	0.0	-	-	0.0	0.2
Cars & Light Goods	2520	23	0	-	2543	11	2245	1	-	2257	0	0	0	-	0	4800
% Cars & Light Goods	95.9	100.0	-	-	95.9	84.6	97.1	100.0	-	97.1	-	0.0	-	-	0.0	96.4
Buses	60	0	0	-	60	0	28	0	-	28	0	0	0	-	0	88
% Buses	2.3	0.0	-	-	2.3	0.0	1.2	0.0	-	1.2	-	0.0	-	-	0.0	1.8
Single-Unit Trucks	20	0	0	-	20	0	14	0	-	14	0	0	0	-	0	34
% Single-Unit Trucks	0.8	0.0	-	-	0.8	0.0	0.6	0.0	-	0.6	-	0.0	-	-	0.0	0.7
Articulated Trucks	1	0	0	-	1	0	2	0	-	2	0	0	0	-	0	3
% Articulated Trucks	0.0	0.0	-	-	0.0	0.0	0.1	0.0	-	0.1	-	0.0	-	-	0.0	0.1
Bicycles on Road	23	0	0	-	23	2	16	0	-	18	0	1	0	-	1	42
% Bicycles on Road	0.9	0.0	-	-	0.9	15.4	0.7	0.0	-	0.8	-	100.0	-	-	100.0	0.8
Bicycles on Crosswalk	-	-	-	0	-	-	-	-	0	-	-	-	-	14	-	-
% Bicycles on Crosswalk	-	-	-	0.0	-	-	-	-	0.0	-	-	-	-	10.7	-	-
Pedestrians	-	-	-	20	-	-	-	-	9	-	-	-	-	117	-	-
% Pedestrians	-	-	-	100.0	-	-	-	-	100.0	-	-	-	-	89.3	-	-

Turning Movement Data Plot



Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

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

Count Name: Kuntz Lane & William Street
Site Code: 250137
Start Date: 05/15/2025
Page No: 4

Turning Movement Peak Hour Data (8:15 AM)

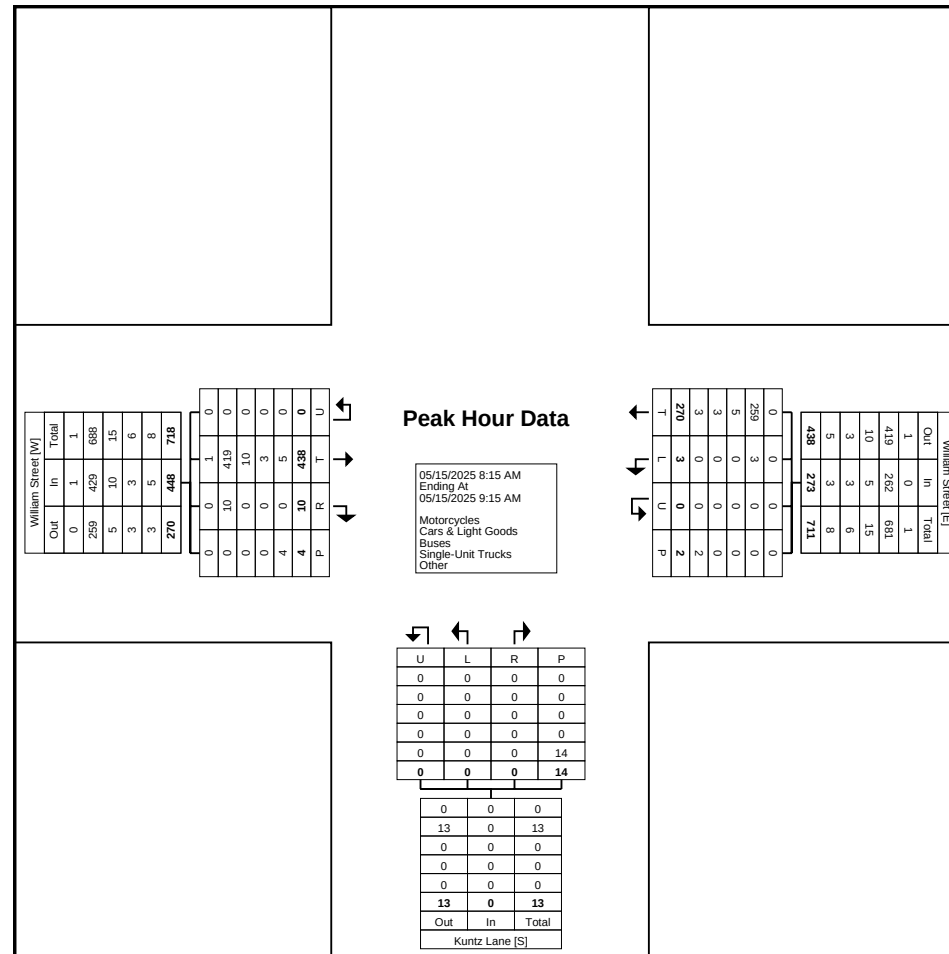
Start Time	William Street Eastbound					William Street Westbound					Kuntz Lane Northbound					Int. Total
	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	U-Turn	Peds	App. Total	Left	Right	U-Turn	Peds	App. Total	
8:15 AM	106	2	0	0	108	0	75	0	0	75	0	0	0	2	0	183
8:30 AM	108	3	0	0	111	1	66	0	0	67	0	0	0	3	0	178
8:45 AM	113	3	0	0	116	2	62	0	0	64	0	0	0	2	0	180
9:00 AM	111	2	0	4	113	0	67	0	2	67	0	0	0	7	0	180
Total	438	10	0	4	448	3	270	0	2	273	0	0	0	14	0	721
Approach %	97.8	2.2	0.0	-	-	1.1	98.9	0.0	-	-	0.0	0.0	0.0	-	-	-
Total %	60.7	1.4	0.0	-	62.1	0.4	37.4	0.0	-	37.9	0.0	0.0	0.0	-	0.0	-
PHF	0.969	0.833	0.000	-	0.966	0.375	0.900	0.000	-	0.910	0.000	0.000	0.000	-	0.000	0.985
Motorcycles	1	0	0	-	1	0	0	0	-	0	0	0	0	-	0	1
% Motorcycles	0.2	0.0	-	-	0.2	0.0	0.0	-	-	0.0	-	-	-	-	-	0.1
Cars & Light Goods	419	10	0	-	429	3	259	0	-	262	0	0	0	-	0	691
% Cars & Light Goods	95.7	100.0	-	-	95.8	100.0	95.9	-	-	96.0	-	-	-	-	-	95.8
Buses	10	0	0	-	10	0	5	0	-	5	0	0	0	-	0	15
% Buses	2.3	0.0	-	-	2.2	0.0	1.9	-	-	1.8	-	-	-	-	-	2.1
Single-Unit Trucks	3	0	0	-	3	0	3	0	-	3	0	0	0	-	0	6
% Single-Unit Trucks	0.7	0.0	-	-	0.7	0.0	1.1	-	-	1.1	-	-	-	-	-	0.8
Articulated Trucks	1	0	0	-	1	0	1	0	-	1	0	0	0	-	0	2
% Articulated Trucks	0.2	0.0	-	-	0.2	0.0	0.4	-	-	0.4	-	-	-	-	-	0.3
Bicycles on Road	4	0	0	-	4	0	2	0	-	2	0	0	0	-	0	6
% Bicycles on Road	0.9	0.0	-	-	0.9	0.0	0.7	-	-	0.7	-	-	-	-	-	0.8
Bicycles on Crosswalk	-	-	-	0	-	-	-	-	0	-	-	-	-	0	-	-
% Bicycles on Crosswalk	-	-	-	0.0	-	-	-	-	0.0	-	-	-	-	0.0	-	-
Pedestrians	-	-	-	4	-	-	-	-	2	-	-	-	-	14	-	-
% Pedestrians	-	-	-	100.0	-	-	-	-	100.0	-	-	-	-	100.0	-	-



Paradigm Transportation Solutions Limited
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Count Name: Kuntz Lane & William Street
Site Code: 250137
Start Date: 05/15/2025
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@ptsll.com

Count Name: Kuntz Lane & William Street
Site Code: 250137
Start Date: 05/15/2025
Page No: 6

Turning Movement Peak Hour Data (11:30 AM)

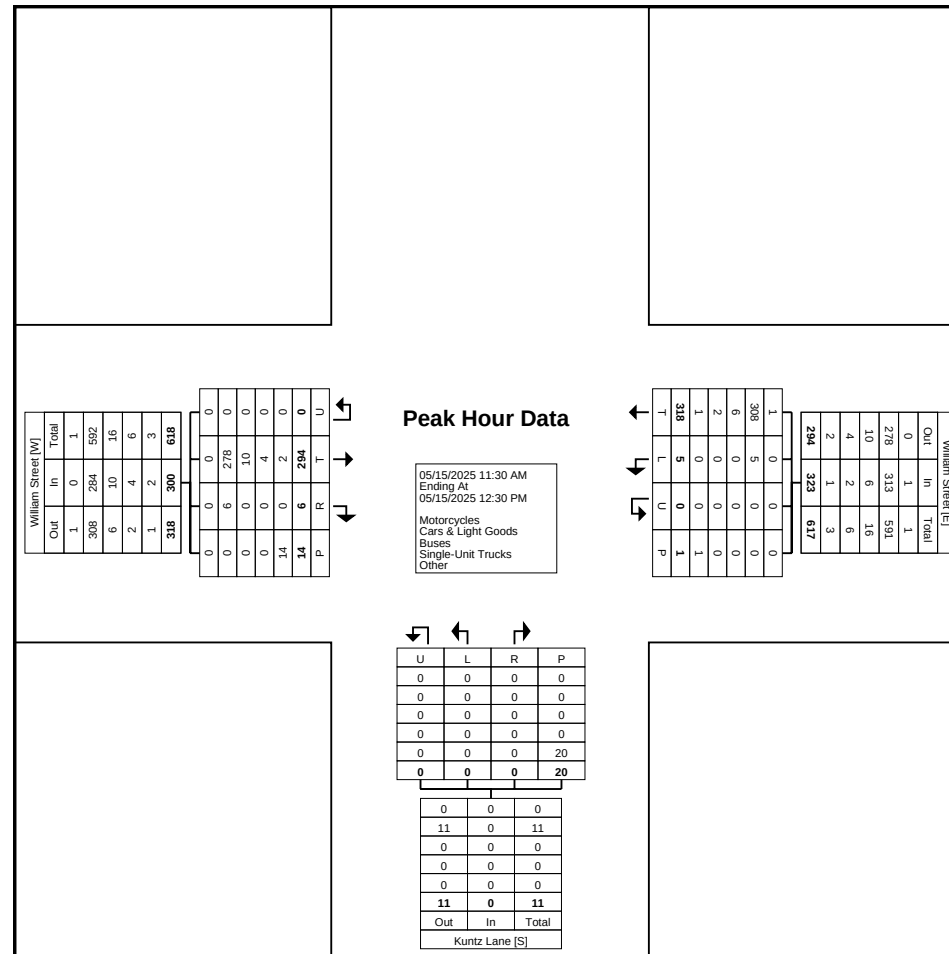
Start Time	William Street Eastbound					William Street Westbound					Kuntz Lane Northbound					Int. Total
	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	U-Turn	Peds	App. Total	Left	Right	U-Turn	Peds	App. Total	
11:30 AM	66	0	0	0	66	0	73	0	0	73	0	0	0	3	0	139
11:45 AM	78	6	0	6	84	0	70	0	0	70	0	0	0	6	0	154
12:00 PM	78	0	0	8	78	3	96	0	0	99	0	0	0	6	0	177
12:15 PM	72	0	0	0	72	2	79	0	1	81	0	0	0	5	0	153
Total	294	6	0	14	300	5	318	0	1	323	0	0	0	20	0	623
Approach %	98.0	2.0	0.0	-	-	1.5	98.5	0.0	-	-	0.0	0.0	0.0	-	-	-
Total %	47.2	1.0	0.0	-	48.2	0.8	51.0	0.0	-	51.8	0.0	0.0	0.0	-	0.0	-
PHF	0.942	0.250	0.000	-	0.893	0.417	0.828	0.000	-	0.816	0.000	0.000	0.000	-	0.000	0.880
Motorcycles	0	0	0	-	0	0	1	0	-	1	0	0	0	-	0	1
% Motorcycles	0.0	0.0	-	-	0.0	0.0	0.3	-	-	0.3	-	-	-	-	-	0.2
Cars & Light Goods	278	6	0	-	284	5	308	0	-	313	0	0	0	-	0	597
% Cars & Light Goods	94.6	100.0	-	-	94.7	100.0	96.9	-	-	96.9	-	-	-	-	-	95.8
Buses	10	0	0	-	10	0	6	0	-	6	0	0	0	-	0	16
% Buses	3.4	0.0	-	-	3.3	0.0	1.9	-	-	1.9	-	-	-	-	-	2.6
Single-Unit Trucks	4	0	0	-	4	0	2	0	-	2	0	0	0	-	0	6
% Single-Unit Trucks	1.4	0.0	-	-	1.3	0.0	0.6	-	-	0.6	-	-	-	-	-	1.0
Articulated Trucks	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
Bicycles on Road	2	0	0	-	2	0	1	0	-	1	0	0	0	-	0	3
% Bicycles on Road	0.7	0.0	-	-	0.7	0.0	0.3	-	-	0.3	-	-	-	-	-	0.5
Bicycles on Crosswalk	-	-	-	0	-	-	-	-	0	-	-	-	-	2	-	-
% Bicycles on Crosswalk	-	-	-	0.0	-	-	-	-	0.0	-	-	-	-	10.0	-	-
Pedestrians	-	-	-	14	-	-	-	-	1	-	-	-	-	18	-	-
% Pedestrians	-	-	-	100.0	-	-	-	-	100.0	-	-	-	-	90.0	-	-



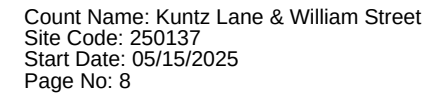
Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

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

Count Name: Kuntz Lane & William Street
Site Code: 250137
Start Date: 05/15/2025
Page No: 7



Turning Movement Peak Hour Data Plot (11:30 AM)

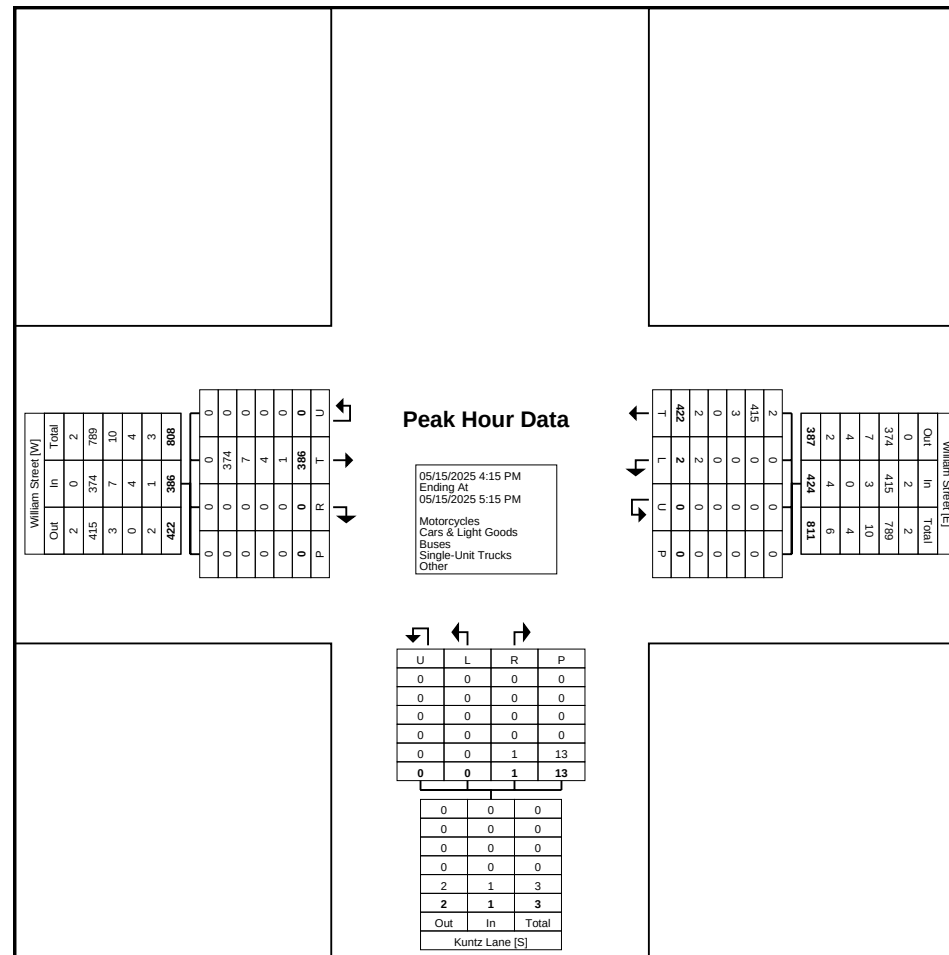
[illegible]



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Count Name: Kuntz Lane & William Street
Site Code: 250137
Start Date: 05/15/2025
Page No: 9



Turning Movement Peak Hour Data Plot (4:15 PM)

CURRENT TRAFFIC SIGNAL TIMING

INT # **84**

KING STREET @ William Street

T08-50/ **30W**

Date Prepared: **May 29, 2025**

Mode of Control **Fixed Time**

Left Info **Actuated NB LT - KING STREET**

*Offsets are a percentage of the cycle length and refers to the beginning of Main Street green

<u>Pattern 1</u>		07:00 - 10:00 Monday to Friday					
King Street						Offset 0%	
NB LT Arrow	Min	5.0	seconds				
	Ext	3.0	seconds				
	Max	6.4	seconds				
Amber		3.0	seconds				
All Red		1.0	seconds				
Green		27.6	seconds				
Amber		4.0	seconds	Walk	21.6	seconds	
All Red		2.0	seconds	FDW	6.0	seconds	

William Street							
Green		30.0	seconds				
Amber		4.0	seconds	Walk	19.0	seconds	
All Red		2.0	seconds	FDW	11.0	seconds	
TOTAL		80.0	seconds				

<u>Pattern 2</u>		10:00 - 14:00 Monday to Friday					
King Street						Offset 40%	
NB LT Arrow	Min	5.0	seconds				
	Ext	3.0	seconds				
	Max	6.4	seconds				
Amber		3.0	seconds				
All Red		1.0	seconds				
Green		27.6	seconds				
Amber		4.0	seconds	Walk	21.6	seconds	
All Red		2.0	seconds	FDW	6.0	seconds	

William Street							
Green		30.0	seconds				
Amber		4.0	seconds	Walk	19.0	seconds	
All Red		2.0	seconds	FDW	11.0	seconds	
TOTAL		80.0	seconds				

Pattern 3

14:00 - 19:00 Monday to Friday, 08:30 - 19:00 Sat, 11:00 - 18:00 Sun

King Street

Offset 33%

NB LT Arrow

Min	5.0	seconds
Ext	3.0	seconds
Max	6.4	seconds

Amber	3.0	seconds
All Red	1.0	seconds
Green	27.6	seconds
Amber	4.0	seconds
All Red	2.0	seconds

Walk	21.6	seconds
FDW	6.0	seconds

William Street

Green	30.0	seconds
Amber	4.0	seconds
All Red	2.0	seconds
TOTAL	80.0	seconds

Walk	19.0	seconds
FDW	11.0	seconds

Pattern 4

All Other Times

King Street

Offset 0%

Green	29.0	seconds
Amber	4.0	seconds
All Red	2.0	seconds

Walk	23.0	seconds
FDW	6.0	seconds

King Street

Green	29.0	seconds
Amber	4.0	seconds
All Red	2.0	seconds
TOTAL	70.0	seconds

Walk	18.0	seconds
FDW	11.0	seconds

Max 1 (TP 2) - AP 11

LRT Plan

King Street

NB LT Arrow

Min	5.0	seconds
Ext	3.0	seconds
Max	6.0	seconds

Amber	3.0	seconds
All Red	1.0	seconds
Green	25.0	seconds
Amber	4.0	seconds
All Red	2.0	seconds

Walk	19.0	seconds
FDW	6.0	seconds

LRT phase - Concurrent with main street through traffic

Pre-flash	6.0	seconds
Green	Min 10.0	seconds
	Ext 1.0	seconds
	Max 20.0	seconds
Bike Green	15.0	seconds
Amber (Post flash)	4.0	seconds
All Red	2.0	seconds
Red Max	5.0	seconds

William Street

Green	18.0	seconds
Amber	4.0	seconds
All Red	2.0	seconds

Walk	7.0	seconds
FDW	11.0	seconds

Min=Minimum Time
Ext=Extension Time
Max=Maximum Time

**This signal timing cannot be
presented as evidence in a court of law.**



CURRENT TRAFFIC SIGNAL TIMING

INT # **714**

CAROLINE STREET @ Allen Street

T08-50/ **137W**

Date Prepared: **May 29, 2025**

Mode of Control **Fixed Time**

*Offsets are a percentage of the cycle length and refers to the beginning of Main Street green

Pattern 1

All Times

Caroline Street

OFFSET 75%

Green	34.0	seconds			
Amber	4.0	seconds	Walk	28.0	seconds
All Red	2.0	seconds	FDW	6.0	seconds

Allen Street

Green	34.0	seconds			
Amber	4.0	seconds	Walk	29.0	seconds
All Red	2.0	seconds	FDW	5.0	seconds
		80.0	seconds		

Max 1 - TP 2 (AP 11)

LRT Plan

Caroline Street

Green	15.0	seconds			
Amber	4.0	seconds	Walk	9.0	seconds
All Red	2.0	seconds	FDW	6.0	seconds

SB LRT phase (Phase 10)

Pre-flash	6.0	seconds
Green	Min 10.0	seconds
	Ext 1.0	seconds
	Max 25.0	seconds
Bike Green	20.0	seconds
Amber (Post flash)	4.0	seconds
All Red	3.0	seconds
Red Max	10.0	seconds

Allen Street

Green	15.0	seconds			
Amber	4.0	seconds	Walk	10.0	seconds
All Red	2.0	seconds	FDW	5.0	seconds

SB LRT phase (Phase 12)

Pre-flash	6.0	seconds
Green	Min 10.0	seconds
	Ext 1.0	seconds
	Max 25.0	seconds
Bike Green	20.0	seconds
Amber (Post flash)	4.0	seconds
All Red	3.0	seconds
Red Max	10.0	seconds

Min=Minimum Time
 Ext=Extension Time
 Max=Maximum Time

**This signal timing cannot be
 presented as evidence in a court of law.**

Appendix B

Existing Traffic Operations Report



Lanes, Volumes, Timings
1: Kuntz Lane & William Street West
Existing AM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

						
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	451	10	3	273	0	0
Future Volume (vph)	451	10	3	273	0	0
Ideal Flow (vphpl)	1650	1650	1650	1650	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt	0.997					
Flt Protected				0.999		
Satd. Flow (prot)	1580	0	0	1583	0	0
Flt Permitted				0.999		
Satd. Flow (perm)	1580	0	0	1583	0	0
Link Speed (k/h)	50			50	50	
Link Distance (m)	50.7			48.6	58.5	
Travel Time (s)	3.7			3.5	4.2	
Confl. Peds. (#/hr)		14	14		4	2
Confl. Bikes (#/hr)	4			2		
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	3%	0%	0%	3%	0%	0%
Adj. Flow (vph)	451	10	3	273	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	461	0	0	276	0	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.5			3.5	0.0	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.9			4.9	4.9	
Two way Left Turn Lane						
Headway Factor	1.21	1.21	1.21	1.21	1.01	1.01
Turning Speed (k/h)		14	24		24	14
Sign Control	Free			Free	Stop	
Intersection Summary						
Area Type:	Other					
Control Type:	Unsignalized					
Intersection Capacity Utilization	38.7%			ICU Level of Service A		
Analysis Period (min)	15					

HCM Unsignalized Intersection Capacity Analysis
1: Kuntz Lane & William Street West
Existing AM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

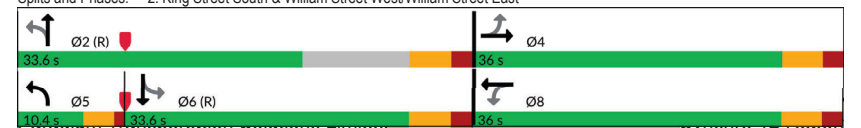
	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↰			↱		
Traffic Volume (veh/h)	451	10	3	273	0	0
Future Volume (Veh/h)	451	10	3	273	0	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	451	10	3	273	0	0
Pedestrians	4			2	14	
Lane Width (m)	3.5			3.5	0.0	
Walking Speed (m/s)	1.0			1.0	1.0	
Percent Blockage	0			0	0	
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)				48		
pX, platoon unblocked					0.93	
vC, conflicting volume			475		753	472
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			475		700	472
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	100
cM capacity (veh/h)			1098		379	595
Direction, Lane #	EB 1	WB 1				
Volume Total	461	276				
Volume Left	0	3				
Volume Right	10	0				
cSH	1700	1098				
Volume to Capacity	0.27	0.00				
Queue Length 95th (m)	0.0	0.1				
Control Delay (s/veh)	0.0	0.1				
Lane LOS		A				
Approach Delay (s/veh)	0.0	0.1				
Approach LOS						
Intersection Summary						
Average Delay		0.0				
Intersection Capacity Utilization		38.7%		ICU Level of Service		A
Analysis Period (min)		15				

Lanes, Volumes, Timings
2: King Street South & William Street West/William Street East
Existing AM Peak Hour (without LRT)

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	←	←	←	←	←	←	←	←	←	←	←	←
Traffic Volume (vph)	61	374	16	38	172	8	44	146	59	15	126	60
Future Volume (vph)	61	374	16	38	172	8	44	146	59	15	126	60
Ideal Flow (vphpl)	1775	1650	1650	1775	1650	1650	1775	1650	1650	1775	1650	1650
Storage Length (m)	15.0	0.0	0.0	25.0	0.0	0.0	35.0	0.0	0.0	25.0	0.0	0.0
Storage Lanes	1	0	0	1	0	0	1	0	0	1	0	0
Taper Length (m)	25.0	0.0	0.0	35.0	0.0	0.0	25.0	0.0	0.0	35.0	0.0	0.0
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	0.97	1.00	0.99	1.00	0.99	0.94	0.98	0.97	0.97	0.97	0.97	0.97
Frt	0.994	0.994	0.994	0.994	0.994	0.994	0.994	0.994	0.994	0.994	0.994	0.994
Flt Protected	0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950
Satd. Flow (prot)	1516	1588	0	1668	1588	0	1588	1397	0	1668	1440	0
Flt Permitted	0.617	0.617	0.617	0.617	0.617	0.617	0.617	0.617	0.617	0.617	0.617	0.617
Satd. Flow (perm)	958	1588	0	656	1588	0	846	1397	0	1070	1440	0
Right Turn on Red	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Satd. Flow (RTOR)	3	3	3	3	3	3	3	3	3	3	3	3
Link Speed (k/h)	50	50	50	50	50	50	50	50	50	50	50	50
Link Distance (m)	48.6	48.6	48.6	48.6	48.6	48.6	48.6	48.6	48.6	48.6	48.6	48.6
Travel Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Confl. Peds. (#/hr)	27	27	27	27	27	27	27	27	27	27	27	27
Confl. Bikes (#/hr)	1	1	1	1	1	1	1	1	1	1	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 (%)	10%	1%	25%	0%	2%	0%	5%	11%	7%	0%	4%	5%
Adj. Flow (vph)	61	374	16	38	172	8	44	146	59	15	126	60
Shared Lane Traffic (%)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	61	390	0	38	180	0	44	205	0	15	186	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)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
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)	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9
Two way Left Turn Lane	1.11	1.21	1.21	1.11	1.21	1.21	1.11	1.21	1.21	1.11	1.21	1.21
Headway Factor	24	24	24	24	24	24	24	24	24	24	24	24
Turning Speed (k/h)	24	24	24	24	24	24	24	24	24	24	24	24
Number of Detectors	1	2	2	1	2	2	1	2	2	1	2	2
Detector Template	Left	Thru	Thru	Left	Thru	Thru	Left	Thru	Thru	Left	Thru	Thru
Leading Detector (m)	6.1	30.5	30.5	6.1	30.5	30.5	6.1	30.5	30.5	6.1	30.5	30.5
Trailing Detector (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
Detector 1 Position(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
Detector 1 Size(m)	6.1	1.8	1.8	6.1	1.8	1.8	6.1	1.8	1.8	6.1	1.8	1.8
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(m)	28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.7
Detector 2 Size(m)	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
Detector 2 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 2 Channel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Lanes, Volumes, Timings
2: King Street South & William Street West/William Street East
Existing AM Peak Hour (without LRT)

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector 2 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Turn Type	Perm	NA	Perm	NA	pm+pt	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases	4	4	4	4	4	4	4	4	4	4	4	4
Permitted Phases	4	4	4	4	4	4	4	4	4	4	4	4
Detector Phase	4	4	4	4	4	4	4	4	4	4	4	4
Switch Phase	4	4	4	4	4	4	4	4	4	4	4	4
Minimum Initial (s)	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0
Minimum Split (s)	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0
Total Split (s)	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0
Total Split (%)	45.0%	45.0%	45.0%	45.0%	45.0%	45.0%	45.0%	45.0%	45.0%	45.0%	45.0%	45.0%
Maximum Green (s)	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead	Lead	Lead	Lead	Lead	Lead	Lead	Lead	Lead	Lead	Lead	Lead
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	None	None	None	None	None	None	None	None	None	None
Walk Time (s)	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0
Flash Don't Walk (s)	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Act Effect Green (s)	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0
Actuated g/C Ratio	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40
v/c Ratio	0.16	0.61	0.15	0.28	0.09	0.29	0.03	0.30	0.03	0.30	0.03	0.30
Control Delay (s/veh)	16.9	24.0	17.2	17.8	10.9	10.8	16.5	15.4	16.5	15.4	16.5	15.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (s/veh)	16.9	24.0	17.2	17.8	10.9	10.8	16.5	15.4	16.5	15.4	16.5	15.4
LOS	B	C	B	B	B	B	B	B	B	B	B	B
Approach Delay (s/veh)	23.0	17.7	10.8	15.4	16.5	15.4	16.5	15.4	16.5	15.4	16.5	15.4
Approach LOS	C	B	B	B	B	B	B	B	B	B	B	B
Intersection Summary												
Area Type:	Other											
Cycle Length: 80												
Actuated Cycle Length: 80												
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBTL, Start of Green												
Natural Cycle: 80												
Control Type: Actuated-Coordinated												
Maximum v/c Ratio: 0.61												
Intersection Signal Delay (s/veh): 17.9												
Intersection Capacity Utilization 99.1%												
Analysis Period (min) 15												
Splits and Phases: 2: King Street South & William Street West/William Street East												



Queues
2: King Street South & William Street West/William Street East
Existing AM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	61	390	38	180	44	205	15	186
v/c Ratio	0.16	0.61	0.15	0.28	0.09	0.29	0.03	0.30
Control Delay (s/veh)	16.9	24.0	17.2	17.8	10.9	10.8	16.5	15.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (s/veh)	16.9	24.0	17.2	17.8	10.9	10.8	16.5	15.4
Queue Length 50th (m)	5.8	45.4	3.6	18.0	3.2	13.8	1.4	15.9
Queue Length 95th (m)	13.6	73.5	9.9	32.2	8.1	26.7	5.1	31.2
Internal Link Dist (m)		24.6		105.2		61.4		113.6
Turn Bay Length (m)	15.0		25.0		35.0		25.0	
Base Capacity (vph)	383	637	262	634	482	716	451	627
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.16	0.61	0.15	0.28	0.09	0.29	0.03	0.30
Intersection Summary								

Lanes, Volumes, Timings
3: King Street South & Kuntz Lane
Existing AM Peak Hour (without LRT)
(250137) 171 King Street South, 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		↔						↔			↔	
Traffic Volume (vph)	1	1	1	0	0	0	1	243	6	7	200	0
Future Volume (vph)	1	1	1	0	0	0	1	243	6	7	200	0
Ideal Flow (vphpl)	1550	1550	1550	1900	1900	1900	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		0.955						0.997				
Flt Protected		0.984									0.998	
Satd. Flow (prot)	0	1440	0	0	0	0	0	1431	0	0	1433	0
Flt Permitted		0.984									0.998	
Satd. Flow (perm)	0	1440	0	0	0	0	0	1431	0	0	1433	0
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		44.8			46.1			132.5			85.4	
Travel Time (s)		3.2			3.3			9.5			6.1	
Confl. Peds. (#/hr)	1					1	58		19	19		58
Confl. Bikes (#/hr)					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%	0%	0%	0%	0%	0%	0%	7%	0%	0%	7%	0%
Adj. Flow (vph)	1	1	1	0	0	0	1	243	6	7	200	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	3	0	0	0	0	0	250	0	0	207	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			3.5			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.9			1.6			4.9			4.9	
Two way Left Turn Lane												
Headway Factor	1.31	1.31	1.31	1.01	1.01	1.01	1.31	1.31	1.31	1.31	1.31	1.31
Turning Speed (k/h)	24		14	24		14	24		14	24		14
Sign Control		Stop			Stop			Free			Free	
Intersection Summary												
Area Type:	Other											
Control Type:	Unsignalized											
Intersection Capacity Utilization	29.4%											
Analysis Period (min)	15											
	ICU Level of Service A											

HCM 7th TWSC
3: King Street South & Kuntz Lane

Existing AM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

Intersection												
Int Delay, s/veh	0.2											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔						↔			↔		
Traffic Vol, veh/h	1	1	1	0	0	0	1	243	6	7	200	0
Future Vol, veh/h	1	1	1	0	0	0	1	243	6	7	200	0
Conflicting Peds, #/hr	1	0	0	0	0	1	58	0	19	19	0	58
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	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	0	0	0	0	0	0	7	0	0	7	0
Mvmt Flow	1	1	1	0	0	0	1	243	6	7	200	0
Major/Minor	Minor2			Major1			Major2					
Conflicting Flow All	518	542	258	258			0	0	268	0	0	
Stage 1	272	272	-	-			-	-	-	-	-	
Stage 2	246	270	-	-			-	-	-	-	-	
Critical Hdwy	6.4	6.5	6.2	4.1			-	-	4.1	-	-	
Critical Hdwy Stg 1	5.4	5.5	-	-			-	-	-	-	-	
Critical Hdwy Stg 2	5.4	5.5	-	-			-	-	-	-	-	
Follow-up Hdwy	3.5	4	3.3	2.2			-	-	2.2	-	-	
Pot Cap-1 Maneuver	521	450	786	1318			-	-	1307	-	-	
Stage 1	778	688	-	-			-	-	-	-	-	
Stage 2	800	690	-	-			-	-	-	-	-	
Platoon blocked, %							-	-	-	-	-	
Mov Cap-1 Maneuver	463	0	743	1247			-	-	1307	-	-	
Mov Cap-2 Maneuver	463	0	-	-			-	-	-	-	-	
Stage 1	736	0	-	-			-	-	-	-	-	
Stage 2	752	0	-	-			-	-	-	-	-	
Approach	EB			NB			SB					
HCM Ctrl Dly, s/v	11.34			0.03			0.26					
HCM LOS	B											
Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	SBL	SBT	SBR					
Capacity (veh/h)	7	-	-	571	61	-	-					
HCM Lane V/C Ratio	0.001	-	-	0.005	0.005	-	-					
HCM Ctrl Dly (s/v)	7.9	0	-	11.3	7.8	0	-					
HCM Lane LOS	A	A	-	B	A	A	-					
HCM 95th %tile Q(veh)	0	-	-	0	0	-	-					

Lanes, Volumes, Timings
4: Caroline Street South & Allen Street West

Existing AM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	6	38	15	7	26	11	5	55	10	36	81	11
Future Volume (vph)	6	38	15	7	26	11	5	55	10	36	81	11
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		0.99			0.99			0.99			0.98	
Frt		0.966			0.966			0.981			0.988	
Flt Protected		0.995			0.992			0.996			0.986	
Satd. Flow (prot)	0	1427	0	0	1456	0	0	1423	0	0	1367	0
Flt Permitted		0.980			0.967			0.988			0.925	
Satd. Flow (perm)	0	1403	0	0	1413	0	0	1404	0	0	1274	0
Right Turn on Red			Yes			Yes			Yes			No
Satd. Flow (RTOR)		15			11			10				
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		81.6			87.7			93.6			95.7	
Travel Time (s)		5.9			6.3			6.7			6.9	
Conf. Peds. (#/hr)	13		27	27		13	72		23	23		72
Conf. Bikes (#/hr)		2										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%	0%	0%	20%	4%	0%	22%	2%	9%
Adj. Flow (vph)	6	38	15	7	26	11	5	55	10	36	81	11
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	59	0	0	44	0	0	70	0	0	128	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)		4.9			4.9			4.9			4.9	
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)	24		14	24		14	24		14	24		14
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	6.1	30.5		6.1	30.5		6.1	30.5		6.1	30.5	
Trailing Detector (m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Position(m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Size(m)	6.1	1.8		6.1	1.8		6.1	1.8		6.1	1.8	
Detector 1 Type	CI+Ex	CI+Ex		CI+Ex	CI+Ex		CI+Ex	CI+Ex		CI+Ex	CI+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(m)		28.7			28.7			28.7			28.7	
Detector 2 Size(m)		1.8			1.8			1.8			1.8	
Detector 2 Type		CI+Ex			CI+Ex			CI+Ex			CI+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	

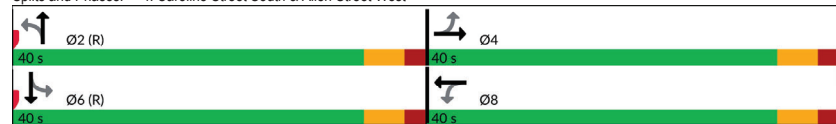
Lanes, Volumes, Timings
4: Caroline Street South & Allen Street West (250137) 171 King Street South, Waterloo TIS

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	34.0	34.0		34.0	34.0		34.0	34.0		34.0	34.0	
Minimum Split (s)	40.0	40.0		40.0	40.0		40.0	40.0		40.0	40.0	
Total Split (s)	40.0	40.0		40.0	40.0		40.0	40.0		40.0	40.0	
Total Split (%)	50.0%	50.0%		50.0%	50.0%		50.0%	50.0%		50.0%	50.0%	
Maximum Green (s)	34.0	34.0		34.0	34.0		34.0	34.0		34.0	34.0	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Lost Time Adjust (s)		-2.0			-2.0			-2.0			-2.0	
Total Lost Time (s)		4.0			4.0			4.0			4.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		C-Max	C-Max		C-Max	C-Max	
Walk Time (s)	29.0	29.0		29.0	29.0		28.0	28.0		28.0	28.0	
Flash Don't Walk (s)	5.0	5.0		5.0	5.0		6.0	6.0		6.0	6.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)		36.0			36.0			53.6			53.6	
Actuated g/C Ratio		0.45			0.45			0.67			0.67	
v/c Ratio		0.09			0.07			0.07			0.15	
Control Delay (s/veh)		10.6			10.5			10.6			11.9	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay (s/veh)		10.6			10.5			10.6			11.9	
LOS		B			B			B			B	
Approach Delay (s/veh)		10.6			10.5			10.6			11.9	
Approach LOS		B			B			B			B	

Intersection Summary

Area Type: Other
Cycle Length: 80
Actuated Cycle Length: 80
Offset: 60 (75%), Referenced to phase 2:NBT and 6:SBTL, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.15
Intersection Signal Delay (s/veh): 11.1
Intersection Capacity Utilization 63.3%
Analysis Period (min) 15

Splits and Phases: 4: Caroline Street South & Allen Street West



Queues
4: Caroline Street South & Allen Street West (250137) 171 King Street South, Waterloo TIS

	EBT	WBT	NBT	SBT
Lane Group Flow (vph)	59	44	70	128
v/c Ratio	0.09	0.07	0.07	0.15
Control Delay (s/veh)	10.6	10.5	10.6	11.9
Queue Delay	0.0	0.0	0.0	0.0
Total Delay (s/veh)	10.6	10.5	10.6	11.9
Queue Length 50th (m)	3.6	2.7	5.0	11.4
Queue Length 95th (m)	10.0	8.1	12.1	22.3
Internal Link Dist (m)	57.6	63.7	69.6	71.7
Turn Bay Length (m)				
Base Capacity (vph)	639	641	944	853
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.09	0.07	0.07	0.15

Intersection Summary

Lanes, Volumes, Timings
5: Caroline Street South & Site Access (250137) 171 King Street South, Waterloo TIS

						
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	8	3	78	6	7	123
Future Volume (vph)	8	3	78	6	7	123
Ideal Flow (vphpl)	1765	1765	1650	1650	1650	1650
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt	0.963		0.990			
Flt Protected	0.965					0.997
Satd. Flow (prot)	1488	0	1572	0	0	1499
Flt Permitted	0.965					0.997
Satd. Flow (perm)	1488	0	1572	0	0	1499
Link Speed (k/h)	50		50			50
Link Distance (m)	57.9		95.7			59.8
Travel Time (s)	4.2		6.9			4.3
Confl. Peds. (#/hr)	2	2		22	22	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	33%	3%	0%	0%	9%
Adj. Flow (vph)	8	3	78	6	7	123
Shared Lane Traffic (%)						
Lane Group Flow (vph)	11	0	84	0	0	130
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)	4.9		4.9			4.9
Two way Left Turn Lane						
Headway Factor	1.12	1.12	1.21	1.21	1.21	1.21
Turning Speed (k/h)	24	14		14	24	
Sign Control	Stop		Free			Free
Intersection Summary						
Area Type:	Other					
Control Type:	Unsignalized					
Intersection Capacity Utilization	24.7%			ICU Level of Service A		
Analysis Period (min)	15					

HCM 7th TWSC
5: Caroline Street South & Site Access (250137) 171 King Street South, Waterloo TIS

Intersection						
Int Delay, s/veh	0.7					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	8	3	78	6	7	123
Future Vol, veh/h	8	3	78	6	7	123
Conflicting Peds, #/hr	2	2	0	22	22	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	33	3	0	0	9
Mvmt Flow	8	3	78	6	7	123
Major/Minor	Minor1	Major1		Major2		
Conflicting Flow All	242	105	0	0	106	0
Stage 1	103	-	-	-	-	-
Stage 2	139	-	-	-	-	-
Critical Hdwy	6.4	6.53	-	-	4.1	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.597	-	-	2.2	-
Pot Cap-1 Maneuver	751	871	-	-	1498	-
Stage 1	926	-	-	-	-	-
Stage 2	893	-	-	-	-	-
Platoon blocked, %		-	-	-	-	-
Mov Cap-1 Maneuver	730	852	-	-	1467	-
Mov Cap-2 Maneuver	730	-	-	-	-	-
Stage 1	907	-	-	-	-	-
Stage 2	886	-	-	-	-	-
Approach	WB	NB		SB		
HCM Ctrl Dly, s/v	9.81	0		0.4		
HCM LOS	A					
Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT		
Capacity (veh/h)	-	-	760	97	-	
HCM Lane V/C Ratio	-	-	0.014	0.005	-	
HCM Ctrl Dly (s/v)	-	-	9.8	7.5	0	
HCM Lane LOS	-	-	A	A	A	
HCM 95th %tile Q(veh)	-	-	0	0	-	

Lanes, Volumes, Timings
1: Kuntz Lane & William Street West
Existing PM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

						
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	386	0	2	426	0	0
Future Volume (vph)	386	0	2	426	0	0
Ideal Flow (vphpl)	1650	1650	1650	1650	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt						
Flt Protected						
Satd. Flow (prot)	1584	0	0	1616	0	0
Flt Permitted						
Satd. Flow (perm)	1584	0	0	1616	0	0
Link Speed (k/h)	50			50	50	
Link Distance (m)	50.7			48.6	58.5	
Travel Time (s)	3.7			3.5	4.2	
Confl. Peds. (#/hr)		13	13			
Confl. Bikes (#/hr)	1		2	2		1
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	3%	0%	0%	1%	0%	0%
Adj. Flow (vph)	386	0	2	426	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	386	0	0	428	0	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.5			3.5	0.0	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.9			4.9	4.9	
Two way Left Turn Lane						
Headway Factor	1.21	1.21	1.21	1.21	1.01	1.01
Turning Speed (k/h)		14	24		24	14
Sign Control	Free			Free	Stop	
Intersection Summary						
Area Type:	Other					
Control Type:	Unsignalized					
Intersection Capacity Utilization	31.0%			ICU Level of Service A		
Analysis Period (min)	15					

HCM Unsignalized Intersection Capacity Analysis
1: Kuntz Lane & William Street West
Existing PM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↔			↔		
Traffic Volume (veh/h)	386	0	2	426	0	0
Future Volume (Veh/h)	386	0	2	426	0	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	386	0	2	426	0	0
Pedestrians					13	
Lane Width (m)					0.0	
Walking Speed (m/s)					1.0	
Percent Blockage					0	
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)				48		
pX, platoon unblocked					0.87	
vC, conflicting volume			399		829	399
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			399		728	399
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	100
cM capacity (veh/h)			1171		341	655
Direction, Lane #						
	EB 1	WB 1				
Volume Total	386	428				
Volume Left	0	2				
Volume Right	0	0				
cSH	1700	1171				
Volume to Capacity	0.23	0.00				
Queue Length 95th (m)	0.0	0.0				
Control Delay (s/veh)	0.0	0.1				
Lane LOS		A				
Approach Delay (s/veh)	0.0	0.1				
Approach LOS						
Intersection Summary						
Average Delay		0.0				
Intersection Capacity Utilization		31.0%		ICU Level of Service		A
Analysis Period (min)		15				

Lanes, Volumes, Timings
2: King Street South & William Street West/William Street East
Existing PM Peak Hour (without LRT)

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	←	→	→	←	→	→	←	→	→	←	→	→
Traffic Volume (vph)	47	319	19	55	279	9	68	189	61	12	229	81
Future Volume (vph)	47	319	19	55	279	9	68	189	61	12	229	81
Ideal Flow (vphpl)	1775	1650	1650	1775	1650	1650	1775	1650	1650	1775	1650	1650
Storage Length (m)	15.0	0.0	0.0	25.0	0.0	0.0	35.0	0.0	0.0	25.0	0.0	0.0
Storage Lanes	1	0	0	1	0	0	1	0	0	1	0	0
Taper Length (m)	25.0	0.0	0.0	35.0	0.0	0.0	25.0	0.0	0.0	35.0	0.0	0.0
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	0.98	1.00	0.98	1.00	0.98	0.98	0.92	0.98	0.98	0.95	0.96	0.96
Frt	0.992	0.992	0.992	0.995	0.995	0.995	0.963	0.963	0.963	0.961	0.961	0.961
Flt Protected	0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950
Satd. Flow (prot)	1573	1580	0	1635	1621	0	1668	1462	0	1668	1451	0
Flt Permitted	0.490	0.490	0.490	0.434	0.434	0.434	0.394	0.394	0.394	0.604	0.604	0.604
Satd. Flow (perm)	793	1580	0	733	1621	0	637	1462	0	1012	1451	0
Right Turn on Red		Yes		No		No		Yes		Yes		Yes
Satd. Flow (RTOR)	4	4	4	4	4	4	29	29	29	25	25	25
Link Speed (k/h)	50	50	50	50	50	50	50	50	50	50	50	50
Link Distance (m)	48.6	48.6	48.6	129.2	129.2	129.2	85.4	85.4	85.4	137.6	137.6	137.6
Travel Time (s)	3.5	3.5	3.5	9.3	9.3	9.3	6.1	6.1	6.1	9.9	9.9	9.9
Confl. Peds. (#/hr)	28	28	26	26	28	28	104	104	44	44	104	104
Confl. Bikes (#/hr)	1	1	1	1	1	1	1	1	1	2	2	2
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 (%)	6%	1%	21%	2%	0%	0%	0%	7%	0%	0%	3%	4%
Adj. Flow (vph)	47	319	19	55	279	9	68	189	61	12	229	81
Shared Lane Traffic (%)												
Lane Group Flow (vph)	47	338	0	55	288	0	68	250	0	12	310	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)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
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)	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9
Two way Left Turn Lane												
Headway Factor	1.11	1.21	1.21	1.11	1.21	1.21	1.11	1.21	1.21	1.11	1.21	1.21
Turning Speed (k/h)	24	24	14	24	24	14	24	24	14	24	24	14
Number of Detectors	1	2	1	1	2	1	1	2	1	1	2	1
Detector Template	Left	Thru	Left	Thru	Left	Thru	Left	Thru	Left	Thru	Left	Thru
Leading Detector (m)	6.1	30.5	6.1	30.5	6.1	30.5	6.1	30.5	6.1	30.5	6.1	30.5
Trailing Detector (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
Detector 1 Position(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
Detector 1 Size(m)	6.1	1.8	6.1	1.8	6.1	1.8	6.1	1.8	6.1	1.8	6.1	1.8
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(m)	28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.7
Detector 2 Size(m)	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
Detector 2 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 2 Channel												

Lanes, Volumes, Timings
2: King Street South & William Street West/William Street East
Existing PM Peak Hour (without LRT)

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector 2 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Turn Type	Perm	NA	Perm	NA	pm+pt	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases	4	4	8	8	5	2	6	6	6	6	6	6
Permitted Phases	4	4	8	8	2	2	6	6	6	6	6	6
Detector Phase	4	4	8	8	5	2	6	6	6	6	6	6
Switch Phase												
Minimum Initial (s)	30.0	30.0	30.0	30.0	5.0	27.6	27.6	27.6	27.6	27.6	27.6	27.6
Minimum Split (s)	36.0	36.0	36.0	36.0	9.0	33.6	33.6	33.6	33.6	33.6	33.6	33.6
Total Split (s)	36.0	36.0	36.0	36.0	10.4	33.6	33.6	33.6	33.6	33.6	33.6	33.6
Total Split (%)	45.0%	45.0%	45.0%	45.0%	13.0%	42.0%	42.0%	42.0%	42.0%	42.0%	42.0%	42.0%
Maximum Green (s)	30.0	30.0	30.0	30.0	6.4	27.6	27.6	27.6	27.6	27.6	27.6	27.6
Yellow Time (s)	4.0	4.0	4.0	4.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	1.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	0.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag					Lead	Lag	Lag	Lag	Lag	Lag	Lag	Lag
Lead-Lag Optimize?					Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	None	None	None	C-Max	C-Max	C-Max	C-Max	C-Max	C-Max	C-Max
Walk Time (s)	19.0	19.0	19.0	19.0	21.6	21.6	21.6	21.6	21.6	21.6	21.6	21.6
Flash Don't Walk (s)	11.0	11.0	11.0	11.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Pedestrian Calls (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Act Effect Green (s)	32.0	32.0	32.0	32.0	40.0	40.0	31.7	31.7	31.7	31.7	31.7	31.7
Actuated g/C Ratio	0.40	0.40	0.40	0.40	0.50	0.50	0.40	0.40	0.40	0.40	0.40	0.40
v/c Ratio	0.15	0.53	0.19	0.44	0.17	0.34	0.03	0.53	0.03	0.53	0.03	0.53
Control Delay (s/veh)	17.0	21.9	17.8	20.3	11.6	12.1	16.5	21.8	16.5	21.8	16.5	21.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (s/veh)	17.0	21.9	17.8	20.3	11.6	12.1	16.5	21.8	16.5	21.8	16.5	21.8
LOS	B	C	B	C	B	B	B	C	B	C	B	C
Approach Delay (s/veh)	21.3	19.9	12.0	21.6	12.0	21.6	12.0	21.6	12.0	21.6	12.0	21.6
Approach LOS	C	B	B	C	B	C	B	C	B	C	B	C

Intersection Summary
Area Type: Other
Cycle Length: 80
Actuated Cycle Length: 80
Offset: 26.4 (33%), Referenced to phase 2:NBT and 6:SBTL, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.53
Intersection Signal Delay (s/veh): 18.8
Intersection Capacity Utilization 104.9%
Analysis Period (min) 15



Queues
2: King Street South & William Street West/William Street East
Existing PM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	47	338	55	288	68	250	12	310
v/c Ratio	0.15	0.53	0.19	0.44	0.17	0.34	0.03	0.53
Control Delay (s/veh)	17.0	21.9	17.8	20.3	11.6	12.1	16.5	21.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (s/veh)	17.0	21.9	17.8	20.3	11.6	12.1	16.5	21.8
Queue Length 50th (m)	4.4	37.7	5.3	31.1	5.1	18.7	1.1	33.6
Queue Length 95th (m)	11.4	61.9	13.1	51.6	11.2	33.8	4.4	58.1
Internal Link Dist (m)		24.6		105.2		61.4		113.6
Turn Bay Length (m)	15.0		25.0		35.0		25.0	
Base Capacity (vph)	317	634	293	648	400	745	400	589
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.15	0.53	0.19	0.44	0.17	0.34	0.03	0.53
Intersection Summary								

Lanes, Volumes, Timings
3: King Street South & Kuntz Lane
Existing PM Peak Hour (without LRT)
(250137) 171 King Street South, 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		↔						↔			↔	
Traffic Volume (vph)	6	0	9	0	0	0	0	300	6	7	302	1
Future Volume (vph)	6	0	9	0	0	0	0	300	6	7	302	1
Ideal Flow (vphpl)	1550	1550	1550	1900	1900	1900	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		0.919						0.997				
Flt Protected		0.980									0.999	
Satd. Flow (prot)	0	1380	0	0	0	0	0	1443	0	0	1474	0
Flt Permitted		0.980									0.999	
Satd. Flow (perm)	0	1380	0	0	0	0	0	1443	0	0	1474	0
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		44.8			46.1			132.5			85.4	
Travel Time (s)		3.2			3.3			9.5			6.1	
Confl. Peds. (#/hr)	1					1	86		36	36		86
Confl. Bikes (#/hr)								1			4	
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%	0%	0%	0%	0%	0%	0%	6%	0%	0%	4%	0%
Adj. Flow (vph)	6	0	9	0	0	0	0	300	6	7	302	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	15	0	0	0	0	0	306	0	0	310	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			3.5			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.9			1.6			4.9			4.9	
Two way Left Turn Lane												
Headway Factor	1.31	1.31	1.31	1.01	1.01	1.01	1.31	1.31	1.31	1.31	1.31	1.31
Turning Speed (k/h)	24		14	24		14	24		14	24		14
Sign Control		Stop			Stop			Free			Free	
Intersection Summary												
Area Type:	Other											
Control Type:	Unsignalized											
Intersection Capacity Utilization	40.9%											
Analysis Period (min)	15											
	ICU Level of Service A											

HCM 7th TWSC
3: King Street South & Kuntz Lane

Existing PM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

Intersection												
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	6	0	9	0	0	0	0	300	6	7	302	1
Future Vol, veh/h	6	0	9	0	0	0	0	300	6	7	302	1
Conflicting Peds, #/hr	1	0	0	0	0	1	86	0	36	36	0	86
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	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	0	0	0	0	0	0	0	6	0	4	0
Mvmt Flow	6	0	9	0	0	0	0	300	6	7	302	1

Major/Minor	Minor2			Major1			Major2		
Conflicting Flow All	704	745	389	389	0	0	342	0	0
Stage 1	403	403	-	-	-	-	-	-	-
Stage 2	301	342	-	-	-	-	-	-	-
Critical Hdwy	6.4	6.5	6.2	4.1	-	-	4.1	-	-
Critical Hdwy Stg 1	5.4	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	5.4	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	407	345	664	1181	-	-	1228	-	-
Stage 1	680	604	-	-	-	-	-	-	-
Stage 2	755	642	-	-	-	-	-	-	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	342	0	611	1086	-	-	1228	-	-
Mov Cap-2 Maneuver	342	0	-	-	-	-	-	-	-
Stage 1	625	0	-	-	-	-	-	-	-
Stage 2	690	0	-	-	-	-	-	-	-

Approach	EB	NB	SB
HCM Ctrl Dly, s/v	13.01	0	0.18
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	SBL	SBT	SBR
Capacity (veh/h)	1086	-	-	465	41	-	-
HCM Lane V/C Ratio	-	-	-	0.032	0.006	-	-
HCM Ctrl Dly (s/v)	0	-	-	13	7.9	0	-
HCM Lane LOS	A	-	-	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0.1	0	-	-

Lanes, Volumes, Timings
4: Caroline Street South & Allen Street West

Existing PM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔				↔			↔		↔		
Traffic Volume (vph)	13	22	10	12	58	9	18	108	19	46	89	25
Future Volume (vph)	13	22	10	12	58	9	18	108	19	46	89	25
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	0.98				0.99				0.98		0.97	
Frt	0.970				0.985				0.982		0.979	
Flt Protected	0.986				0.992				0.994		0.986	
Satd. Flow (prot)	0	1447	0	0	1438	0	0	1464	0	0	1403	0
Flt Permitted	0.929				0.965				0.965		0.900	
Satd. Flow (perm)	0	1356	0	0	1391	0	0	1410	0	0	1269	0
Right Turn on Red			Yes				Yes				Yes	
Satd. Flow (RTOR)	10				9				12			
Link Speed (k/h)	50				50				50		50	
Link Distance (m)	81.6				87.7				93.6		95.7	
Travel Time (s)	5.9				6.3				6.7		6.9	
Confl. Peds. (#/hr)	18		34	34		18	73		35	35		73
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%	0%	0%	0%	5%	0%	0%	1%	5%	13%	0%	0%
Adj. Flow (vph)	13	22	10	12	58	9	18	108	19	46	89	25
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	45	0	0	79	0	0	145	0	0	160	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)	4.9				4.9				4.9		4.9	
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)	24		14	24		14	24		14	24		14
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	6.1	30.5		6.1	30.5		6.1	30.5		6.1	30.5	
Trailing Detector (m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Position(m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Size(m)	6.1	1.8		6.1	1.8		6.1	1.8		6.1	1.8	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(m)	28.7				28.7				28.7		28.7	
Detector 2 Size(m)	1.8				1.8				1.8		1.8	
Detector 2 Type	Cl+Ex				Cl+Ex				Cl+Ex		Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)	0.0				0.0				0.0		0.0	
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases	4				8				2		6	
Permitted Phases	4				8				2		6	

Lanes, Volumes, Timings
4: Caroline Street South & Allen Street West (250137) 171 King Street South, Waterloo TIS

	↖	→	↗	↖	←	↖	↖	↑	↗	↘	↓	↘
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	4	4		8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	34.0	34.0		34.0	34.0		34.0	34.0		34.0	34.0	
Minimum Split (s)	40.0	40.0		40.0	40.0		40.0	40.0		40.0	40.0	
Total Split (s)	40.0	40.0		40.0	40.0		40.0	40.0		40.0	40.0	
Total Split (%)	50.0%	50.0%		50.0%	50.0%		50.0%	50.0%		50.0%	50.0%	
Maximum Green (s)	34.0	34.0		34.0	34.0		34.0	34.0		34.0	34.0	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Lost Time Adjust (s)		-2.0			-2.0			-2.0			-2.0	
Total Lost Time (s)		4.0			4.0			4.0			4.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		C-Max	C-Max		C-Max	C-Max	
Walk Time (s)	29.0	29.0		29.0	29.0		28.0	28.0		28.0	28.0	
Flash Don't Walk (s)	5.0	5.0		5.0	5.0		6.0	6.0		6.0	6.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)		36.0			36.0			53.6			53.6	
Actuated g/C Ratio		0.45			0.45			0.67			0.67	
v/c Ratio		0.07			0.13			0.15			0.19	
Control Delay (s/veh)		10.8			12.2			10.9			12.1	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay (s/veh)		10.8			12.2			10.9			12.1	
LOS		B			B			B			B	
Approach Delay (s/veh)		10.8			12.2			10.9			12.1	
Approach LOS		B			B			B			B	

Intersection Summary

Area Type:	Other
Cycle Length: 80	
Actuated Cycle Length: 80	
Offset: 60 (75%), Referenced to phase 2:NBT and 6:SBTL, Start of Green	
Natural Cycle: 80	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.19	
Intersection Signal Delay (s/veh): 11.6	Intersection LOS: B
Intersection Capacity Utilization 63.3%	ICU Level of Service B
Analysis Period (min) 15	

Splits and Phases: 4: Caroline Street South & Allen Street West



Queues
4: Caroline Street South & Allen Street West (250137) 171 King Street South, Waterloo TIS

	→	←	↑	↓
Lane Group	EBT	WBT	NBT	SBT
Lane Group Flow (vph)	45	79	145	160
v/c Ratio	0.07	0.13	0.15	0.19
Control Delay (s/veh)	10.8	12.2	10.9	12.1
Queue Delay	0.0	0.0	0.0	0.0
Total Delay (s/veh)	10.8	12.2	10.9	12.1
Queue Length 50th (m)	2.9	5.9	11.8	14.7
Queue Length 95th (m)	8.4	13.5	23.0	27.5
Internal Link Dist (m)	57.6	63.7	69.6	71.7
Turn Bay Length (m)				
Base Capacity (vph)	615	630	949	850
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.07	0.13	0.15	0.19

Intersection Summary

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Lanes, Volumes, Timings
5: Caroline Street South & Site Access (250137) 171 King Street South, Waterloo TIS

						
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	9	32	133	4	3	142
Future Volume (vph)	9	32	133	4	3	142
Ideal Flow (vphpl)	1765	1765	1650	1650	1650	1650
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt	0.895		0.996			
Flt Protected	0.989					0.999
Satd. Flow (prot)	1545	0	1610	0	0	1554
Flt Permitted	0.989					0.999
Satd. Flow (perm)	1545	0	1610	0	0	1554
Link Speed (k/h)	50		50			50
Link Distance (m)	57.9		95.7			59.8
Travel Time (s)	4.2		6.9			4.3
Confl. Peds. (#/hr)	2	3		30	30	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	0%	1%	0%	0%	5%
Adj. Flow (vph)	9	32	133	4	3	142
Shared Lane Traffic (%)						
Lane Group Flow (vph)	41	0	137	0	0	145
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)	4.9		4.9			4.9
Two way Left Turn Lane						
Headway Factor	1.12	1.12	1.21	1.21	1.21	1.21
Turning Speed (k/h)	24	14		14	24	
Sign Control	Stop		Free			Free
Intersection Summary						
Area Type:	Other					
Control Type:	Unsignalized					
Intersection Capacity Utilization	22.5%			ICU Level of Service A		
Analysis Period (min)	15					

HCM 7th TWSC
5: Caroline Street South & Site Access (250137) 171 King Street South, Waterloo TIS

Intersection						
Int Delay, s/veh	1.3					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	9	32	133	4	3	142
Future Vol, veh/h	9	32	133	4	3	142
Conflicting Peds, #/hr	2	3	0	30	30	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	1	0	0	5
Mvmt Flow	9	32	133	4	3	142
Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	315	168	0	0	167	0
Stage 1	165	-	-	-	-	-
Stage 2	150	-	-	-	-	-
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	682	881	-	-	1423	-
Stage 1	869	-	-	-	-	-
Stage 2	883	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	660	854	-	-	1383	-
Mov Cap-2 Maneuver	660	-	-	-	-	-
Stage 1	845	-	-	-	-	-
Stage 2	879	-	-	-	-	-
Approach	WB		NB		SB	
HCM Ctrl Dly, s/v	9.73		0		0.16	
HCM LOS	A					
Minor Lane/Major Mvmt	NBT		NBRWBLn1		SBL	SBT
Capacity (veh/h)	-		-		803	37
HCM Lane V/C Ratio	-		-		0.051	0.002
HCM Ctrl Dly (s/v)	-		-		9.7	7.6
HCM Lane LOS	-		-		A	A
HCM 95th %tile Q(veh)	-		-		0.2	0

Appendix C

NCHRP 8-51 Internal Capture Worksheets



NCHRP 8-51 Internal Trip Capture Estimation Tool					
Project Name:	167-171 King Street South		Organization:	Paradigm Transportation Solutions Limited	
Project Location:			Performed By:		
Scenario Description:			Date:		
Analysis Year:			Checked By:		
Analysis Period:	AM Street Peak Hour		Date:		

Table 1-A: Base Vehicle-Trip Generation Estimates (Single-Use Site Estimate)						
Land Use	Development Data (For Information Only)			Estimated Vehicle-Trips		
	ITE LUCs ¹	Quantity	Units	Total	Entering	Exiting
Office				0		
Retail	822	1,810	sq.ft.	4	3	1
Restaurant	932	4,069	sq.ft.	39	21	18
Cinema/Entertainment				0		
Residential	222	834	units	162	18	144
Hotel				0		
All Other Land Uses ²				0		
Total				205	42	163

Table 2-A: Mode Split and Vehicle Occupancy Estimates						
Land Use	Entering Trips			Exiting Trips		
	Veh. Occ.	% Transit	% Non-Motorized	Veh. Occ.	% Transit	% Non-Motorized
Office						
Retail						
Restaurant						
Cinema/Entertainment						
Residential						
Hotel						
All Other Land Uses ²						

Table 3-A: Average Land Use Interchange Distances (Feet Walking Distance)						
Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office						
Retail						
Restaurant						
Cinema/Entertainment						
Residential						
Hotel						

Table 4-A: Internal Person-Trip Origin-Destination Matrix*						
Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office		0	0	0	0	0
Retail	0		0	0	0	0
Restaurant	0	0		0	1	0
Cinema/Entertainment	0	0	0		0	0
Residential	0	1	4	0		0
Hotel	0	0	0	0	0	

Table 5-A: Computations Summary			
	Total	Entering	Exiting
All Person-Trips	205	42	163
Internal Capture Percentage	6%	14%	4%
External Vehicle-Trips ³	193	36	157
External Transit-Trips ⁴	0	0	0
External Non-Motorized Trips ⁴	0	0	0

Table 6-A: Internal Trip Capture Percentages by Land Use		
Land Use	Entering Trips	Exiting Trips
Office	N/A	N/A
Retail	33%	0%
Restaurant	19%	6%
Cinema/Entertainment	N/A	N/A
Residential	6%	3%
Hotel	N/A	N/A

¹ Land Use Codes (LUCs) from <i>Trip Generation Informational Report</i> , published by the Institute of Transportation Engineers.
² Total estimate for all other land uses at mixed-use development site-not subject to internal trip capture computations in this estimator
³ Vehicle-trips computed using the mode split and vehicle occupancy values provided in Table 2-A
⁴ Person-Trips
*Indicates computation that has been rounded to the nearest whole number.
Estimation Tool Developed by the Texas Transportation Institute

Project Name:	167-171 King Street South
Analysis Period:	AM Street Peak Hour

Table 7-A: Conversion of Vehicle-Trip Ends to Person-Trip Ends						
Land Use	Table 7-A (D): Entering Trips				Table 7-A (O): Exiting Trips	
	Veh. Occ.	Vehicle-Trips	Person-Trips*		Veh. Occ.	Person-Trips*
Office	1.00	0	0		1.00	0
Retail	1.00	3	3		1.00	1
Restaurant	1.00	21	21		1.00	18
Cinema/Entertainment	1.00	0	0		1.00	0
Residential	1.00	18	18		1.00	144
Hotel	1.00	0	0		1.00	0

Table 8-A (O): Internal Person-Trip Origin-Destination Matrix (Computed at Origin)						
Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office		0	0	0	0	0
Retail	0		0	0	0	0
Restaurant	6	3		0	1	1
Cinema/Entertainment	0	0	0		0	0
Residential	3	1	29	0		0
Hotel	0	0	0	0	0	

Table 8-A (D): Internal Person-Trip Origin-Destination Matrix (Computed at Destination)						
Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office		1	5	0	0	0
Retail	0		11	0	0	0
Restaurant	0	0		0	1	0
Cinema/Entertainment	0	0	0		0	0
Residential	0	1	4	0		0
Hotel	0	0	1	0	0	

Table 9-A (D): Internal and External Trips Summary (Entering Trips)						
Destination Land Use	Person-Trip Estimates				External Trips by Mode*	
	Internal	External	Total		Vehicles ¹	Non-Motorized ²
Office	0	0	0		0	0
Retail	1	2	3		2	0
Restaurant	4	17	21		17	0
Cinema/Entertainment	0	0	0		0	0
Residential	1	17	18		17	0
Hotel	0	0	0		0	0
All Other Land Uses ³	0	0	0		0	0

Table 9-A (O): Internal and External Trips Summary (Exiting Trips)						
Origin Land Use	Person-Trip Estimates				External Trips by Mode*	
	Internal	External	Total		Vehicles ¹	Non-Motorized ²
Office	0	0	0		0	0
Retail	0	1	1		1	0
Restaurant	1	17	18		17	0
Cinema/Entertainment	0	0	0		0	0
Residential	5	139	144		139	0
Hotel	0	0	0		0	0
All Other Land Uses ³	0	0	0		0	0

¹ Vehicle-trips computed using the mode split and vehicle occupancy values provided in Table 2-A
² Person-Trips
³ Total estimate for all other land uses at mixed-use development site-not subject to internal trip capture computations in this estimator
*Indicates computation that has been rounded to the nearest whole number.

NCHRP 8-51 Internal Trip Capture Estimation Tool					
Project Name:	167-171 King Street South		Organization:	Paradigm Transportation Solutions Limited	
Project Location:			Performed By:		
Scenario Description:			Date:		
Analysis Year:			Checked By:		
Analysis Period:	PM Street Peak Hour		Date:		

Table 1-P: Base Vehicle-Trip Generation Estimates (Single-Use Site Estimate)						
Land Use	Development Data (For Information Only)			Estimated Vehicle-Trips		
	ITE LUCs ¹	Quantity	Units	Total	Entering	Exiting
Office				0		
Retail	822	1,810	sq.ft.	23	12	11
Restaurant	932	4,069	sq.ft.	37	22	15
Cinema/Entertainment				0		
Residential	222	834	units	133	92	41
Hotel				0		
All Other Land Uses ²				0		
Total				193	126	67

Table 2-P: Mode Split and Vehicle Occupancy Estimates						
Land Use	Entering Trips			Exiting Trips		
	Veh. Occ.	% Transit	% Non-Motorized	Veh. Occ.	% Transit	% Non-Motorized
Office						
Retail						
Restaurant						
Cinema/Entertainment						
Residential						
Hotel						
All Other Land Uses ²						

Table 3-P: Average Land Use Interchange Distances (Feet Walking Distance)						
Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office						
Retail					0	
Restaurant						
Cinema/Entertainment						
Residential		0				
Hotel						

Table 4-P: Internal Person-Trip Origin-Destination Matrix*						
Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office		0	0	0	0	0
Retail	0		3	0	3	0
Restaurant	0	6		0	3	0
Cinema/Entertainment	0	0	0		0	0
Residential	0	1	3	0		0
Hotel	0	0	0	0	0	

Table 5-P: Computations Summary			
	Total	Entering	Exiting
All Person-Trips	193	126	67
Internal Capture Percentage	20%	15%	28%
External Vehicle-Trips ³	155	107	48
External Transit-Trips ⁴	0	0	0
External Non-Motorized Trips ⁴	0	0	0

Table 6-P: Internal Trip Capture Percentages by Land Use		
Land Use	Entering Trips	Exiting Trips
Office	N/A	N/A
Retail	58%	55%
Restaurant	27%	60%
Cinema/Entertainment	N/A	N/A
Residential	7%	10%
Hotel	N/A	N/A

¹ Land Use Codes (LUCs) from <i>Trip Generation Informational Report</i> , published by the Institute of Transportation Engineers.
² Total estimate for all other land uses at mixed-use development site-not subject to internal trip capture computations in this estimator
³ Vehicle-trips computed using the mode split and vehicle occupancy values provided in Table 2-P
⁴ Person-Trips
*Indicates computation that has been rounded to the nearest whole number.
Estimation Tool Developed by the Texas Transportation Institute

Project Name:	167-171 King Street South
Analysis Period:	PM Street Peak Hour

Table 7-P: Conversion of Vehicle-Trip Ends to Person-Trip Ends						
Land Use	Table 7-P (D): Entering Trips				Table 7-P (O): Exiting Trips	
	Veh. Occ.	Vehicle-Trips	Person-Trips*		Veh. Occ.	Person-Trips*
Office	1.00	0	0		1.00	0
Retail	1.00	12	12		1.00	11
Restaurant	1.00	22	22		1.00	15
Cinema/Entertainment	1.00	0	0		1.00	0
Residential	1.00	92	92		1.00	41
Hotel	1.00	0	0		1.00	0

Table 8-P (O): Internal Person-Trip Origin-Destination Matrix (Computed at Origin)						
Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office		0	0	0	0	0
Retail	0		3	0	3	1
Restaurant	0	6		1	3	1
Cinema/Entertainment	0	0	0		0	0
Residential	2	17	9	0		1
Hotel	0	0	0	0	0	

Table 8-P (D): Internal Person-Trip Origin-Destination Matrix (Computed at Destination)						
Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office		1	0	0	4	0
Retail	0		6	0	42	0
Restaurant	0	6		0	15	0
Cinema/Entertainment	0	0	1		4	0
Residential	0	1	3	0		0
Hotel	0	0	1	0	0	

Table 9-P (D): Internal and External Trips Summary (Entering Trips)						
Destination Land Use	Person-Trip Estimates				External Trips by Mode*	
	Internal	External	Total		Vehicles ¹	Non-Motorized ²
Office	0	0	0		0	0
Retail	7	5	12		5	0
Restaurant	6	16	22		16	0
Cinema/Entertainment	0	0	0		0	0
Residential	6	86	92		86	0
Hotel	0	0	0		0	0
All Other Land Uses ³	0	0	0		0	0

Table 9-P (O): Internal and External Trips Summary (Exiting Trips)						
Origin Land Use	Person-Trip Estimates				External Trips by Mode*	
	Internal	External	Total		Vehicles ¹	Non-Motorized ²
Office	0	0	0		0	0
Retail	6	5	11		5	0
Restaurant	9	6	15		6	0
Cinema/Entertainment	0	0	0		0	0
Residential	4	37	41		37	0
Hotel	0	0	0		0	0
All Other Land Uses ³	0	0	0		0	0

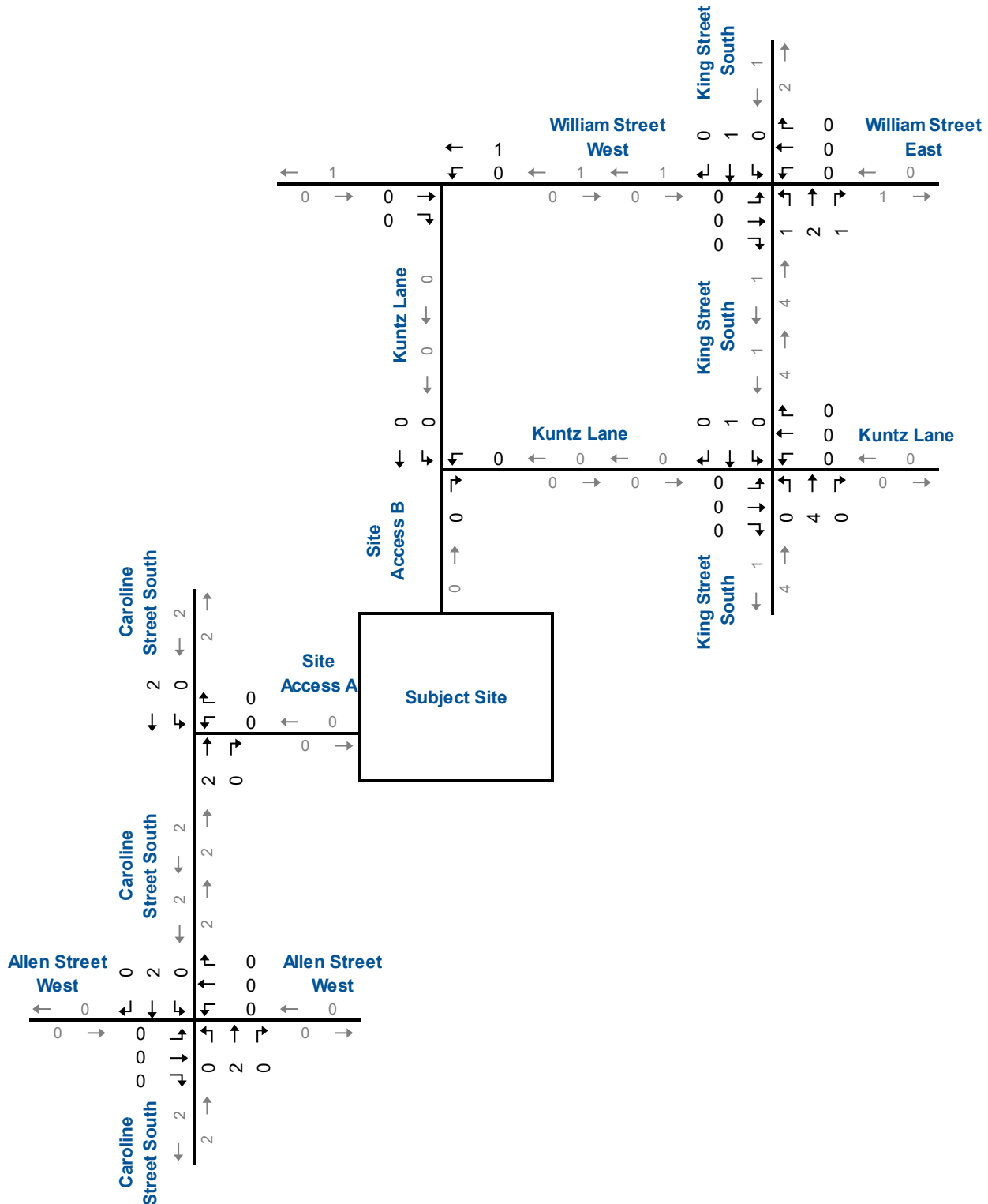
¹ Vehicle-trips computed using the mode split and vehicle occupancy values provided in Table 2-P
² Person-Trips
³ Total estimate for all other land uses at mixed-use development site-not subject to internal trip capture computations in this estimator
*Indicates computation that has been rounded to the nearest whole number.

Appendix D

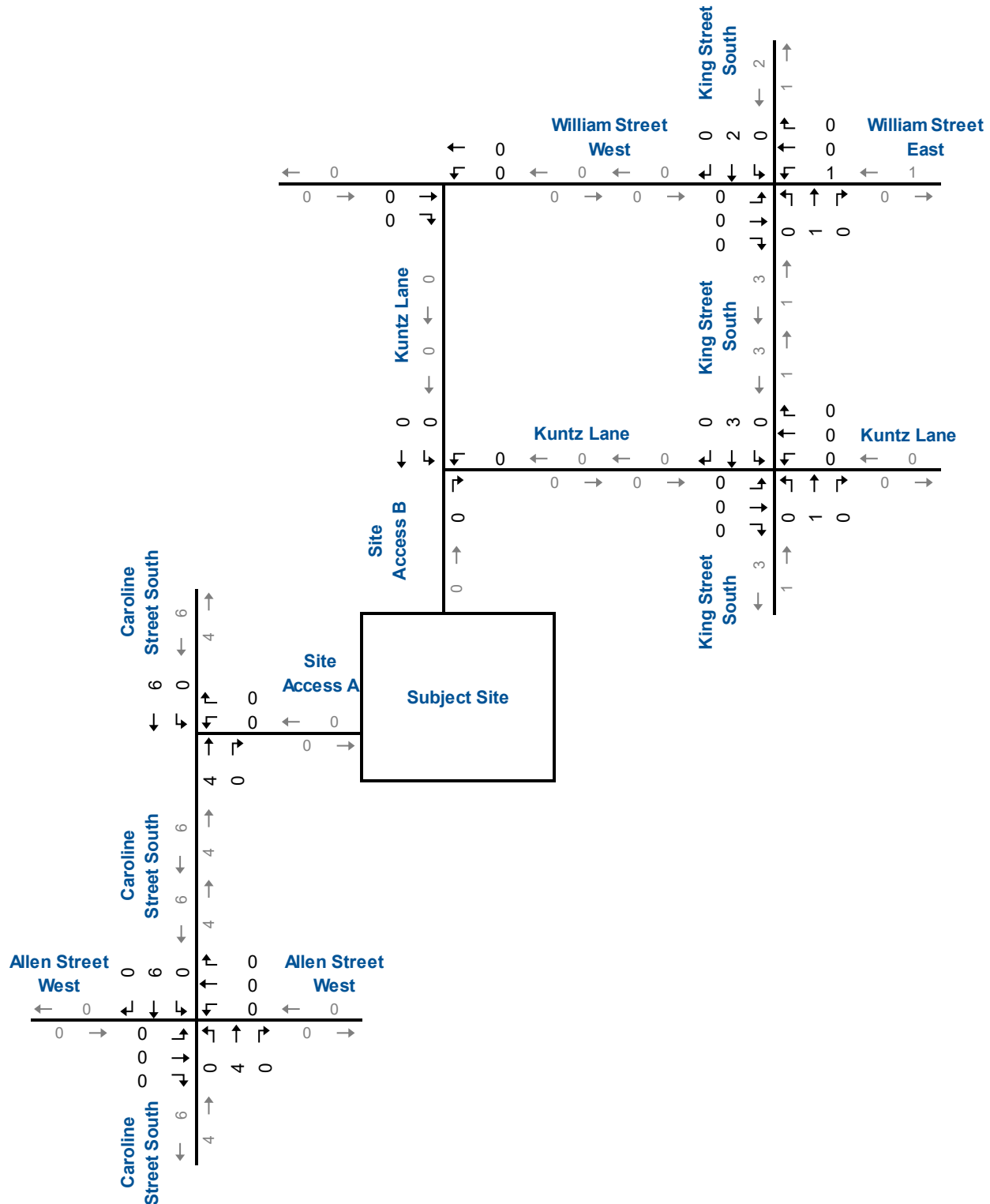
Other Area Development Traffic Volumes



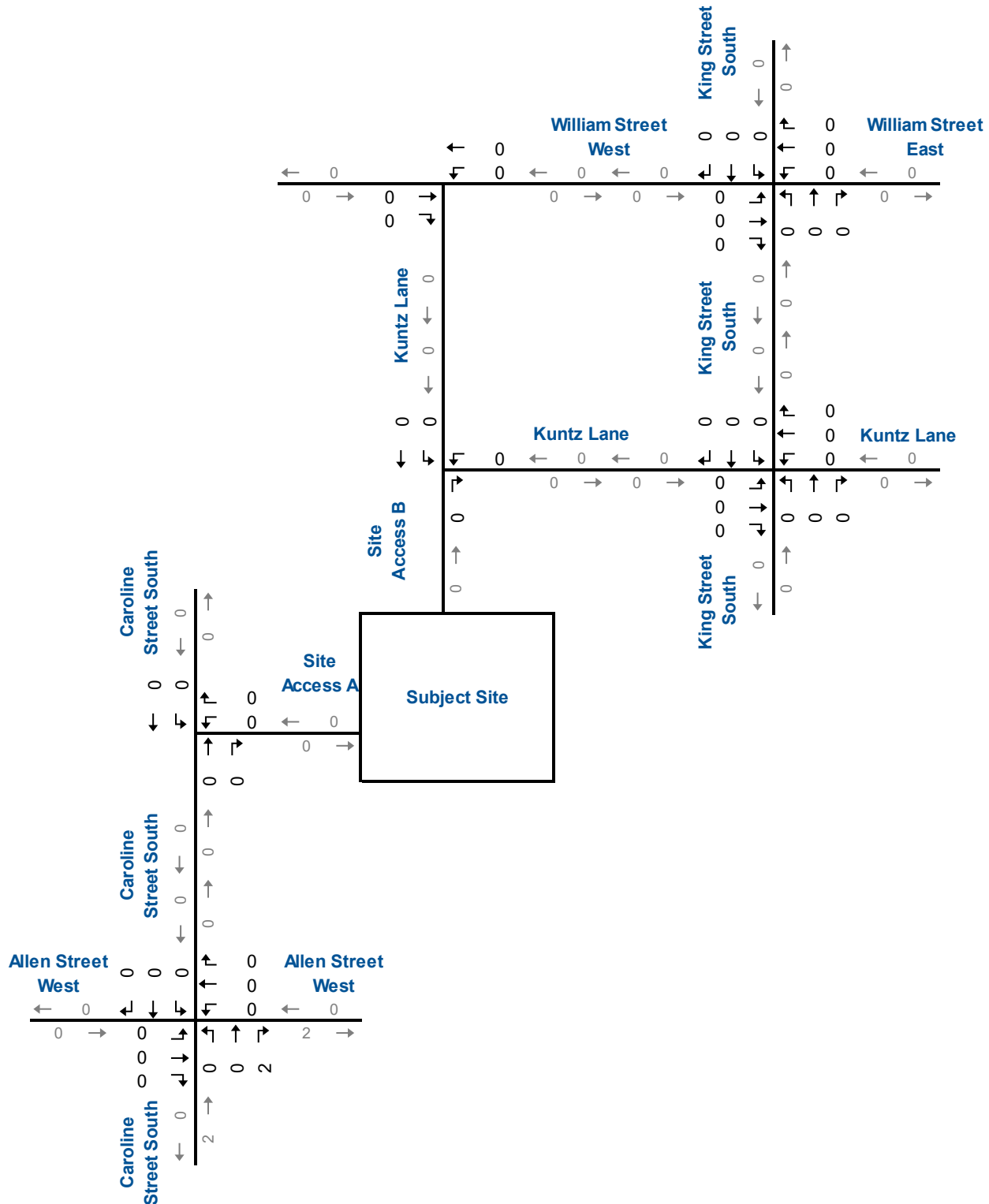
AM Peak Hour



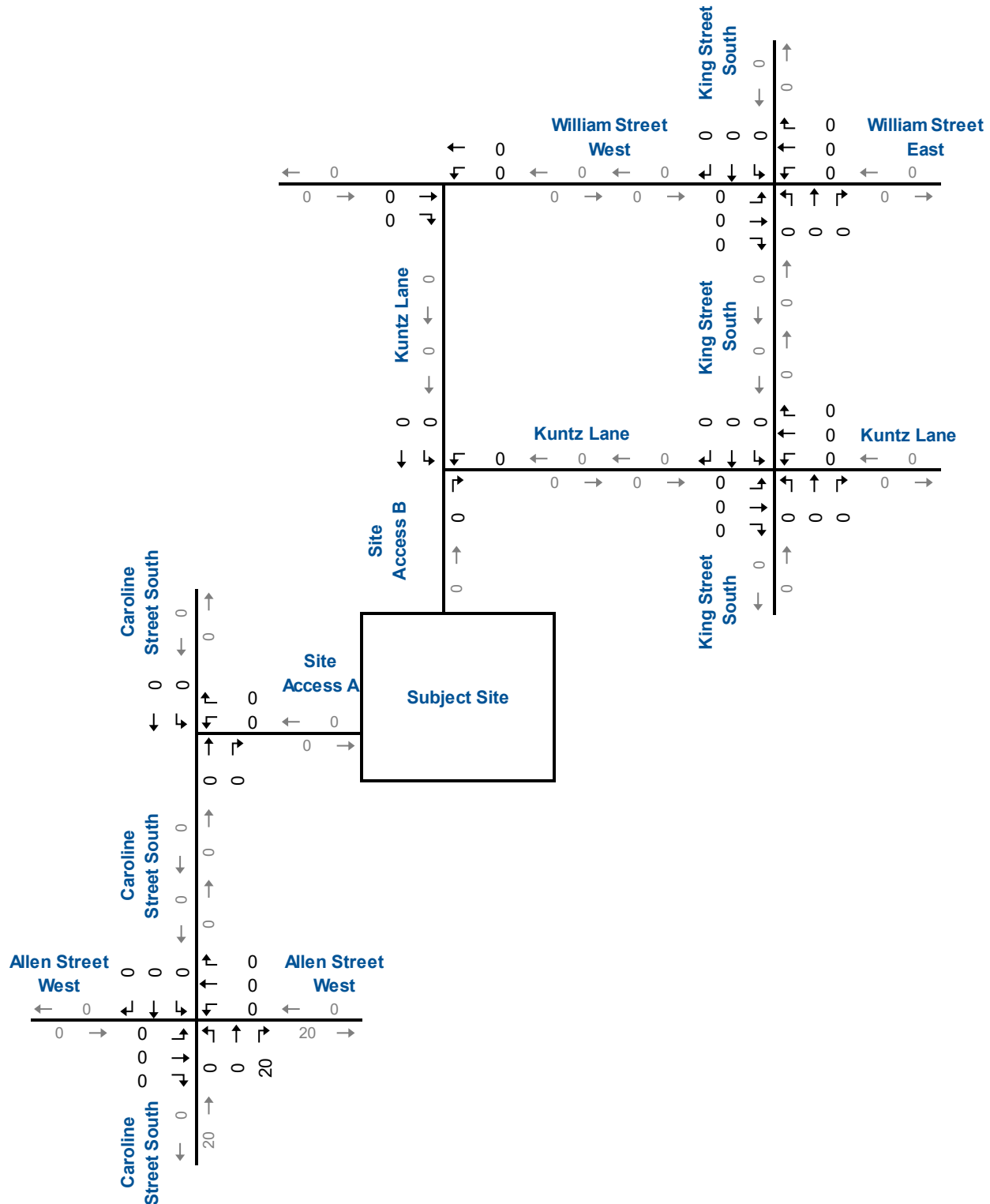
PM Peak Hour



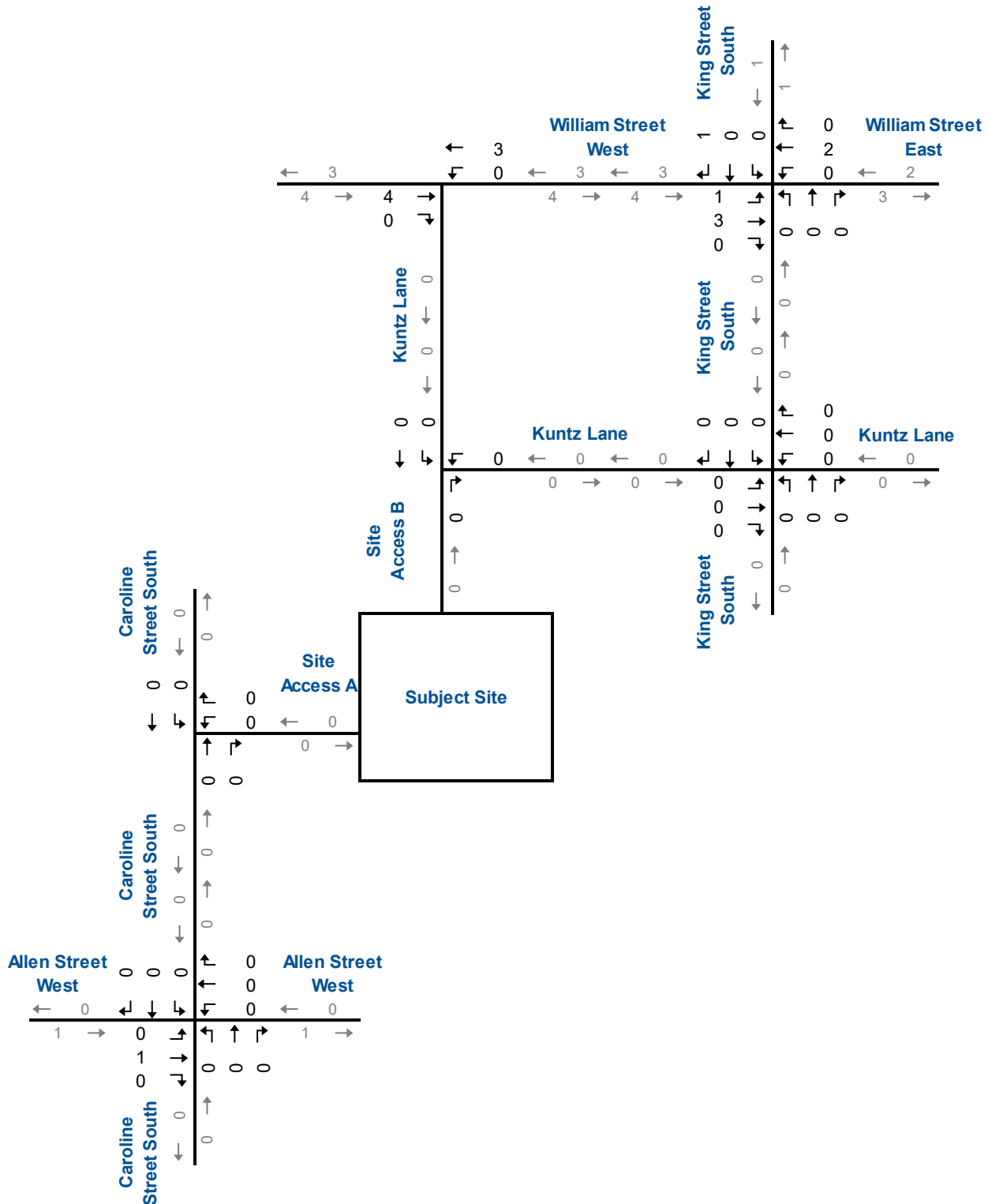
AM Peak Hour



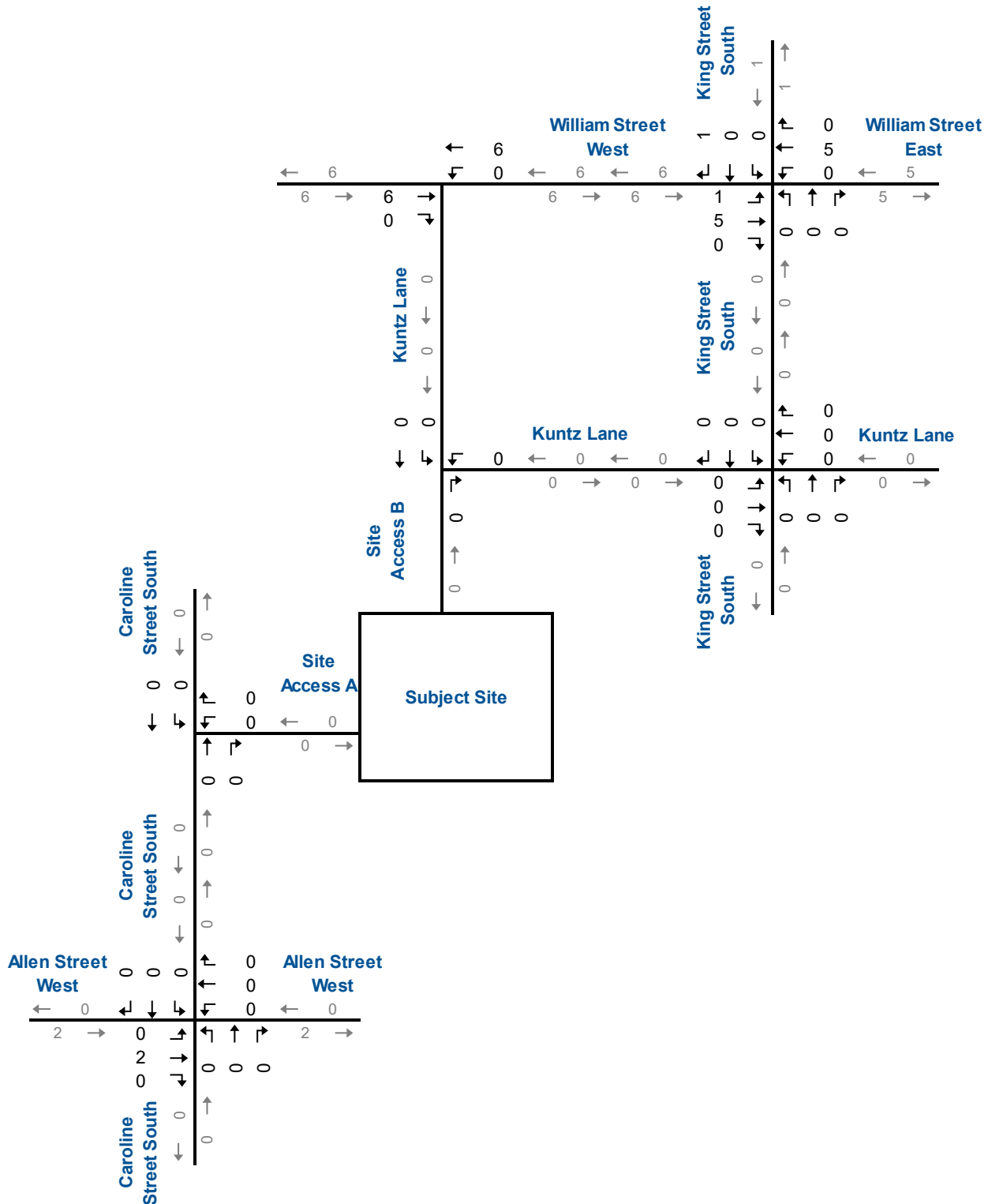
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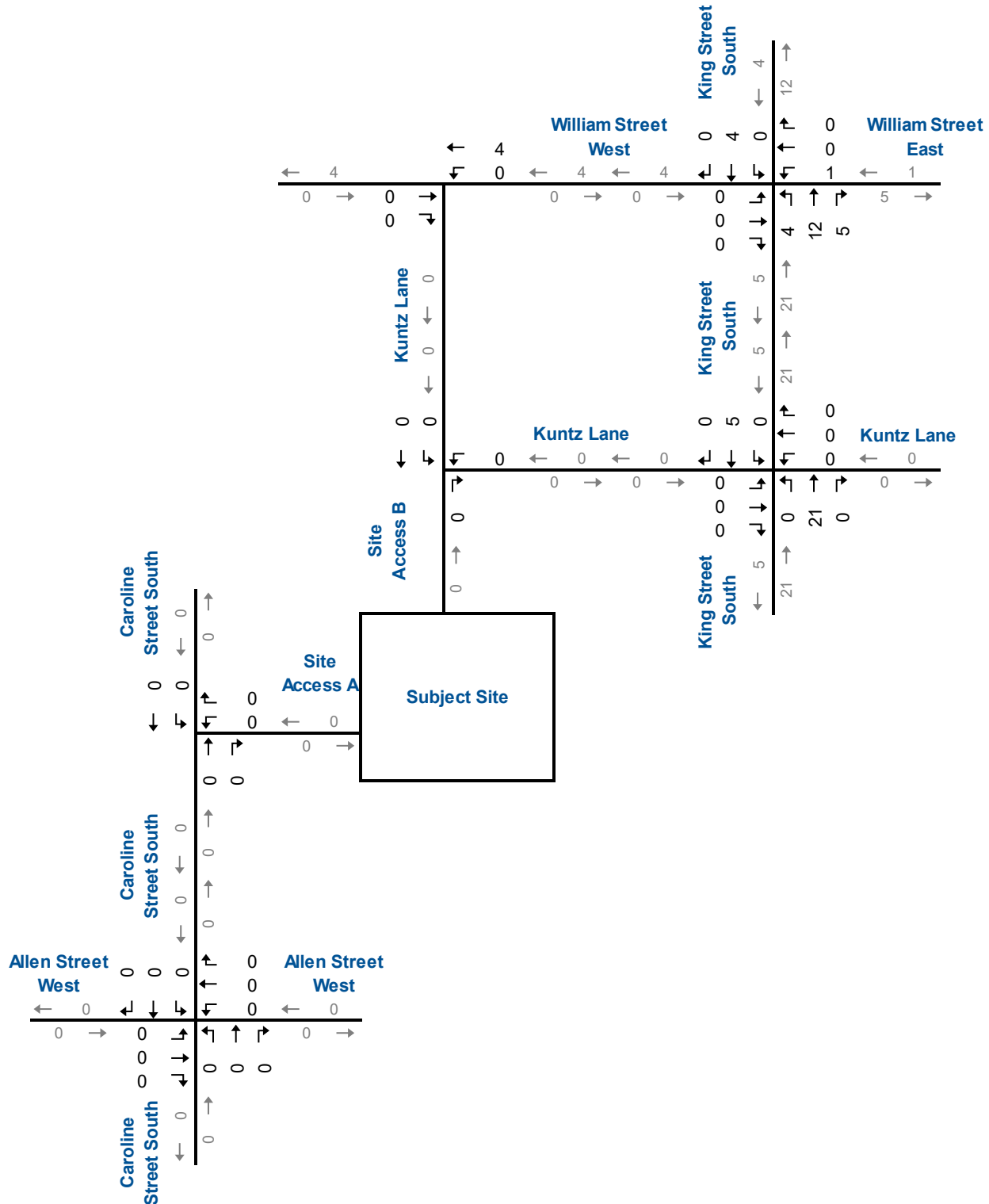
AM Peak Hour



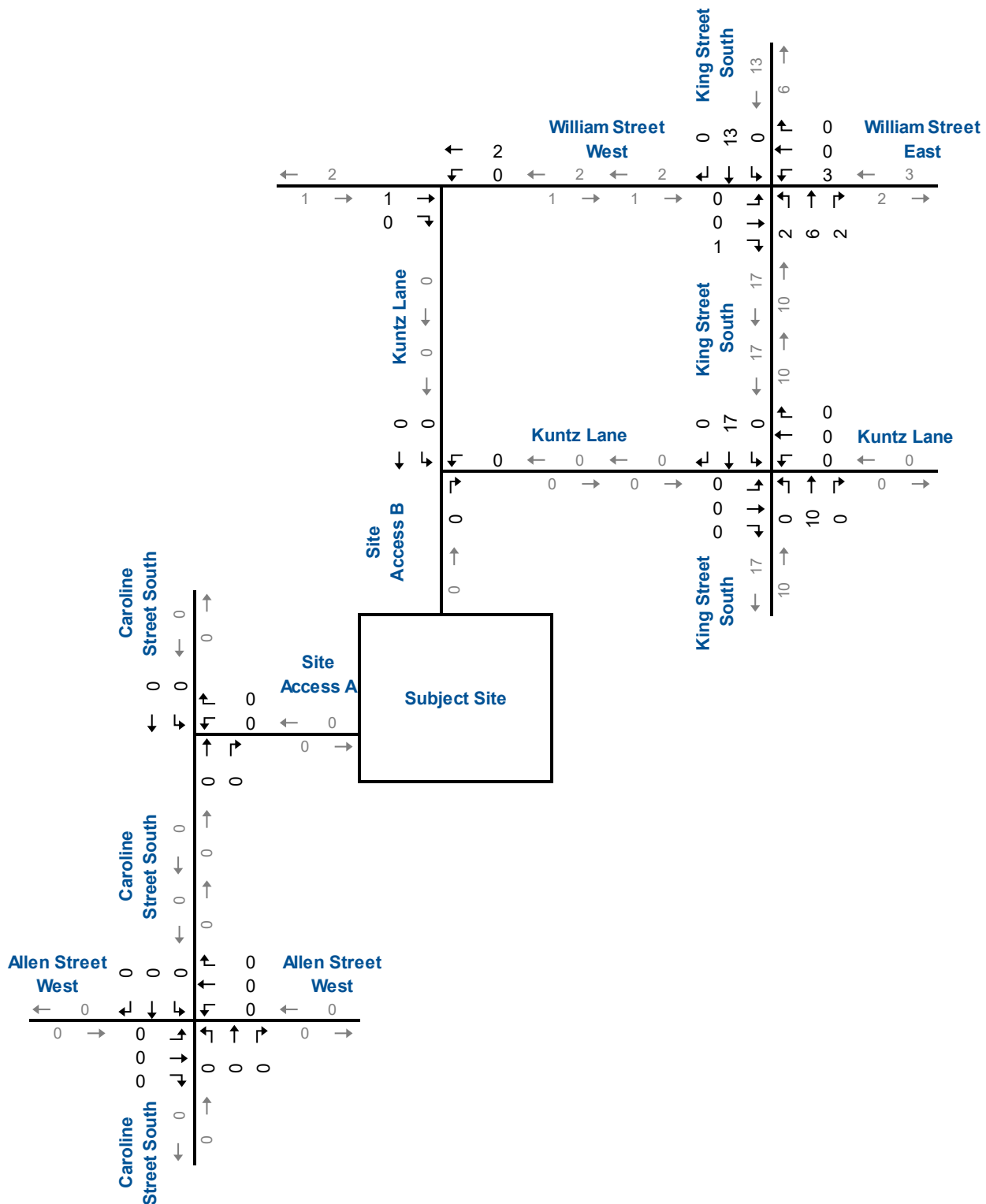
PM Peak Hour



AM Peak Hour

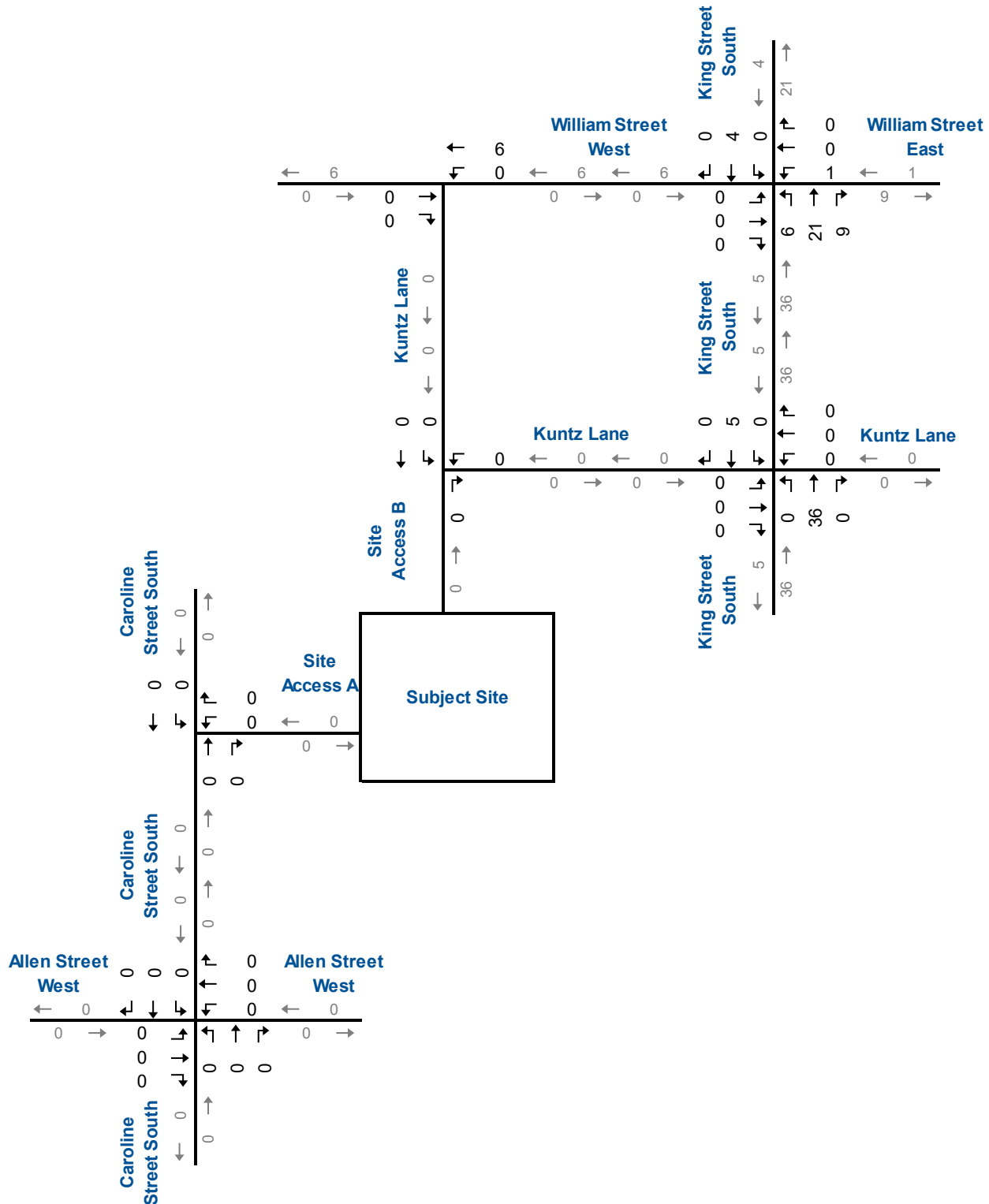


PM Peak Hour

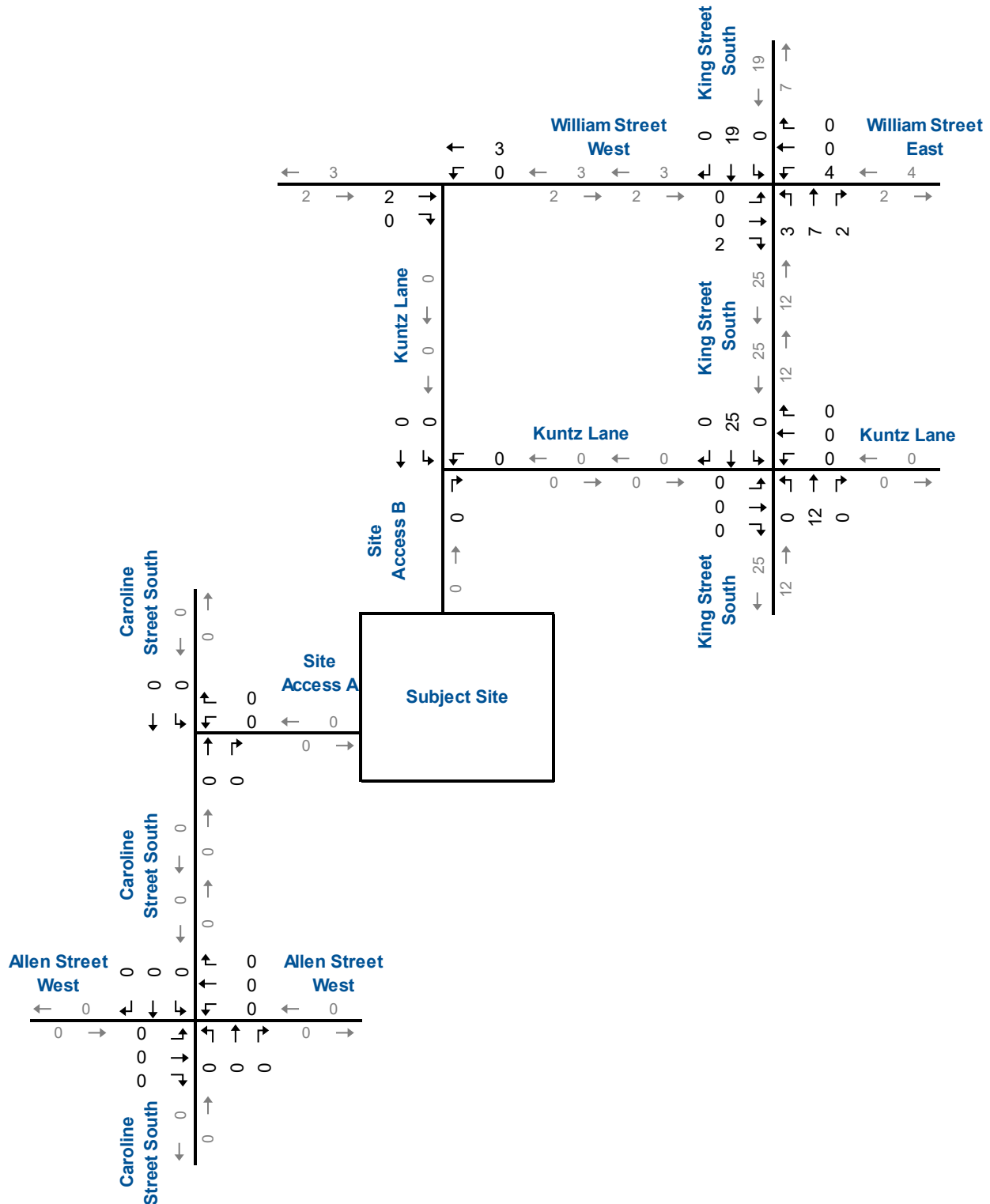


924-944 King Street West PM Peak Hour

AM Peak Hour



PM Peak Hour



Appendix E

2027 Background Traffic Operations Reports



Lanes, Volumes, Timings
1: Kuntz Lane & William Street West

2027 Background AM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

						
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	469	10	3	295	0	0
Future Volume (vph)	469	10	3	295	0	0
Ideal Flow (vphpl)	1650	1650	1650	1650	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt	0.997					
Flt Protected				0.999		
Satd. Flow (prot)	1580	0	0	1583	0	0
Flt Permitted				0.999		
Satd. Flow (perm)	1580	0	0	1583	0	0
Link Speed (k/h)	50			50	50	
Link Distance (m)	50.7			48.6	58.5	
Travel Time (s)	3.7			3.5	4.2	
Confl. Peds. (#/hr)		14	14		4	2
Confl. Bikes (#/hr)	4			2		
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	3%	0%	0%	3%	0%	0%
Adj. Flow (vph)	469	10	3	295	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	479	0	0	298	0	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.5			3.5	0.0	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.9			4.9	4.9	
Two way Left Turn Lane						
Headway Factor	1.21	1.21	1.21	1.21	1.01	1.01
Turning Speed (k/h)		14	24		24	14
Sign Control	Free			Free	Stop	
Intersection Summary						
Area Type:	Other					
Control Type:	Unsignalized					
Intersection Capacity Utilization	39.8%			ICU Level of Service A		
Analysis Period (min)	15					

HCM Unsignalized Intersection Capacity Analysis2027 Background AM Peak Hour (without LRT)
1: Kuntz Lane & William Street West (250137) 171 King Street South, Waterloo TIS

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↔	↘	↙	↔	↖	↗
Traffic Volume (veh/h)	469	10	3	295	0	0
Future Volume (Veh/h)	469	10	3	295	0	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	469	10	3	295	0	0
Pedestrians	4			2	14	
Lane Width (m)	3.5			3.5	0.0	
Walking Speed (m/s)	1.0			1.0	1.0	
Percent Blockage	0			0	0	
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)				48		
pX, platoon unblocked					0.93	
vC, conflicting volume			493		793	490
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			493		739	490
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	100
cM capacity (veh/h)			1081		358	581
Direction, Lane #						
	EB 1	WB 1				
Volume Total	479	298				
Volume Left	0	3				
Volume Right	10	0				
cSH	1700	1081				
Volume to Capacity	0.28	0.00				
Queue Length 95th (m)	0.0	0.1				
Control Delay (s/veh)	0.0	0.1				
Lane LOS		A				
Approach Delay (s/veh)	0.0	0.1				
Approach LOS						
Intersection Summary						
Average Delay		0.0				
Intersection Capacity Utilization		39.8%		ICU Level of Service		A
Analysis Period (min)		15				

Lanes, Volumes, Timings
2: King Street South & William Street West/William Street East King Street South, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	←	←	←	←	←	←	←	←	←	←	←	←
Traffic Volume (vph)	64	389	16	41	179	8	56	185	76	15	139	63
Future Volume (vph)	64	389	16	41	179	8	56	185	76	15	139	63
Ideal Flow (vphpl)	1775	1650	1650	1775	1650	1650	1775	1650	1650	1775	1650	1650
Storage Length (m)	15.0	0.0	25.0	0.0	25.0	0.0	35.0	0.0	25.0	0.0	25.0	0.0
Storage Lanes	1	0	1	0	1	0	1	0	1	0	1	0
Taper Length (m)	25.0			35.0			25.0			35.0		
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	0.97	1.00	0.99	1.00	0.94	0.98	0.97	0.97	0.97	0.97	0.97	0.97
Frt	0.994			0.994			0.956			0.953		
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1516	1589	0	1668	1588	0	1588	1395	0	1668	1443	0
Flt Permitted	0.608			0.361			0.520			0.598		
Satd. Flow (perm)	944	1589	0	628	1588	0	820	1395	0	1020	1443	0
Right Turn on Red		Yes			No			Yes			Yes	
Satd. Flow (RTOR)	3						37			32		
Link Speed (k/h)	50			50			50			50		
Link Distance (m)	48.6			129.2			85.4			137.6		
Travel Time (s)	3.5			9.3			6.1			9.9		
Confl. Peds. (#/hr)	27		13	13		27	58		28	28		58
Confl. Bikes (#/hr)	1	4			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 (%)	10%	1%	25%	0%	2%	0%	5%	11%	7%	0%	4%	5%
Adj. Flow (vph)	64	389	16	41	179	8	56	185	76	15	139	63
Shared Lane Traffic (%)												
Lane Group Flow (vph)	64	405	0	41	187	0	56	261	0	15	202	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)	3.5			3.5			3.5			3.5		
Link Offset(m)	0.0			0.0			0.0			0.0		
Crosswalk Width(m)	4.9			4.9			4.9			4.9		
Two way Left Turn Lane												
Headway Factor	1.11	1.21	1.21	1.11	1.21	1.21	1.11	1.21	1.21	1.11	1.21	1.21
Turning Speed (k/h)	24		14	24		14	24		14	24		14
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	6.1	30.5		6.1	30.5		6.1	30.5		6.1	30.5	
Trailing Detector (m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Position(m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Size(m)	6.1	1.8		6.1	1.8		6.1	1.8		6.1	1.8	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(m)	28.7			28.7			28.7			28.7		
Detector 2 Size(m)	1.8			1.8			1.8			1.8		
Detector 2 Type	Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex		
Detector 2 Channel												

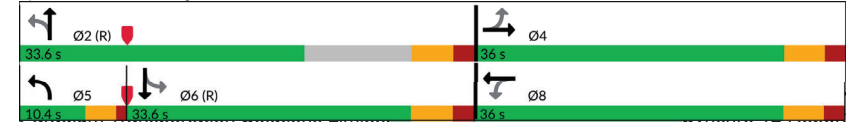
Lanes, Volumes, Timings
2: King Street South & William Street West/William Street East King Street South, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector 2 Extend (s)	0.0			0.0			0.0			0.0		
Turn Type	Perm	NA		Perm	NA		pm+pt	NA		Perm	NA	
Protected Phases	4			8			5	2		6		
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		5	2		6	6	
Switch Phase												
Minimum Initial (s)	30.0	30.0		30.0	30.0		5.0	27.6		27.6	27.6	
Minimum Split (s)	36.0	36.0		36.0	36.0		9.0	33.6		33.6	33.6	
Total Split (s)	36.0	36.0		36.0	36.0		10.4	33.6		33.6	33.6	
Total Split (%)	45.0%	45.0%		45.0%	45.0%		13.0%	42.0%		42.0%	42.0%	
Maximum Green (s)	30.0	30.0		30.0	30.0		6.4	27.6		27.6	27.6	
Yellow Time (s)	4.0	4.0		4.0	4.0		3.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		1.0	2.0		2.0	2.0	
Lost Time Adjust (s)	-2.0	-2.0		-2.0	-2.0		0.0	-2.0		-2.0	-2.0	
Total Lost Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lead/Lag							Lead			Lag	Lag	
Lead-Lag Optimize?							Yes			Yes	Yes	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		None	C-Max		C-Max	C-Max	
Walk Time (s)	19.0	19.0		19.0	19.0		21.6			21.6		
Flash Don't Walk (s)	11.0	11.0		11.0	11.0		6.0			6.0	6.0	
Pedestrian Calls (#/hr)	0	0		0	0		0			0	0	
Act Effect Green (s)	32.0	32.0		32.0	32.0		40.0	40.0		33.8	33.8	
Actuated g/C Ratio	0.40	0.40		0.40	0.40		0.50	0.50		0.42	0.42	
v/c Ratio	0.17	0.64		0.16	0.29		0.12	0.36		0.03	0.32	
Control Delay (s/veh)	17.0	24.7		17.6	18.0		11.1	12.1		16.5	16.1	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay (s/veh)	17.0	24.7		17.6	18.0		11.1	12.1		16.5	16.1	
LOS	B	C		B	B		B	B		B	B	
Approach Delay (s/veh)	23.6			17.9			12.0			16.1		
Approach LOS	C			B			B			B		

Intersection Summary

Area Type:	Other
Cycle Length: 80	
Actuated Cycle Length: 80	
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green	
Natural Cycle: 80	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.64	
Intersection Signal Delay (s/veh): 18.2	Intersection LOS: B
Intersection Capacity Utilization 109.3%	ICU Level of Service H
Analysis Period (min) 15	

Splits and Phases: 2: King Street South & William Street West/William Street East



Queues
2: King Street South & William Street West/William Street East King Street South, Waterloo TIS

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	64	405	41	187	56	261	15	202
v/c Ratio	0.17	0.64	0.16	0.29	0.12	0.36	0.03	0.32
Control Delay (s/veh)	17.0	24.7	17.6	18.0	11.1	12.1	16.5	16.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (s/veh)	17.0	24.7	17.6	18.0	11.1	12.1	16.5	16.1
Queue Length 50th (m)	6.1	47.8	3.9	18.8	4.2	19.2	1.4	18.1
Queue Length 95th (m)	14.2	77.0	10.7	33.3	9.8	35.3	5.2	34.6
Internal Link Dist (m)		24.6		105.2		61.4		113.6
Turn Bay Length (m)	15.0		25.0		35.0		25.0	
Base Capacity (vph)	377	637	251	635	471	716	430	627
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.17	0.64	0.16	0.29	0.12	0.36	0.03	0.32
Intersection Summary								

Lanes, Volumes, Timings
3: King Street South & Kuntz Lane
2027 Background AM Peak Hour (without LRT)
(250137) 171 King Street South, 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		↔						↔			↔	
Traffic Volume (vph)	1	1	1	0	0	0	1	311	6	7	217	0
Future Volume (vph)	1	1	1	0	0	0	1	311	6	7	217	0
Ideal Flow (vphpl)	1550	1550	1550	1900	1900	1900	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		0.955						0.997				
Flt Protected		0.984									0.998	
Satd. Flow (prot)	0	1440	0	0	0	0	0	1430	0	0	1433	0
Flt Permitted		0.984									0.998	
Satd. Flow (perm)	0	1440	0	0	0	0	0	1430	0	0	1433	0
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		44.8			46.1			132.5			85.4	
Travel Time (s)		3.2			3.3			9.5			6.1	
Confl. Peds. (#/hr)	1					1	58		19	19		58
Confl. Bikes (#/hr)					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%	0%	0%	0%	0%	0%	0%	7%	0%	0%	7%	0%
Adj. Flow (vph)	1	1	1	0	0	0	1	311	6	7	217	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	3	0	0	0	0	0	318	0	0	224	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			3.5			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.9			1.6			4.9			4.9	
Two way Left Turn Lane												
Headway Factor	1.31	1.31	1.31	1.01	1.01	1.01	1.31	1.31	1.31	1.31	1.31	1.31
Turning Speed (k/h)	24		14	24		14	24		14	24		14
Sign Control		Stop			Stop			Free			Free	
Intersection Summary												
Area Type:	Other											
Control Type:	Unsignalized											
Intersection Capacity Utilization	31.4%											
Analysis Period (min)	15											
	ICU Level of Service A											

HCM 7th TWSC
3: King Street South & Kuntz Lane

2027 Background AM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

Intersection												
Int Delay, s/veh	0.2											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔↔↔↔↔↔↔↔↔↔↔											
Traffic Vol, veh/h	1	1	1	0	0	0	1	311	6	7	217	0
Future Vol, veh/h	1	1	1	0	0	0	1	311	6	7	217	0
Conflicting Peds, #/hr	1	0	0	0	0	1	58	0	19	19	0	58
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	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	0	0	0	0	0	0	7	0	0	7	0
Mvmt Flow	1	1	1	0	0	0	1	311	6	7	217	0
Major/Minor	Minor2			Major1			Major2					
Conflicting Flow All	603	627	275	275			0	0	336	0	0	
Stage 1	289	289	-	-			-	-	-	-	-	
Stage 2	314	338	-	-			-	-	-	-	-	
Critical Hdwy	6.4	6.5	6.2	4.1			-	-	4.1	-	-	
Critical Hdwy Stg 1	5.4	5.5	-	-			-	-	-	-	-	
Critical Hdwy Stg 2	5.4	5.5	-	-			-	-	-	-	-	
Follow-up Hdwy	3.5	4	3.3	2.2			-	-	2.2	-	-	
Pot Cap-1 Maneuver	465	403	769	1300			-	-	1235	-	-	
Stage 1	765	677	-	-			-	-	-	-	-	
Stage 2	745	644	-	-			-	-	-	-	-	
Platoon blocked, %							-	-	-	-	-	
Mov Cap-1 Maneuver	413	0	727	1229			-	-	1235	-	-	
Mov Cap-2 Maneuver	413	0	-	-			-	-	-	-	-	
Stage 1	723	0	-	-			-	-	-	-	-	
Stage 2	700	0	-	-			-	-	-	-	-	
Approach	EB			NB			SB					
HCM Ctrl Dly, s/v	11.87			0.02			0.25					
HCM LOS	B											
Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	SBL	SBT	SBR					
Capacity (veh/h)	6	-	-	527	56	-	-					
HCM Lane V/C Ratio	0.001	-	-	0.006	0.006	-	-					
HCM Ctrl Dly (s/v)	7.9	0	-	11.9	7.9	0	-					
HCM Lane LOS	A	A	-	B	A	A	-					
HCM 95th %tile Q(veh)	0	-	-	0	0	-	-					

Lanes, Volumes, Timings
4: Caroline Street South & Allen Street West

2027 Background AM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

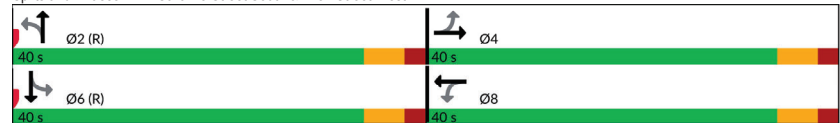
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔				↔			↔			↔	
Traffic Volume (vph)	6	40	15	7	27	11	5	59	12	37	85	11
Future Volume (vph)	6	40	15	7	27	11	5	59	12	37	85	11
Ideal Flow (vphpl)	1550	1550	1550	1550	1550	1550	1550	1550	1550	1550	1550	1550
Lane Util. Factor	1.00	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	0.99				0.99			0.99			0.98	
Frt	0.967				0.967			0.979			0.989	
Flt Protected	0.995				0.992			0.997			0.986	
Satd. Flow (prot)	0	1428	0	0	1458	0	0	1422	0	0	1370	0
Flt Permitted	0.981				0.967			0.989			0.924	
Satd. Flow (perm)	0	1406	0	0	1415	0	0	1404	0	0	1275	0
Right Turn on Red			Yes				Yes		Yes			No
Satd. Flow (RTOR)	15				11			12				
Link Speed (k/h)	50				50			50			50	
Link Distance (m)	81.6				87.7			93.6			95.7	
Travel Time (s)	5.9				6.3			6.7			6.9	
Conf. Peds. (#/hr)	13		27	27		13	72		23	23		72
Conf. Bikes (#/hr)	2											
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%	0%	0%	20%	4%	0%	22%	2%	9%
Adj. Flow (vph)	6	40	15	7	27	11	5	59	12	37	85	11
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	61	0	0	45	0	0	76	0	0	133	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)	4.9				4.9			4.9			4.9	
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)	24		14	24		14	24		14	24		14
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	6.1	30.5		6.1	30.5		6.1	30.5		6.1	30.5	
Trailing Detector (m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Position(m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Size(m)	6.1	1.8		6.1	1.8		6.1	1.8		6.1	1.8	
Detector 1 Type	CI+Ex	CI+Ex		CI+Ex	CI+Ex		CI+Ex	CI+Ex		CI+Ex	CI+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(m)	28.7				28.7			28.7			28.7	
Detector 2 Size(m)	1.8				1.8			1.8			1.8	
Detector 2 Type	CI+Ex				CI+Ex			CI+Ex			CI+Ex	
Detector 2 Channel												
Detector 2 Extend (s)	0.0				0.0			0.0			0.0	
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases	4				8			2			6	

Lanes, Volumes, Timings
4: Caroline Street South & Allen Street West 2027 Background AM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	34.0	34.0		34.0	34.0		34.0	34.0		34.0	34.0	
Minimum Split (s)	40.0	40.0		40.0	40.0		40.0	40.0		40.0	40.0	
Total Split (s)	40.0	40.0		40.0	40.0		40.0	40.0		40.0	40.0	
Total Split (%)	50.0%	50.0%		50.0%	50.0%		50.0%	50.0%		50.0%	50.0%	
Maximum Green (s)	34.0	34.0		34.0	34.0		34.0	34.0		34.0	34.0	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Lost Time Adjust (s)		-2.0			-2.0			-2.0			-2.0	
Total Lost Time (s)		4.0			4.0			4.0			4.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		C-Max	C-Max		C-Max	C-Max	
Walk Time (s)	29.0	29.0		29.0	29.0		28.0	28.0		28.0	28.0	
Flash Don't Walk (s)	5.0	5.0		5.0	5.0		6.0	6.0		6.0	6.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)		36.0			36.0			53.6			53.6	
Actuated g/C Ratio		0.45			0.45			0.67			0.67	
v/c Ratio		0.10			0.07			0.08			0.16	
Control Delay (s/veh)		10.7			10.6			10.4			11.9	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay (s/veh)		10.7			10.6			10.4			11.9	
LOS		B			B			B			B	
Approach Delay (s/veh)		10.7			10.6			10.4			11.9	
Approach LOS		B			B			B			B	

Intersection Summary												
Area Type:	Other											
Cycle Length: 80												
Actuated Cycle Length: 80												
Offset: 60 (75%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green												
Natural Cycle: 80												
Control Type: Actuated-Coordinated												
Maximum v/c Ratio: 0.16												
Intersection Signal Delay (s/veh): 11.1	Intersection LOS: B											
Intersection Capacity Utilization 63.3%	ICU Level of Service B											
Analysis Period (min) 15												

Splits and Phases: 4: Caroline Street South & Allen Street West



Queues
4: Caroline Street South & Allen Street West 2027 Background AM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

Lane Group	EBT	WBT	NBT	SBT
Lane Group Flow (vph)	61	45	76	133
v/c Ratio	0.10	0.07	0.08	0.16
Control Delay (s/veh)	10.7	10.6	10.4	11.9
Queue Delay	0.0	0.0	0.0	0.0
Total Delay (s/veh)	10.7	10.6	10.4	11.9
Queue Length 50th (m)	3.8	2.8	5.4	11.9
Queue Length 95th (m)	10.3	8.3	12.8	23.0
Internal Link Dist (m)	57.6	63.7	69.6	71.7
Turn Bay Length (m)				
Base Capacity (vph)	640	642	944	854
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.10	0.07	0.08	0.16

Intersection Summary

Lanes, Volumes, Timings
5: Caroline Street South & Site Access

2027 Background AM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

						
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	8	3	82	6	7	129
Future Volume (vph)	8	3	82	6	7	129
Ideal Flow (vphpl)	1765	1765	1650	1650	1650	1650
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt	0.963		0.991			
Flt Protected	0.965					0.997
Satd. Flow (prot)	1488	0	1573	0	0	1499
Flt Permitted	0.965					0.997
Satd. Flow (perm)	1488	0	1573	0	0	1499
Link Speed (k/h)	50		50			50
Link Distance (m)	57.9		95.7			59.8
Travel Time (s)	4.2		6.9			4.3
Confl. Peds. (#/hr)	2	2		22	22	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	33%	3%	0%	0%	9%
Adj. Flow (vph)	8	3	82	6	7	129
Shared Lane Traffic (%)						
Lane Group Flow (vph)	11	0	88	0	0	136
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)	4.9		4.9			4.9
Two way Left Turn Lane						
Headway Factor	1.12	1.12	1.21	1.21	1.21	1.21
Turning Speed (k/h)	24	14		14	24	
Sign Control	Stop		Free			Free
Intersection Summary						
Area Type:	Other					
Control Type:	Unsignalized					
Intersection Capacity Utilization	25.0%			ICU Level of Service A		
Analysis Period (min)	15					

HCM 7th TWSC
5: Caroline Street South & Site Access

2027 Background AM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

Intersection						
Int Delay, s/veh	0.7					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	W		R			L
Traffic Vol, veh/h	8	3	82	6	7	129
Future Vol, veh/h	8	3	82	6	7	129
Conflicting Peds, #/hr	2	2	0	22	22	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	33	3	0	0	9
Mvmt Flow	8	3	82	6	7	129
Major/Minor						
Minor1	Major1		Major2			
Conflicting Flow All	252	109	0	0	110	0
Stage 1	107	-	-	-	-	-
Stage 2	145	-	-	-	-	-
Critical Hdwy	6.4	6.53	-	-	4.1	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.597	-	-	2.2	-
Pot Cap-1 Maneuver	741	867	-	-	1493	-
Stage 1	922	-	-	-	-	-
Stage 2	887	-	-	-	-	-
Platoon blocked, %	-	-	-	-	-	-
Mov Cap-1 Maneuver	721	847	-	-	1462	-
Mov Cap-2 Maneuver	721	-	-	-	-	-
Stage 1	904	-	-	-	-	-
Stage 2	881	-	-	-	-	-
Approach						
WB	NB		SB			
HCM Ctrl Dly, s/v	9.86	0	0.38			
HCM LOS	A					
Minor Lane/Major Mvmt						
NBT	NBRWBLn1	SBL	SBT			
Capacity (veh/h)	-	-	751	93	-	-
HCM Lane V/C Ratio	-	-	0.015	0.005	-	-
HCM Ctrl Dly (s/v)	-	-	9.9	7.5	0	-
HCM Lane LOS	-	-	A	A	A	-
HCM 95th %tile Q(veh)	-	-	0	0	-	-

Lanes, Volumes, Timings
1: Kuntz Lane & William Street West

2027 Background PM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

						
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	407	0	2	450	0	0
Future Volume (vph)	407	0	2	450	0	0
Ideal Flow (vphpl)	1650	1650	1650	1650	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt						
Flt Protected						
Satd. Flow (prot)	1584	0	0	1616	0	0
Flt Permitted						
Satd. Flow (perm)	1584	0	0	1616	0	0
Link Speed (k/h)	50			50	50	
Link Distance (m)	50.7			48.6	58.5	
Travel Time (s)	3.7			3.5	4.2	
Confl. Peds. (#/hr)		13	13			
Confl. Bikes (#/hr)	1		2	2		1
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	3%	0%	0%	1%	0%	0%
Adj. Flow (vph)	407	0	2	450	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	407	0	0	452	0	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.5			3.5	0.0	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.9			4.9	4.9	
Two way Left Turn Lane						
Headway Factor	1.21	1.21	1.21	1.21	1.01	1.01
Turning Speed (k/h)		14	24		24	14
Sign Control	Free			Free	Stop	
Intersection Summary						
Area Type:	Other					
Control Type:	Unsignalized					
Intersection Capacity Utilization	32.4%			ICU Level of Service A		
Analysis Period (min)	15					

HCM Unsignalized Intersection Capacity Analysis2027 Background PM Peak Hour (without LRT)
1: Kuntz Lane & William Street West (250137) 171 King Street South, Waterloo TIS

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↘			↗		
Traffic Volume (veh/h)	407	0	2	450	0	0
Future Volume (Veh/h)	407	0	2	450	0	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	407	0	2	450	0	0
Pedestrians					13	
Lane Width (m)					0.0	
Walking Speed (m/s)					1.0	
Percent Blockage					0	
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)				48		
pX, platoon unblocked					0.86	
vC, conflicting volume			420		874	420
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			420		770	420
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	100
cM capacity (veh/h)			1150		318	638
Direction, Lane #						
	EB 1	WB 1				
Volume Total	407	452				
Volume Left	0	2				
Volume Right	0	0				
cSH	1700	1150				
Volume to Capacity	0.24	0.00				
Queue Length 95th (m)	0.0	0.0				
Control Delay (s/veh)	0.0	0.1				
Lane LOS		A				
Approach Delay (s/veh)	0.0	0.1				
Approach LOS						
Intersection Summary						
Average Delay		0.0				
Intersection Capacity Utilization		32.4%		ICU Level of Service		A
Analysis Period (min)		15				

Lanes, Volumes, Timings
2: King Street South & William Street West/William Street East King Street South, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	←	←	←	←	←	←	←	←	←	←	←	←
Traffic Volume (vph)	50	334	23	65	293	9	75	209	67	12	270	84
Future Volume (vph)	50	334	23	65	293	9	75	209	67	12	270	84
Ideal Flow (vphpl)	1775	1650	1650	1775	1650	1650	1775	1650	1650	1775	1650	1650
Storage Length (m)	15.0	0.0	0.0	25.0	0.0	0.0	35.0	0.0	0.0	25.0	0.0	0.0
Storage Lanes	1	0	0	1	0	0	1	0	0	1	0	0
Taper Length (m)	25.0	0.0	0.0	35.0	0.0	0.0	25.0	0.0	0.0	35.0	0.0	0.0
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	0.98	1.00	0.98	1.00	0.98	0.98	0.93	0.98	0.98	0.96	0.96	0.96
Frt	0.990	0.990	0.990	0.996	0.996	0.996	0.964	0.964	0.964	0.964	0.964	0.964
Flt Protected	0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950
Satd. Flow (prot)	1573	1574	0	1635	1622	0	1668	1464	0	1668	1462	0
Flt Permitted	0.474	0.474	0.474	0.413	0.413	0.413	0.349	0.349	0.349	0.590	0.590	0.590
Satd. Flow (perm)	767	1574	0	698	1622	0	569	1464	0	991	1462	0
Right Turn on Red		Yes		No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Satd. Flow (RTOR)	5	5	5	5	5	5	29	29	29	22	22	22
Link Speed (k/h)	50	50	50	50	50	50	50	50	50	50	50	50
Link Distance (m)	48.6	48.6	48.6	129.2	129.2	129.2	85.4	85.4	85.4	137.6	137.6	137.6
Travel Time (s)	3.5	3.5	3.5	9.3	9.3	9.3	6.1	6.1	6.1	9.9	9.9	9.9
Confl. Peds. (#/hr)	28	28	26	26	26	28	104	104	44	44	104	104
Confl. Bikes (#/hr)	1	1	1	1	1	1	1	1	1	2	2	2
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 (%)	6%	1%	21%	2%	0%	0%	0%	7%	0%	0%	3%	4%
Adj. Flow (vph)	50	334	23	65	293	9	75	209	67	12	270	84
Shared Lane Traffic (%)												
Lane Group Flow (vph)	50	357	0	65	302	0	75	276	0	12	354	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)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
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)	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9
Two way Left Turn Lane												
Headway Factor	1.11	1.21	1.21	1.11	1.21	1.21	1.11	1.21	1.21	1.11	1.21	1.21
Turning Speed (k/h)	24	24	14	24	24	14	24	24	14	24	24	14
Number of Detectors	1	2	1	1	2	1	1	2	1	1	2	1
Detector Template	Left	Thru	Left	Thru	Left	Thru	Left	Thru	Left	Thru	Left	Thru
Leading Detector (m)	6.1	30.5	6.1	30.5	6.1	30.5	6.1	30.5	6.1	30.5	6.1	30.5
Trailing Detector (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
Detector 1 Position(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
Detector 1 Size(m)	6.1	1.8	6.1	1.8	6.1	1.8	6.1	1.8	6.1	1.8	6.1	1.8
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(m)	28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.7
Detector 2 Size(m)	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
Detector 2 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 2 Channel												

Lanes, Volumes, Timings
2: King Street South & William Street West/William Street East King Street South, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector 2 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Turn Type	Perm	NA	Perm	NA	pm+pt	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases	4	4	8	8	5	2	6	6	6	6	6	6
Permitted Phases	4	4	8	8	2	2	6	6	6	6	6	6
Detector Phase	4	4	8	8	5	2	6	6	6	6	6	6
Switch Phase												
Minimum Initial (s)	30.0	30.0	30.0	30.0	5.0	27.6	27.6	27.6	27.6	27.6	27.6	27.6
Minimum Split (s)	36.0	36.0	36.0	36.0	9.0	33.6	33.6	33.6	33.6	33.6	33.6	33.6
Total Split (s)	36.0	36.0	36.0	36.0	10.4	33.6	33.6	33.6	33.6	33.6	33.6	33.6
Total Split (%)	45.0%	45.0%	45.0%	45.0%	13.0%	42.0%	42.0%	42.0%	42.0%	42.0%	42.0%	42.0%
Maximum Green (s)	30.0	30.0	30.0	30.0	6.4	27.6	27.6	27.6	27.6	27.6	27.6	27.6
Yellow Time (s)	4.0	4.0	4.0	4.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	1.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	0.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag					Lead	Lag	Lag	Lag	Lag	Lag	Lag	Lag
Lead-Lag Optimize?					Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	None	None	None	C-Max	C-Max	C-Max	C-Max	C-Max	C-Max	C-Max
Walk Time (s)	19.0	19.0	19.0	19.0	21.6	21.6	21.6	21.6	21.6	21.6	21.6	21.6
Flash Don't Walk (s)	11.0	11.0	11.0	11.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Pedestrian Calls (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Act Effect Green (s)	32.0	32.0	32.0	32.0	40.0	40.0	31.7	31.7	31.7	31.7	31.7	31.7
Actuated g/C Ratio	0.40	0.40	0.40	0.40	0.50	0.50	0.40	0.40	0.40	0.40	0.40	0.40
v/c Ratio	0.16	0.56	0.23	0.47	0.20	0.37	0.03	0.60	0.03	0.60	0.03	0.60
Control Delay (s/veh)	17.3	22.6	18.7	20.6	11.9	12.6	16.6	24.0	16.6	24.0	16.6	24.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (s/veh)	17.3	22.6	18.7	20.6	11.9	12.6	16.6	24.0	16.6	24.0	16.6	24.0
LOS	B	C	B	C	B	B	B	C	B	C	B	C
Approach Delay (s/veh)	21.9	20.3	12.5	23.7								
Approach LOS	C	C	B	C								

Intersection Summary
Area Type: Other
Cycle Length: 80
Actuated Cycle Length: 80
Offset: 26.4 (33%), Referenced to phase 2:NBT and 6:SBTL, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.60
Intersection Signal Delay (s/veh): 19.8
Intersection LOS: B
Intersection Capacity Utilization 109.3%
ICU Level of Service H
Analysis Period (min) 15



Queues
2: King Street South & William Street West/William Street East
250137 171 King Street South, Waterloo TIS

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	50	357	65	302	75	276	12	354
v/c Ratio	0.16	0.56	0.23	0.47	0.20	0.37	0.03	0.60
Control Delay (s/veh)	17.3	22.6	18.7	20.6	11.9	12.6	16.6	24.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (s/veh)	17.3	22.6	18.7	20.6	11.9	12.6	16.6	24.0
Queue Length 50th (m)	4.8	40.3	6.4	32.9	5.6	21.4	1.1	40.8
Queue Length 95th (m)	12.0	66.0	15.4	54.5	12.2	38.0	4.4	69.1
Internal Link Dist (m)		24.6		105.2		61.4		113.6
Turn Bay Length (m)	15.0		25.0		35.0		25.0	
Base Capacity (vph)	306	632	279	648	372	746	392	592
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.16	0.56	0.23	0.47	0.20	0.37	0.03	0.60
Intersection Summary								

Lanes, Volumes, Timings
3: King Street South & Kuntz Lane
250137 171 King Street South, 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		↔						↔			↔	
Traffic Volume (vph)	6	0	9	0	0	0	0	332	6	7	356	1
Future Volume (vph)	6	0	9	0	0	0	0	332	6	7	356	1
Ideal Flow (vphpl)	1550	1550	1550	1900	1900	1900	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		0.919						0.998				
Flt Protected		0.980									0.999	
Satd. Flow (prot)	0	1380	0	0	0	0	0	1445	0	0	1474	0
Flt Permitted		0.980									0.999	
Satd. Flow (perm)	0	1380	0	0	0	0	0	1445	0	0	1474	0
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		44.8			46.1			132.5			85.4	
Travel Time (s)		3.2			3.3			9.5			6.1	
Confl. Peds. (#/hr)	1					1	86		36	36		86
Confl. Bikes (#/hr)								1			4	
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%	0%	0%	0%	0%	0%	0%	6%	0%	0%	4%	0%
Adj. Flow (vph)	6	0	9	0	0	0	0	332	6	7	356	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	15	0	0	0	0	0	338	0	0	364	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			3.5			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.9			1.6			4.9			4.9	
Two way Left Turn Lane												
Headway Factor	1.31	1.31	1.31	1.01	1.01	1.01	1.31	1.31	1.31	1.31	1.31	1.31
Turning Speed (k/h)	24		14	24		14	24		14	24		14
Sign Control		Stop			Stop			Free			Free	
Intersection Summary												
Area Type:	Other											
Control Type:	Unsignalized											
Intersection Capacity Utilization	44.4%											
Analysis Period (min)	15											
	ICU Level of Service A											

HCM 7th TWSC
3: King Street South & Kuntz Lane

2027 Background PM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

Intersection												
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	6	0	9	0	0	0	0	332	6	7	356	1
Future Vol, veh/h	6	0	9	0	0	0	0	332	6	7	356	1
Conflicting Peds, #/hr	1	0	0	0	0	1	86	0	36	36	0	86
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	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	0	0	0	0	0	0	6	0	0	4	0
Mvmt Flow	6	0	9	0	0	0	0	332	6	7	356	1
Major/Minor	Minor2			Major1			Major2					
Conflicting Flow All	790	831	443				443	0	0	374	0	0
Stage 1	457	457	-				-	-	-	-	-	-
Stage 2	333	374	-				-	-	-	-	-	-
Critical Hdwy	6.4	6.5	6.2				4.1	-	-	4.1	-	-
Critical Hdwy Stg 1	5.4	5.5	-				-	-	-	-	-	-
Critical Hdwy Stg 2	5.4	5.5	-				-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3				2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	362	308	619				1128	-	-	1196	-	-
Stage 1	642	571	-				-	-	-	-	-	-
Stage 2	731	621	-				-	-	-	-	-	-
Platoon blocked, %							-	-	-	-	-	-
Mov Cap-1 Maneuver	304	0	570				1037	-	-	1196	-	-
Mov Cap-2 Maneuver	304	0	-				-	-	-	-	-	-
Stage 1	591	0	-				-	-	-	-	-	-
Stage 2	667	0	-				-	-	-	-	-	-
Approach	EB						NB			SB		
HCM Ctrl Dly, s/v	13.84						0			0.15		
HCM LOS	B											
Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	SBL	SBT	SBR					
Capacity (veh/h)	1037	-	-	422	35	-	-					
HCM Lane V/C Ratio	-	-	-	0.036	0.006	-	-					
HCM Ctrl Dly (s/v)	0	-	-	13.8	8	0	-					
HCM Lane LOS	A	-	-	B	A	A	-					
HCM 95th %tile Q(veh)	0	-	-	0.1	0	-	-					

Lanes, Volumes, Timings
4: Caroline Street South & Allen Street West

2027 Background PM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔				↔			↔			↔	
Traffic Volume (vph)	13	25	10	12	60	9	19	115	40	47	98	26
Future Volume (vph)	13	25	10	12	60	9	19	115	40	47	98	26
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	0.98				0.99			0.98			0.98	
Frt	0.972				0.985			0.969			0.979	
Flt Protected	0.987				0.993			0.995			0.986	
Satd. Flow (prot)	0	1452	0	0	1439	0	0	1431	0	0	1406	0
Flt Permitted	0.933				0.966			0.967			0.896	
Satd. Flow (perm)	0	1366	0	0	1392	0	0	1381	0	0	1267	0
Right Turn on Red			Yes				Yes			Yes		
Satd. Flow (RTOR)	10				9			24				
Link Speed (k/h)	50				50			50			50	
Link Distance (m)	81.6				87.7			93.6			95.7	
Travel Time (s)	5.9				6.3			6.7			6.9	
Conf. Peds. (#/hr)	18		34	34		18	73		35	35		73
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%	0%	0%	0%	5%	0%	0%	1%	5%	13%	0%	0%
Adj. Flow (vph)	13	25	10	12	60	9	19	115	40	47	98	26
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	48	0	0	81	0	0	174	0	0	171	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)	4.9				4.9			4.9			4.9	
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)	24		14	24		14	24		14	24		14
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	6.1	30.5		6.1	30.5		6.1	30.5		6.1	30.5	
Trailing Detector (m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Position(m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Size(m)	6.1	1.8		6.1	1.8		6.1	1.8		6.1	1.8	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(m)	28.7			28.7			28.7			28.7		
Detector 2 Size(m)	1.8			1.8			1.8			1.8		
Detector 2 Type	Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex		
Detector 2 Channel												
Detector 2 Extend (s)	0.0			0.0			0.0			0.0		
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases	4			8			2			6		
Permitted Phases	4			8			2			6		

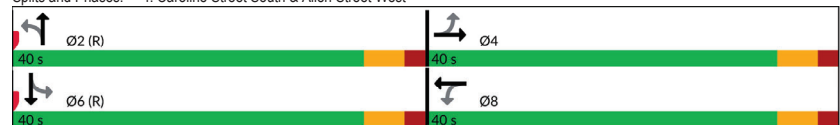
Lanes, Volumes, Timings
4: Caroline Street South & Allen Street West 2027 Background PM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

	↖	→	↗	↖	←	↖	↖	↑	↗	↘	↓	↘
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	4	4		8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	34.0	34.0		34.0	34.0		34.0	34.0		34.0	34.0	
Minimum Split (s)	40.0	40.0		40.0	40.0		40.0	40.0		40.0	40.0	
Total Split (s)	40.0	40.0		40.0	40.0		40.0	40.0		40.0	40.0	
Total Split (%)	50.0%	50.0%		50.0%	50.0%		50.0%	50.0%		50.0%	50.0%	
Maximum Green (s)	34.0	34.0		34.0	34.0		34.0	34.0		34.0	34.0	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Lost Time Adjust (s)		-2.0			-2.0			-2.0			-2.0	
Total Lost Time (s)		4.0			4.0			4.0			4.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		C-Max	C-Max		C-Max	C-Max	
Walk Time (s)	29.0	29.0		29.0	29.0		28.0	28.0		28.0	28.0	
Flash Don't Walk (s)	5.0	5.0		5.0	5.0		6.0	6.0		6.0	6.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)		36.0			36.0			53.6			53.6	
Actuated g/C Ratio		0.45			0.45			0.67			0.67	
v/c Ratio		0.08			0.13			0.19			0.20	
Control Delay (s/veh)		11.0			12.3			10.5			12.2	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay (s/veh)		11.0			12.3			10.5			12.2	
LOS		B			B			B			B	
Approach Delay (s/veh)		11.0			12.3			10.5			12.2	
Approach LOS		B			B			B			B	

Intersection Summary

Area Type:	Other
Cycle Length: 80	
Actuated Cycle Length: 80	
Offset: 60 (75%), Referenced to phase 2:NBT and 6:SBTL, Start of Green	
Natural Cycle: 80	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.20	
Intersection Signal Delay (s/veh): 11.5	Intersection LOS: B
Intersection Capacity Utilization 63.3%	ICU Level of Service B
Analysis Period (min) 15	

Splits and Phases: 4: Caroline Street South & Allen Street West



Queues
4: Caroline Street South & Allen Street West 2027 Background PM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

	→	←	↑	↓
Lane Group	EBT	WBT	NBT	SBT
Lane Group Flow (vph)	48	81	174	171
v/c Ratio	0.08	0.13	0.19	0.20
Control Delay (s/veh)	11.0	12.3	10.5	12.2
Queue Delay	0.0	0.0	0.0	0.0
Total Delay (s/veh)	11.0	12.3	10.5	12.2
Queue Length 50th (m)	3.1	6.1	13.5	15.9
Queue Length 95th (m)	8.8	13.8	26.4	29.4
Internal Link Dist (m)	57.6	63.7	69.6	71.7
Turn Bay Length (m)				
Base Capacity (vph)	620	631	933	849
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.08	0.13	0.19	0.20

Intersection Summary

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Lanes, Volumes, Timings
5: Caroline Street South & Site Access

2027 Background PM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

						
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	9	32	141	4	3	152
Future Volume (vph)	9	32	141	4	3	152
Ideal Flow (vphpl)	1765	1765	1650	1650	1650	1650
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt	0.895		0.996			
Flt Protected	0.989					0.999
Satd. Flow (prot)	1545	0	1609	0	0	1554
Flt Permitted	0.989					0.999
Satd. Flow (perm)	1545	0	1609	0	0	1554
Link Speed (k/h)	50		50			50
Link Distance (m)	57.9		95.7			59.8
Travel Time (s)	4.2		6.9			4.3
Confl. Peds. (#/hr)	2	3		30	30	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	0%	1%	0%	0%	5%
Adj. Flow (vph)	9	32	141	4	3	152
Shared Lane Traffic (%)						
Lane Group Flow (vph)	41	0	145	0	0	155
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)	4.9		4.9			4.9
Two way Left Turn Lane						
Headway Factor	1.12	1.12	1.21	1.21	1.21	1.21
Turning Speed (k/h)	24	14		14	24	
Sign Control	Stop		Free			Free
Intersection Summary						
Area Type:	Other					
Control Type:	Unsignalized					
Intersection Capacity Utilization	22.9%			ICU Level of Service A		
Analysis Period (min)	15					

HCM 7th TWSC
5: Caroline Street South & Site Access

2027 Background PM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

Intersection						
Int Delay, s/veh	1.2					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	9	32	141	4	3	152
Future Vol, veh/h	9	32	141	4	3	152
Conflicting Peds, #/hr	2	3	0	30	30	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	1	0	0	5
Mvmt Flow	9	32	141	4	3	152
Major/Minor	Minor1	Major1		Major2		
Conflicting Flow All	333	176	0	0	175	0
Stage 1	173	-	-	-	-	-
Stage 2	160	-	-	-	-	-
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	666	872	-	-	1414	-
Stage 1	862	-	-	-	-	-
Stage 2	874	-	-	-	-	-
Platoon blocked, %		-	-	-	-	-
Mov Cap-1 Maneuver	645	846	-	-	1374	-
Mov Cap-2 Maneuver	645	-	-	-	-	-
Stage 1	838	-	-	-	-	-
Stage 2	870	-	-	-	-	-
Approach	WB	NB		SB		
HCM Ctrl Dly, s/v	9.8	0		0.15		
HCM LOS	A					
Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT		
Capacity (veh/h)	-	-	792	35	-	
HCM Lane V/C Ratio	-	-	0.052	0.002	-	
HCM Ctrl Dly (s/v)	-	-	9.8	7.6	0	
HCM Lane LOS	-	-	A	A	A	
HCM 95th %tile Q(veh)	-	-	0.2	0	-	

Appendix F

2027 Total Traffic Operations Reports



Lanes, Volumes, Timings
1: Kuntz Lane & William Street West

2027 Total AM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

	→	↘	↙	←	↖	↗
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↗			↖		
Traffic Volume (vph)	486	10	3	297	0	0
Future Volume (vph)	486	10	3	297	0	0
Ideal Flow (vphpl)	1650	1650	1650	1650	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt	0.997					
Flt Protected						
Satd. Flow (prot)	1580	0	0	1585	0	0
Flt Permitted						
Satd. Flow (perm)	1580	0	0	1585	0	0
Link Speed (k/h)	50			50	50	
Link Distance (m)	50.7			48.6	58.5	
Travel Time (s)	3.7			3.5	4.2	
Confl. Peds. (#/hr)		14	14		4	2
Confl. Bikes (#/hr)	4			2		
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	3%	0%	0%	3%	0%	0%
Adj. Flow (vph)	486	10	3	297	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	496	0	0	300	0	0
Sign Control	Free			Free	Stop	

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	40.8%
ICU Level of Service	A
Analysis Period (min)	15

HCM Unsignalized Intersection Capacity Analysis
1: Kuntz Lane & William Street West

2027 Total AM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↗			↖		
Traffic Volume (veh/h)	486	10	3	297	0	0
Future Volume (Veh/h)	486	10	3	297	0	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	486	10	3	297	0	0
Pedestrians	4			2	14	
Lane Width (m)	3.5			3.5	0.0	
Walking Speed (m/s)	1.0			1.0	1.0	
Percent Blockage	0			0	0	
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)				48		
pX, platoon unblocked					0.93	
vC, conflicting volume			510		812	507
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			510		759	507
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	100
cM capacity (veh/h)			1065		348	569

Direction, Lane #	EB 1	WB 1
Volume Total	496	300
Volume Left	0	3
Volume Right	10	0
cSH	1700	1065
Volume to Capacity	0.29	0.00
Queue Length 95th (m)	0.0	0.1
Control Delay (s/veh)	0.0	0.1
Lane LOS		A
Approach Delay (s/veh)	0.0	0.1
Approach LOS		

Intersection Summary

Average Delay	0.0		
Intersection Capacity Utilization	40.8%	ICU Level of Service	A
Analysis Period (min)	15		

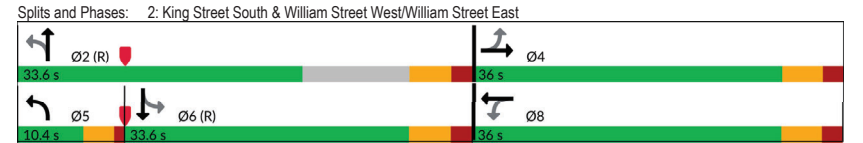
Lanes, Volumes, Timings
2: King Street South & William Street West/William Street East King Street South, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↰	↰	↰	↰	↰	↰	↰	↰	↰	↰	↰
Traffic Volume (vph)	70	400	16	41	180	8	56	185	76	15	139	64
Future Volume (vph)	70	400	16	41	180	8	56	185	76	15	139	64
Ideal Flow (vphpl)	1775	1650	1650	1775	1650	1650	1775	1650	1650	1775	1650	1650
Storage Length (m)	15.0		0.0	25.0		0.0	35.0		0.0	25.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	25.0			35.0			25.0			35.0		
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	0.98			0.99			0.96	0.98		0.97	0.97	
Frt	0.994				0.994			0.956			0.953	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1516	1589	0	1668	1588	0	1588	1395	0	1668	1443	0
Flt Permitted	0.607			0.350			0.518			0.598		
Satd. Flow (perm)	948	1589	0	609	1588	0	832	1395	0	1020	1443	0
Right Turn on Red			Yes			No			Yes			Yes
Satd. Flow (RTOR)		3						37			33	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		48.6			129.2			85.4			137.6	
Travel Time (s)		3.5			9.3			6.1			9.9	
Confl. Peds. (#/hr)	27		13	13		27	58		28	28		58
Confl. Bikes (#/hr)	1	4			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 (%)	10%	1%	25%	0%	2%	0%	5%	11%	7%	0%	4%	5%
Adj. Flow (vph)	70	400	16	41	180	8	56	185	76	15	139	64
Shared Lane Traffic (%)												
Lane Group Flow (vph)	70	416	0	41	188	0	56	261	0	15	203	0
Turn Type	Perm	NA		Perm	NA	pm+pt	NA		Perm	NA		
Protected Phases		4			8		5	2			6	
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		5	2		6	6	
Switch Phase												
Minimum Initial (s)	30.0	30.0		30.0	30.0		5.0	27.6		27.6	27.6	
Minimum Split (s)	36.0	36.0		36.0	36.0		9.0	33.6		33.6	33.6	
Total Split (s)	36.0	36.0		36.0	36.0		10.4	33.6		33.6	33.6	
Total Split (%)	45.0%	45.0%		45.0%	45.0%		13.0%	42.0%		42.0%	42.0%	
Yellow Time (s)	4.0	4.0		4.0	4.0		3.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		1.0	2.0		2.0	2.0	
Lost Time Adjust (s)	-2.0	-2.0		-2.0	-2.0		0.0	-2.0		-2.0	-2.0	
Total Lost Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lead/Lag							Lead			Lag		Lag
Lead-Lag Optimize?							Yes			Yes		Yes
Recall Mode	None	None		None	None		None	C-Max		C-Max	C-Max	
Act Effct Green (s)	32.0	32.0		32.0	32.0		40.0	40.0		33.8	33.8	
Actuated g/C Ratio	0.40	0.40		0.40	0.40		0.50	0.50		0.42	0.42	
v/c Ratio	0.18	0.65		0.17	0.30		0.12	0.36		0.03	0.32	
Control Delay (s/veh)	17.3	25.3		17.8	18.0		11.1	12.1		16.5	16.0	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay (s/veh)	17.3	25.3		17.8	18.0		11.1	12.1		16.5	16.0	
LOS	B	C		B	B		B	B		B	B	

Lanes, Volumes, Timings
2: King Street South & William Street West/William Street East King Street South, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Approach Delay (s/veh)	24.1			17.9			12.0			16.1		
Approach LOS	C			B			B			B		
Queue Length 50th (m)	6.7	49.6		3.9	18.9		4.2	19.2		1.4	18.1	
Queue Length 95th (m)	15.3	79.9		10.7	33.5		9.8	35.3		5.2	34.7	
Internal Link Dist (m)	24.6			105.2			61.4			113.6		
Turn Bay Length (m)	15.0			25.0			35.0			25.0		
Base Capacity (vph)	379	637		243	635		476	716		430	628	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.18	0.65		0.17	0.30		0.12	0.36		0.03	0.32	

Intersection Summary												
Area Type:	Other											
Cycle Length: 80												
Actuated Cycle Length: 80												
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBTL, Start of Green												
Natural Cycle: 80												
Control Type: Actuated-Coordinated												
Maximum v/c Ratio: 0.65												
Intersection Signal Delay (s/veh): 18.5	Intersection LOS: B											
Intersection Capacity Utilization 109.7%	ICU Level of Service H											
Analysis Period (min) 15												



Lanes, Volumes, Timings
3: King Street South & Kuntz Lane

2027 Total AM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔						↔			↔	
Traffic Volume (vph)	1	1	1	0	0	0	0	311	6	7	217	0
Future Volume (vph)	1	1	1	0	0	0	0	311	6	7	217	0
Ideal Flow (vphpl)	1550	1550	1550	1900	1900	1900	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		0.955						0.997				
Flt Protected		0.984									0.998	
Satd. Flow (prot)	0	1440	0	0	0	0	0	1430	0	0	1433	0
Flt Permitted		0.984									0.998	
Satd. Flow (perm)	0	1440	0	0	0	0	0	1430	0	0	1433	0
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		44.8			46.1			132.5			85.4	
Travel Time (s)		3.2			3.3			9.5			6.1	
Confl. Peds. (#/hr)	1					1	58		19	19		58
Confl. Bikes (#/hr)					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%	0%	0%	0%	0%	0%	0%	7%	0%	0%	7%	0%
Adj. Flow (vph)	1	1	1	0	0	0	0	311	6	7	217	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	3	0	0	0	0	0	317	0	0	224	0
Sign Control		Stop			Stop			Free			Free	

Intersection Summary												
Area Type:	Other											
Control Type:	Unsignalized											
Intersection Capacity Utilization 31.3%	ICU Level of Service A											
Analysis Period (min)	15											

HCM 7th TWSC
3: King Street South & Kuntz Lane

2027 Total AM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

Intersection												
Int Delay, s/veh	0.2											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔						↔			↔	
Traffic Vol, veh/h	1	1	1	0	0	0	0	311	6	7	217	0
Future Vol, veh/h	1	1	1	0	0	0	0	311	6	7	217	0
Conflicting Peds, #/hr	1	0	0	0	0	1	58	0	19	19	0	58
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	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	0	0	0	0	0	0	7	0	0	7	0
Mvmt Flow	1	1	1	0	0	0	0	311	6	7	217	0

Major/Minor	Minor2	Major1	Major2
Conflicting Flow All	601 625 275	275 0 0 336 0 0	
Stage 1	289 289 -	- - - - -	
Stage 2	312 336 -	- - - - -	
Critical Hdwy	6.4 6.5 6.2	4.1 - - 4.1 - -	
Critical Hdwy Stg 1	5.4 5.5 -	- - - - -	
Critical Hdwy Stg 2	5.4 5.5 -	- - - - -	
Follow-up Hdwy	3.5 4 3.3	2.2 - - 2.2 - -	
Pot Cap-1 Maneuver	467 404 769	1300 - - 1235 - -	
Stage 1	765 677 -	- - - - -	
Stage 2	747 645 -	- - - - -	
Platoon blocked, %		- - - - -	
Mov Cap-1 Maneuver	415 0 727	1229 - - 1235 - -	
Mov Cap-2 Maneuver	415 0 -	- - - - -	
Stage 1	723 0 -	- - - - -	
Stage 2	702 0 -	- - - - -	

Approach	EB	NB	SB
HCM Ctrl Dly, s/v	11.85	0	0.25
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	SBL	SBT	SBR
Capacity (veh/h)	1229	-	-	528	56	-	-
HCM Lane V/C Ratio	-	-	-	0.006	0.006	-	-
HCM Ctrl Dly (s/v)	0	-	-	11.9	7.9	0	-
HCM Lane LOS	A	-	-	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0	0	-	-

Lanes, Volumes, Timings
4: Caroline Street South & Allen Street West (250137) 171 King Street South, Waterloo TIS

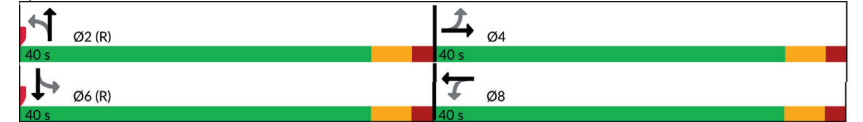
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	6	40	15	7	27	11	5	57	12	57	80	16
Future Volume (vph)	6	40	15	7	27	11	5	57	12	57	80	16
Ideal Flow (vphpl)	1550	1550	1550	1550	1550	1550	1550	1550	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	0.99			0.99			0.99			0.98		
Frt	0.967			0.967			0.978			0.986		
Flt Protected	0.995			0.992			0.997			0.982		
Satd. Flow (prot)	0	1428	0	0	1458	0	0	1420	0	0	1332	0
Flt Permitted	0.981			0.967			0.988			0.888		
Satd. Flow (perm)	0	1406	0	0	1415	0	0	1401	0	0	1194	0
Right Turn on Red		Yes			Yes			Yes			No	
Satd. Flow (RTOR)		15			11			12				
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		81.6			87.7			93.6			95.7	
Travel Time (s)		5.9			6.3			6.7			6.9	
Confl. Peds. (#/hr)	13		27	27		13	72		23	23		72
Confl. Bikes (#/hr)		2										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%	0%	0%	20%	4%	0%	22%	2%	9%
Adj. Flow (vph)	6	40	15	7	27	11	5	57	12	57	80	16
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	61	0	0	45	0	0	74	0	0	153	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases	4			8			2			6		
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	34.0	34.0		34.0	34.0		34.0	34.0		34.0	34.0	
Minimum Split (s)	40.0	40.0		40.0	40.0		40.0	40.0		40.0	40.0	
Total Split (s)	40.0	40.0		40.0	40.0		40.0	40.0		40.0	40.0	
Total Split (%)	50.0%	50.0%		50.0%	50.0%		50.0%	50.0%		50.0%	50.0%	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Lost Time Adjust (s)		-2.0			-2.0			-2.0			-2.0	
Total Lost Time (s)		4.0			4.0			4.0			4.0	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	None	None		None	None		C-Max	C-Max		C-Max	C-Max	
Act Effct Green (s)		36.0			36.0			53.6			53.6	
Actuated g/C Ratio		0.45			0.45			0.67			0.67	
v/c Ratio		0.10			0.07			0.08			0.19	
Control Delay (s/veh)		10.7			10.6			10.4			12.3	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay (s/veh)		10.7			10.6			10.4			12.3	
LOS		B			B			B			B	
Approach Delay (s/veh)		10.7			10.6			10.4			12.3	
Approach LOS		B			B			B			B	
Queue Length 50th (m)		3.8			2.8			5.2			14.1	

Lanes, Volumes, Timings
4: Caroline Street South & Allen Street West (250137) 171 King Street South, Waterloo TIS

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 95th (m)		10.3			8.3			12.5			26.7	
Internal Link Dist (m)		57.6			63.7			69.6			71.7	
Turn Bay Length (m)												
Base Capacity (vph)		640			642			943			800	
Starvation Cap Reductn		0			0			0			0	
Spillback Cap Reductn		0			0			0			0	
Storage Cap Reductn		0			0			0			0	
Reduced v/c Ratio		0.10			0.07			0.08			0.19	

Intersection Summary	
Area Type:	Other
Cycle Length: 80	
Actuated Cycle Length: 80	
Offset: 60 (75%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green	
Natural Cycle: 80	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.19	
Intersection Signal Delay (s/veh): 11.3	Intersection LOS: B
Intersection Capacity Utilization 63.3%	ICU Level of Service B
Analysis Period (min) 15	

Spits and Phases: 4: Caroline Street South & Allen Street West



Lanes, Volumes, Timings
 5: Caroline Street South & Site Access 2027 Total AM Peak Hour (without LRT)
 (250137) 171 King Street South, Waterloo TIS

						
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	28	48	82	4	5	129
Future Volume (vph)	28	48	82	4	5	129
Ideal Flow (vphpl)	1765	1765	1650	1650	1650	1650
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt	0.915		0.994			
Flt Protected	0.982					0.998
Satd. Flow (prot)	1568	0	1577	0	0	1499
Flt Permitted	0.982					0.998
Satd. Flow (perm)	1568	0	1577	0	0	1499
Link Speed (k/h)	50		50			50
Link Distance (m)	57.9		95.7			59.8
Travel Time (s)	4.2		6.9			4.3
Confl. Peds. (#/hr)	2	2		22	22	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	0%	3%	0%	0%	9%
Adj. Flow (vph)	28	48	82	4	5	129
Shared Lane Traffic (%)						
Lane Group Flow (vph)	76	0	86	0	0	134
Sign Control	Stop		Free			Free
Intersection Summary						
Area Type:	Other					
Control Type:	Unsignalized					
Intersection Capacity Utilization	24.7%			ICU Level of Service A		
Analysis Period (min)	15					

HCM 7th TWSC 2027 Total AM Peak Hour (without LRT)
 5: Caroline Street South & Site Access (250137) 171 King Street South, Waterloo TIS

Intersection						
Int Delay, s/veh	2.6					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	W		R			L
Traffic Vol, veh/h	28	48	82	4	5	129
Future Vol, veh/h	28	48	82	4	5	129
Conflicting Peds, #/hr	2	2	0	22	22	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	3	0	0	9
Mvmt Flow	28	48	82	4	5	129
Major/Minor						
Minor1	Major1		Major2			
Conflicting Flow All	247	108	0	0	108	0
Stage 1	106	-	-	-	-	-
Stage 2	141	-	-	-	-	-
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	746	951	-	-	1495	-
Stage 1	923	-	-	-	-	-
Stage 2	891	-	-	-	-	-
Platoon blocked, %	-	-	-	-	-	-
Mov Cap-1 Maneuver	726	930	-	-	1465	-
Mov Cap-2 Maneuver	726	-	-	-	-	-
Stage 1	904	-	-	-	-	-
Stage 2	886	-	-	-	-	-
Approach						
WB	NB		SB			
HCM Ctrl Dly, s/v	9.69	0	0.28			
HCM LOS	A					
Minor Lane/Major Mvmt						
NBT	NBRWBLn1	SBL	SBT			
Capacity (veh/h)	-	-	843	67	-	-
HCM Lane V/C Ratio	-	-	0.09	0.003	-	-
HCM Ctrl Dly (s/v)	-	-	9.7	7.5	0	-
HCM Lane LOS	-	-	A	A	A	-
HCM 95th %tile Q(veh)	-	-	0.3	0	-	-

Lanes, Volumes, Timings
1: Kuntz Lane & William Street West

2027 Total PM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

						
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	412	0	2	461	0	0
Future Volume (vph)	412	0	2	461	0	0
Ideal Flow (vphpl)	1650	1650	1650	1650	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt						
Flt Protected						
Satd. Flow (prot)	1584	0	0	1616	0	0
Flt Permitted						
Satd. Flow (perm)	1584	0	0	1616	0	0
Link Speed (k/h)	50			50	50	
Link Distance (m)	50.7			48.6	58.5	
Travel Time (s)	3.7			3.5	4.2	
Confl. Peds. (#/hr)		13	13			
Confl. Bikes (#/hr)	1		2	2		1
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	3%	0%	0%	1%	0%	0%
Adj. Flow (vph)	412	0	2	461	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	412	0	0	463	0	0
Sign Control	Free			Free	Stop	
Intersection Summary						
Area Type:	Other					
Control Type:	Unsignalized					
Intersection Capacity Utilization	33.1%			ICU Level of Service A		
Analysis Period (min)	15					

HCM Unsignalized Intersection Capacity Analysis
1: Kuntz Lane & William Street West

2027 Total PM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↗			↖		
Traffic Volume (veh/h)	412	0	2	461	0	0
Future Volume (Veh/h)	412	0	2	461	0	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	412	0	2	461	0	0
Pedestrians					13	
Lane Width (m)					0.0	
Walking Speed (m/s)					1.0	
Percent Blockage					0	
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)				48		
pX, platoon unblocked					0.85	
vC, conflicting volume			425		890	425
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			425		785	425
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	100
cM capacity (veh/h)			1145		310	634
Direction, Lane #	EB 1	WB 1				
Volume Total	412	463				
Volume Left	0	2				
Volume Right	0	0				
cSH	1700	1145				
Volume to Capacity	0.24	0.00				
Queue Length 95th (m)	0.0	0.0				
Control Delay (s/veh)	0.0	0.1				
Lane LOS		A				
Approach Delay (s/veh)	0.0	0.1				
Approach LOS						
Intersection Summary						
Average Delay		0.0				
Intersection Capacity Utilization		33.1%		ICU Level of Service		A
Analysis Period (min)		15				

Lanes, Volumes, Timings
2: King Street South & William Street West/William Street East King Street South, Waterloo TIS

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱		↰	↱		↰	↱		↰	↱	
Traffic Volume (vph)	52	337	23	65	300	9	75	209	67	12	269	88
Future Volume (vph)	52	337	23	65	300	9	75	209	67	12	269	88
Ideal Flow (vphpl)	1775	1650	1650	1775	1650	1650	1775	1650	1650	1775	1650	1650
Storage Length (m)	15.0		0.0	25.0		0.0	35.0		0.0	25.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	25.0			35.0			25.0			35.0		
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	0.98	1.00		0.98	1.00		0.93	0.98		0.96	0.96	
Frt		0.990			0.996			0.964			0.963	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1573	1574	0	1635	1622	0	1668	1464	0	1668	1458	0
Flt Permitted	0.466			0.410			0.345			0.590		
Satd. Flow (perm)	755	1574	0	693	1622	0	563	1464	0	991	1458	0
Right Turn on Red			Yes			No			Yes			Yes
Satd. Flow (RTOR)		5						29			23	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		48.6			129.2			85.4			137.6	
Travel Time (s)		3.5			9.3			6.1			9.9	
Confl. Peds. (#/hr)	28		26	26		28	104		44	44		104
Confl. Bikes (#/hr)		1			1			1		1	2	2
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 (%)	6%	1%	21%	2%	0%	0%	7%	0%	0%	0%	3%	4%
Adj. Flow (vph)	52	337	23	65	300	9	75	209	67	12	269	88
Shared Lane Traffic (%)												
Lane Group Flow (vph)	52	360	0	65	309	0	75	276	0	12	357	0
Turn Type	Perm	NA		Perm	NA	pm+pt	NA		Perm	NA		
Protected Phases		4			8		5	2			6	
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		5	2		6	6	
Switch Phase												
Minimum Initial (s)	30.0	30.0		30.0	30.0		5.0	27.6		27.6	27.6	
Minimum Split (s)	36.0	36.0		36.0	36.0		9.0	33.6		33.6	33.6	
Total Split (s)	36.0	36.0		36.0	36.0		10.4	33.6		33.6	33.6	
Total Split (%)	45.0%	45.0%		45.0%	45.0%		13.0%	42.0%		42.0%	42.0%	
Yellow Time (s)	4.0	4.0		4.0	4.0		3.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		1.0	2.0		2.0	2.0	
Lost Time Adjust (s)	-2.0	-2.0		-2.0	-2.0		0.0	-2.0		-2.0	-2.0	
Total Lost Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lead/Lag							Lead			Lag		Lag
Lead-Lag Optimize?							Yes			Yes		Yes
Recall Mode	None	None		None	None		None	C-Max		C-Max	C-Max	
Act Effct Green (s)	32.0	32.0		32.0	32.0		40.0	40.0		31.7	31.7	
Actuated g/C Ratio	0.40	0.40		0.40	0.40		0.50	0.50		0.40	0.40	
v/c Ratio	0.17	0.57		0.23	0.48		0.20	0.37		0.03	0.61	
Control Delay (s/veh)	17.4	22.7		18.8	20.9		11.9	12.6		16.6	24.1	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay (s/veh)	17.4	22.7		18.8	20.9		11.9	12.6		16.6	24.1	
LOS	B	C		B	C		B	B		B	C	

Lanes, Volumes, Timings
2: King Street South & William Street West/William Street East King Street South, Waterloo TIS

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Approach Delay (s/veh)	22.1				20.5					12.5		23.9
Approach LOS	C				C					B		C
Queue Length 50th (m)	5.0	40.8		6.4	33.8		5.6	21.4		1.1	41.1	
Queue Length 95th (m)	12.5	66.6		15.4	55.8		12.2	38.0		4.4	69.6	
Internal Link Dist (m)		24.6			105.2			61.4			113.6	
Turn Bay Length (m)	15.0			25.0			35.0			25.0		
Base Capacity (vph)	302	632		277	648		369	746		392	590	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.17	0.57		0.23	0.48		0.20	0.37		0.03	0.61	

Intersection Summary												
Area Type:	Other											
Cycle Length: 80												
Actuated Cycle Length: 80												
Offset: 26.4 (33%), Referenced to phase 2:NBT and 6:SBTL, Start of Green												
Natural Cycle: 80												
Control Type: Actuated-Coordinated												
Maximum v/c Ratio: 0.61												
Intersection Signal Delay (s/veh): 19.9	Intersection LOS: B											
Intersection Capacity Utilization 109.3%	ICU Level of Service H											
Analysis Period (min) 15												



Lanes, Volumes, Timings
3: King Street South & Kuntz Lane

2027 Total PM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔						↔			↔	
Traffic Volume (vph)	6	0	9	0	0	0	0	332	6	7	356	0
Future Volume (vph)	6	0	9	0	0	0	0	332	6	7	356	0
Ideal Flow (vphpl)	1550	1550	1550	1900	1900	1900	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		0.919						0.998				
Flt Protected		0.980									0.999	
Satd. Flow (prot)	0	1380	0	0	0	0	0	1445	0	0	1473	0
Flt Permitted		0.980									0.999	
Satd. Flow (perm)	0	1380	0	0	0	0	0	1445	0	0	1473	0
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		44.8			46.1			132.5			85.4	
Travel Time (s)		3.2			3.3			9.5			6.1	
Confl. Peds. (#/hr)	1					1	86		36	36		86
Confl. Bikes (#/hr)								1			4	
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%	0%	0%	0%	0%	0%	0%	6%	0%	0%	4%	0%
Adj. Flow (vph)	6	0	9	0	0	0	0	332	6	7	356	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	15	0	0	0	0	0	338	0	0	363	0
Sign Control		Stop			Stop			Free			Free	

Intersection Summary												
Area Type:	Other											
Control Type:	Unsignalized											
Intersection Capacity Utilization	44.3%											
Analysis Period (min)	15											
	ICU Level of Service A											

HCM 7th TWSC
3: King Street South & Kuntz Lane

2027 Total PM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

Intersection												
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	6	0	9	0	0	0	0	332	6	7	356	0
Future Vol, veh/h	6	0	9	0	0	0	0	332	6	7	356	0
Conflicting Peds, #/hr	1	0	0	0	0	1	86	0	36	36	0	86
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	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	0	0	0	0	0	0	6	0	0	4	0
Mvmt Flow	6	0	9	0	0	0	0	332	6	7	356	0

Major/Minor	Minor2	Major1	Major2
Conflicting Flow All	789 830 442	442 0 0 374 0 0	
Stage 1	456 456 -	- - - - -	
Stage 2	333 374 -	- - - - -	
Critical Hdwy	6.4 6.5 6.2	4.1 - - 4.1 - -	
Critical Hdwy Stg 1	5.4 5.5 -	- - - - -	
Critical Hdwy Stg 2	5.4 5.5 -	- - - - -	
Follow-up Hdwy	3.5 4 3.3	2.2 - - 2.2 - -	
Pot Cap-1 Maneuver	362 308 620	1129 - - 1196 - -	
Stage 1	643 572 -	- - - - -	
Stage 2	731 621 -	- - - - -	
Platoon blocked, %		- - - - -	
Mov Cap-1 Maneuver	304 0 570	1038 - - 1196 - -	
Mov Cap-2 Maneuver	304 0 -	- - - - -	
Stage 1	591 0 -	- - - - -	
Stage 2	667 0 -	- - - - -	

Approach	EB	NB	SB
HCM Ctrl Dly, s/v	13.83	0	0.15
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	SBL	SBT	SBR
Capacity (veh/h)	1038	-	-	423	35	-	-
HCM Lane V/C Ratio	-	-	-	0.036	0.006	-	-
HCM Ctrl Dly (s/v)	0	-	-	13.8	8	0	-
HCM Lane LOS	A	-	-	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0.1	0	-	-

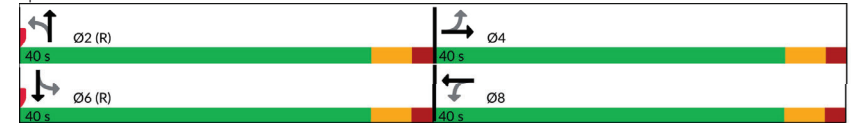
Lanes, Volumes, Timings
4: Caroline Street South & Allen Street West (250137) 171 King Street South, Waterloo TIS

	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												
Traffic Volume (vph)	17	25	10	12	60	12	19	122	40	50	93	27
Future Volume (vph)	17	25	10	12	60	12	19	122	40	50	93	27
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		0.98			0.99			0.98			0.97	
Frt		0.974			0.981			0.970			0.979	
Flt Protected		0.984			0.993			0.995			0.986	
Satd. Flow (prot)	0	1452	0	0	1433	0	0	1434	0	0	1402	0
Flt Permitted		0.922			0.970			0.967			0.883	
Satd. Flow (perm)	0	1352	0	0	1393	0	0	1384	0	0	1244	0
Right Turn on Red		Yes			Yes			Yes			No	
Satd. Flow (RTOR)		10			12			23				
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		81.6			87.7			93.6			95.7	
Travel Time (s)		5.9			6.3			6.7			6.9	
Confl. Peds. (#/hr)	18		34	34		18	73		35	35		73
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%	0%	0%	0%	5%	0%	0%	1%	5%	13%	0%	0%
Adj. Flow (vph)	17	25	10	12	60	12	19	122	40	50	93	27
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	52	0	0	84	0	0	181	0	0	170	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	34.0	34.0		34.0	34.0		34.0	34.0		34.0	34.0	
Minimum Split (s)	40.0	40.0		40.0	40.0		40.0	40.0		40.0	40.0	
Total Split (s)	40.0	40.0		40.0	40.0		40.0	40.0		40.0	40.0	
Total Split (%)	50.0%	50.0%		50.0%	50.0%		50.0%	50.0%		50.0%	50.0%	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Lost Time Adjust (s)		-2.0			-2.0			-2.0			-2.0	
Total Lost Time (s)		4.0			4.0			4.0			4.0	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	None	None		None		C-Max	C-Max		C-Max	C-Max		
Act Effct Green (s)		36.0			36.0			44.8			44.8	
Actuated g/C Ratio		0.45			0.45			0.56			0.56	
v/c Ratio		0.08			0.13			0.23			0.24	
Control Delay (s/veh)		11.2			11.9			12.5			14.5	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay (s/veh)		11.2			11.9			12.5			14.5	
LOS		B			B			B			B	
Approach Delay (s/veh)		11.2			11.9			12.5			14.5	
Approach LOS		B			B			B			B	
Queue Length 50th (m)		3.5			6.1			14.3			15.8	
Queue Length 95th (m)		9.5			14.0			27.5			29.4	

Lanes, Volumes, Timings
4: Caroline Street South & Allen Street West (250137) 171 King Street South, 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
Internal Link Dist (m)		57.6			63.7			69.6			71.7	
Turn Bay Length (m)												
Base Capacity (vph)		613			633			785			696	
Starvation Cap Reductn		0			0			0			0	
Spillback Cap Reductn		0			0			0			0	
Storage Cap Reductn		0			0			0			0	
Reduced v/c Ratio		0.08			0.13			0.23			0.24	
Intersection Summary												
Area Type:	Other											
Cycle Length: 80												
Actuated Cycle Length: 80												
Offset: 60 (75%), Referenced to phase 2:NBT and 6:SBTL, Start of Green												
Natural Cycle: 80												
Control Type: Actuated-Coordinated												
Maximum v/c Ratio: 0.24												
Intersection Signal Delay (s/veh): 13.0	Intersection LOS: B											
Intersection Capacity Utilization 63.3%	ICU Level of Service B											
Analysis Period (min) 15												

Splits and Phases: 4: Caroline Street South & Allen Street West



Lanes, Volumes, Timings
5: Caroline Street South & Site Access

2027 Total PM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	8	13	141	18	30	152
Future Volume (vph)	8	13	141	18	30	152
Ideal Flow (vphpl)	1765	1765	1650	1650	1650	1650
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt	0.916		0.985			
Flt Protected	0.981				0.992	
Satd. Flow (prot)	1568		0	1593	0	0
Flt Permitted	0.981				0.992	
Satd. Flow (perm)	1568		0	1593	0	0
Link Speed (k/h)	50		50		50	
Link Distance (m)	57.9		95.7		59.8	
Travel Time (s)	4.2		6.9		4.3	
Confl. Peds. (#/hr)	2		3		30	30
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	0%	1%	0%	0%	5%
Adj. Flow (vph)	8	13	141	18	30	152
Shared Lane Traffic (%)						
Lane Group Flow (vph)	21	0	159	0	0	182
Sign Control	Stop		Free		Free	
Intersection Summary						
Area Type:	Other					
Control Type:	Unsignalized					
Intersection Capacity Utilization	37.6%			ICU Level of Service A		
Analysis Period (min)	15					

HCM 7th TWSC
5: Caroline Street South & Site Access

2027 Total PM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

Intersection						
Int Delay, s/veh	1.2					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	W		T			T
Traffic Vol, veh/h	8	13	141	18	30	152
Future Vol, veh/h	8	13	141	18	30	152
Conflicting Peds, #/hr	2	3	0	30	30	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	1	0	0	5
Mvmt Flow	8	13	141	18	30	152
Major/Minor						
Minor1	Major1		Major2			
Conflicting Flow All	394	183	0	0	189	0
Stage 1	180	-	-	-	-	-
Stage 2	214	-	-	-	-	-
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	615	865	-	-	1397	-
Stage 1	856	-	-	-	-	-
Stage 2	826	-	-	-	-	-
Platoon blocked, %	-	-	-	-	-	-
Mov Cap-1 Maneuver	582	838	-	-	1358	-
Mov Cap-2 Maneuver	582	-	-	-	-	-
Stage 1	832	-	-	-	-	-
Stage 2	805	-	-	-	-	-
Approach						
WB	NB		SB			
HCM Ctrl Dly, s/v	10.17	0	1.27			
HCM LOS	B					
Minor Lane/Major Mvmt						
NBT	NBRWBLn1	SBL	SBT			
Capacity (veh/h)	-	-	718	297	-	-
HCM Lane V/C Ratio	-	-	0.029	0.022	-	-
HCM Ctrl Dly (s/v)	-	-	10.2	7.7	0	-
HCM Lane LOS	-	-	B	A	A	-
HCM 95th %tile Q(veh)	-	-	0.1	0.1	-	-

Appendix G

2028 Background Traffic Operations Reports



Lanes, Volumes, Timings
1: Kuntz Lane & William Street West

2028 Background AM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

						
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	476	10	3	300	0	0
Future Volume (vph)	476	10	3	300	0	0
Ideal Flow (vphpl)	1650	1650	1650	1650	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt	0.997					
Flt Protected						
Satd. Flow (prot)	1580	0	0	1585	0	0
Flt Permitted						
Satd. Flow (perm)	1580	0	0	1585	0	0
Link Speed (k/h)	40			40	50	
Link Distance (m)	50.7			48.6	58.5	
Travel Time (s)	4.6			4.4	4.2	
Confl. Peds. (#/hr)		14	14		4	2
Confl. Bikes (#/hr)	4			2		
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	3%	0%	0%	3%	0%	0%
Adj. Flow (vph)	476	10	3	300	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	486	0	0	303	0	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.5			3.5	0.0	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.9			4.9	4.9	
Two way Left Turn Lane						
Headway Factor	1.21	1.21	1.21	1.21	1.01	1.01
Turning Speed (k/h)		14	24		24	14
Sign Control	Free			Free	Stop	
Intersection Summary						
Area Type:	Other					
Control Type:	Unsignalized					
Intersection Capacity Utilization	40.2%		ICU Level of Service A			
Analysis Period (min)	15					

HCM Unsignalized Intersection Capacity Analysis2028 Background AM Peak Hour (without LRT)
1: Kuntz Lane & William Street West (250137) 171 King Street South, Waterloo TIS

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	476	10	3	300	0	0
Future Volume (Veh/h)	476	10	3	300	0	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	476	10	3	300	0	0
Pedestrians	4			2	14	
Lane Width (m)	3.5			3.5	0.0	
Walking Speed (m/s)	1.0			1.0	1.0	
Percent Blockage	0			0	0	
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)				48		
pX, platoon unblocked					0.93	
vC, conflicting volume			500		805	497
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			500		754	497
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	100
cM capacity (veh/h)			1075		352	576
Direction, Lane #	EB 1	WB 1				
Volume Total	486	303				
Volume Left	0	3				
Volume Right	10	0				
cSH	1700	1075				
Volume to Capacity	0.29	0.00				
Queue Length 95th (m)	0.0	0.1				
Control Delay (s/veh)	0.0	0.1				
Lane LOS		A				
Approach Delay (s/veh)	0.0	0.1				
Approach LOS						
Intersection Summary						
Average Delay			0.0			
Intersection Capacity Utilization		40.2%		ICU Level of Service		A
Analysis Period (min)		15				

Lanes, Volumes, Timings
2: King Street South & William Street West/William Street East King Street South, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	←	←	←	←	←	←	←	←	←	←	←	←
Traffic Volume (vph)	65	394	17	42	182	8	57	188	77	16	141	64
Future Volume (vph)	65	394	17	42	182	8	57	188	77	16	141	64
Ideal Flow (vphpl)	1775	1650	1650	1775	1650	1650	1775	1650	1650	1775	1650	1650
Storage Length (m)	15.0	0.0	25.0	0.0	35.0	0.0	35.0	0.0	25.0	0.0	35.0	0.0
Storage Lanes	1	0	1	0	1	0	1	0	1	0	1	0
Taper Length (m)	25.0			35.0			25.0			35.0		
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	0.97	1.00	0.99	1.00	0.94	0.98	0.97	0.97	0.97	0.97	0.97	0.97
Frt	0.994			0.994			0.956			0.953		
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1516	1588	0	1668	1588	0	1588	1395	0	1668	1443	0
Flt Permitted	0.605			0.355			0.516			0.596		
Satd. Flow (perm)	939	1588	0	618	1588	0	814	1395	0	1017	1443	0
Right Turn on Red		Yes			No			Yes			Yes	
Satd. Flow (RTOR)	3						37			32		
Link Speed (k/h)	40				40		50			50		
Link Distance (m)	48.6				129.2		85.4			137.6		
Travel Time (s)	4.4				11.6		6.1			9.9		
Confl. Peds. (#/hr)	27		13	13		27	58		28	28		58
Confl. Bikes (#/hr)	1	4			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 (%)	10%	1%	25%	0%	2%	0%	5%	11%	7%	0%	4%	5%
Adj. Flow (vph)	65	394	17	42	182	8	57	188	77	16	141	64
Shared Lane Traffic (%)												
Lane Group Flow (vph)	65	411	0	42	190	0	57	265	0	16	205	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)	3.5				3.5			3.5			3.5	
Link Offset(m)	0.0				0.0			0.0			0.0	
Crosswalk Width(m)	4.9				4.9			4.9			4.9	
Two way Left Turn Lane												
Headway Factor	1.11	1.21	1.21	1.11	1.21	1.21	1.11	1.21	1.21	1.11	1.21	1.21
Turning Speed (k/h)	24		14	24		14	24		14	24		14
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	6.1	30.5		6.1	30.5		6.1	30.5		6.1	30.5	
Trailing Detector (m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Position(m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Size(m)	6.1	1.8		6.1	1.8		6.1	1.8		6.1	1.8	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(m)	28.7			28.7			28.7			28.7		
Detector 2 Size(m)	1.8			1.8			1.8			1.8		
Detector 2 Type	Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex		
Detector 2 Channel												

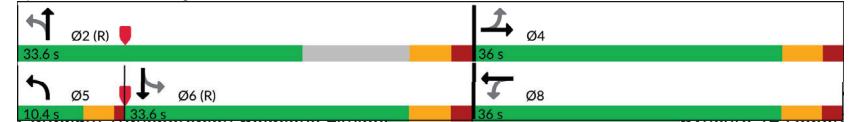
Lanes, Volumes, Timings
2: King Street South & William Street West/William Street East King Street South, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA		Perm	NA		pm+pt	NA		Perm	NA	
Protected Phases		4			8		5	2			6	
Permitted Phases	4				8		2			6		
Detector Phase	4	4			8	8	5	2		6	6	
Switch Phase												
Minimum Initial (s)	30.0	30.0		30.0	30.0		5.0	27.6		27.6	27.6	
Minimum Split (s)	36.0	36.0		36.0	36.0		9.0	33.6		33.6	33.6	
Total Split (s)	36.0	36.0		36.0	36.0		10.4	33.6		33.6	33.6	
Total Split (%)	45.0%	45.0%		45.0%	45.0%		13.0%	42.0%		42.0%	42.0%	
Maximum Green (s)	30.0	30.0		30.0	30.0		6.4	27.6		27.6	27.6	
Yellow Time (s)	4.0	4.0		4.0	4.0		3.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		1.0	2.0		2.0	2.0	
Lost Time Adjust (s)	-2.0	-2.0		-2.0	-2.0		0.0	-2.0		-2.0	-2.0	
Total Lost Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lead/Lag							Lead			Lag	Lag	
Lead-Lag Optimize?							Yes			Yes	Yes	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		None	C-Max		C-Max	C-Max	
Walk Time (s)	19.0	19.0		19.0	19.0		21.6			21.6		
Flash Don't Walk (s)	11.0	11.0		11.0	11.0		6.0			6.0	6.0	
Pedestrian Calls (#/hr)	0	0		0	0		0			0	0	
Act Effect Green (s)	32.0	32.0		32.0	32.0		40.0	40.0		33.8	33.8	
Actuated g/C Ratio	0.40	0.40		0.40	0.40		0.50	0.50		0.42	0.42	
v/c Ratio	0.17	0.65		0.17	0.30		0.12	0.37		0.04	0.33	
Control Delay (s/veh)	17.1	25.0		17.8	18.0		11.1	12.2		16.5	16.2	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay (s/veh)	17.1	25.0		17.8	18.0		11.1	12.2		16.5	16.2	
LOS	B	C		B	B		B	B		B	B	
Approach Delay (s/veh)		23.9			18.0			12.0			16.2	
Approach LOS		C			B			B			B	

Intersection Summary

Area Type:	Other
Cycle Length: 80	
Actuated Cycle Length: 80	
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBTL, Start of Green	
Natural Cycle: 80	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.65	
Intersection Signal Delay (s/veh): 18.4	Intersection LOS: B
Intersection Capacity Utilization 109.5%	ICU Level of Service H
Analysis Period (min) 15	

Splits and Phases: 2: King Street South & William Street West/William Street East



Queues
2: King Street South & William Street West/William Street East
250137) 171 King Street South, Waterloo TIS

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	65	411	42	190	57	265	16	205
v/c Ratio	0.17	0.65	0.17	0.30	0.12	0.37	0.04	0.33
Control Delay (s/veh)	17.1	25.0	17.8	18.0	11.1	12.2	16.5	16.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (s/veh)	17.1	25.0	17.8	18.0	11.1	12.2	16.5	16.2
Queue Length 50th (m)	6.2	48.8	4.0	19.2	4.2	19.6	1.5	18.4
Queue Length 95th (m)	14.5	78.9	11.0	33.9	9.8	36.0	5.4	35.3
Internal Link Dist (m)		24.6		105.2		61.4		113.6
Turn Bay Length (m)	15.0		25.0		35.0		25.0	
Base Capacity (vph)	375	637	247	635	468	716	429	627
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.17	0.65	0.17	0.30	0.12	0.37	0.04	0.33
Intersection Summary								

Lanes, Volumes, Timings
3: King Street South & Kuntz Lane
250137) 171 King Street South, 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		↔						↔			↔	
Traffic Volume (vph)	1	1	1	0	0	0	1	315	6	7	220	0
Future Volume (vph)	1	1	1	0	0	0	1	315	6	7	220	0
Ideal Flow (vphpl)	1550	1550	1550	1900	1900	1900	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		0.955						0.997				
Flt Protected		0.984									0.998	
Satd. Flow (prot)	0	1440	0	0	0	0	0	1430	0	0	1433	0
Flt Permitted		0.984									0.998	
Satd. Flow (perm)	0	1440	0	0	0	0	0	1430	0	0	1433	0
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		44.8			46.1			132.5			85.4	
Travel Time (s)		3.2			3.3			9.5			6.1	
Confl. Peds. (#/hr)	1					1	58		19	19		58
Confl. Bikes (#/hr)					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%	0%	0%	0%	0%	0%	0%	7%	0%	0%	7%	0%
Adj. Flow (vph)	1	1	1	0	0	0	1	315	6	7	220	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	3	0	0	0	0	0	322	0	0	227	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			3.5			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.9			1.6			4.9			4.9	
Two way Left Turn Lane												
Headway Factor	1.31	1.31	1.31	1.01	1.01	1.01	1.31	1.31	1.31	1.31	1.31	1.31
Turning Speed (k/h)	24		14	24		14	24		14	24		14
Sign Control		Stop			Stop			Free			Free	
Intersection Summary												
Area Type:	Other											
Control Type:	Unsignalized											
Intersection Capacity Utilization	31.6%											
Analysis Period (min)	15											
	ICU Level of Service A											

HCM 7th TWSC
3: King Street South & Kuntz Lane

2028 Background AM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

Intersection												
Int Delay, s/veh	0.2											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔↔↔↔↔↔↔↔↔↔↔											
Traffic Vol, veh/h	1	1	1	0	0	0	1	315	6	7	220	0
Future Vol, veh/h	1	1	1	0	0	0	1	315	6	7	220	0
Conflicting Peds, #/hr	1	0	0	0	0	1	58	0	19	19	0	58
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	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	0	0	0	0	0	0	7	0	0	7	0
Mvmt Flow	1	1	1	0	0	0	1	315	6	7	220	0
Major/Minor	Minor2			Major1			Major2					
Conflicting Flow All	610	634	278	278			0	0	340	0	0	
Stage 1	292	292	-	-			-	-	-	-	-	
Stage 2	318	342	-	-			-	-	-	-	-	
Critical Hdwy	6.4	6.5	6.2	4.1			-	-	4.1	-	-	
Critical Hdwy Stg 1	5.4	5.5	-	-			-	-	-	-	-	
Critical Hdwy Stg 2	5.4	5.5	-	-			-	-	-	-	-	
Follow-up Hdwy	3.5	4	3.3	2.2			-	-	2.2	-	-	
Pot Cap-1 Maneuver	461	399	766	1296			-	-	1230	-	-	
Stage 1	762	675	-	-			-	-	-	-	-	
Stage 2	742	642	-	-			-	-	-	-	-	
Platoon blocked, %							-	-	-	-	-	
Mov Cap-1 Maneuver	409	0	724	1226			-	-	1230	-	-	
Mov Cap-2 Maneuver	409	0	-	-			-	-	-	-	-	
Stage 1	721	0	-	-			-	-	-	-	-	
Stage 2	697	0	-	-			-	-	-	-	-	
Approach	EB			NB			SB					
HCM Ctrl Dly, s/v	11.92			0.02			0.24					
HCM LOS	B											
Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	SBL	SBT	SBR					
Capacity (veh/h)	6	-	-	523	56	-	-					
HCM Lane V/C Ratio	0.001	-	-	0.006	0.006	-	-					
HCM Ctrl Dly (s/v)	7.9	0	-	11.9	7.9	0	-					
HCM Lane LOS	A	A	-	B	A	A	-					
HCM 95th %tile Q(veh)	0	-	-	0	0	-	-					

Lanes, Volumes, Timings
4: Caroline Street South & Allen Street West

2028 Background AM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔			↔			↔			↔		
Traffic Volume (vph)	6	41	16	7	27	12	5	60	12	38	87	12
Future Volume (vph)	6	41	16	7	27	12	5	60	12	38	87	12
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	0.99			0.99			0.99			0.98		
Frt	0.966			0.965			0.979			0.988		
Flt Protected	0.995			0.992			0.997			0.986		
Satd. Flow (prot)	0	1426	0	0	1454	0	0	1422	0	0	1368	0
Flt Permitted	0.981			0.968			0.989			0.923		
Satd. Flow (perm)	0	1404	0	0	1412	0	0	1405	0	0	1272	0
Right Turn on Red	Yes			Yes			Yes			No		
Satd. Flow (RTOR)	16			12			12					
Link Speed (k/h)	50			50			50			50		
Link Distance (m)	81.6			87.7			93.6			95.7		
Travel Time (s)	5.9			6.3			6.7			6.9		
Conf. Peds. (#/hr)	13	27		27	13		72	23		23	72	
Conf. Bikes (#/hr)	2											
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%	0%	0%	20%	4%	0%	22%	2%	9%
Adj. Flow (vph)	6	41	16	7	27	12	5	60	12	38	87	12
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	63	0	0	46	0	0	77	0	0	137	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)	4.9			4.9			4.9			4.9		
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)	24	14		24	14		24	14		24	14	
Number of Detectors	1	2	1		2	1		2	1		2	
Detector Template	Left	Thru	Left		Thru	Left		Thru	Left		Thru	
Leading Detector (m)	6.1	30.5	6.1		30.5	6.1		30.5	6.1		30.5	
Trailing Detector (m)	0.0	0.0	0.0		0.0	0.0		0.0	0.0		0.0	
Detector 1 Position(m)	0.0	0.0	0.0		0.0	0.0		0.0	0.0		0.0	
Detector 1 Size(m)	6.1	1.8	6.1		1.8	6.1		1.8	6.1		1.8	
Detector 1 Type	CI+Ex	CI+Ex	CI+Ex		CI+Ex	CI+Ex		CI+Ex	CI+Ex		CI+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0		0.0	0.0		0.0	0.0		0.0	
Detector 1 Queue (s)	0.0	0.0	0.0		0.0	0.0		0.0	0.0		0.0	
Detector 1 Delay (s)	0.0	0.0	0.0		0.0	0.0		0.0	0.0		0.0	
Detector 2 Position(m)	28.7			28.7			28.7			28.7		
Detector 2 Size(m)	1.8			1.8			1.8			1.8		
Detector 2 Type	CI+Ex			CI+Ex			CI+Ex			CI+Ex		
Detector 2 Channel												
Detector 2 Extend (s)	0.0			0.0			0.0			0.0		
Turn Type	Perm	NA	Perm		NA	Perm		NA	Perm		NA	
Protected Phases	4			8			2			6		

Lanes, Volumes, Timings 2028 Background AM Peak Hour (without LRT)
4: Caroline Street South & Allen Street West (250137) 171 King Street South, Waterloo TIS

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	34.0	34.0		34.0	34.0		34.0	34.0		34.0	34.0	
Minimum Split (s)	40.0	40.0		40.0	40.0		40.0	40.0		40.0	40.0	
Total Split (s)	40.0	40.0		40.0	40.0		40.0	40.0		40.0	40.0	
Total Split (%)	50.0%	50.0%		50.0%	50.0%		50.0%	50.0%		50.0%	50.0%	
Maximum Green (s)	34.0	34.0		34.0	34.0		34.0	34.0		34.0	34.0	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Lost Time Adjust (s)		-2.0			-2.0			-2.0			-2.0	
Total Lost Time (s)		4.0			4.0			4.0			4.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		C-Max	C-Max		C-Max	C-Max	
Walk Time (s)	29.0	29.0		29.0	29.0		28.0	28.0		28.0	28.0	
Flash Don't Walk (s)	5.0	5.0		5.0	5.0		6.0	6.0		6.0	6.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)		36.0			36.0			53.6			53.6	
Actuated g/C Ratio		0.45			0.45			0.67			0.67	
v/c Ratio		0.10			0.07			0.08			0.16	
Control Delay (s/veh)		10.6			10.4			10.4			11.9	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay (s/veh)		10.6			10.4			10.4			11.9	
LOS		B			B			B			B	
Approach Delay (s/veh)		10.6			10.4			10.4			11.9	
Approach LOS		B			B			B			B	
Intersection Summary												
Area Type:	Other											
Cycle Length: 80												
Actuated Cycle Length: 80												
Offset: 60 (75%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green												
Natural Cycle: 80												
Control Type: Actuated-Coordinated												
Maximum v/c Ratio: 0.16												
Intersection Signal Delay (s/veh): 11.1	Intersection LOS: B											
Intersection Capacity Utilization 63.3%	ICU Level of Service B											
Analysis Period (min) 15												

Splits and Phases: 4: Caroline Street South & Allen Street West



Queues 2028 Background AM Peak Hour (without LRT)
4: Caroline Street South & Allen Street West (250137) 171 King Street South, Waterloo TIS

	EBT	WBT	NBT	SBT
Lane Group Flow (vph)	63	46	77	137
v/c Ratio	0.10	0.07	0.08	0.16
Control Delay (s/veh)	10.6	10.4	10.4	11.9
Queue Delay	0.0	0.0	0.0	0.0
Total Delay (s/veh)	10.6	10.4	10.4	11.9
Queue Length 50th (m)	3.9	2.8	5.5	12.3
Queue Length 95th (m)	10.5	8.4	13.0	23.6
Internal Link Dist (m)	57.6	63.7	69.6	71.7
Turn Bay Length (m)				
Base Capacity (vph)	640	642	945	852
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.10	0.07	0.08	0.16
Intersection Summary				

Lanes, Volumes, Timings
5: Caroline Street South & Site Access

2028 Background AM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

						
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	8	3	84	6	7	131
Future Volume (vph)	8	3	84	6	7	131
Ideal Flow (vphpl)	1765	1765	1650	1650	1650	1650
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt	0.963		0.991			
Flt Protected	0.965					0.997
Satd. Flow (prot)	1488	0	1573	0	0	1499
Flt Permitted	0.965					0.997
Satd. Flow (perm)	1488	0	1573	0	0	1499
Link Speed (k/h)	50		50			50
Link Distance (m)	57.9		95.7			59.8
Travel Time (s)	4.2		6.9			4.3
Confl. Peds. (#/hr)	2	2		22	22	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	33%	3%	0%	0%	9%
Adj. Flow (vph)	8	3	84	6	7	131
Shared Lane Traffic (%)						
Lane Group Flow (vph)	11	0	90	0	0	138
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)	4.9		4.9			4.9
Two way Left Turn Lane						
Headway Factor	1.12	1.12	1.21	1.21	1.21	1.21
Turning Speed (k/h)	24	14		14	24	
Sign Control	Stop		Free			Free
Intersection Summary						
Area Type:	Other					
Control Type:	Unsignalized					
Intersection Capacity Utilization	25.2%			ICU Level of Service A		
Analysis Period (min)	15					

HCM 7th TWSC
5: Caroline Street South & Site Access

2028 Background AM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

Intersection						
Int Delay, s/veh	0.7					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	8	3	84	6	7	131
Future Vol, veh/h	8	3	84	6	7	131
Conflicting Peds, #/hr	2	2	0	22	22	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	33	3	0	0	9
Mvmt Flow	8	3	84	6	7	131
Major/Minor	Minor1	Major1		Major2		
Conflicting Flow All	256	111	0	0	112	0
Stage 1	109	-	-	-	-	-
Stage 2	147	-	-	-	-	-
Critical Hdwy	6.4	6.53	-	-	4.1	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.597	-	-	2.2	-
Pot Cap-1 Maneuver	737	865	-	-	1490	-
Stage 1	921	-	-	-	-	-
Stage 2	885	-	-	-	-	-
Platoon blocked, %			-	-	-	-
Mov Cap-1 Maneuver	717	845	-	-	1460	-
Mov Cap-2 Maneuver	717	-	-	-	-	-
Stage 1	902	-	-	-	-	-
Stage 2	879	-	-	-	-	-
Approach	WB	NB		SB		
HCM Ctrl Dly, s/v	9.89	0		0.38		
HCM LOS	A					
Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT		
Capacity (veh/h)	-	-	748	91	-	
HCM Lane V/C Ratio	-	-	0.015	0.005	-	
HCM Ctrl Dly (s/v)	-	-	9.9	7.5	0	
HCM Lane LOS	-	-	A	A	A	
HCM 95th %tile Q(veh)	-	-	0	0	-	

Lanes, Volumes, Timings
1: Kuntz Lane & William Street West

2028 Background PM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

						
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	413	0	2	457	0	0
Future Volume (vph)	413	0	2	457	0	0
Ideal Flow (vphpl)	1650	1650	1650	1650	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt						
Flt Protected						
Satd. Flow (prot)	1584	0	0	1616	0	0
Flt Permitted						
Satd. Flow (perm)	1584	0	0	1616	0	0
Link Speed (k/h)	50			50	50	
Link Distance (m)	50.7			48.6	58.5	
Travel Time (s)	3.7			3.5	4.2	
Confl. Peds. (#/hr)		13	13			
Confl. Bikes (#/hr)	1		2	2		1
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	3%	0%	0%	1%	0%	0%
Adj. Flow (vph)	413	0	2	457	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	413	0	0	459	0	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.5			3.5	0.0	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.9			4.9	4.9	
Two way Left Turn Lane						
Headway Factor	1.21	1.21	1.21	1.21	1.01	1.01
Turning Speed (k/h)		14	24		24	14
Sign Control	Free			Free	Stop	
Intersection Summary						
Area Type:	Other					
Control Type:	Unsignalized					
Intersection Capacity Utilization	32.9%			ICU Level of Service A		
Analysis Period (min)	15					

HCM Unsignalized Intersection Capacity Analysis2028 Background PM Peak Hour (without LRT)
1: Kuntz Lane & William Street West (250137) 171 King Street South, Waterloo TIS

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↰			↱		
Traffic Volume (veh/h)	413	0	2	457	0	0
Future Volume (Veh/h)	413	0	2	457	0	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	413	0	2	457	0	0
Pedestrians					13	
Lane Width (m)					0.0	
Walking Speed (m/s)					1.0	
Percent Blockage					0	
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)				48		
pX, platoon unblocked					0.85	
vC, conflicting volume			426		887	426
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			426		783	426
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	100
cM capacity (veh/h)			1144		312	633
Direction, Lane #	EB 1	WB 1				
Volume Total	413	459				
Volume Left	0	2				
Volume Right	0	0				
cSH	1700	1144				
Volume to Capacity	0.24	0.00				
Queue Length 95th (m)	0.0	0.0				
Control Delay (s/veh)	0.0	0.1				
Lane LOS		A				
Approach Delay (s/veh)	0.0	0.1				
Approach LOS						
Intersection Summary						
Average Delay		0.0				
Intersection Capacity Utilization		32.9%		ICU Level of Service		A
Analysis Period (min)		15				

Lanes, Volumes, Timings
2: King Street South & William Street West/William Street East King Street South, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	←	←	←	←	←	←	←	←	←	←	←	←
Traffic Volume (vph)	51	339	23	66	297	9	76	212	68	13	273	86
Future Volume (vph)	51	339	23	66	297	9	76	212	68	13	273	86
Ideal Flow (vphpl)	1775	1650	1650	1775	1650	1650	1775	1650	1650	1775	1650	1650
Storage Length (m)	15.0	0.0	25.0	0.0	35.0	0.0	35.0	0.0	25.0	0.0	35.0	0.0
Storage Lanes	1	0	1	0	1	0	1	0	1	0	1	0
Taper Length (m)	25.0			35.0			25.0			35.0		
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	0.98	1.00	0.98	1.00	0.93	0.98	0.96	0.96	0.96	0.96	0.96	0.96
Frt	0.990			0.996			0.964			0.964		
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1573	1574	0	1635	1622	0	1668	1464	0	1668	1462	0
Flt Permitted	0.469			0.407			0.343			0.588		
Satd. Flow (perm)	760	1574	0	688	1622	0	559	1464	0	987	1462	0
Right Turn on Red			Yes			No			Yes			Yes
Satd. Flow (RTOR)		5						29			23	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		48.6			129.2			85.4			137.6	
Travel Time (s)		3.5			9.3			6.1			9.9	
Confl. Peds. (#/hr)	28		26	26		28	104		44	44		104
Confl. Bikes (#/hr)		1			1			1		1	2	2
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 (%)	6%	1%	21%	2%	0%	0%	0%	7%	0%	0%	3%	4%
Adj. Flow (vph)	51	339	23	66	297	9	76	212	68	13	273	86
Shared Lane Traffic (%)												
Lane Group Flow (vph)	51	362	0	66	306	0	76	280	0	13	359	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)		3.5			3.5			3.5			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.9			4.9			4.9			4.9	
Two way Left Turn Lane												
Headway Factor	1.11	1.21	1.21	1.11	1.21	1.21	1.11	1.21	1.21	1.11	1.21	1.21
Turning Speed (k/h)	24		14	24		14	24		14	24		14
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	6.1	30.5		6.1	30.5		6.1	30.5		6.1	30.5	
Trailing Detector (m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Position(m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Size(m)	6.1	1.8		6.1	1.8		6.1	1.8		6.1	1.8	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(m)		28.7			28.7			28.7			28.7	
Detector 2 Size(m)		1.8			1.8			1.8			1.8	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												

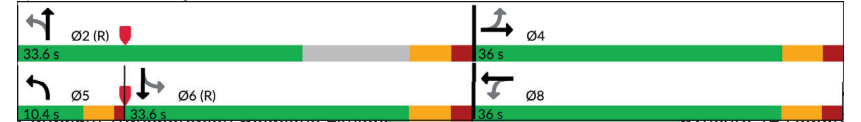
Lanes, Volumes, Timings
2: King Street South & William Street West/William Street East King Street South, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA		Perm	NA		pm+pt	NA		Perm	NA	
Protected Phases		4			8		5	2			6	
Permitted Phases		4			8		2				6	
Detector Phase		4	4		8	8	5	2			6	6
Switch Phase												
Minimum Initial (s)	30.0	30.0		30.0	30.0		5.0	27.6			27.6	27.6
Minimum Split (s)	36.0	36.0		36.0	36.0		9.0	33.6			33.6	33.6
Total Split (s)	36.0	36.0		36.0	36.0		10.4	33.6			33.6	33.6
Total Split (%)	45.0%	45.0%		45.0%	45.0%		13.0%	42.0%			42.0%	42.0%
Maximum Green (s)	30.0	30.0		30.0	30.0		6.4	27.6			27.6	27.6
Yellow Time (s)	4.0	4.0		4.0	4.0		3.0	4.0			4.0	4.0
All-Red Time (s)	2.0	2.0		2.0	2.0		1.0	2.0			2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0		-2.0	-2.0		0.0	-2.0			-2.0	-2.0
Total Lost Time (s)	4.0	4.0		4.0	4.0		4.0	4.0			4.0	4.0
Lead/Lag							Lead			Lag		Lag
Lead-Lag Optimize?							Yes			Yes		Yes
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Recall Mode	None	None		None	None		None	C-Max		C-Max	C-Max	C-Max
Walk Time (s)	19.0	19.0		19.0	19.0		21.6			21.6		21.6
Flash Don't Walk (s)	11.0	11.0		11.0	11.0		6.0			6.0		6.0
Pedestrian Calls (#/hr)	0	0		0	0		0			0		0
Act Effect Green (s)	32.0	32.0		32.0	32.0		40.0	40.0		31.7	31.7	31.7
Actuated g/C Ratio	0.40	0.40		0.40	0.40		0.50	0.50		0.40	0.40	0.40
v/c Ratio	0.17	0.57		0.24	0.47		0.21	0.38		0.03	0.61	0.61
Control Delay (s/veh)	17.3	22.8		18.9	20.8		12.0	12.7		16.5	24.1	24.1
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Delay (s/veh)	17.3	22.8		18.9	20.8		12.0	12.7		16.5	24.1	24.1
LOS	B	C		B	C		B	B		B	C	C
Approach Delay (s/veh)		22.1			20.4			12.6			23.9	
Approach LOS		C			C			B			C	

Intersection Summary

Area Type:	Other
Cycle Length: 80	
Actuated Cycle Length: 80	
Offset: 26.4 (33%), Referenced to phase 2:NBT and 6:SBTL, Start of Green	
Natural Cycle: 80	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.61	
Intersection Signal Delay (s/veh): 19.9	Intersection LOS: B
Intersection Capacity Utilization 109.3%	ICU Level of Service H
Analysis Period (min) 15	

Splits and Phases: 2: King Street South & William Street West/William Street East



Queues
2: King Street South & William Street West/William Street East
250137) 171 King Street South, Waterloo TIS

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	51	362	66	306	76	280	13	359
v/c Ratio	0.17	0.57	0.24	0.47	0.21	0.38	0.03	0.61
Control Delay (s/veh)	17.3	22.8	18.9	20.8	12.0	12.7	16.5	24.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (s/veh)	17.3	22.8	18.9	20.8	12.0	12.7	16.5	24.1
Queue Length 50th (m)	4.9	41.0	6.5	33.4	5.7	21.8	1.2	41.4
Queue Length 95th (m)	12.3	67.2	15.6	55.0	12.3	38.7	4.7	69.9
Internal Link Dist (m)		24.6		105.2		61.4		113.6
Turn Bay Length (m)	15.0		25.0		35.0		25.0	
Base Capacity (vph)	304	632	275	648	368	746	391	592
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.17	0.57	0.24	0.47	0.21	0.38	0.03	0.61
Intersection Summary								

Lanes, Volumes, Timings
3: King Street South & Kuntz Lane
250137) 171 King Street South, 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		↔						↔			↔	
Traffic Volume (vph)	6	0	9	0	0	0	0	337	6	7	361	1
Future Volume (vph)	6	0	9	0	0	0	0	337	6	7	361	1
Ideal Flow (vphpl)	1550	1550	1550	1900	1900	1900	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		0.919						0.998				
Flt Protected		0.980									0.999	
Satd. Flow (prot)	0	1380	0	0	0	0	0	1445	0	0	1474	0
Flt Permitted		0.980									0.999	
Satd. Flow (perm)	0	1380	0	0	0	0	0	1445	0	0	1474	0
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		44.8			46.1			132.5			85.4	
Travel Time (s)		3.2			3.3			9.5			6.1	
Confl. Peds. (#/hr)	1					1	86		36	36		86
Confl. Bikes (#/hr)								1			4	
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%	0%	0%	0%	0%	0%	0%	6%	0%	0%	4%	0%
Adj. Flow (vph)	6	0	9	0	0	0	0	337	6	7	361	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	15	0	0	0	0	0	343	0	0	369	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			3.5			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.9			1.6			4.9			4.9	
Two way Left Turn Lane												
Headway Factor	1.31	1.31	1.31	1.01	1.01	1.01	1.31	1.31	1.31	1.31	1.31	1.31
Turning Speed (k/h)	24		14	24		14	24		14	24		14
Sign Control		Stop			Stop			Free			Free	
Intersection Summary												
Area Type:	Other											
Control Type:	Unsignalized											
Intersection Capacity Utilization	44.7%											
Analysis Period (min)	15											
	ICU Level of Service A											

HCM 7th TWSC
3: King Street South & Kuntz Lane

2028 Background PM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

Intersection												
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	6	0	9	0	0	0	0	337	6	7	361	1
Future Vol, veh/h	6	0	9	0	0	0	0	337	6	7	361	1
Conflicting Peds, #/hr	1	0	0	0	0	1	86	0	36	36	0	86
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	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	0	0	0	0	0	0	6	0	0	4	0
Mvmt Flow	6	0	9	0	0	0	0	337	6	7	361	1
Major/Minor	Minor2			Major1			Major2					
Conflicting Flow All	800	841	448	448			0	0	379	0	0	
Stage 1	462	462	-	-			-	-	-	-	-	
Stage 2	338	379	-	-			-	-	-	-	-	
Critical Hdwy	6.4	6.5	6.2	4.1			-	-	4.1	-	-	
Critical Hdwy Stg 1	5.4	5.5	-	-			-	-	-	-	-	
Critical Hdwy Stg 2	5.4	5.5	-	-			-	-	-	-	-	
Follow-up Hdwy	3.5	4	3.3	2.2			-	-	2.2	-	-	
Pot Cap-1 Maneuver	357	304	615	1123			-	-	1191	-	-	
Stage 1	639	568	-	-			-	-	-	-	-	
Stage 2	727	618	-	-			-	-	-	-	-	
Platoon blocked, %							-	-	-	-	-	
Mov Cap-1 Maneuver	300	0	566	1033			-	-	1191	-	-	
Mov Cap-2 Maneuver	300	0	-	-			-	-	-	-	-	
Stage 1	588	0	-	-			-	-	-	-	-	
Stage 2	664	0	-	-			-	-	-	-	-	
Approach	EB			NB			SB					
HCM Ctrl Dly, s/v	13.94			0			0.15					
HCM LOS	B											
Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	SBL	SBT	SBR					
Capacity (veh/h)	1033	-	-	418	34	-	-					
HCM Lane V/C Ratio	-	-	-	0.036	0.006	-	-					
HCM Ctrl Dly (s/v)	0	-	-	13.9	8	0	-					
HCM Lane LOS	A	-	-	B	A	A	-					
HCM 95th %tile Q(veh)	0	-	-	0.1	0	-	-					

Lanes, Volumes, Timings
4: Caroline Street South & Allen Street West

2028 Background PM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	14	25	10	13	61	9	19	117	40	48	99	26
Future Volume (vph)	14	25	10	13	61	9	19	117	40	48	99	26
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		0.98			0.99			0.98			0.98	
Frt		0.972			0.985			0.969			0.980	
Flt Protected		0.986			0.992			0.995			0.986	
Satd. Flow (prot)	0	1451	0	0	1438	0	0	1432	0	0	1407	0
Flt Permitted		0.928			0.963			0.967			0.894	
Satd. Flow (perm)	0	1359	0	0	1388	0	0	1382	0	0	1265	0
Right Turn on Red			Yes			Yes			Yes			No
Satd. Flow (RTOR)		10			9			24				
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		81.6			87.7			93.6			95.7	
Travel Time (s)		5.9			6.3			6.7			6.9	
Confl. Peds. (#/hr)	18		34	34		18	73		35	35		73
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%	0%	0%	0%	5%	0%	0%	1%	5%	13%	0%	0%
Adj. Flow (vph)	14	25	10	13	61	9	19	117	40	48	99	26
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	49	0	0	83	0	0	176	0	0	173	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)		4.9			4.9			4.9			4.9	
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)	24		14	24		14	24		14	24		14
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	6.1	30.5		6.1	30.5		6.1	30.5		6.1	30.5	
Trailing Detector (m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Position(m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Size(m)	6.1	1.8		6.1	1.8		6.1	1.8		6.1	1.8	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(m)		28.7			28.7			28.7			28.7	
Detector 2 Size(m)		1.8			1.8			1.8			1.8	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		

Lanes, Volumes, Timings
4: Caroline Street South & Allen Street West 2028 Background PM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

	↖	→	↗	↖	←	↖	↖	↑	↗	↘	↓	↘
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	4	4		8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	34.0	34.0		34.0	34.0		34.0	34.0		34.0	34.0	
Minimum Split (s)	40.0	40.0		40.0	40.0		40.0	40.0		40.0	40.0	
Total Split (s)	40.0	40.0		40.0	40.0		40.0	40.0		40.0	40.0	
Total Split (%)	50.0%	50.0%		50.0%	50.0%		50.0%	50.0%		50.0%	50.0%	
Maximum Green (s)	34.0	34.0		34.0	34.0		34.0	34.0		34.0	34.0	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Lost Time Adjust (s)		-2.0			-2.0			-2.0			-2.0	
Total Lost Time (s)		4.0			4.0			4.0			4.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		C-Max	C-Max		C-Max	C-Max	
Walk Time (s)	29.0	29.0		29.0	29.0		28.0	28.0		28.0	28.0	
Flash Don't Walk (s)	5.0	5.0		5.0	5.0		6.0	6.0		6.0	6.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)		36.0			36.0			53.6			53.6	
Actuated g/C Ratio		0.45			0.45			0.67			0.67	
v/c Ratio		0.08			0.13			0.19			0.20	
Control Delay (s/veh)		11.0			12.3			10.5			12.2	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay (s/veh)		11.0			12.3			10.5			12.2	
LOS		B			B			B			B	
Approach Delay (s/veh)		11.0			12.3			10.5			12.2	
Approach LOS		B			B			B			B	

Intersection Summary

Area Type:	Other
Cycle Length: 80	
Actuated Cycle Length: 80	
Offset: 60 (75%), Referenced to phase 2:NBT and 6:SBTL, Start of Green	
Natural Cycle: 80	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.20	
Intersection Signal Delay (s/veh): 11.5	Intersection LOS: B
Intersection Capacity Utilization 63.3%	ICU Level of Service B
Analysis Period (min) 15	

Splits and Phases: 4: Caroline Street South & Allen Street West



Queues
4: Caroline Street South & Allen Street West 2028 Background PM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

	→	←	↑	↓
Lane Group	EBT	WBT	NBT	SBT
Lane Group Flow (vph)	49	83	176	173
v/c Ratio	0.08	0.13	0.19	0.20
Control Delay (s/veh)	11.0	12.3	10.5	12.2
Queue Delay	0.0	0.0	0.0	0.0
Total Delay (s/veh)	11.0	12.3	10.5	12.2
Queue Length 50th (m)	3.2	6.3	13.7	16.1
Queue Length 95th (m)	9.0	14.2	26.7	29.7
Internal Link Dist (m)	57.6	63.7	69.6	71.7
Turn Bay Length (m)				
Base Capacity (vph)	617	629	934	847
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.08	0.13	0.19	0.20

Intersection Summary

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Lanes, Volumes, Timings
5: Caroline Street South & Site Access

2028 Background PM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

						
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	9	32	143	4	3	154
Future Volume (vph)	9	32	143	4	3	154
Ideal Flow (vphpl)	1765	1765	1650	1650	1650	1650
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt	0.895		0.996			
Flt Protected	0.989					0.999
Satd. Flow (prot)	1545	0	1609	0	0	1554
Flt Permitted	0.989					0.999
Satd. Flow (perm)	1545	0	1609	0	0	1554
Link Speed (k/h)	50		50			50
Link Distance (m)	57.9		95.7			59.8
Travel Time (s)	4.2		6.9			4.3
Confl. Peds. (#/hr)	2	3		30	30	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	0%	1%	0%	0%	5%
Adj. Flow (vph)	9	32	143	4	3	154
Shared Lane Traffic (%)						
Lane Group Flow (vph)	41	0	147	0	0	157
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)	4.9		4.9			4.9
Two way Left Turn Lane						
Headway Factor	1.12	1.12	1.21	1.21	1.21	1.21
Turning Speed (k/h)	24	14		14	24	
Sign Control	Stop		Free			Free
Intersection Summary						
Area Type:	Other					
Control Type:	Unsignalized					
Intersection Capacity Utilization	23.1%			ICU Level of Service A		
Analysis Period (min)	15					

HCM 7th TWSC
5: Caroline Street South & Site Access

2028 Background PM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

Intersection						
Int Delay, s/veh	1.2					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	W		R			L
Traffic Vol, veh/h	9	32	143	4	3	154
Future Vol, veh/h	9	32	143	4	3	154
Conflicting Peds, #/hr	2	3	0	30	30	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	1	0	0	5
Mvmt Flow	9	32	143	4	3	154
Major/Minor	Minor1	Major1		Major2		
Conflicting Flow All	337	178	0	0	177	0
Stage 1	175	-	-	-	-	-
Stage 2	162	-	-	-	-	-
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	663	870	-	-	1411	-
Stage 1	860	-	-	-	-	-
Stage 2	872	-	-	-	-	-
Platoon blocked, %			-	-	-	-
Mov Cap-1 Maneuver	641	843	-	-	1372	-
Mov Cap-2 Maneuver	641	-	-	-	-	-
Stage 1	836	-	-	-	-	-
Stage 2	868	-	-	-	-	-
Approach	WB	NB		SB		
HCM Ctrl Dly, s/v	9.81	0		0.15		
HCM LOS	A					
Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT		
Capacity (veh/h)	-	-	789	34	-	
HCM Lane V/C Ratio	-	-	0.052	0.002	-	
HCM Ctrl Dly (s/v)	-	-	9.8	7.6	0	
HCM Lane LOS	-	-	A	A	A	
HCM 95th %tile Q(veh)	-	-	0.2	0	-	

Appendix H

2028 Total Traffic Operations Reports



Lanes, Volumes, Timings
1: Kuntz Lane & William Street West

2028 Total AM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

	→	↘	↙	←	↖	↗
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↗			↖		
Traffic Volume (vph)	493	15	3	316	0	0
Future Volume (vph)	493	15	3	316	0	0
Ideal Flow (vphpl)	1650	1650	1650	1650	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt	0.996					
Flt Protected						
Satd. Flow (prot)	1579	0	0	1585	0	0
Flt Permitted						
Satd. Flow (perm)	1579	0	0	1585	0	0
Link Speed (k/h)	50			50	50	
Link Distance (m)	50.7			48.6	58.5	
Travel Time (s)	3.7			3.5	4.2	
Confl. Peds. (#/hr)		14	14		4	2
Confl. Bikes (#/hr)	4			2		
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	3%	0%	0%	3%	0%	0%
Adj. Flow (vph)	493	15	3	316	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	508	0	0	319	0	0
Sign Control	Free			Free	Stop	

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	41.6%
ICU Level of Service A	
Analysis Period (min)	15

HCM Unsignalized Intersection Capacity Analysis
1: Kuntz Lane & William Street West

2028 Total AM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↗			↖		
Traffic Volume (veh/h)	493	15	3	316	0	0
Future Volume (Veh/h)	493	15	3	316	0	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	493	15	3	316	0	0
Pedestrians	4			2	14	
Lane Width (m)	3.5			3.5	0.0	
Walking Speed (m/s)	1.0			1.0	1.0	
Percent Blockage	0			0	0	
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)				48		
pX, platoon unblocked					0.92	
vC, conflicting volume			522		841	517
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			522		782	517
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	100
cM capacity (veh/h)			1055		334	562

Direction, Lane #	EB 1	WB 1
Volume Total	508	319
Volume Left	0	3
Volume Right	15	0
cSH	1700	1055
Volume to Capacity	0.30	0.00
Queue Length 95th (m)	0.0	0.1
Control Delay (s/veh)	0.0	0.1
Lane LOS		A
Approach Delay (s/veh)	0.0	0.1
Approach LOS		

Intersection Summary

Average Delay	0.0		
Intersection Capacity Utilization	41.6%	ICU Level of Service	A
Analysis Period (min)	15		

Lanes, Volumes, Timings
2: King Street South & William Street West/William Street East
2028 Total AM Peak Hour (without LRT)

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↰	↰	↰	↰	↰	↰	↰	↰	↰	↰	↰
Traffic Volume (vph)	71	405	17	46	183	8	71	202	89	16	146	65
Future Volume (vph)	71	405	17	46	183	8	71	202	89	16	146	65
Ideal Flow (vphpl)	1775	1650	1650	1775	1650	1650	1775	1650	1650	1775	1650	1650
Storage Length (m)	15.0		0.0	25.0		0.0	35.0		0.0	25.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	25.0			35.0			25.0			35.0		
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	0.97	1.00		0.99	1.00		0.94	0.98		0.97	0.97	
Frt		0.994			0.994			0.954			0.954	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1516	1588	0	1668	1588	0	1588	1392	0	1668	1445	0
Flt Permitted	0.604			0.343			0.502			0.582		
Satd. Flow (perm)	938	1588	0	597	1588	0	792	1392	0	994	1445	0
Right Turn on Red			Yes			No			Yes			Yes
Satd. Flow (RTOR)		3						40			32	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		48.6			129.2			85.4			137.6	
Travel Time (s)		3.5			9.3			6.1			9.9	
Confl. Peds. (#/hr)	27		13	13		27	58		28	28		58
Confl. Bikes (#/hr)	1	4			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 (%)	10%	1%	25%	0%	2%	0%	5%	11%	7%	0%	4%	5%
Adj. Flow (vph)	71	405	17	46	183	8	71	202	89	16	146	65
Shared Lane Traffic (%)												
Lane Group Flow (vph)	71	422	0	46	191	0	71	291	0	16	211	0
Turn Type	Perm	NA		Perm	NA	pm+pt	NA		Perm	NA		
Protected Phases		4			8		5	2			6	
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		5	2		6	6	
Switch Phase												
Minimum Initial (s)	30.0	30.0		30.0	30.0		5.0	27.6		27.6	27.6	
Minimum Split (s)	36.0	36.0		36.0	36.0		9.0	33.6		33.6	33.6	
Total Split (s)	36.0	36.0		36.0	36.0		10.4	33.6		33.6	33.6	
Total Split (%)	45.0%	45.0%		45.0%	45.0%		13.0%	42.0%		42.0%	42.0%	
Yellow Time (s)	4.0	4.0		4.0	4.0		3.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		1.0	2.0		2.0	2.0	
Lost Time Adjust (s)	-2.0	-2.0		-2.0	-2.0		0.0	-2.0		-2.0	-2.0	
Total Lost Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lead/Lag							Lead			Lag		Lag
Lead-Lag Optimize?							Yes			Yes		Yes
Recall Mode	None	None		None	None		None	C-Max		C-Max	C-Max	
Act Effct Green (s)	32.0	32.0		32.0	32.0		40.0	40.0		31.7	31.7	
Actuated g/C Ratio	0.40	0.40		0.40	0.40		0.50	0.50		0.40	0.40	
v/c Ratio	0.19	0.66		0.19	0.30		0.16	0.41		0.04	0.36	
Control Delay (s/veh)	17.3	25.6		18.3	18.0		11.4	12.8		16.7	17.4	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay (s/veh)	17.3	25.6		18.3	18.0		11.4	12.8		16.7	17.4	
LOS	B	C		B	B		B	B		B	B	

Lanes, Volumes, Timings
2: King Street South & William Street West/William Street East
2028 Total AM Peak Hour (without LRT)

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Approach Delay (s/veh)		24.4			18.1			12.5				17.3
Approach LOS		C			B			B				B
Queue Length 50th (m)	6.8	50.6		4.4	19.3		5.3	22.2		1.5	19.2	
Queue Length 95th (m)	15.6	81.4		11.8	34.2		11.8	40.0		5.4	36.3	
Internal Link Dist (m)		24.6			105.2			61.4			113.6	
Turn Bay Length (m)	15.0			25.0			35.0			25.0		
Base Capacity (vph)	375	637		238	635		459	716		393	591	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.19	0.66		0.19	0.30		0.15	0.41		0.04	0.36	

Intersection Summary	
Area Type:	Other
Cycle Length: 80	
Actuated Cycle Length: 80	
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green	
Natural Cycle: 80	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.66	
Intersection Signal Delay (s/veh): 18.8	Intersection LOS: B
Intersection Capacity Utilization 110.1%	ICU Level of Service H
Analysis Period (min) 15	



Lanes, Volumes, Timings
3: King Street South & Kuntz Lane

2028 Total AM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔						↔			↔	
Traffic Volume (vph)	41	1	18	0	0	0	5	315	6	7	220	9
Future Volume (vph)	41	1	18	0	0	0	5	315	6	7	220	9
Ideal Flow (vphpl)	1550	1550	1550	1900	1900	1900	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		0.959						0.998			0.995	
Flt Protected		0.967						0.999			0.999	
Satd. Flow (prot)	0	1421	0	0	0	0	0	1431	0	0	1430	0
Flt Permitted		0.967						0.999			0.999	
Satd. Flow (perm)	0	1421	0	0	0	0	0	1431	0	0	1430	0
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		44.8			46.1			132.5			85.4	
Travel Time (s)		3.2			3.3			9.5			6.1	
Confl. Peds. (#/hr)	1						1	58		19	19	58
Confl. Bikes (#/hr)					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%	0%	0%	0%	0%	0%	0%	7%	0%	0%	7%	0%
Adj. Flow (vph)	41	1	18	0	0	0	5	315	6	7	220	9
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	60	0	0	0	0	0	326	0	0	236	0
Sign Control		Stop			Stop			Free			Free	

Intersection Summary												
Area Type:	Other											
Control Type:	Unsignalized											
Intersection Capacity Utilization	41.0%											
ICU Level of Service	A											
Analysis Period (min)	15											

HCM 7th TWSC
3: King Street South & Kuntz Lane

2028 Total AM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

Intersection												
Int Delay, s/veh	1.5											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔						↔			↔	
Traffic Vol, veh/h	41	1	18	0	0	0	5	315	6	7	220	9
Future Vol, veh/h	41	1	18	0	0	0	5	315	6	7	220	9
Conflicting Peds, #/hr	1	0	0	0	0	1	58	0	19	19	0	58
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	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	0	0	0	0	0	0	7	0	0	7	0
Mvmt Flow	41	1	18	0	0	0	5	315	6	7	220	9

Major/Minor	Minor2	Major1	Major2
Conflicting Flow All	623 647 283	287 0 0 340 0 0	
Stage 1	297 297 -	- - - - - -	
Stage 2	326 350 -	- - - - - -	
Critical Hdwy	6.4 6.5 6.2	4.1 - - 4.1 - -	
Critical Hdwy Stg 1	5.4 5.5 -	- - - - - -	
Critical Hdwy Stg 2	5.4 5.5 -	- - - - - -	
Follow-up Hdwy	3.5 4 3.3	2.2 - - 2.2 - -	
Pot Cap-1 Maneuver	453 393 761	1287 - - 1230 - -	
Stage 1	759 672 -	- - - - - -	
Stage 2	736 636 -	- - - - - -	
Platoon blocked, %		- - - - - -	
Mov Cap-1 Maneuver	401 0 720	1217 - - 1230 - -	
Mov Cap-2 Maneuver	401 0 -	- - - - - -	
Stage 1	714 0 -	- - - - - -	
Stage 2	692 0 -	- - - - - -	

Approach	EB	NB	SB
HCM Ctrl Dly, s/v	13.91	0.12	0.24
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	SBL	SBT	SBR
Capacity (veh/h)	28	-	-	464	53	-	-
HCM Lane V/C Ratio	0.004	-	-	0.129	0.006	-	-
HCM Ctrl Dly (s/v)	8	0	-	13.9	7.9	0	-
HCM Lane LOS	A	A	-	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0.4	0	-	-

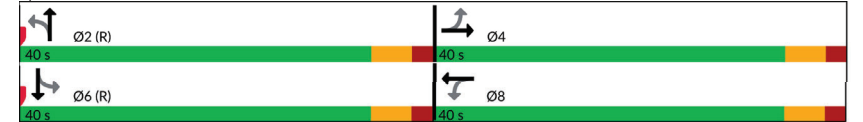
Lanes, Volumes, Timings
4: Caroline Street South & Allen Street West (250137) 171 King Street South, Waterloo TIS

	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	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Traffic Volume (vph)	8	41	16	7	27	14	5	58	12	65	82	23
Future Volume (vph)	8	41	16	7	27	14	5	58	12	65	82	23
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	0.99				0.99			0.99			0.98	
Frt	0.967				0.961			0.978			0.982	
Flt Protected	0.994				0.993			0.997			0.981	
Satd. Flow (prot)	0	1428	0	0	1448	0	0	1421	0	0	1316	0
Flt Permitted	0.974				0.969			0.987			0.881	
Satd. Flow (perm)	0	1397	0	0	1407	0	0	1400	0	0	1171	0
Right Turn on Red		Yes			Yes			Yes			No	
Satd. Flow (RTOR)		16			14			12				
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		81.6			87.7			93.6			95.7	
Travel Time (s)		5.9			6.3			6.7			6.9	
Confl. Peds. (#/hr)	13		27	27		13	72		23	23		72
Confl. Bikes (#/hr)		2										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%	0%	0%	20%	4%	0%	22%	2%	9%
Adj. Flow (vph)	8	41	16	7	27	14	5	58	12	65	82	23
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	65	0	0	48	0	0	75	0	0	170	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases	4			8			2			6		
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	34.0	34.0		34.0	34.0		34.0	34.0		34.0	34.0	
Minimum Split (s)	40.0	40.0		40.0	40.0		40.0	40.0		40.0	40.0	
Total Split (s)	40.0	40.0		40.0	40.0		40.0	40.0		40.0	40.0	
Total Split (%)	50.0%	50.0%		50.0%	50.0%		50.0%	50.0%		50.0%	50.0%	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Lost Time Adjust (s)		-2.0			-2.0			-2.0			-2.0	
Total Lost Time (s)		4.0			4.0			4.0			4.0	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	None	None		None	None		C-Max	C-Max		C-Max	C-Max	
Act Effct Green (s)		36.0			36.0			53.6			53.6	
Actuated g/C Ratio		0.45			0.45			0.67			0.67	
v/c Ratio		0.10			0.08			0.08			0.22	
Control Delay (s/veh)		10.7			10.1			10.4			12.5	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay (s/veh)		10.7			10.1			10.4			12.5	
LOS		B			B			B			B	
Approach Delay (s/veh)		10.7			10.1			10.4			12.5	
Approach LOS		B			B			B			B	
Queue Length 50th (m)		4.1			2.8			5.3			16.0	

Lanes, Volumes, Timings
4: Caroline Street South & Allen Street West (250137) 171 King Street South, Waterloo TIS

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 95th (m)	10.8				8.5			12.7			30.0	
Internal Link Dist (m)	57.6				63.7			69.6			71.7	
Turn Bay Length (m)												
Base Capacity (vph)	637				640			942			784	
Starvation Cap Reductn	0				0			0			0	
Spillback Cap Reductn	0				0			0			0	
Storage Cap Reductn	0				0			0			0	
Reduced v/c Ratio	0.10				0.08			0.08			0.22	
Intersection Summary												
Area Type:	Other											
Cycle Length: 80												
Actuated Cycle Length: 80												
Offset: 60 (75%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green												
Natural Cycle: 80												
Control Type: Actuated-Coordinated												
Maximum v/c Ratio: 0.22												
Intersection Signal Delay (s/veh): 11.4												
Intersection LOS: B												
Intersection Capacity Utilization 63.3%												
ICU Level of Service B												
Analysis Period (min) 15												

Splits and Phases: 4: Caroline Street South & Allen Street West



Lanes, Volumes, Timings
5: Caroline Street South & Site Access

2028 Total AM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

						
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	41	59	84	8	9	131
Future Volume (vph)	41	59	84	8	9	131
Ideal Flow (vphpl)	1765	1765	1650	1650	1650	1650
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt	0.920		0.988			
Flt Protected	0.980					0.997
Satd. Flow (prot)	1574	0	1569	0	0	1500
Flt Permitted	0.980					0.997
Satd. Flow (perm)	1574	0	1569	0	0	1500
Link Speed (k/h)	50		50			50
Link Distance (m)	57.9		95.7			59.8
Travel Time (s)	4.2		6.9			4.3
Confl. Peds. (#/hr)	2	2		22	22	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	0%	3%	0%	0%	9%
Adj. Flow (vph)	41	59	84	8	9	131
Shared Lane Traffic (%)						
Lane Group Flow (vph)	100	0	92	0	0	140
Sign Control	Stop		Free			Free
Intersection Summary						
Area Type:	Other					
Control Type:	Unsignalized					
Intersection Capacity Utilization	28.8%			ICU Level of Service A		
Analysis Period (min)	15					

HCM 7th TWSC
5: Caroline Street South & Site Access

2028 Total AM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

Intersection						
Int Delay, s/veh	3.2					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	41	59	84	8	9	131
Future Vol, veh/h	41	59	84	8	9	131
Conflicting Peds, #/hr	2	2	0	22	22	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	3	0	0	9
Mvmt Flow	41	59	84	8	9	131

Major/Minor	Minor1	Major1	Major2
Conflicting Flow All	261	112	0
Stage 1	110	-	-
Stage 2	151	-	-
Critical Hdwy	6.4	6.2	-
Critical Hdwy Stg 1	5.4	-	-
Critical Hdwy Stg 2	5.4	-	-
Follow-up Hdwy	3.5	3.3	-
Pot Cap-1 Maneuver	732	947	-
Stage 1	920	-	-
Stage 2	882	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	711	925	-
Mov Cap-2 Maneuver	711	-	-
Stage 1	901	-	-
Stage 2	874	-	-

Approach	WB	NB	SB
HCM Ctrl Dly, s/v	9.97	0	0.48
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	-	824	116
HCM Lane V/C Ratio	-	-	0.121	0.006
HCM Ctrl Dly (s/v)	-	-	10	7.5
HCM Lane LOS	-	-	A	A
HCM 95th %tile Q(veh)	-	-	0.4	0

Lanes, Volumes, Timings
1: Kuntz Lane & William Street West

2028 Total PM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

	→	↘	↙	←	↖	↗
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↩			↩		
Traffic Volume (vph)	418	9	2	471	0	0
Future Volume (vph)	418	9	2	471	0	0
Ideal Flow (vphpl)	1650	1650	1650	1650	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt	0.997					
Flt Protected						
Satd. Flow (prot)	1580	0	0	1616	0	0
Flt Permitted						
Satd. Flow (perm)	1580	0	0	1616	0	0
Link Speed (k/h)	50			50	50	
Link Distance (m)	50.7			48.6	58.5	
Travel Time (s)	3.7			3.5	4.2	
Confl. Peds. (#/hr)		13	13			
Confl. Bikes (#/hr)	1		2	2		1
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	3%	0%	0%	1%	0%	0%
Adj. Flow (vph)	418	9	2	471	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	427	0	0	473	0	0
Sign Control	Free			Free	Stop	

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	33.7%
ICU Level of Service	A
Analysis Period (min)	15

HCM Unsignalized Intersection Capacity Analysis
1: Kuntz Lane & William Street West

2028 Total PM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↩			↩		
Traffic Volume (veh/h)	418	9	2	471	0	0
Future Volume (Veh/h)	418	9	2	471	0	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	418	9	2	471	0	0
Pedestrians					13	
Lane Width (m)					0.0	
Walking Speed (m/s)					1.0	
Percent Blockage					0	
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)				48		
pX, platoon unblocked					0.85	
vC, conflicting volume			440		911	436
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			440		806	436
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	100
cM capacity (veh/h)			1131		300	625

Direction, Lane #	EB 1	WB 1
Volume Total	427	473
Volume Left	0	2
Volume Right	9	0
cSH	1700	1131
Volume to Capacity	0.25	0.00
Queue Length 95th (m)	0.0	0.0
Control Delay (s/veh)	0.0	0.1
Lane LOS		A
Approach Delay (s/veh)	0.0	0.1
Approach LOS		

Intersection Summary

Average Delay	0.0
Intersection Capacity Utilization	33.7%
ICU Level of Service	A
Analysis Period (min)	15

Lanes, Volumes, Timings
2: King Street South & William Street West/William Street East King Street South, 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	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Traffic Volume (vph)	53	342	23	74	304	9	79	216	71	13	281	90
Future Volume (vph)	53	342	23	74	304	9	79	216	71	13	281	90
Ideal Flow (vphpl)	1775	1650	1650	1775	1650	1650	1775	1650	1650	1775	1650	1650
Storage Length (m)	15.0		0.0	25.0		0.0	35.0		0.0	25.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	25.0			35.0			25.0			35.0		
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	0.98	1.00		0.98	1.00		0.93	0.98		0.96	0.96	
Frt	0.991				0.996			0.963				0.964
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1573	1576	0	1635	1622	0	1668	1462	0	1668	1461	0
Flt Permitted	0.461			0.404			0.331			0.584		
Satd. Flow (perm)	747	1576	0	683	1622	0	540	1462	0	981	1461	0
Right Turn on Red			Yes			No			Yes			Yes
Satd. Flow (RTOR)		5						30			23	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		48.6			129.2			85.4			137.6	
Travel Time (s)		3.5			9.3			6.1			9.9	
Confl. Peds. (#/hr)	28		26	26		28	104		44	44		104
Confl. Bikes (#/hr)		1			1			1		1	2	2
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 (%)	6%	1%	21%	2%	0%	0%	0%	7%	0%	0%	3%	4%
Adj. Flow (vph)	53	342	23	74	304	9	79	216	71	13	281	90
Shared Lane Traffic (%)												
Lane Group Flow (vph)	53	365	0	74	313	0	79	287	0	13	371	0
Turn Type	Perm	NA		Perm	NA	pm+pt	NA		Perm	NA		
Protected Phases		4			8		5	2			6	
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		5	2		6	6	
Switch Phase												
Minimum Initial (s)	30.0	30.0		30.0	30.0		5.0	27.6		27.6	27.6	
Minimum Split (s)	36.0	36.0		36.0	36.0		9.0	33.6		33.6	33.6	
Total Split (s)	36.0	36.0		36.0	36.0		10.4	33.6		33.6	33.6	
Total Split (%)	45.0%	45.0%		45.0%	45.0%		13.0%	42.0%		42.0%	42.0%	
Yellow Time (s)	4.0	4.0		4.0	4.0		3.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		1.0	2.0		2.0	2.0	
Lost Time Adjust (s)	-2.0	-2.0		-2.0	-2.0		0.0	-2.0		-2.0	-2.0	
Total Lost Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lead/Lag							Lead			Lag		Lag
Lead-Lag Optimize?							Yes			Yes		Yes
Recall Mode	None	None		None	None		None	C-Max		C-Max	C-Max	
Act Effct Green (s)	32.0	32.0		32.0	32.0		40.0	40.0		31.7	31.7	
Actuated g/C Ratio	0.40	0.40		0.40	0.40		0.50	0.50		0.40	0.40	
v/c Ratio	0.18	0.58		0.27	0.48		0.22	0.38		0.03	0.63	
Control Delay (s/veh)	17.6	22.9		19.6	21.0		12.1	12.8		16.5	24.8	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay (s/veh)	17.6	22.9		19.6	21.0		12.1	12.8		16.5	24.8	
LOS	B	C		B	C		B	B		B	C	

Lanes, Volumes, Timings
2: King Street South & William Street West/William Street East King Street South, 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
Approach Delay (s/veh)	22.2			20.7			12.7			24.5		
Approach LOS	C			C			B			C		
Queue Length 50th (m)	5.1	41.5		7.4	34.4		6.0	22.5		1.2	43.4	
Queue Length 95th (m)	12.7	67.7		17.3	56.5		12.6	39.7		4.7	73.2	
Internal Link Dist (m)		24.6			105.2			61.4			113.6	
Turn Bay Length (m)	15.0			25.0			35.0			25.0		
Base Capacity (vph)	298	633		273	648		360	746		388	592	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.18	0.58		0.27	0.48		0.22	0.38		0.03	0.63	

Intersection Summary	
Area Type:	Other
Cycle Length: 80	
Actuated Cycle Length: 80	
Offset: 26.4 (33%), Referenced to phase 2:NRTL and 6:SBTL, Start of Green	
Natural Cycle: 80	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.63	
Intersection Signal Delay (s/veh): 20.2	Intersection LOS: C
Intersection Capacity Utilization 109.3%	ICU Level of Service H
Analysis Period (min) 15	



Lanes, Volumes, Timings
3: King Street South & Kuntz Lane

2028 Total PM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔						↔			↔	
Traffic Volume (vph)	19	0	17	0	0	0	13	334	6	7	357	21
Future Volume (vph)	19	0	17	0	0	0	13	334	6	7	357	21
Ideal Flow (vphpl)	1550	1550	1550	1900	1900	1900	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		0.936						0.998			0.993	
Flt Protected		0.974						0.998			0.999	
Satd. Flow (prot)	0	1397	0	0	0	0	0	1445	0	0	1466	0
Flt Permitted		0.974						0.998			0.999	
Satd. Flow (perm)	0	1397	0	0	0	0	0	1445	0	0	1466	0
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		44.8			46.1			132.5			85.4	
Travel Time (s)		3.2			3.3			9.5			6.1	
Confl. Peds. (#/hr)	1					1	86		36	36		86
Confl. Bikes (#/hr)								1			4	
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%	0%	0%	0%	0%	0%	0%	6%	0%	0%	4%	0%
Adj. Flow (vph)	19	0	17	0	0	0	13	334	6	7	357	21
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	36	0	0	0	0	0	353	0	0	385	0
Sign Control		Stop			Stop			Free			Free	

Intersection Summary												
Area Type:	Other											
Control Type:	Unsignalized											
Intersection Capacity Utilization	46.4%											
Analysis Period (min)	15											
	ICU Level of Service A											

HCM 7th TWSC
3: King Street South & Kuntz Lane

2028 Total PM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

Intersection												
Int Delay, s/veh	0.9											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔						↔			↔	
Traffic Vol, veh/h	19	0	17	0	0	0	13	334	6	7	357	21
Future Vol, veh/h	19	0	17	0	0	0	13	334	6	7	357	21
Conflicting Peds, #/hr	1	0	0	0	0	1	86	0	36	36	0	86
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	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	0	0	0	0	0	0	6	0	0	4	0
Mvmt Flow	19	0	17	0	0	0	13	334	6	7	357	21

Major/Minor	Minor2	Major1	Major2
Conflicting Flow All	829 870 454	464 0 0 376 0 0	
Stage 1	468 468 -	- - - - -	
Stage 2	361 402 -	- - - - -	
Critical Hdwy	6.4 6.5 6.2	4.1 - - 4.1 - -	
Critical Hdwy Stg 1	5.4 5.5 -	- - - - -	
Critical Hdwy Stg 2	5.4 5.5 -	- - - - -	
Follow-up Hdwy	3.5 4 3.3	2.2 - - 2.2 - -	
Pot Cap-1 Maneuver	343 292 611	1108 - - 1194 - -	
Stage 1	635 565 -	- - - - -	
Stage 2	710 604 -	- - - - -	
Platoon blocked, %		- - - - -	
Mov Cap-1 Maneuver	284 0 562	1019 - - 1194 - -	
Mov Cap-2 Maneuver	284 0 -	- - - - -	
Stage 1	575 0 -	- - - - -	
Stage 2	648 0 -	- - - - -	

Approach	EB	NB	SB
HCM Ctrl Dly, s/v	15.76	0.32	0.15
HCM LOS	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	SBL	SBT	SBR
Capacity (veh/h)	66	-	-	370	32	-	-
HCM Lane V/C Ratio	0.013	-	-	0.097	0.006	-	-
HCM Ctrl Dly (s/v)	8.6	0	-	15.8	8	0	-
HCM Lane LOS	A	A	-	C	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0.3	0	-	-

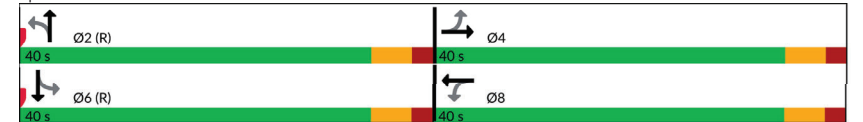
Lanes, Volumes, Timings
4: Caroline Street South & Allen Street West (250137) 171 King Street South, Waterloo TIS

	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												
Traffic Volume (vph)	22	25	10	13	61	17	19	124	40	53	94	29
Future Volume (vph)	22	25	10	13	61	17	19	124	40	53	94	29
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		0.98			0.99			0.98			0.97	
Frt		0.976			0.975			0.970			0.978	
Flt Protected		0.981			0.993			0.995			0.985	
Satd. Flow (prot)	0	1452	0	0	1425	0	0	1434	0	0	1397	0
Flt Permitted		0.901			0.969			0.967			0.878	
Satd. Flow (perm)	0	1324	0	0	1383	0	0	1385	0	0	1234	0
Right Turn on Red		Yes			Yes			Yes			No	
Satd. Flow (RTOR)		10			17			23				
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		81.6			87.7			93.6			95.7	
Travel Time (s)		5.9			6.3			6.7			6.9	
Confl. Peds. (#/hr)	18		34	34		18	73		35	35		73
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%	0%	0%	0%	5%	0%	0%	1%	5%	13%	0%	0%
Adj. Flow (vph)	22	25	10	13	61	17	19	124	40	53	94	29
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	57	0	0	91	0	0	183	0	0	176	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	34.0	34.0		34.0	34.0		34.0	34.0		34.0	34.0	
Minimum Split (s)	40.0	40.0		40.0	40.0		40.0	40.0		40.0	40.0	
Total Split (s)	40.0	40.0		40.0	40.0		40.0	40.0		40.0	40.0	
Total Split (%)	50.0%	50.0%		50.0%	50.0%		50.0%	50.0%		50.0%	50.0%	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Lost Time Adjust (s)		-2.0			-2.0			-2.0			-2.0	
Total Lost Time (s)		4.0			4.0			4.0			4.0	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	None	None		None		C-Max	C-Max		C-Max	C-Max		
Act Effct Green (s)		36.0			36.0			44.8			44.8	
Actuated g/C Ratio		0.45			0.45			0.56			0.56	
v/c Ratio		0.09			0.14			0.23			0.25	
Control Delay (s/veh)		11.4			11.4			12.5			14.6	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay (s/veh)		11.4			11.4			12.5			14.6	
LOS		B			B			B			B	
Approach Delay (s/veh)		11.4			11.4			12.5			14.6	
Approach LOS		B			B			B			B	
Queue Length 50th (m)		3.9			6.3			14.5			16.5	
Queue Length 95th (m)		10.2			14.4			27.9			30.5	

Lanes, Volumes, Timings
4: Caroline Street South & Allen Street West (250137) 171 King Street South, 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
Internal Link Dist (m)		57.6			63.7			69.6			71.7	
Turn Bay Length (m)												
Base Capacity (vph)		601			631			785			691	
Starvation Cap Reductn		0			0			0			0	
Spillback Cap Reductn		0			0			0			0	
Storage Cap Reductn		0			0			0			0	
Reduced v/c Ratio		0.09			0.14			0.23			0.25	
Intersection Summary												
Area Type:		Other										
Cycle Length: 80												
Actuated Cycle Length: 80												
Offset: 60 (75%), Referenced to phase 2:NBT and 6:SBTL, Start of Green												
Natural Cycle: 80												
Control Type: Actuated-Coordinated												
Maximum v/c Ratio: 0.25												
Intersection Signal Delay (s/veh): 12.9												
Intersection Capacity Utilization 63.3%												
Analysis Period (min) 15												

Splits and Phases: 4: Caroline Street South & Allen Street West



Lanes, Volumes, Timings
5: Caroline Street South & Site Access

2028 Total PM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

						
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	12	15	143	27	37	154
Future Volume (vph)	12	15	143	27	37	154
Ideal Flow (vphpl)	1765	1765	1650	1650	1650	1650
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt	0.925		0.979			
Flt Protected	0.978					0.990
Satd. Flow (prot)	1579	0	1584	0	0	1553
Flt Permitted	0.978					0.990
Satd. Flow (perm)	1579	0	1584	0	0	1553
Link Speed (k/h)	50		50			50
Link Distance (m)	57.9		95.7			59.8
Travel Time (s)	4.2		6.9			4.3
Confl. Peds. (#/hr)	2	3		30	30	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	0%	1%	0%	0%	5%
Adj. Flow (vph)	12	15	143	27	37	154
Shared Lane Traffic (%)						
Lane Group Flow (vph)	27	0	170	0	0	191
Sign Control	Stop		Free			Free
Intersection Summary						
Area Type:	Other					
Control Type:	Unsignalized					
Intersection Capacity Utilization	38.4%			ICU Level of Service A		
Analysis Period (min)	15					

HCM 7th TWSC
5: Caroline Street South & Site Access

2028 Total PM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

Intersection						
Int Delay, s/veh	1.5					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	W		T			T
Traffic Vol, veh/h	12	15	143	27	37	154
Future Vol, veh/h	12	15	143	27	37	154
Conflicting Peds, #/hr	2	3	0	30	30	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	1	0	0	5
Mvmt Flow	12	15	143	27	37	154
Major/Minor						
Minor1	Major1		Major2			
Conflicting Flow All	417	190	0	0	200	0
Stage 1	187	-	-	-	-	-
Stage 2	230	-	-	-	-	-
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	597	857	-	-	1384	-
Stage 1	850	-	-	-	-	-
Stage 2	813	-	-	-	-	-
Platoon blocked, %	-	-	-	-	-	-
Mov Cap-1 Maneuver	561	831	-	-	1346	-
Mov Cap-2 Maneuver	561	-	-	-	-	-
Stage 1	826	-	-	-	-	-
Stage 2	787	-	-	-	-	-
Approach						
WB	NB		SB			
HCM Ctrl Dly, s/v	10.47	0	1.5			
HCM LOS	B					
Minor Lane/Major Mvmt						
NBT	NBRWBLn1	SBL	SBT			
Capacity (veh/h)	-	-	685	349	-	-
HCM Lane V/C Ratio	-	-	0.039	0.027	-	-
HCM Ctrl Dly (s/v)	-	-	10.5	7.8	0	-
HCM Lane LOS	-	-	B	A	A	-
HCM 95th %tile Q(veh)	-	-	0.1	0.1	-	-

Appendix I

2033 Background Traffic Operations Reports



Lanes, Volumes, Timings
1: Kuntz Lane & William Street West

2033 Background AM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

						
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	512	10	3	323	0	0
Future Volume (vph)	512	10	3	323	0	0
Ideal Flow (vphpl)	1650	1650	1650	1650	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt	0.997					
Flt Protected						
Satd. Flow (prot)	1580	0	0	1585	0	0
Flt Permitted						
Satd. Flow (perm)	1580	0	0	1585	0	0
Link Speed (k/h)	50			50	50	
Link Distance (m)	50.7			48.6	58.5	
Travel Time (s)	3.7			3.5	4.2	
Confl. Peds. (#/hr)	14		14	4		
Confl. Bikes (#/hr)	4			2		
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	3%	0%	0%	3%	0%	0%
Adj. Flow (vph)	512	10	3	323	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	522	0	0	326	0	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.5			3.5	0.0	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.9			4.9	4.9	
Two way Left Turn Lane						
Headway Factor	1.21	1.21	1.21	1.21	1.01	1.01
Turning Speed (k/h)	14		24	24		
Sign Control	Free			Free	Stop	
Intersection Summary						
Area Type:	Other					
Control Type:	Unsignalized					
Intersection Capacity Utilization	42.4%			ICU Level of Service A		
Analysis Period (min)	15					

HCM Unsignalized Intersection Capacity Analysis2033 Background AM Peak Hour (without LRT)
1: Kuntz Lane & William Street West (250137) 171 King Street South, Waterloo TIS

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	512	10	3	323	0	0
Future Volume (Veh/h)	512	10	3	323	0	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	512	10	3	323	0	0
Pedestrians	4			2	14	
Lane Width (m)	3.5			3.5	0.0	
Walking Speed (m/s)	1.0			1.0	1.0	
Percent Blockage	0			0	0	
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)				48		
pX, platoon unblocked					0.92	
vC, conflicting volume			536		864	533
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			536		806	533
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	100
cM capacity (veh/h)			1042		322	550
Direction, Lane #	EB 1	WB 1				
Volume Total	522	326				
Volume Left	0	3				
Volume Right	10	0				
cSH	1700	1042				
Volume to Capacity	0.31	0.00				
Queue Length 95th (m)	0.0	0.1				
Control Delay (s/veh)	0.0	0.1				
Lane LOS		A				
Approach Delay (s/veh)	0.0	0.1				
Approach LOS						
Intersection Summary						
Average Delay		0.0				
Intersection Capacity Utilization		42.4%		ICU Level of Service		A
Analysis Period (min)		15				

Lanes, Volumes, Timings
2: King Street South & William Street West/William Street East King Street South, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱	↲	↰	↱	↲	↰	↱	↲	↰	↱	↲
Traffic Volume (vph)	70	424	18	45	196	9	61	199	81	17	151	69
Future Volume (vph)	70	424	18	45	196	9	61	199	81	17	151	69
Ideal Flow (vphpl)	1775	1650	1650	1775	1650	1650	1775	1650	1650	1775	1650	1650
Storage Length (m)	15.0	0.0	0.0	25.0	0.0	0.0	35.0	0.0	0.0	25.0	0.0	0.0
Storage Lanes	1	0	0	1	0	0	1	0	0	1	0	0
Taper Length (m)	25.0	0.0	0.0	35.0	0.0	0.0	25.0	0.0	0.0	35.0	0.0	0.0
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	0.97	1.00	0.99	1.00	0.95	0.98	0.97	0.97	0.97	0.97	0.97	0.97
Frt	0.994	0.993	0.993	0.993	0.993	0.993	0.993	0.993	0.993	0.993	0.993	0.993
Flt Protected	0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950
Satd. Flow (prot)	1516	1588	0	1668	1586	0	1588	1397	0	1668	1443	0
Flt Permitted	0.587	0.587	0.587	0.587	0.587	0.587	0.587	0.587	0.587	0.587	0.587	0.587
Satd. Flow (perm)	912	1588	0	563	1586	0	790	1397	0	1004	1443	0
Right Turn on Red	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Satd. Flow (RTOR)	3	3	3	3	3	3	3	3	3	3	3	3
Link Speed (k/h)	50	50	50	50	50	50	50	50	50	50	50	50
Link Distance (m)	48.6	48.6	48.6	48.6	48.6	48.6	48.6	48.6	48.6	48.6	48.6	48.6
Travel Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Confl. Peds. (#/hr)	27	13	13	13	27	58	28	28	28	28	58	27
Confl. Bikes (#/hr)	1	4	4	4	1	1	1	1	1	1	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 (%)	10%	1%	25%	0%	2%	0%	5%	11%	7%	0%	4%	5%
Adj. Flow (vph)	70	424	18	45	196	9	61	199	81	17	151	69
Shared Lane Traffic (%)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	70	442	0	45	205	0	61	280	0	17	220	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)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
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)	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9
Two way Left Turn Lane	1.11	1.21	1.21	1.11	1.21	1.21	1.11	1.21	1.21	1.11	1.21	1.21
Headway Factor	24	24	24	24	24	24	24	24	24	24	24	24
Turning Speed (k/h)	24	24	24	24	24	24	24	24	24	24	24	24
Number of Detectors	1	2	2	1	2	2	1	2	2	1	2	2
Detector Template	Left	Thru	Thru	Left	Thru	Thru	Left	Thru	Thru	Left	Thru	Thru
Leading Detector (m)	6.1	30.5	30.5	6.1	30.5	30.5	6.1	30.5	30.5	6.1	30.5	30.5
Trailing Detector (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
Detector 1 Position(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
Detector 1 Size(m)	6.1	1.8	1.8	6.1	1.8	1.8	6.1	1.8	1.8	6.1	1.8	1.8
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(m)	28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.7
Detector 2 Size(m)	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
Detector 2 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 2 Channel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

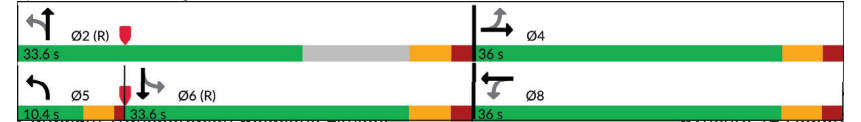
Lanes, Volumes, Timings
2: King Street South & William Street West/William Street East King Street South, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector 2 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Turn Type	Perm	NA	Perm	NA	pm+pt	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases	4	4	4	4	4	4	4	4	4	4	4	4
Permitted Phases	4	4	4	4	4	4	4	4	4	4	4	4
Detector Phase	4	4	4	4	4	4	4	4	4	4	4	4
Switch Phase	4	4	4	4	4	4	4	4	4	4	4	4
Minimum Initial (s)	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0
Minimum Split (s)	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0
Total Split (s)	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0
Total Split (%)	45.0%	45.0%	45.0%	45.0%	45.0%	45.0%	45.0%	45.0%	45.0%	45.0%	45.0%	45.0%
Maximum Green (s)	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead	Lead	Lead	Lead	Lead	Lead	Lead	Lead	Lead	Lead	Lead	Lead
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	None	None	None	None	None	None	None	None	None	None
Walk Time (s)	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0
Flash Don't Walk (s)	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Act Effect Green (s)	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0
Actuated g/C Ratio	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40
v/c Ratio	0.19	0.69	0.20	0.32	0.13	0.39	0.04	0.35	0.04	0.35	0.04	0.35
Control Delay (s/veh)	17.4	26.7	18.6	18.4	11.2	12.6	16.6	16.6	16.6	16.6	16.6	16.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (s/veh)	17.4	26.7	18.6	18.4	11.2	12.6	16.6	16.6	16.6	16.6	16.6	16.6
LOS	B	C	B	B	B	B	B	B	B	B	B	B
Approach Delay (s/veh)	25.5	18.4	12.4	16.6	16.6	16.6	16.6	16.6	16.6	16.6	16.6	16.6
Approach LOS	C	B	B	B	B	B	B	B	B	B	B	B

Intersection Summary

Area Type:	Other
Cycle Length: 80	
Actuated Cycle Length: 80	
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBTL, Start of Green	
Natural Cycle: 80	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.69	
Intersection Signal Delay (s/veh): 19.2	Intersection LOS: B
Intersection Capacity Utilization 111.3%	ICU Level of Service H
Analysis Period (min) 15	

Splits and Phases: 2: King Street South & William Street West/William Street East



Queues
2: King Street South & William Street West/William Street East
250137) 171 King Street South, Waterloo TIS

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	70	442	45	205	61	280	17	220
v/c Ratio	0.19	0.69	0.20	0.32	0.13	0.39	0.04	0.35
Control Delay (s/veh)	17.4	26.7	18.6	18.4	11.2	12.6	16.6	16.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (s/veh)	17.4	26.7	18.6	18.4	11.2	12.6	16.6	16.6
Queue Length 50th (m)	6.7	53.9	4.3	20.9	4.6	21.3	1.6	20.2
Queue Length 95th (m)	15.4	86.8	11.7	36.6	10.4	38.6	5.6	38.0
Internal Link Dist (m)		24.6		105.2		61.4		113.6
Turn Bay Length (m)	15.0		25.0		35.0		25.0	
Base Capacity (vph)	364	637	225	634	458	717	423	628
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.19	0.69	0.20	0.32	0.13	0.39	0.04	0.35
Intersection Summary								

Lanes, Volumes, Timings
3: King Street South & Kuntz Lane
250137) 171 King Street South, 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		↔						↔			↔	
Traffic Volume (vph)	1	1	1	0	0	0	1	335	6	7	236	0
Future Volume (vph)	1	1	1	0	0	0	1	335	6	7	236	0
Ideal Flow (vphpl)	1550	1550	1550	1900	1900	1900	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		0.955						0.998				
Flt Protected		0.984									0.999	
Satd. Flow (prot)	0	1440	0	0	0	0	0	1432	0	0	1434	0
Flt Permitted		0.984									0.999	
Satd. Flow (perm)	0	1440	0	0	0	0	0	1432	0	0	1434	0
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		44.8			46.1			132.5			85.4	
Travel Time (s)		3.2			3.3			9.5			6.1	
Confl. Peds. (#/hr)	1					1	58		19	19		58
Confl. Bikes (#/hr)					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%	0%	0%	0%	0%	0%	0%	7%	0%	0%	7%	0%
Adj. Flow (vph)	1	1	1	0	0	0	1	335	6	7	236	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	3	0	0	0	0	0	342	0	0	243	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			3.5			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.9			1.6			4.9			4.9	
Two way Left Turn Lane												
Headway Factor	1.31	1.31	1.31	1.01	1.01	1.01	1.31	1.31	1.31	1.31	1.31	1.31
Turning Speed (k/h)	24		14	24		14	24		14	24		14
Sign Control		Stop			Stop			Free			Free	
Intersection Summary												
Area Type:	Other											
Control Type:	Unsignalized											
Intersection Capacity Utilization	32.9%											
Analysis Period (min)	15											
	ICU Level of Service A											

HCM 7th TWSC
3: King Street South & Kuntz Lane

2033 Background AM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

Intersection												
Int Delay, s/veh	0.2											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔↔↔↔↔↔↔↔↔↔↔											
Traffic Vol, veh/h	1	1	1	0	0	0	1	335	6	7	236	0
Future Vol, veh/h	1	1	1	0	0	0	1	335	6	7	236	0
Conflicting Peds, #/hr	1	0	0	0	0	1	58	0	19	19	0	58
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	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	0	0	0	0	0	0	7	0	0	7	0
Mvmt Flow	1	1	1	0	0	0	1	335	6	7	236	0
Major/Minor	Minor2			Major1			Major2					
Conflicting Flow All	646	670	294	294			0	0	360	0	0	
Stage 1	308	308	-	-			-	-	-	-	-	
Stage 2	338	362	-	-			-	-	-	-	-	
Critical Hdwy	6.4	6.5	6.2	4.1			-	-	4.1	-	-	
Critical Hdwy Stg 1	5.4	5.5	-	-			-	-	-	-	-	
Critical Hdwy Stg 2	5.4	5.5	-	-			-	-	-	-	-	
Follow-up Hdwy	3.5	4	3.3	2.2			-	-	2.2	-	-	
Pot Cap-1 Maneuver	439	381	750	1279			-	-	1210	-	-	
Stage 1	750	664	-	-			-	-	-	-	-	
Stage 2	727	629	-	-			-	-	-	-	-	
Platoon blocked, %							-	-	-	-	-	
Mov Cap-1 Maneuver	390	0	710	1210			-	-	1210	-	-	
Mov Cap-2 Maneuver	390	0	-	-			-	-	-	-	-	
Stage 1	709	0	-	-			-	-	-	-	-	
Stage 2	683	0	-	-			-	-	-	-	-	
Approach	EB			NB			SB					
HCM Ctrl Dly, s/v	12.19			0.02			0.23					
HCM LOS	B											
Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	SBL	SBT	SBR					
Capacity (veh/h)	5	-	-	503	52	-	-					
HCM Lane V/C Ratio	0.001	-	-	0.006	0.006	-	-					
HCM Ctrl Dly (s/v)	8	0	-	12.2	8	0	-					
HCM Lane LOS	A	A	-	B	A	A	-					
HCM 95th %tile Q(veh)	0	-	-	0	0	-	-					

Lanes, Volumes, Timings
4: Caroline Street South & Allen Street West

2033 Background AM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔				↕			↕			↕	
Traffic Volume (vph)	7	44	17	8	29	12	6	64	13	41	93	12
Future Volume (vph)	7	44	17	8	29	12	6	64	13	41	93	12
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	0.99				0.99			0.99			0.98	
Frt	0.966				0.967			0.979			0.989	
Flt Protected	0.995				0.992			0.996			0.986	
Satd. Flow (prot)	0	1427	0	0	1458	0	0	1419	0	0	1370	0
Flt Permitted	0.979				0.964			0.986			0.919	
Satd. Flow (perm)	0	1402	0	0	1410	0	0	1398	0	0	1268	0
Right Turn on Red	Yes					Yes				Yes		No
Satd. Flow (RTOR)	17				12		13					
Link Speed (k/h)	50				50		50				50	
Link Distance (m)	81.6				87.7		93.6				95.7	
Travel Time (s)	5.9				6.3		6.7				6.9	
Conf. Peds. (#/hr)	13		27	27		13	72		23	23		72
Conf. Bikes (#/hr)	2											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%	0%	0%	20%	4%	0%	22%	2%	9%
Adj. Flow (vph)	7	44	17	8	29	12	6	64	13	41	93	12
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	68	0	0	49	0	0	83	0	0	146	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)	4.9			4.9			4.9			4.9		
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)	24		14	24		14	24		14	24		14
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	6.1	30.5		6.1	30.5		6.1	30.5		6.1	30.5	
Trailing Detector (m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Position(m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Size(m)	6.1	1.8		6.1	1.8		6.1	1.8		6.1	1.8	
Detector 1 Type	CI+Ex	CI+Ex		CI+Ex	CI+Ex		CI+Ex	CI+Ex		CI+Ex	CI+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(m)	28.7			28.7			28.7			28.7		
Detector 2 Size(m)	1.8			1.8			1.8			1.8		
Detector 2 Type	CI+Ex			CI+Ex			CI+Ex			CI+Ex		
Detector 2 Channel												
Detector 2 Extend (s)	0.0			0.0			0.0			0.0		
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases	4			8			2			6		

Lanes, Volumes, Timings 2033 Background AM Peak Hour (without LRT)
4: Caroline Street South & Allen Street West (250137) 171 King Street South, Waterloo TIS

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	34.0	34.0		34.0	34.0		34.0	34.0		34.0	34.0	
Minimum Split (s)	40.0	40.0		40.0	40.0		40.0	40.0		40.0	40.0	
Total Split (s)	40.0	40.0		40.0	40.0		40.0	40.0		40.0	40.0	
Total Split (%)	50.0%	50.0%		50.0%	50.0%		50.0%	50.0%		50.0%	50.0%	
Maximum Green (s)	34.0	34.0		34.0	34.0		34.0	34.0		34.0	34.0	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Lost Time Adjust (s)		-2.0			-2.0			-2.0			-2.0	
Total Lost Time (s)		4.0			4.0			4.0			4.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		C-Max	C-Max		C-Max	C-Max	
Walk Time (s)	29.0	29.0		29.0	29.0		28.0	28.0		28.0	28.0	
Flash Don't Walk (s)	5.0	5.0		5.0	5.0		6.0	6.0		6.0	6.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)		36.0			36.0			53.6			53.6	
Actuated g/C Ratio		0.45			0.45			0.67			0.67	
v/c Ratio		0.11			0.08			0.09			0.17	
Control Delay (s/veh)		10.7			10.6			10.4			12.0	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay (s/veh)		10.7			10.6			10.4			12.0	
LOS		B			B			B			B	
Approach Delay (s/veh)		10.7			10.6			10.4			12.0	
Approach LOS		B			B			B			B	
Intersection Summary												
Area Type:	Other											
Cycle Length: 80												
Actuated Cycle Length: 80												
Offset: 60 (75%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green												
Natural Cycle: 80												
Control Type: Actuated-Coordinated												
Maximum v/c Ratio: 0.17												
Intersection Signal Delay (s/veh): 11.2	Intersection LOS: B											
Intersection Capacity Utilization 63.3%	ICU Level of Service B											
Analysis Period (min) 15												

Splits and Phases: 4: Caroline Street South & Allen Street West



Queues 2033 Background AM Peak Hour (without LRT)
4: Caroline Street South & Allen Street West (250137) 171 King Street South, Waterloo TIS

	EBT	WBT	NBT	SBT
Lane Group Flow (vph)	68	49	83	146
v/c Ratio	0.11	0.08	0.09	0.17
Control Delay (s/veh)	10.7	10.6	10.4	12.0
Queue Delay	0.0	0.0	0.0	0.0
Total Delay (s/veh)	10.7	10.6	10.4	12.0
Queue Length 50th (m)	4.2	3.1	5.9	13.2
Queue Length 95th (m)	11.2	8.7	13.8	25.1
Internal Link Dist (m)	57.6	63.7	69.6	71.7
Turn Bay Length (m)				
Base Capacity (vph)	640	641	941	849
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.11	0.08	0.09	0.17
Intersection Summary				

Lanes, Volumes, Timings
5: Caroline Street South & Site Access

2033 Background AM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	W		R			R
Traffic Volume (vph)	8	3	90	6	7	141
Future Volume (vph)	8	3	90	6	7	141
Ideal Flow (vphpl)	1765	1765	1650	1650	1650	1650
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt	0.963		0.992			
Flt Protected	0.965					0.998
Satd. Flow (prot)	1488	0	1574	0	0	1500
Flt Permitted	0.965					0.998
Satd. Flow (perm)	1488	0	1574	0	0	1500
Link Speed (k/h)	50		50			50
Link Distance (m)	57.9		95.7			59.8
Travel Time (s)	4.2		6.9			4.3
Confl. Peds. (#/hr)	2	2		22	22	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	33%	3%	0%	0%	9%
Adj. Flow (vph)	8	3	90	6	7	141
Shared Lane Traffic (%)						
Lane Group Flow (vph)	11	0	96	0	0	148
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)	4.9		4.9			4.9
Two way Left Turn Lane						
Headway Factor	1.12	1.12	1.21	1.21	1.21	1.21
Turning Speed (k/h)	24	14		14	24	
Sign Control	Stop		Free			Free
Intersection Summary						
Area Type:	Other					
Control Type:	Unsignalized					
Intersection Capacity Utilization 25.8%	ICU Level of Service A					
Analysis Period (min) 15						

HCM 7th TWSC
5: Caroline Street South & Site Access

2033 Background AM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

Intersection						
Int Delay, s/veh	0.6					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	8	3	90	6	7	141
Future Vol, veh/h	8	3	90	6	7	141
Conflicting Peds, #/hr	2	2	0	22	22	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	33	3	0	0	9
Mvmt Flow	8	3	90	6	7	141
Major/Minor	Minor1	Major1		Major2		
Conflicting Flow All	272	117	0	0	118	0
Stage 1	115	-	-	-	-	-
Stage 2	157	-	-	-	-	-
Critical Hdwy	6.4	6.53	-	-	4.1	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.597	-	-	2.2	-
Pot Cap-1 Maneuver	722	858	-	-	1483	-
Stage 1	915	-	-	-	-	-
Stage 2	876	-	-	-	-	-
Platoon blocked, %		-	-	-	-	-
Mov Cap-1 Maneuver	702	839	-	-	1452	-
Mov Cap-2 Maneuver	702	-	-	-	-	-
Stage 1	896	-	-	-	-	-
Stage 2	870	-	-	-	-	-
Approach	WB	NB		SB		
HCM Ctrl Dly, s/v	9.98	0		0.35		
HCM LOS	A					
Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT		
Capacity (veh/h)	-	-	735	85	-	
HCM Lane V/C Ratio	-	-	0.015	0.005	-	
HCM Ctrl Dly (s/v)	-	-	10	7.5	0	
HCM Lane LOS	-	-	A	A	A	
HCM 95th %tile Q(veh)	-	-	0	0	-	

Lanes, Volumes, Timings
1: Kuntz Lane & William Street West

2033 Background PM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

						
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	444	0	2	491	0	0
Future Volume (vph)	444	0	2	491	0	0
Ideal Flow (vphpl)	1650	1650	1650	1650	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt						
Flt Protected						
Satd. Flow (prot)	1584	0	0	1616	0	0
Flt Permitted						
Satd. Flow (perm)	1584	0	0	1616	0	0
Link Speed (k/h)	50			50	50	
Link Distance (m)	50.7			48.6	58.5	
Travel Time (s)	3.7			3.5	4.2	
Confl. Peds. (#/hr)		13	13			
Confl. Bikes (#/hr)	1		2	2		1
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	3%	0%	0%	1%	0%	0%
Adj. Flow (vph)	444	0	2	491	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	444	0	0	493	0	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.5			3.5	0.0	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.9			4.9	4.9	
Two way Left Turn Lane						
Headway Factor	1.21	1.21	1.21	1.21	1.01	1.01
Turning Speed (k/h)		14	24		24	14
Sign Control	Free			Free	Stop	
Intersection Summary						
Area Type:	Other					
Control Type:	Unsignalized					
Intersection Capacity Utilization	34.9%			ICU Level of Service A		
Analysis Period (min)	15					

HCM Unsignalized Intersection Capacity Analysis2033 Background PM Peak Hour (without LRT)
1: Kuntz Lane & William Street West (250137) 171 King Street South, Waterloo TIS

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↰			↱		
Traffic Volume (veh/h)	444	0	2	491	0	0
Future Volume (Veh/h)	444	0	2	491	0	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	444	0	2	491	0	0
Pedestrians					13	
Lane Width (m)					0.0	
Walking Speed (m/s)					1.0	
Percent Blockage					0	
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)				48		
pX, platoon unblocked					0.84	
vC, conflicting volume			457		952	457
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			457		847	457
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	100
cM capacity (veh/h)			1114		281	608
Direction, Lane #						
	EB 1	WB 1				
Volume Total	444	493				
Volume Left	0	2				
Volume Right	0	0				
cSH	1700	1114				
Volume to Capacity	0.26	0.00				
Queue Length 95th (m)	0.0	0.0				
Control Delay (s/veh)	0.0	0.1				
Lane LOS		A				
Approach Delay (s/veh)	0.0	0.1				
Approach LOS						
Intersection Summary						
Average Delay		0.0				
Intersection Capacity Utilization		34.9%		ICU Level of Service		A
Analysis Period (min)		15				

Lanes, Volumes, Timings
2: King Street South & William Street West/William Street East King Street South, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	←	←	←	←	←	←	←	←	←	←	←	←
Traffic Volume (vph)	54	365	25	70	319	10	82	227	73	14	292	92
Future Volume (vph)	54	365	25	70	319	10	82	227	73	14	292	92
Ideal Flow (vphpl)	1775	1650	1650	1775	1650	1650	1775	1650	1650	1775	1650	1650
Storage Length (m)	15.0	0.0	0.0	25.0	0.0	0.0	35.0	0.0	0.0	25.0	0.0	0.0
Storage Lanes	1	0	0	1	0	0	1	0	0	1	0	0
Taper Length (m)	25.0	0.0	0.0	35.0	0.0	0.0	25.0	0.0	0.0	35.0	0.0	0.0
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	0.98	1.00	0.98	1.00	0.98	0.93	0.93	0.98	0.96	0.96	0.96	0.96
Frt	0.990	0.990	0.990	0.995	0.995	0.963	0.963	0.963	0.963	0.963	0.963	0.963
Flt Protected	0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950
Satd. Flow (prot)	1573	1574	0	1635	1621	0	1668	1462	0	1668	1462	0
Flt Permitted	0.444	0.444	0.377	0.377	0.377	0.318	0.318	0.577	0.577	0.577	0.577	0.577
Satd. Flow (perm)	720	1574	0	638	1621	0	521	1462	0	970	1462	0
Right Turn on Red		Yes		No			Yes			Yes		
Satd. Flow (RTOR)	5	5	5	5	5	5	29	23	23	23	23	23
Link Speed (k/h)	50	50	50	50	50	50	50	50	50	50	50	50
Link Distance (m)	48.6	48.6	48.6	129.2	129.2	129.2	85.4	137.6	137.6	137.6	137.6	137.6
Travel Time (s)	3.5	3.5	3.5	9.3	9.3	9.3	6.1	9.9	9.9	9.9	9.9	9.9
Confl. Peds. (#/hr)	28	28	26	26	28	104	44	44	104	44	44	104
Confl. Bikes (#/hr)	1	1	1	1	1	1	1	1	1	1	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 (%)	6%	1%	21%	2%	0%	0%	0%	7%	0%	0%	3%	4%
Adj. Flow (vph)	54	365	25	70	319	10	82	227	73	14	292	92
Shared Lane Traffic (%)												
Lane Group Flow (vph)	54	390	0	70	329	0	82	300	0	14	384	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)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
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)	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9
Two way Left Turn Lane												
Headway Factor	1.11	1.21	1.21	1.11	1.21	1.21	1.11	1.21	1.21	1.11	1.21	1.21
Turning Speed (k/h)	24	24	24	24	24	24	24	24	24	24	24	24
Number of Detectors	1	2	2	1	2	2	1	2	2	1	2	2
Detector Template	Left	Thru	Thru	Left	Thru	Thru	Left	Thru	Thru	Left	Thru	Thru
Leading Detector (m)	6.1	30.5	30.5	6.1	30.5	30.5	6.1	30.5	30.5	6.1	30.5	30.5
Trailing Detector (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
Detector 1 Position(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
Detector 1 Size(m)	6.1	1.8	1.8	6.1	1.8	1.8	6.1	1.8	1.8	6.1	1.8	1.8
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(m)	28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.7
Detector 2 Size(m)	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
Detector 2 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 2 Channel												

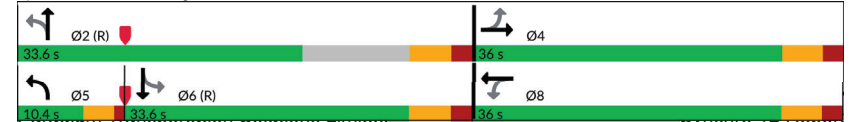
Lanes, Volumes, Timings
2: King Street South & William Street West/William Street East King Street South, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector 2 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Turn Type	Perm	NA	Perm	NA	pm+pt	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases	4	4	8	8	5	2	6	6	6	6	6	6
Permitted Phases	4	4	8	8	2	2	6	6	6	6	6	6
Detector Phase	4	4	8	8	5	2	6	6	6	6	6	6
Switch Phase												
Minimum Initial (s)	30.0	30.0	30.0	30.0	5.0	27.6	27.6	27.6	27.6	27.6	27.6	27.6
Minimum Split (s)	36.0	36.0	36.0	36.0	9.0	33.6	33.6	33.6	33.6	33.6	33.6	33.6
Total Split (s)	36.0	36.0	36.0	36.0	10.4	33.6	33.6	33.6	33.6	33.6	33.6	33.6
Total Split (%)	45.0%	45.0%	45.0%	45.0%	13.0%	42.0%	42.0%	42.0%	42.0%	42.0%	42.0%	42.0%
Maximum Green (s)	30.0	30.0	30.0	30.0	6.4	27.6	27.6	27.6	27.6	27.6	27.6	27.6
Yellow Time (s)	4.0	4.0	4.0	4.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	1.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	0.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag					Lead	Lag	Lag	Lag	Lag	Lag	Lag	Lag
Lead-Lag Optimize?					Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	None	None	None	C-Max	C-Max	C-Max	C-Max	C-Max	C-Max	C-Max
Walk Time (s)	19.0	19.0	19.0	19.0	21.6	21.6	21.6	21.6	21.6	21.6	21.6	21.6
Flash Don't Walk (s)	11.0	11.0	11.0	11.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Pedestrian Calls (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Act Effect Green (s)	32.0	32.0	32.0	32.0	40.0	40.0	31.7	31.7	31.7	31.7	31.7	31.7
Actuated g/C Ratio	0.40	0.40	0.40	0.40	0.50	0.50	0.40	0.40	0.40	0.40	0.40	0.40
v/c Ratio	0.19	0.62	0.27	0.51	0.23	0.40	0.04	0.65	0.04	0.65	0.04	0.65
Control Delay (s/veh)	17.8	24.1	19.9	21.5	12.3	13.2	16.6	25.6	16.6	25.6	16.6	25.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (s/veh)	17.8	24.1	19.9	21.5	12.3	13.2	16.6	25.6	16.6	25.6	16.6	25.6
LOS	B	C	B	C	B	B	B	C	B	C	B	C
Approach Delay (s/veh)	23.3	21.2	13.0	25.3								
Approach LOS	C	C	B	C								

Intersection Summary

Area Type:	Other
Cycle Length: 80	
Actuated Cycle Length: 80	
Offset: 26.4 (33%), Referenced to phase 2:NBT and 6:SBTL, Start of Green	
Natural Cycle: 80	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.65	
Intersection Signal Delay (s/veh): 20.8	Intersection LOS: C
Intersection Capacity Utilization 109.3%	ICU Level of Service H
Analysis Period (min) 15	

Splits and Phases: 2: King Street South & William Street West/William Street East



Queues
2: King Street South & William Street West/William Street East
250137 171 King Street South, Waterloo TIS

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	54	390	70	329	82	300	14	384
v/c Ratio	0.19	0.62	0.27	0.51	0.23	0.40	0.04	0.65
Control Delay (s/veh)	17.8	24.1	19.9	21.5	12.3	13.2	16.6	25.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (s/veh)	17.8	24.1	19.9	21.5	12.3	13.2	16.6	25.6
Queue Length 50th (m)	5.2	45.3	7.0	36.6	6.2	24.1	1.3	45.5
Queue Length 95th (m)	13.0	73.6	16.8	59.7	13.1	41.9	5.0	76.5
Internal Link Dist (m)		24.6		105.2		61.4		113.6
Turn Bay Length (m)	15.0		25.0		35.0		25.0	
Base Capacity (vph)	288	632	255	648	352	745	383	592
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.19	0.62	0.27	0.51	0.23	0.40	0.04	0.65
Intersection Summary								

Lanes, Volumes, Timings
3: King Street South & Kuntz Lane
250137 171 King Street South, Waterloo TIS

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	6	0	9	0	0	0	0	361	6	7	385	1
Future Volume (vph)	6	0	9	0	0	0	0	361	6	7	385	1
Ideal Flow (vphpl)	1550	1550	1550	1900	1900	1900	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		0.919						0.998				
Flt Protected		0.980									0.999	
Satd. Flow (prot)	0	1380	0	0	0	0	0	1444	0	0	1474	0
Flt Permitted		0.980									0.999	
Satd. Flow (perm)	0	1380	0	0	0	0	0	1444	0	0	1474	0
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		44.8			46.1			132.5			85.4	
Travel Time (s)		3.2			3.3			9.5			6.1	
Confl. Peds. (#/hr)	1					1	86		36	36		86
Confl. Bikes (#/hr)								1			4	
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%	0%	0%	0%	0%	0%	0%	6%	0%	0%	4%	0%
Adj. Flow (vph)	6	0	9	0	0	0	0	361	6	7	385	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	15	0	0	0	0	0	367	0	0	393	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			3.5			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.9			1.6			4.9			4.9	
Two way Left Turn Lane												
Headway Factor	1.31	1.31	1.31	1.01	1.01	1.01	1.31	1.31	1.31	1.31	1.31	1.31
Turning Speed (k/h)	24		14	24		14	24		14	24		14
Sign Control		Stop			Stop			Free			Free	
Intersection Summary												
Area Type:	Other											
Control Type:	Unsignalized											
Intersection Capacity Utilization	46.2%						ICU Level of Service A					
Analysis Period (min)	15											

HCM 7th TWSC
3: King Street South & Kuntz Lane

2033 Background PM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

Intersection												
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	6	0	9	0	0	0	0	361	6	7	385	1
Future Vol, veh/h	6	0	9	0	0	0	0	361	6	7	385	1
Conflicting Peds, #/hr	1	0	0	0	0	1	86	0	36	36	0	86
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	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	0	0	0	0	0	0	6	0	0	4	0
Mvmt Flow	6	0	9	0	0	0	0	361	6	7	385	1
Major/Minor	Minor2			Major1			Major2					
Conflicting Flow All	848	889	472				472	0	0	403	0	0
Stage 1	486	486	-				-	-	-	-	-	-
Stage 2	362	403	-				-	-	-	-	-	-
Critical Hdwy	6.4	6.5	6.2				4.1	-	-	4.1	-	-
Critical Hdwy Stg 1	5.4	5.5	-				-	-	-	-	-	-
Critical Hdwy Stg 2	5.4	5.5	-				-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3				2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	335	285	596				1100	-	-	1167	-	-
Stage 1	623	555	-				-	-	-	-	-	-
Stage 2	709	603	-				-	-	-	-	-	-
Platoon blocked, %							-	-	-	-	-	-
Mov Cap-1 Maneuver	281	0	549				1012	-	-	1167	-	-
Mov Cap-2 Maneuver	281	0	-				-	-	-	-	-	-
Stage 1	573	0	-				-	-	-	-	-	-
Stage 2	647	0	-				-	-	-	-	-	-
Approach	EB						NB			SB		
HCM Ctrl Dly, s/v	14.42						0			0.14		
HCM LOS	B											
Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	SBL	SBT	SBR					
Capacity (veh/h)	1012	-	-	397	32	-	-					
HCM Lane V/C Ratio	-	-	-	0.038	0.006	-	-					
HCM Ctrl Dly (s/v)	0	-	-	14.4	8.1	0	-					
HCM Lane LOS	A	-	-	B	A	A	-					
HCM 95th %tile Q(veh)	0	-	-	0.1	0	-	-					

Lanes, Volumes, Timings
4: Caroline Street South & Allen Street West

2033 Background PM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔			↔			↔			↔		
Traffic Volume (vph)	15	27	11	14	65	10	20	126	41	52	106	28
Future Volume (vph)	15	27	11	14	65	10	20	126	41	52	106	28
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	0.98			0.99			0.98			0.98		
Frt	0.972			0.985			0.970			0.980		
Flt Protected	0.986			0.992			0.995			0.986		
Satd. Flow (prot)	0	1451	0	0	1438	0	0	1434	0	0	1407	0
Flt Permitted	0.933			0.965			0.965			0.885		
Satd. Flow (perm)	0	1366	0	0	1391	0	0	1382	0	0	1252	0
Right Turn on Red	Yes			Yes			Yes			No		
Satd. Flow (RTOR)	11			10			23					
Link Speed (k/h)	50			50			50			50		
Link Distance (m)	81.6			87.7			93.6			95.7		
Travel Time (s)	5.9			6.3			6.7			6.9		
Confl. Peds. (#/hr)	18		34	34		18	73		35	35		73
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%	0%	0%	0%	5%	0%	0%	1%	5%	13%	0%	0%
Adj. Flow (vph)	15	27	11	14	65	10	20	126	41	52	106	28
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	53	0	0	89	0	0	187	0	0	186	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)	4.9			4.9			4.9			4.9		
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)	24		14	24		14	24		14	24		14
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	6.1	30.5		6.1	30.5		6.1	30.5		6.1	30.5	
Trailing Detector (m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Position(m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Size(m)	6.1	1.8		6.1	1.8		6.1	1.8		6.1	1.8	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(m)	28.7			28.7			28.7			28.7		
Detector 2 Size(m)	1.8			1.8			1.8			1.8		
Detector 2 Type	Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex		
Detector 2 Channel												
Detector 2 Extend (s)	0.0			0.0			0.0			0.0		
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases	4			8			2			6		
Permitted Phases	4			8			2			6		

Lanes, Volumes, Timings
4: Caroline Street South & Allen Street West 2033 Background PM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

	↖	→	↗	↖	←	↖	↖	↑	↗	↘	↓	↘
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	4	4		8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	34.0	34.0		34.0	34.0		34.0	34.0		34.0	34.0	
Minimum Split (s)	40.0	40.0		40.0	40.0		40.0	40.0		40.0	40.0	
Total Split (s)	40.0	40.0		40.0	40.0		40.0	40.0		40.0	40.0	
Total Split (%)	50.0%	50.0%		50.0%	50.0%		50.0%	50.0%		50.0%	50.0%	
Maximum Green (s)	34.0	34.0		34.0	34.0		34.0	34.0		34.0	34.0	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Lost Time Adjust (s)		-2.0			-2.0			-2.0			-2.0	
Total Lost Time (s)		4.0			4.0			4.0			4.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		C-Max	C-Max		C-Max	C-Max	
Walk Time (s)	29.0	29.0		29.0	29.0		28.0	28.0		28.0	28.0	
Flash Don't Walk (s)	5.0	5.0		5.0	5.0		6.0	6.0		6.0	6.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)		36.0			36.0			44.8			44.8	
Actuated g/C Ratio		0.45			0.45			0.56			0.56	
v/c Ratio		0.09			0.14			0.24			0.27	
Control Delay (s/veh)		11.0			12.3			12.6			14.7	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay (s/veh)		11.0			12.3			12.6			14.7	
LOS		B			B			B			B	
Approach Delay (s/veh)		11.0			12.3			12.6			14.7	
Approach LOS		B			B			B			B	

Intersection Summary

Area Type:	Other
Cycle Length: 80	
Actuated Cycle Length: 80	
Offset: 60 (75%), Referenced to phase 2:NBT and 6:SBTL, Start of Green	
Natural Cycle: 80	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.27	
Intersection Signal Delay (s/veh): 13.2	Intersection LOS: B
Intersection Capacity Utilization 63.3%	ICU Level of Service B
Analysis Period (min) 15	

Splits and Phases: 4: Caroline Street South & Allen Street West



Queues
4: Caroline Street South & Allen Street West 2033 Background PM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

	→	←	↑	↓
Lane Group	EBT	WBT	NBT	SBT
Lane Group Flow (vph)	53	89	187	186
v/c Ratio	0.09	0.14	0.24	0.27
Control Delay (s/veh)	11.0	12.3	12.6	14.7
Queue Delay	0.0	0.0	0.0	0.0
Total Delay (s/veh)	11.0	12.3	12.6	14.7
Queue Length 50th (m)	3.5	6.7	14.9	17.5
Queue Length 95th (m)	9.5	15.0	28.5	31.9
Internal Link Dist (m)	57.6	63.7	69.6	71.7
Turn Bay Length (m)				
Base Capacity (vph)	620	631	784	701
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.09	0.14	0.24	0.27

Intersection Summary

Lanes, Volumes, Timings
5: Caroline Street South & Site Access

2033 Background PM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

						
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	9	32	154	4	3	166
Future Volume (vph)	9	32	154	4	3	166
Ideal Flow (vphpl)	1765	1765	1650	1650	1650	1650
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt	0.895		0.997			
Flt Protected	0.989					0.999
Satd. Flow (prot)	1545	0	1611	0	0	1554
Flt Permitted	0.989					0.999
Satd. Flow (perm)	1545	0	1611	0	0	1554
Link Speed (k/h)	50		50			50
Link Distance (m)	57.9		95.7			59.8
Travel Time (s)	4.2		6.9			4.3
Confl. Peds. (#/hr)	2	3		30	30	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	0%	1%	0%	0%	5%
Adj. Flow (vph)	9	32	154	4	3	166
Shared Lane Traffic (%)						
Lane Group Flow (vph)	41	0	158	0	0	169
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)	4.9		4.9			4.9
Two way Left Turn Lane						
Headway Factor	1.12	1.12	1.21	1.21	1.21	1.21
Turning Speed (k/h)	24	14		14	24	
Sign Control	Stop		Free			Free
Intersection Summary						
Area Type:	Other					
Control Type:	Unsignalized					
Intersection Capacity Utilization	23.8%			ICU Level of Service A		
Analysis Period (min)	15					

HCM 7th TWSC
5: Caroline Street South & Site Access

2033 Background PM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

Intersection						
Int Delay, s/veh	1.2					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	9	32	154	4	3	166
Future Vol, veh/h	9	32	154	4	3	166
Conflicting Peds, #/hr	2	3	0	30	30	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	1	0	0	5
Mvmt Flow	9	32	154	4	3	166
Major/Minor	Minor1	Major1		Major2		
Conflicting Flow All	360	189	0	0	188	0
Stage 1	186	-	-	-	-	-
Stage 2	174	-	-	-	-	-
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	643	858	-	-	1398	-
Stage 1	851	-	-	-	-	-
Stage 2	861	-	-	-	-	-
Platoon blocked, %		-	-	-	-	-
Mov Cap-1 Maneuver	622	832	-	-	1359	-
Mov Cap-2 Maneuver	622	-	-	-	-	-
Stage 1	827	-	-	-	-	-
Stage 2	857	-	-	-	-	-
Approach	WB	NB		SB		
HCM Ctrl Dly, s/v	9.91	0		0.14		
HCM LOS	A					
Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT		
Capacity (veh/h)	-	-	774	32	-	
HCM Lane V/C Ratio	-	-	0.053	0.002	-	
HCM Ctrl Dly (s/v)	-	-	9.9	7.7	0	
HCM Lane LOS	-	-	A	A	A	
HCM 95th %tile Q(veh)	-	-	0.2	0	-	

Appendix J

2033 Total Traffic Operations Reports



Lanes, Volumes, Timings
1: Kuntz Lane & William Street West

2033 Total AM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

	→	↘	↙	←	↖	↗
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↔	↔	↔	↔	↔	↔
Traffic Volume (vph)	529	15	3	339	0	0
Future Volume (vph)	529	15	3	339	0	0
Ideal Flow (vphpl)	1650	1650	1650	1650	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt	0.996					
Flt Protected						
Satd. Flow (prot)	1579	0	0	1585	0	0
Flt Permitted						
Satd. Flow (perm)	1579	0	0	1585	0	0
Link Speed (k/h)	50			50	50	
Link Distance (m)	50.7			48.6	58.5	
Travel Time (s)	3.7			3.5	4.2	
Confl. Peds. (#/hr)		14	14		4	2
Confl. Bikes (#/hr)	4			2		
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	3%	0%	0%	3%	0%	0%
Adj. Flow (vph)	529	15	3	339	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	544	0	0	342	0	0
Sign Control	Free			Free	Stop	

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	43.8%
ICU Level of Service	A
Analysis Period (min)	15

HCM Unsignalized Intersection Capacity Analysis
1: Kuntz Lane & William Street West

2033 Total AM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↔	↔	↔	↔	↔	↔
Traffic Volume (veh/h)	529	15	3	339	0	0
Future Volume (Veh/h)	529	15	3	339	0	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	529	15	3	339	0	0
Pedestrians	4			2	14	
Lane Width (m)	3.5			3.5	0.0	
Walking Speed (m/s)	1.0			1.0	1.0	
Percent Blockage	0			0	0	
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)				48		
pX, platoon unblocked					0.91	
vC, conflicting volume			558		900	553
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			558		840	553
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	100
cM capacity (veh/h)			1023		305	536

Direction, Lane #	EB 1	WB 1
Volume Total	544	342
Volume Left	0	3
Volume Right	15	0
cSH	1700	1023
Volume to Capacity	0.32	0.00
Queue Length 95th (m)	0.0	0.1
Control Delay (s/veh)	0.0	0.1
Lane LOS		A
Approach Delay (s/veh)	0.0	0.1
Approach LOS		

Intersection Summary

Average Delay	0.0		
Intersection Capacity Utilization	43.8%	ICU Level of Service	A
Analysis Period (min)	15		

Lanes, Volumes, Timings
2: King Street South & William Street West/William Street East King Street South, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱	↲	↰	↱	↲	↰	↱	↲	↰	↱	↲
Traffic Volume (vph)	76	435	18	49	197	9	75	213	93	17	156	70
Future Volume (vph)	76	435	18	49	197	9	75	213	93	17	156	70
Ideal Flow (vphpl)	1775	1650	1650	1775	1650	1650	1775	1650	1650	1775	1650	1650
Storage Length (m)	15.0		0.0	25.0		0.0	35.0		0.0	25.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	25.0			35.0			25.0			35.0		
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	0.97	1.00		0.99	1.00		0.95	0.98		0.97	0.97	
Frt		0.994			0.993			0.954			0.954	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1516	1588	0	1668	1586	0	1588	1392	0	1668	1445	0
Flt Permitted	0.585			0.311			0.485			0.574		
Satd. Flow (perm)	909	1588	0	542	1586	0	768	1392	0	981	1445	0
Right Turn on Red			Yes			No			Yes			Yes
Satd. Flow (RTOR)		3						39			32	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		48.6			129.2			85.4			137.6	
Travel Time (s)		3.5			9.3			6.1			9.9	
Confl. Peds. (#/hr)	27		13	13		27	58		28	28		58
Confl. Bikes (#/hr)	1	4			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 (%)	10%	1%	25%	0%	2%	0%	5%	11%	7%	0%	4%	5%
Adj. Flow (vph)	76	435	18	49	197	9	75	213	93	17	156	70
Shared Lane Traffic (%)												
Lane Group Flow (vph)	76	453	0	49	206	0	75	306	0	17	226	0
Turn Type	Perm	NA		Perm	NA		pm+pt	NA		Perm	NA	
Protected Phases		4			8		5	2			6	
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		5	2		6	6	
Switch Phase												
Minimum Initial (s)	30.0	30.0		30.0	30.0		5.0	27.6		27.6	27.6	
Minimum Split (s)	36.0	36.0		36.0	36.0		9.0	33.6		33.6	33.6	
Total Split (s)	36.0	36.0		36.0	36.0		10.4	33.6		33.6	33.6	
Total Split (%)	45.0%	45.0%		45.0%	45.0%		13.0%	42.0%		42.0%	42.0%	
Yellow Time (s)	4.0	4.0		4.0	4.0		3.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		1.0	2.0		2.0	2.0	
Lost Time Adjust (s)	-2.0	-2.0		-2.0	-2.0		0.0	-2.0		-2.0	-2.0	
Total Lost Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lead/Lag							Lead			Lag		Lag
Lead-Lag Optimize?							Yes			Yes		Yes
Recall Mode	None	None		None	None		None	C-Max		C-Max	C-Max	
Act Effct Green (s)	32.0	32.0		32.0	32.0		40.0	40.0		31.7	31.7	
Actuated g/C Ratio	0.40	0.40		0.40	0.40		0.50	0.50		0.40	0.40	
v/c Ratio	0.21	0.71		0.23	0.32		0.17	0.43		0.04	0.38	
Control Delay (s/veh)	17.7	27.5		19.3	18.4		11.5	13.2		16.7	17.9	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay (s/veh)	17.7	27.5		19.3	18.4		11.5	13.2		16.7	17.9	
LOS	B	C		B	B		B	B		B	B	

Lanes, Volumes, Timings
2: King Street South & William Street West/William Street East King Street South, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Approach Delay (s/veh)	26.1			18.6			12.9				17.8	
Approach LOS	C			B			B				B	
Queue Length 50th (m)	7.4	55.8		4.8	21.0		5.7	23.9		1.6	21.1	
Queue Length 95th (m)	16.6	89.5		12.7	36.7		12.3	42.7		5.6	39.3	
Internal Link Dist (m)		24.6			105.2			61.4			113.6	
Turn Bay Length (m)	15.0			25.0			35.0				25.0	
Base Capacity (vph)	363	637		216	634		449	715		388	591	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.21	0.71		0.23	0.32		0.17	0.43		0.04	0.38	

Intersection Summary												
Area Type:	Other											
Cycle Length: 80												
Actuated Cycle Length: 80												
Offset: 0 (0%), Referenced to phase 2:NBTl and 6:SBTL, Start of Green												
Natural Cycle: 80												
Control Type: Actuated-Coordinated												
Maximum v/c Ratio: 0.71												
Intersection Signal Delay (s/veh): 19.7	Intersection LOS: B											
Intersection Capacity Utilization 112.0%	ICU Level of Service H											
Analysis Period (min) 15												



Lanes, Volumes, Timings
3: King Street South & Kuntz Lane

2033 Total AM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔						↔			↔	
Traffic Volume (vph)	41	1	18	0	0	0	5	335	6	7	236	9
Future Volume (vph)	41	1	18	0	0	0	5	335	6	7	236	9
Ideal Flow (vphpl)	1550	1550	1550	1900	1900	1900	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		0.959						0.998			0.995	
Flt Protected		0.967						0.999			0.999	
Satd. Flow (prot)	0	1421	0	0	0	0	0	1431	0	0	1430	0
Flt Permitted		0.967						0.999			0.999	
Satd. Flow (perm)	0	1421	0	0	0	0	0	1431	0	0	1430	0
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		44.8			46.1			132.5			85.4	
Travel Time (s)		3.2			3.3			9.5			6.1	
Confl. Peds. (#/hr)	1					1	58		19	19		58
Confl. Bikes (#/hr)					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%	0%	0%	0%	0%	0%	0%	7%	0%	0%	7%	0%
Adj. Flow (vph)	41	1	18	0	0	0	5	335	6	7	236	9
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	60	0	0	0	0	0	346	0	0	252	0
Sign Control		Stop			Stop			Free			Free	

Intersection Summary												
Area Type:	Other											
Control Type:	Unsignalized											
Intersection Capacity Utilization	42.3%											
Analysis Period (min)	15											
	ICU Level of Service A											

HCM 7th TWSC
3: King Street South & Kuntz Lane

2033 Total AM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

Intersection												
Int Delay, s/veh	1.5											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔						↔			↔	
Traffic Vol, veh/h	41	1	18	0	0	0	5	335	6	7	236	9
Future Vol, veh/h	41	1	18	0	0	0	5	335	6	7	236	9
Conflicting Peds, #/hr	1	0	0	0	0	1	58	0	19	19	0	58
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	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	0	0	0	0	0	0	7	0	0	7	0
Mvmt Flow	41	1	18	0	0	0	5	335	6	7	236	9

Major/Minor	Minor2		Major1	Major2								
Conflicting Flow All	659	683	299	303	0	0	360	0	0			
Stage 1	313	313	-	-	-	-	-	-	-			
Stage 2	346	370	-	-	-	-	-	-	-			
Critical Hdwy	6.4	6.5	6.2	4.1	-	-	4.1	-	-			
Critical Hdwy Stg 1	5.4	5.5	-	-	-	-	-	-	-			
Critical Hdwy Stg 2	5.4	5.5	-	-	-	-	-	-	-			
Follow-up Hdwy	3.5	4	3.3	2.2	-	-	2.2	-	-			
Pot Cap-1 Maneuver	432	374	746	1269	-	-	1210	-	-			
Stage 1	746	661	-	-	-	-	-	-	-			
Stage 2	721	624	-	-	-	-	-	-	-			
Platoon blocked, %				-	-	-	-	-	-			
Mov Cap-1 Maneuver	382	0	705	1201	-	-	1210	-	-			
Mov Cap-2 Maneuver	382	0	-	-	-	-	-	-	-			
Stage 1	702	0	-	-	-	-	-	-	-			
Stage 2	677	0	-	-	-	-	-	-	-			

Approach	EB	NB	SB
HCM Ctrl Dly, s/v	14.37	0.12	0.22
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	SBL	SBT	SBR
Capacity (veh/h)	26	-	-	444	50	-	-
HCM Lane V/C Ratio	0.004	-	-	0.135	0.006	-	-
HCM Ctrl Dly (s/v)	8	0	-	14.4	8	0	-
HCM Lane LOS	A	A	-	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0.5	0	-	-

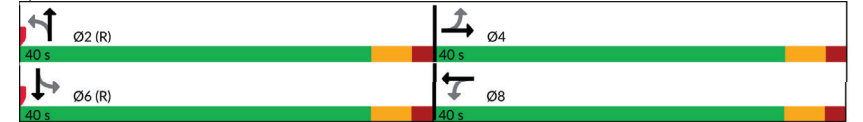
Lanes, Volumes, Timings
4: Caroline Street South & Allen Street West (250137) 171 King Street South, Waterloo TIS

	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												
Traffic Volume (vph)	9	44	17	8	29	14	6	62	13	68	88	23
Future Volume (vph)	9	44	17	8	29	14	6	62	13	68	88	23
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	0.99				0.99			0.99			0.98	
Frt	0.967				0.963			0.978			0.983	
Flt Protected	0.994				0.992			0.996			0.981	
Satd. Flow (prot)	0	1428	0	0	1450	0	0	1418	0	0	1320	0
Flt Permitted	0.972				0.965			0.985			0.878	
Satd. Flow (perm)	0	1394	0	0	1404	0	0	1395	0	0	1170	0
Right Turn on Red		Yes			Yes			Yes			No	
Satd. Flow (RTOR)	17				14			13				
Link Speed (k/h)	50				50			50			50	
Link Distance (m)	81.6				87.7			93.6			95.7	
Travel Time (s)	5.9				6.3			6.7			6.9	
Confl. Peds. (#/hr)	13		27	27		13	72		23	23		72
Confl. Bikes (#/hr)	2											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%	0%	0%	20%	4%	0%	22%	2%	9%
Adj. Flow (vph)	9	44	17	8	29	14	6	62	13	68	88	23
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	70	0	0	51	0	0	81	0	0	179	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases	4			8			2			6		
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	34.0	34.0		34.0	34.0		34.0	34.0		34.0	34.0	
Minimum Split (s)	40.0	40.0		40.0	40.0		40.0	40.0		40.0	40.0	
Total Split (s)	40.0	40.0		40.0	40.0		40.0	40.0		40.0	40.0	
Total Split (%)	50.0%	50.0%		50.0%	50.0%		50.0%	50.0%		50.0%	50.0%	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Lost Time Adjust (s)	-2.0			-2.0			-2.0			-2.0		
Total Lost Time (s)	4.0			4.0			4.0			4.0		
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	None	None		None		C-Max	C-Max		C-Max	C-Max		
Act Effct Green (s)	36.0			36.0			53.6			53.6		
Actuated g/C Ratio	0.45			0.45			0.67			0.67		
v/c Ratio	0.11			0.08			0.09			0.23		
Control Delay (s/veh)	10.8			10.3			10.4			12.6		
Queue Delay	0.0			0.0			0.0			0.0		
Total Delay (s/veh)	10.8			10.3			10.4			12.6		
LOS	B			B			B			B		
Approach Delay (s/veh)	10.8			10.3			10.4			12.6		
Approach LOS	B			B			B			B		
Queue Length 50th (m)	4.4			3.1			5.7			17.0		

Lanes, Volumes, Timings
4: Caroline Street South & Allen Street West (250137) 171 King Street South, Waterloo TIS

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 95th (m)	11.4				8.9			13.4			31.5	
Internal Link Dist (m)	57.6				63.7			69.6			71.7	
Turn Bay Length (m)												
Base Capacity (vph)	636				639			938			784	
Starvation Cap Reductn	0				0			0			0	
Spillback Cap Reductn	0				0			0			0	
Storage Cap Reductn	0				0			0			0	
Reduced v/c Ratio	0.11				0.08			0.09			0.23	
Intersection Summary												
Area Type:	Other											
Cycle Length: 80												
Actuated Cycle Length: 80												
Offset: 60 (75%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green												
Natural Cycle: 80												
Control Type: Actuated-Coordinated												
Maximum v/c Ratio: 0.23												
Intersection Signal Delay (s/veh): 11.5												
Intersection LOS: B												
Intersection Capacity Utilization 63.3%												
ICU Level of Service B												
Analysis Period (min) 15												

Splits and Phases: 4: Caroline Street South & Allen Street West



Lanes, Volumes, Timings
5: Caroline Street South & Site Access

2033 Total AM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

						
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	41	59	90	8	9	141
Future Volume (vph)	41	59	90	8	9	141
Ideal Flow (vphpl)	1765	1765	1650	1650	1650	1650
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt	0.920		0.989			
Flt Protected	0.980					0.997
Satd. Flow (prot)	1574	0	1570	0	0	1500
Flt Permitted	0.980					0.997
Satd. Flow (perm)	1574	0	1570	0	0	1500
Link Speed (k/h)	50		50			50
Link Distance (m)	57.9		95.7			59.8
Travel Time (s)	4.2		6.9			4.3
Confl. Peds. (#/hr)	2	2		22	22	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	0%	3%	0%	0%	9%
Adj. Flow (vph)	41	59	90	8	9	141
Shared Lane Traffic (%)						
Lane Group Flow (vph)	100	0	98	0	0	150
Sign Control	Stop		Free			Free
Intersection Summary						
Area Type:	Other					
Control Type:	Unsignalized					
Intersection Capacity Utilization	29.4%			ICU Level of Service A		
Analysis Period (min)	15					

HCM 7th TWSC
5: Caroline Street South & Site Access

2033 Total AM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

Intersection						
Int Delay, s/veh	3.1					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	41	59	90	8	9	141
Future Vol, veh/h	41	59	90	8	9	141
Conflicting Peds, #/hr	2	2	0	22	22	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	3	0	0	9
Mvmt Flow	41	59	90	8	9	141
Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	277	118	0	0	120	0
Stage 1	116	-	-	-	-	-
Stage 2	161	-	-	-	-	-
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	717	939	-	-	1480	-
Stage 1	914	-	-	-	-	-
Stage 2	873	-	-	-	-	-
Platoon blocked, %			-	-	-	-
Mov Cap-1 Maneuver	696	918	-	-	1450	-
Mov Cap-2 Maneuver	696	-	-	-	-	-
Stage 1	895	-	-	-	-	-
Stage 2	865	-	-	-	-	-
Approach	WB		NB		SB	
HCM Ctrl Dly, s/v	10.05		0		0.45	
HCM LOS	B					
Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT		
Capacity (veh/h)	-	-	812	108	-	
HCM Lane V/C Ratio	-	-	0.123	0.006	-	
HCM Ctrl Dly (s/v)	-	-	10.1	7.5	0	
HCM Lane LOS	-	-	B	A	A	
HCM 95th %tile Q(veh)	-	-	0.4	0	-	

Lanes, Volumes, Timings
1: Kuntz Lane & William Street West

2033 Total PM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

	→	↘	↙	←	↖	↗
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↗			↖		
Traffic Volume (vph)	449	9	2	505	0	0
Future Volume (vph)	449	9	2	505	0	0
Ideal Flow (vphpl)	1650	1650	1650	1650	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt	0.997					
Flt Protected						
Satd. Flow (prot)	1580	0	0	1616	0	0
Flt Permitted						
Satd. Flow (perm)	1580	0	0	1616	0	0
Link Speed (k/h)	50			50	50	
Link Distance (m)	50.7			48.6	58.5	
Travel Time (s)	3.7			3.5	4.2	
Confl. Peds. (#/hr)		13	13			
Confl. Bikes (#/hr)	1		2	2		1
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	3%	0%	0%	1%	0%	0%
Adj. Flow (vph)	449	9	2	505	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	458	0	0	507	0	0
Sign Control	Free			Free	Stop	

Intersection Summary	
Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization 35.8%	ICU Level of Service A
Analysis Period (min)	15

HCM Unsignalized Intersection Capacity Analysis
1: Kuntz Lane & William Street West

2033 Total PM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↗			↖		
Traffic Volume (veh/h)	449	9	2	505	0	0
Future Volume (Veh/h)	449	9	2	505	0	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	449	9	2	505	0	0
Pedestrians					13	
Lane Width (m)					0.0	
Walking Speed (m/s)					1.0	
Percent Blockage					0	
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)				48		
pX, platoon unblocked					0.83	
vC, conflicting volume			471		976	467
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			471		871	467
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	100
cM capacity (veh/h)			1101		270	600

Direction, Lane #	EB 1	WB 1
Volume Total	458	507
Volume Left	0	2
Volume Right	9	0
cSH	1700	1101
Volume to Capacity	0.27	0.00
Queue Length 95th (m)	0.0	0.0
Control Delay (s/veh)	0.0	0.1
Lane LOS		A
Approach Delay (s/veh)	0.0	0.1
Approach LOS		

Intersection Summary	
Average Delay	0.0
Intersection Capacity Utilization	35.8%
ICU Level of Service	A
Analysis Period (min)	15

Lanes, Volumes, Timings
2: King Street South & William Street West/William Street East King Street South, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	←	←	←	←	←	←	←	←	←	←	←	←
Traffic Volume (vph)	56	368	25	78	326	10	85	231	76	14	300	96
Future Volume (vph)	56	368	25	78	326	10	85	231	76	14	300	96
Ideal Flow (vphpl)	1775	1650	1650	1775	1650	1650	1775	1650	1650	1775	1650	1650
Storage Length (m)	15.0		0.0	25.0		0.0	35.0		0.0	25.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	25.0			35.0			25.0			35.0		
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	0.98	1.00		0.98	1.00		0.93	0.98		0.96	0.96	
Frt		0.990			0.996			0.963			0.964	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1573	1574	0	1635	1622	0	1668	1462	0	1668	1461	0
Flt Permitted	0.436			0.374			0.306			0.573		
Satd. Flow (perm)	707	1574	0	633	1622	0	502	1462	0	964	1461	0
Right Turn on Red			Yes			No			Yes			Yes
Satd. Flow (RTOR)		5						30			23	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		48.6			129.2			85.4			137.6	
Travel Time (s)		3.5			9.3			6.1			9.9	
Confl. Peds. (#/hr)	28		26	26		28	104		44	44		104
Confl. Bikes (#/hr)		1			1			1		1	2	2
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 (%)	6%	1%	21%	2%	0%	0%	0%	7%	0%	0%	3%	4%
Adj. Flow (vph)	56	368	25	78	326	10	85	231	76	14	300	96
Shared Lane Traffic (%)												
Lane Group Flow (vph)	56	393	0	78	336	0	85	307	0	14	396	0
Turn Type	Perm	NA		Perm	NA		pm+pt	NA		Perm	NA	
Protected Phases		4			8		5	2			6	
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		5	2		6	6	
Switch Phase												
Minimum Initial (s)	30.0	30.0		30.0	30.0		5.0	27.6		27.6	27.6	
Minimum Split (s)	36.0	36.0		36.0	36.0		9.0	33.6		33.6	33.6	
Total Split (s)	36.0	36.0		36.0	36.0		10.4	33.6		33.6	33.6	
Total Split (%)	45.0%	45.0%		45.0%	45.0%		13.0%	42.0%		42.0%	42.0%	
Yellow Time (s)	4.0	4.0		4.0	4.0		3.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		1.0	2.0		2.0	2.0	
Lost Time Adjust (s)	-2.0	-2.0		-2.0	-2.0		0.0	-2.0		-2.0	-2.0	
Total Lost Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lead/Lag							Lead			Lag		Lag
Lead-Lag Optimize?							Yes			Yes		Yes
Recall Mode	None	None		None	None		None	C-Max		C-Max	C-Max	
Act Effct Green (s)	32.0	32.0		32.0	32.0		40.0	40.0		31.7	31.7	
Actuated g/C Ratio	0.40	0.40		0.40	0.40		0.50	0.50		0.40	0.40	
v/c Ratio	0.20	0.62		0.31	0.52		0.25	0.41		0.04	0.67	
Control Delay (s/veh)	18.0	24.2		20.7	21.7		12.5	13.3		16.6	26.4	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay (s/veh)	18.0	24.2		20.7	21.7		12.5	13.3		16.6	26.4	
LOS	B	C		C	C		B	B		B	C	

Lanes, Volumes, Timings
2: King Street South & William Street West/William Street East King Street South, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Approach Delay (s/veh)		23.4			21.5			13.1			26.1	
Approach LOS		C			C			B			C	
Queue Length 50th (m)	5.4	45.8		7.9	37.6		6.4	24.7		1.3	47.6	
Queue Length 95th (m)	13.5	74.5		18.7	61.3		13.4	43.1		5.0	79.8	
Internal Link Dist (m)		24.6			105.2			61.4			113.6	
Turn Bay Length (m)	15.0			25.0			35.0			25.0		
Base Capacity (vph)	282	632		253	648		344	746		381	592	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.20	0.62		0.31	0.52		0.25	0.41		0.04	0.67	

Intersection Summary												
Area Type:	Other											
Cycle Length: 80												
Actuated Cycle Length: 80												
Offset: 26.4 (33%), Referenced to phase 2:NRTL and 6:SBTL, Start of Green												
Natural Cycle: 80												
Control Type: Actuated-Coordinated												
Maximum v/c Ratio: 0.67												
Intersection Signal Delay (s/veh): 21.2	Intersection LOS: C											
Intersection Capacity Utilization 109.3%	ICU Level of Service H											
Analysis Period (min) 15												



Lanes, Volumes, Timings
3: King Street South & Kuntz Lane

2033 Total PM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔						↔			↔	
Traffic Volume (vph)	19	0	17	0	0	0	13	358	6	7	381	21
Future Volume (vph)	19	0	17	0	0	0	13	358	6	7	381	21
Ideal Flow (vphpl)	1550	1550	1550	1900	1900	1900	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		0.936						0.998			0.993	
Flt Protected		0.974						0.998			0.999	
Satd. Flow (prot)	0	1397	0	0	0	0	0	1444	0	0	1466	0
Flt Permitted		0.974						0.998			0.999	
Satd. Flow (perm)	0	1397	0	0	0	0	0	1444	0	0	1466	0
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		44.8			46.1			132.5			85.4	
Travel Time (s)		3.2			3.3			9.5			6.1	
Confl. Peds. (#/hr)	1					1	86		36	36		86
Confl. Bikes (#/hr)								1			4	
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%	0%	0%	0%	0%	0%	0%	6%	0%	0%	4%	0%
Adj. Flow (vph)	19	0	17	0	0	0	13	358	6	7	381	21
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	36	0	0	0	0	0	377	0	0	409	0
Sign Control		Stop			Stop			Free			Free	
Intersection Summary												
Area Type:	Other											
Control Type:	Unsignalized											
Intersection Capacity Utilization	48.1%											
ICU Level of Service	A											
Analysis Period (min)	15											

HCM 7th TWSC
3: King Street South & Kuntz Lane

2033 Total PM Peak Hour (without LRT)
(250137) 171 King Street South, Waterloo TIS

Intersection												
Int Delay, s/veh	0.9											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	19	0	17	0	0	0	13	358	6	7	381	21
Future Vol, veh/h	19	0	17	0	0	0	13	358	6	7	381	21
Conflicting Peds, #/hr	1	0	0	0	0	1	86	0	36	36	0	86
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	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	0	0	0	0	0	0	6	0	0	4	0
Mvmt Flow	19	0	17	0	0	0	13	358	6	7	381	21
Major/Minor	Minor2						Major1		Major2			
Conflicting Flow All	877	918	478				488	0	0	400	0	0
Stage 1	492	492	-				-	-	-	-	-	-
Stage 2	385	426	-				-	-	-	-	-	-
Critical Hdwy	6.4	6.5	6.2				4.1	-	-	4.1	-	-
Critical Hdwy Stg 1	5.4	5.5	-				-	-	-	-	-	-
Critical Hdwy Stg 2	5.4	5.5	-				-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3				2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	322	274	592				1086	-	-	1170	-	-
Stage 1	619	551	-				-	-	-	-	-	-
Stage 2	692	589	-				-	-	-	-	-	-
Platoon blocked, %							-	-	-	-	-	-
Mov Cap-1 Maneuver	266	0	544				999	-	-	1170	-	-
Mov Cap-2 Maneuver	266	0	-				-	-	-	-	-	-
Stage 1	560	0	-				-	-	-	-	-	-
Stage 2	632	0	-				-	-	-	-	-	-
Approach	EB						NB		SB			
HCM Ctrl Dly, s/v	16.44						0.3		0.14			
HCM LOS	C											
Minor Lane/Major Mvmt	NBL		NBT	NBR EBLn1		SBL	SBT	SBR				
Capacity (veh/h)	62		-	-		350	30	-				
HCM Lane V/C Ratio	0.013		-	-		0.103	0.006	-				
HCM Ctrl Dly (s/v)	8.7		0	-		16.4	8.1	0				
HCM Lane LOS	A		A	-		C	A	A				
HCM 95th %tile Q(veh)	0		-	-		0.3	0	-				

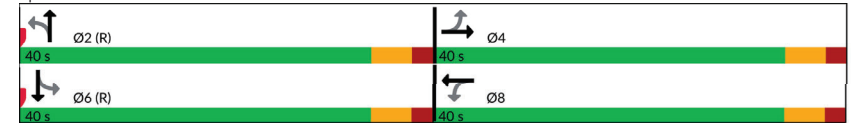
Lanes, Volumes, Timings
4: Caroline Street South & Allen Street West (250137) 171 King Street South, Waterloo TIS

	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												
Traffic Volume (vph)	23	27	11	14	65	18	20	133	41	57	101	31
Future Volume (vph)	23	27	11	14	65	18	20	133	41	57	101	31
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		0.98			0.99			0.98			0.97	
Frt		0.976			0.975			0.971			0.978	
Flt Protected		0.981			0.993			0.995			0.985	
Satd. Flow (prot)	0	1452	0	0	1425	0	0	1437	0	0	1397	0
Flt Permitted		0.900			0.967			0.966			0.873	
Satd. Flow (perm)	0	1323	0	0	1380	0	0	1386	0	0	1227	0
Right Turn on Red		Yes			Yes			Yes			No	
Satd. Flow (RTOR)		11			18			22				
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		81.6			87.7			93.6			95.7	
Travel Time (s)		5.9			6.3			6.7			6.9	
Confl. Peds. (#/hr)	18		34	34		18	73		35	35		73
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%	0%	0%	0%	5%	0%	0%	1%	5%	13%	0%	0%
Adj. Flow (vph)	23	27	11	14	65	18	20	133	41	57	101	31
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	61	0	0	97	0	0	194	0	0	189	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	34.0	34.0		34.0	34.0		34.0	34.0		34.0	34.0	
Minimum Split (s)	40.0	40.0		40.0	40.0		40.0	40.0		40.0	40.0	
Total Split (s)	40.0	40.0		40.0	40.0		40.0	40.0		40.0	40.0	
Total Split (%)	50.0%	50.0%		50.0%	50.0%		50.0%	50.0%		50.0%	50.0%	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Lost Time Adjust (s)		-2.0			-2.0			-2.0			-2.0	
Total Lost Time (s)		4.0			4.0			4.0			4.0	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	None	None		None	None		C-Max	C-Max		C-Max	C-Max	
Act Effct Green (s)		36.0			36.0			44.8			44.8	
Actuated g/C Ratio		0.45			0.45			0.56			0.56	
v/c Ratio		0.10			0.15			0.25			0.28	
Control Delay (s/veh)		11.4			11.5			12.8			14.9	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay (s/veh)		11.4			11.5			12.8			14.9	
LOS		B			B			B			B	
Approach Delay (s/veh)		11.4			11.5			12.8			14.9	
Approach LOS		B			B			B			B	
Queue Length 50th (m)		4.2			6.7			15.8			17.9	
Queue Length 95th (m)		10.7			15.3			29.8			32.8	

Lanes, Volumes, Timings
4: Caroline Street South & Allen Street West (250137) 171 King Street South, 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
Internal Link Dist (m)		57.6			63.7			69.6			71.7	
Turn Bay Length (m)												
Base Capacity (vph)		601			630			785			687	
Starvation Cap Reductn		0			0			0			0	
Spillback Cap Reductn		0			0			0			0	
Storage Cap Reductn		0			0			0			0	
Reduced v/c Ratio		0.10			0.15			0.25			0.28	
Intersection Summary												
Area Type:		Other										
Cycle Length: 80												
Actuated Cycle Length: 80												
Offset: 60 (75%), Referenced to phase 2:NBT and 6:SBTL, Start of Green												
Natural Cycle: 80												
Control Type: Actuated-Coordinated												
Maximum v/c Ratio: 0.28												
Intersection Signal Delay (s/veh): 13.1												
Intersection Capacity Utilization 63.4%												
Analysis Period (min) 15												

Splits and Phases: 4: Caroline Street South & Allen Street West



Lanes, Volumes, Timings
 5: Caroline Street South & Site Access 2033 Total PM Peak Hour (without LRT)
 (250137) 171 King Street South, Waterloo TIS

						
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	12	15	154	27	37	166
Future Volume (vph)	12	15	154	27	37	166
Ideal Flow (vphpl)	1765	1765	1650	1650	1650	1650
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt	0.925		0.980			
Flt Protected	0.978					0.991
Satd. Flow (prot)	1579	0	1586	0	0	1553
Flt Permitted	0.978					0.991
Satd. Flow (perm)	1579	0	1586	0	0	1553
Link Speed (k/h)	50		50			50
Link Distance (m)	57.9		95.7			59.8
Travel Time (s)	4.2		6.9			4.3
Confl. Peds. (#/hr)	2	3		30	30	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	0%	1%	0%	0%	5%
Adj. Flow (vph)	12	15	154	27	37	166
Shared Lane Traffic (%)						
Lane Group Flow (vph)	27	0	181	0	0	203
Sign Control	Stop		Free			Free
Intersection Summary						
Area Type:	Other					
Control Type:	Unsignalized					
Intersection Capacity Utilization	39.4%			ICU Level of Service A		
Analysis Period (min)	15					

HCM 7th TWSC 2033 Total PM Peak Hour (without LRT)
 5: Caroline Street South & Site Access (250137) 171 King Street South, Waterloo TIS

Intersection						
Int Delay, s/veh	1.4					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	W		R			R
Traffic Vol, veh/h	12	15	154	27	37	166
Future Vol, veh/h	12	15	154	27	37	166
Conflicting Peds, #/hr	2	3	0	30	30	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	1	0	0	5
Mvmt Flow	12	15	154	27	37	166
Major/Minor	Minor1	Major1		Major2		
Conflicting Flow All	440	201	0	0	211	0
Stage 1	198	-	-	-	-	-
Stage 2	242	-	-	-	-	-
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	579	846	-	-	1372	-
Stage 1	841	-	-	-	-	-
Stage 2	803	-	-	-	-	-
Platoon blocked, %		-	-		-	-
Mov Cap-1 Maneuver	544	820	-	-	1333	-
Mov Cap-2 Maneuver	544	-	-	-	-	-
Stage 1	817	-	-	-	-	-
Stage 2	777	-	-	-	-	-
Approach	WB	NB		SB		
HCM Ctrl Dly, s/v	10.61	0		1.42		
HCM LOS	B					
Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT		
Capacity (veh/h)	-	-	669	328	-	
HCM Lane V/C Ratio	-	-	0.04	0.028	-	
HCM Ctrl Dly (s/v)	-	-	10.6	7.8	0	
HCM Lane LOS	-	-	B	A	A	
HCM 95th %tile Q(veh)	-	-	0.1	0.1	-	

Appendix K

Existing Traffic Operations Report with LRT Plan



Lanes, Volumes, Timings
2: King Street South & William Street West/William Street East Existing AM Peak Hour (with LRT)

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	←	←	←	←	←	←	←	←	←	←	←	←
Traffic Volume (vph)	61	374	16	38	172	8	44	146	59	15	126	60
Future Volume (vph)	61	374	16	38	172	8	44	146	59	15	126	60
Ideal Flow (vphpl)	1775	1650	1650	1775	1650	1650	1775	1650	1650	1775	1650	1650
Storage Length (m)	15.0	0.0	0.0	25.0	0.0	0.0	35.0	0.0	0.0	25.0	0.0	0.0
Storage Lanes	1	0	0	1	0	0	1	0	0	1	0	0
Taper Length (m)	25.0	0.0	0.0	35.0	0.0	0.0	25.0	0.0	0.0	35.0	0.0	0.0
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	0.95	1.00	0.99	1.00	0.93	0.98	0.96	0.96	0.96	0.96	0.96	0.96
Frt	0.994	0.993	0.993	0.993	0.993	0.993	0.993	0.993	0.993	0.993	0.993	0.993
Flt Protected	0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950
Satd. Flow (prot)	1516	1587	0	1668	1584	0	1588	1394	0	1668	1433	0
Flt Permitted	0.540	0.540	0.540	0.540	0.540	0.540	0.540	0.540	0.540	0.540	0.540	0.540
Satd. Flow (perm)	823	1587	0	347	1584	0	916	1394	0	1065	1433	0
Right Turn on Red	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Satd. Flow (RTOR)	2	2	2	2	2	2	2	2	2	2	2	2
Link Speed (k/h)	50	50	50	50	50	50	50	50	50	50	50	50
Link Distance (m)	48.6	48.6	48.6	48.6	48.6	48.6	48.6	48.6	48.6	48.6	48.6	48.6
Travel Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Confl. Peds. (#/hr)	27	13	13	13	13	13	13	13	13	13	13	13
Confl. Bikes (#/hr)	1	4	4	4	4	4	4	4	4	4	4	4
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 (%)	10%	1%	25%	0%	2%	0%	5%	11%	7%	0%	4%	5%
Adj. Flow (vph)	61	374	16	38	172	8	44	146	59	15	126	60
Shared Lane Traffic (%)												
Lane Group Flow (vph)	61	390	0	38	180	0	44	205	0	15	186	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)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
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)	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9
Two way Left Turn Lane												
Headway Factor	1.11	1.21	1.21	1.11	1.21	1.21	1.11	1.21	1.21	1.11	1.21	1.21
Turning Speed (k/h)	24	24	24	24	24	24	24	24	24	24	24	24
Number of Detectors	1	2	2	1	2	2	1	2	2	1	2	2
Detector Template	Left	Thru	Thru	Left	Thru	Thru	Left	Thru	Thru	Left	Thru	Thru
Leading Detector (m)	6.1	30.5	30.5	6.1	30.5	30.5	6.1	30.5	30.5	6.1	30.5	30.5
Trailing Detector (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
Detector 1 Position(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
Detector 1 Size(m)	6.1	1.8	1.8	6.1	1.8	1.8	6.1	1.8	1.8	6.1	1.8	1.8
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(m)	28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.7
Detector 2 Size(m)	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
Detector 2 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 2 Channel												

Lanes, Volumes, Timings
2: King Street South & William Street West/William Street East Existing AM Peak Hour (with LRT)

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector 2 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Turn Type	Perm	NA	Perm	NA	pm+pt	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases	4	4	4	4	4	4	4	4	4	4	4	4
Permitted Phases	4	4	4	4	4	4	4	4	4	4	4	4
Detector Phase	4	4	4	4	4	4	4	4	4	4	4	4
Switch Phase												
Minimum Initial (s)	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0
Minimum Split (s)	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0
Total Split (s)	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0
Total Split (%)	28.2%	28.2%	28.2%	28.2%	28.2%	28.2%	28.2%	28.2%	28.2%	28.2%	28.2%	28.2%
Maximum Green (s)	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag												
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	None	None	None	None	None	None	None	None	None	None
Walk Time (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Flash Don't Walk (s)	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Act Effect Green (s)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Actuated g/C Ratio	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
v/c Ratio	0.32	1.04	0.47	0.48	0.07	0.22	0.02	0.21	0.02	0.21	0.02	0.21
Control Delay (s/veh)	32.3	92.3	49.6	33.2	5.0	4.6	8.7	7.5	8.7	7.5	8.7	7.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (s/veh)	32.3	92.3	49.6	33.2	5.0	4.6	8.7	7.5	8.7	7.5	8.7	7.5
LOS	C	F	D	C	A	A	A	A	A	A	A	A
Approach Delay (s/veh)	84.2	36.1	4.6	7.5	4.6	7.5	4.6	7.5	4.6	7.5	4.6	7.5
Approach LOS	F	D	A	A	A	A	A	A	A	A	A	A
Intersection Summary												
Area Type:	Other											
Cycle Length: 85												
Actuated Cycle Length: 85												
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green												
Natural Cycle: 65												
Control Type: Actuated-Coordinated												
Maximum v/c Ratio: 1.04												
Intersection Signal Delay (s/veh): 43.3												
Intersection Capacity Utilization 88.0%												
Analysis Period (min) 15												
Splits and Phases: 2: King Street South & William Street West/William Street East												
Diagram												

Queues

Existing AM Peak Hour (with LRT)
2: King Street South & William Street West/William Street East

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	61	390	38	180	44	205	15	186
v/c Ratio	0.32	1.04	0.47	0.48	0.07	0.22	0.02	0.21
Control Delay (s/veh)	32.3	92.3	49.6	33.2	5.0	4.6	8.7	7.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (s/veh)	32.3	92.3	49.6	33.2	5.0	4.6	8.7	7.5
Queue Length 50th (m)	8.2	~69.2	5.3	25.3	2.1	8.0	1.0	10.6
Queue Length 95th (m)	19.4	#122.1	#18.2	44.6	5.2	15.6	3.5	21.0
Internal Link Dist (m)		24.6		105.2		61.4		113.6
Turn Bay Length (m)	15.0		25.0		35.0		25.0	
Base Capacity (vph)	193	374	81	372	661	951	638	877
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.32	1.04	0.47	0.48	0.07	0.22	0.02	0.21

Intersection Summary

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

Lanes, Volumes, Timings

Existing AM Peak Hour (with LRT)
4: Caroline Street South & Allen Street West (250137) 171 King Street South, 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		↔			↔			↔			↔	
Traffic Volume (vph)	6	38	15	7	26	11	5	55	10	36	81	11
Future Volume (vph)	6	38	15	7	26	11	5	55	10	36	81	11
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		0.97			0.97			0.98			0.96	
Frt		0.966			0.966			0.981			0.988	
Flt Protected		0.995			0.992			0.996			0.986	
Satd. Flow (prot)	0	1410	0	0	1448	0	0	1415	0	0	1353	0
Flt Permitted		0.969			0.949			0.977			0.905	
Satd. Flow (perm)	0	1368	0	0	1370	0	0	1373	0	0	1222	0
Right Turn on Red		Yes			Yes			Yes			No	
Satd. Flow (RTOR)		15			11			9				
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		81.6			87.7			93.6			95.7	
Travel Time (s)		5.9			6.3			6.7			6.9	
Confl. Peds. (#/hr)	13		27	27		13	72		23	23		72
Confl. Bikes (#/hr)		2										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%	0%	0%	20%	4%	0%	22%	2%	9%
Adj. Flow (vph)	6	38	15	7	26	11	5	55	10	36	81	11
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	59	0	0	44	0	0	70	0	0	128	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)		4.9			4.9			4.9			4.9	
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)	24		14	24		14	24		14	24		14
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	6.1	30.5		6.1	30.5		6.1	30.5		6.1	30.5	
Trailing Detector (m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Position(m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Size(m)	6.1	1.8		6.1	1.8		6.1	1.8		6.1	1.8	
Detector 1 Type	CI+Ex	CI+Ex		CI+Ex	CI+Ex		CI+Ex	CI+Ex		CI+Ex	CI+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(m)		28.7			28.7			28.7			28.7	
Detector 2 Size(m)		1.8			1.8			1.8			1.8	
Detector 2 Type		CI+Ex			CI+Ex			CI+Ex			CI+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	

Lanes, Volumes, Timings
4: Caroline Street South & Allen Street West (250137) 171 King Street South, Waterloo TIS

Lane Group	Ø9
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Util. Factor	
Ped Bike Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (k/h)	
Link Distance (m)	
Travel Time (s)	
Confl. Peds. (#/hr)	
Confl. Bikes (#/hr)	
Peak Hour Factor	
Heavy Vehicles (%)	
Adj. Flow (vph)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Enter Blocked Intersection	
Lane Alignment	
Median Width(m)	
Link Offset(m)	
Crosswalk Width(m)	
Two way Left Turn Lane	
Headway Factor	
Turning Speed (k/h)	
Number of Detectors	
Detector Template	
Leading Detector (m)	
Trailing Detector (m)	
Detector 1 Position(m)	
Detector 1 Size(m)	
Detector 1 Type	
Detector 1 Channel	
Detector 1 Extend (s)	
Detector 1 Queue (s)	
Detector 1 Delay (s)	
Detector 2 Position(m)	
Detector 2 Size(m)	
Detector 2 Type	
Detector 2 Channel	
Detector 2 Extend (s)	
Turn Type	
Protected Phases	9

Lanes, Volumes, Timings
4: Caroline Street South & Allen Street West (250137) 171 King Street South, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	15.0	15.0		15.0	15.0		15.0	15.0		15.0	15.0	
Minimum Split (s)	21.0	21.0		21.0	21.0		21.0	21.0		21.0	21.0	
Total Split (s)	21.0	21.0		21.0	21.0		21.0	21.0		21.0	21.0	
Total Split (%)	24.1%	24.1%		24.1%	24.1%		24.1%	24.1%		24.1%	24.1%	
Maximum Green (s)	15.0	15.0		15.0	15.0		15.0	15.0		15.0	15.0	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Lost Time Adjust (s)		-2.0			-2.0			-2.0			-2.0	
Total Lost Time (s)		4.0			4.0			4.0			4.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		C-Max	C-Max		C-Max	C-Max	
Walk Time (s)	10.0	10.0		10.0	10.0		9.0	9.0		9.0	9.0	
Flash Don't Walk (s)	5.0	5.0		5.0	5.0		6.0	6.0		6.0	6.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)		17.0			17.0			17.0			17.0	
Actuated g/C Ratio		0.20			0.20			0.20			0.20	
v/c Ratio		0.21			0.16			0.25			0.54	
Control Delay (s/veh)		25.6			25.2			29.3			40.9	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay (s/veh)		25.6			25.2			29.3			40.9	
LOS		C			C			C			D	
Approach Delay (s/veh)		25.6			25.2			29.3			40.9	
Approach LOS		C			C			C			D	
Intersection Summary												
Area Type:	Other											
Cycle Length: 87												
Actuated Cycle Length: 87												
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green												
Natural Cycle: 90												
Control Type: Actuated-Coordinated												
Maximum v/c Ratio: 0.54												
Intersection Signal Delay (s/veh): 32.9	Intersection LOS: C											
Intersection Capacity Utilization 34.7%	ICU Level of Service A											
Analysis Period (min) 15												



Lanes, Volumes, Timings

4: Caroline Street South & Allen Street West (250137) 171 King Street South, Waterloo TIS

Existing AM Peak Hour (with LRT)

Lane Group	Ø9
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	10.0
Minimum Split (s)	45.0
Total Split (s)	45.0
Total Split (%)	52%
Maximum Green (s)	31.0
Yellow Time (s)	4.0
All-Red Time (s)	10.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Vehicle Extension (s)	3.0
Recall Mode	Max
Walk Time (s)	
Flash Don't Walk (s)	
Pedestrian Calls (#/hr)	
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay (s/veh)	
Queue Delay	
Total Delay (s/veh)	
LOS	
Approach Delay (s/veh)	
Approach LOS	
Intersection Summary	

Queues

4: Caroline Street South & Allen Street West (250137) 171 King Street South, Waterloo TIS

Existing AM Peak Hour (with LRT)

	→	←	↑	↓
Lane Group	EBT	WBT	NBT	SBT
Lane Group Flow (vph)	59	44	70	128
v/c Ratio	0.21	0.16	0.25	0.54
Control Delay (s/veh)	25.6	25.2	29.3	40.9
Queue Delay	0.0	0.0	0.0	0.0
Total Delay (s/veh)	25.6	25.2	29.3	40.9
Queue Length 50th (m)	6.2	4.6	8.6	19.3
Queue Length 95th (m)	16.3	13.3	20.1	36.9
Internal Link Dist (m)	57.6	63.7	69.6	71.7
Turn Bay Length (m)				
Base Capacity (vph)	279	276	275	238
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.21	0.16	0.25	0.54
Intersection Summary				

Lanes, Volumes, Timings
2: King Street South & William Street West/William Street East Existing PM Peak Hour (with LRT)

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱	↲	↰	↱	↲	↰	↱	↲	↰	↱	↲
Traffic Volume (vph)	47	319	19	55	279	9	68	189	61	12	229	81
Future Volume (vph)	47	319	19	55	279	9	68	189	61	12	229	81
Ideal Flow (vphpl)	1775	1650	1650	1775	1650	1650	1775	1650	1650	1775	1650	1650
Storage Length (m)	15.0	0.0	25.0	0.0	35.0	0.0	35.0	0.0	25.0	0.0	35.0	0.0
Storage Lanes	1	0	1	0	1	0	1	0	1	0	1	0
Taper Length (m)	25.0			35.0			25.0			35.0		
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	0.97	1.00		0.97	1.00		0.90	0.98		0.95	0.95	
Frt	0.992			0.995			0.963			0.961		
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1573	1578	0	1635	1619	0	1668	1458	0	1668	1441	0
Flt Permitted	0.339			0.250			0.485			0.604		
Satd. Flow (perm)	542	1578	0	419	1619	0	769	1458	0	1004	1441	0
Right Turn on Red			Yes			No			Yes			Yes
Satd. Flow (RTOR)		3						41			34	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		48.6			129.2			85.4			137.6	
Travel Time (s)		3.5			9.3			6.1			9.9	
Confl. Peds. (#/hr)	28		26	26		28	104		44	44		104
Confl. Bikes (#/hr)		1			1			1		1	2	2
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 (%)	6%	1%	21%	2%	0%	0%	0%	7%	0%	0%	3%	4%
Adj. Flow (vph)	47	319	19	55	279	9	68	189	61	12	229	81
Shared Lane Traffic (%)												
Lane Group Flow (vph)	47	338	0	55	288	0	68	250	0	12	310	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)		3.5			3.5			3.5			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.9			4.9			4.9			4.9	
Two way Left Turn Lane												
Headway Factor	1.11	1.21	1.21	1.11	1.21	1.21	1.11	1.21	1.21	1.11	1.21	1.21
Turning Speed (k/h)	24		14	24		14	24		14	24		14
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	6.1	30.5		6.1	30.5		6.1	30.5		6.1	30.5	
Trailing Detector (m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Position(m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Size(m)	6.1	1.8		6.1	1.8		6.1	1.8		6.1	1.8	
Detector 1 Type	CI+Ex	CI+Ex		CI+Ex	CI+Ex		CI+Ex	CI+Ex		CI+Ex	CI+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(m)		28.7			28.7			28.7			28.7	
Detector 2 Size(m)		1.8			1.8			1.8			1.8	
Detector 2 Type		CI+Ex			CI+Ex			CI+Ex			CI+Ex	
Detector 2 Channel												

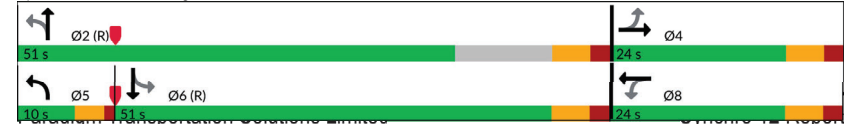
Lanes, Volumes, Timings
2: King Street South & William Street West/William Street East Existing PM Peak Hour (with LRT)

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA		Perm	NA		pm+pt	NA		Perm	NA	
Protected Phases		4			8		5	2			6	
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		5	2		6	6	
Switch Phase												
Minimum Initial (s)	18.0	18.0		18.0	18.0		5.0	25.0		25.0	25.0	
Minimum Split (s)	24.0	24.0		24.0	24.0		9.0	31.0		31.0	31.0	
Total Split (s)	24.0	24.0		24.0	24.0		10.0	51.0		51.0	51.0	
Total Split (%)	28.2%	28.2%		28.2%	28.2%		11.8%	60.0%		60.0%	60.0%	
Maximum Green (s)	18.0	18.0		18.0	18.0		6.0	45.0		45.0	45.0	
Yellow Time (s)	4.0	4.0		4.0	4.0		3.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		1.0	2.0		2.0	2.0	
Lost Time Adjust (s)	-2.0	-2.0		-2.0	-2.0		0.0	-2.0		-2.0	-2.0	
Total Lost Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lead/Lag							Lead			Lag	Lag	
Lead-Lag Optimize?							Yes			Yes	Yes	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		None	C-Max		C-Max	C-Max	
Walk Time (s)	7.0	7.0		7.0	7.0			19.0		19.0	19.0	
Flash Don't Walk (s)	11.0	11.0		11.0	11.0			6.0		6.0	6.0	
Pedestrian Calls (#/hr)	0	0		0	0			0		0	0	
Act Effect Green (s)	20.0	20.0		20.0	20.0		57.0	57.0		49.0	49.0	
Actuated g/C Ratio	0.24	0.24		0.24	0.24		0.67	0.67		0.58	0.58	
v/c Ratio	0.37	0.91		0.56	0.76		0.12	0.25		0.02	0.37	
Control Delay (s/veh)	37.1	61.5		53.7	44.9		5.3	5.3		8.8	10.7	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay (s/veh)	37.1	61.5		53.7	44.9		5.3	5.3		8.8	10.7	
LOS	D	E		D	D		A	A		A	B	
Approach Delay (s/veh)		58.5			46.3			5.3			10.6	
Approach LOS		E			D			A			B	

Intersection Summary

Area Type:	Other
Cycle Length: 85	
Actuated Cycle Length: 85	
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green	
Natural Cycle: 65	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.91	
Intersection Signal Delay (s/veh): 31.8	Intersection LOS: C
Intersection Capacity Utilization 90.8%	ICU Level of Service E
Analysis Period (min) 15	

Splits and Phases: 2: King Street South & William Street West/William Street East



Queues

Existing PM Peak Hour (with LRT)
2: King Street South & William Street West/William Street East

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	47	338	55	288	68	250	12	310
v/c Ratio	0.37	0.91	0.56	0.76	0.12	0.25	0.02	0.37
Control Delay (s/veh)	37.1	61.5	53.7	44.9	5.3	5.3	8.8	10.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (s/veh)	37.1	61.5	53.7	44.9	5.3	5.3	8.8	10.7
Queue Length 50th (m)	6.4	53.1	7.9	43.6	3.3	11.4	0.8	23.2
Queue Length 95th (m)	16.8	#101.5	#24.6	#79.6	7.1	20.4	3.1	40.0
Internal Link Dist (m)		24.6		105.2		61.4		113.6
Turn Bay Length (m)	15.0		25.0		35.0		25.0	
Base Capacity (vph)	127	373	98	380	579	991	579	844
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.37	0.91	0.56	0.76	0.12	0.25	0.02	0.37

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Lanes, Volumes, Timings

Existing PM Peak Hour (with LRT)
4: Caroline Street South & Allen Street West (250137) 171 King Street South, 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		↔			↔			↔			↔	
Traffic Volume (vph)	13	22	10	12	58	9	18	108	19	46	89	25
Future Volume (vph)	13	22	10	12	58	9	18	108	19	46	89	25
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		0.96			0.98			0.97			0.95	
Frt		0.970			0.985			0.982			0.979	
Flt Protected		0.986			0.992			0.994			0.986	
Satd. Flow (prot)	0	1428	0	0	1433	0	0	1452	0	0	1376	0
Flt Permitted		0.910			0.955			0.953			0.831	
Satd. Flow (perm)	0	1302	0	0	1360	0	0	1370	0	0	1137	0
Right Turn on Red		Yes			Yes			Yes			No	
Satd. Flow (RTOR)		10			7			8				
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		81.6			87.7			93.6			95.7	
Travel Time (s)		5.9			6.3			6.7			6.9	
Confl. Peds. (#/hr)	18		34	34		18	73		35	35		73
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%	0%	0%	0%	5%	0%	0%	1%	5%	13%	0%	0%
Adj. Flow (vph)	13	22	10	12	58	9	18	108	19	46	89	25
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	45	0	0	79	0	0	145	0	0	160	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)		4.9			4.9			4.9			4.9	
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)	24		14	24		14	24		14	24		14
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	6.1	30.5		6.1	30.5		6.1	30.5		6.1	30.5	
Trailing Detector (m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Position(m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Size(m)	6.1	1.8		6.1	1.8		6.1	1.8		6.1	1.8	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(m)		28.7			28.7			28.7			28.7	
Detector 2 Size(m)		1.8			1.8			1.8			1.8	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases		4			8			2			6	

Lanes, Volumes, Timings
4: Caroline Street South & Allen Street West (250137) 171 King Street South, Waterloo TIS

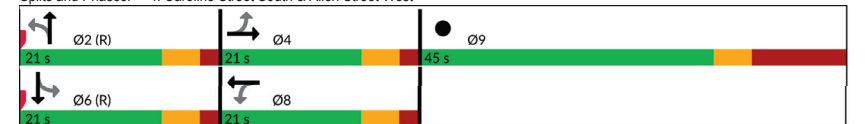
Lane Group	Ø9
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Util. Factor	
Ped Bike Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (k/h)	
Link Distance (m)	
Travel Time (s)	
Confl. Peds. (#/hr)	
Peak Hour Factor	
Heavy Vehicles (%)	
Adj. Flow (vph)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Enter Blocked Intersection	
Lane Alignment	
Median Width(m)	
Link Offset(m)	
Crosswalk Width(m)	
Two way Left Turn Lane	
Headway Factor	
Turning Speed (k/h)	
Number of Detectors	
Detector Template	
Leading Detector (m)	
Trailing Detector (m)	
Detector 1 Position(m)	
Detector 1 Size(m)	
Detector 1 Type	
Detector 1 Channel	
Detector 1 Extend (s)	
Detector 1 Queue (s)	
Detector 1 Delay (s)	
Detector 2 Position(m)	
Detector 2 Size(m)	
Detector 2 Type	
Detector 2 Channel	
Detector 2 Extend (s)	
Turn Type	
Protected Phases	9
Permitted Phases	

Lanes, Volumes, Timings
4: Caroline Street South & Allen Street West (250137) 171 King Street South, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	4	4		8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	15.0	15.0		15.0	15.0		15.0	15.0		15.0	15.0	
Minimum Split (s)	21.0	21.0		21.0	21.0		21.0	21.0		21.0	21.0	
Total Split (s)	21.0	21.0		21.0	21.0		21.0	21.0		21.0	21.0	
Total Split (%)	24.1%	24.1%		24.1%	24.1%		24.1%	24.1%		24.1%	24.1%	
Maximum Green (s)	15.0	15.0		15.0	15.0		15.0	15.0		15.0	15.0	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Lost Time Adjust (s)		-2.0			-2.0			-2.0			-2.0	
Total Lost Time (s)		4.0			4.0			4.0			4.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		C-Max	C-Max		C-Max	C-Max	
Walk Time (s)	10.0	10.0		10.0	10.0		9.0	9.0		9.0	9.0	
Flash Don't Walk (s)	5.0	5.0		5.0	5.0		6.0	6.0		6.0	6.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)		17.0			17.0			17.0			17.0	
Actuated g/C Ratio		0.20			0.20			0.20			0.20	
v/c Ratio		0.17			0.29			0.53			0.72	
Control Delay (s/veh)		26.0			30.7			37.6			53.0	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay (s/veh)		26.0			30.7			37.6			53.0	
LOS		C			C			D			D	
Approach Delay (s/veh)		26.0			30.7			37.6			53.0	
Approach LOS		C			C			D			D	

Intersection Summary	
Area Type:	Other
Cycle Length:	87
Actuated Cycle Length:	87
Offset:	0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle:	90
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.72
Intersection Signal Delay (s/veh):	40.9
Intersection Capacity Utilization	40.6%
Analysis Period (min)	15
Intersection LOS:	D
ICU Level of Service	A

Splits and Phases: 4: Caroline Street South & Allen Street West



Lanes, Volumes, Timings

4: Caroline Street South & Allen Street West (250137) 171 King Street South, Waterloo TIS

Existing PM Peak Hour (with LRT)

Lane Group	Ø9
Detector Phase	
Switch Phase	
Minimum Initial (s)	10.0
Minimum Split (s)	45.0
Total Split (s)	45.0
Total Split (%)	52%
Maximum Green (s)	31.0
Yellow Time (s)	4.0
All-Red Time (s)	10.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Vehicle Extension (s)	3.0
Recall Mode	Max
Walk Time (s)	
Flash Don't Walk (s)	
Pedestrian Calls (#/hr)	
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay (s/veh)	
Queue Delay	
Total Delay (s/veh)	
LOS	
Approach Delay (s/veh)	
Approach LOS	
Intersection Summary	

Queues

4: Caroline Street South & Allen Street West (250137) 171 King Street South, Waterloo TIS

Existing PM Peak Hour (with LRT)

	→	←	↑	↓
Lane Group	EBT	WBT	NBT	SBT
Lane Group Flow (vph)	45	79	145	160
v/c Ratio	0.17	0.29	0.53	0.72
Control Delay (s/veh)	26.0	30.7	37.6	53.0
Queue Delay	0.0	0.0	0.0	0.0
Total Delay (s/veh)	26.0	30.7	37.6	53.0
Queue Length 50th (m)	4.9	10.3	20.6	25.2
Queue Length 95th (m)	13.7	22.6	38.9	#54.0
Internal Link Dist (m)	57.6	63.7	69.6	71.7
Turn Bay Length (m)				
Base Capacity (vph)	262	271	274	222
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.17	0.29	0.53	0.72

Intersection Summary

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

Appendix L

Background Traffic Operations Report with LRT Plan



Lanes, Volumes, Timings
2: King Street South & William Street West/William Street East King Street South, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	←	←	←	←	←	←	←	←	←	←	←	←
Traffic Volume (vph)	64	389	16	41	179	8	56	185	76	15	139	63
Future Volume (vph)	64	389	16	41	179	8	56	185	76	15	139	63
Ideal Flow (vphpl)	1775	1650	1650	1775	1650	1650	1775	1650	1650	1775	1650	1650
Storage Length (m)	15.0	0.0	0.0	25.0	0.0	0.0	35.0	0.0	0.0	25.0	0.0	0.0
Storage Lanes	1	0	0	1	0	0	1	0	0	1	0	0
Taper Length (m)	25.0	0.0	0.0	35.0	0.0	0.0	25.0	0.0	0.0	35.0	0.0	0.0
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	0.96	1.00	0.99	1.00	0.93	0.98	0.97	0.96	0.97	0.96	0.96	0.96
Frt	0.994	0.994	0.994	0.994	0.994	0.994	0.994	0.994	0.994	0.994	0.994	0.994
Flt Protected	0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950
Satd. Flow (prot)	1516	1588	0	1668	1586	0	1588	1393	0	1668	1436	0
Flt Permitted	0.527	0.527	0.527	0.527	0.527	0.527	0.527	0.527	0.527	0.527	0.527	0.527
Satd. Flow (perm)	804	1588	0	347	1586	0	898	1393	0	1015	1436	0
Right Turn on Red	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Satd. Flow (RTOR)	2	2	2	2	2	2	2	2	2	2	2	2
Link Speed (k/h)	50	50	50	50	50	50	50	50	50	50	50	50
Link Distance (m)	48.6	48.6	48.6	48.6	48.6	48.6	48.6	48.6	48.6	48.6	48.6	48.6
Travel Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Confl. Peds. (#/hr)	27	13	13	13	13	13	27	58	28	28	58	27
Confl. Bikes (#/hr)	1	4	4	4	4	4	1	58	28	28	58	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 (%)	10%	1%	25%	0%	2%	0%	5%	11%	7%	0%	4%	5%
Adj. Flow (vph)	64	389	16	41	179	8	56	185	76	15	139	63
Shared Lane Traffic (%)												
Lane Group Flow (vph)	64	405	0	41	187	0	56	261	0	15	202	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)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
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)	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9
Two way Left Turn Lane												
Headway Factor	1.11	1.21	1.21	1.11	1.21	1.21	1.11	1.21	1.21	1.11	1.21	1.21
Turning Speed (k/h)	24	24	24	24	24	24	24	24	24	24	24	24
Number of Detectors	1	2	2	1	2	2	1	2	2	1	2	2
Detector Template	Left	Thru	Thru	Left	Thru	Thru	Left	Thru	Thru	Left	Thru	Thru
Leading Detector (m)	6.1	30.5	30.5	6.1	30.5	30.5	6.1	30.5	30.5	6.1	30.5	30.5
Trailing Detector (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
Detector 1 Position(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
Detector 1 Size(m)	6.1	1.8	1.8	6.1	1.8	1.8	6.1	1.8	1.8	6.1	1.8	1.8
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(m)	28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.7
Detector 2 Size(m)	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
Detector 2 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 2 Channel												

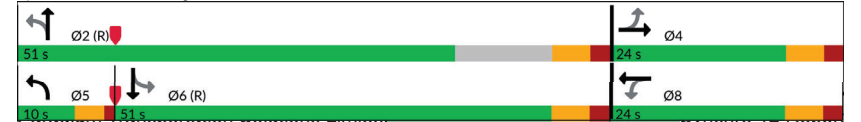
Lanes, Volumes, Timings
2: King Street South & William Street West/William Street East King Street South, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector 2 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Turn Type	Perm	NA	Perm	Perm	NA	pm+pt	NA	Perm	NA	Perm	NA	NA
Protected Phases	4	4	4	4	4	4	4	4	4	4	4	4
Permitted Phases	4	4	4	4	4	4	4	4	4	4	4	4
Detector Phase	4	4	4	4	4	4	4	4	4	4	4	4
Switch Phase												
Minimum Initial (s)	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0
Minimum Split (s)	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0
Total Split (s)	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0
Total Split (%)	28.2%	28.2%	28.2%	28.2%	28.2%	28.2%	28.2%	28.2%	28.2%	28.2%	28.2%	28.2%
Maximum Green (s)	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag												
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	None	None	None	None	None	None	None	None	None	None
Walk Time (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Flash Don't Walk (s)	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Act Effect Green (s)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Actuated g/C Ratio	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
v/c Ratio	0.34	1.08	0.51	0.50	0.09	0.27	0.02	0.23	0.02	0.23	0.02	0.23
Control Delay (s/veh)	33.0	103.1	53.0	33.7	5.1	5.2	8.8	7.8	5.1	5.2	8.8	7.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (s/veh)	33.0	103.1	53.0	33.7	5.1	5.2	8.8	7.8	5.1	5.2	8.8	7.8
LOS	C	F	D	C	A	A	A	A	A	A	A	A
Approach Delay (s/veh)	93.5	37.1	5.2	7.9	5.2	7.9	5.2	7.9	5.2	7.9	5.2	7.9
Approach LOS	F	D	A	A	A	A	A	A	A	A	A	A

Intersection Summary

Area Type:	Other
Cycle Length: 85	
Actuated Cycle Length: 85	
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green	
Natural Cycle: 65	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 1.08	
Intersection Signal Delay (s/veh): 45.2	Intersection LOS: D
Intersection Capacity Utilization 94.7%	ICU Level of Service F
Analysis Period (min) 15	

Splits and Phases: 2: King Street South & William Street West/William Street East



Queues
2: King Street South & William Street West/William Street East King Street South, Waterloo TIS

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	64	405	41	187	56	261	15	202
v/c Ratio	0.34	1.08	0.51	0.50	0.09	0.27	0.02	0.23
Control Delay (s/veh)	33.0	103.1	53.0	33.7	5.1	5.2	8.8	7.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (s/veh)	33.0	103.1	53.0	33.7	5.1	5.2	8.8	7.8
Queue Length 50th (m)	8.7	~74.4	5.8	26.4	2.7	11.4	1.0	12.1
Queue Length 95th (m)	20.2	#128.0	#19.9	46.1	6.2	20.9	3.6	23.3
Internal Link Dist (m)		24.6		105.2		61.4		113.6
Turn Bay Length (m)	15.0		25.0		35.0		25.0	
Base Capacity (vph)	189	375	81	373	650	951	609	879
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.34	1.08	0.51	0.50	0.09	0.27	0.02	0.23

Intersection Summary

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

Lanes, Volumes, Timings
4: Caroline Street South & Allen Street West (250137) 171 King Street South, Waterloo TIS

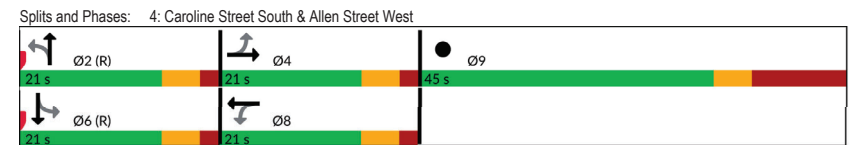
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	6	40	15	7	27	11	5	59	12	37	85	11
Future Volume (vph)	6	40	15	7	27	11	5	59	12	37	85	11
Ideal Flow (vphpl)	1550	1550	1550	1550	1550	1550	1550	1550	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		0.97			0.98			0.98			0.97	
Frt		0.967			0.967			0.979			0.989	
Flt Protected		0.995			0.992			0.997			0.986	
Satd. Flow (prot)	0	1412	0	0	1450	0	0	1413	0	0	1356	0
Flt Permitted		0.974			0.957			0.979			0.901	
Satd. Flow (perm)	0	1377	0	0	1384	0	0	1375	0	0	1220	0
Right Turn on Red		Yes			Yes			Yes			No	
Satd. Flow (RTOR)		15			11			10				
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		81.6			87.7			93.6			95.7	
Travel Time (s)		5.9			6.3			6.7			6.9	
Confl. Peds. (#/hr)	13		27	27		13	72		23	23		72
Confl. Bikes (#/hr)		2										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%	0%	0%	20%	4%	0%	22%	2%	9%
Adj. Flow (vph)	6	40	15	7	27	11	5	59	12	37	85	11
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	61	0	0	45	0	0	76	0	0	133	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)		4.9			4.9			4.9			4.9	
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)	24		14	24		14	24		14	24		14
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	6.1	30.5		6.1	30.5		6.1	30.5		6.1	30.5	
Trailing Detector (m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Position(m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Size(m)	6.1	1.8		6.1	1.8		6.1	1.8		6.1	1.8	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(m)		28.7			28.7			28.7			28.7	
Detector 2 Size(m)		1.8			1.8			1.8			1.8	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	

Lanes, Volumes, Timings
4: Caroline Street South & Allen Street West (250137) 171 King Street South, Waterloo TIS

Lane Group	Ø9
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Util. Factor	
Ped Bike Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (k/h)	
Link Distance (m)	
Travel Time (s)	
Confl. Peds. (#/hr)	
Confl. Bikes (#/hr)	
Peak Hour Factor	
Heavy Vehicles (%)	
Adj. Flow (vph)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Enter Blocked Intersection	
Lane Alignment	
Median Width(m)	
Link Offset(m)	
Crosswalk Width(m)	
Two way Left Turn Lane	
Headway Factor	
Turning Speed (k/h)	
Number of Detectors	
Detector Template	
Leading Detector (m)	
Trailing Detector (m)	
Detector 1 Position(m)	
Detector 1 Size(m)	
Detector 1 Type	
Detector 1 Channel	
Detector 1 Extend (s)	
Detector 1 Queue (s)	
Detector 1 Delay (s)	
Detector 2 Position(m)	
Detector 2 Size(m)	
Detector 2 Type	
Detector 2 Channel	
Detector 2 Extend (s)	
Turn Type	
Protected Phases	9

Lanes, Volumes, Timings
4: Caroline Street South & Allen Street West (250137) 171 King Street South, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	15.0	15.0		15.0	15.0		15.0	15.0		15.0	15.0	
Minimum Split (s)	21.0	21.0		21.0	21.0		21.0	21.0		21.0	21.0	
Total Split (s)	21.0	21.0		21.0	21.0		21.0	21.0		21.0	21.0	
Total Split (%)	24.1%	24.1%		24.1%	24.1%		24.1%	24.1%		24.1%	24.1%	
Maximum Green (s)	15.0	15.0		15.0	15.0		15.0	15.0		15.0	15.0	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Lost Time Adjust (s)		-2.0			-2.0			-2.0			-2.0	
Total Lost Time (s)		4.0			4.0			4.0			4.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		C-Max	C-Max		C-Max	C-Max	
Walk Time (s)	10.0	10.0		10.0	10.0		9.0	9.0		9.0	9.0	
Flash Don't Walk (s)	5.0	5.0		5.0	5.0		6.0	6.0		6.0	6.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)		17.0			17.0			17.0			17.0	
Actuated g/C Ratio		0.20			0.20			0.20			0.20	
v/c Ratio		0.22			0.16			0.28			0.56	
Control Delay (s/veh)		25.9			25.3			29.3			41.8	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay (s/veh)		25.9			25.3			29.3			41.8	
LOS		C			C			C			D	
Approach Delay (s/veh)		25.9			25.3			29.3			41.8	
Approach LOS		C			C			C			D	
Intersection Summary												
Area Type:	Other											
Cycle Length: 87												
Actuated Cycle Length: 87												
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green												
Natural Cycle: 90												
Control Type: Actuated-Coordinated												
Maximum v/c Ratio: 0.56												
Intersection Signal Delay (s/veh): 33.3	Intersection LOS: C											
Intersection Capacity Utilization 35.1%	ICU Level of Service A											
Analysis Period (min) 15												



Lanes, Volumes, Timings
4: Caroline Street South & Allen Street West 2027 Background AM Peak Hour (with LRT)
(250137) 171 King Street South, Waterloo TIS

Lane Group	Ø9
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	10.0
Minimum Split (s)	45.0
Total Split (s)	45.0
Total Split (%)	52%
Maximum Green (s)	31.0
Yellow Time (s)	4.0
All-Red Time (s)	10.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Vehicle Extension (s)	3.0
Recall Mode	Max
Walk Time (s)	
Flash Don't Walk (s)	
Pedestrian Calls (#/hr)	
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay (s/veh)	
Queue Delay	
Total Delay (s/veh)	
LOS	
Approach Delay (s/veh)	
Approach LOS	
Intersection Summary	

Queues
4: Caroline Street South & Allen Street West 2027 Background AM Peak Hour (with LRT)
(250137) 171 King Street South, Waterloo TIS

	→	←	↑	↓
Lane Group	EBT	WBT	NBT	SBT
Lane Group Flow (vph)	61	45	76	133
v/c Ratio	0.22	0.16	0.28	0.56
Control Delay (s/veh)	25.9	25.3	29.3	41.8
Queue Delay	0.0	0.0	0.0	0.0
Total Delay (s/veh)	25.9	25.3	29.3	41.8
Queue Length 50th (m)	6.5	4.7	9.4	20.2
Queue Length 95th (m)	17.0	13.5	21.3	38.3
Internal Link Dist (m)	57.6	63.7	69.6	71.7
Turn Bay Length (m)				
Base Capacity (vph)	281	279	276	238
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.22	0.16	0.28	0.56
Intersection Summary				

Lanes, Volumes, Timings
2: King Street South & William Street West/William Street East King Street South, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	←	←	→	←	←	→	←	←	→	←	←	→
Traffic Volume (vph)	50	334	23	65	293	9	75	209	67	12	270	84
Future Volume (vph)	50	334	23	65	293	9	75	209	67	12	270	84
Ideal Flow (vphpl)	1775	1650	1650	1775	1650	1650	1775	1650	1650	1775	1650	1650
Storage Length (m)	15.0	0.0	0.0	25.0	0.0	0.0	35.0	0.0	0.0	25.0	0.0	0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	25.0			35.0			25.0			35.0		
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	0.97	0.99		0.98	1.00		0.91	0.98		0.95	0.95	
Frt	0.990			0.996			0.964			0.964		
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1573	1571	0	1635	1621	0	1668	1460	0	1668	1453	0
Flt Permitted	0.314			0.217			0.451			0.590		
Satd. Flow (perm)	503	1571	0	364	1621	0	722	1460	0	983	1453	0
Right Turn on Red			Yes			No			Yes			Yes
Satd. Flow (RTOR)		4						41			29	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		48.6			129.2			85.4			137.6	
Travel Time (s)		3.5			9.3			6.1			9.9	
Confl. Peds. (#/hr)	28		26	26		28	104		44	44		104
Confl. Bikes (#/hr)		1			1			1		1	2	2
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 (%)	6%	1%	21%	2%	0%	0%	0%	7%	0%	0%	3%	4%
Adj. Flow (vph)	50	334	23	65	293	9	75	209	67	12	270	84
Shared Lane Traffic (%)												
Lane Group Flow (vph)	50	357	0	65	302	0	75	276	0	12	354	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)		3.5			3.5			3.5			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.9			4.9			4.9			4.9	
Two way Left Turn Lane												
Headway Factor	1.11	1.21	1.21	1.11	1.21	1.21	1.11	1.21	1.21	1.11	1.21	1.21
Turning Speed (k/h)	24		14	24		14	24		14	24		14
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	6.1	30.5		6.1	30.5		6.1	30.5		6.1	30.5	
Trailing Detector (m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Position(m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Size(m)	6.1	1.8		6.1	1.8		6.1	1.8		6.1	1.8	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(m)		28.7			28.7			28.7			28.7	
Detector 2 Size(m)		1.8			1.8			1.8			1.8	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												

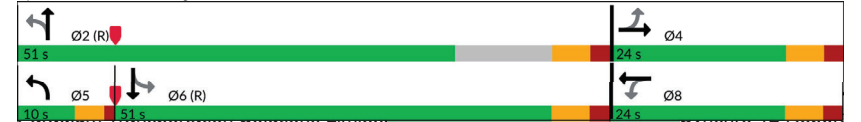
Lanes, Volumes, Timings
2: King Street South & William Street West/William Street East King Street South, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA		Perm	NA		pm+pt	NA		Perm	NA	
Protected Phases		4			8		5	2			6	
Permitted Phases		4			8		2				6	
Detector Phase		4	4		8	8	5	2			6	6
Switch Phase												
Minimum Initial (s)	18.0	18.0		18.0	18.0		5.0	25.0		25.0	25.0	
Minimum Split (s)	24.0	24.0		24.0	24.0		9.0	31.0		31.0	31.0	
Total Split (s)	24.0	24.0		24.0	24.0		10.0	51.0		51.0	51.0	
Total Split (%)	28.2%	28.2%		28.2%	28.2%		11.8%	60.0%		60.0%	60.0%	
Maximum Green (s)	18.0	18.0		18.0	18.0		6.0	45.0		45.0	45.0	
Yellow Time (s)	4.0	4.0		4.0	4.0		3.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		1.0	2.0		2.0	2.0	
Lost Time Adjust (s)	-2.0	-2.0		-2.0	-2.0		0.0	-2.0		-2.0	-2.0	
Total Lost Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lead/Lag							Lead			Lag	Lag	
Lead-Lag Optimize?							Yes			Yes	Yes	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		None	C-Max		C-Max	C-Max	
Walk Time (s)	7.0	7.0		7.0	7.0		19.0	19.0		19.0	19.0	
Flash Don't Walk (s)	11.0	11.0		11.0	11.0		6.0	6.0		6.0	6.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effect Green (s)	20.0	20.0		20.0	20.0		57.0	57.0		49.0	49.0	
Actuated g/C Ratio	0.24	0.24		0.24	0.24		0.67	0.67		0.58	0.58	
v/c Ratio	0.42	0.96		0.76	0.79		0.14	0.28		0.02	0.42	
Control Delay (s/veh)	40.4	71.8		83.6	47.6		5.4	5.6		8.8	11.6	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay (s/veh)	40.4	71.8		83.6	47.6		5.4	5.6		8.8	11.6	
LOS	D	E		F	D		A	A		A	B	
Approach Delay (s/veh)		67.9			54.0			5.6			11.5	
Approach LOS		E			D			A			B	

Intersection Summary

Area Type:	Other
Cycle Length: 85	
Actuated Cycle Length: 85	
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green	
Natural Cycle: 65	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.96	
Intersection Signal Delay (s/veh): 36.0	Intersection LOS: D
Intersection Capacity Utilization 92.0%	ICU Level of Service F
Analysis Period (min) 15	

Splits and Phases: 2: King Street South & William Street West/William Street East



Queues
2: King Street South & William Street West/William Street East
250137 171 King Street South, Waterloo TIS

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	50	357	65	302	75	276	12	354
v/c Ratio	0.42	0.96	0.76	0.79	0.14	0.28	0.02	0.42
Control Delay (s/veh)	40.4	71.8	83.6	47.6	5.4	5.6	8.8	11.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (s/veh)	40.4	71.8	83.6	47.6	5.4	5.6	8.8	11.6
Queue Length 50th (m)	6.9	56.9	9.9	46.2	3.7	13.0	0.8	28.6
Queue Length 95th (m)	18.2	#108.9	#31.9	#85.0	7.7	23.1	3.1	48.0
Internal Link Dist (m)		24.6		105.2		61.4		113.6
Turn Bay Length (m)	15.0		25.0		35.0		25.0	
Base Capacity (vph)	118	372	85	381	550	992	566	849
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.42	0.96	0.76	0.79	0.14	0.28	0.02	0.42
Intersection Summary								
# 95th percentile volume exceeds capacity, queue may be longer.								
Queue shown is maximum after two cycles.								

Lanes, Volumes, Timings
4: Caroline Street South & Allen Street West
250137 171 King Street South, 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		↔			↔			↔			↔	
Traffic Volume (vph)	13	25	10	12	60	9	19	115	40	47	98	26
Future Volume (vph)	13	25	10	12	60	9	19	115	40	47	98	26
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		0.96			0.98			0.96			0.95	
Frt		0.972			0.985			0.969			0.979	
Flt Protected		0.987			0.993			0.995			0.986	
Satd. Flow (prot)	0	1435	0	0	1434	0	0	1412	0	0	1379	0
Flt Permitted		0.914			0.956			0.952			0.785	
Satd. Flow (perm)	0	1313	0	0	1362	0	0	1332	0	0	1080	0
Right Turn on Red		Yes			Yes			Yes			No	
Satd. Flow (RTOR)		10			6			15				
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		81.6			87.7			93.6			95.7	
Travel Time (s)		5.9			6.3			6.7			6.9	
Confl. Peds. (#/hr)	18		34	34		18	73		35	35		73
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%	0%	0%	0%	5%	0%	0%	1%	5%	13%	0%	0%
Adj. Flow (vph)	13	25	10	12	60	9	19	115	40	47	98	26
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	48	0	0	81	0	0	174	0	0	171	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)		4.9			4.9			4.9			4.9	
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)	24		14	24		14	24		14	24		14
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	6.1	30.5		6.1	30.5		6.1	30.5		6.1	30.5	
Trailing Detector (m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Position(m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Size(m)	6.1	1.8		6.1	1.8		6.1	1.8		6.1	1.8	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(m)		28.7			28.7			28.7			28.7	
Detector 2 Size(m)		1.8			1.8			1.8			1.8	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases		4			8			2			6	

Lanes, Volumes, Timings
4: Caroline Street South & Allen Street West 2027 Background PM Peak Hour (with LRT)
(250137) 171 King Street South, Waterloo TIS

Lane Group	Ø9
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Util. Factor	
Ped Bike Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (k/h)	
Link Distance (m)	
Travel Time (s)	
Confl. Peds. (#/hr)	
Peak Hour Factor	
Heavy Vehicles (%)	
Adj. Flow (vph)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Enter Blocked Intersection	
Lane Alignment	
Median Width(m)	
Link Offset(m)	
Crosswalk Width(m)	
Two way Left Turn Lane	
Headway Factor	
Turning Speed (k/h)	
Number of Detectors	
Detector Template	
Leading Detector (m)	
Trailing Detector (m)	
Detector 1 Position(m)	
Detector 1 Size(m)	
Detector 1 Type	
Detector 1 Channel	
Detector 1 Extend (s)	
Detector 1 Queue (s)	
Detector 1 Delay (s)	
Detector 2 Position(m)	
Detector 2 Size(m)	
Detector 2 Type	
Detector 2 Channel	
Detector 2 Extend (s)	
Turn Type	
Protected Phases	9
Permitted Phases	

Lanes, Volumes, Timings
4: Caroline Street South & Allen Street West 2027 Background PM Peak Hour (with LRT)
(250137) 171 King Street South, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	4	4		8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	15.0	15.0		15.0	15.0		15.0	15.0		15.0	15.0	
Minimum Split (s)	21.0	21.0		21.0	21.0		21.0	21.0		21.0	21.0	
Total Split (s)	21.0	21.0		21.0	21.0		21.0	21.0		21.0	21.0	
Total Split (%)	24.1%	24.1%		24.1%	24.1%		24.1%	24.1%		24.1%	24.1%	
Maximum Green (s)	15.0	15.0		15.0	15.0		15.0	15.0		15.0	15.0	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Lost Time Adjust (s)		-2.0			-2.0			-2.0			-2.0	
Total Lost Time (s)		4.0			4.0			4.0			4.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		C-Max	C-Max		C-Max	C-Max	
Walk Time (s)	10.0	10.0		10.0	10.0		9.0	9.0		9.0	9.0	
Flash Don't Walk (s)	5.0	5.0		5.0	5.0		6.0	6.0		6.0	6.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)		17.0			17.0			17.0			17.0	
Actuated g/C Ratio		0.20			0.20			0.20			0.20	
v/c Ratio		0.18			0.30			0.64			0.81	
Control Delay (s/veh)		26.5			31.2			41.5			63.5	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay (s/veh)		26.5			31.2			41.5			63.5	
LOS		C			C			D			E	
Approach Delay (s/veh)		26.5			31.2			41.5			63.5	
Approach LOS		C			C			D			E	

Intersection Summary												
Area Type: Other												
Cycle Length: 87												
Actuated Cycle Length: 87												
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green												
Natural Cycle: 90												
Control Type: Actuated-Coordinated												
Maximum v/c Ratio: 0.81												
Intersection Signal Delay (s/veh): 46.1 Intersection LOS: D												
Intersection Capacity Utilization 42.7% ICU Level of Service A												
Analysis Period (min) 15												



Lanes, Volumes, Timings
4: Caroline Street South & Allen Street West 2027 Background PM Peak Hour (with LRT)
(250137) 171 King Street South, Waterloo TIS

Lane Group	Ø9
Detector Phase	
Switch Phase	
Minimum Initial (s)	10.0
Minimum Split (s)	45.0
Total Split (s)	45.0
Total Split (%)	52%
Maximum Green (s)	31.0
Yellow Time (s)	4.0
All-Red Time (s)	10.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Vehicle Extension (s)	3.0
Recall Mode	Max
Walk Time (s)	
Flash Don't Walk (s)	
Pedestrian Calls (#/hr)	
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay (s/veh)	
Queue Delay	
Total Delay (s/veh)	
LOS	
Approach Delay (s/veh)	
Approach LOS	
Intersection Summary	

Queues
4: Caroline Street South & Allen Street West 2027 Background PM Peak Hour (with LRT)
(250137) 171 King Street South, Waterloo TIS

	→	←	↑	↓
Lane Group	EBT	WBT	NBT	SBT
Lane Group Flow (vph)	48	81	174	171
v/c Ratio	0.18	0.30	0.64	0.81
Control Delay (s/veh)	26.5	31.2	41.5	63.5
Queue Delay	0.0	0.0	0.0	0.0
Total Delay (s/veh)	26.5	31.2	41.5	63.5
Queue Length 50th (m)	5.3	10.7	24.5	27.5
Queue Length 95th (m)	14.5	23.2	#49.4	#60.5
Internal Link Dist (m)	57.6	63.7	69.6	71.7
Turn Bay Length (m)				
Base Capacity (vph)	264	270	272	211
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.18	0.30	0.64	0.81
Intersection Summary				
# 95th percentile volume exceeds capacity, queue may be longer. Queue shown is maximum after two cycles.				

Lanes, Volumes, Timings
2: King Street South & William Street West/William Street East King Street South, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	←	←	←	←	←	←	←	←	←	←	←	←
Traffic Volume (vph)	65	394	17	42	182	8	57	188	77	16	141	64
Future Volume (vph)	65	394	17	42	182	8	57	188	77	16	141	64
Ideal Flow (vphpl)	1775	1650	1650	1775	1650	1650	1775	1650	1650	1775	1650	1650
Storage Length (m)	15.0	0.0	0.0	25.0	0.0	0.0	35.0	0.0	0.0	25.0	0.0	0.0
Storage Lanes	1	0	0	1	0	0	1	0	0	1	0	0
Taper Length (m)	25.0	0.0	0.0	35.0	0.0	0.0	25.0	0.0	0.0	35.0	0.0	0.0
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	0.96	1.00	0.99	1.00	0.93	0.98	0.97	0.96	0.97	0.96	0.96	0.96
Frt	0.994	0.994	0.994	0.994	0.994	0.994	0.994	0.994	0.994	0.994	0.994	0.994
Flt Protected	0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950
Satd. Flow (prot)	1516	1587	0	1668	1586	0	1588	1393	0	1668	1436	0
Flt Permitted	0.521	0.521	0.521	0.521	0.521	0.521	0.521	0.521	0.521	0.521	0.521	0.521
Satd. Flow (perm)	795	1587	0	348	1586	0	894	1393	0	1012	1436	0
Right Turn on Red	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Satd. Flow (RTOR)	2	2	2	2	2	2	2	2	2	2	2	2
Link Speed (k/h)	40	40	40	40	40	40	40	40	40	40	40	40
Link Distance (m)	48.6	48.6	48.6	48.6	48.6	48.6	48.6	48.6	48.6	48.6	48.6	48.6
Travel Time (s)	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4
Confl. Peds. (#/hr)	27	13	13	13	27	58	28	28	58	27	13	13
Confl. Bikes (#/hr)	1	4	4	4	1	1	1	1	1	1	4	4
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 (%)	10%	1%	25%	0%	2%	0%	5%	11%	7%	0%	4%	5%
Adj. Flow (vph)	65	394	17	42	182	8	57	188	77	16	141	64
Shared Lane Traffic (%)												
Lane Group Flow (vph)	65	411	0	42	190	0	57	265	0	16	205	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)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
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)	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9
Two way Left Turn Lane												
Headway Factor	1.11	1.21	1.21	1.11	1.21	1.21	1.11	1.21	1.21	1.11	1.21	1.21
Turning Speed (k/h)	24	24	24	24	24	24	24	24	24	24	24	24
Number of Detectors	1	2	2	1	2	2	1	2	2	1	2	2
Detector Template	Left	Thru	Thru	Left	Thru	Thru	Left	Thru	Thru	Left	Thru	Thru
Leading Detector (m)	6.1	30.5	30.5	6.1	30.5	30.5	6.1	30.5	30.5	6.1	30.5	30.5
Trailing Detector (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
Detector 1 Position(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
Detector 1 Size(m)	6.1	1.8	1.8	6.1	1.8	1.8	6.1	1.8	1.8	6.1	1.8	1.8
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(m)	28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.7
Detector 2 Size(m)	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
Detector 2 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 2 Channel												

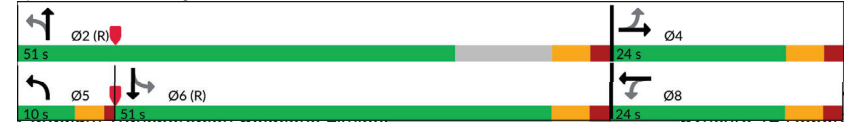
Lanes, Volumes, Timings
2: King Street South & William Street West/William Street East King Street South, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector 2 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Turn Type	Perm	NA	Perm	NA	pm+pt	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases	4	4	4	4	4	4	4	4	4	4	4	4
Permitted Phases	4	4	4	4	4	4	4	4	4	4	4	4
Detector Phase	4	4	4	4	4	4	4	4	4	4	4	4
Switch Phase												
Minimum Initial (s)	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0
Minimum Split (s)	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0
Total Split (s)	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0
Total Split (%)	28.2%	28.2%	28.2%	28.2%	28.2%	28.2%	28.2%	28.2%	28.2%	28.2%	28.2%	28.2%
Maximum Green (s)	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag												
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	None	None	None	None	None	None	None	None	None	None
Walk Time (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Flash Don't Walk (s)	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Act Effect Green (s)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Actuated g/C Ratio	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
v/c Ratio	0.35	1.10	0.52	0.51	0.09	0.28	0.03	0.23	0.03	0.23	0.03	0.23
Control Delay (s/veh)	33.4	109.1	54.1	33.9	5.1	5.3	8.8	7.9	8.8	7.9	8.8	7.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (s/veh)	33.4	109.1	54.1	33.9	5.1	5.3	8.8	7.9	8.8	7.9	8.8	7.9
LOS	C	F	D	C	A	A	A	A	A	A	A	A
Approach Delay (s/veh)	98.7	37.5	5.3	7.9	8.8	7.9	8.8	7.9	8.8	7.9	8.8	7.9
Approach LOS	F	D	A	A	A	A	A	A	A	A	A	A

Intersection Summary

Area Type:	Other
Cycle Length: 85	
Actuated Cycle Length: 85	
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green	
Natural Cycle: 65	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 1.10	
Intersection Signal Delay (s/veh): 47.3	Intersection LOS: D
Intersection Capacity Utilization 95.1%	ICU Level of Service F
Analysis Period (min) 15	

Splits and Phases: 2: King Street South & William Street West/William Street East



Queues
2: King Street South & William Street West/William Street East King Street South, Waterloo TIS

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	65	411	42	190	57	265	16	205
v/c Ratio	0.35	1.10	0.52	0.51	0.09	0.28	0.03	0.23
Control Delay (s/veh)	33.4	109.1	54.1	33.9	5.1	5.3	8.8	7.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (s/veh)	33.4	109.1	54.1	33.9	5.1	5.3	8.8	7.9
Queue Length 50th (m)	8.8	~76.5	6.0	26.9	2.8	11.6	1.1	12.4
Queue Length 95th (m)	20.5	#130.5	#20.2	46.9	6.3	21.3	3.8	23.6
Internal Link Dist (m)		24.6		105.2		61.4		113.6
Turn Bay Length (m)	15.0		25.0		35.0		25.0	
Base Capacity (vph)	187	374	81	373	648	951	607	879
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.35	1.10	0.52	0.51	0.09	0.28	0.03	0.23

Intersection Summary

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

Lanes, Volumes, Timings
4: Caroline Street South & Allen Street West (250137) 171 King Street South, Waterloo TIS

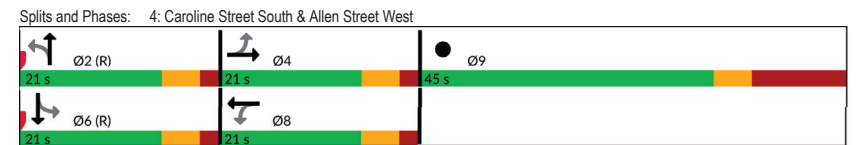
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↔			↔	
Traffic Volume (vph)	6	41	16	7	27	12	5	60	12	38	87	12
Future Volume (vph)	6	41	16	7	27	12	5	60	12	38	87	12
Ideal Flow (vphpl)	1550	1550	1550	1550	1550	1550	1550	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		0.97			0.97			0.98			0.97	
Frt		0.966			0.965			0.979			0.988	
Flt Protected		0.995			0.992			0.997			0.986	
Satd. Flow (prot)	0	1410	0	0	1446	0	0	1414	0	0	1353	0
Flt Permitted		0.975			0.957			0.979			0.904	
Satd. Flow (perm)	0	1377	0	0	1380	0	0	1376	0	0	1222	0
Right Turn on Red		Yes			Yes			Yes			No	
Satd. Flow (RTOR)		16			12			9				
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		81.6			87.7			93.6			95.7	
Travel Time (s)		5.9			6.3			6.7			6.9	
Confl. Peds. (#/hr)	13		27	27		13	72		23	23		72
Confl. Bikes (#/hr)		2										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%	0%	0%	20%	4%	0%	22%	2%	9%
Adj. Flow (vph)	6	41	16	7	27	12	5	60	12	38	87	12
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	63	0	0	46	0	0	77	0	0	137	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)		4.9			4.9			4.9			4.9	
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)	24		14	24		14	24		14	24		14
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	6.1	30.5		6.1	30.5		6.1	30.5		6.1	30.5	
Trailing Detector (m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Position(m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Size(m)	6.1	1.8		6.1	1.8		6.1	1.8		6.1	1.8	
Detector 1 Type	CI+Ex	CI+Ex		CI+Ex	CI+Ex		CI+Ex	CI+Ex		CI+Ex	CI+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(m)		28.7			28.7			28.7			28.7	
Detector 2 Size(m)		1.8			1.8			1.8			1.8	
Detector 2 Type		CI+Ex			CI+Ex			CI+Ex			CI+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	

Lanes, Volumes, Timings 2028 Background AM Peak Hour (with LRT)
4: Caroline Street South & Allen Street West (250137) 171 King Street South, Waterloo TIS

Lane Group	Ø9
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Util. Factor	
Ped Bike Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (k/h)	
Link Distance (m)	
Travel Time (s)	
Confl. Peds. (#/hr)	
Confl. Bikes (#/hr)	
Peak Hour Factor	
Heavy Vehicles (%)	
Adj. Flow (vph)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Enter Blocked Intersection	
Lane Alignment	
Median Width(m)	
Link Offset(m)	
Crosswalk Width(m)	
Two way Left Turn Lane	
Headway Factor	
Turning Speed (k/h)	
Number of Detectors	
Detector Template	
Leading Detector (m)	
Trailing Detector (m)	
Detector 1 Position(m)	
Detector 1 Size(m)	
Detector 1 Type	
Detector 1 Channel	
Detector 1 Extend (s)	
Detector 1 Queue (s)	
Detector 1 Delay (s)	
Detector 2 Position(m)	
Detector 2 Size(m)	
Detector 2 Type	
Detector 2 Channel	
Detector 2 Extend (s)	
Turn Type	
Protected Phases	9

Lanes, Volumes, Timings 2028 Background AM Peak Hour (with LRT)
4: Caroline Street South & Allen Street West (250137) 171 King Street South, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	15.0	15.0		15.0	15.0		15.0	15.0		15.0	15.0	
Minimum Split (s)	21.0	21.0		21.0	21.0		21.0	21.0		21.0	21.0	
Total Split (s)	21.0	21.0		21.0	21.0		21.0	21.0		21.0	21.0	
Total Split (%)	24.1%	24.1%		24.1%	24.1%		24.1%	24.1%		24.1%	24.1%	
Maximum Green (s)	15.0	15.0		15.0	15.0		15.0	15.0		15.0	15.0	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Lost Time Adjust (s)		-2.0			-2.0			-2.0			-2.0	
Total Lost Time (s)		4.0			4.0			4.0			4.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		C-Max	C-Max		C-Max	C-Max	
Walk Time (s)	10.0	10.0		10.0	10.0		9.0	9.0		9.0	9.0	
Flash Don't Walk (s)	5.0	5.0		5.0	5.0		6.0	6.0		6.0	6.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)		17.0			17.0			17.0			17.0	
Actuated g/C Ratio		0.20			0.20			0.20			0.20	
v/c Ratio		0.22			0.16			0.28			0.58	
Control Delay (s/veh)		25.7			24.9			29.7			42.5	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay (s/veh)		25.7			24.9			29.7			42.5	
LOS		C			C			C			D	
Approach Delay (s/veh)		25.7			24.9			29.7			42.5	
Approach LOS		C			C			C			D	
Intersection Summary												
Area Type:	Other											
Cycle Length: 87												
Actuated Cycle Length: 87												
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green												
Natural Cycle: 90												
Control Type: Actuated-Coordinated												
Maximum v/c Ratio: 0.58												
Intersection Signal Delay (s/veh): 33.7	Intersection LOS: C											
Intersection Capacity Utilization 35.4%	ICU Level of Service A											
Analysis Period (min) 15												



Lanes, Volumes, Timings
4: Caroline Street South & Allen Street West 2028 Background AM Peak Hour (with LRT)
(250137) 171 King Street South, Waterloo TIS

Lane Group	Ø9
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	10.0
Minimum Split (s)	45.0
Total Split (s)	45.0
Total Split (%)	52%
Maximum Green (s)	31.0
Yellow Time (s)	4.0
All-Red Time (s)	10.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Vehicle Extension (s)	3.0
Recall Mode	Max
Walk Time (s)	
Flash Don't Walk (s)	
Pedestrian Calls (#/hr)	
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay (s/veh)	
Queue Delay	
Total Delay (s/veh)	
LOS	
Approach Delay (s/veh)	
Approach LOS	
Intersection Summary	

Queues
4: Caroline Street South & Allen Street West 2028 Background AM Peak Hour (with LRT)
(250137) 171 King Street South, Waterloo TIS

	→	←	↑	↓
Lane Group	EBT	WBT	NBT	SBT
Lane Group Flow (vph)	63	46	77	137
v/c Ratio	0.22	0.16	0.28	0.58
Control Delay (s/veh)	25.7	24.9	29.7	42.5
Queue Delay	0.0	0.0	0.0	0.0
Total Delay (s/veh)	25.7	24.9	29.7	42.5
Queue Length 50th (m)	6.6	4.7	9.7	20.9
Queue Length 95th (m)	17.1	13.6	21.8	39.3
Internal Link Dist (m)	57.6	63.7	69.6	71.7
Turn Bay Length (m)				
Base Capacity (vph)	281	279	276	238
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.22	0.16	0.28	0.58
Intersection Summary				

Lanes, Volumes, Timings
2: King Street South & William Street West/William Street East King Street South, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	←	→	→	←	→	→	←	→	→	←	→	→
Traffic Volume (vph)	51	339	23	66	297	9	76	212	68	13	273	86
Future Volume (vph)	51	339	23	66	297	9	76	212	68	13	273	86
Ideal Flow (vphpl)	1775	1650	1650	1775	1650	1650	1775	1650	1650	1775	1650	1650
Storage Length (m)	15.0	0.0	0.0	25.0	0.0	0.0	35.0	0.0	0.0	25.0	0.0	0.0
Storage Lanes	1	0	0	1	0	0	1	0	0	1	0	0
Taper Length (m)	25.0	0.0	0.0	35.0	0.0	0.0	25.0	0.0	0.0	35.0	0.0	0.0
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	0.97	0.99	0.98	0.98	1.00	0.91	0.98	0.95	0.95	0.95	0.95	0.95
Frt	0.990	0.990	0.996	0.996	0.964	0.964	0.964	0.964	0.964	0.964	0.964	0.964
Flt Protected	0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950
Satd. Flow (prot)	1573	1571	0	1635	1621	0	1668	1460	0	1668	1453	0
Flt Permitted	0.307	0.307	0.208	0.208	0.447	0.447	0.588	0.588	0.588	0.588	0.588	0.588
Satd. Flow (perm)	492	1571	0	349	1621	0	716	1460	0	980	1453	0
Right Turn on Red		Yes		No		No		Yes			Yes	
Satd. Flow (RTOR)	4	4	4	4	4	4	4	4	4	4	4	4
Link Speed (k/h)	50	50	50	50	50	50	50	50	50	50	50	50
Link Distance (m)	48.6	48.6	48.6	48.6	48.6	48.6	48.6	48.6	48.6	48.6	48.6	48.6
Travel Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Confl. Peds. (#/hr)	28	26	26	26	28	104	44	44	44	104	28	28
Confl. Bikes (#/hr)	1	1	1	1	1	1	1	1	1	1	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 (%)	6%	1%	21%	2%	0%	0%	7%	0%	0%	3%	4%	4%
Adj. Flow (vph)	51	339	23	66	297	9	76	212	68	13	273	86
Shared Lane Traffic (%)												
Lane Group Flow (vph)	51	362	0	66	306	0	76	280	0	13	359	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)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
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)	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9
Two way Left Turn Lane												
Headway Factor	1.11	1.21	1.21	1.11	1.21	1.21	1.11	1.21	1.21	1.11	1.21	1.21
Turning Speed (k/h)	24	24	24	24	24	24	24	24	24	24	24	24
Number of Detectors	1	2	2	1	2	2	1	2	2	1	2	2
Detector Template	Left	Thru	Thru	Left	Thru	Thru	Left	Thru	Thru	Left	Thru	Thru
Leading Detector (m)	6.1	30.5	30.5	6.1	30.5	30.5	6.1	30.5	30.5	6.1	30.5	30.5
Trailing Detector (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
Detector 1 Position(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
Detector 1 Size(m)	6.1	1.8	1.8	6.1	1.8	1.8	6.1	1.8	1.8	6.1	1.8	1.8
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(m)	28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.7
Detector 2 Size(m)	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
Detector 2 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 2 Channel												

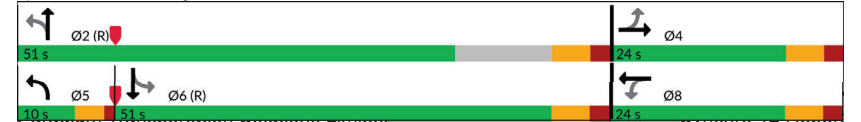
Lanes, Volumes, Timings
2: King Street South & William Street West/William Street East King Street South, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector 2 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Turn Type	Perm	NA	Perm	NA	pm+pt	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases	4	4	8	8	5	2	6	6	6	6	6	6
Permitted Phases	4	4	8	8	2	2	6	6	6	6	6	6
Detector Phase	4	4	8	8	5	2	6	6	6	6	6	6
Switch Phase												
Minimum Initial (s)	18.0	18.0	18.0	18.0	5.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0
Minimum Split (s)	24.0	24.0	24.0	24.0	9.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0
Total Split (s)	24.0	24.0	24.0	24.0	10.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0
Total Split (%)	28.2%	28.2%	28.2%	28.2%	11.8%	60.0%	60.0%	60.0%	60.0%	60.0%	60.0%	60.0%
Maximum Green (s)	18.0	18.0	18.0	18.0	6.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0
Yellow Time (s)	4.0	4.0	4.0	4.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	1.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	0.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag					Lead	Lag	Lag	Lag	Lag	Lag	Lag	Lag
Lead-Lag Optimize?					Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	None	None	None	C-Max	C-Max	C-Max	C-Max	C-Max	C-Max	C-Max
Walk Time (s)	7.0	7.0	7.0	7.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0
Flash Don't Walk (s)	11.0	11.0	11.0	11.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Pedestrian Calls (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Act Effect Green (s)	20.0	20.0	20.0	20.0	57.0	57.0	49.0	49.0	49.0	49.0	49.0	49.0
Actuated g/C Ratio	0.24	0.24	0.24	0.24	0.67	0.67	0.58	0.58	0.58	0.58	0.58	0.58
v/c Ratio	0.44	0.97	0.80	0.80	0.14	0.28	0.02	0.42	0.42	0.42	0.42	0.42
Control Delay (s/veh)	41.8	74.8	92.4	48.5	5.5	5.6	8.8	11.7	11.7	11.7	11.7	11.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (s/veh)	41.8	74.8	92.4	48.5	5.5	5.6	8.8	11.7	11.7	11.7	11.7	11.7
LOS	D	E	F	D	A	A	A	B	B	B	B	B
Approach Delay (s/veh)	70.7	70.7	56.3	56.3	5.6	11.6	11.6	11.6	11.6	11.6	11.6	11.6
Approach LOS	E	E	E	E	A	B	B	B	B	B	B	B

Intersection Summary

Area Type:	Other
Cycle Length: 85	
Actuated Cycle Length: 85	
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green	
Natural Cycle: 65	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.97	
Intersection Signal Delay (s/veh): 37.3	Intersection LOS: D
Intersection Capacity Utilization 92.3%	ICU Level of Service F
Analysis Period (min) 15	

Splits and Phases: 2: King Street South & William Street West/William Street East



Queues
2: King Street South & William Street West/William Street East
250137 171 King Street South, Waterloo TIS

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	51	362	66	306	76	280	13	359
v/c Ratio	0.44	0.97	0.80	0.80	0.14	0.28	0.02	0.42
Control Delay (s/veh)	41.8	74.8	92.4	48.5	5.5	5.6	8.8	11.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (s/veh)	41.8	74.8	92.4	48.5	5.5	5.6	8.8	11.7
Queue Length 50th (m)	7.1	57.9	10.1	47.0	3.7	13.3	0.9	29.0
Queue Length 95th (m)	18.5	#111.0	#33.2	#86.7	7.8	23.4	3.3	48.8
Internal Link Dist (m)		24.6		105.2		61.4		113.6
Turn Bay Length (m)	15.0		25.0		35.0		25.0	
Base Capacity (vph)	115	372	82	381	547	992	564	850
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.44	0.97	0.80	0.80	0.14	0.28	0.02	0.42
Intersection Summary								
# 95th percentile volume exceeds capacity, queue may be longer.								
Queue shown is maximum after two cycles.								

Lanes, Volumes, Timings
4: Caroline Street South & Allen Street West
250137 171 King Street South, 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		↔			↔			↔			↔	
Traffic Volume (vph)	14	25	10	13	61	9	19	117	40	48	99	26
Future Volume (vph)	14	25	10	13	61	9	19	117	40	48	99	26
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		0.96			0.98			0.96			0.95	
Frt		0.972			0.985			0.969			0.980	
Flt Protected		0.986			0.992			0.995			0.986	
Satd. Flow (prot)	0	1434	0	0	1433	0	0	1412	0	0	1381	0
Flt Permitted		0.908			0.953			0.952			0.777	
Satd. Flow (perm)	0	1305	0	0	1358	0	0	1333	0	0	1070	0
Right Turn on Red		Yes			Yes			Yes			No	
Satd. Flow (RTOR)		10			6			15				
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		81.6			87.7			93.6			95.7	
Travel Time (s)		5.9			6.3			6.7			6.9	
Confl. Peds. (#/hr)	18		34	34		18	73		35	35		73
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%	0%	0%	0%	5%	0%	0%	1%	5%	13%	0%	0%
Adj. Flow (vph)	14	25	10	13	61	9	19	117	40	48	99	26
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	49	0	0	83	0	0	176	0	0	173	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)		4.9			4.9			4.9			4.9	
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)	24		14	24		14	24		14	24		14
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	6.1	30.5		6.1	30.5		6.1	30.5		6.1	30.5	
Trailing Detector (m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Position(m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Size(m)	6.1	1.8		6.1	1.8		6.1	1.8		6.1	1.8	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(m)		28.7			28.7			28.7			28.7	
Detector 2 Size(m)		1.8			1.8			1.8			1.8	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases		4			8			2			6	

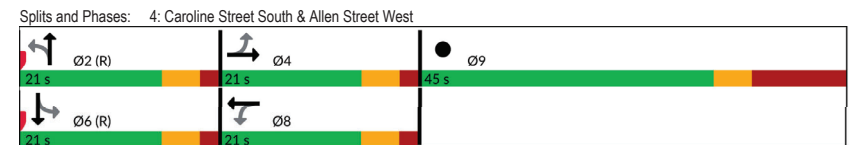
Lanes, Volumes, Timings
4: Caroline Street South & Allen Street West 2028 Background PM Peak Hour (with LRT)
(250137) 171 King Street South, Waterloo TIS

Lane Group	Ø9
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Util. Factor	
Ped Bike Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (k/h)	
Link Distance (m)	
Travel Time (s)	
Confl. Peds. (#/hr)	
Peak Hour Factor	
Heavy Vehicles (%)	
Adj. Flow (vph)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Enter Blocked Intersection	
Lane Alignment	
Median Width(m)	
Link Offset(m)	
Crosswalk Width(m)	
Two way Left Turn Lane	
Headway Factor	
Turning Speed (k/h)	
Number of Detectors	
Detector Template	
Leading Detector (m)	
Trailing Detector (m)	
Detector 1 Position(m)	
Detector 1 Size(m)	
Detector 1 Type	
Detector 1 Channel	
Detector 1 Extend (s)	
Detector 1 Queue (s)	
Detector 1 Delay (s)	
Detector 2 Position(m)	
Detector 2 Size(m)	
Detector 2 Type	
Detector 2 Channel	
Detector 2 Extend (s)	
Turn Type	
Protected Phases	9
Permitted Phases	

Lanes, Volumes, Timings
4: Caroline Street South & Allen Street West 2028 Background PM Peak Hour (with LRT)
(250137) 171 King Street South, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	4	4		8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	15.0	15.0		15.0	15.0		15.0	15.0		15.0	15.0	
Minimum Split (s)	21.0	21.0		21.0	21.0		21.0	21.0		21.0	21.0	
Total Split (s)	21.0	21.0		21.0	21.0		21.0	21.0		21.0	21.0	
Total Split (%)	24.1%	24.1%		24.1%	24.1%		24.1%	24.1%		24.1%	24.1%	
Maximum Green (s)	15.0	15.0		15.0	15.0		15.0	15.0		15.0	15.0	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Lost Time Adjust (s)		-2.0			-2.0			-2.0			-2.0	
Total Lost Time (s)		4.0			4.0			4.0			4.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		C-Max	C-Max		C-Max	C-Max	
Walk Time (s)	10.0	10.0		10.0	10.0		9.0	9.0		9.0	9.0	
Flash Don't Walk (s)	5.0	5.0		5.0	5.0		6.0	6.0		6.0	6.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)		17.0			17.0			17.0			17.0	
Actuated g/C Ratio		0.20			0.20			0.20			0.20	
v/c Ratio		0.19			0.31			0.65			0.83	
Control Delay (s/veh)		26.7			31.4			41.9			66.1	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay (s/veh)		26.7			31.4			41.9			66.1	
LOS		C			C			D			E	
Approach Delay (s/veh)		26.7			31.4			41.9			66.1	
Approach LOS		C			C			D			E	

Intersection Summary												
Area Type: Other												
Cycle Length: 87												
Actuated Cycle Length: 87												
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green												
Natural Cycle: 90												
Control Type: Actuated-Coordinated												
Maximum v/c Ratio: 0.83												
Intersection Signal Delay (s/veh): 47.2 Intersection LOS: D												
Intersection Capacity Utilization 43.2% ICU Level of Service A												
Analysis Period (min) 15												



Lanes, Volumes, Timings
4: Caroline Street South & Allen Street West 2028 Background PM Peak Hour (with LRT)
(250137) 171 King Street South, Waterloo TIS

Lane Group	Ø9
Detector Phase	
Switch Phase	
Minimum Initial (s)	10.0
Minimum Split (s)	45.0
Total Split (s)	45.0
Total Split (%)	52%
Maximum Green (s)	31.0
Yellow Time (s)	4.0
All-Red Time (s)	10.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Vehicle Extension (s)	3.0
Recall Mode	Max
Walk Time (s)	
Flash Don't Walk (s)	
Pedestrian Calls (#/hr)	
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay (s/veh)	
Queue Delay	
Total Delay (s/veh)	
LOS	
Approach Delay (s/veh)	
Approach LOS	
Intersection Summary	

Queues
4: Caroline Street South & Allen Street West 2028 Background PM Peak Hour (with LRT)
(250137) 171 King Street South, Waterloo TIS

	→	←	↑	↓
Lane Group	EBT	WBT	NBT	SBT
Lane Group Flow (vph)	49	83	176	173
v/c Ratio	0.19	0.31	0.65	0.83
Control Delay (s/veh)	26.7	31.4	41.9	66.1
Queue Delay	0.0	0.0	0.0	0.0
Total Delay (s/veh)	26.7	31.4	41.9	66.1
Queue Length 50th (m)	5.5	11.0	24.9	27.9
Queue Length 95th (m)	14.8	23.7	#49.7	#61.9
Internal Link Dist (m)	57.6	63.7	69.6	71.7
Turn Bay Length (m)				
Base Capacity (vph)	263	270	272	209
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.19	0.31	0.65	0.83
Intersection Summary				
# 95th percentile volume exceeds capacity, queue may be longer. Queue shown is maximum after two cycles.				

Lanes, Volumes, Timings
2: King Street South & William Street West/William Street East King Street South, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱	↲	↰	↱	↲	↰	↱	↲	↰	↱	↲
Traffic Volume (vph)	70	424	18	45	196	9	61	199	81	17	151	69
Future Volume (vph)	70	424	18	45	196	9	61	199	81	17	151	69
Ideal Flow (vphpl)	1775	1650	1650	1775	1650	1650	1775	1650	1650	1775	1650	1650
Storage Length (m)	15.0	0.0	25.0	0.0	35.0	0.0	35.0	0.0	25.0	0.0	35.0	0.0
Storage Lanes	1	0	1	0	1	0	1	0	1	0	1	0
Taper Length (m)	25.0			35.0			25.0			35.0		
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	0.96	1.00	0.99	1.00	0.94	0.98	0.97	0.96	0.97	0.96	0.97	0.96
Frt	0.994			0.993			0.957			0.953		
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1516	1587	0	1668	1584	0	1588	1394	0	1668	1436	0
Flt Permitted	0.492			0.200			0.557			0.588		
Satd. Flow (perm)	752	1587	0	348	1584	0	871	1394	0	999	1436	0
Right Turn on Red		Yes			No			Yes			Yes	
Satd. Flow (RTOR)		2					52			43		
Link Speed (k/h)		50			50		50			50		
Link Distance (m)		48.6			129.2		85.4			137.6		
Travel Time (s)		3.5			9.3		6.1			9.9		
Confl. Peds. (#/hr)	27		13	13		27	58		28	28		58
Confl. Bikes (#/hr)	1	4			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 (%)	10%	1%	25%	0%	2%	0%	5%	11%	7%	0%	4%	5%
Adj. Flow (vph)	70	424	18	45	196	9	61	199	81	17	151	69
Shared Lane Traffic (%)												
Lane Group Flow (vph)	70	442	0	45	205	0	61	280	0	17	220	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left Right	Left	Left	Left Right	Left	Left	Left Right	Left	Left	Left Right	Left
Median Width(m)		3.5			3.5			3.5			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.9			4.9			4.9			4.9	
Two way Left Turn Lane												
Headway Factor	1.11	1.21	1.21	1.11	1.21	1.21	1.11	1.21	1.21	1.11	1.21	1.21
Turning Speed (k/h)	24		14	24		14	24		14	24		14
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	6.1	30.5		6.1	30.5		6.1	30.5		6.1	30.5	
Trailing Detector (m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Position(m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Size(m)	6.1	1.8		6.1	1.8		6.1	1.8		6.1	1.8	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(m)		28.7			28.7			28.7			28.7	
Detector 2 Size(m)		1.8			1.8			1.8			1.8	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												

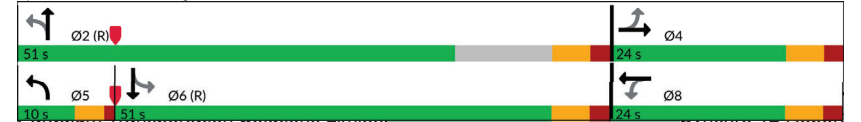
Lanes, Volumes, Timings
2: King Street South & William Street West/William Street East King Street South, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA		Perm	NA		pm+pt	NA		Perm	NA	
Protected Phases		4			8		5	2			6	
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		5	2		6	6	
Switch Phase												
Minimum Initial (s)	18.0	18.0		18.0	18.0		5.0	25.0		25.0	25.0	
Minimum Split (s)	24.0	24.0		24.0	24.0		9.0	31.0		31.0	31.0	
Total Split (s)	24.0	24.0		24.0	24.0		10.0	51.0		51.0	51.0	
Total Split (%)	28.2%	28.2%		28.2%	28.2%		11.8%	60.0%		60.0%	60.0%	
Maximum Green (s)	18.0	18.0		18.0	18.0		6.0	45.0		45.0	45.0	
Yellow Time (s)	4.0	4.0		4.0	4.0		3.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		1.0	2.0		2.0	2.0	
Lost Time Adjust (s)	-2.0	-2.0		-2.0	-2.0		0.0	-2.0		-2.0	-2.0	
Total Lost Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lead/Lag							Lead			Lag	Lag	
Lead-Lag Optimize?							Yes			Yes	Yes	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		None	C-Max		C-Max	C-Max	
Walk Time (s)	7.0	7.0		7.0	7.0		19.0	19.0		19.0	19.0	
Flash Don't Walk (s)	11.0	11.0		11.0	11.0		6.0	6.0		6.0	6.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effect Green (s)	20.0	20.0		20.0	20.0		57.0	57.0		49.0	49.0	
Actuated g/C Ratio	0.24	0.24		0.24	0.24		0.67	0.67		0.58	0.58	
v/c Ratio	0.40	1.18		0.56	0.55		0.10	0.29		0.03	0.26	
Control Delay (s/veh)	35.4	137.8		57.7	35.1		5.2	5.5		8.9	8.7	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay (s/veh)	35.4	137.8		57.7	35.1		5.2	5.5		8.9	8.7	
LOS	D	F		E	D		A	A		A	A	
Approach Delay (s/veh)		123.8			39.2			5.4			8.7	
Approach LOS		F			D			A			A	

Intersection Summary

Area Type:	Other
Cycle Length: 85	
Actuated Cycle Length: 85	
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green	
Natural Cycle: 65	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 1.18	
Intersection Signal Delay (s/veh): 57.5	Intersection LOS: E
Intersection Capacity Utilization 97.0%	ICU Level of Service F
Analysis Period (min) 15	

Splits and Phases: 2: King Street South & William Street West/William Street East



Queues
2: King Street South & William Street West/William Street East King Street South, Waterloo TIS

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	70	442	45	205	61	280	17	220
v/c Ratio	0.40	1.18	0.56	0.55	0.10	0.29	0.03	0.26
Control Delay (s/veh)	35.4	137.8	57.7	35.1	5.2	5.5	8.9	8.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (s/veh)	35.4	137.8	57.7	35.1	5.2	5.5	8.9	8.7
Queue Length 50th (m)	9.6	~87.4	6.5	29.3	3.0	12.7	1.2	13.7
Queue Length 95th (m)	22.2	#142.8	#21.9	50.4	6.7	23.0	3.9	25.7
Internal Link Dist (m)		24.6		105.2		61.4		113.6
Turn Bay Length (m)	15.0		25.0		35.0		25.0	
Base Capacity (vph)	176	374	81	372	634	951	575	846
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.40	1.18	0.56	0.55	0.10	0.29	0.03	0.26

Intersection Summary

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

Lanes, Volumes, Timings
4: Caroline Street South & Allen Street West (250137) 171 King Street South, Waterloo TIS

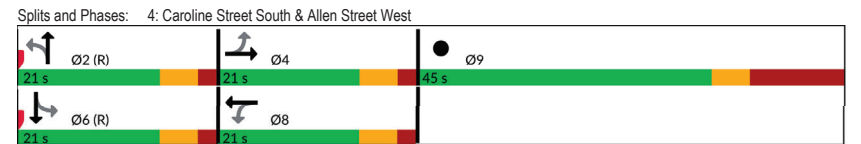
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↔			↔	
Traffic Volume (vph)	7	44	17	8	29	12	6	64	13	41	93	12
Future Volume (vph)	7	44	17	8	29	12	6	64	13	41	93	12
Ideal Flow (vphpl)	1550	1550	1550	1550	1550	1550	1550	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		0.97			0.98			0.98			0.97	
Frt		0.966			0.967			0.979			0.989	
Flt Protected		0.995			0.992			0.996			0.986	
Satd. Flow (prot)	0	1410	0	0	1450	0	0	1411	0	0	1356	0
Flt Permitted		0.972			0.953			0.976			0.908	
Satd. Flow (perm)	0	1373	0	0	1378	0	0	1369	0	0	1230	0
Right Turn on Red		Yes			Yes			Yes			No	
Satd. Flow (RTOR)		17			12			10				
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		81.6			87.7			93.6			95.7	
Travel Time (s)		5.9			6.3			6.7			6.9	
Confl. Peds. (#/hr)	13		27	27		13	72		23	23		72
Confl. Bikes (#/hr)		2										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%	0%	0%	20%	4%	0%	22%	2%	9%
Adj. Flow (vph)	7	44	17	8	29	12	6	64	13	41	93	12
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	68	0	0	49	0	0	83	0	0	146	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)		4.9			4.9			4.9			4.9	
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)	24		14	24		14	24		14	24		14
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	6.1	30.5		6.1	30.5		6.1	30.5		6.1	30.5	
Trailing Detector (m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Position(m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Size(m)	6.1	1.8		6.1	1.8		6.1	1.8		6.1	1.8	
Detector 1 Type	CI+Ex	CI+Ex		CI+Ex	CI+Ex		CI+Ex	CI+Ex		CI+Ex	CI+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(m)		28.7			28.7			28.7			28.7	
Detector 2 Size(m)		1.8			1.8			1.8			1.8	
Detector 2 Type		CI+Ex			CI+Ex			CI+Ex			CI+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	

Lanes, Volumes, Timings
4: Caroline Street South & Allen Street West (250137) 171 King Street South, Waterloo TIS

Lane Group	Ø9
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Util. Factor	
Ped Bike Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (k/h)	
Link Distance (m)	
Travel Time (s)	
Confl. Peds. (#/hr)	
Confl. Bikes (#/hr)	
Peak Hour Factor	
Heavy Vehicles (%)	
Adj. Flow (vph)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Enter Blocked Intersection	
Lane Alignment	
Median Width(m)	
Link Offset(m)	
Crosswalk Width(m)	
Two way Left Turn Lane	
Headway Factor	
Turning Speed (k/h)	
Number of Detectors	
Detector Template	
Leading Detector (m)	
Trailing Detector (m)	
Detector 1 Position(m)	
Detector 1 Size(m)	
Detector 1 Type	
Detector 1 Channel	
Detector 1 Extend (s)	
Detector 1 Queue (s)	
Detector 1 Delay (s)	
Detector 2 Position(m)	
Detector 2 Size(m)	
Detector 2 Type	
Detector 2 Channel	
Detector 2 Extend (s)	
Turn Type	
Protected Phases	9

Lanes, Volumes, Timings
4: Caroline Street South & Allen Street West (250137) 171 King Street South, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	15.0	15.0		15.0	15.0		15.0	15.0		15.0	15.0	
Minimum Split (s)	21.0	21.0		21.0	21.0		21.0	21.0		21.0	21.0	
Total Split (s)	21.0	21.0		21.0	21.0		21.0	21.0		21.0	21.0	
Total Split (%)	24.1%	24.1%		24.1%	24.1%		24.1%	24.1%		24.1%	24.1%	
Maximum Green (s)	15.0	15.0		15.0	15.0		15.0	15.0		15.0	15.0	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Lost Time Adjust (s)		-2.0			-2.0			-2.0			-2.0	
Total Lost Time (s)		4.0			4.0			4.0			4.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		C-Max	C-Max		C-Max	C-Max	
Walk Time (s)	10.0	10.0		10.0	10.0		9.0	9.0		9.0	9.0	
Flash Don't Walk (s)	5.0	5.0		5.0	5.0		6.0	6.0		6.0	6.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)		17.0			17.0			17.0			17.0	
Actuated g/C Ratio		0.20			0.20			0.20			0.20	
v/c Ratio		0.24			0.18			0.30			0.61	
Control Delay (s/veh)		26.1			25.4			29.9			44.1	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay (s/veh)		26.1			25.4			29.9			44.1	
LOS		C			C			C			D	
Approach Delay (s/veh)		26.1			25.4			29.9			44.1	
Approach LOS		C			C			C			D	
Intersection Summary												
Area Type:	Other											
Cycle Length: 87												
Actuated Cycle Length: 87												
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green												
Natural Cycle: 90												
Control Type: Actuated-Coordinated												
Maximum v/c Ratio: 0.61												
Intersection Signal Delay (s/veh): 34.5	Intersection LOS: C											
Intersection Capacity Utilization 35.9%	ICU Level of Service A											
Analysis Period (min) 15												



Lanes, Volumes, Timings
4: Caroline Street South & Allen Street West 2033 Background AM Peak Hour (with LRT)
(250137) 171 King Street South, Waterloo TIS

Lane Group	Ø9
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	10.0
Minimum Split (s)	45.0
Total Split (s)	45.0
Total Split (%)	52%
Maximum Green (s)	31.0
Yellow Time (s)	4.0
All-Red Time (s)	10.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Vehicle Extension (s)	3.0
Recall Mode	Max
Walk Time (s)	
Flash Don't Walk (s)	
Pedestrian Calls (#/hr)	
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay (s/veh)	
Queue Delay	
Total Delay (s/veh)	
LOS	
Approach Delay (s/veh)	
Approach LOS	
Intersection Summary	

Queues
4: Caroline Street South & Allen Street West 2033 Background AM Peak Hour (with LRT)
(250137) 171 King Street South, Waterloo TIS

	→	←	↑	↓
Lane Group	EBT	WBT	NBT	SBT
Lane Group Flow (vph)	68	49	83	146
v/c Ratio	0.24	0.18	0.30	0.61
Control Delay (s/veh)	26.1	25.4	29.9	44.1
Queue Delay	0.0	0.0	0.0	0.0
Total Delay (s/veh)	26.1	25.4	29.9	44.1
Queue Length 50th (m)	7.2	5.1	10.4	22.4
Queue Length 95th (m)	18.3	14.4	23.0	#43.2
Internal Link Dist (m)	57.6	63.7	69.6	71.7
Turn Bay Length (m)				
Base Capacity (vph)	281	278	275	240
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.24	0.18	0.30	0.61
Intersection Summary				
#	95th percentile volume exceeds capacity, queue may be longer. Queue shown is maximum after two cycles.			

Lanes, Volumes, Timings
2: King Street South & William Street West/William Street East King Street South, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱	↲	↰	↱	↲	↰	↱	↲	↰	↱	↲
Traffic Volume (vph)	54	365	25	70	319	10	82	227	73	14	292	92
Future Volume (vph)	54	365	25	70	319	10	82	227	73	14	292	92
Ideal Flow (vphpl)	1775	1650	1650	1775	1650	1650	1775	1650	1650	1775	1650	1650
Storage Length (m)	15.0	0.0	0.0	25.0	0.0	0.0	35.0	0.0	0.0	25.0	0.0	0.0
Storage Lanes	1	0	0	1	0	0	1	0	0	1	0	0
Taper Length (m)	25.0	0.0	0.0	35.0	0.0	0.0	25.0	0.0	0.0	35.0	0.0	0.0
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	0.97	0.99	0.98	0.98	1.00	0.92	0.92	0.98	0.95	0.95	0.95	0.95
Frt	0.990	0.990	0.995	0.995	0.995	0.995	0.963	0.963	0.964	0.964	0.964	0.964
Flt Protected	0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950
Satd. Flow (prot)	1573	1571	0	1635	1619	0	1668	1458	0	1668	1453	0
Flt Permitted	0.266	0.266	0.200	0.200	0.200	0.200	0.428	0.428	0.577	0.577	0.577	0.577
Satd. Flow (perm)	427	1571	0	337	1619	0	689	1458	0	963	1453	0
Right Turn on Red		Yes			No			Yes			Yes	
Satd. Flow (RTOR)	4	4	4	4	4	4	41	41	41	41	30	30
Link Speed (k/h)	50	50	50	50	50	50	50	50	50	50	50	50
Link Distance (m)	48.6	48.6	48.6	48.6	48.6	48.6	85.4	85.4	85.4	85.4	137.6	137.6
Travel Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	6.1	6.1	6.1	6.1	9.9	9.9
Confl. Peds. (#/hr)	28	28	26	26	26	28	104	104	44	44	104	104
Confl. Bikes (#/hr)	1	1	1	1	1	1	1	1	1	1	2	2
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 (%)	6%	1%	21%	2%	0%	0%	0%	7%	0%	0%	3%	4%
Adj. Flow (vph)	54	365	25	70	319	10	82	227	73	14	292	92
Shared Lane Traffic (%)												
Lane Group Flow (vph)	54	390	0	70	329	0	82	300	0	14	384	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)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
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)	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9
Two way Left Turn Lane												
Headway Factor	1.11	1.21	1.21	1.11	1.21	1.21	1.11	1.21	1.21	1.11	1.21	1.21
Turning Speed (k/h)	24	24	14	24	24	14	24	24	14	24	24	14
Number of Detectors	1	2	1	1	2	1	1	2	1	1	2	1
Detector Template	Left	Thru	Left	Thru	Left	Thru	Left	Thru	Left	Thru	Left	Thru
Leading Detector (m)	6.1	30.5	6.1	30.5	6.1	30.5	6.1	30.5	6.1	30.5	6.1	30.5
Trailing Detector (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
Detector 1 Position(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
Detector 1 Size(m)	6.1	1.8	6.1	1.8	6.1	1.8	6.1	1.8	6.1	1.8	6.1	1.8
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(m)	28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.7
Detector 2 Size(m)	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
Detector 2 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 2 Channel												

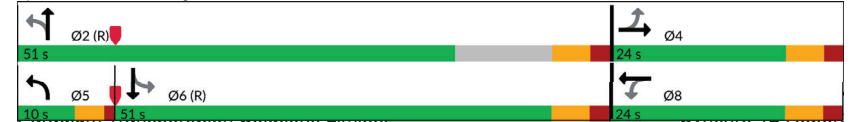
Lanes, Volumes, Timings
2: King Street South & William Street West/William Street East King Street South, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector 2 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Turn Type	Perm	NA	Perm	NA	pm+pt	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases	4	4	8	8	5	2	6	6	6	6	6	6
Permitted Phases	4	4	8	8	2	2	6	6	6	6	6	6
Detector Phase	4	4	8	8	5	2	6	6	6	6	6	6
Switch Phase												
Minimum Initial (s)	18.0	18.0	18.0	18.0	5.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0
Minimum Split (s)	24.0	24.0	24.0	24.0	9.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0
Total Split (s)	24.0	24.0	24.0	24.0	10.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0
Total Split (%)	28.2%	28.2%	28.2%	28.2%	11.8%	60.0%	60.0%	60.0%	60.0%	60.0%	60.0%	60.0%
Maximum Green (s)	18.0	18.0	18.0	18.0	6.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0
Yellow Time (s)	4.0	4.0	4.0	4.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	1.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	-2.0	-2.0	-2.0	-2.0	0.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag					Lead	Lag	Lag	Lag	Lag	Lag	Lag	Lag
Lead-Lag Optimize?					Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	None	None	None	C-Max	C-Max	C-Max	C-Max	C-Max	C-Max	C-Max
Walk Time (s)	7.0	7.0	7.0	7.0	7.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0
Flash Don't Walk (s)	11.0	11.0	11.0	11.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Pedestrian Calls (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Act Effect Green (s)	20.0	20.0	20.0	20.0	57.0	57.0	49.0	49.0	49.0	49.0	49.0	49.0
Actuated g/C Ratio	0.24	0.24	0.24	0.24	0.67	0.67	0.58	0.58	0.58	0.58	0.58	0.58
v/c Ratio	0.54	1.05	0.89	0.87	0.15	0.30	0.03	0.45	0.45	0.45	0.45	0.45
Control Delay (s/veh)	51.3	93.8	111.2	55.4	5.6	5.9	8.9	12.2	12.2	12.2	12.2	12.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (s/veh)	51.3	93.8	111.2	55.4	5.6	5.9	8.9	12.2	12.2	12.2	12.2	12.2
LOS	D	F	F	E	A	A	A	B	B	B	B	B
Approach Delay (s/veh)	88.6	88.6	65.2	65.2	5.8	5.8	12.0	12.0	12.0	12.0	12.0	12.0
Approach LOS	F	F	E	E	A	A	B	B	B	B	B	B

Intersection Summary

Area Type:	Other
Cycle Length: 85	
Actuated Cycle Length: 85	
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green	
Natural Cycle: 65	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 1.05	
Intersection Signal Delay (s/veh): 44.6	Intersection LOS: D
Intersection Capacity Utilization 94.0%	ICU Level of Service F
Analysis Period (min) 15	

Splits and Phases: 2: King Street South & William Street West/William Street East



Queues
2: King Street South & William Street West/William Street East
250137 171 King Street South, Waterloo TIS

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	54	390	70	329	82	300	14	384
v/c Ratio	0.54	1.05	0.89	0.87	0.15	0.30	0.03	0.45
Control Delay (s/veh)	51.3	93.8	111.2	55.4	5.6	5.9	8.9	12.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay (s/veh)	51.3	93.8	111.2	55.4	5.6	5.9	8.9	12.2
Queue Length 50th (m)	7.7	~69.3	11.0	51.4	4.0	14.6	1.0	32.0
Queue Length 95th (m)	#23.9	#122.2	#35.7	#96.0	8.3	25.6	3.5	53.5
Internal Link Dist (m)		24.6		105.2		61.4		113.6
Turn Bay Length (m)	15.0		25.0		35.0		25.0	
Base Capacity (vph)	100	372	79	380	531	991	555	850
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.54	1.05	0.89	0.87	0.15	0.30	0.03	0.45
Intersection Summary								
~ Volume exceeds capacity, queue is theoretically infinite.								
Queue shown is maximum after two cycles.								
# 95th percentile volume exceeds capacity, queue may be longer.								
Queue shown is maximum after two cycles.								

Lanes, Volumes, Timings
4: Caroline Street South & Allen Street West
250137 171 King Street South, 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		↔			↔			↔			↔	
Traffic Volume (vph)	15	27	11	14	65	10	20	126	41	52	106	28
Future Volume (vph)	15	27	11	14	65	10	20	126	41	52	106	28
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		0.96			0.98			0.96			0.95	
Frt		0.972			0.985			0.970			0.980	
Flt Protected		0.986			0.992			0.995			0.986	
Satd. Flow (prot)	0	1433	0	0	1433	0	0	1416	0	0	1380	0
Flt Permitted		0.906			0.951			0.944			0.745	
Satd. Flow (perm)	0	1302	0	0	1355	0	0	1326	0	0	1026	0
Right Turn on Red		Yes			Yes			Yes			No	
Satd. Flow (RTOR)		11			7			14				
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		81.6			87.7			93.6			95.7	
Travel Time (s)		5.9			6.3			6.7			6.9	
Confl. Peds. (#/hr)	18		34	34		18	73		35	35		73
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%	0%	0%	0%	5%	0%	0%	1%	5%	13%	0%	0%
Adj. Flow (vph)	15	27	11	14	65	10	20	126	41	52	106	28
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	53	0	0	89	0	0	187	0	0	186	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)		4.9			4.9			4.9			4.9	
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)	24		14	24		14	24		14	24		14
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	6.1	30.5		6.1	30.5		6.1	30.5		6.1	30.5	
Trailing Detector (m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Position(m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Size(m)	6.1	1.8		6.1	1.8		6.1	1.8		6.1	1.8	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(m)		28.7			28.7			28.7			28.7	
Detector 2 Size(m)		1.8			1.8			1.8			1.8	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases		4			8			2			6	

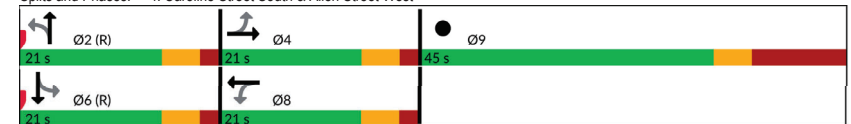
Lanes, Volumes, Timings
4: Caroline Street South & Allen Street West 2033 Background PM Peak Hour (with LRT)
(250137) 171 King Street South, Waterloo TIS

Lane Group	Ø9
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Util. Factor	
Ped Bike Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (k/h)	
Link Distance (m)	
Travel Time (s)	
Confl. Peds. (#/hr)	
Peak Hour Factor	
Heavy Vehicles (%)	
Adj. Flow (vph)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Enter Blocked Intersection	
Lane Alignment	
Median Width(m)	
Link Offset(m)	
Crosswalk Width(m)	
Two way Left Turn Lane	
Headway Factor	
Turning Speed (k/h)	
Number of Detectors	
Detector Template	
Leading Detector (m)	
Trailing Detector (m)	
Detector 1 Position(m)	
Detector 1 Size(m)	
Detector 1 Type	
Detector 1 Channel	
Detector 1 Extend (s)	
Detector 1 Queue (s)	
Detector 1 Delay (s)	
Detector 2 Position(m)	
Detector 2 Size(m)	
Detector 2 Type	
Detector 2 Channel	
Detector 2 Extend (s)	
Turn Type	
Protected Phases	9
Permitted Phases	

Lanes, Volumes, Timings
4: Caroline Street South & Allen Street West 2033 Background PM Peak Hour (with LRT)
(250137) 171 King Street South, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	4	4		8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	15.0	15.0		15.0	15.0		15.0	15.0		15.0	15.0	
Minimum Split (s)	21.0	21.0		21.0	21.0		21.0	21.0		21.0	21.0	
Total Split (s)	21.0	21.0		21.0	21.0		21.0	21.0		21.0	21.0	
Total Split (%)	24.1%	24.1%		24.1%	24.1%		24.1%	24.1%		24.1%	24.1%	
Maximum Green (s)	15.0	15.0		15.0	15.0		15.0	15.0		15.0	15.0	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Lost Time Adjust (s)		-2.0			-2.0			-2.0			-2.0	
Total Lost Time (s)		4.0			4.0			4.0			4.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		C-Max	C-Max		C-Max	C-Max	
Walk Time (s)	10.0	10.0		10.0	10.0		9.0	9.0		9.0	9.0	
Flash Don't Walk (s)	5.0	5.0		5.0	5.0		6.0	6.0		6.0	6.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)		17.0			17.0			17.0			17.0	
Actuated g/C Ratio		0.20			0.20			0.20			0.20	
v/c Ratio		0.20			0.33			0.69			0.93	
Control Delay (s/veh)		26.8			31.7			45.2			85.2	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay (s/veh)		26.8			31.7			45.2			85.2	
LOS		C			C			D			F	
Approach Delay (s/veh)		26.8			31.7			45.2			85.2	
Approach LOS		C			C			D			F	
Intersection Summary												
Area Type: Other												
Cycle Length: 87												
Actuated Cycle Length: 87												
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green												
Natural Cycle: 90												
Control Type: Actuated-Coordinated												
Maximum v/c Ratio: 0.93												
Intersection Signal Delay (s/veh): 55.4 Intersection LOS: E												
Intersection Capacity Utilization 45.2% ICU Level of Service A												
Analysis Period (min) 15												

Splits and Phases: 4: Caroline Street South & Allen Street West



Lanes, Volumes, Timings
4: Caroline Street South & Allen Street West 2033 Background PM Peak Hour (with LRT)
(250137) 171 King Street South, Waterloo TIS

Lane Group	Ø9
Detector Phase	
Switch Phase	
Minimum Initial (s)	10.0
Minimum Split (s)	45.0
Total Split (s)	45.0
Total Split (%)	52%
Maximum Green (s)	31.0
Yellow Time (s)	4.0
All-Red Time (s)	10.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Vehicle Extension (s)	3.0
Recall Mode	Max
Walk Time (s)	
Flash Don't Walk (s)	
Pedestrian Calls (#/hr)	
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay (s/veh)	
Queue Delay	
Total Delay (s/veh)	
LOS	
Approach Delay (s/veh)	
Approach LOS	
Intersection Summary	

Queues
4: Caroline Street South & Allen Street West 2033 Background PM Peak Hour (with LRT)
(250137) 171 King Street South, Waterloo TIS

	→	←	↑	↓
Lane Group	EBT	WBT	NBT	SBT
Lane Group Flow (vph)	53	89	187	186
v/c Ratio	0.20	0.33	0.69	0.93
Control Delay (s/veh)	26.8	31.7	45.2	85.2
Queue Delay	0.0	0.0	0.0	0.0
Total Delay (s/veh)	26.8	31.7	45.2	85.2
Queue Length 50th (m)	5.9	11.8	27.0	30.7
Queue Length 95th (m)	15.6	25.1	#55.6	#69.0
Internal Link Dist (m)	57.6	63.7	69.6	71.7
Turn Bay Length (m)				
Base Capacity (vph)	263	270	270	200
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.20	0.33	0.69	0.93
Intersection Summary				
# 95th percentile volume exceeds capacity, queue may be longer. Queue shown is maximum after two cycles.				

Appendix M

Total Traffic Operations Report with LRT Plan



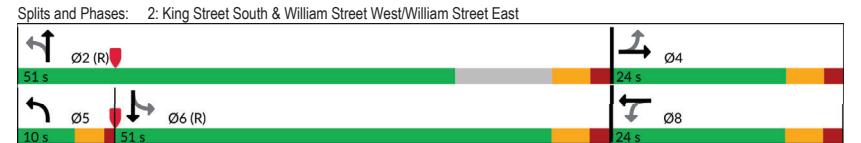
Lanes, Volumes, Timings
2: King Street South & William Street West/William Street East
2027 Total AM Peak Hour (with LRT)

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↰	↰	↰	↰	↰	↰	↰	↰	↰	↰	↰
Traffic Volume (vph)	70	400	16	41	180	8	56	185	76	15	139	64
Future Volume (vph)	70	400	16	41	180	8	56	185	76	15	139	64
Ideal Flow (vphpl)	1775	1650	1650	1775	1650	1650	1775	1650	1650	1775	1650	1650
Storage Length (m)	15.0		0.0	25.0		0.0	35.0		0.0	25.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	25.0			35.0			25.0			35.0		
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	0.96	1.00		0.99	1.00		0.93	0.98		0.97	0.96	
Frt	0.994				0.994			0.956			0.953	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1516	1588	0	1668	1586	0	1588	1393	0	1668	1436	0
Flt Permitted	0.525			0.200			0.575			0.598		
Satd. Flow (perm)	801	1588	0	348	1586	0	897	1393	0	1015	1436	0
Right Turn on Red			Yes			No			Yes			Yes
Satd. Flow (RTOR)		2						53			44	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		48.6			129.2			85.4			137.6	
Travel Time (s)		3.5			9.3			6.1			9.9	
Confl. Peds. (#/hr)	27		13	13		27	58		28	28		58
Confl. Bikes (#/hr)	1	4			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 (%)	10%	1%	25%	0%	2%	0%	5%	11%	7%	0%	4%	5%
Adj. Flow (vph)	70	400	16	41	180	8	56	185	76	15	139	64
Shared Lane Traffic (%)												
Lane Group Flow (vph)	70	416	0	41	188	0	56	261	0	15	203	0
Turn Type	Perm	NA		Perm	NA	pm+pt	NA		Perm	NA		
Protected Phases		4			8		5	2			6	
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		5	2		6	6	
Switch Phase												
Minimum Initial (s)	18.0	18.0		18.0	18.0		5.0	25.0		25.0	25.0	
Minimum Split (s)	24.0	24.0		24.0	24.0		9.0	31.0		31.0	31.0	
Total Split (s)	24.0	24.0		24.0	24.0		10.0	51.0		51.0	51.0	
Total Split (%)	28.2%	28.2%		28.2%	28.2%		11.8%	60.0%		60.0%	60.0%	
Yellow Time (s)	4.0	4.0		4.0	4.0		3.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		1.0	2.0		2.0	2.0	
Lost Time Adjust (s)	-2.0	-2.0		-2.0	-2.0		0.0	-2.0		-2.0	-2.0	
Total Lost Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lead/Lag							Lead			Lag		Lag
Lead-Lag Optimize?							Yes			Yes		Yes
Recall Mode	None	None		None	None		None	C-Max		C-Max	C-Max	
Act Effct Green (s)	20.0	20.0		20.0	20.0		57.0	57.0		51.0	51.0	
Actuated g/C Ratio	0.24	0.24		0.24	0.24		0.67	0.67		0.60	0.60	
v/c Ratio	0.37	1.11		0.51	0.50		0.09	0.27		0.02	0.23	
Control Delay (s/veh)	34.1	112.4		52.9	33.7		5.1	5.2		8.8	7.8	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay (s/veh)	34.1	112.4		52.9	33.7		5.1	5.2		8.8	7.8	
LOS	C	F		D	C		A	A		A	A	

Lanes, Volumes, Timings
2: King Street South & William Street West/William Street East
2027 Total AM Peak Hour (with LRT)

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Approach Delay (s/veh)	101.1				37.2			5.2			7.9	
Approach LOS	F				D			A			A	
Queue Length 50th (m)	9.6	~78.2		5.8	26.6		2.7	11.4		1.0	12.1	
Queue Length 95th (m)	21.9	#132.6		#19.9	46.5		6.2	20.9		3.6	23.3	
Internal Link Dist (m)		24.6			105.2			61.4			113.6	
Turn Bay Length (m)	15.0			25.0			35.0			25.0		
Base Capacity (vph)	188	375		81	373		650	951		609	879	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.37	1.11		0.51	0.50		0.09	0.27		0.02	0.23	

Intersection Summary	
Area Type:	Other
Cycle Length:	85
Actuated Cycle Length:	85
Offset:	0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle:	65
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	1.11
Intersection Signal Delay (s/veh):	48.8
	Intersection LOS: D
Intersection Capacity Utilization	95.4%
	ICU Level of Service F
Analysis Period (min)	15
~ Volume exceeds capacity, queue is theoretically infinite.	
Queue shown is maximum after two cycles.	
# 95th percentile volume exceeds capacity, queue may be longer.	
Queue shown is maximum after two cycles.	



Lanes, Volumes, Timings
4: Caroline Street South & Allen Street West (250137) 171 King Street South, Waterloo TIS

	↖	→	↗	↖	←	↖	↖	↑	↗	↘	↓	↘
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↔			↔	
Traffic Volume (vph)	6	40	15	7	27	11	5	57	12	57	80	16
Future Volume (vph)	6	40	15	7	27	11	5	57	12	57	80	16
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		0.97			0.98			0.98			0.96	
Frt		0.967			0.967			0.978			0.986	
Flt Protected		0.995			0.992			0.997			0.982	
Satd. Flow (prot)	0	1412	0	0	1450	0	0	1411	0	0	1315	0
Flt Permitted		0.974			0.957			0.978			0.879	
Satd. Flow (perm)	0	1377	0	0	1384	0	0	1372	0	0	1153	0
Right Turn on Red		Yes				Yes			Yes			No
Satd. Flow (RTOR)		15			11			10				
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		81.6			87.7			93.6			95.7	
Travel Time (s)		5.9			6.3			6.7			6.9	
Confl. Peds. (#/hr)	13		27	27		13	72		23	23		72
Confl. Bikes (#/hr)		2										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%	0%	0%	20%	4%	0%	22%	2%	9%
Adj. Flow (vph)	6	40	15	7	27	11	5	57	12	57	80	16
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	61	0	0	45	0	0	74	0	0	153	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	15.0	15.0		15.0	15.0		15.0	15.0		15.0	15.0	
Minimum Split (s)	21.0	21.0		21.0	21.0		21.0	21.0		21.0	21.0	
Total Split (s)	21.0	21.0		21.0	21.0		21.0	21.0		21.0	21.0	
Total Split (%)	24.1%	24.1%		24.1%	24.1%		24.1%	24.1%		24.1%	24.1%	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Lost Time Adjust (s)		-2.0			-2.0			-2.0			-2.0	
Total Lost Time (s)		4.0			4.0			4.0			4.0	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	None	None		None	None		C-Max	C-Max		C-Max	C-Max	
Act Effct Green (s)		17.0			17.0			17.0			17.0	
Actuated g/C Ratio		0.20			0.20			0.20			0.20	
v/c Ratio		0.22			0.16			0.27			0.68	
Control Delay (s/veh)		25.9			25.3			29.2			49.6	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay (s/veh)		25.9			25.3			29.2			49.6	
LOS		C			C			C			D	
Approach Delay (s/veh)		25.9			25.3			29.2			49.6	
Approach LOS		C			C			C			D	
Queue Length 50th (m)		6.5			4.7			9.1			23.9	

Lanes, Volumes, Timings
4: Caroline Street South & Allen Street West (250137) 171 King Street South, Waterloo TIS

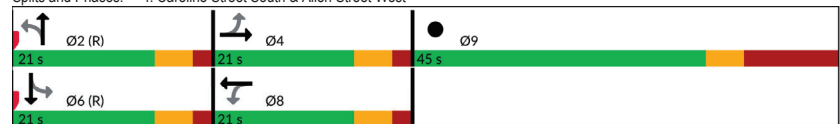
Lane Group	Ø9
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Util. Factor	
Ped Bike Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (k/h)	
Link Distance (m)	
Travel Time (s)	
Confl. Peds. (#/hr)	
Confl. Bikes (#/hr)	
Peak Hour Factor	
Heavy Vehicles (%)	
Adj. Flow (vph)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	9
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	10.0
Minimum Split (s)	45.0
Total Split (s)	45.0
Total Split (%)	52%
Yellow Time (s)	4.0
All-Red Time (s)	10.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Recall Mode	Max
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay (s/veh)	
Queue Delay	
Total Delay (s/veh)	
LOS	
Approach Delay (s/veh)	
Approach LOS	
Queue Length 50th (m)	

Lanes, Volumes, Timings
4: Caroline Street South & Allen Street West (250137) 171 King Street South, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 95th (m)		17.0			13.5			20.9			#50.3	
Internal Link Dist (m)		57.6			63.7			69.6			71.7	
Turn Bay Length (m)												
Base Capacity (vph)		281			279			276			225	
Starvation Cap Reductn		0			0			0			0	
Spillback Cap Reductn		0			0			0			0	
Storage Cap Reductn		0			0			0			0	
Reduced v/c Ratio		0.22			0.16			0.27			0.68	

Intersection Summary	
Area Type:	Other
Cycle Length: 87	
Actuated Cycle Length: 87	
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green	
Natural Cycle: 90	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.68	
Intersection Signal Delay (s/veh): 37.4	Intersection LOS: D
Intersection Capacity Utilization 36.6%	ICU Level of Service A
Analysis Period (min) 15	
# 95th percentile volume exceeds capacity, queue may be longer.	
Queue shown is maximum after two cycles.	

Splits and Phases: 4: Caroline Street South & Allen Street West



Lanes, Volumes, Timings
4: Caroline Street South & Allen Street West (250137) 171 King Street South, Waterloo TIS

Lane Group	Ø9
Queue Length 95th (m)	
Internal Link Dist (m)	
Turn Bay Length (m)	
Base Capacity (vph)	
Starvation Cap Reductn	
Spillback Cap Reductn	
Storage Cap Reductn	
Reduced v/c Ratio	

Intersection Summary

Lanes, Volumes, Timings

2027 Total PM Peak Hour (with LRT)

2: King Street South & William Street West/William Street East

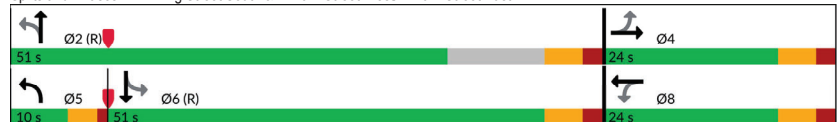
												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	52	337	23	65	300	9	75	209	67	12	269	88
Future Volume (vph)	52	337	23	65	300	9	75	209	67	12	269	88
Ideal Flow (vphpl)	1775	1650	1650	1775	1650	1650	1775	1650	1650	1775	1650	1650
Storage Length (m)	15.0		0.0	25.0		0.0	35.0		0.0	25.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	25.0			35.0			25.0			35.0		
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	0.97	0.99		0.98	1.00		0.91	0.98		0.95	0.95	
Frt		0.990			0.996			0.964			0.963	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1573	1571	0	1635	1621	0	1668	1460	0	1668	1449	0
Flt Permitted	0.301			0.212			0.448			0.590		
Satd. Flow (perm)	483	1571	0	356	1621	0	718	1460	0	983	1449	0
Right Turn on Red			Yes			No			Yes			Yes
Satd. Flow (RTOR)		4						41			31	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		48.6			129.2			85.4			137.6	
Travel Time (s)		3.5			9.3			6.1			9.9	
Confl. Peds. (#/hr)	28		26	26		28	104		44	44		104
Confl. Bikes (#/hr)		1			1			1		1	2	2
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 (%)	6%	1%	21%	2%	0%	0%	0%	7%	0%	0%	3%	4%
Adj. Flow (vph)	52	337	23	65	300	9	75	209	67	12	269	88
Shared Lane Traffic (%)												
Lane Group Flow (vph)	52	360	0	65	309	0	75	276	0	12	357	0
Turn Type	Perm	NA		Perm	NA		pm+pt	NA		Perm	NA	
Protected Phases		4			8		5	2			6	
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		5	2		6	6	
Switch Phase												
Minimum Initial (s)	18.0	18.0		18.0	18.0		5.0	25.0		25.0	25.0	
Minimum Split (s)	24.0	24.0		24.0	24.0		9.0	31.0		31.0	31.0	
Total Split (s)	24.0	24.0		24.0	24.0		10.0	51.0		51.0	51.0	
Total Split (%)	28.2%	28.2%		28.2%	28.2%		11.8%	60.0%		60.0%	60.0%	
Yellow Time (s)	4.0	4.0		4.0	4.0		3.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		1.0	2.0		2.0	2.0	
Lost Time Adjust (s)	-2.0	-2.0		-2.0	-2.0		0.0	-2.0		-2.0	-2.0	
Total Lost Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lead/Lag							Lead			Lag	Lag	
Lead-Lag Optimize?							Yes			Yes	Yes	
Recall Mode	None	None		None	None		None	C-Max		C-Max	C-Max	
Act Effct Green (s)	20.0	20.0		20.0	20.0		57.0	57.0		49.0	49.0	
Actuated g/C Ratio	0.24	0.24		0.24	0.24		0.67	0.67		0.58	0.58	
v/c Ratio	0.46	0.97		0.78	0.81		0.14	0.28		0.02	0.42	
Control Delay (s/veh)	43.0	73.5		87.8	49.3		5.5	5.6		8.8	11.6	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay (s/veh)	43.0	73.5		87.8	49.3		5.5	5.6		8.8	11.6	
LOS	D	E		F	D		A	A		A	B	

Lanes, Volumes, Timings
2: King Street South & William Street West/William Street East (250137) 171 King Street South, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Approach Delay (s/veh)		69.7			56.0			5.6			11.5	
Approach LOS		E			E			A			B	
Queue Length 50th (m)	7.3	57.5		9.9	47.6		3.7	13.0		0.8	28.8	
Queue Length 95th (m)	#19.6	#110.3		#32.2	#87.7		7.7	23.1		3.1	48.2	
Internal Link Dist (m)		24.6			105.2			61.4			113.6	
Turn Bay Length (m)	15.0			25.0			35.0			25.0		
Base Capacity (vph)	113	372		83	381		548	992		566	848	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.46	0.97		0.78	0.81		0.14	0.28		0.02	0.42	

Intersection Summary	
Area Type:	Other
Cycle Length: 85	
Actuated Cycle Length: 85	
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green	
Natural Cycle: 65	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.97	
Intersection Signal Delay (s/veh): 37.1	Intersection LOS: D
Intersection Capacity Utilization 92.2%	ICU Level of Service F
Analysis Period (min) 15	
# 95th percentile volume exceeds capacity, queue may be longer.	
Queue shown is maximum after two cycles.	

Splits and Phases: 2: King Street South & William Street West/William Street East



Lanes, Volumes, Timings
4: Caroline Street South & Allen Street West (250137) 171 King Street South, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↔			↔	
Traffic Volume (vph)	17	25	10	12	60	12	19	122	40	50	93	27
Future Volume (vph)	17	25	10	12	60	12	19	122	40	50	93	27
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		0.96			0.98			0.96			0.95	
Frt		0.974			0.981			0.970			0.979	
Flt Protected		0.984			0.993			0.995			0.986	
Satd. Flow (prot)	0	1436	0	0	1427	0	0	1415	0	0	1374	0
Flt Permitted		0.892			0.957			0.955			0.752	
Satd. Flow (perm)	0	1284	0	0	1358	0	0	1340	0	0	1030	0
Right Turn on Red		Yes			Yes			Yes			No	
Satd. Flow (RTOR)		10			9			15				
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		81.6			87.7			93.6			95.7	
Travel Time (s)		5.9			6.3			6.7			6.9	
Confl. Peds. (#/hr)	18		34	34		18	73		35	35		73
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%	0%	0%	0%	5%	0%	0%	1%	5%	13%	0%	0%
Adj. Flow (vph)	17	25	10	12	60	12	19	122	40	50	93	27
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	52	0	0	84	0	0	181	0	0	170	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	15.0	15.0		15.0	15.0		15.0	15.0		15.0	15.0	
Minimum Split (s)	21.0	21.0		21.0	21.0		21.0	21.0		21.0	21.0	
Total Split (s)	21.0	21.0		21.0	21.0		21.0	21.0		21.0	21.0	
Total Split (%)	24.1%	24.1%		24.1%	24.1%		24.1%	24.1%		24.1%	24.1%	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Lost Time Adjust (s)		-2.0			-2.0			-2.0			-2.0	
Total Lost Time (s)		4.0			4.0			4.0			4.0	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	None	None		None	None		C-Max	C-Max		C-Max	C-Max	
Act Effct Green (s)		17.0			17.0			17.0			17.0	
Actuated g/C Ratio		0.20			0.20			0.20			0.20	
v/c Ratio		0.20			0.31			0.66			0.85	
Control Delay (s/veh)		27.2			30.4			42.9			69.8	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay (s/veh)		27.2			30.4			42.9			69.8	
LOS		C			C			D			E	
Approach Delay (s/veh)		27.2			30.4			42.9			69.8	
Approach LOS		C			C			D			E	
Queue Length 50th (m)		5.9			10.7			25.8			27.5	
Queue Length 95th (m)		15.5			23.5			#52.0			#61.9	

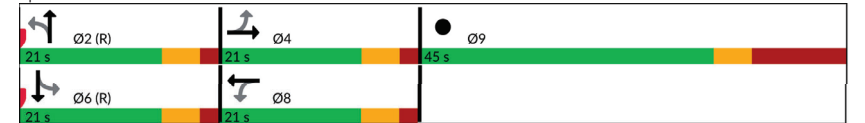
Lanes, Volumes, Timings
4: Caroline Street South & Allen Street West (250137) 171 King Street South, Waterloo TIS

Lane Group	Ø9
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Util. Factor	
Ped Bike Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (k/h)	
Link Distance (m)	
Travel Time (s)	
Confl. Peds. (#/hr)	
Peak Hour Factor	
Heavy Vehicles (%)	
Adj. Flow (vph)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	9
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	10.0
Minimum Split (s)	45.0
Total Split (s)	45.0
Total Split (%)	52%
Yellow Time (s)	4.0
All-Red Time (s)	10.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Recall Mode	Max
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay (s/veh)	
Queue Delay	
Total Delay (s/veh)	
LOS	
Approach Delay (s/veh)	
Approach LOS	
Queue Length 50th (m)	
Queue Length 95th (m)	

Lanes, Volumes, Timings
4: Caroline Street South & Allen Street West (250137) 171 King Street South, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Internal Link Dist (m)		57.6			63.7			69.6			71.7	
Turn Bay Length (m)												
Base Capacity (vph)		258			272			273			201	
Starvation Cap Reductn		0			0			0			0	
Spillback Cap Reductn		0			0			0			0	
Storage Cap Reductn		0			0			0			0	
Reduced v/c Ratio		0.20			0.31			0.66			0.85	
Intersection Summary												
Area Type:	Other											
Cycle Length: 87												
Actuated Cycle Length: 87												
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green												
Natural Cycle: 90												
Control Type: Actuated-Coordinated												
Maximum v/c Ratio: 0.85												
Intersection Signal Delay (s/veh): 48.4	Intersection LOS: D											
Intersection Capacity Utilization 44.1%	ICU Level of Service A											
Analysis Period (min) 15												
# 95th percentile volume exceeds capacity, queue may be longer.												
Queue shown is maximum after two cycles.												

Splits and Phases: 4: Caroline Street South & Allen Street West



Lanes, Volumes, Timings
 4: Caroline Street South & Allen Street West (250137) 171 King Street South, Waterloo TIS

Lane Group	Ø9
Internal Link Dist (m)	
Turn Bay Length (m)	
Base Capacity (vph)	
Starvation Cap Reductn	
Spillback Cap Reductn	
Storage Cap Reductn	
Reduced v/c Ratio	
Intersection Summary	

Lanes, Volumes, Timings
 2: King Street South & William Street West/William Street East (250137) 171 King Street South, Waterloo TIS

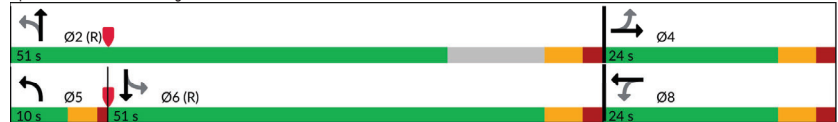
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱		↰	↱		↰	↱		↰	↱	
Traffic Volume (vph)	71	405	17	46	183	8	71	202	89	16	146	65
Future Volume (vph)	71	405	17	46	183	8	71	202	89	16	146	65
Ideal Flow (vphpl)	1775	1650	1650	1775	1650	1650	1775	1650	1650	1775	1650	1650
Storage Length (m)	15.0		0.0	25.0		0.0	35.0		0.0	25.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	25.0			35.0			25.0			35.0		
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	0.96	1.00		0.99	1.00		0.93	0.98		0.97	0.96	
Frt	0.994				0.994			0.954			0.954	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1516	1587	0	1668	1586	0	1588	1389	0	1668	1439	0
Flt Permitted	0.519			0.200			0.565			0.582		
Satd. Flow (perm)	792	1587	0	348	1586	0	881	1389	0	989	1439	0
Right Turn on Red			Yes			No			Yes			Yes
Satd. Flow (RTOR)		2						57			42	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		48.6			129.2			85.4			137.6	
Travel Time (s)		3.5			9.3			6.1			9.9	
Confl. Peds. (#/hr)	27		13	13		27	58		28	28		58
Confl. Bikes (#/hr)	1	4			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 (%)	10%	1%	25%	0%	2%	0%	5%	11%	7%	0%	4%	5%
Adj. Flow (vph)	71	405	17	46	183	8	71	202	89	16	146	65
Shared Lane Traffic (%)												
Lane Group Flow (vph)	71	422	0	46	191	0	71	291	0	16	211	0
Turn Type	Perm	NA		Perm	NA		pm+pt	NA		Perm	NA	
Protected Phases		4			8		5	2			6	
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		5	2		6	6	
Switch Phase												
Minimum Initial (s)	18.0	18.0		18.0	18.0		5.0	25.0		25.0	25.0	
Minimum Split (s)	24.0	24.0		24.0	24.0		9.0	31.0		31.0	31.0	
Total Split (s)	24.0	24.0		24.0	24.0		10.0	51.0		51.0	51.0	
Total Split (%)	28.2%	28.2%		28.2%	28.2%		11.8%	60.0%		60.0%	60.0%	
Yellow Time (s)	4.0	4.0		4.0	4.0		3.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		1.0	2.0		2.0	2.0	
Lost Time Adjust (s)	-2.0	-2.0		-2.0	-2.0		0.0	-2.0		-2.0	-2.0	
Total Lost Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lead/Lag							Lead			Lag	Lag	
Lead-Lag Optimize?							Yes			Yes	Yes	
Recall Mode	None	None		None	None		None	C-Max		C-Max	C-Max	
Act Effct Green (s)	20.0	20.0		20.0	20.0		57.0	57.0		49.0	49.0	
Actuated g/C Ratio	0.24	0.24		0.24	0.24		0.67	0.67		0.58	0.58	
v/c Ratio	0.38	1.13		0.57	0.51		0.11	0.31		0.03	0.25	
Control Delay (s/veh)	34.5	118.8		59.0	33.9		5.3	5.5		8.9	8.5	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay (s/veh)	34.5	118.8		59.0	33.9		5.3	5.5		8.9	8.5	
LOS	C	F		E	C		A	A		A	A	

Lanes, Volumes, Timings
2: King Street South & William Street West/William Street East (250137) 171 King Street South, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Approach Delay (s/veh)		106.7			38.8			5.5			8.6	
Approach LOS		F			D			A			A	
Queue Length 50th (m)	9.7	~80.4		6.6	27.1		3.5	13.1		1.1	12.9	
Queue Length 95th (m)	22.1	#135.1		#22.6	47.0		7.4	23.8		3.8	24.5	
Internal Link Dist (m)		24.6			105.2			61.4			113.6	
Turn Bay Length (m)	15.0			25.0			35.0			25.0		
Base Capacity (vph)	186	374		81	373		640	950		569	847	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.38	1.13		0.57	0.51		0.11	0.31		0.03	0.25	

Intersection Summary	
Area Type:	Other
Cycle Length: 85	
Actuated Cycle Length: 85	
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green	
Natural Cycle: 65	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 1.13	
Intersection Signal Delay (s/veh): 49.8	Intersection LOS: D
Intersection Capacity Utilization 95.8%	ICU Level of Service F
Analysis Period (min) 15	
~ Volume exceeds capacity, queue is theoretically infinite.	
Queue shown is maximum after two cycles.	
# 95th percentile volume exceeds capacity, queue may be longer.	
Queue shown is maximum after two cycles.	

Splits and Phases: 2: King Street South & William Street West/William Street East



Lanes, Volumes, Timings
4: Caroline Street South & Allen Street West (250137) 171 King Street South, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↔			↔	
Traffic Volume (vph)	8	41	16	7	27	14	5	58	12	65	82	23
Future Volume (vph)	8	41	16	7	27	14	5	58	12	65	82	23
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		0.97			0.97			0.98			0.95	
Frt		0.967			0.961			0.978			0.982	
Flt Protected		0.994			0.993			0.997			0.981	
Satd. Flow (prot)	0	1412	0	0	1438	0	0	1412	0	0	1294	0
Flt Permitted		0.966			0.959			0.981			0.868	
Satd. Flow (perm)	0	1366	0	0	1375	0	0	1377	0	0	1121	0
Right Turn on Red		Yes			Yes			Yes			No	
Satd. Flow (RTOR)		16			14			10				
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		81.6			87.7			93.6			95.7	
Travel Time (s)		5.9			6.3			6.7			6.9	
Confl. Peds. (#/hr)	13		27	27		13	72		23	23		72
Confl. Bikes (#/hr)		2										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%	0%	0%	20%	4%	0%	22%	2%	9%
Adj. Flow (vph)	8	41	16	7	27	14	5	58	12	65	82	23
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	65	0	0	48	0	0	75	0	0	170	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	15.0	15.0		15.0	15.0		15.0	15.0		15.0	15.0	
Minimum Split (s)	21.0	21.0		21.0	21.0		21.0	21.0		21.0	21.0	
Total Split (s)	21.0	21.0		21.0	21.0		21.0	21.0		21.0	21.0	
Total Split (%)	24.1%	24.1%		24.1%	24.1%		24.1%	24.1%		24.1%	24.1%	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Lost Time Adjust (s)		-2.0			-2.0			-2.0			-2.0	
Total Lost Time (s)		4.0			4.0			4.0			4.0	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	None	None		None	None		C-Max	C-Max		C-Max	C-Max	
Act Effct Green (s)		17.0			17.0			17.0			17.0	
Actuated g/C Ratio		0.20			0.20			0.20			0.20	
v/c Ratio		0.23			0.17			0.27			0.78	
Control Delay (s/veh)		26.1			24.3			29.2			58.6	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay (s/veh)		26.1			24.3			29.2			58.6	
LOS		C			C			C			E	
Approach Delay (s/veh)		26.1			24.3			29.2			58.6	
Approach LOS		C			C			C			E	
Queue Length 50th (m)		6.9			4.7			9.2			27.1	

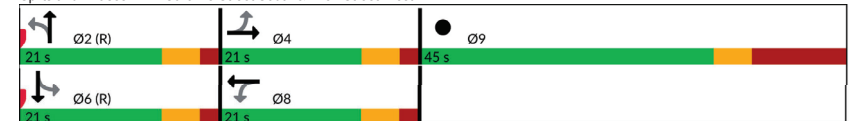
Lanes, Volumes, Timings
4: Caroline Street South & Allen Street West (250137) 171 King Street South, Waterloo TIS

Lane Group	Ø9
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Util. Factor	
Ped Bike Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (k/h)	
Link Distance (m)	
Travel Time (s)	
Confl. Peds. (#/hr)	
Confl. Bikes (#/hr)	
Peak Hour Factor	
Heavy Vehicles (%)	
Adj. Flow (vph)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	9
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	10.0
Minimum Split (s)	45.0
Total Split (s)	45.0
Total Split (%)	52%
Yellow Time (s)	4.0
All-Red Time (s)	10.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Recall Mode	Max
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay (s/veh)	
Queue Delay	
Total Delay (s/veh)	
LOS	
Approach Delay (s/veh)	
Approach LOS	
Queue Length 50th (m)	

Lanes, Volumes, Timings
4: Caroline Street South & Allen Street West (250137) 171 King Street South, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 95th (m)		17.6			13.8			21.1			#58.7	
Internal Link Dist (m)		57.6			63.7			69.6			71.7	
Turn Bay Length (m)												
Base Capacity (vph)		279			279			277			219	
Starvation Cap Reductn		0			0			0			0	
Spillback Cap Reductn		0			0			0			0	
Storage Cap Reductn		0			0			0			0	
Reduced v/c Ratio		0.23			0.17			0.27			0.78	
Intersection Summary												
Area Type:	Other											
Cycle Length: 87												
Actuated Cycle Length: 87												
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBTL, Start of Green												
Natural Cycle: 90												
Control Type: Actuated-Coordinated												
Maximum v/c Ratio: 0.78												
Intersection Signal Delay (s/veh): 41.9	Intersection LOS: D											
Intersection Capacity Utilization 37.9%	ICU Level of Service A											
Analysis Period (min) 15												
# 95th percentile volume exceeds capacity, queue may be longer.												
Queue shown is maximum after two cycles.												

Splits and Phases: 4: Caroline Street South & Allen Street West



Lanes, Volumes, Timings
 4: Caroline Street South & Allen Street West (250137) 171 King Street South, Waterloo TIS

Lane Group	Ø9
Queue Length 95th (m)	
Internal Link Dist (m)	
Turn Bay Length (m)	
Base Capacity (vph)	
Starvation Cap Reductn	
Spillback Cap Reductn	
Storage Cap Reductn	
Reduced v/c Ratio	
Intersection Summary	

Lanes, Volumes, Timings
 2: King Street South & William Street West/William Street East (250137) 171 King Street South, Waterloo TIS

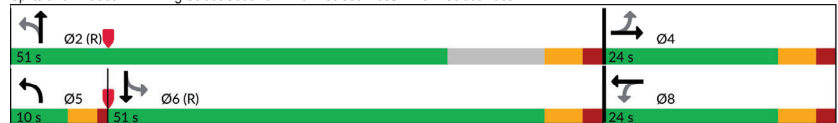
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱	↲	↰	↱	↲	↰	↱	↲	↰	↱	↲
Traffic Volume (vph)	53	342	23	74	304	9	79	216	71	13	281	90
Future Volume (vph)	53	342	23	74	304	9	79	216	71	13	281	90
Ideal Flow (vphpl)	1775	1650	1650	1775	1650	1650	1775	1650	1650	1775	1650	1650
Storage Length (m)	15.0		0.0	25.0		0.0	35.0		0.0	25.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	25.0			35.0			25.0			35.0		
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	0.97	0.99		0.98	1.00		0.91	0.98		0.95	0.95	
Frt	0.991				0.996			0.963			0.964	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1573	1573	0	1635	1621	0	1668	1458	0	1668	1452	0
Flt Permitted	0.294			0.203			0.438			0.584		
Satd. Flow (perm)	471	1573	0	341	1621	0	702	1458	0	974	1452	0
Right Turn on Red			Yes			No			Yes			Yes
Satd. Flow (RTOR)		4						42			30	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		48.6			129.2			85.4			137.6	
Travel Time (s)		3.5			9.3			6.1			9.9	
Confl. Peds. (#/hr)	28		26	26		28	104		44	44		104
Confl. Bikes (#/hr)		1			1			1		1	2	2
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 (%)	6%	1%	21%	2%	0%	0%	0%	7%	0%	0%	3%	4%
Adj. Flow (vph)	53	342	23	74	304	9	79	216	71	13	281	90
Shared Lane Traffic (%)												
Lane Group Flow (vph)	53	365	0	74	313	0	79	287	0	13	371	0
Turn Type	Perm	NA		Perm	NA		pm+pt	NA		Perm	NA	
Protected Phases		4			8		5	2			6	
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		5	2		6	6	
Switch Phase												
Minimum Initial (s)	18.0	18.0		18.0	18.0		5.0	25.0		25.0	25.0	
Minimum Split (s)	24.0	24.0		24.0	24.0		9.0	31.0		31.0	31.0	
Total Split (s)	24.0	24.0		24.0	24.0		10.0	51.0		51.0	51.0	
Total Split (%)	28.2%	28.2%		28.2%	28.2%		11.8%	60.0%		60.0%	60.0%	
Yellow Time (s)	4.0	4.0		4.0	4.0		3.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		1.0	2.0		2.0	2.0	
Lost Time Adjust (s)	-2.0	-2.0		-2.0	-2.0		0.0	-2.0		-2.0	-2.0	
Total Lost Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lead/Lag							Lead			Lag		Lag
Lead-Lag Optimize?							Yes			Yes		Yes
Recall Mode	None	None		None	None		None	C-Max		C-Max	C-Max	
Act Effct Green (s)	20.0	20.0		20.0	20.0		57.0	57.0		49.0	49.0	
Actuated g/C Ratio	0.24	0.24		0.24	0.24		0.67	0.67		0.58	0.58	
v/c Ratio	0.48	0.98		0.93	0.82		0.15	0.29		0.02	0.44	
Control Delay (s/veh)	44.9	76.0		119.8	50.3		5.5	5.7		8.8	11.9	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay (s/veh)	44.9	76.0		119.8	50.3		5.5	5.7		8.8	11.9	
LOS	D	E		F	D		A	A		A	B	

Lanes, Volumes, Timings
2: King Street South & William Street West/William Street East (250137) 171 King Street South, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Approach Delay (s/veh)		72.1			63.6			5.6			11.8	
Approach LOS		E			E			A			B	
Queue Length 50th (m)	7.5	58.5		11.8	48.3		3.9	13.7		0.9	30.5	
Queue Length 95th (m)	#21.4	#112.3		#37.3	#89.4		8.1	24.1		3.3	50.9	
Internal Link Dist (m)		24.6			105.2			61.4			113.6	
Turn Bay Length (m)	15.0			25.0			35.0			25.0		
Base Capacity (vph)	110	373		80	381		538	991		561	849	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.48	0.98		0.93	0.82		0.15	0.29		0.02	0.44	

Intersection Summary	
Area Type:	Other
Cycle Length: 85	
Actuated Cycle Length: 85	
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green	
Natural Cycle: 65	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.98	
Intersection Signal Delay (s/veh): 39.4	Intersection LOS: D
Intersection Capacity Utilization 92.5%	ICU Level of Service F
Analysis Period (min) 15	
# 95th percentile volume exceeds capacity, queue may be longer.	
Queue shown is maximum after two cycles.	

Splits and Phases: 2: King Street South & William Street West/William Street East



Lanes, Volumes, Timings
4: Caroline Street South & Allen Street West (250137) 171 King Street South, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↔			↔	
Traffic Volume (vph)	22	25	10	13	61	17	19	124	40	53	94	29
Future Volume (vph)	22	25	10	13	61	17	19	124	40	53	94	29
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		0.96			0.97			0.96			0.95	
Frt		0.976			0.975			0.970			0.978	
Flt Protected		0.981			0.993			0.995			0.985	
Satd. Flow (prot)	0	1438	0	0	1417	0	0	1416	0	0	1368	0
Flt Permitted		0.892			0.955			0.953			0.736	
Satd. Flow (perm)	0	1286	0	0	1345	0	0	1338	0	0	1004	0
Right Turn on Red		Yes			Yes			Yes			No	
Satd. Flow (RTOR)		10			12			14				
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		81.6			87.7			93.6			95.7	
Travel Time (s)		5.9			6.3			6.7			6.9	
Confl. Peds. (#/hr)	18		34	34		18	73		35	35		73
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%	0%	0%	0%	5%	0%	0%	1%	5%	13%	0%	0%
Adj. Flow (vph)	22	25	10	13	61	17	19	124	40	53	94	29
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	57	0	0	91	0	0	183	0	0	176	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	15.0	15.0		15.0	15.0		15.0	15.0		15.0	15.0	
Minimum Split (s)	21.0	21.0		21.0	21.0		21.0	21.0		21.0	21.0	
Total Split (s)	21.0	21.0		21.0	21.0		21.0	21.0		21.0	21.0	
Total Split (%)	24.1%	24.1%		24.1%	24.1%		24.1%	24.1%		24.1%	24.1%	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Lost Time Adjust (s)		-2.0			-2.0			-2.0			-2.0	
Total Lost Time (s)		4.0			4.0			4.0			4.0	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	None	None		None	None		C-Max	C-Max		C-Max	C-Max	
Act Effct Green (s)		17.0			17.0			17.0			17.0	
Actuated g/C Ratio		0.20			0.20			0.20			0.20	
v/c Ratio		0.22			0.33			0.67			0.90	
Control Delay (s/veh)		27.8			30.1			43.8			79.4	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay (s/veh)		27.8			30.1			43.8			79.4	
LOS		C			C			D			E	
Approach Delay (s/veh)		27.8			30.1			43.8			79.4	
Approach LOS		C			C			D			E	
Queue Length 50th (m)		6.6			11.4			26.3			28.9	
Queue Length 95th (m)		16.8			24.8			#53.0			#65.2	

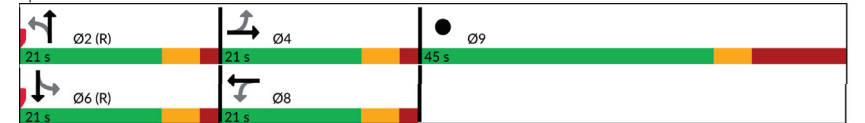
Lanes, Volumes, Timings
4: Caroline Street South & Allen Street West (250137) 171 King Street South, Waterloo TIS

Lane Group	Ø9
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Util. Factor	
Ped Bike Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (k/h)	
Link Distance (m)	
Travel Time (s)	
Confl. Peds. (#/hr)	
Peak Hour Factor	
Heavy Vehicles (%)	
Adj. Flow (vph)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	9
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	10.0
Minimum Split (s)	45.0
Total Split (s)	45.0
Total Split (%)	52%
Yellow Time (s)	4.0
All-Red Time (s)	10.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Recall Mode	Max
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay (s/veh)	
Queue Delay	
Total Delay (s/veh)	
LOS	
Approach Delay (s/veh)	
Approach LOS	
Queue Length 50th (m)	
Queue Length 95th (m)	

Lanes, Volumes, Timings
4: Caroline Street South & Allen Street West (250137) 171 King Street South, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Internal Link Dist (m)		57.6			63.7			69.6			71.7	
Turn Bay Length (m)												
Base Capacity (vph)		259			272			272			196	
Starvation Cap Reductn		0			0			0			0	
Spillback Cap Reductn		0			0			0			0	
Storage Cap Reductn		0			0			0			0	
Reduced v/c Ratio		0.22			0.33			0.67			0.90	
Intersection Summary												
Area Type:	Other											
Cycle Length: 87												
Actuated Cycle Length: 87												
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green												
Natural Cycle: 90												
Control Type: Actuated-Coordinated												
Maximum v/c Ratio: 0.90												
Intersection Signal Delay (s/veh): 51.9						Intersection LOS: D						
Intersection Capacity Utilization 45.5%						ICU Level of Service A						
Analysis Period (min) 15												
# 95th percentile volume exceeds capacity, queue may be longer.												
Queue shown is maximum after two cycles.												

Splits and Phases: 4: Caroline Street South & Allen Street West



Lanes, Volumes, Timings
 4: Caroline Street South & Allen Street West (250137) 2028 Total PM Peak Hour (with LRT)
 171 King Street South, Waterloo TIS

Lane Group	Ø9
Internal Link Dist (m)	
Turn Bay Length (m)	
Base Capacity (vph)	
Starvation Cap Reductn	
Spillback Cap Reductn	
Storage Cap Reductn	
Reduced v/c Ratio	
Intersection Summary	

Lanes, Volumes, Timings
 2: King Street South & William Street West/William Street East (250137) 2033 Total AM Peak Hour (with LRT)
 171 King Street South, Waterloo TIS

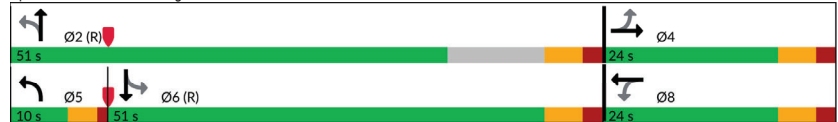
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱		↰	↱		↰	↱		↰	↱	
Traffic Volume (vph)	76	435	18	49	197	9	75	213	93	17	156	70
Future Volume (vph)	76	435	18	49	197	9	75	213	93	17	156	70
Ideal Flow (vphpl)	1775	1650	1650	1775	1650	1650	1775	1650	1650	1775	1650	1650
Storage Length (m)	15.0		0.0	25.0		0.0	35.0		0.0	25.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	25.0			35.0			25.0			35.0		
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	0.96	1.00		0.99	1.00		0.94	0.98		0.97	0.96	
Frt	0.994				0.993			0.954			0.954	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1516	1588	0	1668	1584	0	1588	1389	0	1668	1438	0
Flt Permitted	0.490			0.200			0.552			0.574		
Satd. Flow (perm)	749	1588	0	348	1584	0	863	1389	0	976	1438	0
Right Turn on Red			Yes			No			Yes			Yes
Satd. Flow (RTOR)		2						56			43	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		48.6			129.2			85.4			137.6	
Travel Time (s)		3.5			9.3			6.1			9.9	
Confl. Peds. (#/hr)	27		13	13		27	58		28	28		58
Confl. Bikes (#/hr)	1	4			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 (%)	10%	1%	25%	0%	2%	0%	5%	11%	7%	0%	4%	5%
Adj. Flow (vph)	76	435	18	49	197	9	75	213	93	17	156	70
Shared Lane Traffic (%)												
Lane Group Flow (vph)	76	453	0	49	206	0	75	306	0	17	226	0
Turn Type	Perm	NA		Perm	NA		pm+pt	NA		Perm	NA	
Protected Phases		4			8		5	2			6	
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		5	2		6	6	
Switch Phase												
Minimum Initial (s)	18.0	18.0		18.0	18.0		5.0	25.0		25.0	25.0	
Minimum Split (s)	24.0	24.0		24.0	24.0		9.0	31.0		31.0	31.0	
Total Split (s)	24.0	24.0		24.0	24.0		10.0	51.0		51.0	51.0	
Total Split (%)	28.2%	28.2%		28.2%	28.2%		11.8%	60.0%		60.0%	60.0%	
Yellow Time (s)	4.0	4.0		4.0	4.0		3.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		1.0	2.0		2.0	2.0	
Lost Time Adjust (s)	-2.0	-2.0		-2.0	-2.0		0.0	-2.0		-2.0	-2.0	
Total Lost Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lead/Lag							Lead			Lag	Lag	
Lead-Lag Optimize?							Yes			Yes	Yes	
Recall Mode	None	None		None	None		None	C-Max		C-Max	C-Max	
Act Effct Green (s)	20.0	20.0		20.0	20.0		57.0	57.0		49.0	49.0	
Actuated g/C Ratio	0.24	0.24		0.24	0.24		0.67	0.67		0.58	0.58	
v/c Ratio	0.43	1.21		0.60	0.55		0.12	0.32		0.03	0.27	
Control Delay (s/veh)	36.7	147.5		62.9	35.2		5.3	5.7		8.9	8.8	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay (s/veh)	36.7	147.5		62.9	35.2		5.3	5.7		8.9	8.8	
LOS	D	F		E	D		A	A		A	A	

Lanes, Volumes, Timings
2: King Street South & William Street West/William Street East 2033 Total AM Peak Hour (with LRT)
(250137) 171 King Street South, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Approach Delay (s/veh)		131.6			40.5			5.7			8.8	
Approach LOS		F			D			A			A	
Queue Length 50th (m)	10.5	~91.2		7.1	29.5		3.7	14.2		1.2	14.2	
Queue Length 95th (m)	23.8	#147.3		#24.3	50.8		7.8	25.4		3.9	26.5	
Internal Link Dist (m)		24.6			105.2			61.4			113.6	
Turn Bay Length (m)	15.0			25.0			35.0			25.0		
Base Capacity (vph)	176	375		81	372		629	949		562	847	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.43	1.21		0.60	0.55		0.12	0.32		0.03	0.27	

Intersection Summary		
Area Type:	Other	
Cycle Length: 85		
Actuated Cycle Length: 85		
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green		
Natural Cycle: 65		
Control Type: Actuated-Coordinated		
Maximum v/c Ratio: 1.21		
Intersection Signal Delay (s/veh): 59.8	Intersection LOS: E	
Intersection Capacity Utilization 97.7%	ICU Level of Service F	
Analysis Period (min) 15		
~	Volume exceeds capacity, queue is theoretically infinite.	
	Queue shown is maximum after two cycles.	
#	95th percentile volume exceeds capacity, queue may be longer.	
	Queue shown is maximum after two cycles.	

Splits and Phases: 2: King Street South & William Street West/William Street East



Lanes, Volumes, Timings
4: Caroline Street South & Allen Street West (250137) 171 King Street South, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↔			↔	
Traffic Volume (vph)	9	44	17	8	29	14	6	62	13	68	88	23
Future Volume (vph)	9	44	17	8	29	14	6	62	13	68	88	23
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		0.97			0.97			0.98			0.95	
Frt		0.967			0.963			0.978			0.983	
Flt Protected		0.994			0.992			0.996			0.981	
Satd. Flow (prot)	0	1412	0	0	1441	0	0	1409	0	0	1299	0
Flt Permitted		0.963			0.954			0.979			0.857	
Satd. Flow (perm)	0	1362	0	0	1372	0	0	1372	0	0	1111	0
Right Turn on Red		Yes			Yes			Yes			No	
Satd. Flow (RTOR)		16			14			10				
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		81.6			87.7			93.6			95.7	
Travel Time (s)		5.9			6.3			6.7			6.9	
Confl. Peds. (#/hr)	13		27	27		13	72		23	23		72
Confl. Bikes (#/hr)		2										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%	0%	0%	20%	4%	0%	22%	2%	9%
Adj. Flow (vph)	9	44	17	8	29	14	6	62	13	68	88	23
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	70	0	0	51	0	0	81	0	0	179	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	15.0	15.0		15.0	15.0		15.0	15.0		15.0	15.0	
Minimum Split (s)	21.0	21.0		21.0	21.0		21.0	21.0		21.0	21.0	
Total Split (s)	21.0	21.0		21.0	21.0		21.0	21.0		21.0	21.0	
Total Split (%)	24.1%	24.1%		24.1%	24.1%		24.1%	24.1%		24.1%	24.1%	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Lost Time Adjust (s)		-2.0			-2.0			-2.0			-2.0	
Total Lost Time (s)		4.0			4.0			4.0			4.0	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	None	None		None	None		C-Max	C-Max		C-Max	C-Max	
Act Effct Green (s)		17.0			17.0			17.0			17.0	
Actuated g/C Ratio		0.20			0.20			0.20			0.20	
v/c Ratio		0.25			0.18			0.29			0.82	
Control Delay (s/veh)		26.7			24.8			29.7			64.7	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay (s/veh)		26.7			24.8			29.7			64.7	
LOS		C			C			C			E	
Approach Delay (s/veh)		26.7			24.8			29.7			64.7	
Approach LOS		C			C			C			E	
Queue Length 50th (m)		7.6			5.1			10.1			28.9	

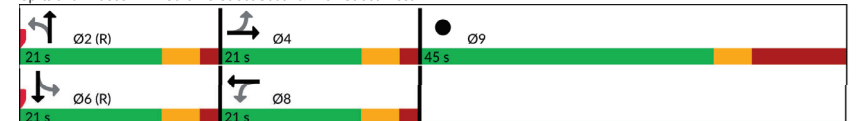
Lanes, Volumes, Timings
4: Caroline Street South & Allen Street West (250137) 171 King Street South, Waterloo TIS

Lane Group	Ø9
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Util. Factor	
Ped Bike Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (k/h)	
Link Distance (m)	
Travel Time (s)	
Confl. Peds. (#/hr)	
Confl. Bikes (#/hr)	
Peak Hour Factor	
Heavy Vehicles (%)	
Adj. Flow (vph)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	9
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	10.0
Minimum Split (s)	45.0
Total Split (s)	45.0
Total Split (%)	52%
Yellow Time (s)	4.0
All-Red Time (s)	10.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Recall Mode	Max
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay (s/veh)	
Queue Delay	
Total Delay (s/veh)	
LOS	
Approach Delay (s/veh)	
Approach LOS	
Queue Length 50th (m)	

Lanes, Volumes, Timings
4: Caroline Street South & Allen Street West (250137) 171 King Street South, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 95th (m)		18.9			14.6			22.5			#63.3	
Internal Link Dist (m)		57.6			63.7			69.6			71.7	
Turn Bay Length (m)												
Base Capacity (vph)		279			279			276			217	
Starvation Cap Reductn		0			0			0			0	
Spillback Cap Reductn		0			0			0			0	
Storage Cap Reductn		0			0			0			0	
Reduced v/c Ratio		0.25			0.18			0.29			0.82	
Intersection Summary												
Area Type:	Other											
Cycle Length: 87												
Actuated Cycle Length: 87												
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBTL, Start of Green												
Natural Cycle: 90												
Control Type: Actuated-Coordinated												
Maximum v/c Ratio: 0.82												
Intersection Signal Delay (s/veh): 44.9	Intersection LOS: D											
Intersection Capacity Utilization 38.5%	ICU Level of Service A											
Analysis Period (min) 15												
# 95th percentile volume exceeds capacity, queue may be longer.												
Queue shown is maximum after two cycles.												

Splits and Phases: 4: Caroline Street South & Allen Street West



Lanes, Volumes, Timings
 4: Caroline Street South & Allen Street West (250137) 171 King Street South, Waterloo TIS

Lane Group	Ø9
Queue Length 95th (m)	
Internal Link Dist (m)	
Turn Bay Length (m)	
Base Capacity (vph)	
Starvation Cap Reductn	
Spillback Cap Reductn	
Storage Cap Reductn	
Reduced v/c Ratio	
Intersection Summary	

Lanes, Volumes, Timings
 2: King Street South & William Street West/William Street East (250137) 171 King Street South, Waterloo TIS

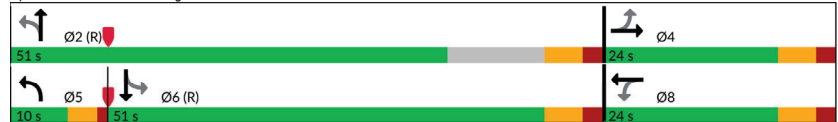
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱		↰	↱		↰	↱		↰	↱	
Traffic Volume (vph)	56	368	25	78	326	10	85	231	76	14	300	96
Future Volume (vph)	56	368	25	78	326	10	85	231	76	14	300	96
Ideal Flow (vphpl)	1775	1650	1650	1775	1650	1650	1775	1650	1650	1775	1650	1650
Storage Length (m)	15.0		0.0	25.0		0.0	35.0		0.0	25.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	25.0			35.0			25.0			35.0		
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	0.97	0.99		0.98	1.00		0.92	0.98		0.95	0.95	
Frt	0.990				0.996			0.963			0.964	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1573	1571	0	1635	1621	0	1668	1458	0	1668	1452	0
Flt Permitted	0.254			0.200			0.419			0.573		
Satd. Flow (perm)	408	1571	0	337	1621	0	676	1458	0	957	1452	0
Right Turn on Red			Yes			No			Yes			Yes
Satd. Flow (RTOR)		4						42			30	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		48.6			129.2			85.4			137.6	
Travel Time (s)		3.5			9.3			6.1			9.9	
Confl. Peds. (#/hr)	28		26	26		28	104		44	44		104
Confl. Bikes (#/hr)		1			1			1		1	2	2
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 (%)	6%	1%	21%	2%	0%	0%	0%	7%	0%	0%	3%	4%
Adj. Flow (vph)	56	368	25	78	326	10	85	231	76	14	300	96
Shared Lane Traffic (%)												
Lane Group Flow (vph)	56	393	0	78	336	0	85	307	0	14	396	0
Turn Type	Perm	NA		Perm	NA		pm+pt	NA		Perm	NA	
Protected Phases		4			8		5	2			6	
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		5	2		6	6	
Switch Phase												
Minimum Initial (s)	18.0	18.0		18.0	18.0		5.0	25.0		25.0	25.0	
Minimum Split (s)	24.0	24.0		24.0	24.0		9.0	31.0		31.0	31.0	
Total Split (s)	24.0	24.0		24.0	24.0		10.0	51.0		51.0	51.0	
Total Split (%)	28.2%	28.2%		28.2%	28.2%		11.8%	60.0%		60.0%	60.0%	
Yellow Time (s)	4.0	4.0		4.0	4.0		3.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		1.0	2.0		2.0	2.0	
Lost Time Adjust (s)	-2.0	-2.0		-2.0	-2.0		0.0	-2.0		-2.0	-2.0	
Total Lost Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lead/Lag							Lead			Lag		Lag
Lead-Lag Optimize?							Yes			Yes		Yes
Recall Mode	None	None		None	None		None	C-Max		C-Max	C-Max	
Act Effct Green (s)	20.0	20.0		20.0	20.0		57.0	57.0		49.0	49.0	
Actuated g/C Ratio	0.24	0.24		0.24	0.24		0.67	0.67		0.58	0.58	
v/c Ratio	0.58	1.06		0.99	0.88		0.16	0.31		0.03	0.47	
Control Delay (s/veh)	56.2	96.1		136.9	57.6		5.6	5.9		8.9	12.4	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay (s/veh)	56.2	96.1		136.9	57.6		5.6	5.9		8.9	12.4	
LOS	E	F		F	E		A	A		A	B	

Lanes, Volumes, Timings
2: King Street South & William Street West/William Street East 2033 Total PM Peak Hour (with LRT)
(250137) 171 King Street South, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Approach Delay (s/veh)		91.1			72.6			5.8			12.3	
Approach LOS		F			E			A			B	
Queue Length 50th (m)	8.1	~70.3		12.6	52.8		4.2	15.1		1.0	33.5	
Queue Length 95th (m)	#25.3	#123.6		#39.8	#98.7		8.6	26.3		3.5	55.6	
Internal Link Dist (m)		24.6			105.2			61.4			113.6	
Turn Bay Length (m)	15.0			25.0			35.0			25.0		
Base Capacity (vph)	96	372		79	381		523	991		551	849	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.58	1.06		0.99	0.88		0.16	0.31		0.03	0.47	

Intersection Summary												
Area Type:	Other											
Cycle Length: 85												
Actuated Cycle Length: 85												
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBTL, Start of Green												
Natural Cycle: 65												
Control Type: Actuated-Coordinated												
Maximum v/c Ratio: 1.06												
Intersection Signal Delay (s/veh): 47.0	Intersection LOS: D											
Intersection Capacity Utilization 94.2%	ICU Level of Service F											
Analysis Period (min) 15												
~ Volume exceeds capacity, queue is theoretically infinite.												
Queue shown is maximum after two cycles.												
# 95th percentile volume exceeds capacity, queue may be longer.												
Queue shown is maximum after two cycles.												

Splits and Phases: 2: King Street South & William Street West/William Street East



Lanes, Volumes, Timings
4: Caroline Street South & Allen Street West (250137) 171 King Street South, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↔			↔	
Traffic Volume (vph)	23	27	11	14	65	18	20	133	41	57	101	31
Future Volume (vph)	23	27	11	14	65	18	20	133	41	57	101	31
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		0.96			0.97			0.96			0.95	
Frt		0.976			0.975			0.971			0.978	
Flt Protected		0.981			0.993			0.995			0.985	
Satd. Flow (prot)	0	1437	0	0	1417	0	0	1419	0	0	1368	0
Flt Permitted		0.894			0.954			0.946			0.705	
Satd. Flow (perm)	0	1289	0	0	1344	0	0	1333	0	0	963	0
Right Turn on Red		Yes			Yes			Yes			No	
Satd. Flow (RTOR)		11			12			14				
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		81.6			87.7			93.6			95.7	
Travel Time (s)		5.9			6.3			6.7			6.9	
Confl. Peds. (#/hr)	18		34	34		18	73		35	35		73
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%	0%	0%	0%	5%	0%	0%	1%	5%	13%	0%	0%
Adj. Flow (vph)	23	27	11	14	65	18	20	133	41	57	101	31
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	61	0	0	97	0	0	194	0	0	189	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	15.0	15.0		15.0	15.0		15.0	15.0		15.0	15.0	
Minimum Split (s)	21.0	21.0		21.0	21.0		21.0	21.0		21.0	21.0	
Total Split (s)	21.0	21.0		21.0	21.0		21.0	21.0		21.0	21.0	
Total Split (%)	24.1%	24.1%		24.1%	24.1%		24.1%	24.1%		24.1%	24.1%	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Lost Time Adjust (s)		-2.0			-2.0			-2.0			-2.0	
Total Lost Time (s)		4.0			4.0			4.0			4.0	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	None	None		None	None		C-Max	C-Max		C-Max	C-Max	
Act Effct Green (s)		17.0			17.0			17.0			17.0	
Actuated g/C Ratio		0.20			0.20			0.20			0.20	
v/c Ratio		0.23			0.36			0.72			1.01	
Control Delay (s/veh)		27.9			30.8			46.9			105.4	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay (s/veh)		27.9			30.8			46.9			105.4	
LOS		C			C			D			F	
Approach Delay (s/veh)		27.9			30.8			46.9			105.4	
Approach LOS		C			C			D			F	
Queue Length 50th (m)		7.0			12.3			28.3			~32.0	
Queue Length 95th (m)		17.7			26.2			#58.2			#72.6	

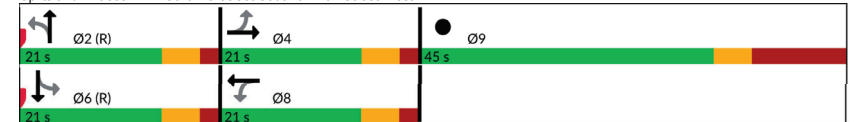
Lanes, Volumes, Timings
4: Caroline Street South & Allen Street West (250137) 171 King Street South, Waterloo TIS

Lane Group	Ø9
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Util. Factor	
Ped Bike Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (k/h)	
Link Distance (m)	
Travel Time (s)	
Confl. Peds. (#/hr)	
Peak Hour Factor	
Heavy Vehicles (%)	
Adj. Flow (vph)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	9
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	10.0
Minimum Split (s)	45.0
Total Split (s)	45.0
Total Split (%)	52%
Yellow Time (s)	4.0
All-Red Time (s)	10.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Recall Mode	Max
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay (s/veh)	
Queue Delay	
Total Delay (s/veh)	
LOS	
Approach Delay (s/veh)	
Approach LOS	
Queue Length 50th (m)	
Queue Length 95th (m)	

Lanes, Volumes, Timings
4: Caroline Street South & Allen Street West (250137) 171 King Street South, Waterloo TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Internal Link Dist (m)		57.6			63.7			69.6			71.7	
Turn Bay Length (m)												
Base Capacity (vph)		260			272			271			188	
Starvation Cap Reductn		0			0			0			0	
Spillback Cap Reductn		0			0			0			0	
Storage Cap Reductn		0			0			0			0	
Reduced v/c Ratio		0.23			0.36			0.72			1.01	
Intersection Summary												
Area Type:	Other											
Cycle Length: 87												
Actuated Cycle Length: 87												
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green												
Natural Cycle: 90												
Control Type: Actuated-Coordinated												
Maximum v/c Ratio: 1.01												
Intersection Signal Delay (s/veh): 62.3					Intersection LOS: E							
Intersection Capacity Utilization 47.5%					ICU Level of Service A							
Analysis Period (min) 15												
~ Volume exceeds capacity, queue is theoretically infinite.												
Queue shown is maximum after two cycles.												
# 95th percentile volume exceeds capacity, queue may be longer.												
Queue shown is maximum after two cycles.												

Splits and Phases: 4: Caroline Street South & Allen Street West



Lane Group	Ø9
Internal Link Dist (m)	
Turn Bay Length (m)	
Base Capacity (vph)	
Starvation Cap Reductn	
Spillback Cap Reductn	
Storage Cap Reductn	
Reduced v/c Ratio	
Intersection Summary	

Appendix N

TDM Checklist





Travel Demand Management (TDM) Implementation Checklist

Version 9/18/2013

Appendix H

Case Study: _____

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)						
		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).				X		
Category Max =		10		Total Points Applicable =		10	Score =	4

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				
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.		
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 =	18



Region of Waterloo TDM Checklist v2.0

FORM-1

Case Study: 0 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.	X	
Category Max =		25	Total Points Applicable =	25
			Score =	7

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	4	
Public Transit Access		5	5	
Parking		25	18	
SUB-TOTAL		40	27	
Trip Reduction Incentives		25	7	
OVERALL TOTAL		65	34	

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:
