

1085 Clearview Avenue & 1082, 1086 &1090 St. Matthews Avenue Transportation Impact, Parking and TDM Study

Paradigm Transportation Solutions Limited

December 2018

Project Summary

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1085 Clearview Avenue & 1082, 1086 & 1090 St. Matthews Avenue - Transportation Impact, Parking and TDM Study

Signatures and Seals



Signature Engineer's Seal

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Executive Summary

Content

Paradigm Transportation Solutions Limited (Paradigm) was retained to carry out this Transportation Impact Study (TIS), Parking and Transportation Demand Management (TDM) Options Report for a proposed mid-rise residential development located at 1085 Clearview Avenue and 1082, 1086 and 1090 St. Matthews Avenue in the City of Burlington, Halton Region. The site is located within the Aldershot Mobility Hub area.

The study includes an analysis of existing traffic conditions, a description of the proposed development, traffic forecasts, parking demand analysis, outlines the site's parking supply and provides recommendations to improve future traffic conditions and strategies to reduce dependency on single occupancy vehicle travel.

Development Concept

The development proposes a 6-storey, 160-unit mid-rise residential condominium building. The site's parking supply is noted to consist of 203 spaces. Vehicular access is proposed by two (2) driveways to Masonry Court. Build-out is anticipated to occur by Year 2021, however timing is subject to market conditions.

Conclusions

The main findings and conclusions of this study are as follows:

- **Study Area**: The intersections that form the study area include the Masonry Court intersections with Waterdown Road and Cooke Boulevard and the Plains Road East intersections with Waterdown Road and Cooke Boulevard.
- **Existing Traffic Conditions**: The intersections within the study area are currently operating with generally acceptable levels of service during the AM and PM peak hours. Localized congestion is occurring for select turning movements at the Waterdown Road intersections with Masonry Court and Plains Road.
- **Forecast Traffic**: The forecast traffic volumes near the subject site have been assessed for five years (Year 2026) beyond the opening date (Year 2021). The likely future traffic volumes near the subject site are estimated to consist of:
  - Generalized background traffic growth;
  - Build-out of six (6) adjacent development applications; and
  - traffic generated by the subject site.

- **Background Traffic Conditions**: Localized congestion previously identified under existing conditions at Waterdown Road with Masonry Court and Plains Road is anticipated to continue to occur. In addition, high levels of delay are forecast to occur on the northbound approach of Cooke Boulevard to Masonry Court. Improvements to the existing form of two-way stop control should be considered by the City of Burlington.
- **Proposed Development**: The subject site is located at 1085 Clearview Avenue and 1082, 1086 and 1090 St. Matthews Avenue in the City of Burlington, Halton Region. The development proposes a 6-storey, 160-unit mid-rise residential condominium building. The site's parking supply is noted to consist of 203 spaces.
- **Transportation Demand Management**: The site concept plan includes TDM measures intended to assist in mitigating the site's transportation and parking impacts. Additional TDM measures are recommended to be included in the final site plan.
- **Development Generated Traffic**: The subject site is estimated to generate approximately 41 new AM peak hour vehicle trips and approximately 53 new PM peak hour vehicle trips
- **Total Traffic Conditions**: The intersections within the study area are forecast to operate with levels of service similar to the background traffic condition.
- **Remedial Measures**: Improvements to the existing form of two-way stop control should be considered at the intersection of Cooke Boulevard to Masonry Court. The need for traffic control improvements is driven in part by the forecast background traffic.

Recommendations

Based on the findings of this study, the following is recommended:

- The proposed driveway connections to the external road network operate under two-way stop control.
- To accommodate the occupant and visitor parking demands it is recommended that the site's structured parking supply (154 spaces) and six (6) surface spaces be assigned to occupants. The remaining at grade parking spaces should be allocated to visitor parking (41 spaces) and maintenance vehicle parking (two (2) spaces).
- The TDM measures outline in **Section 3.2** and **Section 5.3** be included in the future design of the subject site. Some elements of the TDM plan can be designed directly into the site plan while other elements are amenities that can only be achieved after occupancy.
- The proposed driveway connection to Masonry Court operate under two-way stop control.
- The City of Burlington monitor the operation of the Masonry Court intersection with Cooke Boulevard to ensure an appropriate form of

traffic control is provided to accommodate the future travel demands. In the longer term.

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1 Introduction

1.1 Overview

Paradigm Transportation Solutions Limited (Paradigm) was retained to carry out this Transportation Impact Study (TIS), Parking and Transportation Demand Management (TDM) Options Report for a proposed mid-rise residential development located at 1085 Clearview Avenue and 1082, 1086 and 1090 St. Matthews Avenue in the City of Burlington, Halton Region. The site is located with in the Aldershot Mobility Hub area. **Figure 1.1** details the location of the subject site.

The purpose of the study is to determine the impacts of the development traffic on the surrounding road network and to identify any improvements necessary to accommodate this traffic. The scope of the study includes:

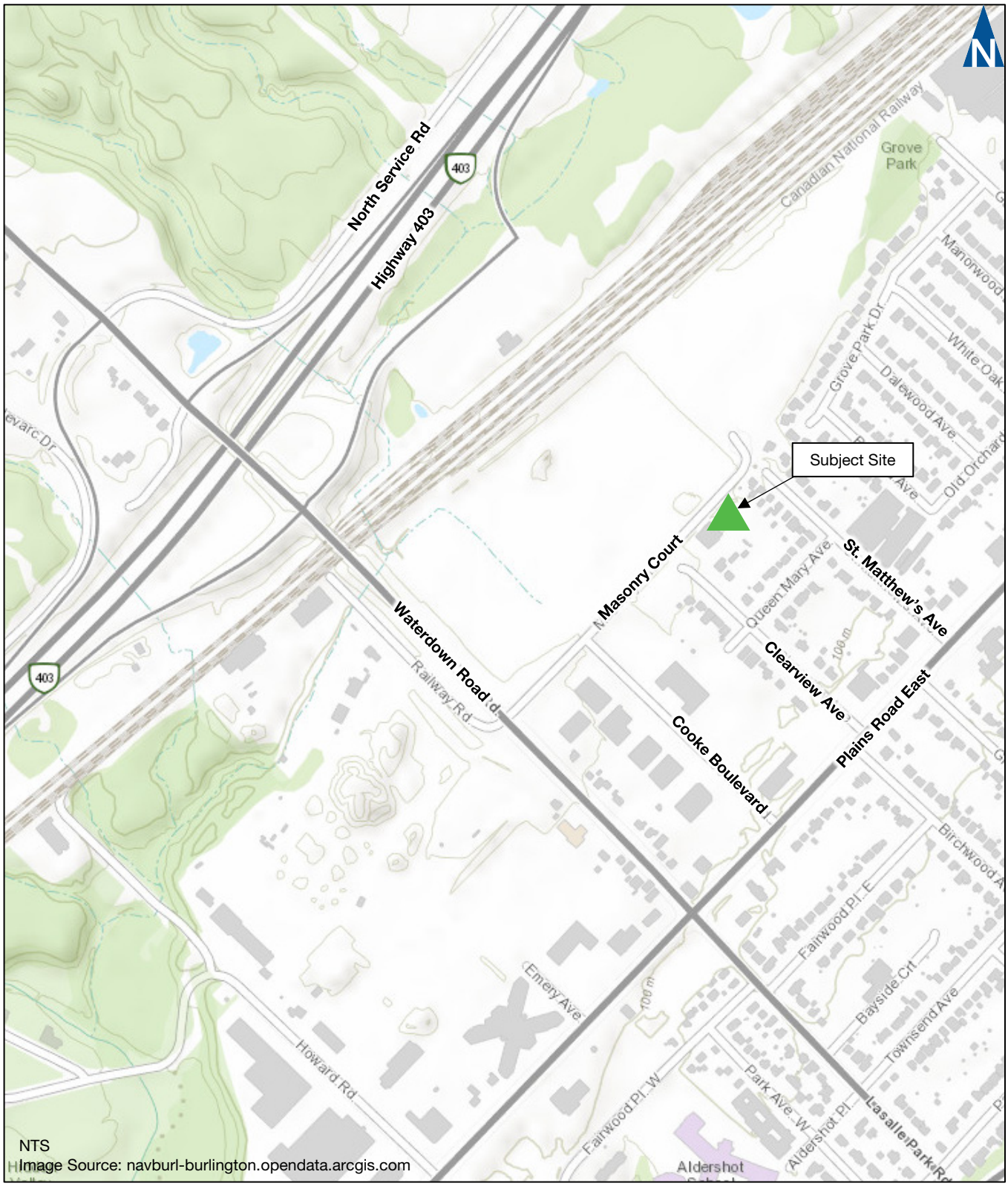
- Assessment of the current traffic and site conditions within the study area;
- Estimates of background traffic growth;
- Estimates of additional traffic generated by the subject site;
- Analyses of the impact of the future traffic on the surrounding road network;
- Identification and recommendation of Transportation Demand Management (TDM) measures specific to this site;
- Determining the site's parking needs and providing recommendations to mitigate parking demands; and
- Recommendations necessary to mitigate the site generated traffic in a satisfactory manner.

Appendix A contains the pre-study consultation material and responses from the City of Burlington and the Ministry of Transportation (MTO). The subject site is noted by the MTO to be located outside the Ministry's permit control area. As a result, the proponent will not require MTO Building and Land Use Permits.

1.2 Study Area

The municipal roadway intersections assessed in this study include:

- Masonry Court and Waterdown Road;
- Masonry Court and Cooke Boulevard
- Plains Road and Waterdown Road;
- Plains Road and Cooke Boulevard; and
- The proposed site driveway connections to Masonry Court.



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Location of Subject Site

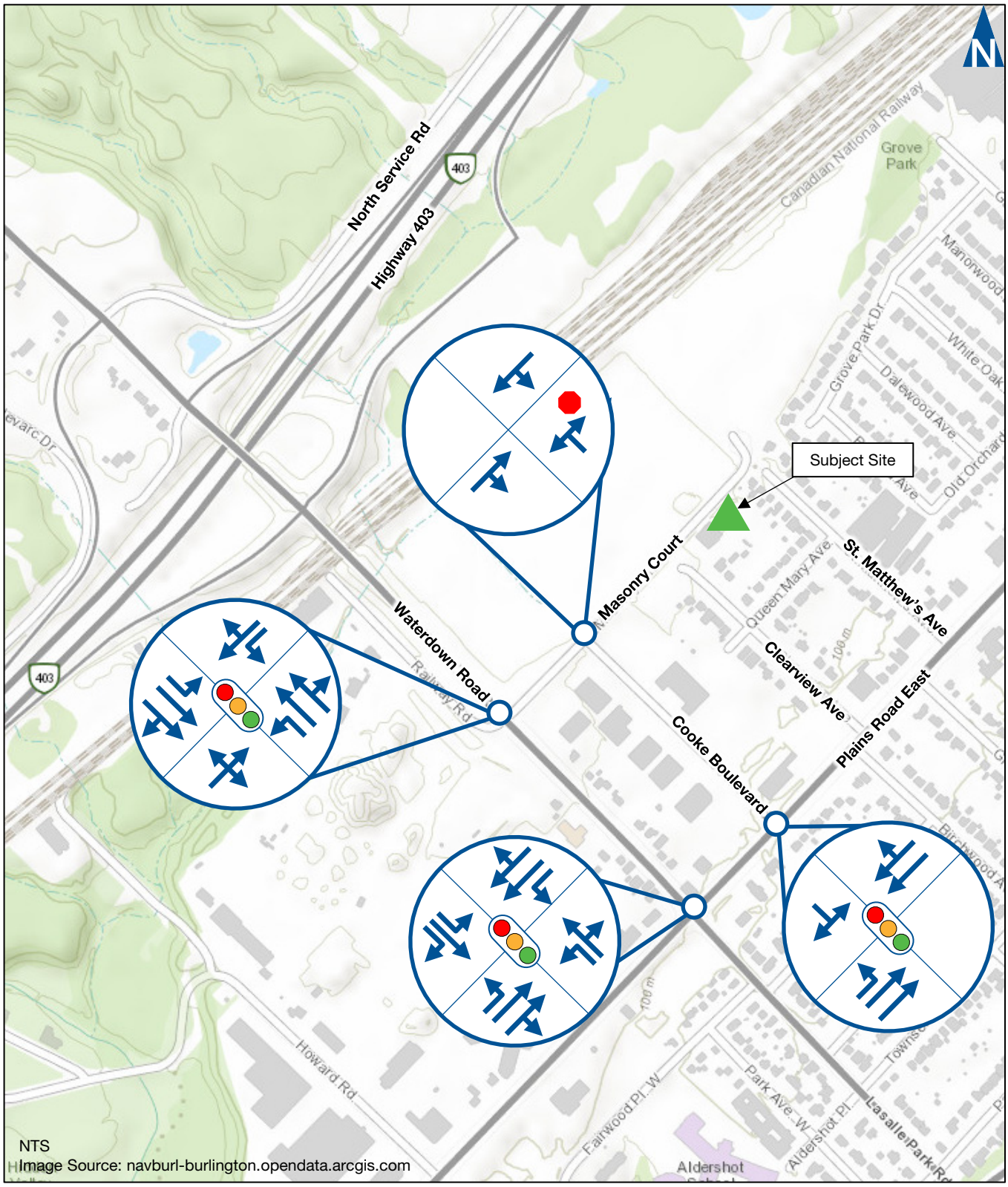
2 Existing Conditions

2.1 Existing Roadways

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

- **Masonry Court** in the area of the subject site is an east-west two-lane local roadway with an unposted, assumed speed limit of 50 kilometres per hour. Sidewalks are present along the north side of this roadway. The terminus of Masonry Court is a private driveway connection to the Aldershot GO station. Beyond the Cooke Boulevard intersection, no other roadway connections are provided to Masonry Court. Parking is permitted along the south side this roadway between Waterdown Road and the Aldershot GO Station driveway with corner and intersection stopping restrictions. The roadway is identified as a shared use lane through use of sharrow pavement markings. The intersection with Waterdown Road is signalized.
- **Waterdown Road** in the area of the subject site is a north-south four-lane minor arterial roadway with a posted speed limit of 50 kilometres per hour. Sidewalks are present south of Masonry Court on both sides of the road, whereas to the north of Masonry Court, sidewalks are provided along the west side of the roadway. On-street bicycle lanes are present from North Shore Boulevard to the North Service Road with a discontinuous section over the CNR and Highway 403 corridors. The intersection with Plains Road East is signalized.
- **Plains Road East** in the area of the subject site is an east-west five-lane multi-purpose arterial roadway with a Two-Way Left-Turn Lane (TWLTL) and posted speed limit of 60 kilometres per . Sidewalks are present on both sides of this roadway. Parking is generally restricted at all times along this roadway. The intersections with Cooke Boulevard is signalized.
- **Cooke Boulevard** is a north-south two-lane local roadway with an unposted assumed speed limit of 50 kilometres per hour. Sidewalk facilities are present along the east side of this roadway. Parking is restricted at all times along both sides of this roadway.

Figure 2.1 details the existing lane configurations and traffic control at the study area intersections.



Existing Lane Configuration & Traffic Control

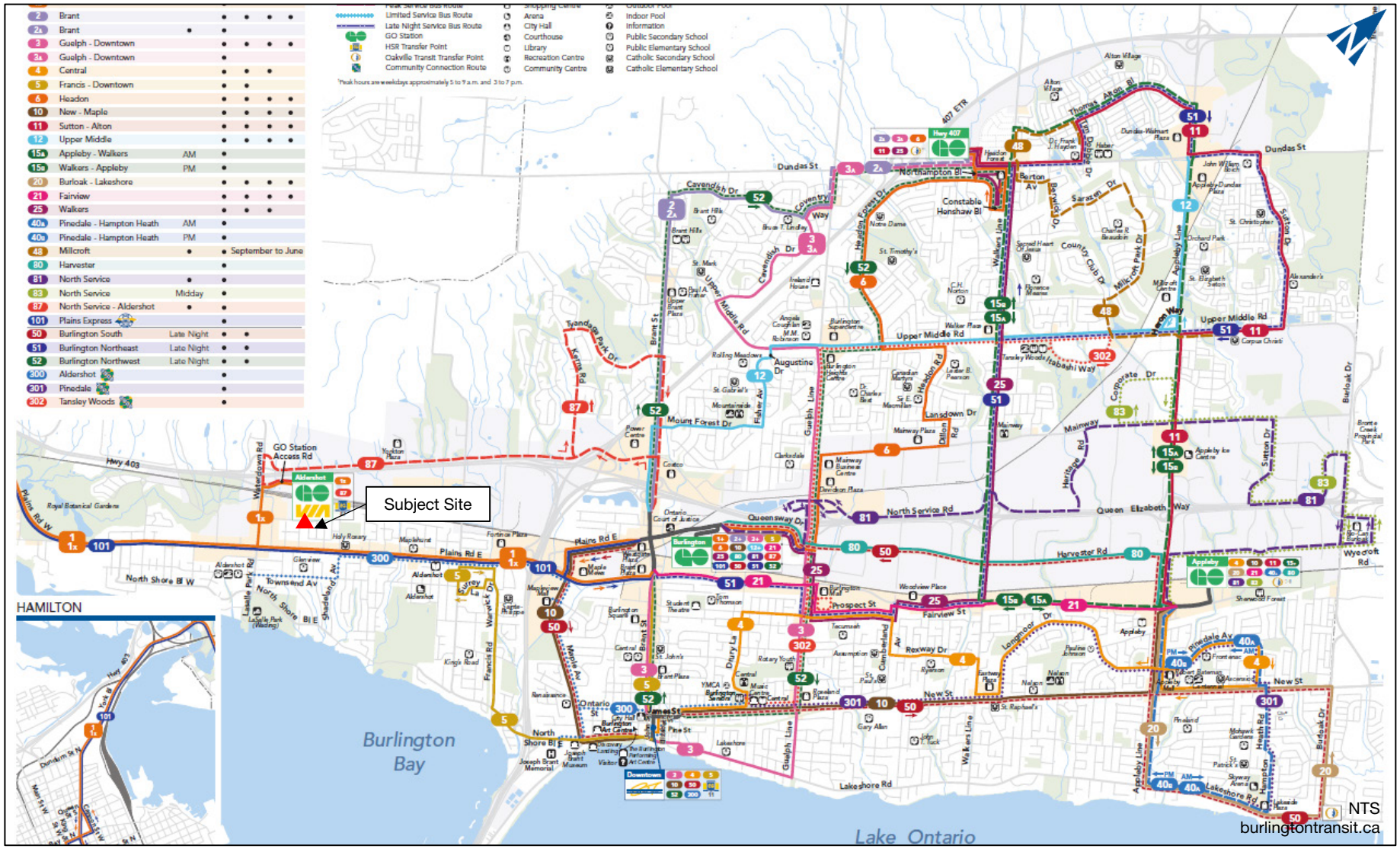
2.2 Existing Transit Service

Transit service in the area is provided by Burlington Transit, Hamilton Street Railway, GO Transit and Via Rail and is centralized around the Aldershot GO Station. The GO Station offers both GO Transit Bus and GO Transit Train service and functions as a turnaround point for a number of Burlington Transit and Hamilton Street Railway (HSR) local transit routes. **Figure 2.2** details the existing transit network.

The Aldershot GO Rail station platforms are accessible from areas north and south of the tracks and are connected via underground walkways. There is a bus loop located in the GO Station's northwest area used by BT, HSR, and GO Transit. Parking areas with the Aldershot GO Station are located north and south of the CNR corridor and are designed with pick-up/drop-off areas. In the future the south parking area may be expanded to include additional parking.

The following describes the existing transit service presently provided:

- Burlington Transit operates Route 1 and 1x (Plains) along Plains Road and Waterdown Road with a turnaround at the Aldershot GO Station. Service is provided 7 days a week with weekday headways in the order of 30 minutes. Transit stops are located at the Waterdown Road and Clearview Avenue/Birchwood Avenue intersections with Plains Road East.
- The Route 101 Plains Express operates along the Plains Road East corridor within the study area. This route offers express transit service between the Burlington GO Station and downtown Hamilton with service provided Monday to Friday. Headways are in the order of 15-minutes.
- HSR service in the area is limited to Route 18 – WATERDOWN. The route serves the community of Waterdown and connects to the Aldershot GO Station. Transfer opportunities to Burlington Transit are available at the Aldershot GO Station.
- Interprovincial and international train service is provided by Via Rail's Quebec City-Windsor corridor, and the joint Via-Amtrak Maple Leaf train, connecting Toronto and New York through Niagara Falls.



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Existing Transit Network

1085 Clearview Avenue & 1082, 1086 & 1090 St. Matthews Avenue TIS TDM
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Figure 2.2

2.3 Existing Cycling Network

A variety of cycling infrastructure is provided on the roadways within the study area and within the area surrounding the subject site. The following cycling infrastructure is noted:

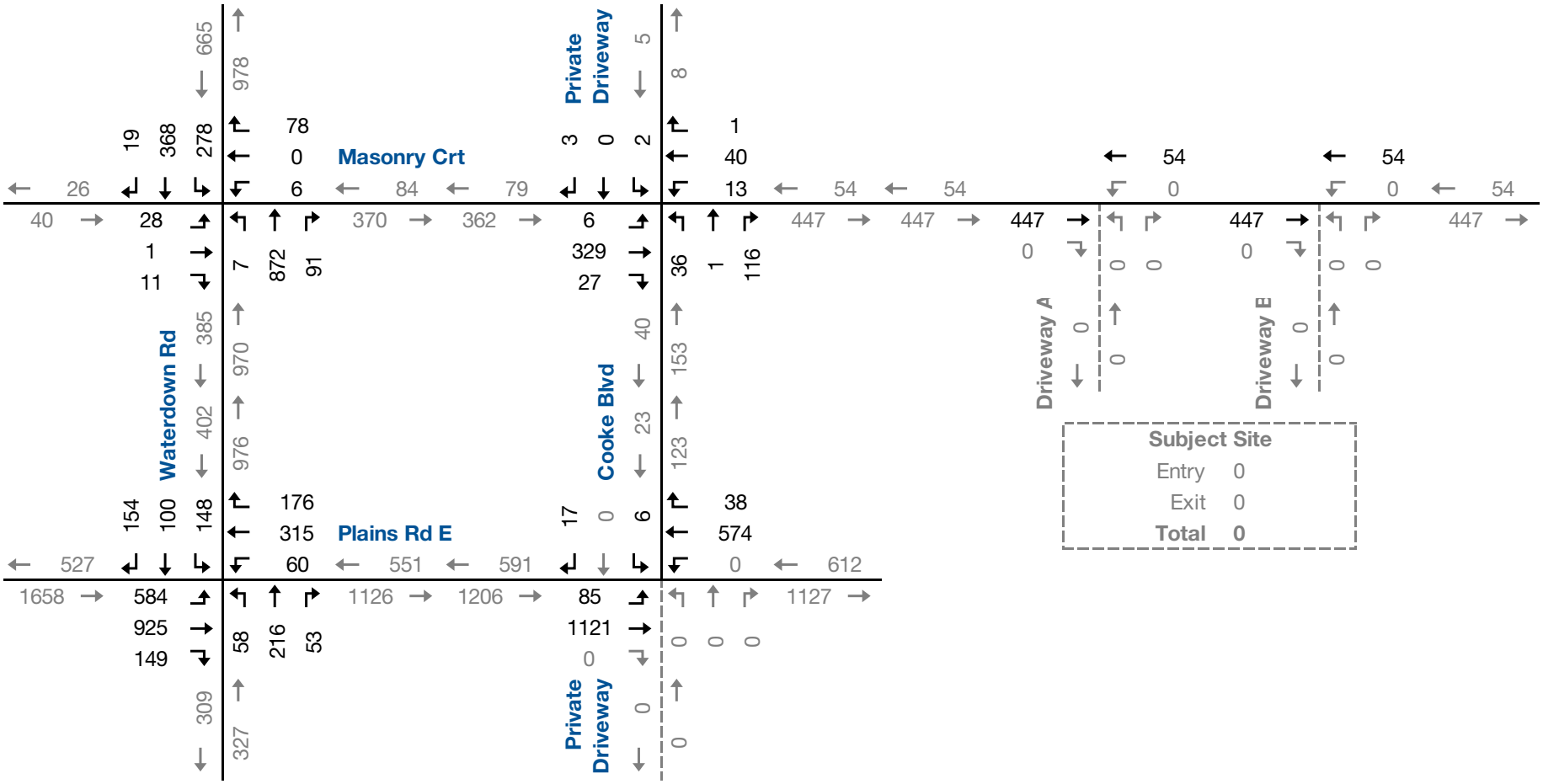
- Waterdown Road – On-street bicycle lanes are present in both directions between North Shore Boulevard and the CNR corridor. The on-street bicycle lanes are discontinuous for short section over the CNR and Highway 403 corridors before beginning again at the Highway 403 westbound off-ramp intersection with Waterdown Road. The on-street bicycle lanes terminate approximately 160 metres north of the North Service Road intersection.
- Masonry Court – The roadway is identified as a shared use lane through use of sharrow pavement markings.
- St. Matthews Avenue – The roadway is identified as a shared use lane through use of sharrow pavement markings.
- Plains Road East – On-street bicycle lanes are present east of Gallagher Road/Shadeland Avenue in both directions of travel. West of Gallagher Road/Shadeland no visible cycling infrastructure is present.
- North Service Road – On-street bicycle lanes are present east of Waterdown Road.

2.4 Existing Traffic Volumes

Table 2.1 summarizes the location and date of the existing turning movement count (TMC) data used in the analysis. The data was collected by Pyramid Traffic Incorporated during September 2018. **Appendix B** contains the detailed existing count data. **Figure 2.3A-B** details the existing weekday peak hour traffic volumes at the study area intersections.

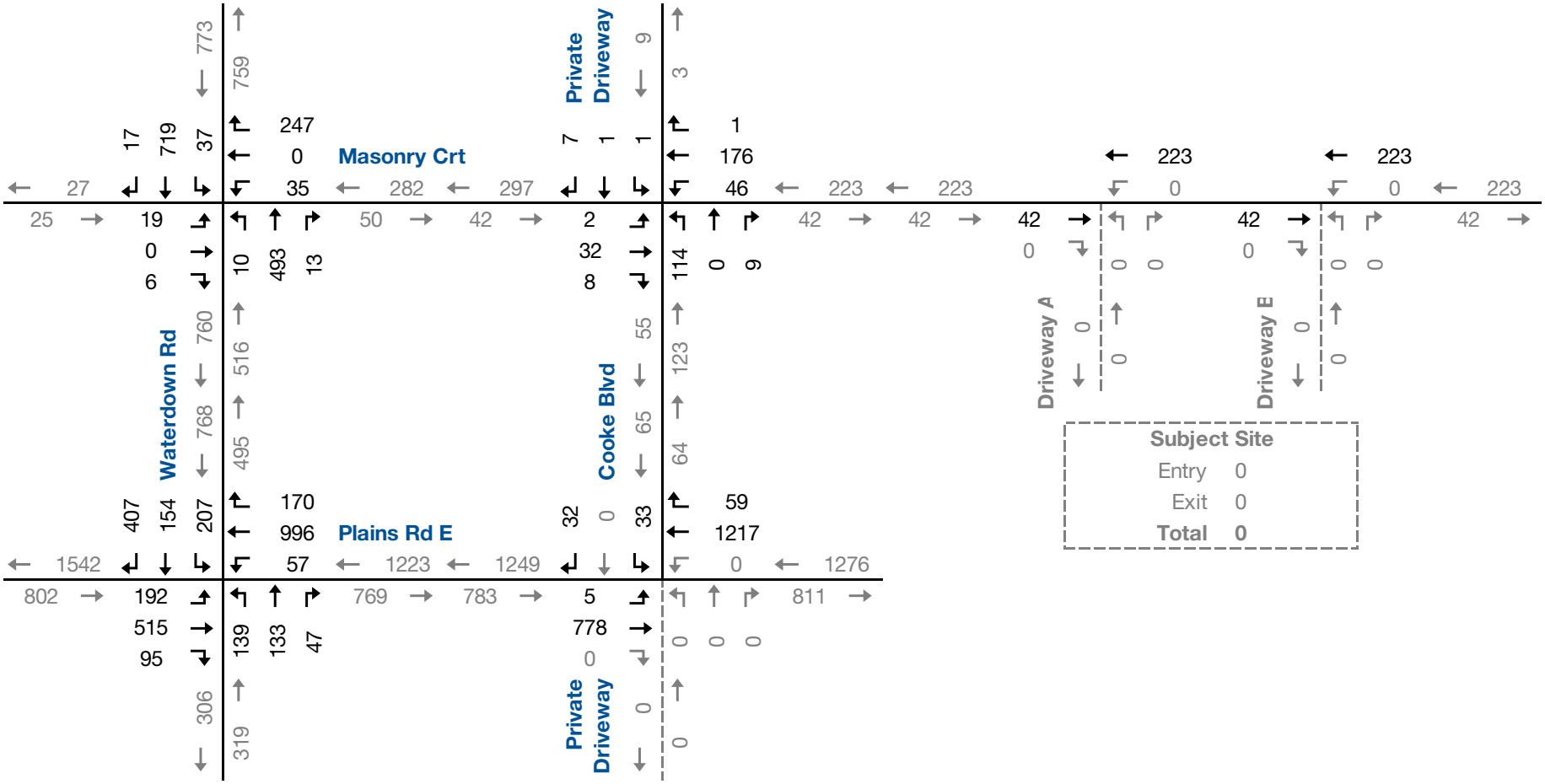
TABLE 2.1: EXISTING COUNT DATA SUMMARY

Intersection	Date	Peak Hour	
		AM	PM
Masonry Court and Waterdown Road	Thursday, 20 September 2018	07:00	16:30
Masonry Court and Cooke Boulevard	Thursday, 20 September 2018	07:00	16:45
Plains Road and Waterdown Road	Thursday, 20 September 2018	07:15	16:45
Plains Road and Cooke Boulevard	Thursday, 20 September 2018	07:30	16:45



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Existing Traffic – AM Peak Hour



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Existing Traffic – PM Peak Hour

2.5 Existing Traffic Operations

Intersection level of service (LOS) is a recognized method of quantifying the efficiency of traffic flow at intersections. It is based on the delay experienced by individual vehicles executing the various movements. The delay is related to the number of vehicles desiring to make a movement, compared to the estimated capacity for that movement. The capacity is based on several criteria related to the opposing traffic flows. The highest possible rating is LOS A, under which the average total delay is equal or less than 10.0 seconds per vehicle. When the average delay exceeds 80 seconds at signalized intersections (50 seconds at unsignalized intersections), the movement is considered to have a LOS F and remedial measures are usually implemented, if they are feasible.

The operations of the intersections in the study area were evaluated using the existing lane configurations, traffic controls and the existing traffic peak volumes.

The level of service conditions on the existing road network have been assessed using Synchro 9 with HCM 2000 procedures. Movements are considered critical under the following conditions[1]:

- Volume/capacity (V/C) ratios for overall intersection operations, through movements or shared through/turning movements increased to 0.85 or above.
- V/C ratios for exclusive movements that will exceed 0.95.
- 95th percentile queue lengths for individual movements exceeds available lane storage. Queue lengths estimated using Synchro 9.
- LOS E or worse for individual movements at unsignalized intersections.

Table 2.2 details the existing level of service conditions. The intersections in the study area are operating with generally acceptable levels of service during the AM and PM peak hours. The following critical movements are noted:

- AM Peak Hour
  - Waterdown Road and Masonry Court – the southbound left-turn movement is forecast to operate with a queue length greater than the current available storage.
  - Waterdown Road and Plains Road – the eastbound left-turn movement is forecast to operate with delays in the LOS E range with a v/c ratio of 1.02 and a queue length greater than the current available storage.

[1] Halton Region Transportation Impact Study Guidelines – January 2015

- Waterdown Road and Plains Road – the overall intersection v/c ratio is estimated to be greater than 0.85.

- PM peak Hour
  - Waterdown Road and Plains Road – the eastbound left-turn movement is forecast to operate with a queue length greater than the current available storage. However, the upstream existing TWLTL can function as additional storage for this movement.
  - Waterdown Road and Plains Road – the queue length for the westbound through/right-turn movement is forecast to extend through the upstream signalized intersection of Cooke Boulevard.
  - Waterdown Road and Plains Road – the northbound left-turn movement is forecast to operate with a queue length greater than the current available storage.

Appendix C contains the supporting detailed Synchro 9.



TABLE 2.2: EXISTING TRAFFIC OPERATIONS

Analysis Period	Intersection	Control Type	MOE	Direction / Movement / Approach																
				Eastbound				Westbound				Northbound				Southbound				
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	OVERALL
AM Peak Hour	Waterdown Road & Masonry Court	TCS	LOS	<	D	>	D	D	D	>	D	A	B	>	B	A	A	>	A	B
			Delay	<	43	>	43	40	40	>	40	8	12	>	12	8	2	>	4	11
			V/C	<	0.33	>		0.04	0.05	>		0.02	0.49	>		0.56	0.15	>		0.53
			95th	<	16	>		5	0	>		3	94	>		29	14	>		
			Storage	<	-	>		30	-	>		25	-	>		20	-	>		
			Avail.	<	-	>		25	-	>		22	-	>		-9	-	>		
	Waterdown Road & Plains Road	TCS	LOS	E	C	>	D	C	D	>	D	C	D	>	D	D	C	C	D	D
			Delay	69	22	>	39	33	40	>	39	34	45	>	39	41	32	33	36	39
			V/C	1.02	0.66	>		0.38	0.58	>		0.20	0.70	>		0.72	0.23	0.12		0.91
			95th	217	140	>		14	64	>		18	82	>		40	32	17		
			Storage	30	-	>		40	-	>		30	-	>		-	-	40		
			Avail.	-187	-	>		27	-	>		12	-	>		-	-	23		
	Cooke Boulevard & Masonry Court	TWSC	LOS	<	A	>	A	<	A	>	A	<	B	>	B	<	B	>	B	
			Delay	<	0	>	0	<	2	>	2	<	14	>	14	<	12	>	12	
			V/C	<	0.00	>		<	0.01	>		<	0.32	>		<	0.01	>		
			95th	<	0	>		<	0	>		<	11	>		<	0	>		
			Storage	<	-	>		<	-	>		<	-	>		<	-	>		
			Avail.	<	-	>		<	-	>		<	-	>		<	-	>		
	Cooke Boulevard & Plains Road	TCS	LOS	A	A		A		A	>	A					D		>	D	A
			Delay	2	2		2		3	>	3					39		>	39	3
			V/C	0.15	0.39				0.24	>						0.07		>		0.39
			95th	5	35				29	>						7		>		
			Storage	40	-				-	>						-		>		
			Avail.	35	-				-	>						-		>		
PM Peak Hour	Waterdown Road & Masonry Court	TCS	LOS	<	D	>	D	D	D	>	D	A	A	>	A	A	A	>	A	B
			Delay	<	44	>	44	46	44	>	45	4	5	>	5	3	3	>	3	11
			V/C	<	0.06	>		0.27	0.17	>		0.03	0.20	>		0.06	0.27	>		0.28
			95th	<	1	>		18	0	>		3	28	>		4	26	>		
			Storage	<	-	>		30	-	>		25	-	>		20	-	>		
			Avail.	<	-	>		13	-	>		23	-	>		16	-	>		
	Waterdown Road & Plains Road	TCS	LOS	C	B	>	B	B	B	>	B	D	D	>	B	D	D	B	C	C
			Delay	30	14	>	18	11	20	>	20	38	41	>	20	53	36	17	30	24
			V/C	0.75	0.33	>		0.14	0.72	>		0.56	0.57	>		0.83	0.42	0.28		0.77
			95th	44	56	>		6	169	>		35	51	>		55	45	20		
			Storage	30	-	>		40	-	>		30	-	>		-	-	40		
			Avail.	-14	-	>		35	-	>		-5	-	>		-	-	20		
	Cooke Boulevard & Masonry Court	TWSC	LOS	<	A	>	A	<	A	>	A	<	B	>	B	<	B	>	B	
			Delay	<	0	>	0	<	2	>	2	<	14	>	14	<	11	>	11	
			V/C	<	0.00	>		<	0.04	>		<	0.27	>		<	0.02	>		
			95th	<	0	>		<	1	>		<	9	>		<	0	>		
			Storage	<	-	>		<	-	>		<	-	>		<	-	>		
			Avail.	<	-	>		<	-	>		<	-	>		<	-	>		
	Cooke Boulevard & Plains Road	TCS	LOS	A	A		A		A	>	A					D		>	D	A
			Delay	4	3		3		5	>	5					42		>	42	5
			V/C	0.02	0.27				0.48	>						0.22		>		0.46
			95th	1	23				78	>						19		>		
			Storage	40	-				-	>						-		>		
			Avail.	40	-				-	>						-		>		

MOE - Measure of Effectiveness
TCS - Traffic Control Signal
TWSC - Two-Way Stop Control
V/C - Volume to Capacity Ratio
95th - 95th Percentile Queue Length
LOS - Level of Service
> - Shared Right-Turn Lane
< - Shared Left-Turn Lane

3 Development Concept

3.1 Site Description

The subject site is located at 1085 Clearview Avenue and 1082, 1086 and 1090 St. Matthews Avenue in City of Burlington. The site is located with in the City of Burlington's Aldershot Mobility Hub area. The City defines this area as an intensification area. **Figure 3.1** details the layout of the subject site.

The development proposes a 6-storey, 160-unit mid-rise residential condominium building. The site's parking supply is noted to consist of 203 spaces.

Vehicular access is proposed by two (2) driveway connections to Masonry Court. No vehicular, pedestrian or bicycle connections are proposed to Clearview Avenue or St. Matthews Avenue. The vehicular connections are noted as follows:

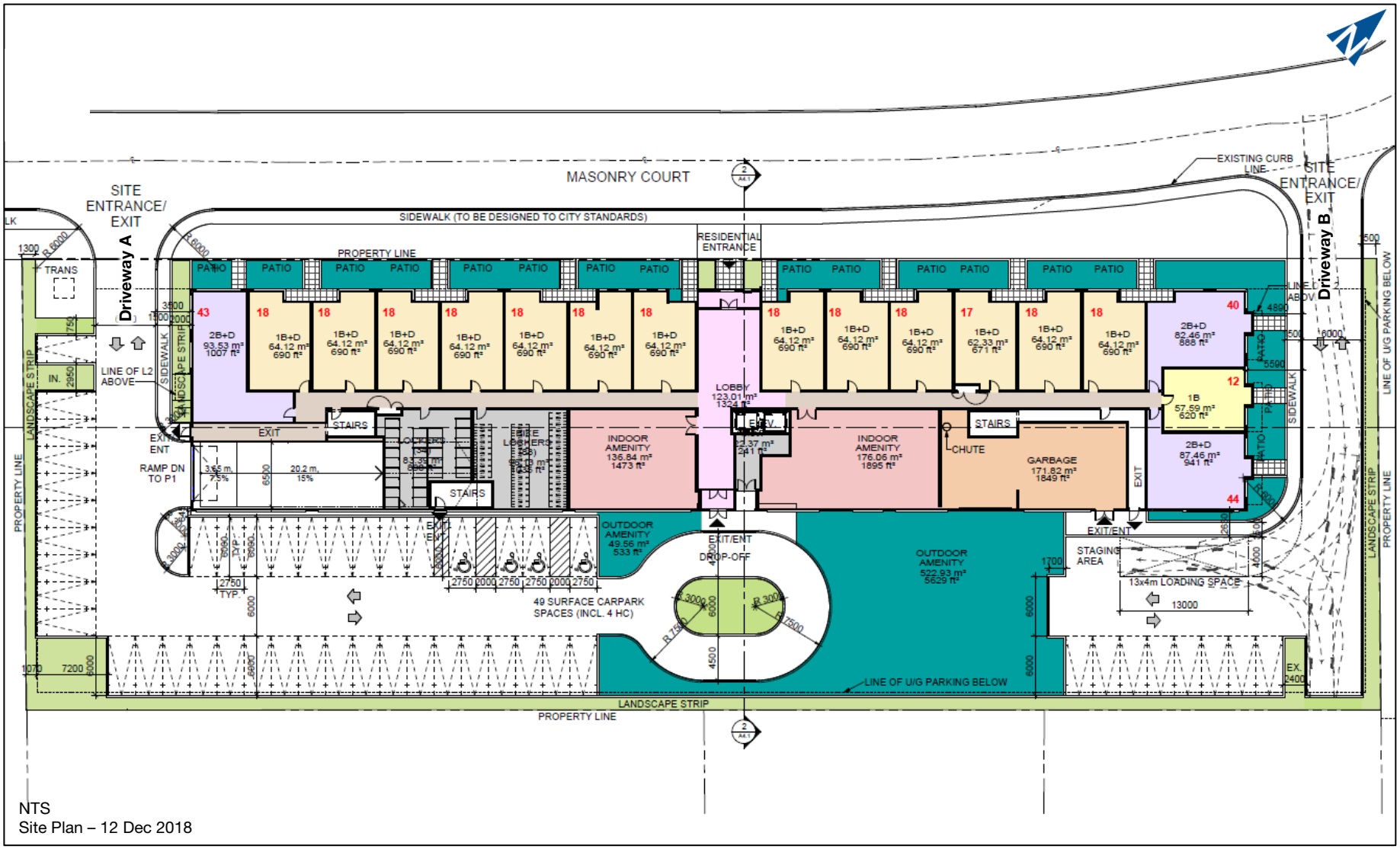
- Driveway A is proposed approximately 170 metres east of Cooke Boulevard on the south side of Masonry Court.
- Driveway B is proposed approximately 290 metres east of Cooke Boulevard on the south side of Masonry Court.

To define the site driveway connections, it may be desirable to form an on-street parking bay across the site's frontage. However, these spaces should be positioned to not impact driveway sight distances. This would reduce the likelihood of parked vehicles obstructing sightlines and could assist in developing a more pedestrianized cross-section for Masonry Court. Parked vehicles can provide a buffer between traffic and pedestrians on sidewalks and could also provide additional opportunities to develop curb extensions to reduced pedestrian crossing distances.

A turn around area is proposed to the rear of the site which can accommodate pick-up/drop-off activity. The site's loading zone is located to the rear of the building and is accessible by Driveway B.

Pedestrian sidewalks are proposed across the site's frontage to Masonry Court. The sidewalk will be discontinuous east and west of the subject site. To complete the pedestrian network, the City of Burlington could consider providing sidewalk facilities along the south side of Masonry Court between Cooke Boulevard and the terminus of Masonry Court.

Build-out is anticipated to occur by the Year 2021, however timing is subject to market conditions.



NTS
Site Plan – 12 Dec 2018

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Site Concept Plan

1085 Clearview Avenue & 1082, 1086 & 1090 St. Matthews Avenue TIS TDM
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Figure 3.1

3.2 Transportation Demand Management Proposed

Transportation Demand Management (TDM) refers to ways of making the capacity of our roads more efficient by reducing vehicle demands. 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 the reliance on automobiles.

The following TDM measures have been included in the current site design:

Walking Infrastructure

- Safe, attractive and direct walkways for pedestrians linking building entrances with public sidewalks.
- All on-site sidewalks will conform to the City of Burlington's design standards and the Accessibility for Ontarians with Disabilities Act (AODA) design standards.
- Outdoor amenity space is provided to form an on-site pedestrian realm.

Cycling Infrastructure

- A bike room with a long-term bicycle parking capacity of 88 spaces (0.55 spaces per unit).

Transit Infrastructure

- The development will be supportive to transit and promote active transportation by taking advantage of its geographical location. The site is located to allow direct and convenient connections to the Aldershot GO Station. Access to the existing Burlington Transit network is available within 500 metres

Additional TDM measures are outlined in **Section 5.4** to further assist in mitigating the site's transportation impacts.

3.3 Site Traffic Generation

The Institute of Transportation Engineers (ITE) Trip Generation[2] methods predict the site trip generation. Land Use Code 221 (Multifamily Housing

[2] Trip Generation Manual 10th Edition Institute of Transportation Engineers Washington DC

(Mid-Rise) was used to estimate the site's trip generation. **Table 3.1** details the estimated trip generation.

The subject site is forecast to generate approximately 57 vehicle trips during the AM peak hour and approximately 73 vehicle trips during the PM peak hour.

Modal choice is expected to reduce the site's net generation to approximately 41 vehicle trips during the AM peak hour and approximately 53 vehicle trips during the PM peak hour. The site's modal split is consistent with the City's Modal split target for the Aldershot Mobility hub and was confirmed during the initial pre-study consultation.

TABLE 3.1: ESTIMATED TRIP GENERATION

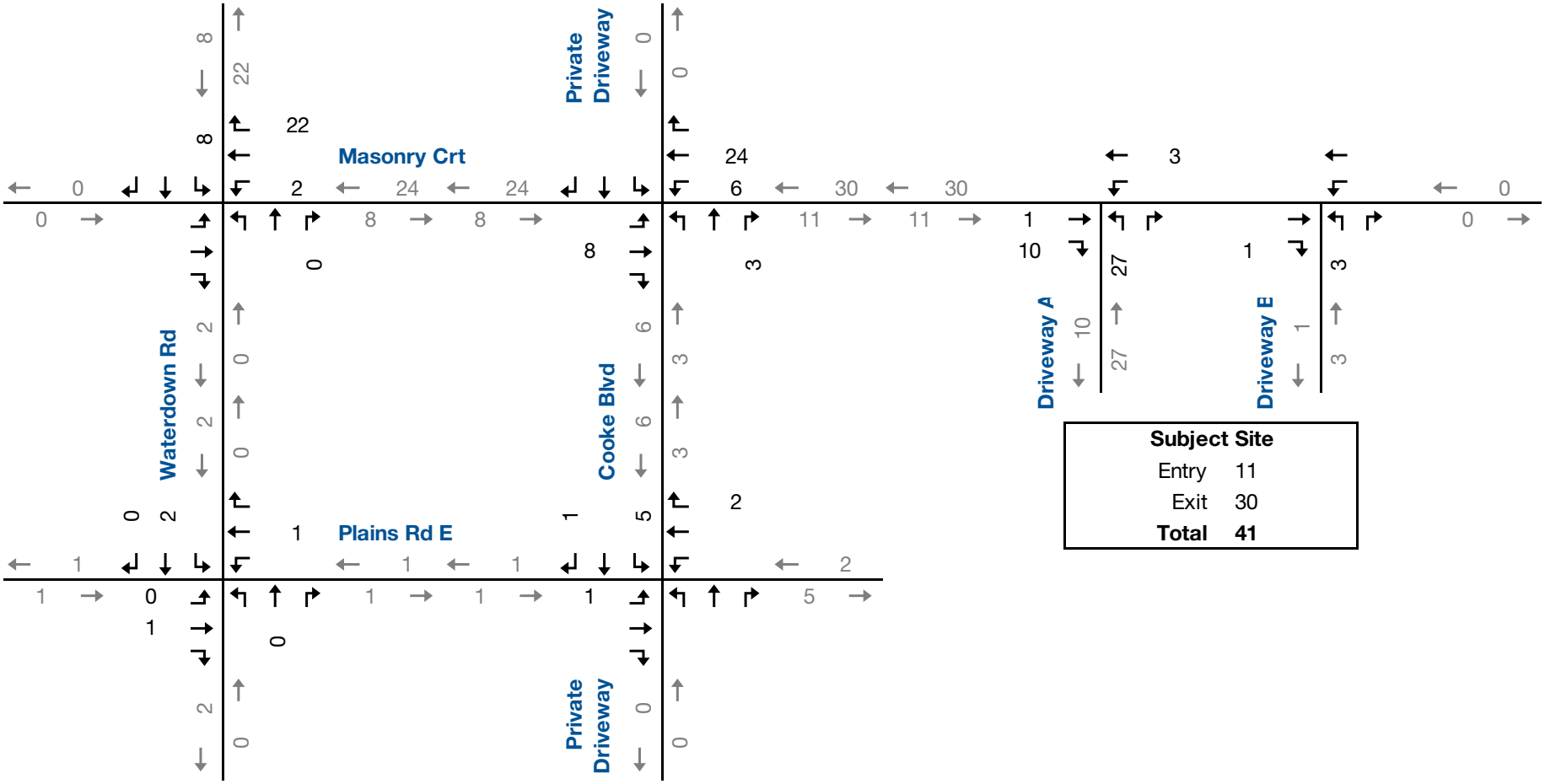
Land Use Code	Number of Units	AM Peak Hour			PM Peak Hour		
		Entry	Exit	Total	Entry	Exit	Total
Multifamily Housing (Mid-Rise) (221)*	160	15	42	**57**	44	29	**73**
Total Generation		**15**	**42**	**57**	**44**	**29**	**73**
Modal Split - 28%		4	12	**16**	12	8	**20**
Net Generation		**11**	**30**	**41**	**32**	**21**	**53**

Fitted Curve Equations, AM Ln(T) = 0.98 Ln(X) - 0.98 | PM Ln(T) = 0.96 Ln(X) - 0.63

Table 3.2 summarizes the estimated trip distribution. The distribution for site generated traffic has been developed using Transportation Tomorrow Survey (TTS) Data (**Appendix B**). The distribution estimates that approximately 60-70 percent of the site traffic, depending on the peak hour and direction, will be attracted to/from the Provincial highway network to the north. **Figure 3.2A-B** details the site-generated traffic estimates. **Appendix D** contains a detailed site traffic assignment through the Highway 403 interchange.

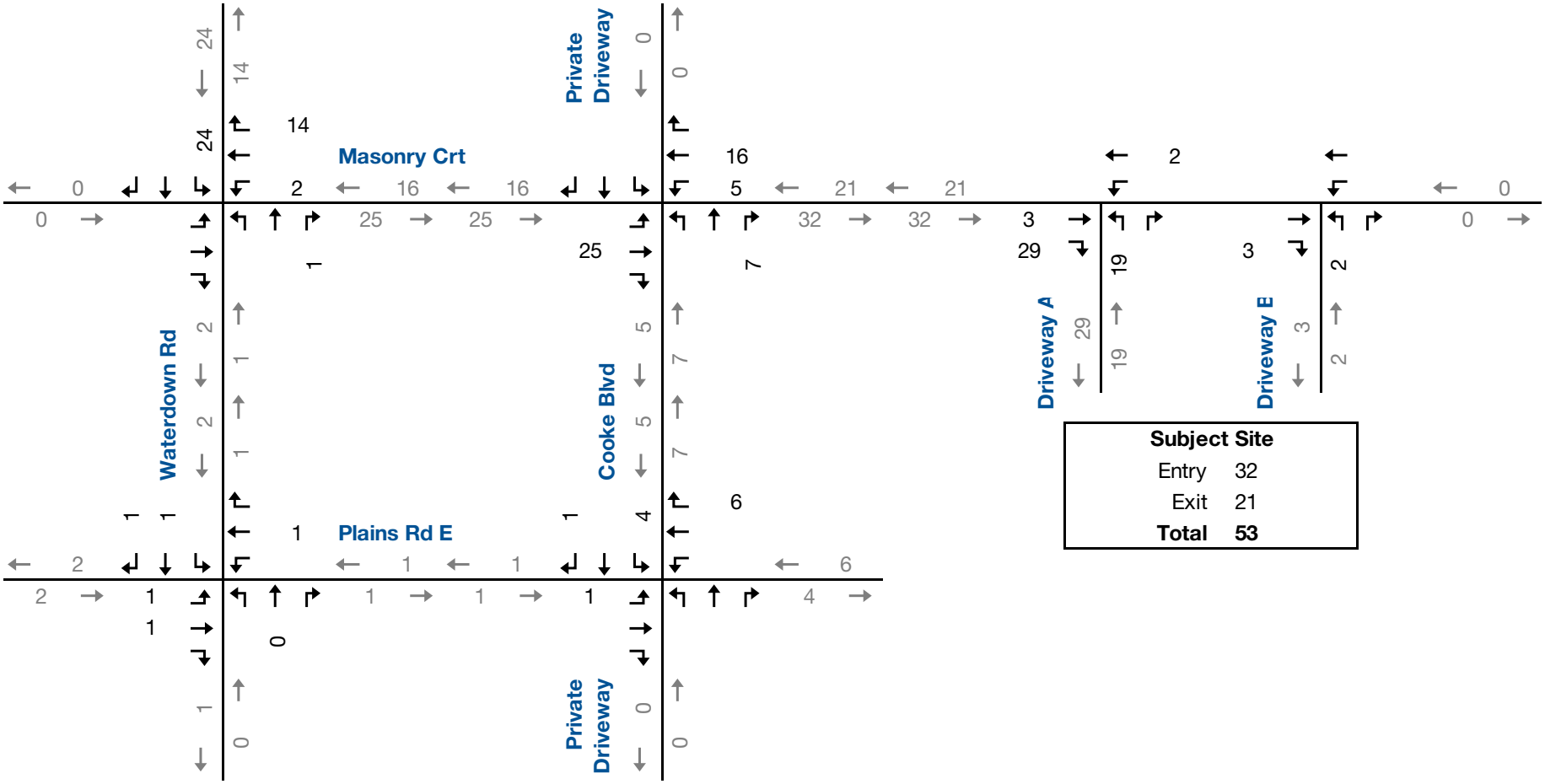
TABLE 3.2: ESTIMATED TRIP DISTRIBUTION

Origin/Destination	AM Peak Hour		PM Peak Hour	
	Entry	Exit	Entry	Exit
North via Waterdown Rd	5%	0%	5%	0%
South via Waterdown Rd	0%	5%	0%	5%
East via Highway 403	60%	65%	55%	50%
East via North Service Road	5%	5%	5%	5%
East via Plains Rd	15%	15%	20%	20%
West via Highway 403	5%	5%	5%	10%
West via Plains Rd	10%	5%	10%	10%
Total	**100%**	**100%**	**100%**	**100%**



NTS

Estimated Site Generated Traffic – AM Peak Hour



NTS

Estimated Site Generated Traffic – PM Peak Hour

3.4 Proposed Parking Supply

The site's parking supply is proposed to consist of 203 parking spaces. The parking spaces are proposed to be located as follows:

- Parking structure One (1) level – 154 spaces;
- At grade – 49 spaces.

Four (4) at grade parking spaces and two (2) structured parking space are identified as accessible spaces.

The site plan identifies a bike room with a long-term bicycle parking capacity of 88 spaces (0.55 spaces per unit).

3.4.1 Parking Requirements

The City of Burlington is in the process of updating the 30-year old Zoning By-law that regulates off-street parking requirements. The Burlington City-Wide Parking Standards Review[3] report outlines recommended parking rates for various land uses throughout the city and provides unique rates for sites located within intensification areas such as the subject site.

The recommended parking rates for apartment units in an intensification area are noted as follows:

- Maximum Parking Ratio
  - Occupant parking – 1.50 spaces per unit
  - Visitor parking – 0.25 spaces per unit.
- Minimum Parking Ratio
  - Occupant parking – 1.00 spaces per unit
  - Visitor parking – 0.25 spaces per unit.
- 1.00 space per 75 units is recommended to be reserved as "maintenance vehicle parking."

Table 3.3 details the site's parking requirements. Based on the minimum parking ratios, the site's parking supply meets the City-Wide Parking Standards.

[3] Burlington City-Wide Parking Standards Review Prepared for City of Burlington by IBI Group July 21, 2017

TABLE 3.3: CITY-WIDE PARKING STANDARD REVIEW REQUIREMENTS

Land Use	Number of Units	Range	Ratio		Supply		
			O	V	O	V	Total
Apartment	160	Min	1.00	0.25	160	40	**200**
Maintenance Vehicle Parking			1.00/75 units		0	2	**2**
Total		**Minimum**			**160**	**42**	**202**

3.4.2 Parking Allocation

To accommodate the occupant and visitor parking demands it is recommended that the site's structured parking supply (154 spaces) and six (6) surface spaces be assigned to occupants. The remaining at grade parking spaces should be allocated to visitor parking (41 spaces) and maintenance vehicle parking (two (2) spaces). **Table 3.4** details the recommended on-site parking allocation.

TABLE 3.4: RECOMMENDED PARKING ALLOCATION

Parking Location	Parking Assignment			
	Occupant	Visitor	Service	Total
Parking Structure	154	0		**154**
At Grade	6	41	2	**49**
Total	**160**	**41**	**2**	**203**

4 Future Traffic Conditions

The assessment of the future traffic conditions contained in this section includes the future traffic forecasts as well as the level of service analysis.

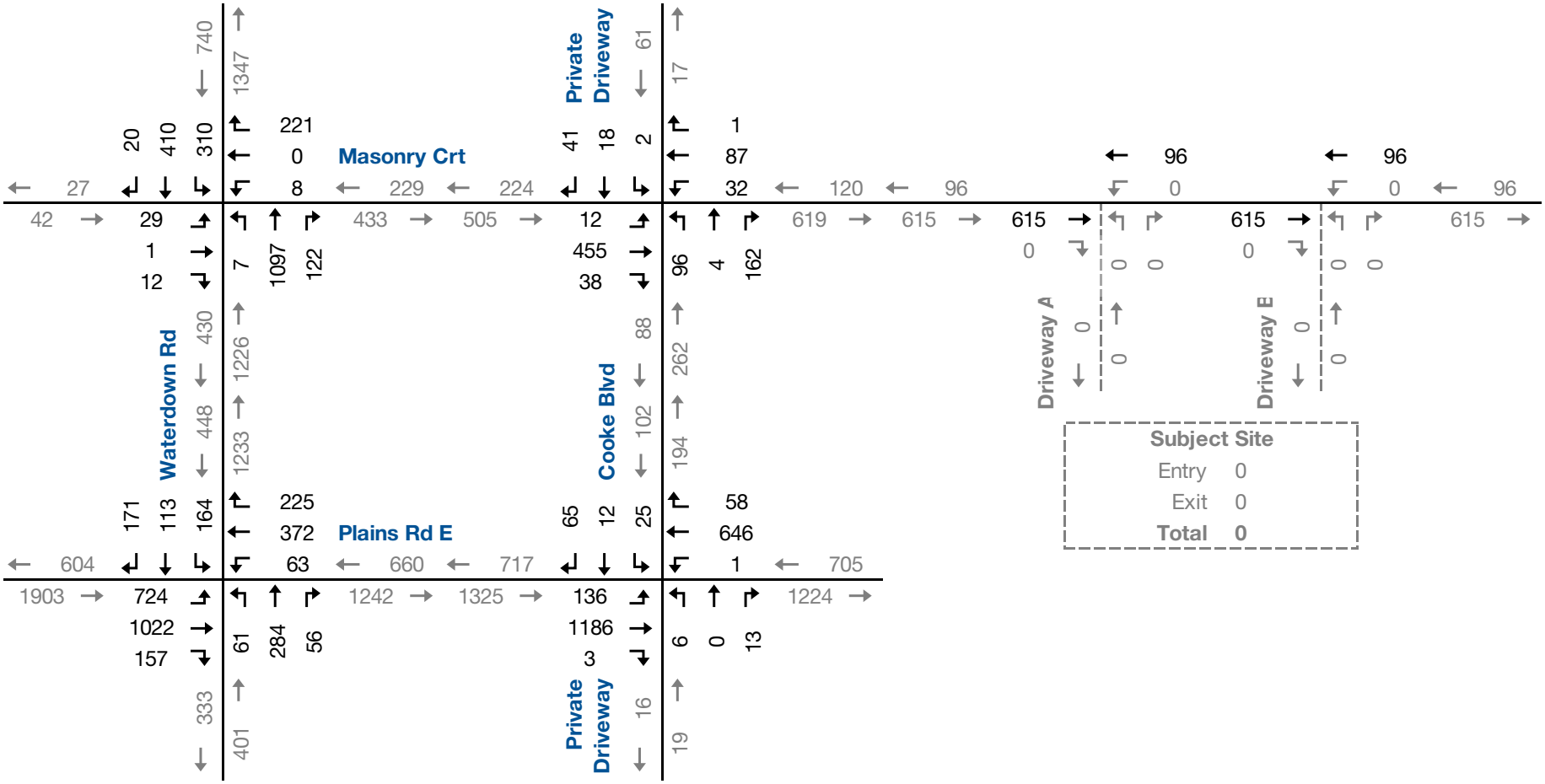
4.1 Forecast Traffic Volumes

A five-year horizon (Year 2026) beyond the anticipated build-out date (Year 2021) has been assessed. The likely future traffic volumes are estimated to consist of:

- Increased non-site traffic (generalized background traffic growth);
  - Estimated to be 1.00 percent per annum[4]
- Traffic generated by adjacent future developments; and
  - Aldershot GO Station Parking Lot Expansion – 500 additional surface parking spaces south of the CNR corridor;
  - 35 Plains Road West – 80 condominium units with ground floor retail;
  - 40, 46 & 50 Plains Road East – 51 condominium units. The development is proposing a new driveway connection to the intersection of Plains Road East and Cooke Boulevard to form the south leg to the intersection;
  - 101 Masonry Court (Phase 1) – Townhouse units of various types and condominium apartment units. The development of the site will result in a new connection (north leg) to the intersection of Masonry Court and Cooke Boulevard;
  - 53 & 71 Plains Road East – 450 condominium units with ground floor retail;
  - 1200 King Road (Phase 1) – 82,785 square metres of typical business park land uses. These lands are located north of the CNR corridor. The complete build-out of the 50-hectare site is anticipated to occur by Year 2030 in 5 Phases. Market conditions could hasten or delay build-out of these lands. Initial estimates suggest build-out will occur at roughly 5 percent per year;
- Traffic generated by the subject site.

Appendix D contains the detailed traffic forecast for the adjacent development applications. **Figure 4.1A-B** details the forecast five-year background traffic volumes. **Figure 4.2A-B** details the forecast five-year total traffic volumes.

[4] Growth rate confirmed by City Staff – Appendix A.

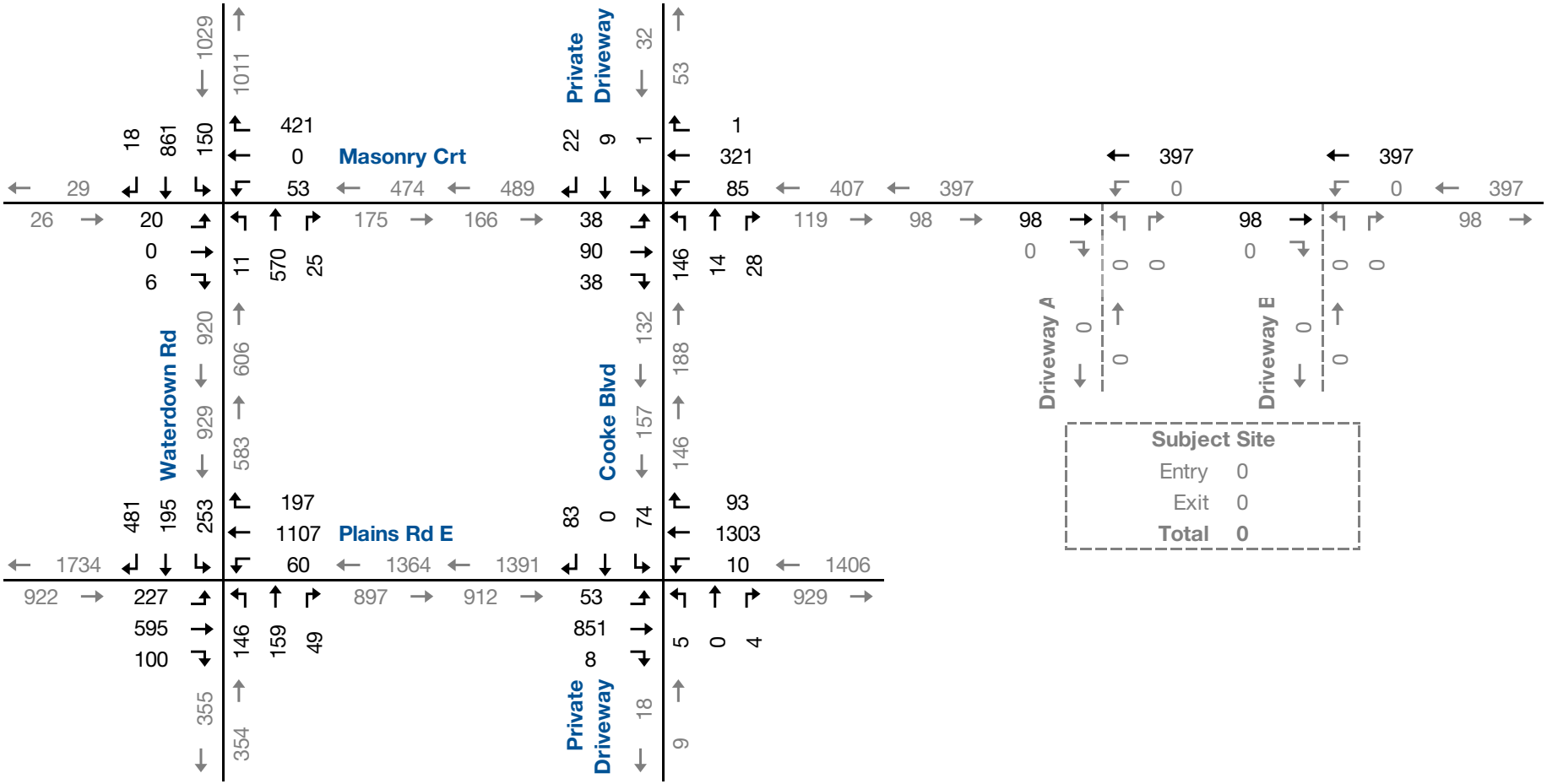


NTS

Forecast Background Traffic – AM Peak Hour

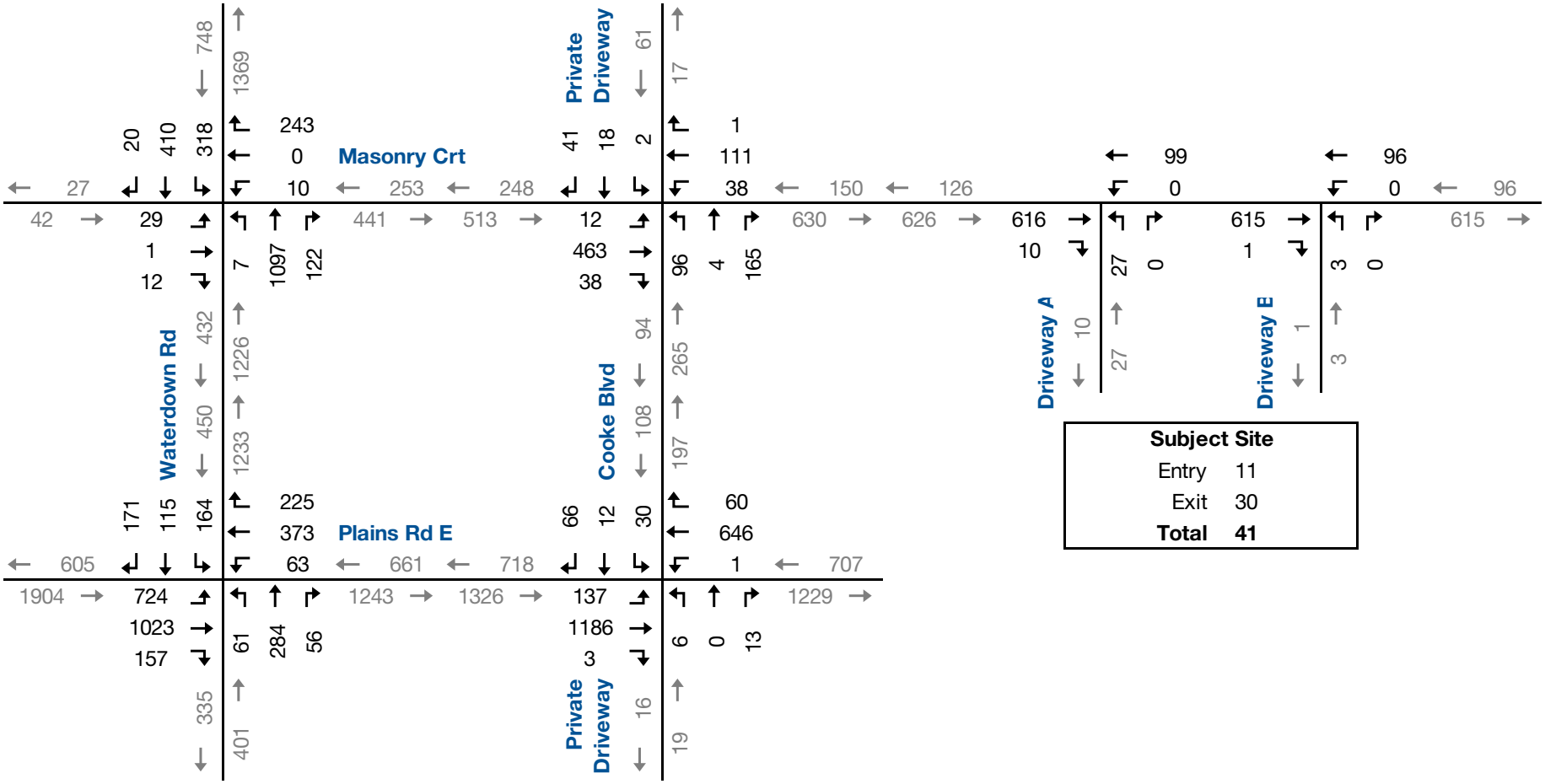
1085 Clearview Avenue & 1082, 1086 & 1090 St. Matthews Avenue TIS TDM
108222

Figure 4.1A



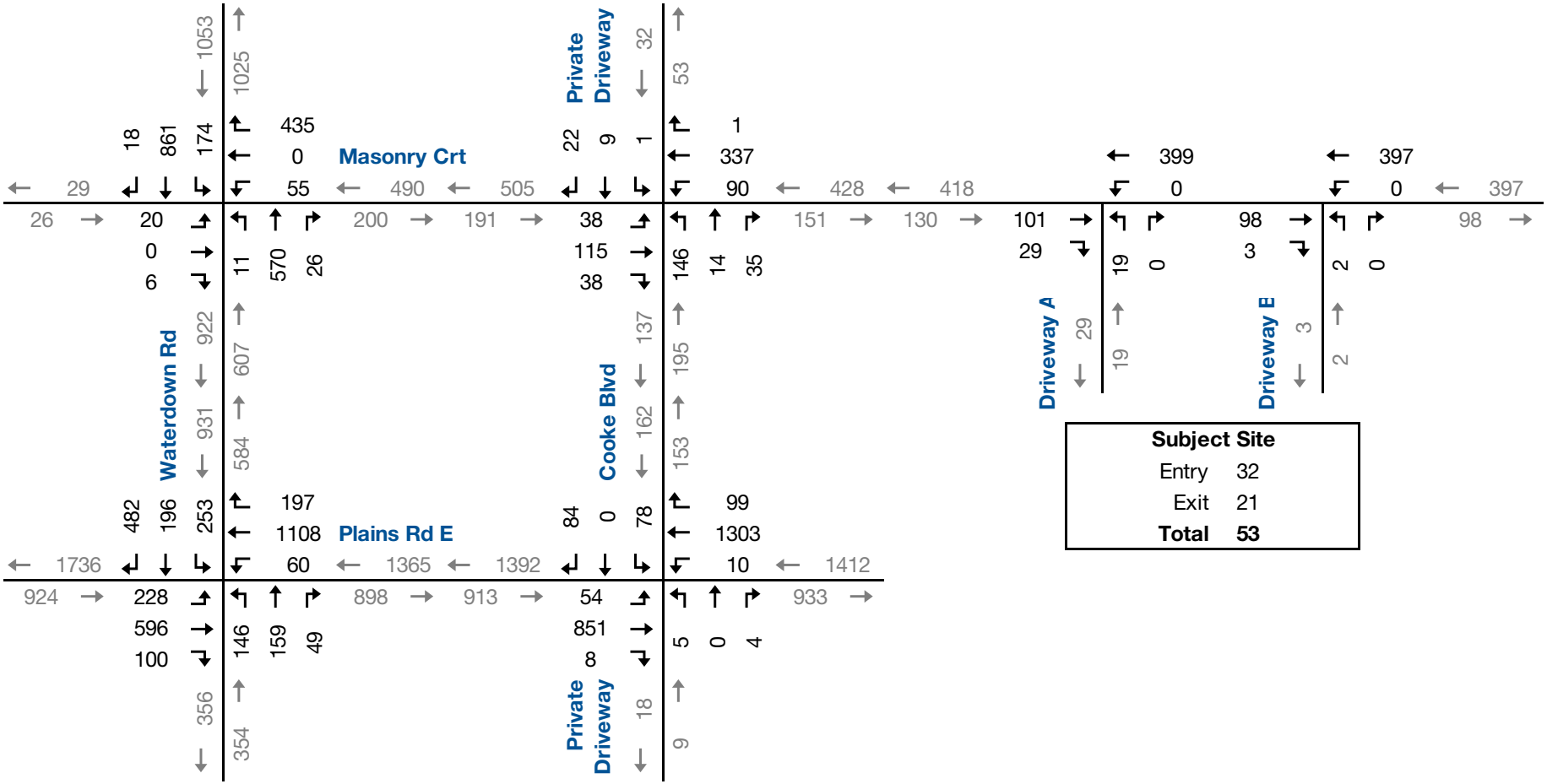
NTS

Forecast Background Traffic – PM Peak Hour



NTS

Forecast Total Traffic – AM Peak Hour



NTS

Forecast Total Traffic – PM Peak Hour

4.2 Background Traffic Operations

The study area intersection operations analyses for the background traffic forecast followed the same methodology used for existing conditions. **Table 4.1** details the level of service conditions. The intersections in the study area are forecast to operate with generally acceptable levels of service during the AM and PM peak hours. The following critical movements are noted:

- AM Peak Hour
  - Waterdown Road and Masonry Court – the southbound left-turn movement is forecast to continue to operate with a queue length greater than the current available storage.
  - Waterdown Road and Plains Road – the eastbound left-turn movement is forecast to continue to operate with delays in the LOS F range with a v/c ratio greater than 1.00 and a queue length greater than the current available storage. The upstream existing TWLTL can function as additional storage for this movement.
  - Waterdown Road and Plains Road – the overall intersection v/c ratio is estimated to be greater than 1.00.
  - Cooke Boulevard and Masonry Court – the northbound approach is forecast to operate with delays in the LOS F range with a v/c ratio greater than 0.85.
- PM Peak Hour
  - Waterdown Road and Plains Road – the eastbound left-turn movement is forecast to continue to operate with a queue length greater than the current available storage. The upstream existing TWLTL can function as additional storage for this movement.
  - Waterdown Road and Plains Road – the westbound shared through/right-turn movement is forecast to operate with a v/c ratio greater than 0.85. Delays are forecast to be in the LOS D range.
  - Waterdown Road and Plains Road – the queue length for the westbound through/right-turn movement is forecast to extend through the upstream signalized intersection of Cooke Boulevard.
  - Waterdown Road and Plains Road – the northbound left-turn movement is forecast to operate with a queue length greater than the current available storage.
  - Waterdown Road and Plains Road – the overall intersection v/c ratio is estimated to be greater than 0.85.
  - Cooke Boulevard and Masonry Court – the northbound approach is forecast to operate with delays in the LOS F range with a v/c ratio greater than 0.85.

Appendix E contains the detailed Synchro 9.

TABLE 4.1: 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	Waterdown Road & Masonry Court	TCS	LOS	<	C	>	C	C	C	>	C	B	C	>	C	C	A	>	B	B
			Delay	<	29	>	29	25	26	>	26	10	20	>	20	23	3	>	12	18
			V/C	<	0.38	>		0.04	0.15	>		0.02	0.80	>		0.74	0.19	>		0.70
			95th	<	14	>		4	1	>		3	112	>		66	15	>		
			Storage	<	-	>		30	-	>		25	-	>		20	-	>		
			Avail.	<	-	>		26	-	>		22	-	>		-46	-	>		
	Waterdown Road & Plains Road	TCS	LOS	F	C	>	F	D	E	>	E	D	E	>	E	E	D	D	D	E
			Delay	176	26	>	83	53	60	>	59	39	62	>	59	61	38	44	49	71
			V/C	1.28	0.69	>		0.60	0.81	>		0.19	0.83	>		0.84	0.24	0.13		1.11
			95th	353	175	>		16	114	>		23	136	>		69	45	21		
			Storage	30	-	>		40	-	>		30	-	>		-	-	40		
			Avail.	-323	-	>		24	-	>		7	-	>		-	-	19		
	Cooke Boulevard & Masonry Court	TWSC	LOS	<	A	>	A	<	A	>	A	<	F	>	F	<	B	>	B	
			Delay	<	0	>	0	<	3	>	3	<	63	>	63	<	13	>	13	
			V/C	<	0.01	>		<	0.04	>		<	0.91	>		<	0.15	>		
			95th	<	0	>		<	1	>		<	74	>		<	4	>		
			Storage	<	-	>		<	-	>		<	-	>		<	-	>		
			Avail.	<	-	>		<	-	>		<	-	>		<	-	>		
	Cooke Boulevard & Plains Road	TCS	LOS	A	A		A		A	>	A					A		>	A	A
			Delay	4	3		3		6	>	6					0		>	0	6
			V/C	0.28	0.45				0.33	>						0.00		>		0.47
			95th	9	43				39	>						0		>		
			Storage	40	-				-	>						-		>		
			Avail.	31	-				-	>						-		>		
PM Peak Hour	Waterdown Road & Masonry Court	TCS	LOS	<	D	>	D	D	D	>	D	A	A	>	A	A	A	>	A	B
			Delay	<	42	>	42	44	44	>	44	6	7	>	7	4	4	>	4	14
			V/C	<	0.08	>		0.33	0.36	>		0.04	0.26	>		0.28	0.33	>		0.35
			95th	<	1	>		22	33	>		4	49	>		18	51	>		
			Storage	<	-	>		30	-	>		25	-	>		20	-	>		
			Avail.	<	-	>		8	-	>		21	-	>		2	-	>		
	Waterdown Road & Plains Road	TCS	LOS	D	B	>	C	B	D	>	D	C	D	>	D	D	C	C	C	C
			Delay	45	19	>	25	11	42	>	41	33	42	>	41	36	34	23	29	33
			V/C	0.83	0.43	>		0.19	0.98	>		0.46	0.62	>		0.75	0.45	0.33		0.87
			95th	57	76	>		5	245	>		32	59	>		54	52	28		
			Storage	30	-	>		40	-	>		30	-	>		-	-	40		
			Avail.	-27	-	>		35	-	>		-2	-	>		-	-	12		
	Cooke Boulevard & Masonry Court	TWSC	LOS	<	A	>	A	<	A	>	A	<	F	>	F	<	B	>	B	
			Delay	<	3	>	3	<	2	>	2	<	76	>	76	<	15	>	15	
			V/C	<	0.05	>		<	0.07	>		<	0.90	>		<	0.10	>		
			95th	<	1	>		<	2	>		<	63	>		<	3	>		
			Storage	<	-	>		<	-	>		<	-	>		<	-	>		
			Avail.	<	-	>		<	-	>		<	-	>		<	-	>		
	Cooke Boulevard & Plains Road	TCS	LOS	A	A		A		A	>	A					A		>	A	A
			Delay	6	3		3		9	>	9					0		>	0	9
			V/C	0.23	0.32				0.59	>						0.00		>		0.58
			95th	4	31				112	>						0		>		
			Storage	40	-				-	>						-		>		
			Avail.	36	-				-	>						-		>		

MOE - Measure of Effectiveness
TCS - Traffic Control Signal
TWSC - Two-Way Stop Control
V/C - Volume to Capacity Ratio
95th - 95th Percentile Queue Length
LOS - Level of Service
> - Shared Right-Turn Lane
< - Shared Left-Turn Lane

4.3 Total Traffic Operations

The study area intersection operations analyses for the future total traffic projections followed the same methodology used for existing conditions. **Table 4.2A-B** details the level of service conditions for the AM and PM peak hours. The intersections in the study area are forecast to operate with generally acceptable levels of service during the AM and PM peak hours. The following critical movements are noted:

- AM Peak Hour
  - Waterdown Road and Masonry Court – the southbound left-turn movement is forecast to continue to operate with a queue length greater than the current available storage.
  - Waterdown Road and Plains Road – the eastbound left-turn movement is forecast to continue to operate with delays in the LOS F range with a v/c ratio greater than 1.00 and a queue length greater than the current available storage.
  - Waterdown Road and Plains Road – the overall intersection v/c ratio is estimated to be greater than 1.00.
  - Cooke Boulevard and Masonry Court – the northbound approach is forecast to continue to operate with delays in the LOS F range with a v/c ratio greater than 0.85.
- PM Peak Hour
  - Waterdown Road and Masonry Court – the southbound left-turn movement is forecast to continue to operate with a queue length greater than the current available storage.
  - Waterdown Road and Plains Road – the eastbound left-turn movement is forecast to continue to operate with a queue length greater than the current available storage.
  - Waterdown Road and Plains Road – the westbound shared through/right-turn movement is forecast to operate with a v/c ratio greater than 0.85. Delays are forecast to be in the LOS D range.
  - Waterdown Road and Plains Road – the queue length for the westbound through/right-turn movement is forecast to extend through the upstream signalized intersection of Cooke Boulevard.
  - Waterdown Road and Plains Road – the northbound left-turn movement is forecast to continue to operate with a queue length greater than the current available storage.
  - Waterdown Road and Plains Road – the overall intersection v/c ratio is estimated to be greater than 0.85.
  - Cooke Boulevard and Masonry Court – the northbound approach is forecast to continue to operate with delays in the LOS F range with a v/c ratio greater than 0.85.

Appendix F contains the detailed Synchro 9.

No capacity issues are forecast to occur at the site driveway connections to Masonry Court that would suggest the need for improvements to the existing form of traffic control or lane configuration.



TABLE 4.2A: TOTAL TRAFFIC OPERATIONS – AM PEAK HOUR

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	Waterdown Road & Masonry Court	TCS	LOS	<	C	>	C	C	C	>	C	B	C	>	C	C	A	>	B	B
			Delay	<	31	>	31	25	26	>	26	10	20	>	20	24	3	>	12	19
			V/C	<	0.43	>		0.05	0.17	>		0.02	0.80	>		0.76	0.19	>		0.72
			95th	<	16	>		6	5	>		3	112	>		69	15	>		
			Storage	<	-	>		30	-	>		25	-	>		20	-	>		
			Avail.	<	-	>		25	-	>		22	-	>		-49	-	>		
	Waterdown Road & Plains Road	TCS	LOS	F	C	>	F	D	E	>	E	D	E	>	E	E	D	D	D	E
			Delay	176	26	>	83	53	60	>	59	39	62	>	59	61	38	44	49	71
			V/C	1.28	0.69	>		0.60	0.81	>		0.19	0.83	>		0.84	0.24	0.13		1.11
			95th	353	175	>		16	115	>		23	136	>		69	46	21		
			Storage	30	-	>		40	-	>		30	-	>		-	-	40		
			Avail.	-323	-	>		24	-	>		7	-	>		-	-	19		
	Cooke Boulevard & Masonry Court	TWSC	LOS	<	A	>	A	<	A	>	A	<	F	>	F	<	B	>	B	
			Delay	<	0	>	0	<	3	>	3	<	81	>	81	<	14	>	14	
			V/C	<	0.01	>		<	0.05	>		<	0.98	>		<	0.16	>		
			95th	<	0	>		<	1	>		<	86	>		<	4	>		
			Storage	<	-	>		<	-	>		<	-	>		<	-	>		
			Avail.	<	-	>		<	-	>		<	-	>		<	-	>		
	Cooke Boulevard & Plains Road	TCS	LOS	A	A		A		A	>	A					A		>	A	A
			Delay	4	4		4		7	>	7					0		>	0	7
			V/C	0.29	0.46				0.33	>						0.00		>		0.48
			95th	10	45				40	>						0		>		
			Storage	40	-				-	>						-		>		
			Avail.	30	-				-	>						-		>		
	Masonry Court & Driveway A	TWSC	LOS		A	>	A	<	A		A	C		>	C					
			Delay		0	>	0	<	0		0	16		>	16					
			V/C		0.40	>		<	0.00			0.08		>						
			95th		0	>		<	0			2		>						
			Storage		-	>		<	-			-		>						
			Avail.		-	>		<	-			-		>						
	Masonry Court & Driveway B	TWSC	LOS		A	>	A	<	A		A	B		>	B					
			Delay		0	>	0	<	0		0	15		>	15					
			V/C		0.39	>		<	0.00			0.01		>						
			95th		0	>		<	0			0		>						
			Storage		-	>		<	-			-		>						
			Avail.		-	>		<	-			-		>						

MOE - Measure of Effectiveness *V/C - Volume to Capacity Ratio* *> - Shared Right-Turn Lane*

TCS - Traffic Control Signal *95th - 95th Percentile Queue Length* *< - Shared Left-Turn Lane*

TWSC - Two-Way Stop Control *LOS - Level of Service*

TABLE 4.2B: TOTAL TRAFFIC OPERATIONS – PM PEAK HOUR

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	
PM Peak Hour	Waterdown Road & Masonry Court	TCS	LOS	<	D	>	D	D	D	>	D	A	A	>	A	A	A	>	A	B
			Delay	<	41	>	41	43	44	>	44	7	8	>	8	5	4	>	4	14
			V/C	<	0.09	>		0.33	0.42	>		0.04	0.27	>		0.32	0.34	>		0.36
			95th	<	1	>		22	37	>		4	52	>		22	54	>		
			Storage	<	-	>		30	-	>		25	-	>		20	-	>		
			Avail.	<	-	>		8	-	>		21	-	>		-2	-	>		
	Waterdown Road & Plains Road	TCS	LOS	D	B	>	C	B	D	>	D	D	D	>	D	D	D	C	C	C
			Delay	50	18	>	26	19	40	>	39	40	49	>	39	52	39	23	35	35
			V/C	0.83	0.39	>		0.18	0.90	>		0.53	0.64	>		0.85	0.47	0.33		
			95th	86	79	>		14	221	>		38	66	>		70	60	23		
			Storage	30	-	>		40	-	>		30	-	>		-	-	40		
			Avail.	-56	-	>		26	-	>		-8	-	>		-	-	17		
	Cooke Boulevard & Masonry Court	TWSC	LOS	<	A	>	A	<	A	>	A	<	F	>	F	<	C	>	C	
			Delay	<	2	>	2	<	2	>	2	<	107	>	107	<	16	>	16	
			V/C	<	0.05	>		<	0.08	>		<	1.01	>		<	0.10	>		
			95th	<	1	>		<	2	>		<	78	>		<	3	>		
			Storage	<	-	>		<	-	>		<	-	>		<	-	>		
			Avail.	<	-	>		<	-	>		<	-	>		<	-	>		
	Cooke Boulevard & Plains Road	TCS	LOS	A	A		A		A	>	A					A		>	A	A
			Delay	7	4		4		9	>	9					0		>	0	9
			V/C	0.24	0.32				0.59	>						0.00		>		0.59
			95th	6	38				114	>						0		>		
			Storage	40	-				-	>						-		>		
			Avail.	34	-				-	>						-		>		
	Masonry Court & Driveway A	TWSC	LOS		A	>	A	<	A		A	B		>	B					
			Delay		0	>	0	<	0		0	13		>	13					
			V/C		0.08	>		<	0.00			0.04		>						
			95th		0	>		<	0			1		>						
			Storage		-	>		<	-			-		>						
			Avail.		-	>		<	-			-		>						
	Masonry Court & Driveway B	TWSC	LOS		A	>	A	<	A		A	B		>	B					
			Delay		0	>	0	<	0		0	12		>	12					
			V/C		0.06	>		<	0.00			0.00		>						
			95th		0	>		<	0			0		>						
			Storage		-	>		<	-			-		>						
			Avail.		-	>		<	-			-		>						

MOE - Measure of Effectiveness *V/C - Volume to Capacity Ratio* *> - Shared Right-Turn Lane*

TCS - Traffic Control Signal *95th - 95th Percentile Queue Length* *< - Shared Left-Turn Lane*

TWSC - Two-Way Stop Control *LOS - Level of Service*

5 Remedial Measures

5.1 Left-Turn Lane Warrants

The need for an auxiliary left-turn lane for inbound traffic at the subject site's driveway was reviewed using the requirements in the MTO's Design Supplement for the TAC Geometric Design Guide for Canadian Roads – June 2017[5]. **Appendix G** contains the warrant analysis. The warrant analysis is summarized as follows:

- Masonry Court at Cooke Boulevard:
  - Eastbound left-turn lane – not warranted.
  - Westbound left-turn lane – 15 metres of storage is warranted under the background/total traffic horizon. No storage is warranted under the existing traffic conditions.

A left-turn lane is not warranted on Masonry Court at the proposed site driveway connections due to the site's location relative to the terminus of Masonry Court. Site generated vehicular trips to/from east (Aldershot GO Station) will be minimal to non-existent and completed using Active Transportation.

5.2 Signal Warrants

The traffic analysis in **Section 4** of the report indicates that traffic control improvements may be required at the Masonry Court and Cook Boulevard intersection to accommodate forecast traffic volumes. The intersection was assessed using the Ontario Traffic Manual (OTM Book 12 – Justification 7) signal warrant[6] procedures. **Appendix H** contains the warrant analysis. The warrant analysis is summarized as follows:

- Existing conditions – Not warranted;
- Background Traffic Conditions – Not Warranted; and
- Total Traffic conditions – Not warranted

Based on the warrant analysis, the criteria necessary to warrant the installation of a traffic control signal is technically not satisfied. However, it is recommended that the City of Burlington consider improving the existing form of traffic control.

[5] MTO Geometric Design Standards for Ontario Highways, Chapter E, 1976
[6] Ontario Traffic Manual Book 12, Ministry of Transportation of Ontario, July 2001.



5.3 Transportation Demand Management Measures

To assist in integrating the site into the surrounding neighbourhood the following Transportation Demand Management (TDM) measures should be included in the site plan.

Walking

- The future landscaping plan will consider enhancing the pedestrian realm to include amenities such as benches, seating areas and/or pedestrian scale lighting.
- The City of Burlington's Aldershot GO Mobility Hub precinct plan envisions a new Active Transportation (AT) connection between Clearview Avenue and Masonry Court. The City of Burlington may find it desirable to construct the new Active Transportation connection during the construction of the subject site.
- The City of Burlington may find it desirable to add sidewalk facilities along Clearview Avenue and St. Matthews Avenue to complete the pedestrian network for the Aldershot GO Mobility Hub precinct.
- The City of Burlington may wish to explore the need for Pedestrian Crossovers (PXO) at the existing Active Transportation connection at the terminus of St. Matthews Avenue and at any future Active Transportation connections along Masonry Court to better link the surrounding community to the Aldershot GO Mobility Hub.

Cycling Infrastructure

- The bicycle room could include a bicycle repair station.
- Short-term bicycle parking for visitors will be located at grade and near the main building entrances. Ideally, the short-term bicycle parking spaces should be protected from weather. The minimum short-term bicycle parking supply is recommended to be at least 0.05 spaces per unit[7] (8 spaces).
- The City of Burlington may find it desirable to improve cycling wayfinding signage to identify the Active Transportation (AT) connection to/from the Aldershot GO Mobility Hub precinct

Parking Infrastructure

- Unbundle parking costs from the cost of purchasing the units.

[7] Final Report Burlington City-Wide Parking Standards Review Consolidated Report, IBI Group, July 2017 Exhibit 7.4: Recommended Bicycle Parking Standards

Transit Infrastructure

- Discounted transit passes for first time purchasers during the first year of occupancy be considered as a marketing item.
- Adaptive real-time transit arrival signage could be considered within the lobby area[8].

Carshare

- The site operator should explore the feasibility of providing a carshare vehicle and space at grade as an amenity for residents.

Wayfinding, Travel Planning, Education/Promotion

- Travel planning resources for residents (individualized marketing, active transportation maps, community resources) be provided.
- Wayfinding signage be considered in the Lobby or near main entrances.
- Contribute to building a strong TDM brand in marketing material; and
- Travel planning resources be provided with new unit purchases (transit information, active transportation maps, etc.)

The above TDM measures can assist in further mitigating the site's impact on the adjacent road network, promote a strong and vibrant economy, and create a livable community that has a balanced transportation network that accommodates all modes of transportation.

5.4 Loading

The site plan illustrates a loading zone for waste collection and moving/delivery vehicles in the southeast corner of the site. The loading zone is dimensioned as 13 metres x 4 metres and is located outside the main drive aisle. The site's waste collection room is located adjacent to the loading zone.

[8] https://transitscreen.com/about/

6 Conclusions and Recommendations

6.1 Conclusions

The main findings and conclusions of this study are as follows:

- **Study Area**: The intersections that form the study area include the Masonry Court intersections with Waterdown Road and Cooke Boulevard and the Plains Road East intersections with Waterdown Road and Cooke Boulevard.
- **Existing Traffic Conditions**: The intersections within the study area are currently operating with generally acceptable levels of service during the AM and PM peak hours. Localized congestion is occurring for select turning movements at the Waterdown Road intersections with Masonry Court and Plains Road.
- **Forecast Traffic**: The forecast traffic volumes near the subject site have been assessed for five years (Year 2026) beyond the opening date (Year 2021). The likely future traffic volumes near the subject site are estimated to consist of:
  - Generalized background traffic growth;
  - Build-out of six (6) adjacent development applications; and
  - traffic generated by the subject site.
- **Background Traffic Conditions**: Localized congestion previously identified under existing conditions at Waterdown Road with Masonry Court and Plains Road is anticipated to continue to occur. In addition, high levels of delay are forecast to occur on the northbound approach of Cooke Boulevard to Masonry Court. Improvements to the existing form of two-way stop control should be considered by the City of Burlington.
- **Proposed Development**: The subject site is located at 1085 Clearview Avenue and 1082, 1086 and 1090 St. Matthews Avenue in the City of Burlington, Halton Region. The development proposes a 6-storey, 160-unit mid-rise residential condominium building. The site's parking supply is noted to consist of 203 spaces.
- **Transportation Demand Management**: The site concept plan includes TDM measures intended to assist in mitigating the site's transportation and parking impacts. Additional TDM measures are recommended to be included in the final site plan.
- **Development Generated Traffic**: The subject site is estimated to generate approximately 41 new AM peak hour vehicle trips and approximately 53 new PM peak hour vehicle trips
- **Total Traffic Conditions**: The intersections within the study area are forecast to operate with levels of service similar to the background traffic condition.

- **Remedial Measures**: Improvements to the existing form of two-way stop control should be considered at the intersection of Cooke Boulevard to Masonry Court. The need for traffic control improvements is driven in part by the forecast background traffic.

6.2 Recommendations

Based on the findings of this study, the following is recommended:

- The proposed driveway connections to the external road network operate under two-way stop control.
- To accommodate the occupant and visitor parking demands it is recommended that the site's structured parking supply (154 spaces) and six (6) surface spaces be assigned to occupants. The remaining at grade parking spaces should be allocated to visitor parking (41 spaces) and maintenance vehicle parking (two (2) spaces).
- The TDM measures outline in **Section 3.2** and **Section 5.3** be included in the future design of the subject site. Some elements of the TDM plan can be designed directly into the site plan while other elements are amenities that can only be achieved after occupancy.
- The proposed driveway connection to Masonry Court operate under two-way stop control.
- The City of Burlington monitor the operation of the Masonry Court intersection with Cooke Boulevard to ensure an appropriate form of traffic control is provided to accommodate the future travel demands. In the longer term.

Appendix A

Pre-Study Consultation

5A-150 Pinebush Road
Cambridge, ON N1R 8L2
p: 519.896.3163
905.381.2229
416.479.9684

www.ptsl.com

28 August 2018
Project: 180222

Kaylan Edgcumbe, C.E.T.
Manager, Transportation Planning and Parking Transportation Services Department
City of Burlington
426 Brant Street P.O. Box 5013,
Burlington, ON L7R 3Z6
kaylan.edgcumbe@burlington.ca

Connor McBride
Corridor Management Officer
Provincial Highways Management | Corridor Management Office
Ministry of Transportation
159 Sir William Hearst Avenue
Toronto, ON M3M 0B7
connor.mcbride@ontario.ca

Dear Ms. Edgcumbe & Mr. McBride:

RE: TRANSPORTATION IMPACT STUDY & TDM STUDY: LIV COMMUNITIES – MASONRY COURT, BURLINGTON, ON

Paradigm Transportation Solutions Limited is pleased to submit these Terms of Reference to complete the supportive Transportation Impact Study (TIS) and Transportation Demand Management (TDM) study for the proposed development of 26-28, 64-66 Masonry Court in the City of Burlington, ON.

Project Understanding

The development application includes a 6-storey residential apartment building containing approximately 169 units with related amenity space. Vehicle access is proposed by two (2) driveway connections to Masonry Court. No vehicular access is proposed to Clearview Avenue and St. Matthews Avenue. A total of 214 parking spaces are proposed (163 underground spaces and 51 surface spaces). The site concept plan can be found attached.

In assessing the transportation impacts, we intend to analyze the proposed driveway connections to Masonry Court as well as the following intersections (subject to the review agencies concurrence):

- Masonry Courtand Waterdown Road;
- Masonry Court and Cooke Boulevard;
- Waterdown Road and Plains Road;
- Waterdown Road and Highway 403 Westbound Off-Ramp; and

- Waterdown Road and Highway 403 Eastbound Off-Ramp.

The TIS will be completed in accordance with the Ministry of Transportation of Ontario (MTO) Traffic Impact Study Guidelines and any additional input from the review agencies.

Work Plan

The following outlines our understanding of the work to be completed:

- **Task 1 – Pre-Study Consultation**: We will contact the review agencies (MTO and City of Burlington) to confirm and refine the study scope and assumptions prior to undertaking the study.
- **Task 2 – Data Collection**: We will request available Turning Movement Count (TMC) data, signal timing plans, background growth rates, transit routes/ridership, relevant background reports, and any other information about the study area pertinent to the assessment (e.g., other development applications in the vicinity). If the review agencies do not have traffic counts collected within the past two years, we will arrange for 8-hour traffic counts to be conducted on a weekday at the study area intersections.

  We will conduct a site visit to view and assess current road and transportation conditions in the study area during the typical peak periods for commuter traffic flow; weekday AM and PM peak hours.
- **Task 3 – Traffic Forecasting**: According to MTO's TIS guidelines, we have assumed that traffic forecasts for the weekday AM and PM peak hours will be developed for multiple horizon years representing Opening Date; five (5) years from Opening Date; and ten (10) years from Opening Date. The components of the traffic forecasts are as follows:
  - Existing (Base Year) – We will develop Existing (2018) vehicle traffic volumes for the weekday AM and PM peak hours from available counts for the study area intersections.
  - Future (Horizon Year) Background – We will estimate Future Background vehicle traffic volumes for the weekday AM and PM peak hours by applying a growth rate to the Existing volumes and adding anticipated trips from any nearby approved developments.
  - Future (Horizon Year) Total – We will forecast the weekday AM and PM peak hour vehicle traffic volumes generated by the proposed development using the Institute of Transportation Engineers (ITE) Trip Generation Manual (10th Edition) as appropriate. The site vehicle trips will be distributed to the adjacent road network based on existing traffic patterns and added to the Future Background estimates to produce Future Total traffic volumes.
- **Task 4 - Operational Analysis**: We will evaluate the operation of the study area intersections and proposed driveways for the Existing, Future Background and Future Total weekday AM and PM peak hour traffic conditions. The operational analyses will assess volume-to-capacity (v/c) ratios, Level of Service (LOS) and queuing conditions.

Based on the analysis results, we will identify any existing transportation deficiencies, as well as the net impact of the proposed development on the study area road network. The need for road improvements (e.g., provision of auxiliary turn lanes) and/or modifications to traffic control devices (e.g., addition of traffic control signals) to address any deficiencies will be determined. An assessment of whether these measures are required due to non-site traffic (i.e. Existing or Future Background) or the increase in traffic resulting from the proposed development will be completed. In addition, a qualitative assessment of the potential impact on transit services and active transportation facilities (i.e. walking and cycling modes) will be provided.

- **Task 5 – Site Driveways**: The proposed driveway connections to Masonry Court will be evaluated for potential conflicts with utilities, other driveways, on-street parking, pedestrian/cycling infrastructure, etc. Sightlines will be evaluated in accordance with TAC.
- **Task 6 - TDM Options**: Based on the site concept plan we will evaluate guidelines and best practice opportunities related to TDM initiatives regarding cycling, walking, transit (buses), parking, carpooling, car share/bikeshare, wayfinding and travel planning and education/promotion as they relate to the site. Based on the above we will recommend TDM measures to be included in the site plan as well as post development TDM programs for consideration.
- **Task 7 – Report and Recommendations**: We will prepare and submit a final report documenting the study findings, conclusions and provide recommendations regarding the proposed development from a transportation perspective.

Yours very truly,

PARADIGM TRANSPORTATION SOLUTIONS LIMITED



Scott Catton, Dipl.T., C.E.T. MITE
Senior Project Manager



Stew Elkins, B.E.S., MITE
Vice President

Statistics

PROJECT STATISTICS
Masonry Court, Burlington
Residential Development - 6 Storey Scheme
Burlington,ON
March 12, 2018 — Project No. 18-035

1.0 SITE AREA

1.1 Site	hectare	acres	sq.m.	sq.ft.
Site Area (to be verified)	**0.627**	**1.549**	**6,268.03**	**67,469**

2.0 Proposed GFA

2.1 Apartments - GFA		floors	sq.m.	sq.m.	sq.ft.
Lev 1		1 x	1,945	1,945	20,941
Lev 2	to 6	5 x	2,142	10,711	115,295
Total Proposed GFA *				**12,657**	**136,236**

Note: * including all residential areas above grade including amenity. Excludes mechanical areas, garbage room and all underground areas

3.0 Proposed Saleable - Apartment Building

3.1 Apartment Building		floors	sq.m.	sq.m.	sq.ft.
Lev 1		1 x	1,078	1,078	11,608
Lev 2	to 6	5 x	1,960	9,799	105,471
Total Proposed Apartment Building Saleable				**10,877**	**117,079**

4.0 Proposed Density - FSI

Total Proposed GFA / Gross Site Area (Item 2 / Item 1) — **2.02**

5.0 Efficiency

Total Proposed Saleable / GFA (Item 3 / Item 2) — **85.94%**

6.0 Unit Count

6.1

Apartment	floors	unit	1B	1B+D	2B	2B+D	Total
Lev 1	1 x	17	8	6	0	3	17
Lev 2	1 x	34	12	18	4	0	34
Lev 3	1 x	34	12	18	4	0	34
Lev 4	1 x	34	12	18	4	0	34
Lev 5	1 x	25	3	0	8	14	25
Lev 6	1 x	25	3	0	8	14	25
Total Apartment Units		**169**	**50**	**60**	**28**	**31**	**169**
			30%	**36%**	**17%**	**18%**	
TOTAL UNITS							**169**

7.0 Amenity

Note: may include open spaces, patios, balconies, communal play areas, lounges, sundecks and roofdecks.

7.1 Amenity Area Required (Under Zoning-by-law - RH5)

Unit type	Requirement	No. of units		No. of BR	sq. m.	sq. ft.
1-Bed (< 60 sq.m.)	15 sq.m. per unit	50 x	15		750	8,073
1-Bed (> 60 sq.m.)	25 sq.m. per bedroom	60 x	25 x	1	1,500	16,146
2-Bed	25 sq.m. per bedroom	59 x	25 x	2	2,950	31,754
Total Amenity Area Required					**5,200**	**55,973**

7.2 Amenity Area Provided	floors	Area - sq.m.	sq.m.	sq.ft.
Level 1 (Indoor amenity)			543	5,847
Level 1 (Outdoor amenity)			415	4,465
Level 1 (Patios)			462	4,969
Level 2-4 (Balconies)	3 x	297	890	9,584
Level 5-6 (Balconies)	2 x	297	594	6,389
Total Amenity Area Provided			**2,904**	**31,255**

8.0 Parking

8.1 Parking Required (Under Zoning-by-law - Apartment)

Unit type	Requirement	No. of units		Parking Spaces
1-Bed	1.25 car per unit (1-Bed)	110 x	1.25	138
2-Bed	1.50 car per unit (2-Bed)	59 x	1.50	89
Visitors	0.35 car per unit	169 x	0.35	60
Total Parking Required				**287**

8.2 Parking Ratio Suggested

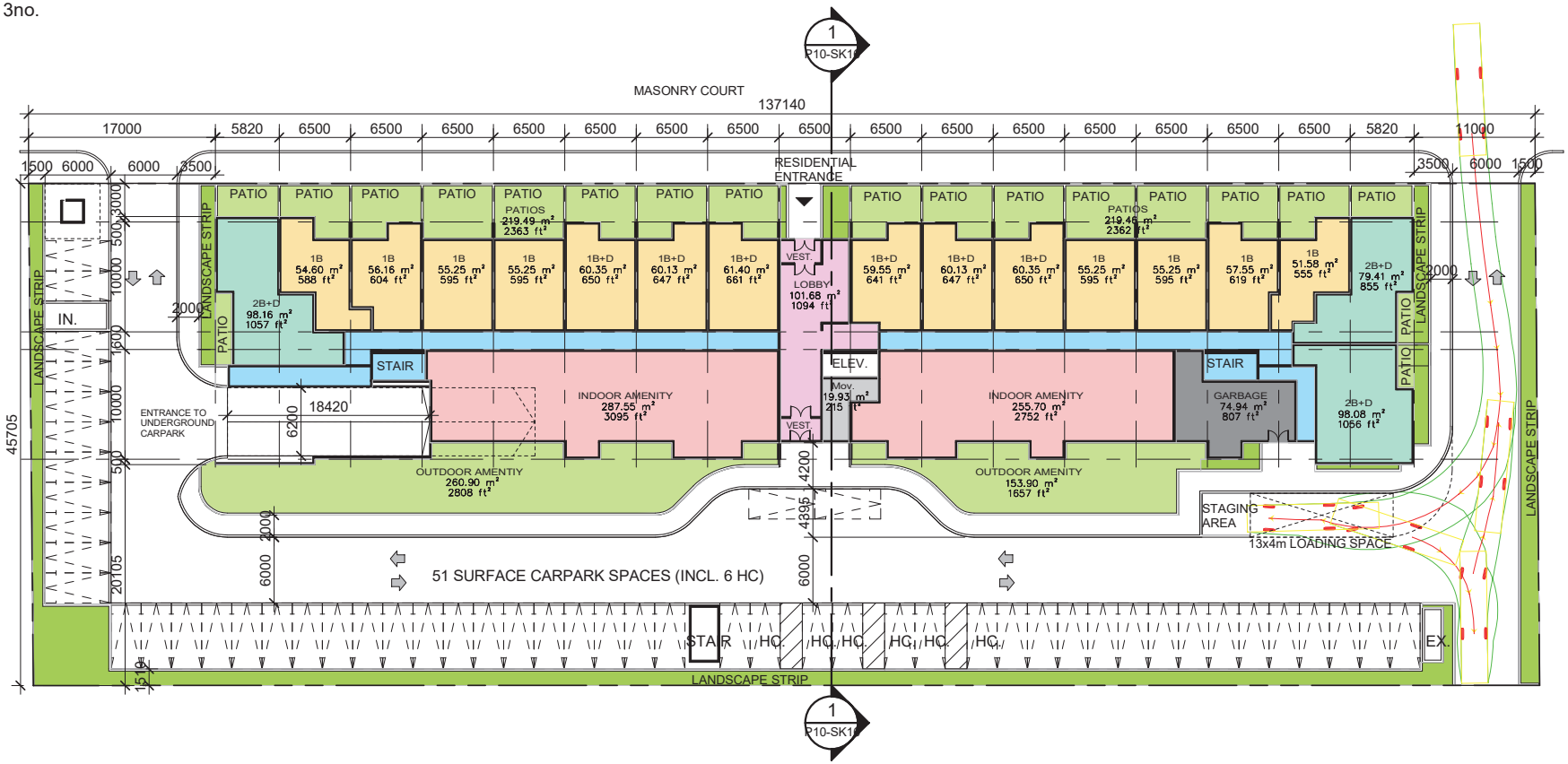
Residential / Visitors — 1.25 **per Residential Unit** — **211**

8.3 Parking Provided

Surface Parking Provided	**51**
Underground Parking Provided	**163**
Total Parking Provided	**214**

Level 1 1:400

RESIDENTIAL GFA: 1,945 SM (20,941 SF)
17 UNITS
1B: 8no.
1B+D: 6no.
2B+D: 3no.



| Lots 26-28, 64-66 Masonry Court, Burlington, ON

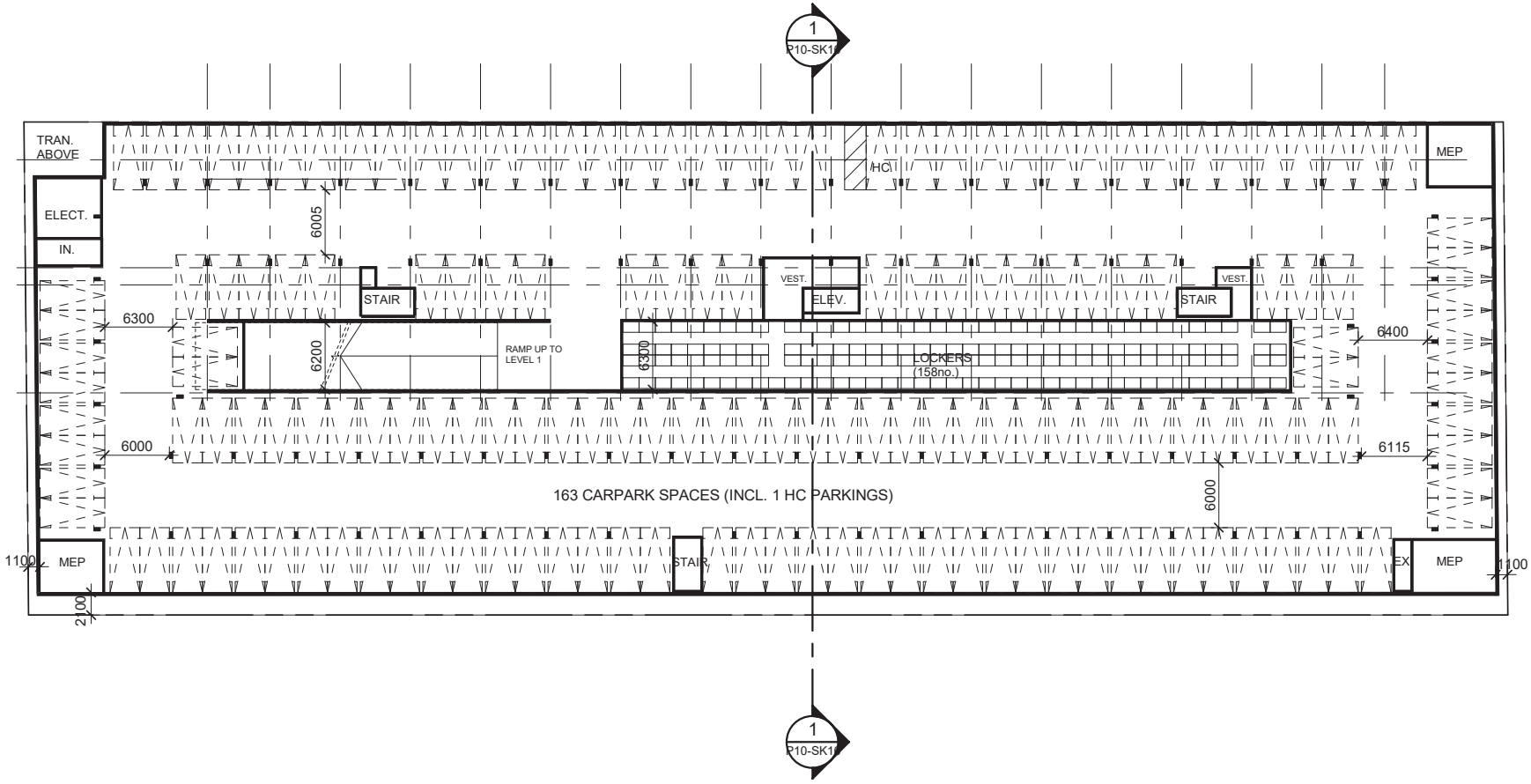
LIV

18-035

03/13/18

KIRKOR ARCHITECTS + PLANNERS

Level P1 1:400



| Lots 26-28, 64-66 Masonry Court, Burlington, ON

LIV

18-035

03/15/18

KIRKOR ARCHITECTS + PLANNERS

Scott Catton

From: Polus, Asia (MTO) <Asia.Polus@ontario.ca>
Sent: Wednesday, 5 September, 2018 09:40 AM
To: Scott Catton
Cc: Caple, Corey (MTO); Lawrence, Morgan (MTO); Singh, Christian (MTO)
Subject: FW: 180222 (26-28, 64-66 Masonry Court TIS) Terms of Reference
Attachments: 180222 (26-28, 64-66 Masonry Court TIS) Terms of Reference

RE: Development Proposal
64-66 Masonry Court
City of Burlington

Hi Scott,

Further to your e-mail, regarding the Terms of Reference for TIS Report in relation to the development proposal located at the above noted address, please note that the land is located outside Ministry's permit control area as a result the proponent will not require MTO Building and Land Use Permit. We do not need to be circulated any further regarding this proposal.

Should you have any other questions or concerns please do not hesitate to contact Corey Caple, the Corridor Management Officer included in this e-mail, at 416-235-4351 or me.

Regards

W. Asia Polus
Corridor Management Planner

Ministry of Transportation
Central Region, Highway Corridor Management Section
159 Sir William Hearst Ave. 7th Floor
Toronto, ON M3M 0B7
Tel. 416 - 235-3991
Fax 416 - 235-4267

From: Scott Catton [mailto:scatton@ptsl.com]
Sent: August 29, 2018 9:57 AM
To: Janakovic, Marina (MTO) <Marina.Janakovic@ontario.ca>
Subject: RE: 180222 (26-28, 64-66 Masonry Court TIS) Terms of Reference

Good morning Marina
I'm looking to scope a Transportation Impact Study with the Ministry for a site in Burlington just south of Highway 403 near the Waterdown Road interchange.

Can you please advise me as to who is the most appropriate contact person for this? Thank you.

Scott Catton, Dipl. T., C.E.T., MITE

Senior Project Manager

Paradigm Transportation Solutions Limited
5A-150 Pinebush Road, Cambridge, ON L1R 8J8
p: 905.381.2229 x302
e: scatton@ptsl.com
w: www.ptsl.com

-----Original Message-----
From: McBride, Connor (MTO) <Connor.McBride@ontario.ca>
Sent: Wednesday, 29 August, 2018 09:48
To: Scott Catton <scatton@ptsl.com>
Subject: Automatic reply: 180222 (26-28, 64-66 Masonry Court TIS) Terms of Reference

Hello,

My final day with the Corridor Management Section will be Friday, August 17th, 2018.

Please ensure that all correspondence between today and end of day Friday is sent to me and cc'ed to Marina Janakovic's attention.

Marina Janakovic – Administration Assistant
Phone: 416-235-5372
Email: marina.janakovic@ontario.ca
After Friday, August 17th, ensure that all correspondence is directed solely to Marina Janakovic. She will redistribute your inquiry as required. After August 17th my email will no longer be monitored.
Thank you,
Connor McBride

This e-mail and any files transmitted with it are confidential and intended solely for the use of the individual or entity to whom they are addressed. If you have received this e-mail in error please notify the sender immediately. Please note that any views or opinions presented in this e-mail are solely those of the author and do not necessarily represent those of Paradigm Transportation Solutions Limited. Finally, the recipient should check this e-mail and any attachments for the presence of viruses. Paradigm Transportation Solutions Limited accepts no liability for any damage caused by any virus transmitted by this e-mail.

Scott Catton

From: Edgcumbe, Kaylan <Kaylan.Edgcumbe@burlington.ca>
Sent: Monday, 10 September, 2018 10:53 AM
To: Scott Catton
Cc: Ozimkovic , Danijel; 'Lawrence, Morgan (MTO)'
Subject: RE: 180222 (26-28, 64-66 Masonry Court TIS) Terms of Reference

Categories: Comments

Hi Scott,

There is significant work being undertaken through this corridor through the QEW prosperity corridor study and future works which will be looking at the interchange. Although the Ministry doesn't need to issue a building permit, I'd still like to see trip assignment extended to the 403 ramps for the purposes of informing the modeling work as part of the QEW prosperity work. No need to analyze the ramps, but it would be helpful to see trip assignments.

Thanks,

Kaylan

Kaylan Edgcumbe, C.E.T.
Manager, Transportation Planning and Parking
Transportation Services Department

From: Scott Catton <scatton@ptsl.com>
Sent: Wednesday, September 05, 2018 10:53 AM
To: Edgcumbe, Kaylan <Kaylan.Edgcumbe@burlington.ca>
Subject: RE: 180222 (26-28, 64-66 Masonry Court TIS) Terms of Reference

Good morning Kaylan,
Hope you enjoyed your vacation last week and got the kids off to school smoothly this week.

If reviewing our proposed terms of reference of the TIS, I've attached an email received from the Ministry this morning. The Ministry notes that "the land is located outside [the] Ministry's permit control area as a result the proponent will not require MTO Building and Land Use Permit. We do not need to be circulated any further regarding this proposal."

As a result, I think it would be appropriate to remove the Waterdown Road and Highway 403 Eastbound Off-Ramp intersection from the study area.

The client has also now provided an estimated build-out date of Year 2021.

If you would like to discuss, my contact info's below.

Thanks again.

Scott Catton, Dipl. T., C.E.T., MITE
Senior Project Manager

Paradigm Transportation Solutions Limited
5A-150 Pinebush Road, Cambridge, ON N1R 8J8
p: 905.381.2229 x302
e: scatton@ptsl.com
w: www.ptsl.com

From: Scott Catton
Sent: Wednesday, 29 August, 2018 09:45
To: Edgcumbe, Kaylan <Kaylan.Edgcumbe@burlington.ca>; McBride, Connor (MTO) <Connor.McBride@ontario.ca>
Subject: 180222 (26-28, 64-66 Masonry Court TIS) Terms of Reference

Good morning Kaylan & Connor
We've been retained to prepare the TIS for the development of 26-28, 64-66 Masonry Court in the City of Burlington. The site is proposed to consist of a 6-storey residential apartment building containing approximately 169 units. Access is proposed by two (2) driveway connections to Masonry Court. No vehicular access is proposed to Clearview Avenue and St. Matthews Avenue. A total of 214 parking spaces are proposed (163 underground spaces and 51 surface spaces).

Our proposed Terms of Reference for the study and the site concept plan can be found attached. Would you kindly review and provide comment at your earliest convenience?

Can you also provide input/data for the following items?

- Availability of TMC data for the study area intersections.
- Existing signal timing data (where applicable) for the study area intersections
- Generalized growth rate. Previous studies in the area have assumed 1.00 percent.
- Development applications to include in the traffic forecast
- Comment on mobility hub mode split target(s).

If you have any questions or require any additional information, please feel free to contact me. Thank you.

Scott Catton, Dipl. T., C.E.T., MITE
Senior Project Manager

Paradigm Transportation Solutions Limited
5A-150 Pinebush Road, Cambridge, ON L1R 8J8
p: 905.381.2229 x302
e: scatton@ptsl.com
w: www.ptsl.com

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Scott Catton

From: Ozimkovic , Danijel <Danijel.Ozimkovic@burlington.ca>
Sent: Friday, 14 September, 2018 10:44 AM
To: Scott Catton
Subject: RE: 180222 (26-28, 64-66 Masonry Court TIS) Terms of Reference

Categories: Comments

Hi Scott,
Sorry I forgot to mention, please add the intersection of Plains/Cooke to the study area.
Have a great weekend.

Dan Ozimkovic, C.E.T
Transportation Planning Technologist
Transportation Services
City of Burlington
(905) 335-7671 ext. 7485
danijel.ozimkovic@burlington.ca

From: Ozimkovic , Danijel
Sent: Friday, September 14, 2018 10:35 AM
To: 'Scott Catton'
Cc: Jokic, Bojan; Popovich, Bobby
Subject: RE: 180222 (26-28, 64-66 Masonry Court TIS) Terms of Reference

Hi Scott,
My answers are below in red.
Have a great weekend.
Thanks,
Dan

Can you please comment on the following items?

- Study area intersection for analysis (adjusted to remove the MTO ramps). Looks good to me.
  - Masonry Court and Waterdown Road;
  - Masonry Court and Cooke Boulevard;
  - Waterdown Road and Plains Road; and
  - Masonry Court and the proposed site driveways.
- Horizon years to assess
  - MTO requires Opening date (Year 2021), five-years post build-out and ten-years post build-out. However, the TIS is not required by the MTO as it is outside the permit control area.
  - Will the City accept a five-year horizon post build-out (Year 2026)? Yes, the City will accept a five-year horizon post build-out
- Availability of TMC data for the study area intersections. My coworker Bojan will be able to let you know what counts we have for this area.
  - I'm anticipating having to collect new data.
- Can you please provide the existing signal timing data (where applicable) for the study area intersections? My coworker Bobby will be able to provide you with the existing signal timing data

- Generalized growth rate.
    - Previous studies in the area have assumed a 1.00 percent growth rate. Is this rate appropriate?
      Yes, 1% growth rate is appropriate.
- Development applications to include in the traffic forecast Looks good to me
    - Previous studies in the area have included the following development applications:
        - Aldershot GO Station parking Lot Expansion;
        - 35 Plains Rd E;
        - 40, 46 & 50 Plains Rd E;
        - 101 Masonry Crt Phase 1;
        - 53 & 71 Plains Road East;
        - 70 Plains Rd West (site is built-out and would be captured by new TMC data); and
        - 1200 King Road (Phase 1).
- Has the City developed a mode split target for the Aldershot Mobility hub? Please assume 28% for modal split
    - Metrolinx's Mobility Hub Guidelines suggests 10-25 percent for Regional Rail hubs.
      http://www.metrolinx.com/mobilityhubs/en/defining/defining.aspx

Dan Ozimkovic, C.E.T
Transportation Planning Technologist
Transportation Services
City of Burlington
(905) 335-7671 ext. 7485
danijel.ozimkovic@burlington.ca

From: Scott Catton [mailto:scatton@ptsl.com]
Sent: Tuesday, September 11, 2018 10:59 AM
To: Ozimkovic , Danijel
Subject: RE: 180222 (26-28, 64-66 Masonry Court TIS) Terms of Reference

Perfect. Thanks Dan.

Scott Catton, Dipl. T., C.E.T., MITE
Senior Project Manager

Paradigm Transportation Solutions Limited
5A-150 Pinebush Road, Cambridge, ON N1R 8J8
p: 905.381.2229 x302
e: scatton@ptsl.com
w: www.ptsl.com

From: Ozimkovic , Danijel <Danijel.Ozimkovic@burlington.ca>
Sent: Tuesday, 11 September, 2018 10:57
To: Scott Catton <scatton@ptsl.com>
Subject: RE: 180222 (26-28, 64-66 Masonry Court TIS) Terms of Reference

Hi Scott,

Hope you are doing well.
Just letting you know that I will review the TofR that you prepared and get back to you within couple of days.
Thanks,
Dan Ozimkovic, C.E.T
Transportation Planning Technologist
Transportation Services
City of Burlington
(905) 335-7671 ext. 7485
danijel.ozimkovic@burlington.ca

From: Scott Catton <scatton@ptsl.com>
Sent: Monday, September 10, 2018 3:24 PM
To: Edgcumbe, Kaylan <Kaylan.Edgcumbe@burlington.ca>
Cc: Ozimkovic , Danijel <Danijel.Ozimkovic@burlington.ca>; Lawrence, Morgan (MTO) <Morgan.Lawrence@ontario.ca>
Subject: RE: 180222 (26-28, 64-66 Masonry Court TIS) Terms of Reference

Afternoon Kaylan
We will include the site traffic forecast to/from the Waterdown Road interchange. We won't provide any capacity analysis for the various interchange intersections as you've noted below.

Can you please comment on the following items?

- Study area intersection for analysis (adjusted to remove the MTO ramps).
  - Masonry Court and Waterdown Road;
  - Masonry Court and Cooke Boulevard;
  - Waterdown Road and Plains Road; and
  - Masonry Court and the proposed site driveways.
- Horizon years to assess
  - MTO requires Opening date (Year 2021), five-years post build-out and ten-years post build-out. However, the TIS is not required by the MTO as it is outside the permit control area.
  - Will the City accept a five-year horizon post build-out (Year 2026)?
- Availability of TMC data for the study area intersections.
  - I'm anticipating having to collect new data.
- Can you please provide the existing signal timing data (where applicable) for the study area intersections?
- Generalized growth rate.
  - Previous studies in the area have assumed a 1.00 percent growth rate. Is this rate appropriate?
- Development applications to include in the traffic forecast
  - Previous studies in the area have included the following development applications:
    - Aldershot GO Station parking Lot Expansion;
    - 35 Plains Rd E;
    - 40, 46 & 50 Plains Rd E;
    - 101 Masonry Crt Phase 1;
    - 53 & 71 Plains Road East;
    - 70 Plains Rd West (site is built-out and would be captured by new TMC data); and
    - 1200 King Road (Phase 1).
- Has the City developed a mode split target for the Aldershot Mobility hub?
  - Metrolinx's Mobility Hub Guidelines suggests 10-25 percent for Regional Rail hubs. http://www.metrolinx.com/mobilityhubs/en/defining/defining.aspx

Thanks very much.

Scott Catton, Dipl. T., C.E.T., MITE

Senior Project Manager

Paradigm Transportation Solutions Limited
5A-150 Pinebush Road, Cambridge, ON N1R 8J8
p: 905.381.2229 x302
e: scatton@ptsl.com
w: www.ptsl.com

From: Edgcumbe, Kaylan <Kaylan.Edgcumbe@burlington.ca>
Sent: Monday, 10 September, 2018 10:53
To: Scott Catton <scatton@ptsl.com>
Cc: Ozimkovic , Danijel <Danijel.Ozimkovic@burlington.ca>; 'Lawrence, Morgan (MTO)' <Morgan.Lawrence@ontario.ca>
Subject: RE: 180222 (26-28, 64-66 Masonry Court TIS) Terms of Reference

Hi Scott,

There is significant work being undertaken through this corridor through the QEW prosperity corridor study and future works which will be looking at the interchange. Although the Ministry doesn't need to issue a building permit, I'd still like to see trip assignment extended to the 403 ramps for the purposes of informing the modeling work as part of the QEW prosperity work. No need to analyze the ramps, but it would be helpful to see trip assignments.

Thanks,

Kaylan

Kaylan Edgcumbe, C.E.T.
Manager, Transportation Planning and Parking
Transportation Services Department

From: Scott Catton <scatton@ptsl.com>
Sent: Wednesday, September 05, 2018 10:53 AM
To: Edgcumbe, Kaylan <Kaylan.Edgcumbe@burlington.ca>
Subject: RE: 180222 (26-28, 64-66 Masonry Court TIS) Terms of Reference

Good morning Kaylan,
Hope you enjoyed your vacation last week and got the kids off to school smoothly this week.

If reviewing our proposed terms of reference of the TIS, I've attached an email received from the Ministry this morning. The Ministry notes that "the land is located outside [the] Ministry's permit control area as a result the proponent will not require MTO Building and Land Use Permit. We do not need to be circulated any further regarding this proposal."

As a result, I think it would be appropriate to remove the Waterdown Road and Highway 403 Eastbound Off-Ramp intersection from the study area.

The client has also now provided an estimated build-out date of Year 2021.

If you would like to discuss, my contact info's below.

Thanks again.

Scott Catton, Dipl. T., C.E.T., MITE
Senior Project Manager

Paradigm Transportation Solutions Limited
5A-150 Pinebush Road, Cambridge, ON N1R 8J8
p: 905.381.2229 x302
e: scatton@ptsl.com
w: www.ptsl.com

From: Scott Catton
Sent: Wednesday, 29 August, 2018 09:45
To: Edgcumbe, Kaylan <Kaylan.Edgcumbe@burlington.ca>; McBride, Connor (MTO) <Connor.McBride@ontario.ca>
Subject: 180222 (26-28, 64-66 Masonry Court TIS) Terms of Reference

Good morning Kaylan & Connor
We've been retained to prepare the TIS for the development of 26-28, 64-66 Masonry Court in the City of Burlington. The site is proposed to consist of a 6-storey residential apartment building containing approximately 169 units. Access is proposed by two (2) driveway connections to Masonry Court. No vehicular access is proposed to Clearview Avenue and St. Matthews Avenue. A total of 214 parking spaces are proposed (163 underground spaces and 51 surface spaces).

Our proposed Terms of Reference for the study and the site concept plan can be found attached. Would you kindly review and provide comment at your earliest convenience?

Can you also provide input/data for the following items?

- Availability of TMC data for the study area intersections.
- Existing signal timing data (where applicable) for the study area intersections
- Generalized growth rate. Previous studies in the area have assumed 1.00 percent.
- Development applications to include in the traffic forecast
- Comment on mobility hub mode split target(s).

If you have any questions or require any additional information, please feel free to contact me. Thank you.

Scott Catton, Dipl. T., C.E.T., MITE
Senior Project Manager

Paradigm Transportation Solutions Limited
5A-150 Pinebush Road, Cambridge, ON L1R 8J8
p: 905.381.2229 x302
e: scatton@ptsl.com
w: www.ptsl.com

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Appendix B

Existing Count Data

Masonry Crt @ Waterdown Rd

Morning Peak Diagram

Specified Period
From: 7:00:00
To: 10:00:00

One Hour Peak
From: 7:00:00
To: 8:00:00

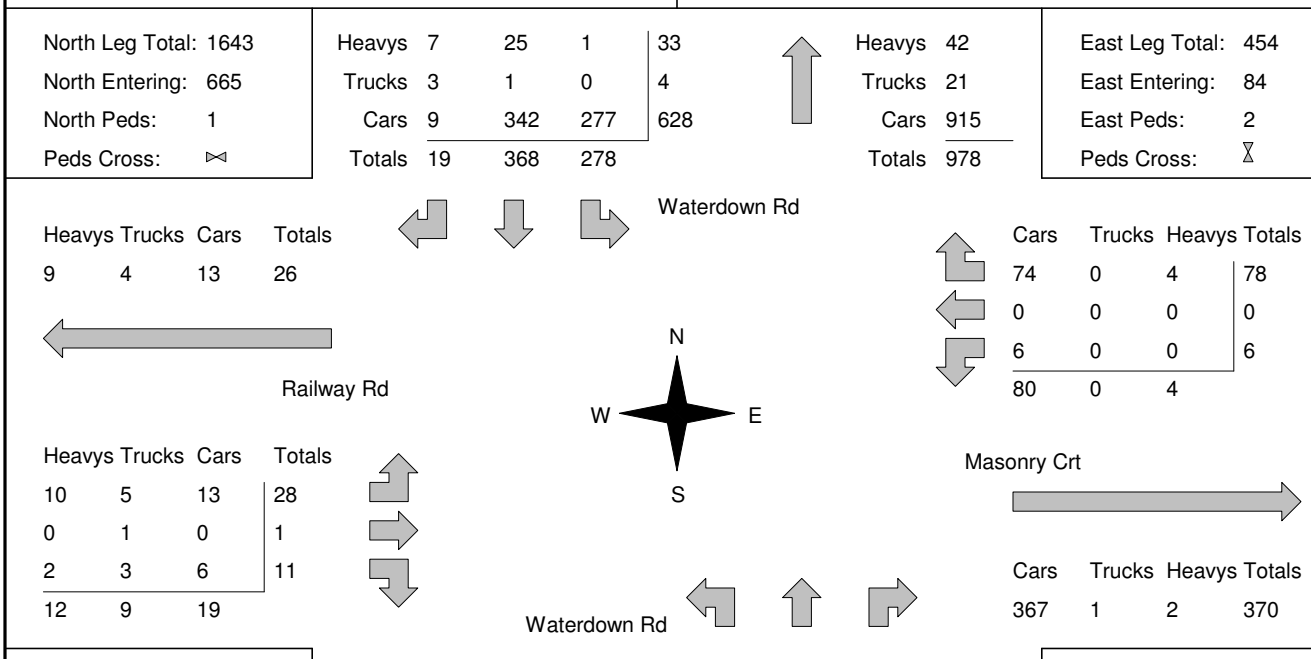
Municipality: Burlington
Site #: 0000000001
Intersection: Waterdown Rd & Masonry Crt
TFR File #: 1
Count date: 20-Sep-2018

Weather conditions:
Cloudy/Dry

Person(s) who counted:
Cam

**** Signalized Intersection ****

Major Road: Waterdown Rd runs N/S



Comments

Masonry Crt @ Waterdown Rd

Mid-day Peak Diagram

Specified Period
From: 11:00:00
To: 13:00:00

One Hour Peak
From: 11:45:00
To: 12:45:00

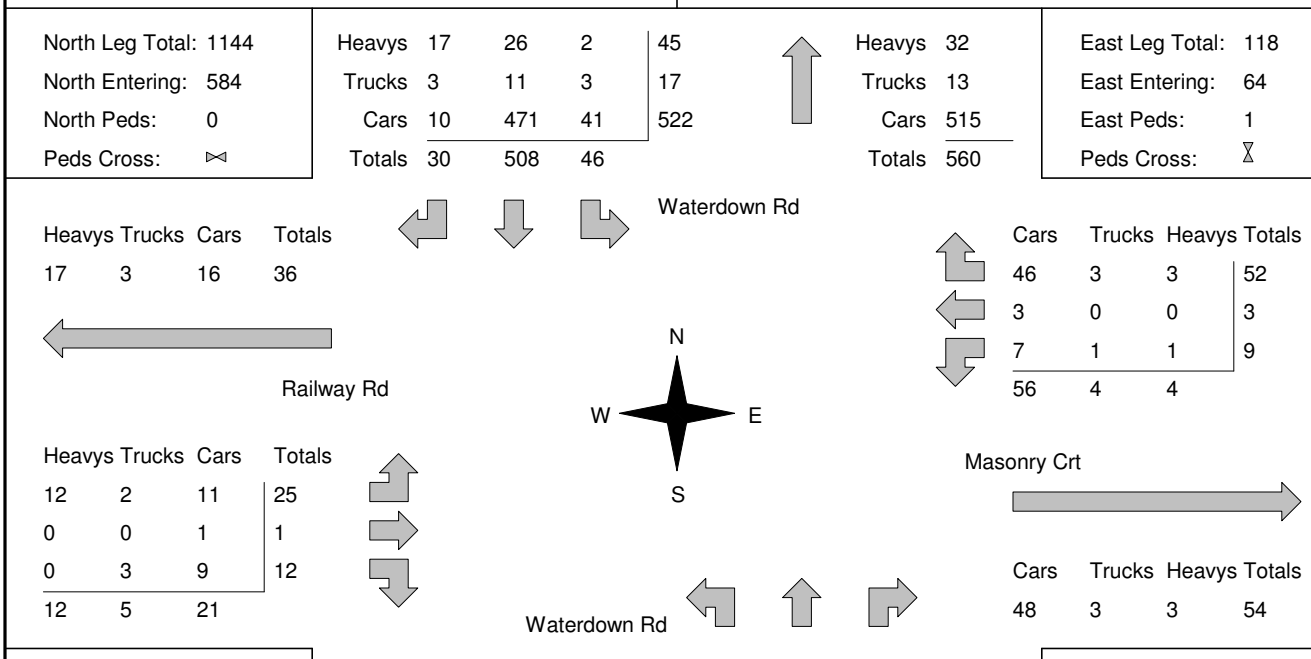
Municipality: Burlington
Site #: 0000000001
Intersection: Waterdown Rd & Masonry Crt
TFR File #: 1
Count date: 20-Sep-2018

Weather conditions:
Cloudy/Dry

Person(s) who counted:
Cam

**** Signalized Intersection ****

Major Road: Waterdown Rd runs N/S



Comments

Masonry Crt @ Waterdown Rd

Afternoon Peak Diagram

Specified Period
From: 15:00:00
To: 18:00:00

One Hour Peak
From: 16:30:00
To: 17:30:00

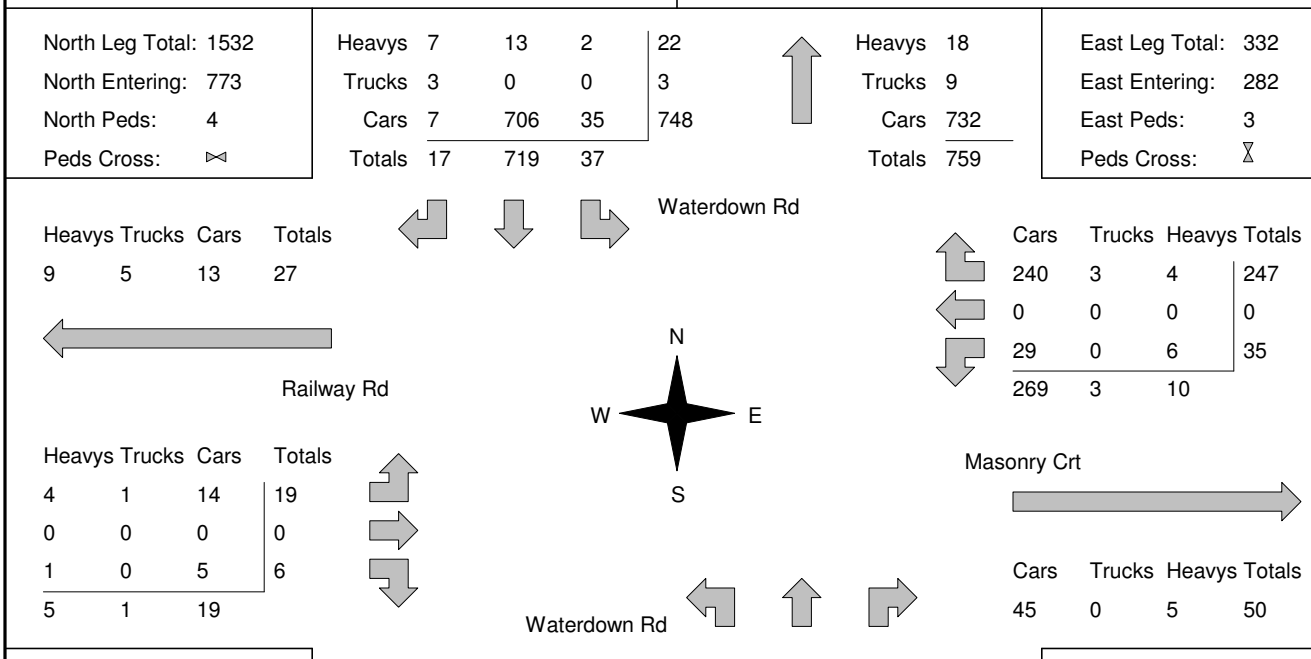
Municipality: Burlington
Site #: 0000000001
Intersection: Waterdown Rd & Masonry Crt
TFR File #: 1
Count date: 20-Sep-2018

Weather conditions:
Cloudy/Dry

Person(s) who counted:
Cam

**** Signalized Intersection ****

Major Road: Waterdown Rd runs N/S



Comments

Masonry Crt @ Waterdown Rd

Total Count Diagram

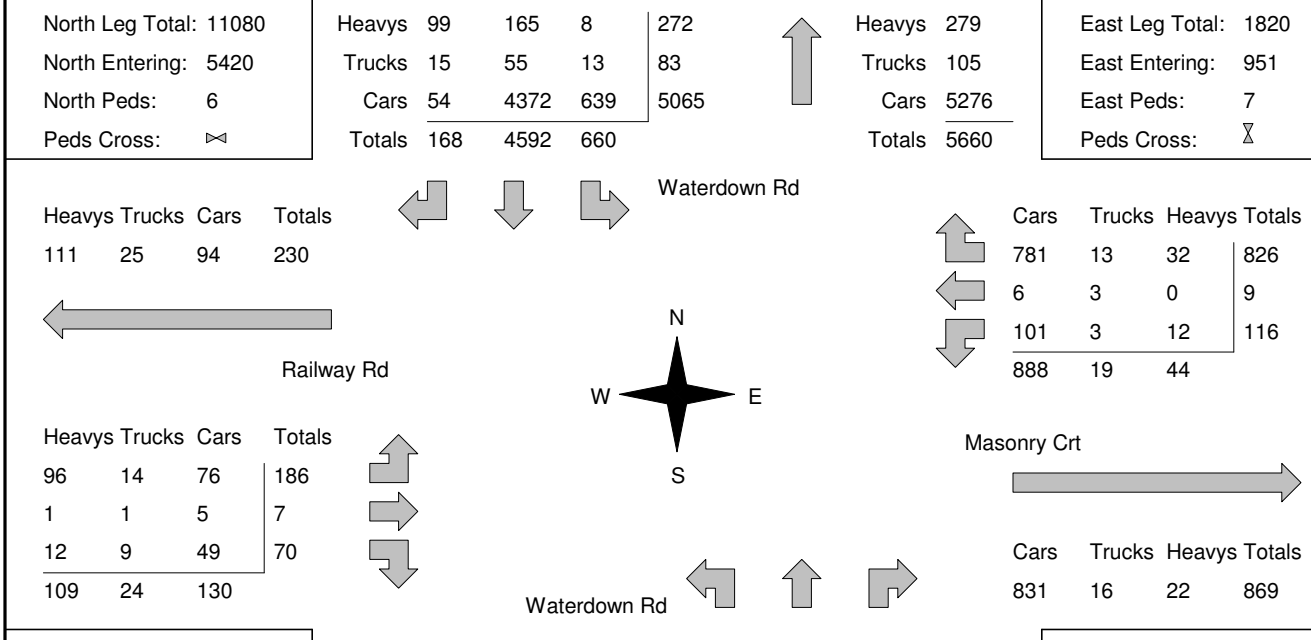
Municipality: Burlington
Site #: 0000000001
Intersection: Waterdown Rd & Masonry Crt
TFR File #: 1
Count date: 20-Sep-2018

Weather conditions:
Cloudy/Dry

Person(s) who counted:
Cam

**** Signalized Intersection ****

Major Road: Waterdown Rd runs N/S



Comments

Plains Rd @ Waterdown Rd

Morning Peak Diagram

Specified Period
From: 7:00:00
To: 10:00:00

One Hour Peak
From: 7:15:00
To: 8:15:00

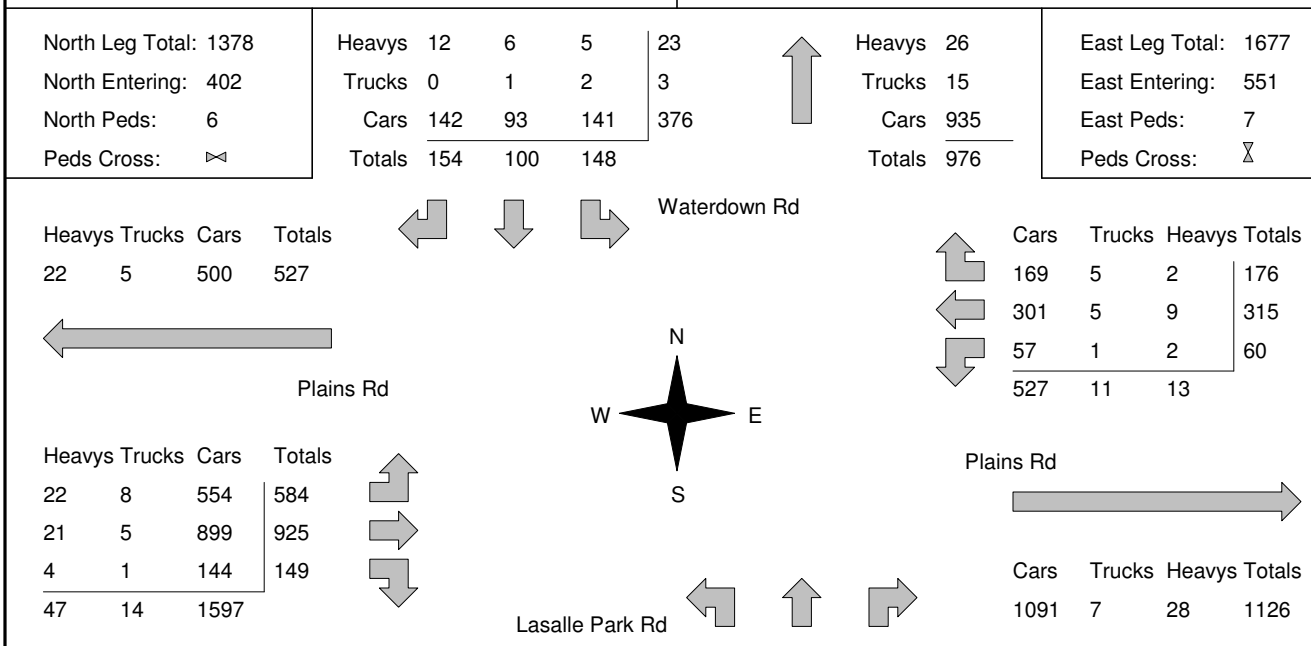
Municipality: Burlington
Site #: 0000000003
Intersection: Plains Rd & Waterdown Rd
TFR File #: 3
Count date: 20-Sep-2018

Weather conditions:
Cloudy/Dry

Person(s) who counted:
Cam

**** Signalized Intersection ****

Major Road: Plains Rd runs W/E



Comments

Plains Rd @ Waterdown Rd

Mid-day Peak Diagram

Specified Period
From: 11:00:00
To: 13:00:00

One Hour Peak
From: 12:00:00
To: 13:00:00

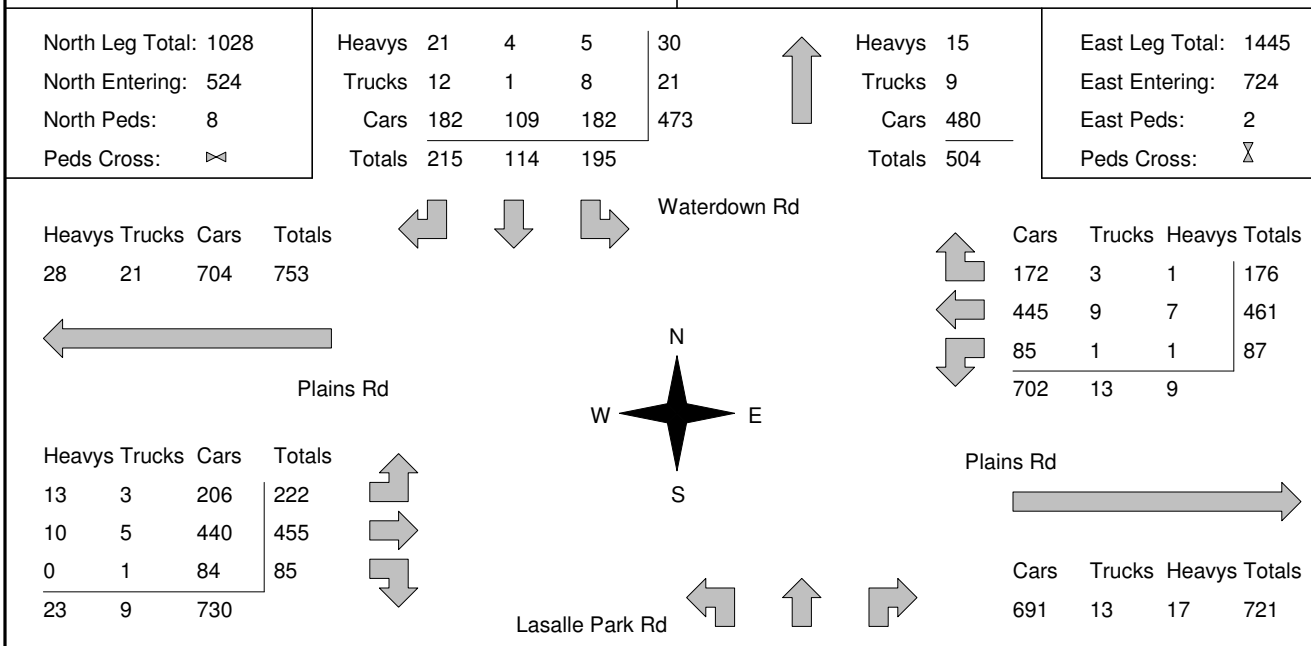
Municipality: Burlington
Site #: 0000000003
Intersection: Plains Rd & Waterdown Rd
TFR File #: 3
Count date: 20-Sep-2018

Weather conditions:
Cloudy/Dry

Person(s) who counted:
Cam

**** Signalized Intersection ****

Major Road: Plains Rd runs W/E



Comments

Plains Rd @ Waterdown Rd

Afternoon Peak Diagram

Specified Period
From: 15:00:00
To: 18:00:00

One Hour Peak
From: 16:45:00
To: 17:45:00

Municipality: Burlington
Site #: 0000000003
Intersection: Plains Rd & Waterdown Rd
TFR File #: 3
Count date: 20-Sep-2018

Weather conditions:
Cloudy/Dry

Person(s) who counted:
Cam

**** Signalized Intersection ****

Major Road: Plains Rd runs W/E

North Leg Total:	1263			
North Entering:	768			
North Peds:	3			
Peds Cross:	⋈			
Heavys	16	0	1	17
Trucks	1	0	0	1
Cars	390	154	206	750
Totals	407	154	207	
Heavys	13			
Trucks	5			
Cars	477			
Totals	495			
East Leg Total:	1992			
East Entering:	1223			
East Peds:	2			
Peds Cross:	⧖			

Waterdown Rd

Heavys	Trucks	Cars	Totals
22	13	1507	1542

Cars	Trucks	Heavys	Totals
164	1	5	170
981	9	6	996
56	0	1	57
1201	10	12	

Plains Rd

N
W E
S

Heavys	Trucks	Cars	Totals
8	1	183	192
4	1	510	515
0	2	93	95
12	4	786	

Plains Rd

Cars	Trucks	Heavys	Totals
763	1	5	769

Lasalle Park Rd

Peds Cross:	⧖			
West Peds:	12			
West Entering:	802			
West Leg Total:	2344			
Cars	303			
Trucks	2			
Heavys	1			
Totals	306			
Cars	136	130	47	313
Trucks	3	3	0	6
Heavys	0	0	0	0
Totals	139	133	47	
Peds Cross:	⋈			
South Peds:	19			
South Entering:	319			
South Leg Total:	625			

Comments

Plains Rd @ Waterdown Rd

Total Count Diagram

Municipality: Burlington
Site #: 0000000003
Intersection: Plains Rd & Waterdown Rd
TFR File #: 3
Count date: 20-Sep-2018

Weather conditions:
Cloudy/Dry

Person(s) who counted:
Cam

**** Signalized Intersection ****

Major Road: Plains Rd runs W/E

North Leg Total:	9663			
North Entering:	4756			
North Peds:	60			
Peds Cross:	⋈			
Heavys	131	17	43	191
Trucks	30	13	27	70
Cars	1885	983	1627	4495
Totals	2046	1013	1697	
Heavys	174			
Trucks	80			
Cars	4653			
Totals	4907			
East Leg Total:	12933			
East Entering:	6278			
East Peds:	37			
Peds Cross:	⧖			

Waterdown Rd

Heavys	Trucks	Cars	Totals
226	89	6887	7202

Cars	Trucks	Heavys	Totals
1301	27	26	1354
4284	53	84	4421
490	7	6	503
6075	87	116	

Plains Rd

N
W E
S

Heavys	Trucks	Cars	Totals
131	39	2160	2330
88	33	4391	4512
17	8	682	707
236	80	7233	

Plains Rd

Cars	Trucks	Heavys	Totals
6455	61	139	6655

Lasalle Park Rd

Peds Cross:	⧖			
West Peds:	113			
West Entering:	7549			
West Leg Total:	14751			
Cars	2155			
Trucks	28			
Heavys	40			
Totals	2223			
Cars	718	1192	437	2347
Trucks	6	14	1	21
Heavys	11	17	8	36
Totals	735	1223	446	
Peds Cross:	⋈			
South Peds:	117			
South Entering:	2404			
South Leg Total:	4627			

Comments

Masonry Crt @ Cooke Blvd

Morning Peak Diagram

Specified Period
From: 7:00:00
To: 10:00:00

One Hour Peak
From: 7:00:00
To: 8:00:00

Municipality: Burlington
Site #: 0000000002
Intersection: Masonry Crt & Cooke Blvd
TFR File #: 2
Count date: 20-Sep-2018

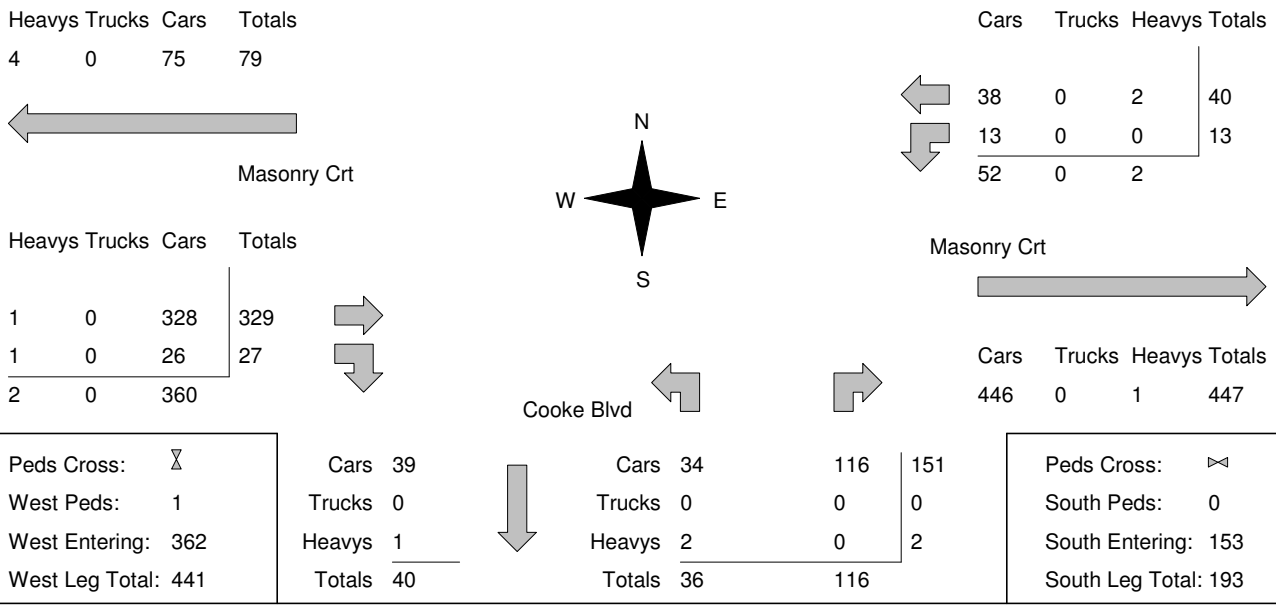
Weather conditions:
Cloudy/Dry

Person(s) who counted:
Cam

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

Major Road: Masonry Crt runs W/E

East Leg Total: 501
East Entering: 54
East Peds: 7
Peds Cross: ⧖



Peds Cross: ⧖
West Peds: 1
West Entering: 362
West Leg Total: 441

Cars 39
Trucks 0
Heavys 1
Totals 40

Cars 34 116 151
Trucks 0 0 0
Heavys 2 0 2
Totals 36 116

Peds Cross: ⋈
South Peds: 0
South Entering: 153
South Leg Total: 193

Comments

Masonry Crt @ Cooke Blvd

Mid-day Peak Diagram

Specified Period
From: 11:00:00
To: 13:00:00

One Hour Peak
From: 12:00:00
To: 13:00:00

Municipality: Burlington
Site #: 0000000002
Intersection: Masonry Crt & Cooke Blvd
TFR File #: 2
Count date: 20-Sep-2018

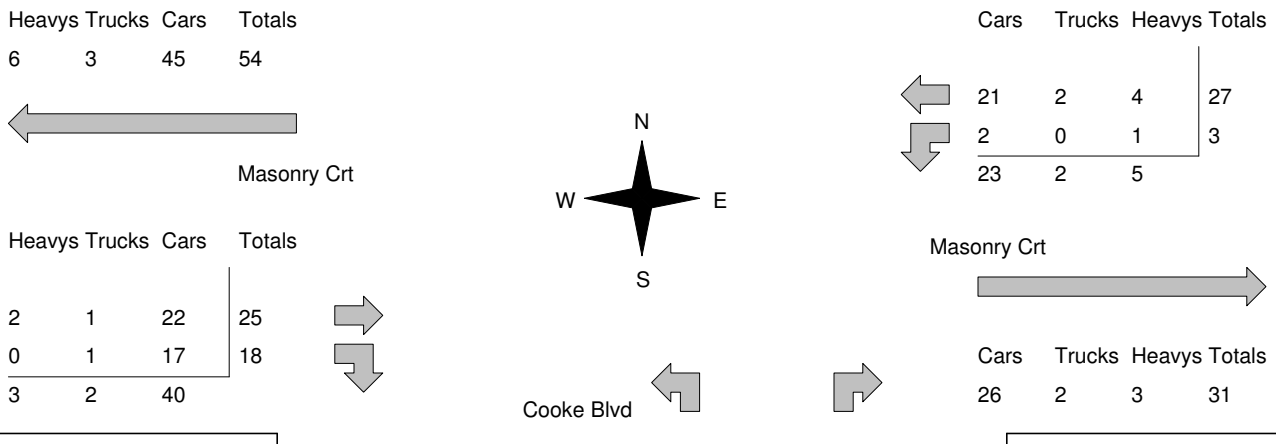
Weather conditions:
Cloudy/Dry

Person(s) who counted:
Cam

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

Major Road: Masonry Crt runs W/E

East Leg Total: 61
East Entering: 30
East Peds: 8
Peds Cross:



Peds Cross:
West Peds: 0
West Entering: 45
West Leg Total: 99

Cars 24
Trucks 1
Heavys 1
Totals 26

Cars 22 4 30
Trucks 1 0 2
Heavys 2 0 2
Totals 25 4

Peds Cross:
South Peds: 1
South Entering: 34
South Leg Total: 60

Comments

Masonry Crt @ Cooke Blvd

Afternoon Peak Diagram

Specified Period
From: 15:00:00
To: 18:00:00

One Hour Peak
From: 16:45:00
To: 17:45:00

Municipality: Burlington
Site #: 0000000002
Intersection: Masonry Crt & Cooke Blvd
TFR File #: 2
Count date: 20-Sep-2018

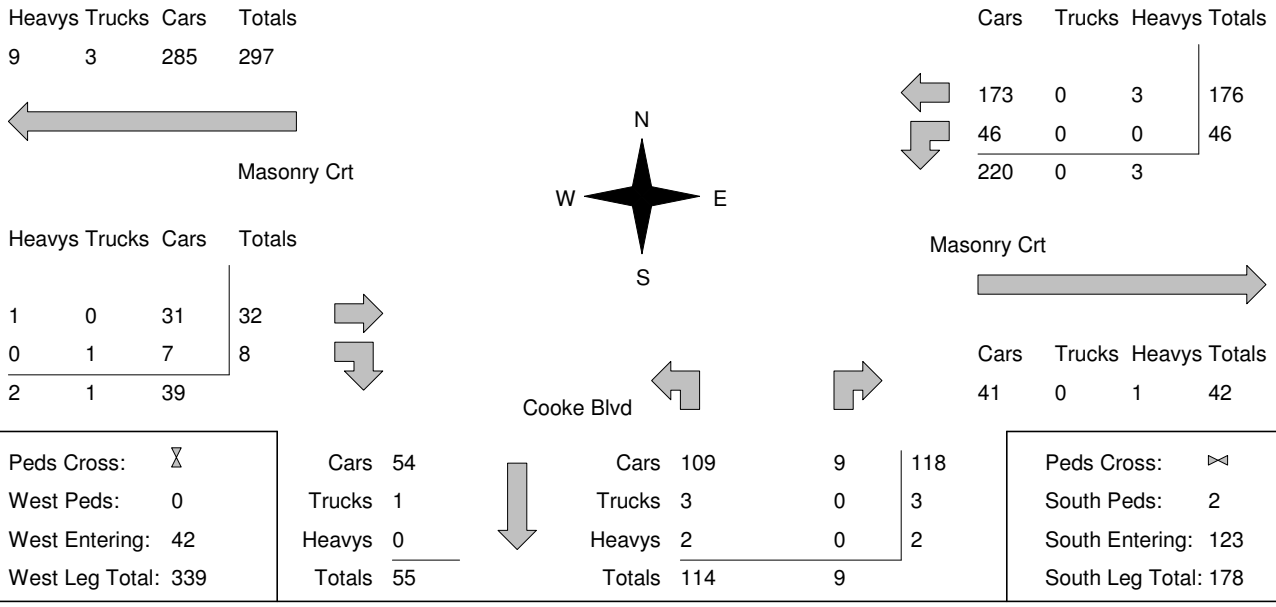
Weather conditions:
Cloudy/Dry

Person(s) who counted:
Cam

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

Major Road: Masonry Crt runs W/E

East Leg Total: 265
East Entering: 223
East Peds: 3
Peds Cross:



Peds Cross:
West Peds: 0
West Entering: 42
West Leg Total: 339

Cars 54
Trucks 1
Heavys 0
Totals 55

Cars 109 9 118
Trucks 3 0 3
Heavys 2 0 2
Totals 114 9

Peds Cross:
South Peds: 2
South Entering: 123
South Leg Total: 178

Comments

Masonry Crt @ Cooke Blvd

Total Count Diagram

Municipality: Burlington
Site #: 0000000002
Intersection: Masonry Crt & Cooke Blvd
TFR File #: 2
Count date: 20-Sep-2018

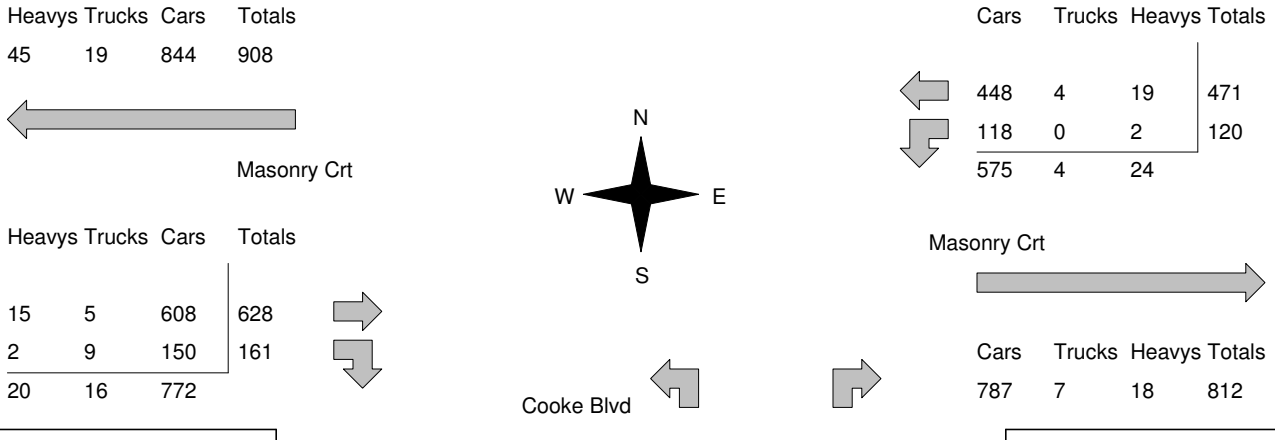
Weather conditions:
Cloudy/Dry

Person(s) who counted:
Cam

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

Major Road: Masonry Crt runs W/E

East Leg Total: 1415
East Entering: 603
East Peds: 28
Peds Cross: ⧖



Peds Cross: ⧖
West Peds: 3
West Entering: 808
West Leg Total: 1716

Cars 279
Trucks 9
Heavys 4
Totals 292

Cars 373 173 555
Trucks 15 1 17
Heavys 19 2 21
Totals 407 176

Peds Cross: ⋈
South Peds: 9
South Entering: 593
South Leg Total: 885

Comments

Plains Rd @ Cooke Blvd

Morning Peak Diagram

Specified Period
From: 7:00:00
To: 10:00:00

One Hour Peak
From: 7:30:00
To: 8:30:00

Municipality: Burlington
Site #: 0000000004
Intersection: Plains Rd & Cooke Blvd
TFR File #: 4
Count date: 20-Sep-2018

Weather conditions:
Cloudy/Dry

Person(s) who counted:
Cam

**** Signalized Intersection ****

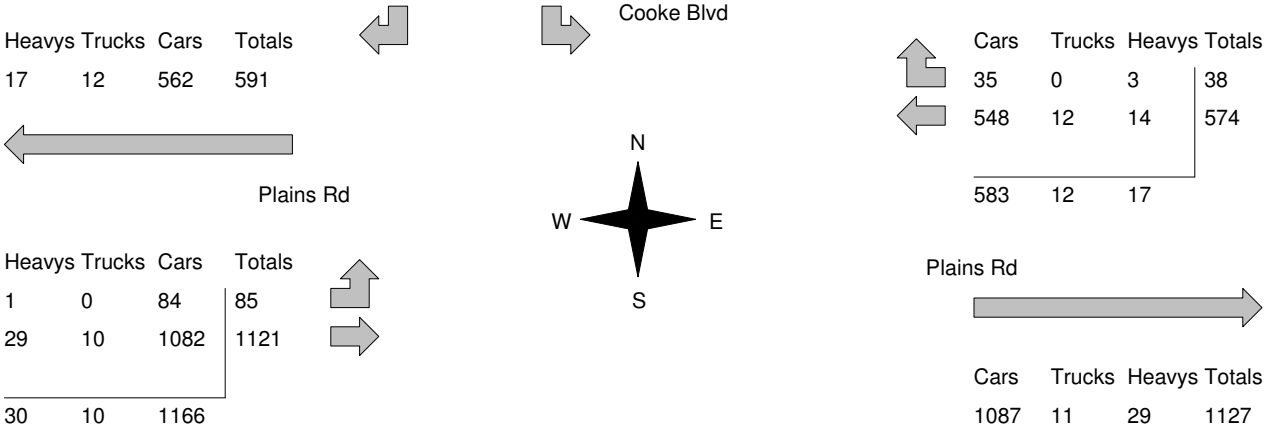
Major Road: Plains Rd runs W/E

North Leg Total: 146
North Entering: 23
North Peds: 4
Peds Cross: ⋈

Heavys	3	0	3
Trucks	0	1	1
Cars	14	5	19
Totals	17	6	

Heavys	4
Trucks	0
Cars	119
Totals	123

East Leg Total: 1739
East Entering: 612
East Peds: 2
Peds Cross: ⧖



Peds Cross: ⧖
West Peds: 3
West Entering: 1206
West Leg Total: 1797

Comments

Plains Rd @ Cooke Blvd

Mid-day Peak Diagram

Specified Period
From: 11:00:00
To: 13:00:00

One Hour Peak
From: 12:00:00
To: 13:00:00

Municipality: Burlington
Site #: 0000000004
Intersection: Plains Rd & Cooke Blvd
TFR File #: 4
Count date: 20-Sep-2018

Weather conditions:
Cloudy/Dry

Person(s) who counted:
Cam

**** Signalized Intersection ****

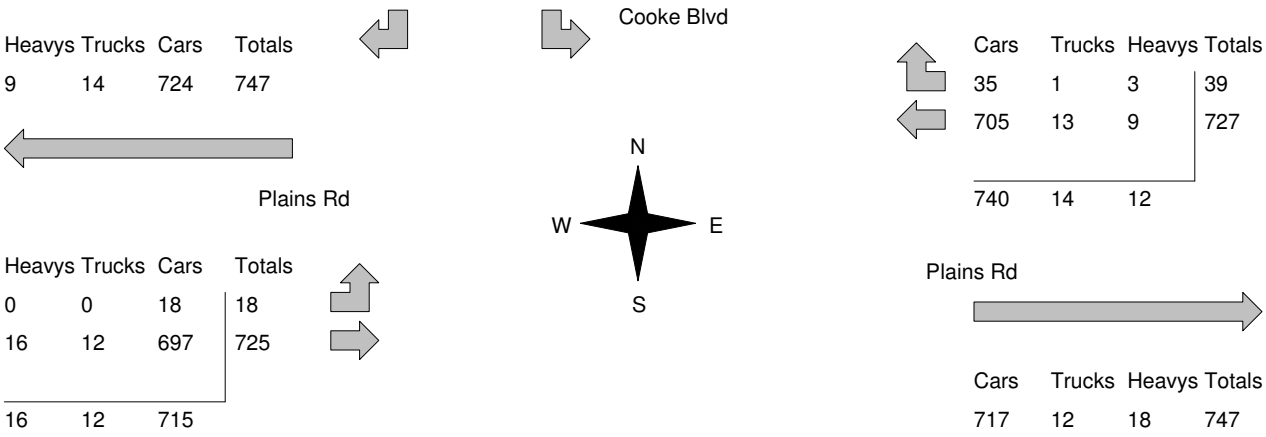
Major Road: Plains Rd runs W/E

North Leg Total: 99
North Entering: 42
North Peds: 15
Peds Cross: ⋈

Heavys	0	2	2
Trucks	1	0	1
Cars	19	20	39
Totals	20	22	

Heavys	3
Trucks	1
Cars	53
Totals	57

East Leg Total: 1513
East Entering: 766
East Peds: 8
Peds Cross: ⧖



Peds Cross: ⧖
West Peds: 17
West Entering: 743
West Leg Total: 1490

Comments

Plains Rd @ Cooke Blvd

Afternoon Peak Diagram

Specified Period
From: 15:00:00
To: 18:00:00

One Hour Peak
From: 16:45:00
To: 17:45:00

Municipality: Burlington
Site #: 0000000004
Intersection: Plains Rd & Cooke Blvd
TFR File #: 4
Count date: 20-Sep-2018

Weather conditions:
Cloudy/Dry

Person(s) who counted:
Cam

**** Signalized Intersection ****

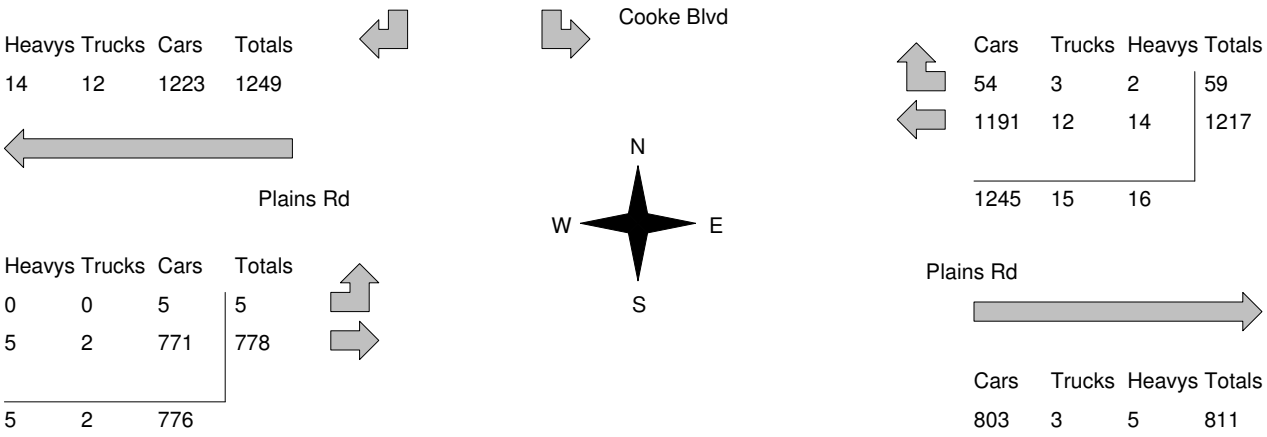
Major Road: Plains Rd runs W/E

North Leg Total: 129
North Entering: 65
North Peds: 5
Peds Cross: ⋈

Heavys	0	0	0
Trucks	0	1	1
Cars	32	32	64
Totals	32	33	

Heavys	2
Trucks	3
Cars	59
Totals	64

East Leg Total: 2087
East Entering: 1276
East Peds: 0
Peds Cross: ⧖



Peds Cross: ⧖
West Peds: 4
West Entering: 783
West Leg Total: 2032

Comments

Plains Rd @ Cooke Blvd

Total Count Diagram

Municipality: Burlington
Site #: 0000000004
Intersection: Plains Rd & Cooke Blvd
TFR File #: 4
Count date: 20-Sep-2018

Weather conditions:
Cloudy/Dry

Person(s) who counted:
Cam

**** Signalized Intersection ****

Major Road: Plains Rd runs W/E

North Leg Total:	817		
North Entering:	317		
North Peds:	74		
Peds Cross:	⋈		

Heavys	5	3	8
Trucks	1	7	8
Cars	162	139	301
Totals	168	149	

Heavys	25
Trucks	9
Cars	466
Totals	500

East Leg Total:	13478
East Entering:	6585
East Peds:	21
Peds Cross:	⧖

Cooke Blvd

Heavys	Trucks	Cars	Totals
110	86	6272	6468

Cars	Trucks	Heavys	Totals
254	9	22	285
6110	85	105	6300
6364	94	127	

Plains Rd

N
W E
S

Heavys	Trucks	Cars	Totals
3	0	212	215
135	64	6545	6744
138	64	6757	

Plains Rd

Cars	Trucks	Heavys	Totals
6684	71	138	6893

Peds Cross:	⧖
West Peds:	44
West Entering:	6959
West Leg Total:	13427

Comments

Intersection Name:	TS ID:	Line No:	Model:	IP address:	Controller Make:
Plains Road @ Cooke Blvd	117	4	ACS/3	172.22.15.2	Econolite

Type of Operation: 8 Phase Semi-Actuated

*-Start from Main Menu

No	Date			Description	Prepared by
	Y	M	D		BP
4	2016	12	20	Timings updated - Plains Road Optimization	

PHASE DESCRIPTION

Ph1		Ph5	EBLT - Plains Road
Ph2	EB - Plains Road	Ph6	WB - Plains Road
Ph3		Ph7	
Ph4	NB - Driveway	Ph8	SB - Cooke Blvd

PHASE IN USE/EXCLUSIVE PED (MM) *- 1 - 2

Phase:	1	2	3	4	5	6	7	8
Phase in Use		X		X	X	X		X
Exclusive PED								

CONTROLLER TIMING DATA - VEHICLE TIMING * - 2 - 1

Timing Plan: 1

	Phase: 1	2	3	4	5	6	7	8
Minimum Green		8		8	6	8		8
Walk		8		8		8		8
Ped. Clearance		11		14		11		14
Pedestrian Carry Over								
Vehicle Extension		3		3	3	3		3
MAX 1		40		30	10	40		30
MAX 2		40		30	10	40		30
Yellow Change		4		4	3	4		4
Red Clearance		3		3		3		3
Phase Minimum:	1	27	1	30	10	27	1	30

PHASE DATA - VEHICLE AND PEDESTRIAN RECALLS * - 2 - 8

Phase:	1	2	3	4	5	6	7	8
Lock Detector								
Vehicle Recall								
Pedestrian Recall		X				X		
MAX Recall		X				X		
Min Recall								

COORDINATION: COORDINATOR PATTERN, SPLIT PATTERN *** - 3 - 2, - 3 - 3**

Coordinator Pattern (CP)	Cycle Length	Offset (sec)	Timing Plan	Split Pattern	Phases (sec)							
					1	2	3	4	5	6	7	8
1	100	20	1	1		68		32	15	53		32
2	90	84	1	2		52		38	12	40		38
3	100	30	1	3		68		32	16	52		32
4	85	52	1	4		55		30	12	43		30
10	0	0	1	10		0		0	0	0		0

TIME BASE: ACTION PLAN, DAY PLAN *** - 5 - 2, - 5 - 3, -5 - 4**

Day Plan	Sched. #	Action Plan	Time Period	Pattern	Timing Plan	
1	1	4	06:00	4	1	
1	1	1	07:00	1	1	Schedule 1 = Day Plan 1
1	1	2	09:00	2	1	Schedule 2 = Day Plan 2
1	1	3	15:30	3	1	Schedule 3 = Day Plan 3
1	1	4	19:00	4	1	
1	1	10	22:00	254	1	Day Plan 1 (Weekday)
2	2	4	08:00	4	1	Day Plan 2 (Saturday)
2	2	3	10:30	3	1	Day Plan 3 (Sunday, Holidays)
2	2	4	17:00	4	1	
2	2	10	21:00	254	1	Action Plan 10 = free (254)
3	3	4	09:30	4	1	
3	3	2	12:00	2	1	
3	3	4	17:00	4	1	
3	3	10	21:00	254	1	

Special Programming:

Intersection Name:	TS ID:	Line No:	Model:	IP address:	Controller Make:
Plains Road @ Waterdown Rd	100	4	ACS/3	172.22.7.2	Econolite

Type of Operation: 8 Phase Semi-Actuated

*-Start from Main Menu

No	Date			Description	Prepared by
	Y	M	D		BP
7	2018	7	4	Reverted back to original after faulty camera repaired (July 3, 2018)	

PHASE DESCRIPTION

Ph1	WBLT - Plains Road	Ph5	EBLT - Plains Road
Ph2	EB - Plains Road	Ph6	WB - Plains Road
Ph3	SBLT - Waterdown Road	Ph7	NBLT - Waterdown Road
Ph4	NB - Waterdown Road	Ph8	SB - Waterdown Road

PHASE IN USE/EXCLUSIVE PED (MM) *- 1 - 2

Phase:	1	2	3	4	5	6	7	8
Phase in Use	X	X	X	X	X	X	X	X
Exclusive PED								

CONTROLLER TIMING DATA - VEHICLE TIMING * - 2 - 1

Timing Plan: 1

	Phase: 1	2	3	4	5	6	7	8
Minimum Green	6	8	6	8	6	8	6	8
Walk		8		10		8		10
Ped. Clearance		13		17		13		17
Pedestrian Carry Over								
Vehicle Extension	3	3	3	3	3	3	3	3
MAX 1	12	35	12	25	12	35	12	25
MAX 2	12	35	12	25	12	35	12	25
Yellow Change	3	4	3	4	3	4	3	4
Red Clearance		2		2		2		2
Phase Minimum:	10	28	10	34	10	28	10	34

PHASE DATA - VEHICLE AND PEDESTRIAN RECALLS * - 2 - 8

Phase:	1	2	3	4	5	6	7	8
Lock Detector								
Vehicle Recall								
Pedestrian Recall		X				X		
MAX Recall		X				X		
Min Recall								

COORDINATION: COORDINATOR PATTERN, SPLIT PATTERN *** - 3 - 2, - 3 - 3**

Coordinator Pattern (CP)	Cycle Length	Offset (sec)	Timing Plan	Split Pattern	Phases (sec)							
					1	2	3	4	5	6	7	8
1	110	0	1	1	12	51	13	34	32	31	10	37
2	90	84	1	2	12	34	10	34	14	32	10	34
3	100	37	1	3	12	42	20	26	18	36	10	36
4	85	52	1	4	12	30	10	33	14	28	10	33
10	0	0	1	10	0	0	0	0	0	0		

TIME BASE: ACTION PLAN, DAY PLAN *** - 5 - 2, - 5 - 3, -5 - 4**

Day Plan	Sched. #	Action Plan	Time Period	Pattern	Timing Plan
1	1	4	06:00	4	1
1	1	1	07:00	1	1
1	1	2	09:00	2	1
1	1	3	15:30	3	1
1	1	4	19:00	4	1
1	1	10	22:00	254	1
2	2	4	08:00	4	1
2	2	3	10:30	3	1
2	2	4	17:00	4	1
2	2	10	21:00	254	1
3	3	4	09:30	4	1
3	3	2	12:00	2	1
3	3	4	17:00	4	1
3	3	10	21:00	254	1

Schedule 1 = Day Plan 1
Schedule 2 = Day Plan 2
Schedule 3 = Day Plan 3

Day Plan 1 (Weekday)
Day Plan 2 (Saturday)
Day Plan 3 (Sunday, Holidays)

Action Plan 10 = free (254)

Special Programming:

Intersection Name:	TS ID:	Line No:	Model:	IP address:	Controller Make:
Waterdown Rd @ Masonry Crt	104	4	ACS/3	172.22.8.2	Econolite

Type of Operation: 8 Phase Semi-Actuated

*-Start from Main Menu

No	Date			Description	Prepared by
	Y	M	D		BP
8	2017	12	19	Timings reverted back to original	

PHASE DESCRIPTION

Ph1	SBL - Waterdown Road	Ph5	
Ph2	NB - Waterdown Road	Ph6	SB - Waterdown Road
Ph3		Ph7	
Ph4	EB - Railway Road	Ph8	WB - Masonry Court

PHASE IN USE/EXCLUSIVE PED (MM) *- 1 - 2

Phase:	1	2	3	4	5	6	7	8
Phase in Use	X	X		X		X		X
Exclusive PED								

CONTROLLER TIMING DATA - VEHICLE TIMING * - 2 - 1

Timing Plan: 1	Phase: 1	2	3	4	5	6	7	8
Minimum Green	8	8		8		8		8
Walk		15		8		15		8
Ped. Clearance		14		14		14		14
Pedestrian Carry Over								
Vehicle Extension	3	3		5		3		5
MAX 1	15	40		30		40		30
MAX 2	15	40		30		40		30
Yellow Change	3	4		4		4		4
Red Clearance	0	2		3		2		3
Phase Minimum:	**12**	**36**	**1**	**30**	**1**	**36**	**1**	**30**

PHASE DATA - VEHICLE AND PEDESTRIAN RECALLS * - 2 - 8

Phase:	1	2	3	4	5	6	7	8
Lock Detector								
Vehicle Recall								
Pedestrian Recall		X				X		

MAX Recall		X				X		
Min Recall								

COORDINATION: COORDINATOR PATTERN, SPLIT PATTERN *** - 3 - 2, - 3 - 3**

Coordinator Pattern (CP)	Cycle Length	Offset (sec)	Timing Plan	Split Pattern	Phases (sec)							
					1	2	3	4	5	6	7	8
1	100	22	1	1	18	42		40		60		40
2	0	0	0	0	0	0		0		0		0
3	110	72	1	3	18	60		32		78		32
10	0	0	1	10	0	0		0		0		0

TIME BASE: ACTION PLAN, DAY PLAN *** - 5 - 2, - 5 - 3, -5 - 4**

Day Plan	Sched. #	Action Plan	Time Period	Pattern	Timing Plan	
1	1	1	06:00	1	1	
1	1	10	09:00	254	1	
1	1	3	15:30	3	1	Schedule 1 = Day Plan 1
1	1	10	19:00	254	1	Schedule 2 = Day Plan 2
2	2	1	09:00	1	1	Schedule 3 = Day Plan 3
2	2	10	18:00	254	1	
3	3	1	9:00	1	1	Day Plan 1 (Weekday)
3	3	10	18:00	254	1	Day Plan 2 (Saturday)
						Day Plan 3 (Sunday, Holidays)
						Action Plan 10 = free (254)

Special Programming:

AM Outbound

```
Thu Sep 13 2018 09:53:39 GMT-0400 (Eastern Daylight Time) - Run Time: 2813ms

Cross Tabulation Query Form - Trip - 2016 v1.1

Row: 2006 GTA zone of destination - gta06_dest
Column: 2006 GTA zone of origin - gta06_orig
Table: No. of trips made by household - n_hhld_trip

RowG:
ColG:(4050,4051,4052,4053,4053,4054,4055,4057,4058,4088,4091,4092)
TblG:(0-99)

Filters:
Primary travel mode of trip - mode_prime In D,M,P,T,U
and
Start time of trip - start_time In 700-900

Trip 2016
Table: 1

,1
50,21
57,5
59,17
157,17
218,26
270,18
313,10
356,27
430,19
3195,40
3325,61
3328,29
3421,14
3495,35
3612,24
3618,60
3621,55
3631,48
3633,55
3636,16
3646,18
3648,23
3700,18
3703,25
3720,15
3721,75
3809,10
3821,40
3847,40
3851,45
3863,21
3870,13
4002,160
4003,91
4004,13
4008,116
4009,9
4011,65
4012,30
4014,62
4015,40
4016,17
4018,58
4022,24
4023,36
4027,68
4029,76
4030,50
4033,17
4035,23
4037,18
4041,107
4042,40
4050,46
4051,390
4052,111
4053,322
4054,68
4056,89
4057,121
4058,23
4059,541
4060,173
4061,103
4062,149
4063,312
4064,134
4065,49
4067,32
4068,273
4069,153
4071,90
4074,78
4075,41
4076,47
4077,195
4078,266
4079,57
4080,134
4081,110
4082,201
4083,71
4084,88
4086,31
4087,78
4088,223
4089,172
4090,47
4091,205
4092,13
4093,38
4097,29
4110,21
4122,30
4124,38
4125,25
4168,35
4183,61
4185,33
4186,29
4187,17
4188,8
4190,166
4193,8
5032,106
5036,30
5039,13
5043,33
5060,18
5075,24
5087,33
5088,34
5092,80
5093,11
5108,123
5113,11
5119,16
5125,23
5130,27
5131,88
5135,71
5137,51
5139,15
5142,106
5144,8
5147,26
5148,80
5159,18
5172,21
5173,29
5176,33
5184,43
5185,20
5190,11
5191,18
5193,54
5194,71
5195,103
5196,12
5197,24
5198,237
5199,38
5201,23
5202,24
5205,25
5208,56
5223,15
5229,59
5230,18
5232,33
5234,51
5235,30
5248,42
5251,17
6002,16
6094,12
6131,32
6163,13
6191,18
6212,59
6323,34
6337,29
6346,19
7021,25
7235,36
7353,12
7372,23
8066,32
8070,12
8108,16
8907,27
9032,20
9065,29
9066,32
9998,118
```

PM Outbound

```
Thu Sep 13 2018 09:54:57 GMT-0400 (Eastern Daylight Time) - Run Time: 2675ms

Cross Tabulation Query Form - Trip - 2016 v1.1

Row: 2006 GTA zone of destination - gta06_dest
Column: 2006 GTA zone of origin - gta06_orig
Table: No. of trips made by household - n_hhld_trip

RowG:
ColG:(4050,4051,4052,4053,4053,4054,4055,4057,4058,4088,4091,4092)
TblG:(0-99)

Filters:
Primary travel mode of trip - mode_prime In D,M,P,T,U
and
Start time of trip - start_time In 1600-1800

Trip 2016
Table: 1

,1
34,20
37,15
313,20
1203,27
2378,16
2863,22
3196,7
3420,37
3432,39
3481,21
3633,9
3647,15
3653,35
3663,8
3679,14
3683,25
3809,42
3810,12
3813,15
3879,3
4001,17
4002,11
4003,27
4011,10
4012,15
4018,15
4037,63
4038,6
4039,11
4041,96
4045,67
4050,55
4051,340
4052,134
4053,426
4054,244
4055,607
4056,75
4057,488
4058,87
4059,254
4060,396
4061,142
4062,243
4063,125
4064,183
4065,55
4066,37
4067,275
4068,149
4069,134
4072,15
4073,22
4074,134
4075,23
4076,35
4077,37
4078,50
4079,189
4080,53
4081,33
4082,30
4083,76
4084,148
4086,212
4087,31
4088,435
4089,378
4090,103
4091,101
4092,45
4093,24
4097,11
4098,20
4105,30
4120,42
4124,14
4127,20
4140,50
4145,41
4160,22
4163,30
4183,23
4186,71
4189,99
4190,195
4191,29
5005,68
5020,31
5032,19
5036,18
5041,90
5044,185
5059,78
5066,28
5073,97
5076,11
5078,19
5080,11
5082,86
5092,35
5095,54
5096,36
5099,36
5100,26
5104,30
5105,11
5112,36
5114,34
5115,30
5116,82
5117,22
5121,120
5122,56
5123,96
5126,67
5150,144
5151,147
5153,8
5154,25
5157,53
5158,50
5165,99
5172,10
5175,17
5178,16
5179,211
5181,39
5182,30
5183,36
5186,14
5190,35
5191,24
5194,18
5196,31
5199,89
5200,113
5203,73
5205,8
5207,101
5208,12
5212,40
5223,43
5224,20
5225,45
5227,11
5229,107
5230,170
5231,32
5232,39
5233,30
5236,77
5241,178
5249,26
5250,27
5252,34
6001,34
6004,21
6005,22
6010,21
6015,24
6023,31
6026,33
6027,50
6044,17
6057,49
6067,6
6144,34
6201,19
6257,50
6354,12
6359,66
6360,12
7225,25
7278,25
7321,4
7409,24
```

```
7415,25
7481,38
7524,22
8003,13
8010,19
8062,10
8118,93
8365,18
8369,11
8711,56
8901,87
8905,64
8906,20
8913,8
8918,49
8935,6
8947,7
8950,4
8960,28
```

AM Inbound

```
Thu Sep 13 2018 09:55:37 GMT-
0400 (Eastern Daylight Time) -
Run Time: 2553ms

Cross Tabulation Query Form -
Trip - 2016 v1.1

Row: 2006 GTA zone of origin -
gta06_orig
Column: 2006 GTA zone of
destination - gta06_dest
Table: No. of trips made by
household - n_hhld_trip

RowG:
ColG:(4050,4051,4052,4053,4053,4
054,4055,4057,4058,4088,4091,409
2)
TblG:(0-99)

Filters:
Primary travel mode of trip -
mode_prime In D,M,P,T,U
and
Start time of trip - start_time
In 700-900

Trip 2016
Table: 1

,1
171,7
284,10
495,14
1203,27
2378,16
2863,22
3376,8
3378,29
3432,25
3481,21
3602,29
3607,14
3610,24
3640,15
3653,35
3724,38
3809,21
3810,35
3820,18
3879,10
4001,17
4002,32
4004,13
4011,20
4031,13
4036,9
4037,63
4038,6
4039,11
4050,181
4051,198
4052,81
4053,59
4054,138
4055,248
4056,10
4057,137
4058,113
4059,250
4060,86
4061,74
4062,114
4063,14
4064,52
4066,16
4067,17
4068,51
4069,81
4070,39
4072,54
4074,52
4075,19
4076,14
4077,7
4078,97
4079,168
4080,44
4083,45
4084,311
4085,112
4086,13
4087,44
4088,121
4089,209
4090,84
4091,147
4092,98
4093,10
4094,9
4097,15
4098,16
4099,5
4105,15
4119,23
4127,20
4140,24
4163,30
4186,45
4188,8
4189,82
4190,206
4191,14
5032,212
5044,166
5059,78
5066,47
5073,97
5078,40
5080,11
5082,86
5089,34
5090,93
5095,27
5096,36
5098,97
5099,11
5104,51
5105,35
5106,8
5108,71
5111,46
5113,11
5114,34
5115,21
5116,82
5121,120
5122,56
5123,143
5144,66
5150,144
5151,39
5158,67
5164,75
5165,99
5182,30
5183,36
5194,27
5195,51
5199,89
5200,51
5203,54
5205,75
5207,132
5214,19
5215,27
5223,62
5225,45
5229,144
5230,91
5233,57
5241,178
5247,14
5250,27
6004,19
6005,29
6010,22
6019,22
6057,49
6067,6
6109,33
6144,34
6354,12
6360,12
7024,29
7101,19
7256,16
7278,25
7409,24
7479,25
8010,19
8365,18
8906,20
8913,8
8947,8
8950,4
8960,28
9061,25
9998,14
```

PM Inbound

```
Thu Sep 13 2018 09:55:53 GMT-0400 (Eastern Daylight Time) - Run Time: 2684ms

Cross Tabulation Query Form - Trip - 2016 v1.1

Row: 2006 GTA zone of origin - gta06_orig
Column: 2006 GTA zone of destination - gta06_dest
Table: No. of trips made by household - n_hhld_trip

RowG:
ColG:(4050,4051,4052,4053,4053,4054,4055,4057,4058,4088,4091,4092)
TblG:(0-99)

Filters:
Primary travel mode of trip - mode_prime In D,M,P,T,U
and
Start time of trip - start_time In 1600-1800

Trip 2016
Table: 1

,1
34,27
57,5
63,113
310,23
313,23
346,10
357,69
358,11
367,33
391,9
494,13
2020,17
2081,13
2374,18
3609,16
3612,24
3618,60
3621,55
3627,27
3631,32
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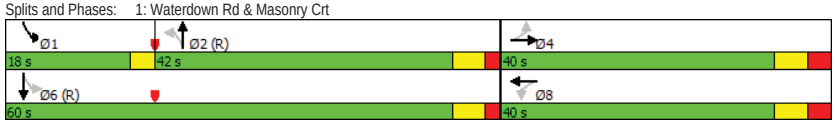
Appendix C

Existing Traffic Operational Conditions

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	28	1	6	0	7	872	278	368
Future Volume (vph)	28	1	6	0	7	872	278	368
Turn Type	Perm	NA	Perm	NA	Perm	NA	pm+pt	NA
Protected Phases		4		8		2	1	6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	1	6
Switch Phase								
Minimum Initial (s)	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Minimum Split (s)	40.0	40.0	40.0	40.0	42.0	42.0	18.0	60.0
Total Split (s)	40.0	40.0	40.0	40.0	42.0	42.0	18.0	60.0
Total Split (%)	40.0%	40.0%	40.0%	40.0%	42.0%	42.0%	18.0%	60.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	3.0	4.0
All-Red Time (s)	3.0	3.0	3.0	3.0	2.0	2.0	0.0	2.0
Lost Time Adjust (s)		-3.0	-3.0	-3.0	-2.0	-2.0	1.0	-2.0
Total Lost Time (s)		4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag					Lag	Lag	Lead	
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	C-Max	C-Max	None	C-Max
Act Effct Green (s)		12.7	12.7	12.7	61.9	61.9	82.3	83.1
Actuated g/C Ratio		0.13	0.13	0.13	0.62	0.62	0.82	0.83
v/c Ratio		0.35	0.03	0.16	0.02	0.48	0.55	0.15
Control Delay		38.4	37.0	0.7	11.6	13.2	7.7	2.5
Queue Delay		0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		38.4	37.0	0.7	11.6	13.2	7.7	2.5
LOS		D	D	A	B	B	A	A
Approach Delay		38.4		3.2		13.1		4.7
Approach LOS		D		A		B		A

Intersection Summary		
Cycle Length: 100		
Actuated Cycle Length: 100		
Offset: 22 (22%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green		
Natural Cycle: 100		
Control Type: Actuated-Coordinated		
Maximum v/c Ratio: 0.55		
Intersection Signal Delay: 10.0	Intersection LOS: B	
Intersection Capacity Utilization 61.4%	ICU Level of Service B	
Analysis Period (min) 15		

Splits and Phases: 1: Waterdown Rd & Masonry Crt



Lane Group	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	42	6	82	7	1014	293	407
v/c Ratio	0.35	0.03	0.16	0.02	0.48	0.55	0.15
Control Delay	38.4	37.0	0.7	11.6	13.2	7.7	2.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	38.4	37.0	0.7	11.6	13.2	7.7	2.5
Queue Length 50th (m)	5.7	1.1	0.0	0.5	57.3	10.5	7.1
Queue Length 95th (m)	15.9	4.7	0.0	3.1	94.4	28.5	14.0
Internal Link Dist (m)	128.3		126.0		326.0		176.0
Turn Bay Length (m)		30.0		25.0		20.0	
Base Capacity (vph)	320	533	770	407	2106	546	2724
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.13	0.01	0.11	0.02	0.48	0.54	0.15

Intersection Summary

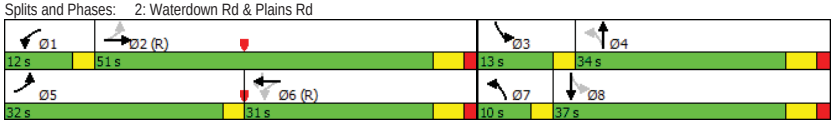
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	28	1	11	6	0	78	7	872	91	278	368	19
Future Volume (vph)	28	1	11	6	0	78	7	872	91	278	368	19
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.6	3.5	3.3	3.6	3.5	3.3	3.6	3.5	3.3	3.6	3.5
Total Lost time (s)		4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor		1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frpb, ped/bikes		1.00		1.00	0.99		1.00	1.00		1.00	1.00	
Flpb, ped/bikes		1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt		0.96		1.00	0.85		1.00	0.99		1.00	0.99	
Flt Protected		0.97		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1157		1745	1518		1219	3394		1745	3276	
Flt Permitted		0.73		0.81	1.00		0.51	1.00		0.21	1.00	
Satd. Flow (perm)		870		1482	1518		658	3394		379	3276	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	29	1	12	6	0	82	7	918	96	293	387	20
RTOR Reduction (vph)	0	11	0	0	73	0	0	5	0	0	2	0
Lane Group Flow (vph)	0	31	0	6	9	0	7	1009	0	293	405	0
Confl. Peds. (#/hr)	1					1	1		2	2		1
Heavy Vehicles (%)	54%	100%	45%	0%	0%	5%	43%	5%	1%	0%	7%	53%
Turn Type	Perm	NA		Perm	NA		Perm	NA		pm+pt	NA	
Protected Phases		4			8			2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		8.1		8.1	8.1		58.5	58.5		78.9	78.9	
Effective Green, g (s)		11.1		11.1	11.1		60.5	60.5		77.9	80.9	
Actuated g/C Ratio		0.11		0.11	0.11		0.60	0.60		0.78	0.81	
Clearance Time (s)		7.0		7.0	7.0		6.0	6.0		3.0	6.0	
Vehicle Extension (s)		3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		96		164	168		398	2053		519	2650	
v/s Ratio Prot					0.01			0.30		c0.09	0.12	
v/s Ratio Perm		c0.04		0.00			0.01			c0.35		
v/c Ratio		0.33		0.04	0.05		0.02	0.49		0.56	0.15	
Uniform Delay, d1		41.0		39.7	39.8		7.9	11.1		6.1	2.1	
Progression Factor		1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		2.0		0.1	0.1		0.1	0.8		1.4	0.1	
Delay (s)		43.0		39.8	39.9		8.0	11.9		7.5	2.2	
Level of Service		D		D	D		A	B		A	A	
Approach Delay (s)		43.0			39.9			11.9			4.4	
Approach LOS		D			D			B			A	

Intersection Summary				
HCM 2000 Control Delay	11.1	HCM 2000 Level of Service	B	
HCM 2000 Volume to Capacity ratio	0.53			
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0	
Intersection Capacity Utilization	61.4%	ICU Level of Service	B	
Analysis Period (min)	15			
c Critical Lane Group				

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations									
Traffic Volume (vph)	584	925	60	315	58	216	148	100	154
Future Volume (vph)	584	925	60	315	58	216	148	100	154
Turn Type	pm+pt	NA	pm+pt	NA	pm+pt	NA	pm+pt	NA	custom
Protected Phases	5	2	1	6	7	4	3	8	
Permitted Phases	2		6		4		8		6
Detector Phase	5	2	1	6	7	4	3	8	6
Switch Phase									
Minimum Initial (s)	6.0	8.0	6.0	8.0	6.0	8.0	6.0	8.0	8.0
Minimum Split (s)	32.0	51.0	12.0	31.0	10.0	34.0	13.0	37.0	31.0
Total Split (s)	32.0	51.0	12.0	31.0	10.0	34.0	13.0	37.0	31.0
Total Split (%)	29.1%	46.4%	10.9%	28.2%	9.1%	30.9%	11.8%	33.6%	28.2%
Yellow Time (s)	3.0	4.0	3.0	4.0	3.0	4.0	3.0	4.0	4.0
All-Red Time (s)	0.0	2.0	0.0	2.0	0.0	2.0	0.0	2.0	2.0
Lost Time Adjust (s)	1.0	-2.0	1.0	-2.0	1.0	-2.0	1.0	-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
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?									
Recall Mode	None	C-Max	None	C-Max	None	None	None	None	C-Max
Act Effct Green (s)	65.4	56.8	33.4	27.0	29.6	23.8	35.8	28.6	27.0
Actuated g/C Ratio	0.59	0.52	0.30	0.25	0.27	0.22	0.33	0.26	0.25
v/c Ratio	1.00	0.65	0.32	0.60	0.18	0.72	0.71	0.23	0.35
Control Delay	63.0	22.9	19.7	33.3	24.9	48.5	44.1	32.9	7.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	63.0	22.9	19.7	33.3	24.9	48.5	44.1	32.9	7.4
LOS	E	C	B	C	C	D	D	C	A
Approach Delay		37.0		31.8		44.3		27.2	
Approach LOS		D		C		D		C	

Intersection Summary			
Cycle Length: 110			
Actuated Cycle Length: 110			
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green			
Natural Cycle: 110			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 1.00			
Intersection Signal Delay: 35.5		Intersection LOS: D	
Intersection Capacity Utilization 87.7%		ICU Level of Service E	
Analysis Period (min) 15			

Splits and Phases: 2: Waterdown Rd & Plains Rd





Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	621	1143	64	522	62	286	157	106	164
v/c Ratio	1.00	0.65	0.32	0.60	0.18	0.72	0.71	0.23	0.35
Control Delay	63.0	22.9	19.7	33.3	24.9	48.5	44.1	32.9	7.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	63.0	22.9	19.7	33.3	24.9	48.5	44.1	32.9	7.4
Queue Length 50th (m)	~118.3	97.7	5.8	45.3	9.6	57.9	25.7	19.2	0.0
Queue Length 95th (m)	#216.5	140.4	13.5	63.7	17.8	82.4	#39.9	32.2	17.1
Internal Link Dist (m)		176.0		136.0		176.0		326.0	
Turn Bay Length (m)	30.0		40.0		30.0				40.0
Base Capacity (vph)	621	1765	226	869	357	497	225	532	472
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	1.00	0.65	0.28	0.60	0.17	0.58	0.70	0.20	0.35

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

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



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	584	925	149	60	315	176	58	216	53	148	100	154
Future Volume (vph)	584	925	149	60	315	176	58	216	53	148	100	154
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.6	3.5	3.3	3.6	3.5	3.3	3.6	3.5	3.3	3.6	3.5
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	1.00
Frpb, ped/bikes	1.00	0.99		1.00	0.99		1.00	1.00		1.00	1.00	0.96
Flpb, ped/bikes	1.00	1.00		1.00	1.00		0.99	1.00		1.00	1.00	1.00
Frt	1.00	0.98		1.00	0.95		1.00	0.97		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1661	3399		1658	3260		1690	1794		1661	1776	1422
Flt Permitted	0.21	1.00		0.25	1.00		0.69	1.00		0.21	1.00	1.00
Satd. Flow (perm)	361	3399		434	3260		1225	1794		371	1776	1422
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	621	984	159	64	335	187	62	230	56	157	106	164
RTOR Reduction (vph)	0	10	0	0	70	0	0	9	0	0	0	125
Lane Group Flow (vph)	621	1133	0	64	452	0	62	277	0	157	106	39
Confl. Peds. (#/hr)	6		19	19		6	17		7	7		17
Heavy Vehicles (%)	5%	3%	3%	5%	4%	4%	2%	2%	4%	5%	7%	8%
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	custom
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases	2			6			4			8		6
Actuated Green, G (s)	62.8	53.6		30.6	24.4		28.0	22.4		35.2	26.6	24.4
Effective Green, g (s)	61.8	55.6		28.6	26.4		26.0	24.4		34.2	28.6	26.4
Actuated g/C Ratio	0.56	0.51		0.26	0.24		0.24	0.22		0.31	0.26	0.24
Clearance Time (s)	3.0	6.0		3.0	6.0		3.0	6.0		3.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	609	1718		170	782		308	397		218	461	341
v/s Ratio Prot	c0.32	0.33		0.02	0.14		0.01	0.15		c0.06	0.06	
v/s Ratio Perm	c0.25			0.08			0.04			c0.17		0.03
v/c Ratio	1.02	0.66		0.38	0.58		0.20	0.70		0.72	0.23	0.12
Uniform Delay, d1	27.2	20.2		31.3	36.9		33.3	39.4		30.2	32.0	32.7
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	41.5	2.0		1.4	3.1		0.3	5.3		11.1	0.3	0.7
Delay (s)	68.7	22.2		32.7	40.0		33.6	44.7		41.3	32.3	33.4
Level of Service	E	C		C	D		C	D		D	C	C
Approach Delay (s)		38.6			39.2			42.7			36.0	
Approach LOS		D			D			D			D	

Intersection Summary

HCM 2000 Control Delay	38.8	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	87.7%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	6	329	27	13	40	1	36	1	116	2	0	3
Future Volume (Veh/h)	6	329	27	13	40	1	36	1	116	2	0	3
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81
Hourly flow rate (vph)	7	406	33	16	49	1	44	1	143	2	0	4
Pedestrians		1			7						5	
Lane Width (m)		3.6			3.6						3.6	
Walking Speed (m/s)		1.2			1.2						1.2	
Percent Blockage		0			1						0	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)		150										
pX, platoon unblocked				0.98			0.98	0.98	0.98	0.98	0.98	
vC, conflicting volume	55			439			523	524	430	674	540	56
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	55			412			498	499	402	652	515	56
tC, single (s)	4.1			4.1			7.1	6.6	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.1	3.3	3.5	4.0	3.3
p0 queue free %	100			99			91	100	77	99	100	100
cM capacity (veh/h)	1556			1129			463	446	633	281	444	1012

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	446	66	188	6
Volume Left	7	16	44	2
Volume Right	33	1	143	4
cSH	1556	1129	582	542
Volume to Capacity	0.00	0.01	0.32	0.01
Queue Length 95th (m)	0.1	0.3	11.1	0.3
Control Delay (s)	0.2	2.1	14.1	11.7
Lane LOS	A	A	B	B
Approach Delay (s)	0.2	2.1	14.1	11.7
Approach LOS			B	B

Intersection Summary				
Average Delay	4.2			
Intersection Capacity Utilization	37.6%	ICU Level of Service	A	
Analysis Period (min)	15			

Lane Group	EBL	EBT	WBT	SBL
Lane Configurations				
Traffic Volume (vph)	85	1121	574	6
Future Volume (vph)	85	1121	574	6
Turn Type	pm+pt	NA	NA	Prot
Protected Phases	5	2	6	8
Permitted Phases	2			
Detector Phase	5	2	6	8
Switch Phase				
Minimum Initial (s)	6.0	8.0	8.0	8.0
Minimum Split (s)	15.0	68.0	53.0	32.0
Total Split (s)	15.0	68.0	53.0	32.0
Total Split (%)	15.0%	68.0%	53.0%	32.0%
Yellow Time (s)	3.0	4.0	4.0	4.0
All-Red Time (s)	0.0	3.0	3.0	3.0
Lost Time Adjust (s)	1.0	-3.0	-3.0	-3.0
Total Lost Time (s)	4.0	4.0	4.0	4.0
Lead/Lag	Lead		Lag	
Lead-Lag Optimize?				
Recall Mode	None	C-Max	C-Max	None
Act Effct Green (s)	89.9	92.3	83.1	11.1
Actuated g/C Ratio	0.90	0.92	0.83	0.11
v/c Ratio	0.13	0.36	0.23	0.13
Control Delay	1.7	1.7	3.2	20.0
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	1.7	1.7	3.2	20.0
LOS	A	A	A	B
Approach Delay		1.7	3.2	20.0
Approach LOS		A	A	B

Intersection Summary			
Cycle Length: 100			
Actuated Cycle Length: 100			
Offset: 20 (20%), Referenced to phase 2:EBTL and 6:WBT, Start of Green			
Natural Cycle: 100			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.36			
Intersection Signal Delay: 2.5		Intersection LOS: A	
Intersection Capacity Utilization 45.4%		ICU Level of Service A	
Analysis Period (min) 15			

Splits and Phases: 4: Plains Rd & Cooke Blvd





Lane Group	EBL	EBT	WBT	SBL
Lane Group Flow (vph)	89	1180	644	24
v/c Ratio	0.13	0.36	0.23	0.13
Control Delay	1.7	1.7	3.2	20.0
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	1.7	1.7	3.2	20.0
Queue Length 50th (m)	0.0	0.0	6.4	1.3
Queue Length 95th (m)	5.4	34.9	28.9	m6.6
Internal Link Dist (m)		136.0	176.0	326.1
Turn Bay Length (m)	40.0			
Base Capacity (vph)	733	3236	2822	442
Starvation Cap Reductn	0	314	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.12	0.40	0.23	0.05

Intersection Summary
m Volume for 95th percentile queue is metered by upstream signal.



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	85	1121	574	38	6	17
Future Volume (vph)	85	1121	574	38	6	17
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.6	3.6	3.5	3.3	3.5
Total Lost time (s)	4.0	4.0	4.0		4.0	
Lane Util. Factor	1.00	0.95	0.95		1.00	
Frpb, ped/bikes	1.00	1.00	1.00		0.99	
Flpb, ped/bikes	1.00	1.00	1.00		1.00	
Frt	1.00	1.00	0.99		0.90	
Flt Protected	0.95	1.00	1.00		0.99	
Satd. Flow (prot)	1725	3505	3394		1534	
Flt Permitted	0.38	1.00	1.00		0.99	
Satd. Flow (perm)	689	3505	3394		1534	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	89	1180	604	40	6	18
RTOR Reduction (vph)	0	0	2	0	17	0
Lane Group Flow (vph)	89	1180	642	0	7	0
Confl. Peds. (#/hr)	4			4	2	3
Heavy Vehicles (%)	1%	3%	5%	8%	17%	1%
Turn Type	pm+pt	NA	NA		Prot	
Protected Phases	5	2	6		8	
Permitted Phases	2					
Actuated Green, G (s)	82.7	82.7	74.4		3.3	
Effective Green, g (s)	81.7	85.7	77.4		6.3	
Actuated g/C Ratio	0.82	0.86	0.77		0.06	
Clearance Time (s)	3.0	7.0	7.0		7.0	
Vehicle Extension (s)	3.0	3.0	3.0		3.0	
Lane Grp Cap (vph)	607	3003	2626		96	
v/s Ratio Prot	0.01	c0.34	0.19		c0.00	
v/s Ratio Perm	0.11					
v/c Ratio	0.15	0.39	0.24		0.07	
Uniform Delay, d1	1.9	1.5	3.1		44.1	
Progression Factor	1.00	1.00	1.00		0.87	
Incremental Delay, d2	0.1	0.4	0.2		0.3	
Delay (s)	2.0	1.9	3.4		38.6	
Level of Service	A	A	A		D	
Approach Delay (s)		1.9	3.4		38.6	
Approach LOS		A	A		D	

Intersection Summary				
HCM 2000 Control Delay	2.9	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.39		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	45.4%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	19	0	35	0	10	493	37	719
Future Volume (vph)	19	0	35	0	10	493	37	719
Turn Type	Perm	NA	Perm	NA	Perm	NA	pm+pt	NA
Protected Phases		4		8		2	1	6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	1	6
Switch Phase								
Minimum Initial (s)	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Minimum Split (s)	32.0	32.0	32.0	32.0	60.0	60.0	18.0	78.0
Total Split (s)	32.0	32.0	32.0	32.0	60.0	60.0	18.0	78.0
Total Split (%)	29.1%	29.1%	29.1%	29.1%	54.5%	54.5%	16.4%	70.9%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	3.0	4.0
All-Red Time (s)	3.0	3.0	3.0	3.0	2.0	2.0	0.0	2.0
Lost Time Adjust (s)		-3.0	-3.0	-3.0	-2.0	-2.0	1.0	-2.0
Total Lost Time (s)		4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag					Lag	Lag	Lead	
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	C-Max	C-Max	None	C-Max
Act Effct Green (s)		12.6	12.6	12.6	82.8	82.8	89.4	89.4
Actuated g/C Ratio		0.11	0.11	0.11	0.75	0.75	0.81	0.81
v/c Ratio		0.26	0.27	0.44	0.03	0.20	0.06	0.27
Control Delay		7.0	49.1	2.4	5.5	4.9	2.5	2.8
Queue Delay		0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		7.0	49.1	2.4	5.5	4.9	2.5	2.8
LOS		A	D	A	A	A	A	A
Approach Delay		7.0		8.1		4.9		2.8
Approach LOS		A		A		A		A

Intersection Summary

Cycle Length: 110
Actuated Cycle Length: 110
Offset: 72 (65%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 110
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.44
Intersection Signal Delay: 4.5 — Intersection LOS: A
Intersection Capacity Utilization 55.0% — ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 1: Waterdown Rd & Masonry Crt



Lane Group	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	26	36	257	10	528	39	767
v/c Ratio	0.26	0.27	0.44	0.03	0.20	0.06	0.27
Control Delay	7.0	49.1	2.4	5.5	4.9	2.5	2.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	7.0	49.1	2.4	5.5	4.9	2.5	2.8
Queue Length 50th (m)	0.0	7.6	0.0	0.6	17.8	1.2	15.7
Queue Length 95th (m)	1.4	17.5	0.0	2.5	27.8	3.7	26.3
Internal Link Dist (m)	128.3		126.0		326.0		176.0
Turn Bay Length (m)		30.0		25.0		20.0	
Base Capacity (vph)	150	295	737	355	2612	722	2826
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.17	0.12	0.35	0.03	0.20	0.05	0.27

Intersection Summary

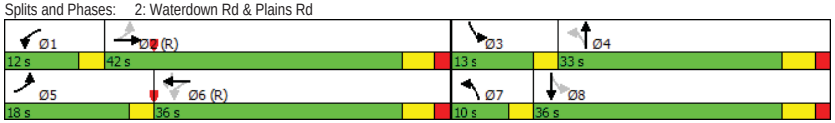
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	19	0	6	35	0	247	10	493	13	37	719	17
Future Volume (vph)	19	0	6	35	0	247	10	493	13	37	719	17
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.6	3.5	3.3	3.6	3.5	3.3	3.6	3.5	3.3	3.6	3.5
Total Lost time (s)		4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor		1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frpb, ped/bikes		1.00		1.00	0.98		1.00	1.00		1.00	1.00	
Flpb, ped/bikes		1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt		0.97		1.00	0.85		1.00	1.00		1.00	1.00	
Flt Protected		0.96		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1423		1489	1540		1245	3471		1660	3479	
Flt Permitted		0.28		0.74	1.00		0.36	1.00		0.43	1.00	
Satd. Flow (perm)		415		1160	1540		473	3471		747	3479	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	20	0	6	36	0	257	10	514	14	39	749	18
RTOR Reduction (vph)	0	23	0	0	228	0	0	1	0	0	1	0
Lane Group Flow (vph)	0	3	0	36	29	0	10	527	0	39	766	0
Confl. Peds. (#/hr)	4		1	1		4	1		3	3		1
Heavy Vehicles (%)	26%	0%	17%	17%	0%	3%	40%	3%	23%	5%	2%	59%
Turn Type	Perm	NA		Perm	NA		Perm	NA		pm+pt	NA	
Protected Phases		4			8			2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		9.6		9.6	9.6		79.6	79.6		87.4	87.4	
Effective Green, g (s)		12.6		12.6	12.6		81.6	81.6		86.4	89.4	
Actuated g/C Ratio		0.11		0.11	0.11		0.74	0.74		0.79	0.81	
Clearance Time (s)		7.0		7.0	7.0		6.0	6.0		3.0	6.0	
Vehicle Extension (s)		3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		47		132	176		350	2574		618	2827	
v/s Ratio Prot					0.02			0.15		0.00	c0.22	
v/s Ratio Perm		0.01		c0.03			0.02			0.05		
v/c Ratio		0.06		0.27	0.17		0.03	0.20		0.06	0.27	
Uniform Delay, d1		43.4		44.5	44.0		3.7	4.3		2.7	2.5	
Progression Factor		1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		0.6		1.1	0.5		0.2	0.2		0.0	0.2	
Delay (s)		44.0		45.6	44.4		3.9	4.5		2.8	2.7	
Level of Service		D		D	D		A	A		A	A	
Approach Delay (s)		44.0			44.6			4.5			2.7	
Approach LOS		D			D			A			A	

Intersection Summary			
HCM 2000 Control Delay	11.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.28		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	55.0%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations									
Traffic Volume (vph)	192	515	57	996	139	133	207	154	407
Future Volume (vph)	192	515	57	996	139	133	207	154	407
Turn Type	pm+pt	NA	pm+pt	NA	pm+pt	NA	pm+pt	NA	custom
Protected Phases	5	2	1	6	7	4	3	8	
Permitted Phases	2		6		4		8		6
Detector Phase	5	2	1	6	7	4	3	8	6
Switch Phase									
Minimum Initial (s)	6.0	8.0	6.0	8.0	6.0	8.0	6.0	8.0	8.0
Minimum Split (s)	18.0	42.0	12.0	36.0	10.0	33.0	13.0	36.0	36.0
Total Split (s)	18.0	42.0	12.0	36.0	10.0	33.0	13.0	36.0	36.0
Total Split (%)	18.0%	42.0%	12.0%	36.0%	10.0%	33.0%	13.0%	36.0%	36.0%
Yellow Time (s)	3.0	4.0	3.0	4.0	3.0	4.0	3.0	4.0	4.0
All-Red Time (s)	0.0	2.0	0.0	2.0	0.0	2.0	0.0	2.0	2.0
Lost Time Adjust (s)	1.0	-2.0	1.0	-2.0	1.0	-2.0	1.0	-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
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?									
Recall Mode	None	C-Max	None	C-Max	None	None	None	None	C-Max
Act Effct Green (s)	62.0	54.1	53.8	47.8	22.7	16.7	28.7	19.7	47.8
Actuated g/C Ratio	0.62	0.54	0.54	0.48	0.23	0.17	0.29	0.20	0.48
v/c Ratio	0.74	0.33	0.13	0.72	0.49	0.59	0.78	0.42	0.45
Control Delay	32.4	14.3	8.4	22.0	33.7	41.6	48.6	37.7	3.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	32.4	14.3	8.4	22.0	33.7	41.6	48.6	37.7	3.9
LOS	C	B	A	C	C	D	D	D	A
Approach Delay		18.6		21.3		38.2		22.7	
Approach LOS		B		C		D		C	

Intersection Summary			
Cycle Length: 100			
Actuated Cycle Length: 100			
Offset: 37 (37%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green			
Natural Cycle: 100			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.78			
Intersection Signal Delay: 22.7		Intersection LOS: C	
Intersection Capacity Utilization 79.2%		ICU Level of Service D	
Analysis Period (min) 15			

Splits and Phases: 2: Waterdown Rd & Plains Rd



Queues
2: Waterdown Rd & Plains Rd

Existing PM
180222

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	196	623	58	1189	142	184	211	157	415
v/c Ratio	0.74	0.33	0.13	0.72	0.49	0.59	0.78	0.42	0.45
Control Delay	32.4	14.3	8.4	22.0	33.7	41.6	48.6	37.7	3.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	32.4	14.3	8.4	22.0	33.7	41.6	48.6	37.7	3.9
Queue Length 50th (m)	18.3	35.2	2.6	94.8	22.1	31.5	34.4	28.3	0.0
Queue Length 95th (m)	44.0	56.0	5.5	#169.0	35.3	50.5	#54.5	44.5	19.9
Internal Link Dist (m)		176.0		136.0		176.0		326.0	
Turn Bay Length (m)	30.0		40.0		30.0				40.0
Base Capacity (vph)	326	1878	482	1654	288	532	271	608	929
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.60	0.33	0.12	0.72	0.49	0.35	0.78	0.26	0.45

Intersection Summary

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

HCM Signalized Intersection Capacity Analysis
2: Waterdown Rd & Plains Rd

Existing PM
180222

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	192	515	95	57	996	170	139	133	47	207	154	407
Future Volume (vph)	192	515	95	57	996	170	139	133	47	207	154	407
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.6	3.5	3.3	3.6	3.5	3.3	3.6	3.5	3.3	3.6	3.5
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	1.00
Frpb, ped/bikes	1.00	0.99		1.00	1.00		1.00	1.00		1.00	1.00	0.97
Flpb, ped/bikes	1.00	1.00		0.99	1.00		0.99	1.00		1.00	1.00	1.00
Frt	1.00	0.98		1.00	0.98		1.00	0.96		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1662	3450		1698	3444		1700	1792		1744	1900	1491
Flt Permitted	0.10	1.00		0.41	1.00		0.63	1.00		0.32	1.00	1.00
Satd. Flow (perm)	178	3450		734	3444		1118	1792		579	1900	1491
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	196	526	97	58	1016	173	142	136	48	211	157	415
RTOR Reduction (vph)	0	11	0	0	10	0	0	15	0	0	0	217
Lane Group Flow (vph)	196	612	0	58	1179	0	142	169	0	211	157	198
Confl. Peds. (#/hr)	3		19	19		3	12		2	2		12
Heavy Vehicles (%)	5%	1%	2%	2%	2%	4%	2%	2%	0%	0%	0%	4%
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	custom
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases	2			6			4			8		6
Actuated Green, G (s)	60.3	51.5		51.5	45.7		21.7	14.7		27.7	17.7	45.7
Effective Green, g (s)	59.3	53.5		49.5	47.7		19.7	16.7		25.7	19.7	47.7
Actuated g/C Ratio	0.59	0.54		0.50	0.48		0.20	0.17		0.26	0.20	0.48
Clearance Time (s)	3.0	6.0		3.0	6.0		3.0	6.0		3.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	262	1845		409	1642		255	299		253	374	711
v/s Ratio Prot	c0.08	0.18		0.01	0.34		0.03	0.09		c0.07	0.08	
v/s Ratio Perm	c0.36			0.06			0.08			c0.14		0.13
v/c Ratio	0.75	0.33		0.14	0.72		0.56	0.57		0.83	0.42	0.28
Uniform Delay, d1	18.8	13.1		13.2	20.8		35.3	38.3		32.8	35.1	15.8
Progression Factor	1.00	1.00		0.85	0.84		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	11.1	0.5		0.1	2.5		2.6	2.4		20.4	0.8	1.0
Delay (s)	29.9	13.6		11.3	19.9		38.0	40.8		53.2	35.9	16.7
Level of Service	C	B		B	B		D	D		D	D	B
Approach Delay (s)		17.5			19.5			39.5			30.4	
Approach LOS		B			B			D			C	

Intersection Summary

HCM 2000 Control Delay	23.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	79.2%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	2	32	8	46	176	1	114	0	9	1	1	7
Future Volume (Veh/h)	2	32	8	46	176	1	114	0	9	1	1	7
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81
Hourly flow rate (vph)	2	40	10	57	217	1	141	0	11	1	1	9
Pedestrians					3			2			3	
Lane Width (m)					3.6			3.6			3.6	
Walking Speed (m/s)					1.2			1.2			1.2	
Percent Blockage					0			0			0	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)		150										
pX, platoon unblocked												
vC, conflicting volume	221			52			392	386	50	398	390	220
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	221			52			392	386	50	398	390	220
tC, single (s)	4.6			4.1			7.1	6.5	6.2	7.1	6.5	6.8
tC, 2 stage (s)												
tF (s)	2.7			2.2			3.5	4.0	3.3	3.5	4.0	3.8
p0 queue free %	100			96			74	100	99	100	100	99
cM capacity (veh/h)	1107			1564			537	528	1020	539	525	698

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	52	275	152	11
Volume Left	2	57	141	1
Volume Right	10	1	11	9
cSH	1107	1564	556	660
Volume to Capacity	0.00	0.04	0.27	0.02
Queue Length 95th (m)	0.0	0.9	8.8	0.4
Control Delay (s)	0.3	1.8	13.9	10.5
Lane LOS	A	A	B	B
Approach Delay (s)	0.3	1.8	13.9	10.5
Approach LOS			B	B

Intersection Summary					
Average Delay			5.6		
Intersection Capacity Utilization			38.8%	ICU Level of Service	A
Analysis Period (min)			15		

Lane Group	EBL	EBT	WBT	SBL
Lane Configurations				
Traffic Volume (vph)	5	778	1217	33
Future Volume (vph)	5	778	1217	33
Turn Type	pm+pt	NA	NA	Prot
Protected Phases	5	2	6	8
Permitted Phases	2			
Detector Phase	5	2	6	8
Switch Phase				
Minimum Initial (s)	6.0	8.0	8.0	8.0
Minimum Split (s)	16.0	68.0	52.0	32.0
Total Split (s)	16.0	68.0	52.0	32.0
Total Split (%)	16.0%	68.0%	52.0%	32.0%
Yellow Time (s)	3.0	4.0	4.0	4.0
All-Red Time (s)	0.0	3.0	3.0	3.0
Lost Time Adjust (s)	1.0	-3.0	-3.0	-3.0
Total Lost Time (s)	4.0	4.0	4.0	4.0
Lead/Lag	Lead		Lag	
Lead-Lag Optimize?				
Recall Mode	None	C-Max	C-Max	None
Act Effct Green (s)	83.1	83.9	82.1	11.9
Actuated g/C Ratio	0.83	0.84	0.82	0.12
v/c Ratio	0.02	0.27	0.46	0.30
Control Delay	2.4	2.8	4.5	27.0
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	2.4	2.8	4.5	27.0
LOS	A	A	A	C
Approach Delay		2.8	4.5	27.0
Approach LOS		A	A	C

Intersection Summary		
Cycle Length: 100		
Actuated Cycle Length: 100		
Offset: 30 (30%), Referenced to phase 2:EBTL and 6:WBT, Start of Green		
Natural Cycle: 100		
Control Type: Actuated-Coordinated		
Maximum v/c Ratio: 0.46		
Intersection Signal Delay: 4.6	Intersection LOS: A	
Intersection Capacity Utilization 50.3%	ICU Level of Service A	
Analysis Period (min) 15		

Splits and Phases: 4: Plains Rd & Cooke Blvd





Lane Group	EBL	EBT	WBT	SBL
Lane Group Flow (vph)	5	802	1316	67
v/c Ratio	0.02	0.27	0.46	0.30
Control Delay	2.4	2.8	4.5	27.0
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	2.4	2.8	4.5	27.0
Queue Length 50th (m)	0.3	22.5	31.9	6.4
Queue Length 95th (m)	m0.5	23.2	78.2	18.9
Internal Link Dist (m)		136.0	176.0	326.1
Turn Bay Length (m)	40.0			
Base Capacity (vph)	432	2998	2874	481
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	0.01	0.27	0.46	0.14

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	5	778	1217	59	33	32
Future Volume (vph)	5	778	1217	59	33	32
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.6	3.6	3.5	3.3	3.5
Total Lost time (s)	4.0	4.0	4.0		4.0	
Lane Util. Factor	1.00	0.95	0.95		1.00	
Frpb, ped/bikes	1.00	1.00	1.00		0.99	
Flpb, ped/bikes	1.00	1.00	1.00		1.00	
Frt	1.00	1.00	0.99		0.93	
Flt Protected	0.95	1.00	1.00		0.98	
Satd. Flow (prot)	1745	3574	3500		1633	
Flt Permitted	0.17	1.00	1.00		0.98	
Satd. Flow (perm)	314	3574	3500		1633	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	5	802	1255	61	34	33
RTOR Reduction (vph)	0	0	2	0	30	0
Lane Group Flow (vph)	5	802	1314	0	37	0
Confl. Peds. (#/hr)	5			5		4
Heavy Vehicles (%)	0%	1%	2%	8%	3%	0%
Turn Type	pm+pt	NA	NA		Prot	
Protected Phases	5	2	6		8	
Permitted Phases	2					
Actuated Green, G (s)	78.7	78.7	74.5		7.3	
Effective Green, g (s)	77.7	81.7	77.5		10.3	
Actuated g/C Ratio	0.78	0.82	0.78		0.10	
Clearance Time (s)	3.0	7.0	7.0		7.0	
Vehicle Extension (s)	3.0	3.0	3.0		3.0	
Lane Grp Cap (vph)	246	2919	2712		168	
v/s Ratio Prot	0.00	c0.22	c0.38		c0.02	
v/s Ratio Perm	0.02					
v/c Ratio	0.02	0.27	0.48		0.22	
Uniform Delay, d1	3.5	2.2	4.1		41.2	
Progression Factor	1.01	1.11	1.00		1.00	
Incremental Delay, d2	0.0	0.2	0.6		0.7	
Delay (s)	3.6	2.6	4.7		41.8	
Level of Service	A	A	A		D	
Approach Delay (s)		2.6	4.7		41.8	
Approach LOS		A	A		D	

Intersection Summary

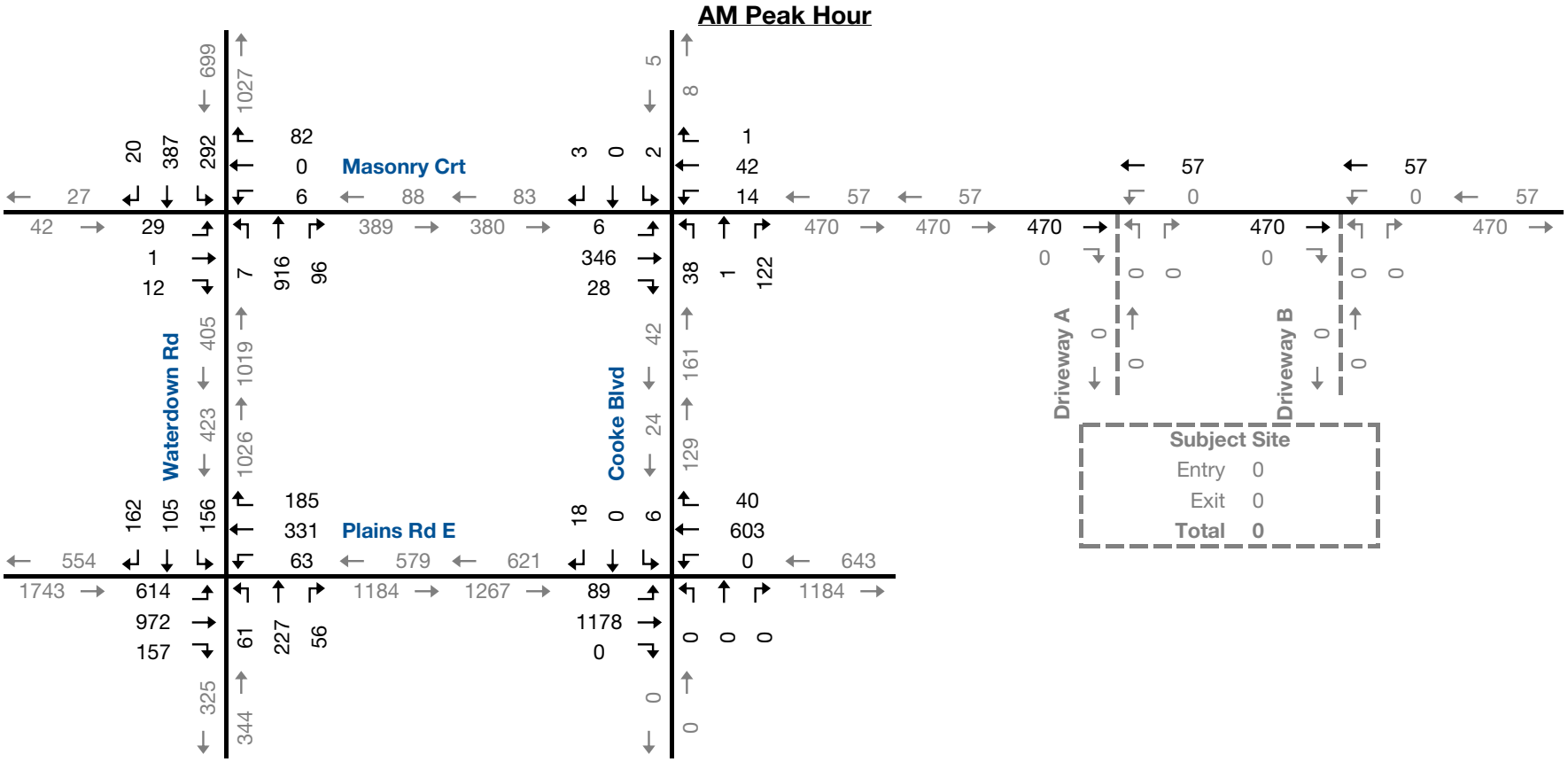
HCM 2000 Control Delay	5.1	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	50.3%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

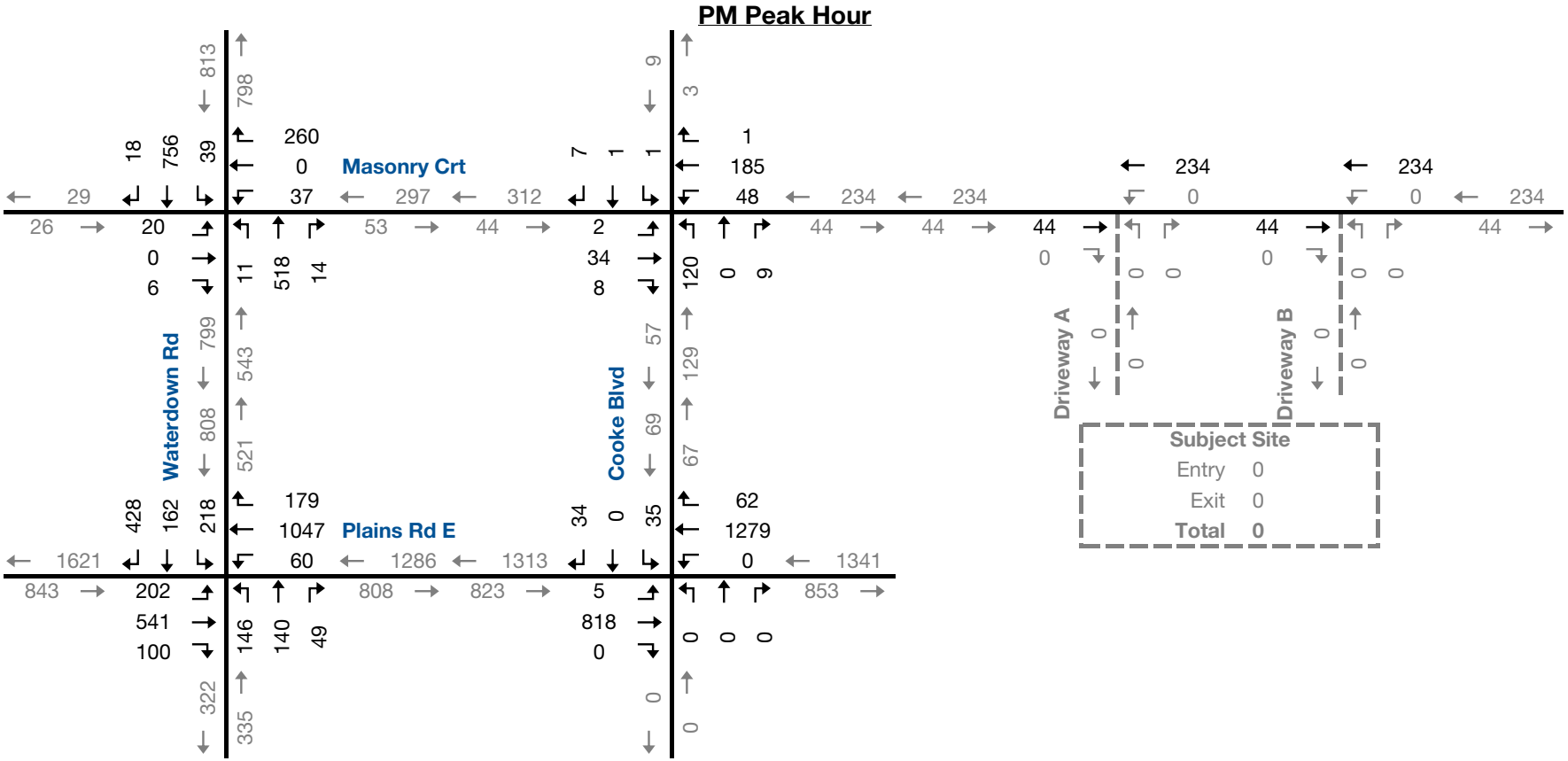
Appendix D

Detailed Background Traffic Forecast

Generalized Background Traffic Growth

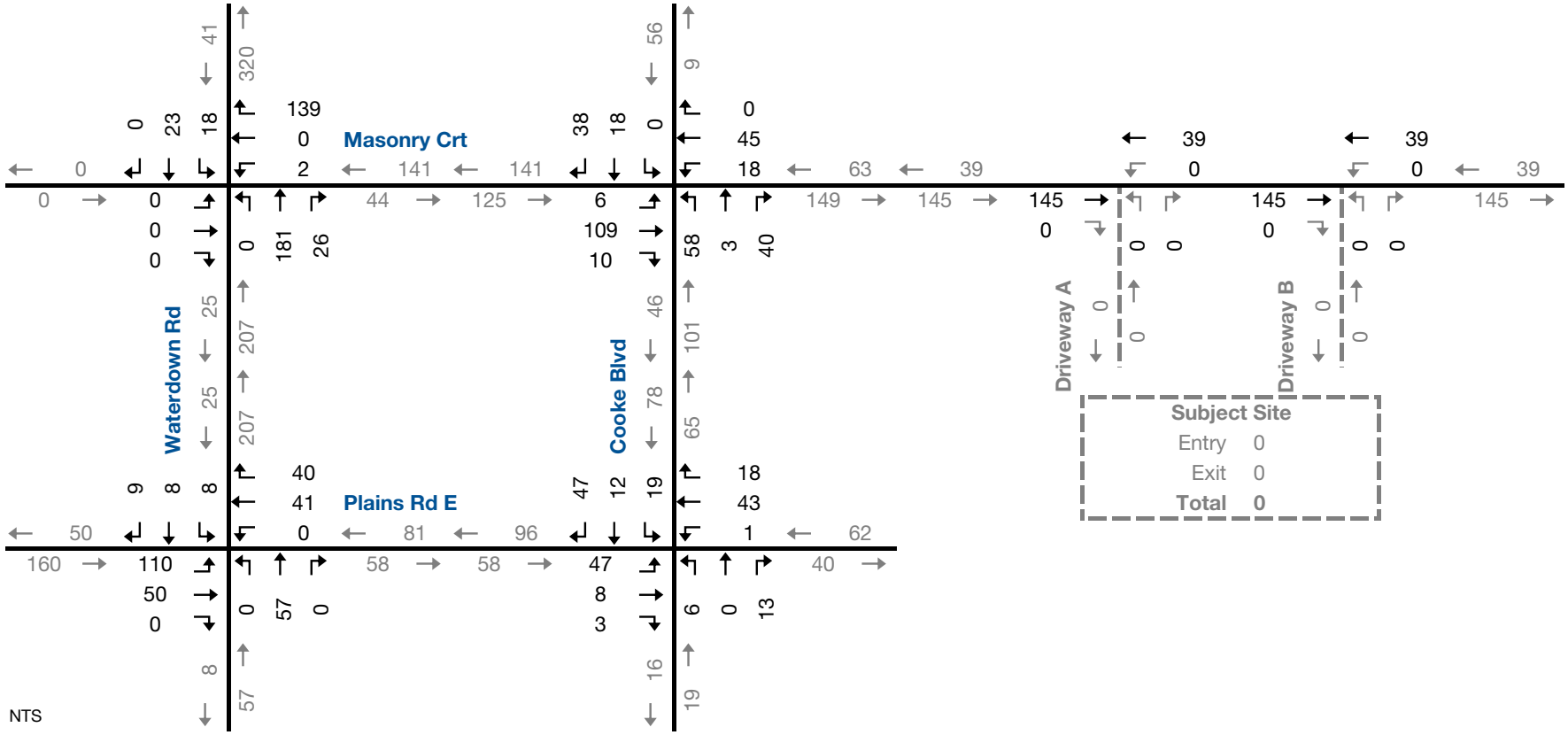


Generalized Background Traffic Growth



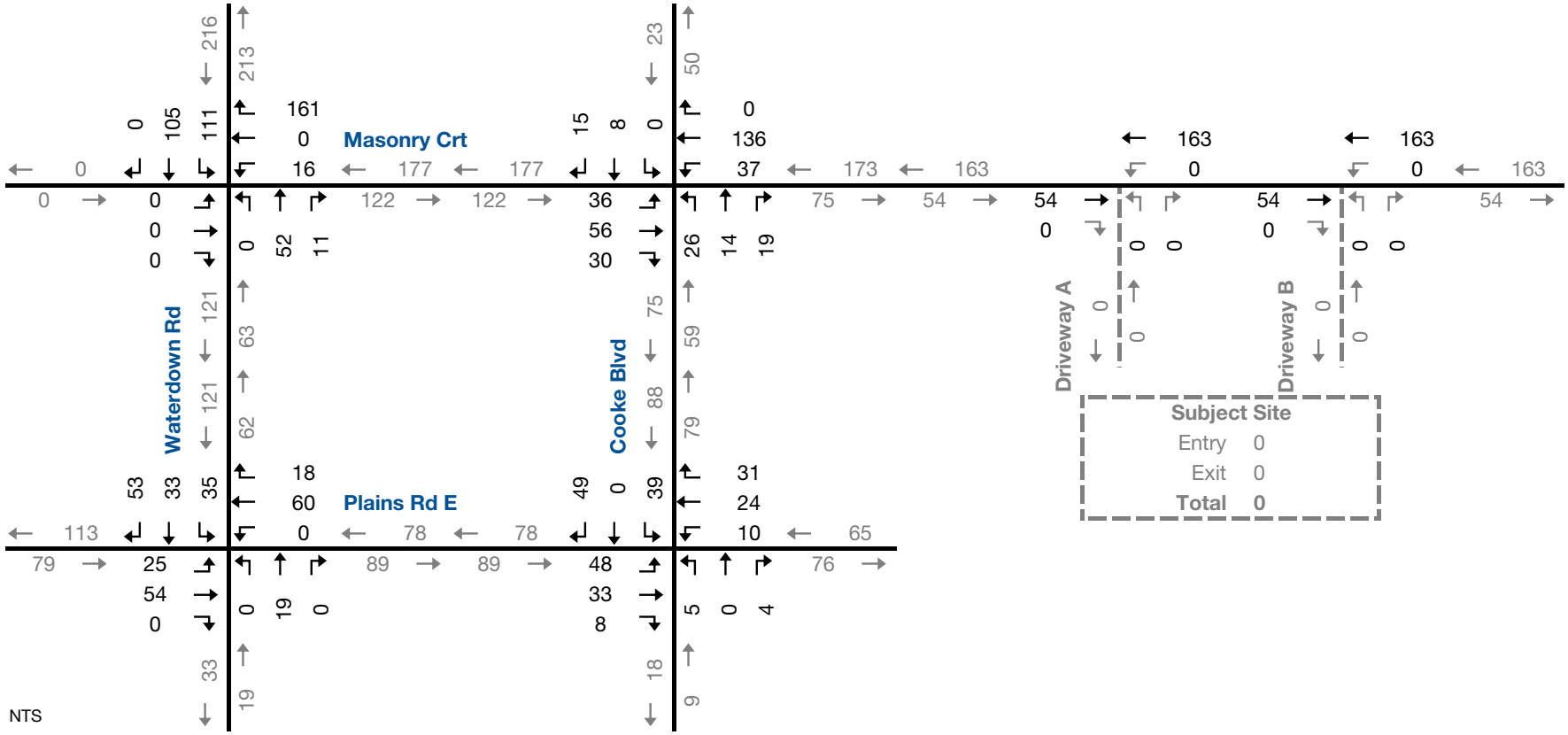
Background Development - Estimated Site Generated Traffic (All Sites)

AM Peak Hour



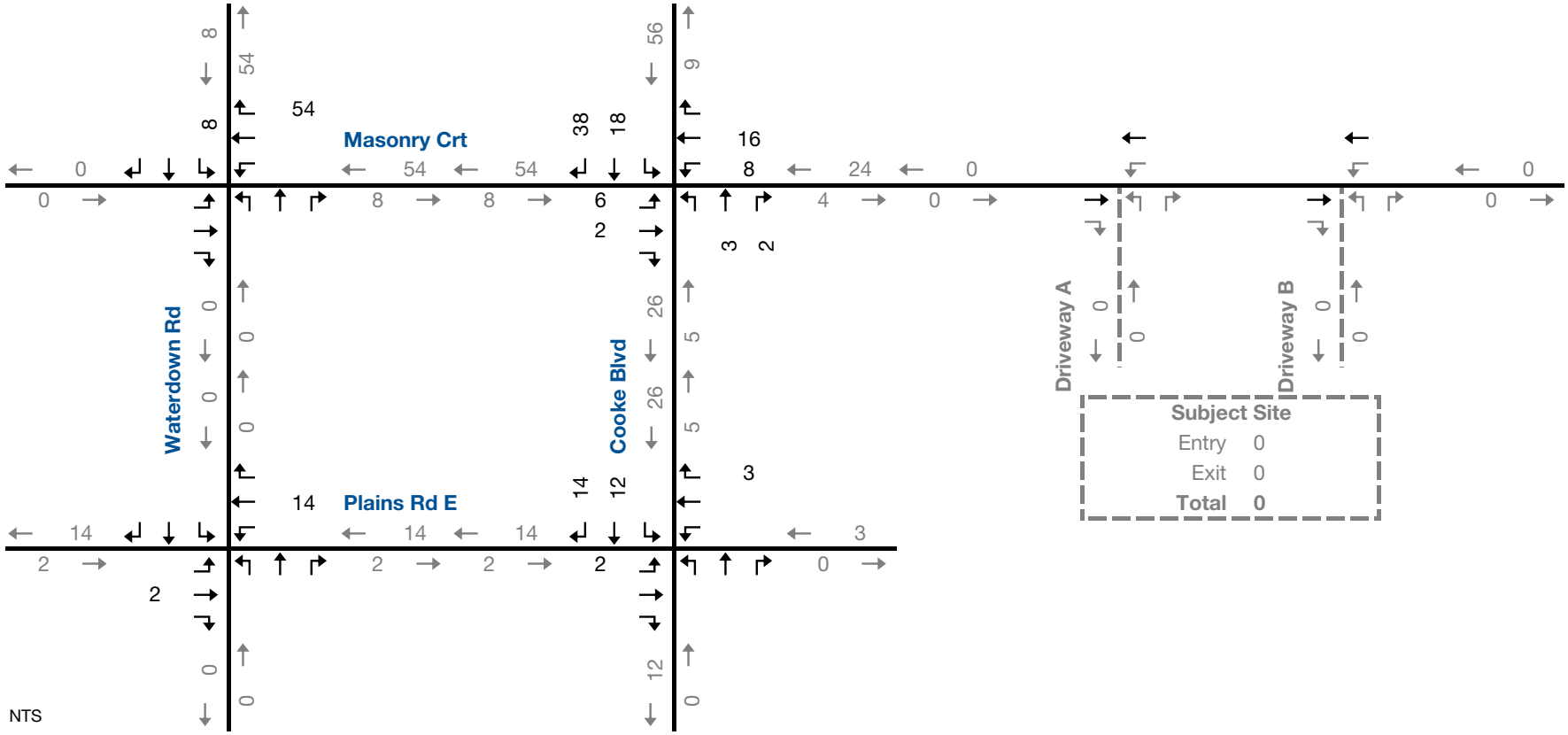
Background Development - Estimated Site Generated Traffic (All Sites)

PM Peak Hour



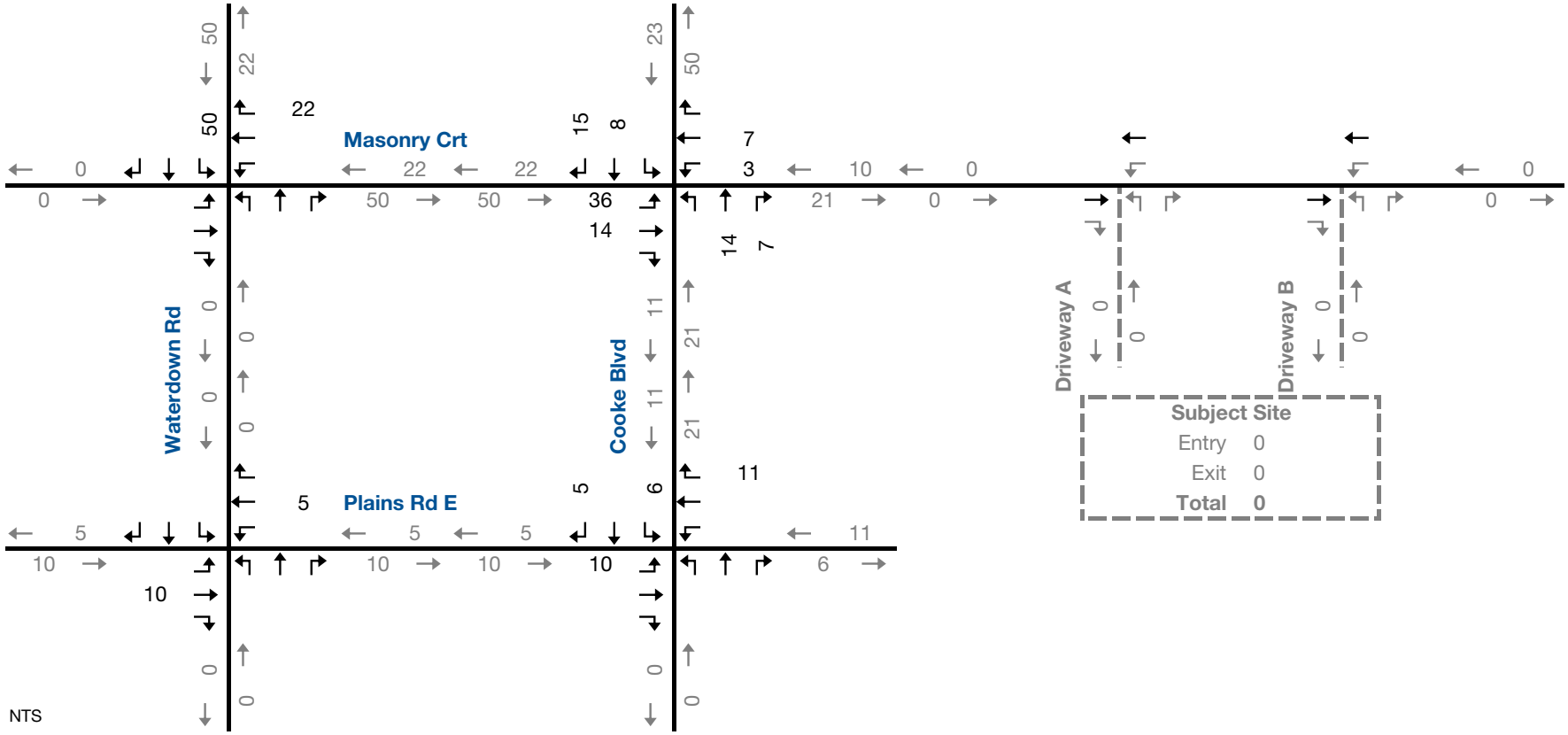
101 Masonry Crt Phase 1 - Estimated Site Generated Traffic

AM Peak Hour



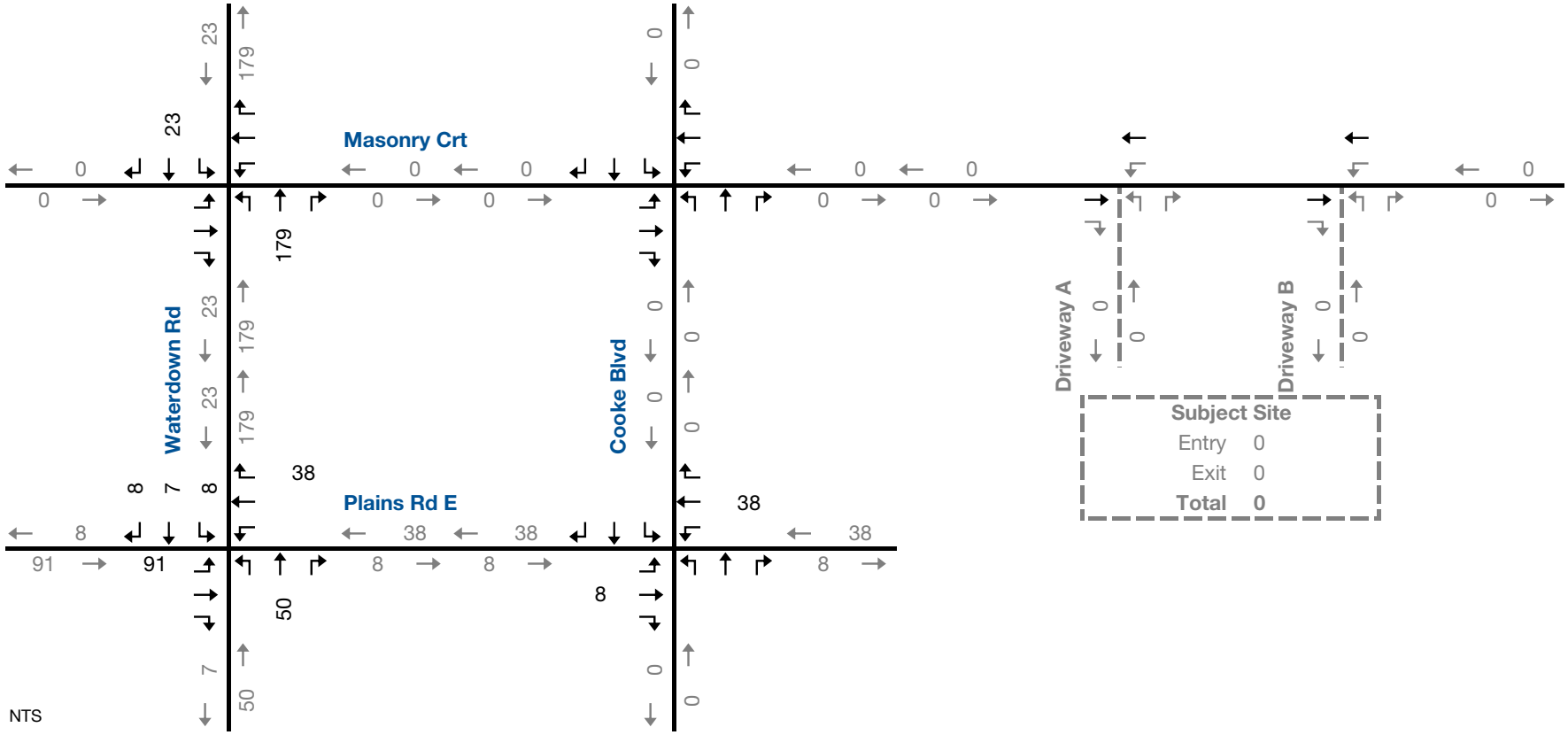
101 Masonry Crt Phase 1 - Estimated Site Generated Traffic

PM Peak Hour



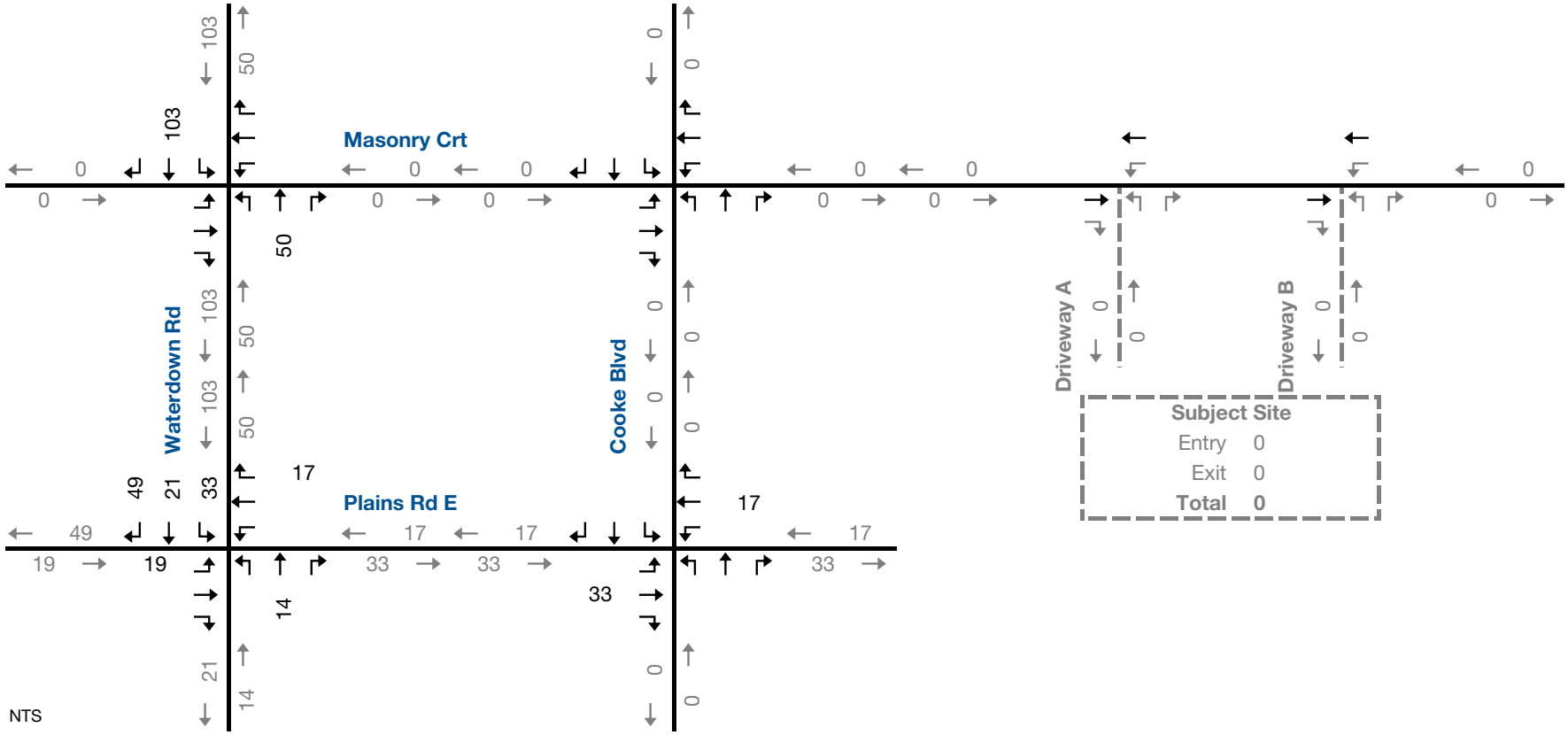
1200 King Rd Phase 1 - Estimated Site Generated Traffic

AM Peak Hour



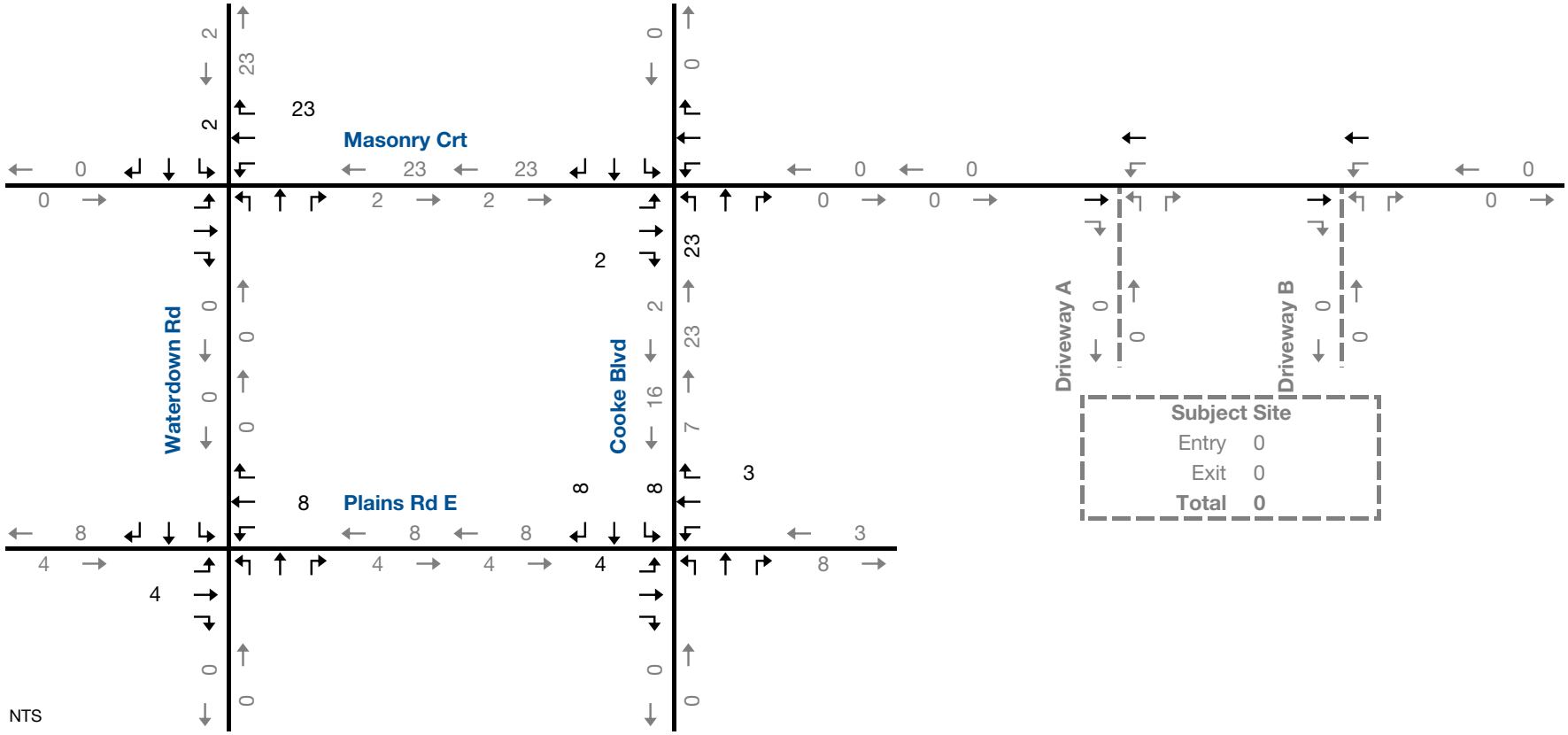
1200 King Rd Phase 1 - Estimated Site Generated Traffic

PM Peak Hour



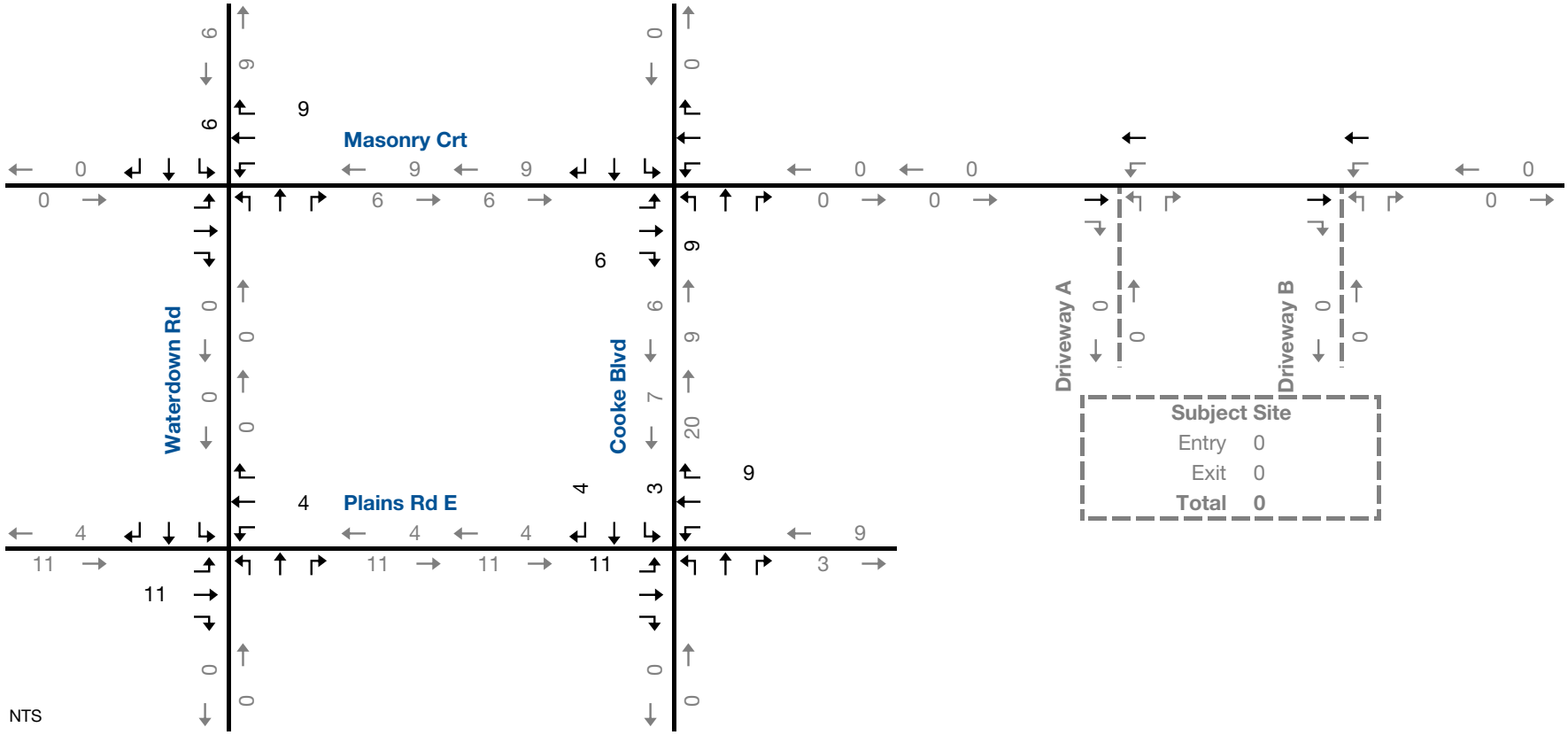
35 Plains Road - Estimated Site Generated Traffic

AM Peak Hour



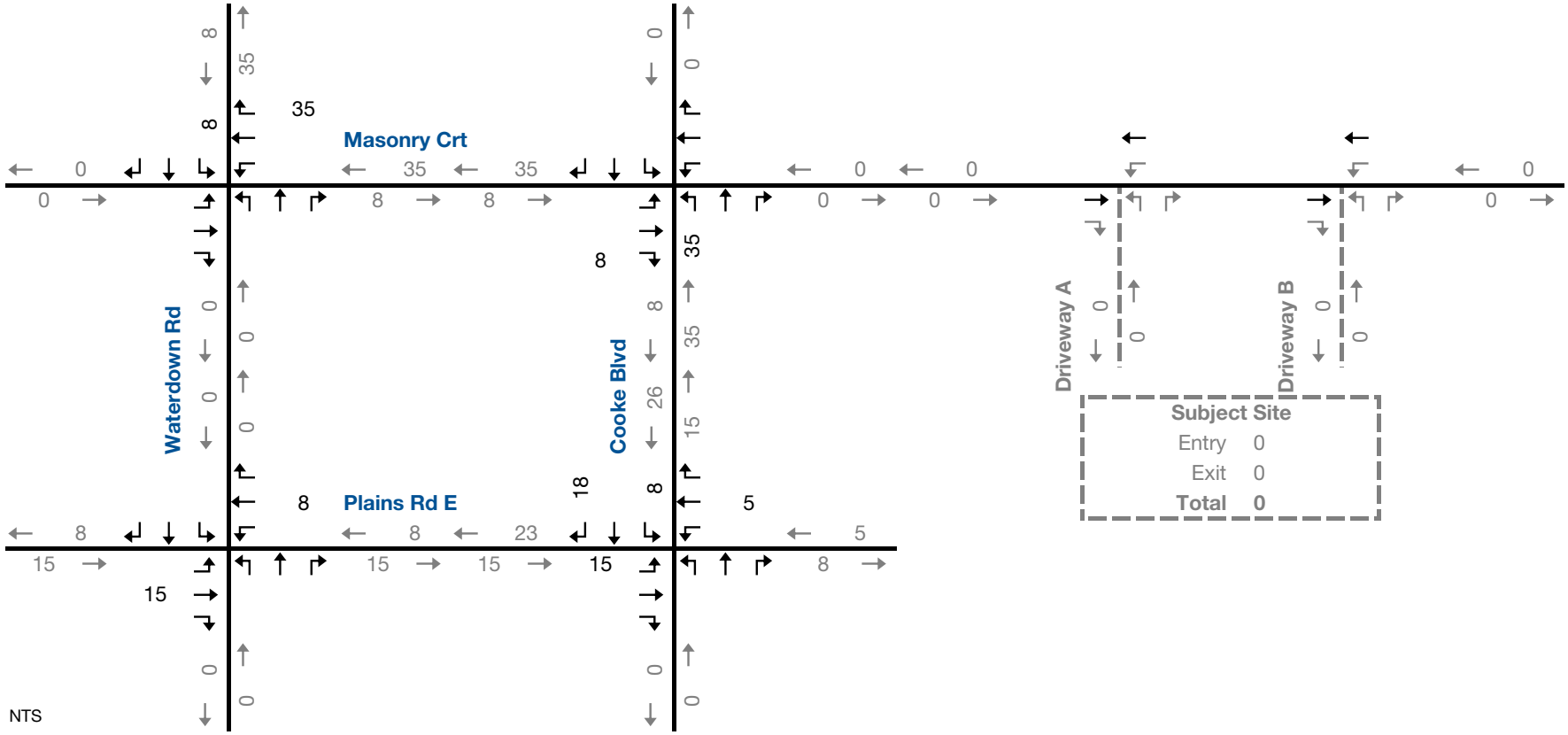
35 Plains Road - Estimated Site Generated Traffic

PM Peak Hour



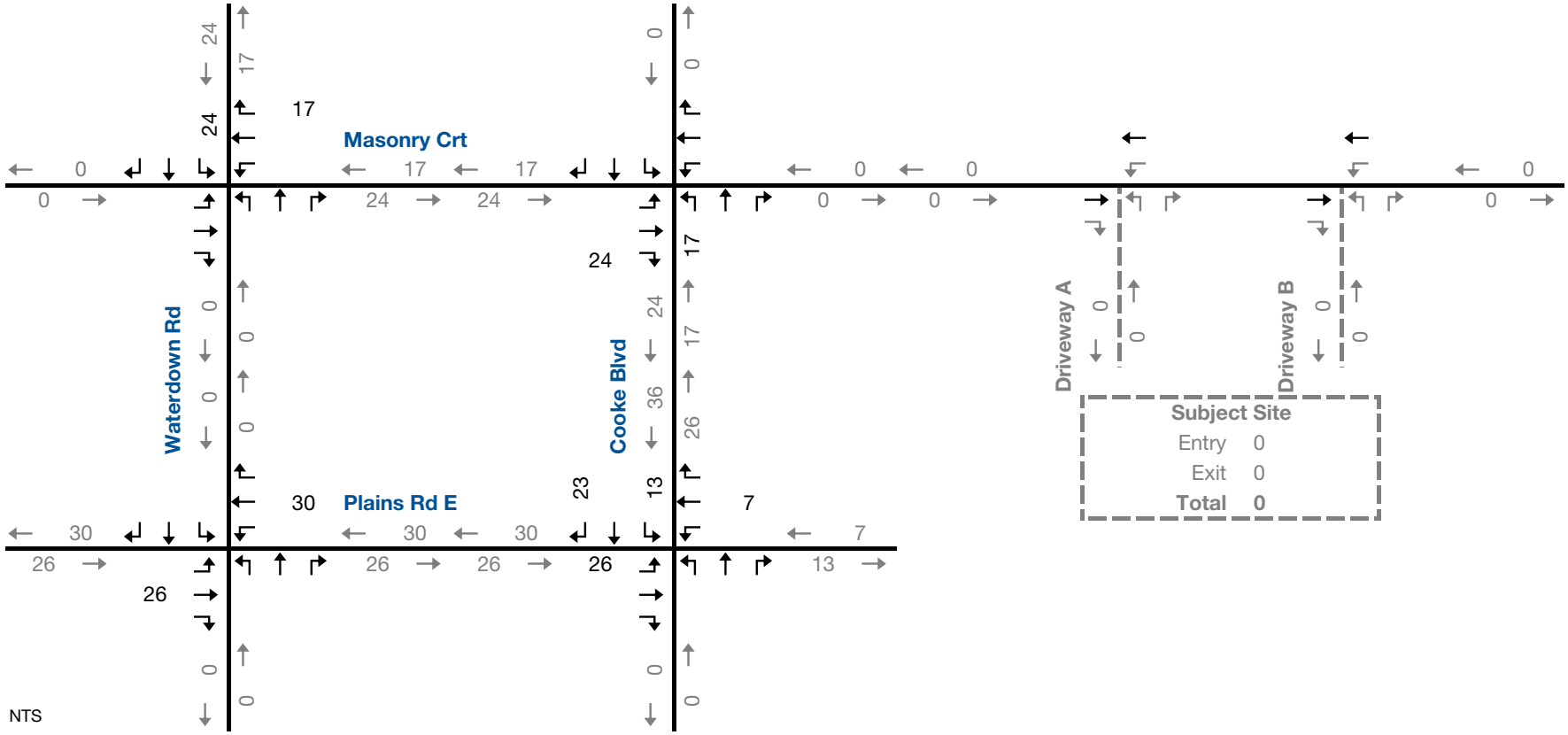
53 & 71 Plains Road East - Estimated Site Generated Traffic

AM Peak Hour



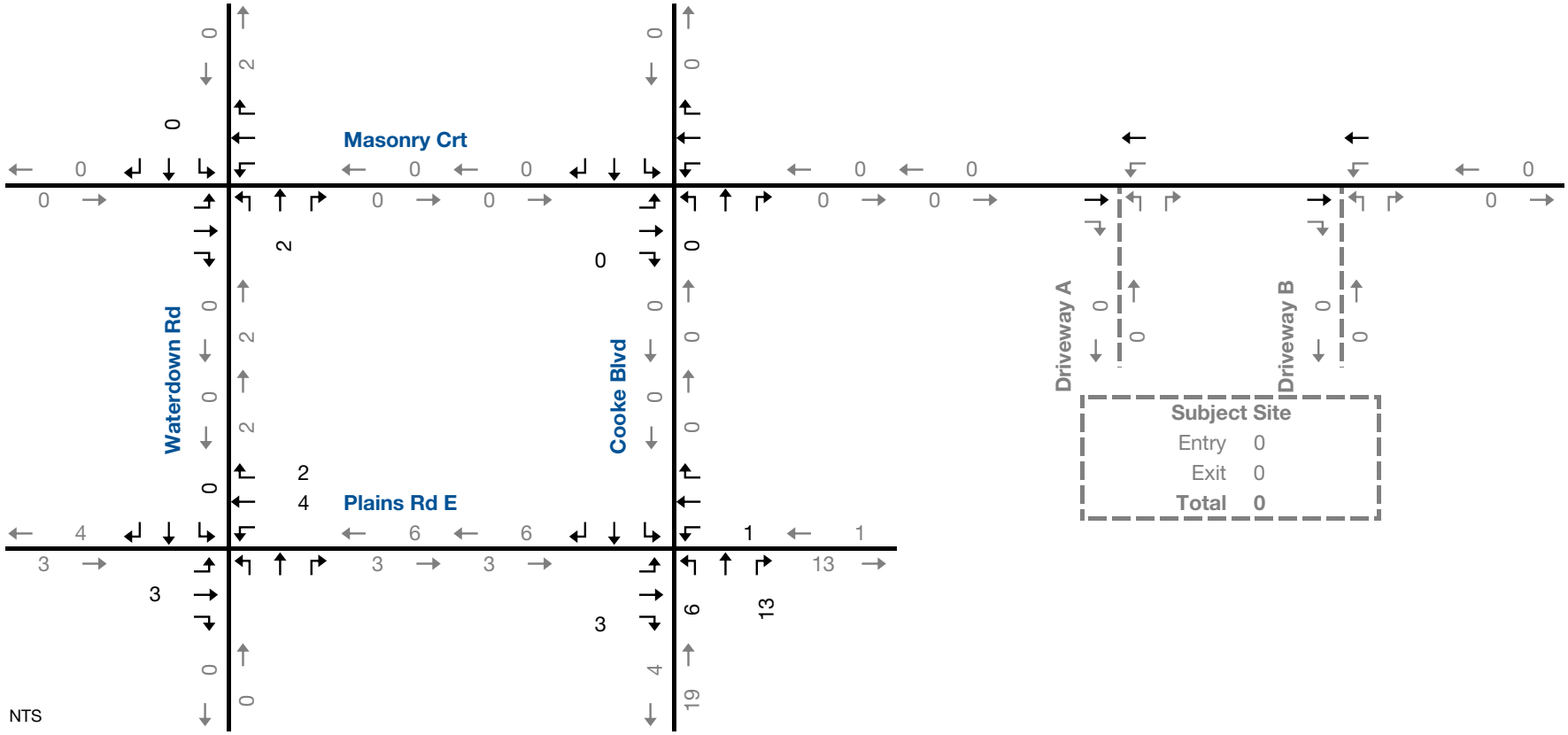
53 & 71 Plains Road East - Estimated Site Generated Traffic

PM Peak Hour



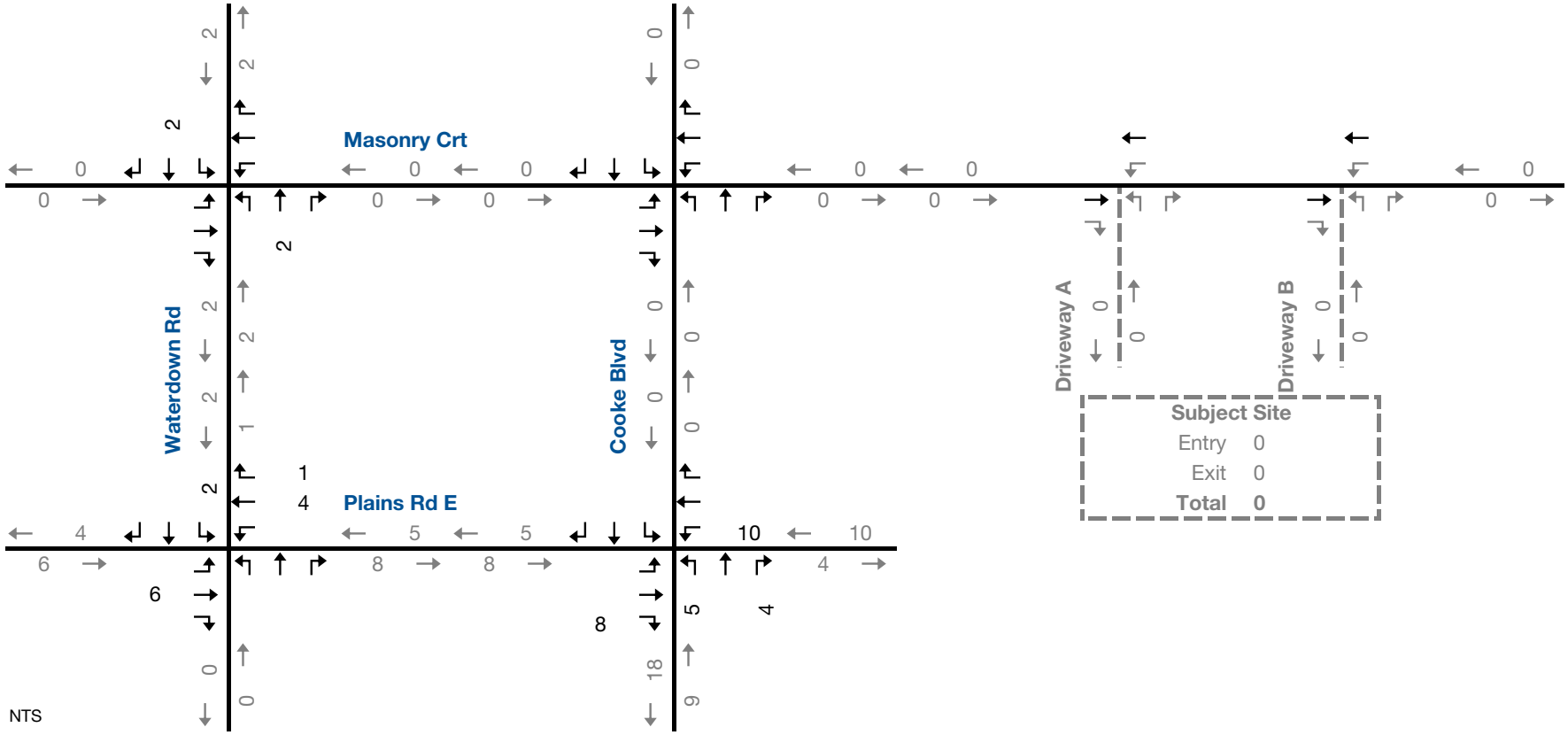
40, 46 & 50 Plains Rd East - Estimated Site Generated Traffic

AM Peak Hour



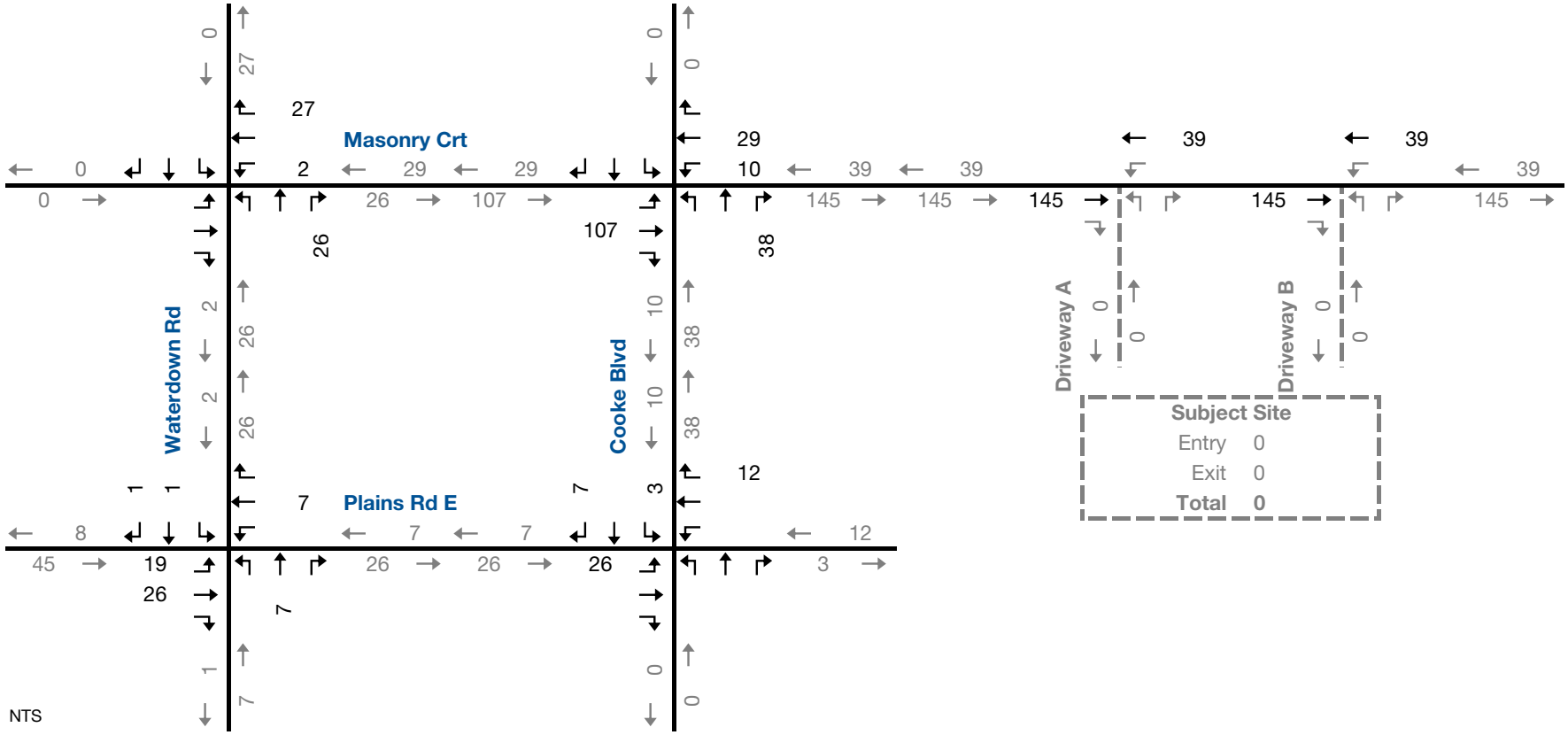
40, 46 & 50 Plains Rd East - Estimated Site Generated Traffic

PM Peak Hour



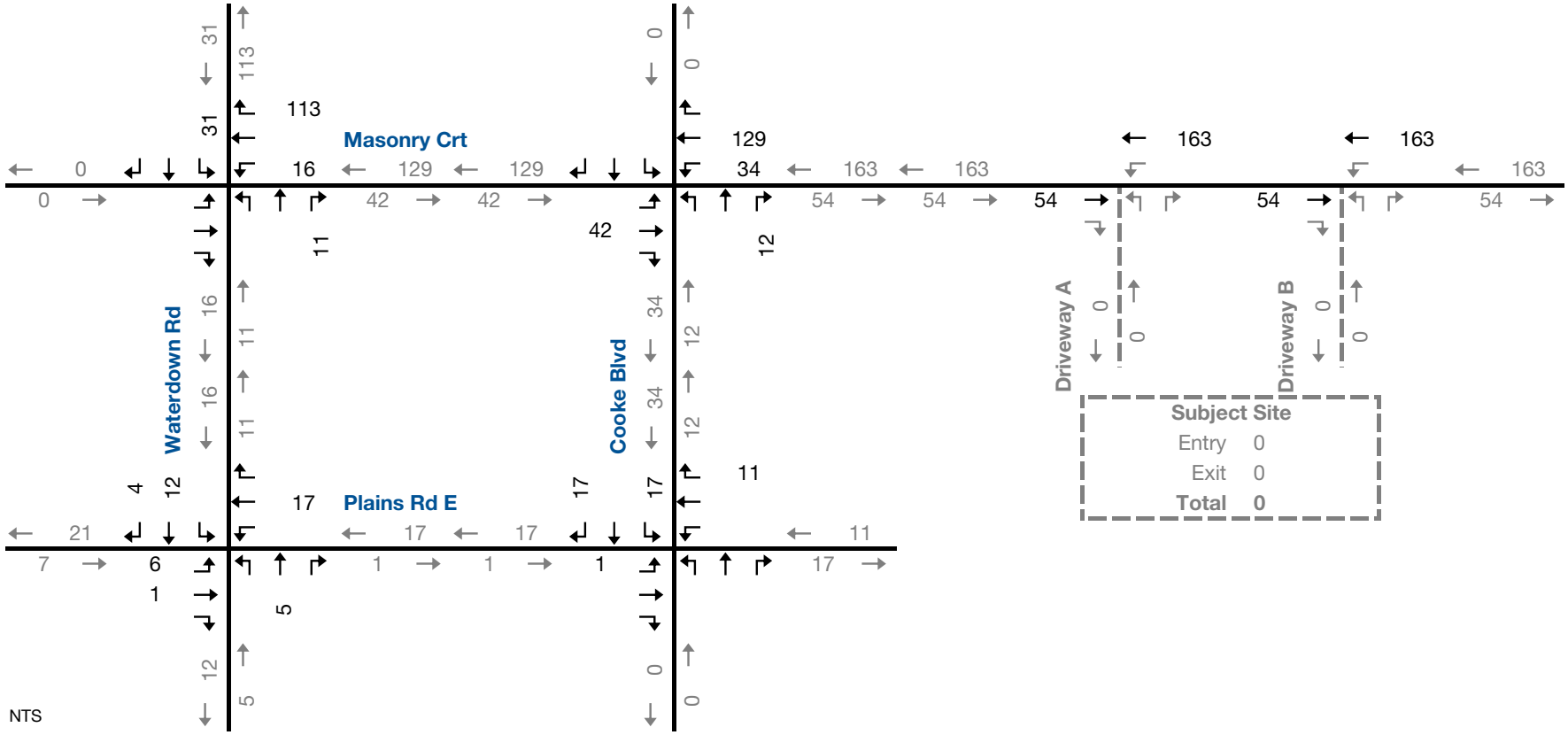
Aldershot GO Station Parking Lot Expansion - 500 parking spaces

AM Peak Hour



Aldershot GO Station Parking Lot Expansion - 500 parking spaces

PM Peak Hour

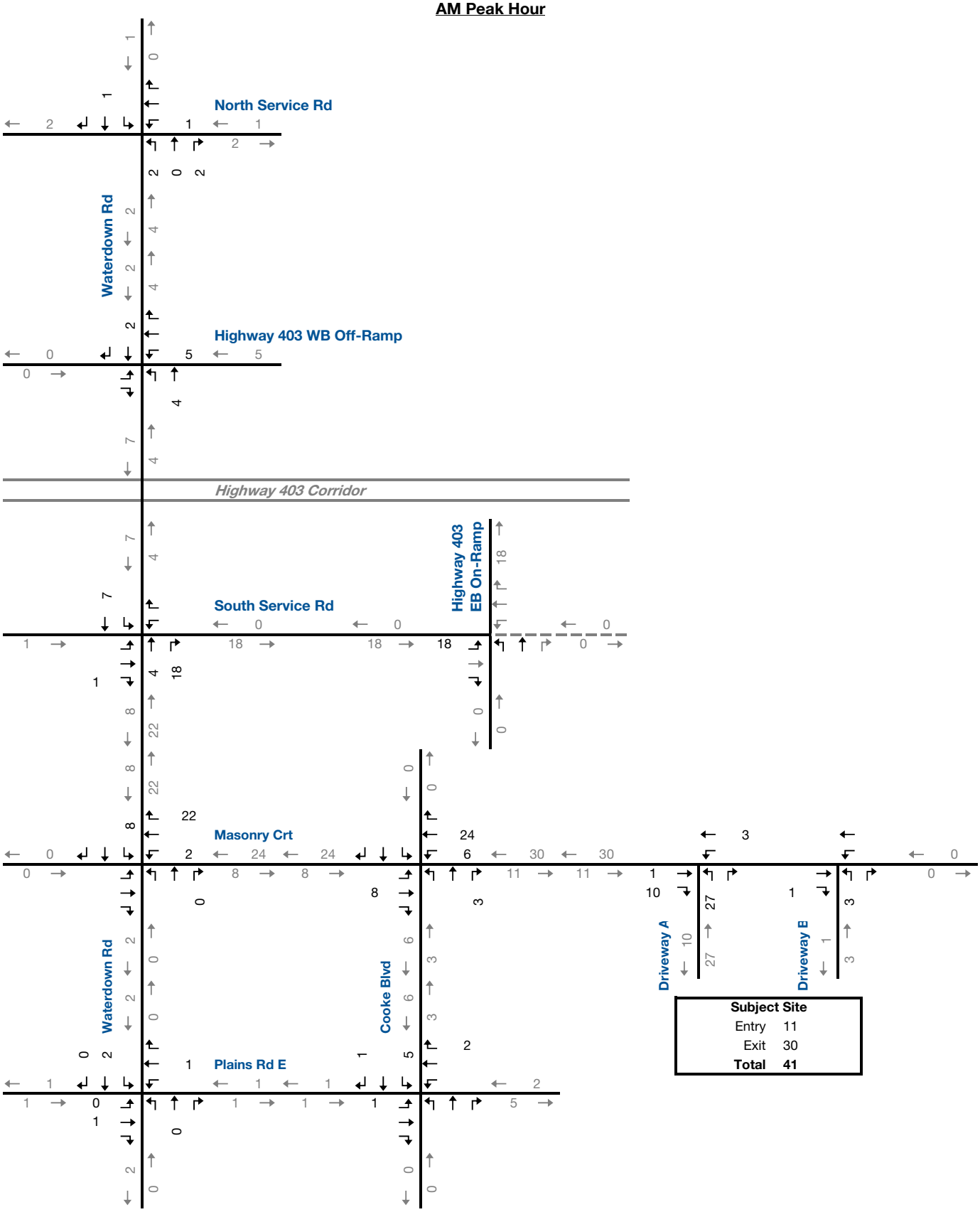


ITE Trip Generation Estimates - 500 Parking Spaces

Park-and-Ride Lot with Bus or Light Rail Service (090)		
Independent Variable:	Parking Spaces	
Time Period:	Weekday	
Peak Hour of Adjacent Street Traffic	One Hour Between 7 and 9 a.m.	One Hour Between 4 and 6 p.m.
Fitted Curve Equation:	Ln(T) = 0.85 Ln(X) - 0.07	T = 0.37(X) + 31.82
R2:	0.70	0.63
Directional Distribution:	79% entering, 21% exiting	25% entering, 75% exiting
Calculated Trip Ends:	**184 (Total), 145 (Entry), 39 (Exit)**	**217 (Total), 54 (Entry), 163 (Exit)**

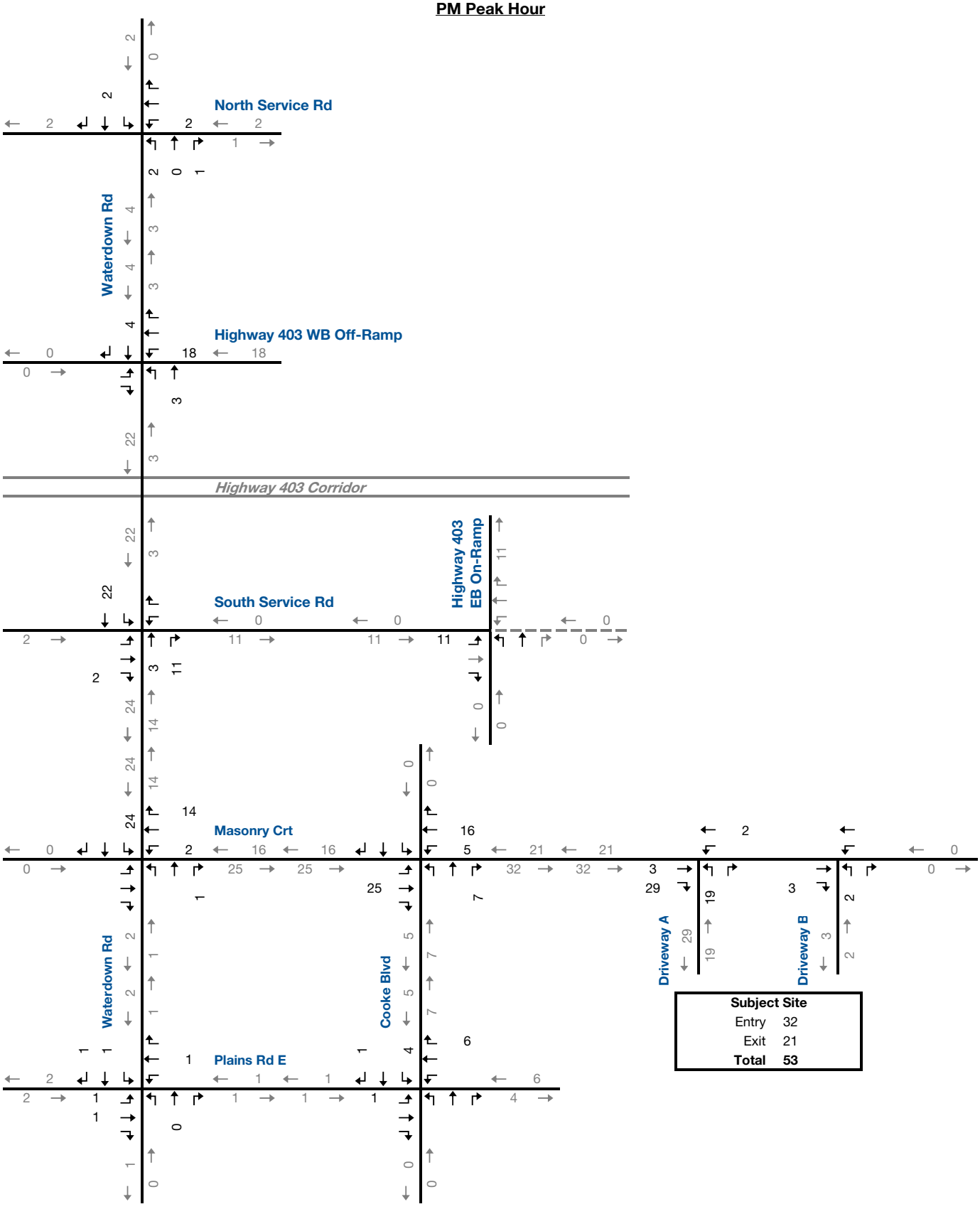
Estimated Site Generated Traffic

AM Peak Hour



Estimated Site Generated Traffic

PM Peak Hour



Appendix E

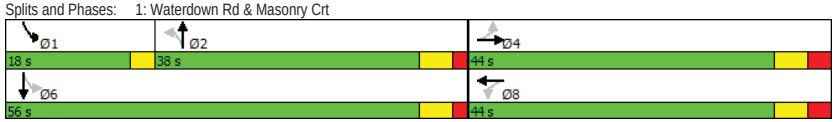
Background Traffic Operational Conditions

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	29	1	8	0	7	1097	310	410
Future Volume (vph)	29	1	8	0	7	1097	310	410
Turn Type	Perm	NA	Perm	NA	Perm	NA	pm+pt	NA
Protected Phases		4		8		2	1	6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	1	6
Switch Phase								
Minimum Initial (s)	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Minimum Split (s)	44.0	44.0	44.0	44.0	38.0	38.0	18.0	56.0
Total Split (s)	44.0	44.0	44.0	44.0	38.0	38.0	18.0	56.0
Total Split (%)	44.0%	44.0%	44.0%	44.0%	38.0%	38.0%	18.0%	56.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	3.0	4.0
All-Red Time (s)	3.0	3.0	3.0	3.0	2.0	2.0	0.0	2.0
Lost Time Adjust (s)		-3.0	-3.0	-3.0	-2.0	-2.0	1.0	-2.0
Total Lost Time (s)		4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag					Lag	Lag	Lead	
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	Max	Max	None	Max
Act Effct Green (s)		12.1	12.1	12.1	34.0	34.0	52.0	52.0
Actuated g/C Ratio		0.17	0.17	0.17	0.47	0.47	0.72	0.72
v/c Ratio		0.44	0.04	0.42	0.02	0.80	0.73	0.19
Control Delay		35.3	25.1	2.7	11.3	21.1	24.3	3.6
Queue Delay		0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		35.3	25.1	2.7	11.3	21.1	24.3	3.6
LOS		D	C	A	B	C	C	A
Approach Delay		35.3		3.4		21.1		12.3
Approach LOS		D		A		C		B

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 72.1
Natural Cycle: 100
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.80
Intersection Signal Delay: 16.6 — Intersection LOS: B
Intersection Capacity Utilization 85.3% — ICU Level of Service E
Analysis Period (min) 15

Splits and Phases: 1: Waterdown Rd & Masonry Crt



Lane Group	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	45	8	233	7	1283	326	453
v/c Ratio	0.44	0.04	0.42	0.02	0.80	0.73	0.19
Control Delay	35.3	25.1	2.7	11.3	21.1	24.3	3.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	35.3	25.1	2.7	11.3	21.1	24.3	3.6
Queue Length 50th (m)	4.1	1.0	0.0	0.5	73.9	23.8	7.8
Queue Length 95th (m)	14.2	4.4	1.3	2.7	112.3	#66.1	15.2
Internal Link Dist (m)	128.3		126.0		326.0		176.0
Turn Bay Length (m)		30.0		25.0		20.0	
Base Capacity (vph)	309	742	1000	297	1606	448	2368
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.15	0.01	0.23	0.02	0.80	0.73	0.19

Intersection Summary

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

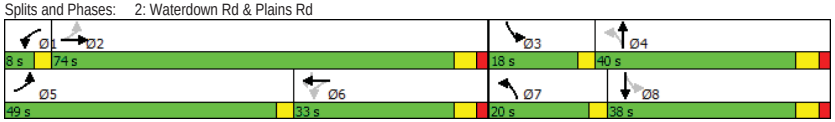
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	29	1	12	8	0	221	7	1097	122	310	410	20
Future Volume (vph)	29	1	12	8	0	221	7	1097	122	310	410	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.6	3.5	3.3	3.6	3.5	3.3	3.6	3.5	3.3	3.6	3.5
Total Lost time (s)		4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor		1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frpb, ped/bikes		1.00		1.00	0.99		1.00	1.00		1.00	1.00	
Flpb, ped/bikes		1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt		0.96		1.00	0.85		1.00	0.99		1.00	0.99	
Flt Protected		0.97		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1158		1745	1518		1219	3392		1745	3282	
Flt Permitted		0.46		0.73	1.00		0.49	1.00		0.11	1.00	
Satd. Flow (perm)		547		1337	1518		630	3392		210	3282	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	31	1	13	8	0	233	7	1155	128	326	432	21
RTOR Reduction (vph)	0	11	0	0	194	0	0	7	0	0	2	0
Lane Group Flow (vph)	0	34	0	8	39	0	7	1276	0	326	451	0
Confl. Peds. (#/hr)	1					1	1		2	2		1
Heavy Vehicles (%)	54%	100%	45%	0%	0%	5%	43%	5%	1%	0%	7%	53%
Turn Type	Perm	NA		Perm	NA		Perm	NA		pm+pt	NA	
Protected Phases		4			8			2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		9.1		9.1	9.1		32.0	32.0		50.0	50.0	
Effective Green, g (s)		12.1		12.1	12.1		34.0	34.0		49.0	52.0	
Actuated g/C Ratio		0.17		0.17	0.17		0.47	0.47		0.68	0.72	
Clearance Time (s)		7.0		7.0	7.0		6.0	6.0		3.0	6.0	
Vehicle Extension (s)		3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		91		224	254		297	1599		440	2367	
v/s Ratio Prot					0.03			c0.38		c0.14	0.14	
v/s Ratio Perm		c0.06		0.01			0.01			0.36		
v/c Ratio		0.38		0.04	0.15		0.02	0.80		0.74	0.19	
Uniform Delay, d1		26.6		25.1	25.6		10.2	16.1		16.3	3.2	
Progression Factor		1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		2.6		0.1	0.3		0.1	4.3		6.6	0.2	
Delay (s)		29.2		25.2	25.9		10.3	20.4		22.9	3.4	
Level of Service		C		C	C		B	C		C	A	
Approach Delay (s)		29.2			25.9			20.3			11.6	
Approach LOS		C			C			C			B	

Intersection Summary				
HCM 2000 Control Delay	18.2	HCM 2000 Level of Service	B	
HCM 2000 Volume to Capacity ratio	0.70			
Actuated Cycle Length (s)	72.1	Sum of lost time (s)	12.0	
Intersection Capacity Utilization	85.3%	ICU Level of Service	E	
Analysis Period (min)	15			
c Critical Lane Group				

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations									
Traffic Volume (vph)	724	1022	63	372	61	284	164	113	171
Future Volume (vph)	724	1022	63	372	61	284	164	113	171
Turn Type	pm+pt	NA	pm+pt	NA	pm+pt	NA	pm+pt	NA	custom
Protected Phases	5	2	1	6	7	4	3	8	
Permitted Phases	2		6		4		8		6
Detector Phase	5	2	1	6	7	4	3	8	6
Switch Phase									
Minimum Initial (s)	6.0	8.0	5.0	8.0	6.0	8.0	6.0	8.0	8.0
Minimum Split (s)	49.0	74.0	8.0	33.0	20.0	40.0	18.0	38.0	33.0
Total Split (s)	49.0	74.0	8.0	33.0	20.0	40.0	18.0	38.0	33.0
Total Split (%)	35.0%	52.9%	5.7%	23.6%	14.3%	28.6%	12.9%	27.1%	23.6%
Yellow Time (s)	3.0	4.0	3.0	4.0	3.0	4.0	3.0	4.0	4.0
All-Red Time (s)	0.0	2.0	0.0	2.0	0.0	2.0	0.0	2.0	2.0
Lost Time Adjust (s)	1.0	-2.0	1.0	-2.0	1.0	-2.0	1.0	-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
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?									
Recall Mode	None	Max	None	Max	None	None	None	None	Max
Act Effct Green (s)	78.2	71.9	33.1	29.1	39.5	31.7	48.4	38.7	29.1
Actuated g/C Ratio	0.58	0.53	0.25	0.22	0.29	0.24	0.36	0.29	0.22
v/c Ratio	1.26	0.69	0.51	0.83	0.17	0.84	0.82	0.24	0.41
Control Delay	161.9	26.7	38.5	54.9	29.4	66.4	60.9	39.1	9.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	161.9	26.7	38.5	54.9	29.4	66.4	60.9	39.1	9.2
LOS	F	C	D	D	C	E	E	D	A
Approach Delay		78.2		53.4		60.8		35.6	
Approach LOS		E		D		E		D	

Intersection Summary			
Cycle Length: 140			
Actuated Cycle Length: 134.7			
Natural Cycle: 150			
Control Type: Semi Act-Uncoord			
Maximum v/c Ratio: 1.26			
Intersection Signal Delay: 65.7		Intersection LOS: E	
Intersection Capacity Utilization 99.6%		ICU Level of Service F	
Analysis Period (min) 15			

Splits and Phases: 2: Waterdown Rd & Plains Rd



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	770	1254	67	635	65	362	174	120	182
v/c Ratio	1.26	0.69	0.51	0.83	0.17	0.84	0.82	0.24	0.41
Control Delay	161.9	26.7	38.5	54.9	29.4	66.4	60.9	39.1	9.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	161.9	26.7	38.5	54.9	29.4	66.4	60.9	39.1	9.2
Queue Length 50th (m)	~268.1	143.3	8.5	82.6	12.0	96.7	34.6	26.3	0.0
Queue Length 95th (m)	#353.2	174.7	16.4	#114.2	22.8	#136.0	#68.9	44.8	21.2
Internal Link Dist (m)		176.0		136.0		176.0		326.0	
Turn Bay Length (m)	30.0		40.0		30.0				40.0
Base Capacity (vph)	612	1821	132	764	481	487	226	510	447
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	1.26	0.69	0.51	0.83	0.14	0.74	0.77	0.24	0.41

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.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	724	1022	157	63	372	225	61	284	56	164	113	171
Future Volume (vph)	724	1022	157	63	372	225	61	284	56	164	113	171
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.6	3.5	3.3	3.6	3.5	3.3	3.6	3.5	3.3	3.6	3.5
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	1.00
Frpb, ped/bikes	1.00	0.99		1.00	0.99		1.00	1.00		1.00	1.00	0.96
Flpb, ped/bikes	1.00	1.00		1.00	1.00		0.99	1.00		1.00	1.00	1.00
Frt	1.00	0.98		1.00	0.94		1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1662	3398		1658	3246		1686	1804		1661	1776	1413
Flt Permitted	0.13	1.00		0.22	1.00		0.68	1.00		0.12	1.00	1.00
Satd. Flow (perm)	228	3398		388	3246		1207	1804		209	1776	1413
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	770	1087	167	67	396	239	65	302	60	174	120	182
RTOR Reduction (vph)	0	8	0	0	64	0	0	5	0	0	0	142
Lane Group Flow (vph)	770	1246	0	67	571	0	65	357	0	174	120	40
Confl. Peds. (#/hr)	6		19	19		6	17		7	7		17
Heavy Vehicles (%)	5%	3%	3%	5%	4%	4%	2%	2%	4%	5%	7%	8%
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	custom
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases	2			6			4			8		6
Actuated Green, G (s)	76.8	69.9		31.6	27.7		37.9	30.4		47.2	36.7	27.7
Effective Green, g (s)	75.8	71.9		29.6	29.7		35.9	32.4		46.2	38.7	29.7
Actuated g/C Ratio	0.56	0.53		0.22	0.22		0.26	0.24		0.34	0.28	0.22
Clearance Time (s)	3.0	6.0		3.0	6.0		3.0	6.0		3.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	602	1796		111	708		341	429		207	505	308
v/s Ratio Prot	c0.42	0.37		0.01	0.18		0.01	c0.20		c0.08	0.07	
v/s Ratio Perm	c0.29			0.12			0.04			0.21		0.03
v/c Ratio	1.28	0.69		0.60	0.81		0.19	0.83		0.84	0.24	0.13
Uniform Delay, d1	38.1	23.9		44.2	50.4		38.3	49.2		36.2	37.3	42.7
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	138.0	2.2		8.9	9.5		0.3	12.9		25.2	0.2	0.9
Delay (s)	176.1	26.1		53.2	60.0		38.6	62.1		61.4	37.6	43.6
Level of Service	F	C		D	E		D	E		E	D	D
Approach Delay (s)		83.2			59.3			58.5			48.6	
Approach LOS		F			E			E			D	

Intersection Summary

HCM 2000 Control Delay	71.1	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.11		
Actuated Cycle Length (s)	136.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	99.6%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	12	455	38	32	87	1	96	4	162	2	18	41
Future Volume (Veh/h)	12	455	38	32	87	1	96	4	162	2	18	41
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81
Hourly flow rate (vph)	15	562	47	40	107	1	119	5	200	2	22	51
Pedestrians		1			7						5	
Lane Width (m)		3.6			3.6						3.6	
Walking Speed (m/s)		1.2			1.2						1.2	
Percent Blockage		0			1						0	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)		150										
pX, platoon unblocked				0.95			0.95	0.95	0.95	0.95	0.95	
vC, conflicting volume	113			609			866	808	592	1018	832	114
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	113			560			831	770	542	991	795	114
tC, single (s)	4.1			4.1			7.1	6.6	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.1	3.3	3.5	4.0	3.3
p0 queue free %	99			96			49	98	61	98	92	95
cM capacity (veh/h)	1483			968			235	292	513	123	289	940

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	624	148	324	75
Volume Left	15	40	119	2
Volume Right	47	1	200	51
cSH	1483	968	355	511
Volume to Capacity	0.01	0.04	0.91	0.15
Queue Length 95th (m)	0.2	1.0	74.1	4.1
Control Delay (s)	0.3	2.7	63.0	13.2
Lane LOS	A	A	F	B
Approach Delay (s)	0.3	2.7	63.0	13.2
Approach LOS			F	B

Intersection Summary					
Average Delay			18.8		
Intersection Capacity Utilization			56.7%	ICU Level of Service	B
Analysis Period (min)			15		

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	136	1186	1	646	6	0	25	12
Future Volume (vph)	136	1186	1	646	6	0	25	12
Turn Type	pm+pt	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases	5	2		6		8		4
Permitted Phases	2		6		8		4	
Detector Phase	5	2	6	6	8	8	4	4
Switch Phase								
Minimum Initial (s)	6.0	8.0	8.0	8.0	8.0	8.0	5.0	5.0
Minimum Split (s)	15.0	68.0	53.0	53.0	32.0	32.0	32.0	32.0
Total Split (s)	15.0	68.0	53.0	53.0	32.0	32.0	32.0	32.0
Total Split (%)	15.0%	68.0%	53.0%	53.0%	32.0%	32.0%	32.0%	32.0%
Yellow Time (s)	3.0	4.0	4.0	4.0	4.0	4.0	3.5	3.5
All-Red Time (s)	0.0	3.0	3.0	3.0	3.0	3.0	1.0	1.0
Lost Time Adjust (s)	1.0	-3.0	0.0	-3.0		0.0		0.0
Total Lost Time (s)	4.0	4.0	7.0	4.0		7.0		4.5
Lead/Lag	Lead		Lag	Lag				
Lead-Lag Optimize?								
Recall Mode	None	Max	Max	Max	None	None	None	None
Act Effct Green (s)	67.0	67.8	53.7	56.7		8.3		9.8
Actuated g/C Ratio	0.80	0.81	0.64	0.68		0.10		0.12
v/c Ratio	0.26	0.44	0.00	0.32		0.10		0.46
Control Delay	3.6	3.6	7.0	6.6		1.0		21.5
Queue Delay	0.0	0.2	0.0	0.0		0.0		0.0
Total Delay	3.6	3.9	7.0	6.6		1.0		21.5
LOS	A	A	A	A		A		C
Approach Delay		3.8		6.6		1.0		21.5
Approach LOS		A		A		A		C

Intersection Summary			
Cycle Length: 100			
Actuated Cycle Length: 83.3			
Natural Cycle: 100			
Control Type: Semi Act-Uncoord			
Maximum v/c Ratio: 0.46			
Intersection Signal Delay: 5.6		Intersection LOS: A	
Intersection Capacity Utilization 61.2%		ICU Level of Service B	
Analysis Period (min) 15			

Splits and Phases: 4: Plains Rd & Cooke Blvd



Lane Group	EBL	EBT	WBL	WBT	NBT	SBT
Lane Group Flow (vph)	143	1251	1	741	21	107
v/c Ratio	0.26	0.44	0.00	0.32	0.10	0.46
Control Delay	3.6	3.6	7.0	6.6	1.0	21.5
Queue Delay	0.0	0.2	0.0	0.0	0.0	0.0
Total Delay	3.6	3.9	7.0	6.6	1.0	21.5
Queue Length 50th (m)	4.5	29.6	0.1	25.2	0.0	5.9
Queue Length 95th (m)	9.2	43.2	0.7	38.8	0.0	20.7
Internal Link Dist (m)		136.0		176.0	26.0	326.1
Turn Bay Length (m)	40.0		15.0			
Base Capacity (vph)	619	2852	267	2306	460	538
Starvation Cap Reductn	0	751	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.23	0.60	0.00	0.32	0.05	0.20

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	136	1186	3	1	646	58	6	0	13	25	12	65
Future Volume (vph)	136	1186	3	1	646	58	6	0	13	25	12	65
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.6	3.6	3.6	3.6	3.5	3.6	3.6	3.6	3.3	3.6	3.5
Total Lost time (s)	4.0	4.0		7.0	4.0			7.0			4.5	
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00			1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00			1.00			0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00			1.00	
Frt	1.00	1.00		1.00	0.99			0.91			0.91	
Flt Protected	0.95	1.00		0.95	1.00			0.98			0.99	
Satd. Flow (prot)	1726	3504		1770	3380			1667			1617	
Flt Permitted	0.32	1.00		0.22	1.00			0.80			0.91	
Satd. Flow (perm)	581	3504		415	3380			1357			1495	
Peak-hour factor, PHF	0.95	0.95	0.92	0.92	0.95	0.95	0.92	0.92	0.92	0.95	0.92	0.95
Adj. Flow (vph)	143	1248	3	1	680	61	7	0	14	26	13	68
RTOR Reduction (vph)	0	0	0	0	4	0	0	19	0	0	61	0
Lane Group Flow (vph)	143	1251	0	1	737	0	0	2	0	0	46	0
Confl. Peds. (#/hr)	4					4				2		3
Heavy Vehicles (%)	1%	3%	2%	2%	5%	8%	2%	2%	2%	17%	2%	1%
Turn Type	pm+pt	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases	5	2			6			8			4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)	64.1	64.1		53.8	53.8			6.7			9.2	
Effective Green, g (s)	63.1	67.1		53.8	56.8			6.7			9.2	
Actuated g/C Ratio	0.74	0.79		0.63	0.67			0.08			0.11	
Clearance Time (s)	3.0	7.0		7.0	7.0			7.0			4.5	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0			3.0	
Lane Grp Cap (vph)	517	2772		263	2263			107			162	
v/s Ratio Prot	0.02	c0.36			0.22							
v/s Ratio Perm	0.19			0.00				0.00			c0.03	
v/c Ratio	0.28	0.45		0.00	0.33			0.02			0.29	
Uniform Delay, d1	3.5	2.9		5.7	5.9			36.0			34.8	
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Incremental Delay, d2	0.3	0.5		0.0	0.4			0.1			1.0	
Delay (s)	3.8	3.4		5.7	6.3			36.1			35.8	
Level of Service	A	A		A	A			D			D	
Approach Delay (s)		3.4			6.3			36.1			35.8	
Approach LOS		A			A			D			D	

Intersection Summary				
HCM 2000 Control Delay	6.2	HCM 2000 Level of Service	A	
HCM 2000 Volume to Capacity ratio	0.47			
Actuated Cycle Length (s)	84.8	Sum of lost time (s)	15.0	
Intersection Capacity Utilization	61.2%	ICU Level of Service	B	
Analysis Period (min)	15			
c Critical Lane Group				

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	20	0	53	0	11	570	150	861
Future Volume (vph)	20	0	53	0	11	570	150	861
Turn Type	Perm	NA	Perm	NA	Perm	NA	pm+pt	NA
Protected Phases		4		8		2	1	6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	1	6
Switch Phase								
Minimum Initial (s)	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Minimum Split (s)	32.0	32.0	32.0	32.0	60.0	60.0	18.0	78.0
Total Split (s)	32.0	32.0	32.0	32.0	60.0	60.0	18.0	78.0
Total Split (%)	29.1%	29.1%	29.1%	29.1%	54.5%	54.5%	16.4%	70.9%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	3.0	4.0
All-Red Time (s)	3.0	3.0	3.0	3.0	2.0	2.0	0.0	2.0
Lost Time Adjust (s)		-3.0	-3.0	-3.0	-2.0	-2.0	1.0	-2.0
Total Lost Time (s)		4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag					Lag	Lag	Lead	
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	C-Max	C-Max	None	C-Max
Act Effct Green (s)		15.7	15.7	15.7	74.5	74.5	86.3	86.3
Actuated g/C Ratio		0.14	0.14	0.14	0.68	0.68	0.78	0.78
v/c Ratio		0.27	0.33	0.76	0.04	0.27	0.27	0.33
Control Delay		7.8	45.8	14.0	9.0	8.1	4.7	4.4
Queue Delay		0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		7.8	45.8	14.0	9.0	8.1	4.7	4.4
LOS		A	D	B	A	A	A	A
Approach Delay		7.8		17.5		8.2		4.4
Approach LOS		A		B		A		A

Intersection Summary

Cycle Length: 110
Actuated Cycle Length: 110
Offset: 72 (65%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 110
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.76
Intersection Signal Delay: 8.4 — Intersection LOS: A
Intersection Capacity Utilization 69.0% — ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 1: Waterdown Rd & Masonry Crt



Lane Group	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	27	55	439	11	620	156	916
v/c Ratio	0.27	0.33	0.76	0.04	0.27	0.27	0.33
Control Delay	7.8	45.8	14.0	9.0	8.1	4.7	4.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	7.8	45.8	14.0	9.0	8.1	4.7	4.4
Queue Length 50th (m)	0.0	11.6	3.9	0.7	23.2	6.0	22.5
Queue Length 95th (m)	1.4	21.7	33.2	4.0	48.5	18.0	51.0
Internal Link Dist (m)	128.3		126.0		326.0		176.0
Turn Bay Length (m)		30.0		25.0		20.0	
Base Capacity (vph)	130	295	705	276	2339	639	2737
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.21	0.19	0.62	0.04	0.27	0.24	0.33

Intersection Summary

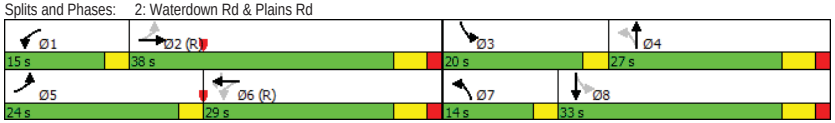
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	20	0	6	53	0	421	11	570	25	150	861	18
Future Volume (vph)	20	0	6	53	0	421	11	570	25	150	861	18
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.6	3.5	3.3	3.6	3.5	3.3	3.6	3.5	3.3	3.6	3.5
Total Lost time (s)		4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor		1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frpb, ped/bikes		1.00		1.00	0.98		1.00	1.00		1.00	1.00	
Flpb, ped/bikes		1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt		0.97		1.00	0.85		1.00	0.99		1.00	1.00	
Flt Protected		0.96		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1424		1489	1540		1246	3451		1661	3486	
Flt Permitted		0.23		0.74	1.00		0.31	1.00		0.37	1.00	
Satd. Flow (perm)		335		1159	1540		408	3451		653	3486	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	21	0	6	55	0	439	11	594	26	156	897	19
RTOR Reduction (vph)	0	23	0	0	360	0	0	2	0	0	1	0
Lane Group Flow (vph)	0	4	0	55	79	0	11	618	0	156	915	0
Confl. Peds. (#/hr)	4		1	1		4	1		3	3		1
Heavy Vehicles (%)	26%	0%	17%	17%	0%	3%	40%	3%	23%	5%	2%	59%
Turn Type	Perm	NA		Perm	NA		Perm	NA		pm+pt	NA	
Protected Phases		4			8			2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		12.7		12.7	12.7		72.5	72.5		84.3	84.3	
Effective Green, g (s)		15.7		15.7	15.7		74.5	74.5		83.3	86.3	
Actuated g/C Ratio		0.14		0.14	0.14		0.68	0.68		0.76	0.78	
Clearance Time (s)		7.0		7.0	7.0		6.0	6.0		3.0	6.0	
Vehicle Extension (s)		3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		47		165	219		276	2337		565	2734	
v/s Ratio Prot					c0.05			0.18		0.02	c0.26	
v/s Ratio Perm		0.01		0.05			0.03			0.19		
v/c Ratio		0.08		0.33	0.36		0.04	0.26		0.28	0.33	
Uniform Delay, d1		40.9		42.4	42.6		5.9	7.0		3.9	3.5	
Progression Factor		1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		0.8		1.2	1.0		0.3	0.3		0.3	0.3	
Delay (s)		41.7		43.6	43.6		6.2	7.3		4.2	3.8	
Level of Service		D		D	D		A	A		A	A	
Approach Delay (s)		41.7			43.6			7.2			3.9	
Approach LOS		D			D			A			A	

Intersection Summary			
HCM 2000 Control Delay	14.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.35		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	69.0%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations									
Traffic Volume (vph)	227	595	60	1107	146	159	253	195	481
Future Volume (vph)	227	595	60	1107	146	159	253	195	481
Turn Type	pm+pt	NA	pm+pt	NA	pm+pt	NA	pm+pt	NA	custom
Protected Phases	5	2	1	6	7	4	3	8	
Permitted Phases	2		6		4		8		6
Detector Phase	5	2	1	6	7	4	3	8	6
Switch Phase									
Minimum Initial (s)	6.0	8.0	6.0	8.0	6.0	8.0	6.0	8.0	8.0
Minimum Split (s)	18.0	42.0	12.0	36.0	10.0	33.0	13.0	36.0	36.0
Total Split (s)	24.0	38.0	15.0	29.0	14.0	27.0	20.0	33.0	29.0
Total Split (%)	24.0%	38.0%	15.0%	29.0%	14.0%	27.0%	20.0%	33.0%	29.0%
Yellow Time (s)	3.0	4.0	3.0	4.0	3.0	4.0	3.0	4.0	4.0
All-Red Time (s)	0.0	2.0	0.0	2.0	0.0	2.0	0.0	2.0	2.0
Lost Time Adjust (s)	1.0	-2.0	1.0	-2.0	1.0	-2.0	1.0	-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
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?									
Recall Mode	None	C-Max	None	C-Max	None	None	None	None	C-Max
Act Effct Green (s)	55.6	47.1	45.3	39.0	27.2	18.0	36.4	23.2	39.0
Actuated g/C Ratio	0.56	0.47	0.45	0.39	0.27	0.18	0.36	0.23	0.39
v/c Ratio	0.82	0.43	0.17	0.98	0.42	0.63	0.72	0.45	0.56
Control Delay	43.2	20.1	9.0	46.2	25.1	43.5	34.7	35.3	5.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	43.2	20.1	9.0	46.2	25.1	43.5	34.7	35.3	5.6
LOS	D	C	A	D	C	D	C	D	A
Approach Delay		25.8		44.6		35.9		19.8	
Approach LOS		C		D		D		B	

Intersection Summary			
Cycle Length: 100			
Actuated Cycle Length: 100			
Offset: 37 (37%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green			
Natural Cycle: 100			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.98			
Intersection Signal Delay: 32.4		Intersection LOS: C	
Intersection Capacity Utilization 89.0%		ICU Level of Service E	
Analysis Period (min) 15			

Splits and Phases: 2: Waterdown Rd & Plains Rd

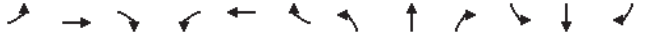




Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	232	709	61	1331	149	212	258	199	491
v/c Ratio	0.82	0.43	0.17	0.98	0.42	0.63	0.72	0.45	0.56
Control Delay	43.2	20.1	9.0	46.2	25.1	43.5	34.7	35.3	5.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	43.2	20.1	9.0	46.2	25.1	43.5	34.7	35.3	5.6
Queue Length 50th (m)	30.1	50.4	2.6	~141.8	20.4	37.5	37.8	34.7	0.0
Queue Length 95th (m)	57.2	76.4	m4.8	#244.9	31.9	58.5	54.2	52.3	28.3
Internal Link Dist (m)		176.0		136.0		176.0		326.0	
Turn Bay Length (m)	30.0		40.0		30.0				40.0
Base Capacity (vph)	394	1638	434	1352	369	424	378	551	881
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.59	0.43	0.14	0.98	0.40	0.50	0.68	0.36	0.56

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.
m Volume for 95th percentile queue is metered by upstream signal.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	227	595	100	60	1107	197	146	159	49	253	195	481
Future Volume (vph)	227	595	100	60	1107	197	146	159	49	253	195	481
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.6	3.5	3.3	3.6	3.5	3.3	3.6	3.5	3.3	3.6	3.5
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	1.00
Frpb, ped/bikes	1.00	0.99		1.00	1.00		1.00	1.00		1.00	1.00	0.97
Flpb, ped/bikes	1.00	1.00		0.99	1.00		0.99	1.00		1.00	1.00	1.00
Frt	1.00	0.98		1.00	0.98		1.00	0.96		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1662	3460		1702	3440		1700	1799		1744	1900	1491
Flt Permitted	0.10	1.00		0.36	1.00		0.62	1.00		0.27	1.00	1.00
Satd. Flow (perm)	175	3460		637	3440		1106	1799		487	1900	1491
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	232	607	102	61	1130	201	149	162	50	258	199	491
RTOR Reduction (vph)	0	11	0	0	12	0	0	11	0	0	0	300
Lane Group Flow (vph)	232	698	0	61	1319	0	149	201	0	258	199	191
Confl. Peds. (#/hr)	3		19	19		3	12		2	2		12
Heavy Vehicles (%)	5%	1%	2%	2%	2%	4%	2%	2%	0%	0%	0%	4%
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	custom
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases	2			6			4			8		6
Actuated Green, G (s)	53.6	44.5		43.1	37.0		26.2	16.0		34.4	21.2	37.0
Effective Green, g (s)	52.6	46.5		41.1	39.0		24.2	18.0		33.4	23.2	39.0
Actuated g/C Ratio	0.53	0.46		0.41	0.39		0.24	0.18		0.33	0.23	0.39
Clearance Time (s)	3.0	6.0		3.0	6.0		3.0	6.0		3.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	279	1608		316	1341		322	323		343	440	581
v/s Ratio Prot	c0.10	0.20		0.01	c0.38		0.04	0.11		c0.11	0.10	
v/s Ratio Perm	0.33			0.07			0.07			c0.14		0.13
v/c Ratio	0.83	0.43		0.19	0.98		0.46	0.62		0.75	0.45	0.33
Uniform Delay, d1	26.0	17.9		18.0	30.2		31.5	37.8		26.8	32.9	21.3
Progression Factor	1.00	1.00		0.61	0.77		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	18.6	0.9		0.2	18.9		1.1	3.7		9.0	0.7	1.5
Delay (s)	44.6	18.8		11.2	42.2		32.5	41.5		35.8	33.7	22.9
Level of Service	D	B		B	D		C	D		D	C	C
Approach Delay (s)		25.1			40.9			37.8			28.7	
Approach LOS		C			D			D			C	

Intersection Summary

HCM 2000 Control Delay	33.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	89.0%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	38	90	38	85	321	1	146	14	28	1	9	22
Future Volume (Veh/h)	38	90	38	85	321	1	146	14	28	1	9	22
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81
Hourly flow rate (vph)	47	111	47	105	396	1	180	17	35	1	11	27
Pedestrians					3			2			3	
Lane Width (m)					3.6			3.6			3.6	
Walking Speed (m/s)					1.2			1.2			1.2	
Percent Blockage					0			0			0	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)		150										
pX, platoon unblocked												
vC, conflicting volume	400			160			870	840	140	884	864	400
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	400			160			870	840	140	884	864	400
tC, single (s)	4.6			4.1			7.1	6.5	6.2	7.1	6.5	6.8
tC, 2 stage (s)												
tF (s)	2.7			2.2			3.5	4.0	3.3	3.5	4.0	3.8
p0 queue free %	95			93			20	94	96	100	96	95
cM capacity (veh/h)	938			1429			224	266	910	221	258	545

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	205	502	232	39
Volume Left	47	105	180	1
Volume Right	47	1	35	27
cSH	938	1429	257	403
Volume to Capacity	0.05	0.07	0.90	0.10
Queue Length 95th (m)	1.3	1.9	63.3	2.6
Control Delay (s)	2.5	2.2	76.1	14.9
Lane LOS	A	A	F	B
Approach Delay (s)	2.5	2.2	76.1	14.9
Approach LOS			F	B

Intersection Summary					
Average Delay			20.3		
Intersection Capacity Utilization			52.0%	ICU Level of Service	A
Analysis Period (min)			15		

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	53	851	10	1303	5	0	74	0
Future Volume (vph)	53	851	10	1303	5	0	74	0
Turn Type	pm+pt	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases	5	2		6		8		4
Permitted Phases	2		6		8		4	
Detector Phase	5	2	6	6	8	8	4	4
Switch Phase								
Minimum Initial (s)	6.0	8.0	8.0	8.0	8.0	8.0	5.0	5.0
Minimum Split (s)	16.0	68.0	52.0	52.0	32.0	32.0	22.5	22.5
Total Split (s)	16.0	68.0	52.0	52.0	32.0	32.0	32.0	32.0
Total Split (%)	16.0%	68.0%	52.0%	52.0%	32.0%	32.0%	32.0%	32.0%
Yellow Time (s)	3.0	4.0	4.0	4.0	4.0	4.0	3.5	3.5
All-Red Time (s)	0.0	3.0	3.0	3.0	3.0	3.0	1.0	1.0
Lost Time Adjust (s)	1.0	-3.0	0.0	-3.0		0.0		0.0
Total Lost Time (s)	4.0	4.0	7.0	4.0		7.0		4.5
Lead/Lag	Lead		Lag	Lag				
Lead-Lag Optimize?								
Recall Mode	None	C-Max	C-Max	C-Max	None	None	None	None
Act Effct Green (s)	78.5	78.5	67.9	70.9		10.5		13.0
Actuated g/C Ratio	0.78	0.78	0.68	0.71		0.10		0.13
v/c Ratio	0.21	0.32	0.03	0.58		0.05		0.64
Control Delay	4.4	2.9	7.5	9.3		0.4		33.3
Queue Delay	0.0	0.0	0.0	0.0		0.0		0.0
Total Delay	4.4	2.9	7.5	9.3		0.4		33.3
LOS	A	A	A	A		A		C
Approach Delay		3.0		9.3		0.4		33.3
Approach LOS		A		A		A		C

Intersection Summary			
Cycle Length: 100			
Actuated Cycle Length: 100			
Offset: 13 (13%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green			
Natural Cycle: 100			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.64			
Intersection Signal Delay: 8.4		Intersection LOS: A	
Intersection Capacity Utilization 62.5%		ICU Level of Service B	
Analysis Period (min) 15			

Splits and Phases: 4: Plains Rd & Cooke Blvd

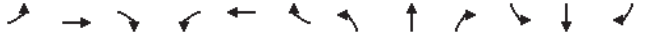




Lane Group	EBL	EBT	WBL	WBT	NBT	SBT
Lane Group Flow (vph)	55	886	11	1439	9	162
v/c Ratio	0.21	0.32	0.03	0.58	0.05	0.64
Control Delay	4.4	2.9	7.5	9.3	0.4	33.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	4.4	2.9	7.5	9.3	0.4	33.3
Queue Length 50th (m)	0.9	12.0	0.7	65.3	0.0	16.8
Queue Length 95th (m)	m4.0	31.4	3.3	111.5	0.0	36.2
Internal Link Dist (m)		136.0		176.0	26.0	326.1
Turn Bay Length (m)	40.0		15.0			
Base Capacity (vph)	365	2799	405	2471	366	455
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.15	0.32	0.03	0.58	0.02	0.36

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	53	851	8	10	1303	93	5	0	4	74	0	83
Future Volume (vph)	53	851	8	10	1303	93	5	0	4	74	0	83
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.6	3.6	3.6	3.6	3.5	3.6	3.6	3.6	3.3	3.6	3.5
Total Lost time (s)	4.0	4.0		7.0	4.0			7.0			4.5	
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00			1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00			1.00			0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00			1.00	
Frt	1.00	1.00		1.00	0.99			0.94			0.93	
Flt Protected	0.95	1.00		0.95	1.00			0.97			0.98	
Satd. Flow (prot)	1745	3568		1770	3482			1704			1683	
Flt Permitted	0.13	1.00		0.32	1.00			0.71			0.85	
Satd. Flow (perm)	235	3568		598	3482			1238			1457	
Peak-hour factor, PHF	0.97	0.97	0.92	0.92	0.97	0.97	0.92	0.92	0.92	0.97	0.92	0.97
Adj. Flow (vph)	55	877	9	11	1343	96	5	0	4	76	0	86
RTOR Reduction (vph)	0	0	0	0	3	0	0	8	0	0	66	0
Lane Group Flow (vph)	55	886	0	11	1436	0	0	1	0	0	96	0
Confl. Peds. (#/hr)	5					5						4
Heavy Vehicles (%)	0%	1%	2%	2%	2%	8%	2%	2%	2%	3%	2%	0%
Turn Type	pm+pt	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases	5	2			6			8			4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)	75.5	75.5		67.3	67.3			10.5			13.0	
Effective Green, g (s)	74.5	78.5		67.3	70.3			10.5			13.0	
Actuated g/C Ratio	0.74	0.78		0.67	0.70			0.10			0.13	
Clearance Time (s)	3.0	7.0		7.0	7.0			7.0			4.5	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0			3.0	
Lane Grp Cap (vph)	238	2800		402	2447			129			189	
v/s Ratio Prot	0.01	c0.25			c0.41							
v/s Ratio Perm	0.16			0.02				0.00			c0.07	
v/c Ratio	0.23	0.32		0.03	0.59			0.01			0.51	
Uniform Delay, d1	6.1	3.1		5.4	7.5			40.1			40.5	
Progression Factor	0.97	0.77		1.00	1.00			1.00			1.00	
Incremental Delay, d2	0.4	0.3		0.1	1.0			0.0			2.1	
Delay (s)	6.4	2.6		5.6	8.5			40.1			42.7	
Level of Service	A	A		A	A			D			D	
Approach Delay (s)		2.9			8.5			40.1			42.7	
Approach LOS		A			A			D			D	

Intersection Summary

HCM 2000 Control Delay	8.7	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	62.5%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Appendix F

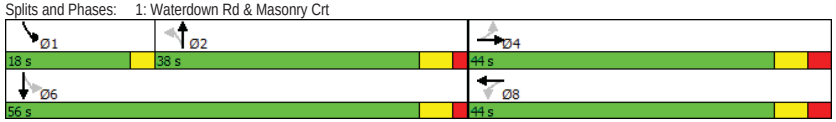
Total Traffic Operational Conditions

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	29	1	10	0	7	1097	318	410
Future Volume (vph)	29	1	10	0	7	1097	318	410
Turn Type	Perm	NA	Perm	NA	Perm	NA	pm+pt	NA
Protected Phases		4		8		2	1	6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	1	6
Switch Phase								
Minimum Initial (s)	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Minimum Split (s)	44.0	44.0	44.0	44.0	38.0	38.0	18.0	56.0
Total Split (s)	44.0	44.0	44.0	44.0	38.0	38.0	18.0	56.0
Total Split (%)	44.0%	44.0%	44.0%	44.0%	38.0%	38.0%	18.0%	56.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	3.0	4.0
All-Red Time (s)	3.0	3.0	3.0	3.0	2.0	2.0	0.0	2.0
Lost Time Adjust (s)		-3.0	-3.0	-3.0	-2.0	-2.0	1.0	-2.0
Total Lost Time (s)		4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag					Lag	Lag	Lead	
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	Max	Max	None	Max
Act Effct Green (s)		12.1	12.1	12.1	34.0	34.0	52.0	52.0
Actuated g/C Ratio		0.17	0.17	0.17	0.47	0.47	0.72	0.72
v/c Ratio		0.50	0.05	0.47	0.02	0.80	0.75	0.19
Control Delay		41.2	25.4	3.7	11.3	21.1	25.8	3.6
Queue Delay		0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		41.2	25.4	3.7	11.3	21.1	25.8	3.6
LOS		D	C	A	B	C	C	A
Approach Delay		41.2		4.6		21.1		13.0
Approach LOS		D		A		C		B

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 72.1
Natural Cycle: 100
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.80
Intersection Signal Delay: 16.9 — Intersection LOS: B
Intersection Capacity Utilization 87.1% — ICU Level of Service E
Analysis Period (min) 15

Splits and Phases: 1: Waterdown Rd & Masonry Crt



Lane Group	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	45	11	256	7	1283	335	453
v/c Ratio	0.50	0.05	0.47	0.02	0.80	0.75	0.19
Control Delay	41.2	25.4	3.7	11.3	21.1	25.8	3.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	41.2	25.4	3.7	11.3	21.1	25.8	3.6
Queue Length 50th (m)	4.1	1.3	0.0	0.5	73.9	25.2	7.8
Queue Length 95th (m)	#15.5	5.5	4.8	2.7	112.3	#69.3	15.2
Internal Link Dist (m)	128.3		126.0		326.0		176.0
Turn Bay Length (m)		30.0		25.0		20.0	
Base Capacity (vph)	268	742	1000	297	1606	448	2368
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.17	0.01	0.26	0.02	0.80	0.75	0.19

Intersection Summary

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

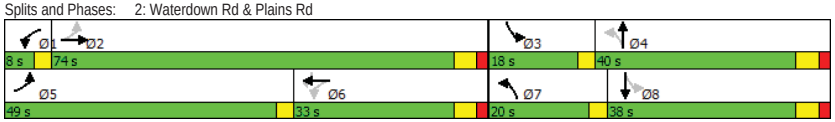
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	29	1	12	10	0	243	7	1097	122	318	410	20
Future Volume (vph)	29	1	12	10	0	243	7	1097	122	318	410	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.6	3.5	3.3	3.6	3.5	3.3	3.6	3.5	3.3	3.6	3.5
Total Lost time (s)		4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor		1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frpb, ped/bikes		1.00		1.00	0.99		1.00	1.00		1.00	1.00	
Flpb, ped/bikes		1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt		0.96		1.00	0.85		1.00	0.99		1.00	0.99	
Flt Protected		0.97		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1158		1745	1518		1219	3392		1745	3282	
Flt Permitted		0.40		0.73	1.00		0.49	1.00		0.11	1.00	
Satd. Flow (perm)		473		1337	1518		630	3392		210	3282	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	31	1	13	11	0	256	7	1155	128	335	432	21
RTOR Reduction (vph)	0	11	0	0	213	0	0	7	0	0	2	0
Lane Group Flow (vph)	0	34	0	11	43	0	7	1276	0	335	451	0
Confl. Peds. (#/hr)	1					1	1		2	2		1
Heavy Vehicles (%)	54%	100%	45%	0%	0%	5%	43%	5%	1%	0%	7%	53%
Turn Type	Perm	NA		Perm	NA		Perm	NA		pm+pt	NA	
Protected Phases		4			8			2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		9.1		9.1	9.1		32.0	32.0		50.0	50.0	
Effective Green, g (s)		12.1		12.1	12.1		34.0	34.0		49.0	52.0	
Actuated g/C Ratio		0.17		0.17	0.17		0.47	0.47		0.68	0.72	
Clearance Time (s)		7.0		7.0	7.0		6.0	6.0		3.0	6.0	
Vehicle Extension (s)		3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		79		224	254		297	1599		440	2367	
v/s Ratio Prot					0.03			c0.38		c0.15	0.14	
v/s Ratio Perm		c0.07		0.01			0.01			0.37		
v/c Ratio		0.43		0.05	0.17		0.02	0.80		0.76	0.19	
Uniform Delay, d1		26.9		25.2	25.7		10.2	16.1		16.7	3.2	
Progression Factor		1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		3.8		0.1	0.3		0.1	4.3		7.6	0.2	
Delay (s)		30.7		25.3	26.0		10.3	20.4		24.3	3.4	
Level of Service		C		C	C		B	C		C	A	
Approach Delay (s)		30.7			26.0			20.3			12.3	
Approach LOS		C			C			C			B	

Intersection Summary				
HCM 2000 Control Delay	18.5	HCM 2000 Level of Service	B	
HCM 2000 Volume to Capacity ratio	0.72			
Actuated Cycle Length (s)	72.1	Sum of lost time (s)	12.0	
Intersection Capacity Utilization	87.1%	ICU Level of Service	E	
Analysis Period (min)	15			
c Critical Lane Group				

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations									
Traffic Volume (vph)	724	1023	63	373	61	284	164	115	171
Future Volume (vph)	724	1023	63	373	61	284	164	115	171
Turn Type	pm+pt	NA	pm+pt	NA	pm+pt	NA	pm+pt	NA	custom
Protected Phases	5	2	1	6	7	4	3	8	
Permitted Phases	2		6		4		8		6
Detector Phase	5	2	1	6	7	4	3	8	6
Switch Phase									
Minimum Initial (s)	6.0	8.0	5.0	8.0	6.0	8.0	6.0	8.0	8.0
Minimum Split (s)	49.0	74.0	8.0	33.0	20.0	40.0	18.0	38.0	33.0
Total Split (s)	49.0	74.0	8.0	33.0	20.0	40.0	18.0	38.0	33.0
Total Split (%)	35.0%	52.9%	5.7%	23.6%	14.3%	28.6%	12.9%	27.1%	23.6%
Yellow Time (s)	3.0	4.0	3.0	4.0	3.0	4.0	3.0	4.0	4.0
All-Red Time (s)	0.0	2.0	0.0	2.0	0.0	2.0	0.0	2.0	2.0
Lost Time Adjust (s)	1.0	-2.0	1.0	-2.0	1.0	-2.0	1.0	-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
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?									
Recall Mode	None	Max	None	Max	None	None	None	None	Max
Act Effct Green (s)	78.2	71.9	33.1	29.1	39.5	31.7	48.4	38.7	29.1
Actuated g/C Ratio	0.58	0.53	0.25	0.22	0.29	0.24	0.36	0.29	0.22
v/c Ratio	1.26	0.69	0.51	0.83	0.17	0.84	0.82	0.24	0.41
Control Delay	161.9	26.7	38.5	55.1	29.4	66.4	60.9	39.2	9.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	161.9	26.7	38.5	55.1	29.4	66.4	60.9	39.2	9.2
LOS	F	C	D	E	C	E	E	D	A
Approach Delay		78.1		53.5		60.8		35.6	
Approach LOS		E		D		E		D	

Intersection Summary			
Cycle Length: 140			
Actuated Cycle Length: 134.7			
Natural Cycle: 150			
Control Type: Semi Act-Uncoord			
Maximum v/c Ratio: 1.26			
Intersection Signal Delay: 65.8		Intersection LOS: E	
Intersection Capacity Utilization 99.6%		ICU Level of Service F	
Analysis Period (min) 15			

Splits and Phases: 2: Waterdown Rd & Plains Rd



Queues
2: Waterdown Rd & Plains Rd

Total AM
180222

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	770	1255	67	636	65	362	174	122	182
v/c Ratio	1.26	0.69	0.51	0.83	0.17	0.84	0.82	0.24	0.41
Control Delay	161.9	26.7	38.5	55.1	29.4	66.4	60.9	39.2	9.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	161.9	26.7	38.5	55.1	29.4	66.4	60.9	39.2	9.2
Queue Length 50th (m)	~268.1	143.5	8.5	82.9	12.0	96.7	34.6	26.8	0.0
Queue Length 95th (m)	#353.2	175.2	16.4	#114.5	22.8	#136.0	#68.9	45.6	21.2
Internal Link Dist (m)		176.0		136.0		176.0		326.0	
Turn Bay Length (m)	30.0		40.0		30.0				40.0
Base Capacity (vph)	612	1821	132	764	480	487	226	510	447
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	1.26	0.69	0.51	0.83	0.14	0.74	0.77	0.24	0.41

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

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

HCM Signalized Intersection Capacity Analysis
2: Waterdown Rd & Plains Rd

Total AM
180222

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	724	1023	157	63	373	225	61	284	56	164	115	171
Future Volume (vph)	724	1023	157	63	373	225	61	284	56	164	115	171
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.6	3.5	3.3	3.6	3.5	3.3	3.6	3.5	3.3	3.6	3.5
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	1.00
Frpb, ped/bikes	1.00	0.99		1.00	0.99		1.00	1.00		1.00	1.00	0.96
Flpb, ped/bikes	1.00	1.00		1.00	1.00		0.99	1.00		1.00	1.00	1.00
Frt	1.00	0.98		1.00	0.94		1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1662	3398		1659	3247		1686	1804		1661	1776	1413
Flt Permitted	0.13	1.00		0.22	1.00		0.68	1.00		0.12	1.00	1.00
Satd. Flow (perm)	228	3398		388	3247		1204	1804		209	1776	1413
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	770	1088	167	67	397	239	65	302	60	174	122	182
RTOR Reduction (vph)	0	8	0	0	63	0	0	5	0	0	0	142
Lane Group Flow (vph)	770	1247	0	67	573	0	65	357	0	174	122	40
Confl. Peds. (#/hr)	6		19	19		6	17		7	7		17
Heavy Vehicles (%)	5%	3%	3%	5%	4%	4%	2%	2%	4%	5%	7%	8%
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	custom
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases	2			6			4			8		6
Actuated Green, G (s)	76.8	69.9		31.6	27.7		37.9	30.4		47.2	36.7	27.7
Effective Green, g (s)	75.8	71.9		29.6	29.7		35.9	32.4		46.2	38.7	29.7
Actuated g/C Ratio	0.56	0.53		0.22	0.22		0.26	0.24		0.34	0.28	0.22
Clearance Time (s)	3.0	6.0		3.0	6.0		3.0	6.0		3.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	602	1796		111	709		340	429		207	505	308
v/s Ratio Prot	c0.42	0.37		0.01	0.18		0.01	c0.20		c0.08	0.07	
v/s Ratio Perm	c0.29			0.12			0.04			0.21		0.03
v/c Ratio	1.28	0.69		0.60	0.81		0.19	0.83		0.84	0.24	0.13
Uniform Delay, d1	38.1	23.9		44.2	50.4		38.3	49.2		36.2	37.4	42.7
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	138.0	2.2		8.9	9.6		0.3	12.9		25.2	0.2	0.9
Delay (s)	176.1	26.1		53.2	60.0		38.6	62.1		61.4	37.6	43.6
Level of Service	F	C		D	E		D	E		E	D	D
Approach Delay (s)		83.2			59.4			58.5			48.6	
Approach LOS		F			E			E			D	

Intersection Summary

HCM 2000 Control Delay	71.1	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.11		
Actuated Cycle Length (s)	136.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	99.6%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	12	463	38	38	111	1	96	4	165	2	18	41
Future Volume (Veh/h)	12	463	38	38	111	1	96	4	165	2	18	41
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81
Hourly flow rate (vph)	15	572	47	47	137	1	119	5	204	2	22	51
Pedestrians		1			7						5	
Lane Width (m)		3.6			3.6						3.6	
Walking Speed (m/s)		1.2			1.2						1.2	
Percent Blockage		0			1						0	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)		150										
pX, platoon unblocked				0.94			0.94	0.94	0.94	0.94	0.94	
vC, conflicting volume	143			619			920	862	602	1076	886	144
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	143			567			886	825	549	1050	849	144
tC, single (s)	4.1			4.1			7.1	6.6	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.1	3.3	3.5	4.0	3.3
p0 queue free %	99			95			44	98	60	98	92	94
cM capacity (veh/h)	1446			958			212	268	506	108	266	905

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	634	185	328	75
Volume Left	15	47	119	2
Volume Right	47	1	204	51
cSH	1446	958	334	476
Volume to Capacity	0.01	0.05	0.98	0.16
Queue Length 95th (m)	0.3	1.2	85.8	4.4
Control Delay (s)	0.3	2.6	80.8	14.0
Lane LOS	A	A	F	B
Approach Delay (s)	0.3	2.6	80.8	14.0
Approach LOS			F	B

Intersection Summary					
Average Delay			23.1		
Intersection Capacity Utilization			57.3%	ICU Level of Service	B
Analysis Period (min)			15		

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	137	1186	1	646	6	0	30	12
Future Volume (vph)	137	1186	1	646	6	0	30	12
Turn Type	pm+pt	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases	5	2		6		8		4
Permitted Phases	2		6		8		4	
Detector Phase	5	2	6	6	8	8	4	4
Switch Phase								
Minimum Initial (s)	6.0	8.0	8.0	8.0	8.0	8.0	5.0	5.0
Minimum Split (s)	15.0	68.0	53.0	53.0	32.0	32.0	32.0	32.0
Total Split (s)	15.0	68.0	53.0	53.0	32.0	32.0	32.0	32.0
Total Split (%)	15.0%	68.0%	53.0%	53.0%	32.0%	32.0%	32.0%	32.0%
Yellow Time (s)	3.0	4.0	4.0	4.0	4.0	4.0	3.5	3.5
All-Red Time (s)	0.0	3.0	3.0	3.0	3.0	3.0	1.0	1.0
Lost Time Adjust (s)	1.0	-3.0	0.0	-3.0		0.0		0.0
Total Lost Time (s)	4.0	4.0	7.0	4.0		7.0		4.5
Lead/Lag	Lead		Lag	Lag				
Lead-Lag Optimize?								
Recall Mode	None	Max	Max	Max	None	None	None	None
Act Effct Green (s)	66.8	66.8	53.4	56.4		8.5		11.0
Actuated g/C Ratio	0.77	0.77	0.62	0.65		0.10		0.13
v/c Ratio	0.27	0.46	0.00	0.34		0.10		0.46
Control Delay	3.9	4.2	7.0	7.2		1.1		21.7
Queue Delay	0.0	0.3	0.0	0.0		0.0		0.0
Total Delay	3.9	4.5	7.0	7.2		1.1		21.7
LOS	A	A	A	A		A		C
Approach Delay		4.4		7.2		1.1		21.7
Approach LOS		A		A		A		C

Intersection Summary			
Cycle Length: 100			
Actuated Cycle Length: 86.3			
Natural Cycle: 100			
Control Type: Semi Act-Uncoord			
Maximum v/c Ratio: 0.46			
Intersection Signal Delay: 6.2		Intersection LOS: A	
Intersection Capacity Utilization 61.3%		ICU Level of Service B	
Analysis Period (min) 15			

Splits and Phases: 4: Plains Rd & Cooke Blvd

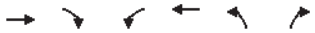


Lane Group	EBL	EBT	WBL	WBT	NBT	SBT
Lane Group Flow (vph)	144	1251	1	743	21	114
v/c Ratio	0.27	0.46	0.00	0.34	0.10	0.46
Control Delay	3.9	4.2	7.0	7.2	1.1	21.7
Queue Delay	0.0	0.3	0.0	0.0	0.0	0.0
Total Delay	3.9	4.5	7.0	7.2	1.1	21.7
Queue Length 50th (m)	4.6	29.6	0.1	25.2	0.0	6.9
Queue Length 95th (m)	9.7	44.8	0.8	39.8	0.0	22.3
Internal Link Dist (m)		136.0		176.0	26.0	326.1
Turn Bay Length (m)	40.0		15.0			
Base Capacity (vph)	589	2711	256	2212	449	519
Starvation Cap Reductn	0	749	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.24	0.64	0.00	0.34	0.05	0.22

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	137	1186	3	1	646	60	6	0	13	30	12	66
Future Volume (vph)	137	1186	3	1	646	60	6	0	13	30	12	66
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.6	3.6	3.6	3.6	3.5	3.6	3.6	3.6	3.3	3.6	3.5
Total Lost time (s)	4.0	4.0		7.0	4.0			7.0			4.5	
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00			1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00			1.00			0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00			1.00	
Frt	1.00	1.00		1.00	0.99			0.91			0.92	
Flt Protected	0.95	1.00		0.95	1.00			0.98			0.99	
Satd. Flow (prot)	1726	3504		1770	3378			1667			1612	
Flt Permitted	0.32	1.00		0.22	1.00			0.80			0.91	
Satd. Flow (perm)	573	3504		415	3378			1357			1480	
Peak-hour factor, PHF	0.95	0.95	0.92	0.92	0.95	0.95	0.92	0.92	0.92	0.95	0.92	0.95
Adj. Flow (vph)	144	1248	3	1	680	63	7	0	14	32	13	69
RTOR Reduction (vph)	0	0	0	0	5	0	0	19	0	0	60	0
Lane Group Flow (vph)	144	1251	0	1	738	0	0	2	0	0	54	0
Confl. Peds. (#/hr)	4					4				2		3
Heavy Vehicles (%)	1%	3%	2%	2%	5%	8%	2%	2%	2%	17%	2%	1%
Turn Type	pm+pt	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases	5	2			6			8			4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)	63.8	63.8		53.5	53.5			8.5			11.0	
Effective Green, g (s)	62.8	66.8		53.5	56.5			8.5			11.0	
Actuated g/C Ratio	0.73	0.77		0.62	0.65			0.10			0.13	
Clearance Time (s)	3.0	7.0		7.0	7.0			7.0			4.5	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0			3.0	
Lane Grp Cap (vph)	501	2712		257	2211			133			188	
v/s Ratio Prot	0.02	c0.36			0.22							
v/s Ratio Perm	0.19			0.00				0.00			c0.04	
v/c Ratio	0.29	0.46		0.00	0.33			0.02			0.29	
Uniform Delay, d1	4.0	3.4		6.2	6.6			35.1			34.1	
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Incremental Delay, d2	0.3	0.6		0.0	0.4			0.0			0.8	
Delay (s)	4.3	4.0		6.3	7.0			35.2			34.9	
Level of Service	A	A		A	A			D			C	
Approach Delay (s)		4.0			7.0			35.2			34.9	
Approach LOS		A			A			D			C	

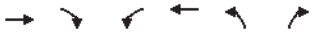
Intersection Summary				
HCM 2000 Control Delay	6.8	HCM 2000 Level of Service	A	
HCM 2000 Volume to Capacity ratio	0.48			
Actuated Cycle Length (s)	86.3	Sum of lost time (s)	15.0	
Intersection Capacity Utilization	61.3%	ICU Level of Service	B	
Analysis Period (min)	15			
c Critical Lane Group				



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	616	10	0	99	27	0
Future Volume (Veh/h)	616	10	0	99	27	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	670	11	0	108	29	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)	320					
pX, platoon unblocked						
vC, conflicting volume			681		784	676
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			681		784	676
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		92	100
cM capacity (veh/h)			921		365	457

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	681	108	29
Volume Left	0	0	29
Volume Right	11	0	0
cSH	1700	921	365
Volume to Capacity	0.40	0.00	0.08
Queue Length 95th (m)	0.0	0.0	2.1
Control Delay (s)	0.0	0.0	15.7
Lane LOS			C
Approach Delay (s)	0.0	0.0	15.7
Approach LOS			C

Intersection Summary				
Average Delay		0.6		
Intersection Capacity Utilization		43.0%	ICU Level of Service	A
Analysis Period (min)		15		



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	615	1	0	96	3	0
Future Volume (Veh/h)	615	1	0	96	3	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	668	1	0	104	3	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			669		772	668
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			669		772	668
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		99	100
cM capacity (veh/h)			931		370	461

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	669	104	3
Volume Left	0	0	3
Volume Right	1	0	0
cSH	1700	931	370
Volume to Capacity	0.39	0.00	0.01
Queue Length 95th (m)	0.0	0.0	0.2
Control Delay (s)	0.0	0.0	14.8
Lane LOS			B
Approach Delay (s)	0.0	0.0	14.8
Approach LOS			B

Intersection Summary				
Average Delay		0.1		
Intersection Capacity Utilization		42.4%	ICU Level of Service	A
Analysis Period (min)		15		

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	20	0	55	0	11	570	174	861
Future Volume (vph)	20	0	55	0	11	570	174	861
Turn Type	Perm	NA	Perm	NA	Perm	NA	pm+pt	NA
Protected Phases		4		8		2	1	6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	1	6
Switch Phase								
Minimum Initial (s)	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Minimum Split (s)	32.0	32.0	32.0	32.0	60.0	60.0	18.0	78.0
Total Split (s)	32.0	32.0	32.0	32.0	60.0	60.0	18.0	78.0
Total Split (%)	29.1%	29.1%	29.1%	29.1%	54.5%	54.5%	16.4%	70.9%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	3.0	4.0
All-Red Time (s)	3.0	3.0	3.0	3.0	2.0	2.0	0.0	2.0
Lost Time Adjust (s)		-3.0	-3.0	-3.0	-2.0	-2.0	1.0	-2.0
Total Lost Time (s)		4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag					Lag	Lag	Lead	
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	C-Max	C-Max	None	C-Max
Act Effct Green (s)		16.3	16.3	16.3	73.5	73.5	85.7	85.7
Actuated g/C Ratio		0.15	0.15	0.15	0.67	0.67	0.78	0.78
v/c Ratio		0.28	0.33	0.77	0.04	0.27	0.31	0.34
Control Delay		7.8	44.9	15.2	9.9	8.8	5.3	4.6
Queue Delay		0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		7.8	44.9	15.2	9.9	8.8	5.3	4.6
LOS		A	D	B	A	A	A	A
Approach Delay		7.8		18.5		8.8		4.8
Approach LOS		A		B		A		A

Intersection Summary

Cycle Length: 110
Actuated Cycle Length: 110
Offset: 72 (65%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 110
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.77
Intersection Signal Delay: 9.0 — Intersection LOS: A
Intersection Capacity Utilization 71.2% — ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 1: Waterdown Rd & Masonry Crt



Lane Group	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	27	57	453	11	621	181	916
v/c Ratio	0.28	0.33	0.77	0.04	0.27	0.31	0.34
Control Delay	7.8	44.9	15.2	9.9	8.8	5.3	4.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	7.8	44.9	15.2	9.9	8.8	5.3	4.6
Queue Length 50th (m)	0.0	12.0	6.8	0.7	23.4	7.1	22.6
Queue Length 95th (m)	1.4	21.7	37.2	4.2	51.7	21.7	53.7
Internal Link Dist (m)	128.3		126.0		326.0		176.0
Turn Bay Length (m)		30.0		25.0		20.0	
Base Capacity (vph)	126	295	705	273	2304	634	2717
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.21	0.19	0.64	0.04	0.27	0.29	0.34

Intersection Summary

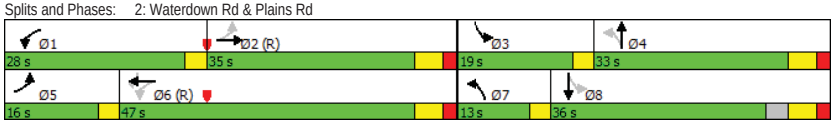
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	20	0	6	55	0	435	11	570	26	174	861	18
Future Volume (vph)	20	0	6	55	0	435	11	570	26	174	861	18
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.6	3.5	3.3	3.6	3.5	3.3	3.6	3.5	3.3	3.6	3.5
Total Lost time (s)		4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor		1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frpb, ped/bikes		1.00		1.00	0.98		1.00	1.00		1.00	1.00	
Flpb, ped/bikes		1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt		0.97		1.00	0.85		1.00	0.99		1.00	1.00	
Flt Protected		0.96		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1424		1489	1540		1246	3449		1661	3486	
Flt Permitted		0.22		0.74	1.00		0.31	1.00		0.37	1.00	
Satd. Flow (perm)		323		1159	1540		408	3449		649	3486	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	21	0	6	57	0	453	11	594	27	181	897	19
RTOR Reduction (vph)	0	23	0	0	358	0	0	2	0	0	1	0
Lane Group Flow (vph)	0	4	0	57	95	0	11	619	0	181	915	0
Confl. Peds. (#/hr)	4		1	1		4	1		3	3		1
Heavy Vehicles (%)	26%	0%	17%	17%	0%	3%	40%	3%	23%	5%	2%	59%
Turn Type	Perm	NA		Perm	NA		Perm	NA		pm+pt	NA	
Protected Phases		4			8			2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		13.3		13.3	13.3		71.5	71.5		83.7	83.7	
Effective Green, g (s)		16.3		16.3	16.3		73.5	73.5		82.7	85.7	
Actuated g/C Ratio		0.15		0.15	0.15		0.67	0.67		0.75	0.78	
Clearance Time (s)		7.0		7.0	7.0		6.0	6.0		3.0	6.0	
Vehicle Extension (s)		3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		47		171	228		272	2304		563	2715	
v/s Ratio Prot					c0.06			0.18		0.02	c0.26	
v/s Ratio Perm		0.01		0.05			0.03			0.22		
v/c Ratio		0.09		0.33	0.42		0.04	0.27		0.32	0.34	
Uniform Delay, d1		40.4		42.0	42.5		6.2	7.4		4.2	3.6	
Progression Factor		1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		0.8		1.2	1.2		0.3	0.3		0.3	0.3	
Delay (s)		41.2		43.1	43.8		6.5	7.7		4.5	4.0	
Level of Service		D		D	D		A	A		A	A	
Approach Delay (s)		41.2			43.7			7.6			4.1	
Approach LOS		D			D			A			A	

Intersection Summary				
HCM 2000 Control Delay	14.4	HCM 2000 Level of Service	B	
HCM 2000 Volume to Capacity ratio	0.36			
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	12.0	
Intersection Capacity Utilization	71.2%	ICU Level of Service	C	
Analysis Period (min)	15			
c Critical Lane Group				

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations									
Traffic Volume (vph)	228	596	60	1108	146	159	253	196	482
Future Volume (vph)	228	596	60	1108	146	159	253	196	482
Turn Type	pm+pt	NA	pm+pt	NA	pm+pt	NA	pm+pt	NA	custom
Protected Phases	5	2	1	6	7	4	3	8	
Permitted Phases	2		6		4		8		6
Detector Phase	5	2	1	6	7	4	3	8	6
Switch Phase									
Minimum Initial (s)	6.0	8.0	6.0	8.0	6.0	8.0	6.0	8.0	8.0
Minimum Split (s)	16.0	35.0	28.0	47.0	13.0	33.0	19.0	36.0	47.0
Total Split (s)	16.0	35.0	28.0	47.0	13.0	33.0	19.0	36.0	47.0
Total Split (%)	13.9%	30.4%	24.3%	40.9%	11.3%	28.7%	16.5%	31.3%	40.9%
Yellow Time (s)	3.0	4.0	3.0	4.0	3.0	4.0	3.0	4.0	4.0
All-Red Time (s)	0.0	2.0	0.0	2.0	0.0	2.0	0.0	2.0	2.0
Lost Time Adjust (s)	1.0	-2.0	1.0	-2.0	1.0	-2.0	1.0	-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
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?									
Recall Mode	None	C-Max	None	C-Max	None	None	None	None	C-Max
Act Effct Green (s)	68.5	59.9	55.6	49.1	28.8	20.1	38.5	25.8	49.1
Actuated g/C Ratio	0.60	0.52	0.48	0.43	0.25	0.17	0.33	0.22	0.43
v/c Ratio	0.81	0.39	0.16	0.90	0.48	0.65	0.82	0.47	0.54
Control Delay	49.6	18.7	13.1	40.9	33.0	50.5	50.6	41.4	4.6
Queue Delay	0.0	0.0	0.0	19.8	0.0	0.0	0.0	0.0	0.0
Total Delay	49.6	18.7	13.1	60.6	33.0	50.5	50.6	41.4	4.6
LOS	D	B	B	E	C	D	D	D	A
Approach Delay		26.3		58.5		43.3		24.8	
Approach LOS		C		E		D		C	

Intersection Summary			
Cycle Length: 115			
Actuated Cycle Length: 115			
Offset: 37 (32%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green			
Natural Cycle: 115			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.90			
Intersection Signal Delay: 39.9		Intersection LOS: D	
Intersection Capacity Utilization 89.1%		ICU Level of Service E	
Analysis Period (min) 15			

Splits and Phases: 2: Waterdown Rd & Plains Rd





Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	233	710	61	1332	149	212	258	200	492
v/c Ratio	0.81	0.39	0.16	0.90	0.48	0.65	0.82	0.47	0.54
Control Delay	49.6	18.7	13.1	40.9	33.0	50.5	50.6	41.4	4.6
Queue Delay	0.0	0.0	0.0	19.8	0.0	0.0	0.0	0.0	0.0
Total Delay	49.6	18.7	13.1	60.6	33.0	50.5	50.6	41.4	4.6
Queue Length 50th (m)	37.3	52.3	5.8	152.7	25.4	44.3	47.0	41.2	0.0
Queue Length 95th (m)	#86.4	78.6	13.7	#220.5	38.4	65.8	#69.6	59.8	22.6
Internal Link Dist (m)		176.0		136.0		176.0		326.0	
Turn Bay Length (m)	30.0		40.0		30.0				40.0
Base Capacity (vph)	286	1806	619	1481	314	463	321	578	917
Starvation Cap Reductn	0	0	0	190	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.81	0.39	0.10	1.03	0.47	0.46	0.80	0.35	0.54

Intersection Summary

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



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	228	596	100	60	1108	197	146	159	49	253	196	482
Future Volume (vph)	228	596	100	60	1108	197	146	159	49	253	196	482
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.6	3.5	3.3	3.6	3.5	3.3	3.6	3.5	3.3	3.6	3.5
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	1.00
Frpb, ped/bikes	1.00	0.99		1.00	1.00		1.00	1.00		1.00	1.00	0.97
Flpb, ped/bikes	1.00	1.00		0.99	1.00		0.99	1.00		1.00	1.00	1.00
Frt	1.00	0.98		1.00	0.98		1.00	0.96		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1662	3457		1699	3440		1700	1799		1744	1900	1488
Flt Permitted	0.08	1.00		0.38	1.00		0.58	1.00		0.25	1.00	1.00
Satd. Flow (perm)	140	3457		675	3440		1043	1799		459	1900	1488
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	233	608	102	61	1131	201	149	162	50	258	200	492
RTOR Reduction (vph)	0	8	0	0	11	0	0	11	0	0	0	282
Lane Group Flow (vph)	233	702	0	61	1321	0	149	201	0	258	200	210
Confl. Peds. (#/hr)	3		19	19		3	12		2	2		12
Heavy Vehicles (%)	5%	1%	2%	2%	2%	4%	2%	2%	0%	0%	0%	4%
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	custom
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases	2			6			4			8		6
Actuated Green, G (s)	66.4	57.2		53.3	47.1		27.8	18.1		36.6	23.9	47.1
Effective Green, g (s)	65.4	59.2		51.3	49.1		25.8	20.1		35.6	25.9	49.1
Actuated g/C Ratio	0.57	0.51		0.45	0.43		0.22	0.17		0.31	0.23	0.43
Clearance Time (s)	3.0	6.0		3.0	6.0		3.0	6.0		3.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	282	1779		347	1468		283	314		304	427	635
v/s Ratio Prot	c0.11	0.20		0.01	c0.38		0.04	0.11		c0.11	0.11	
v/s Ratio Perm	0.36			0.07			0.08			c0.16		0.14
v/c Ratio	0.83	0.39		0.18	0.90		0.53	0.64		0.85	0.47	0.33
Uniform Delay, d1	32.7	17.0		18.3	30.7		37.9	44.1		33.1	38.6	22.0
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	17.6	0.7		0.2	9.1		1.8	4.4		19.3	0.8	1.4
Delay (s)	50.3	17.6		18.5	39.8		39.7	48.5		52.3	39.4	23.4
Level of Service	D	B		B	D		D	D		D	D	C
Approach Delay (s)		25.7			38.9			44.9			34.6	
Approach LOS		C			D			D			C	

Intersection Summary

HCM 2000 Control Delay	35.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	115.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	89.1%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	38	115	38	90	337	1	146	14	35	1	9	22
Future Volume (Veh/h)	38	115	38	90	337	1	146	14	35	1	9	22
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81
Hourly flow rate (vph)	47	142	47	111	416	1	180	17	43	1	11	27
Pedestrians					3			2			3	
Lane Width (m)					3.6			3.6			3.6	
Walking Speed (m/s)					1.2			1.2			1.2	
Percent Blockage					0			0			0	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)		150										
pX, platoon unblocked				1.00			1.00	1.00	1.00	1.00	1.00	
vC, conflicting volume	420			191			932	904	170	956	926	420
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	420			190			932	903	169	955	926	420
tC, single (s)	4.6			4.1			7.1	6.5	6.2	7.1	6.5	6.8
tC, 2 stage (s)												
tF (s)	2.7			2.2			3.5	4.0	3.3	3.5	4.0	3.8
p0 queue free %	95			92			11	93	95	99	95	95
cM capacity (veh/h)	921			1393			201	243	875	194	235	530

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	236	528	240	39
Volume Left	47	111	180	1
Volume Right	47	1	43	27
cSH	921	1393	237	379
Volume to Capacity	0.05	0.08	1.01	0.10
Queue Length 95th (m)	1.3	2.1	77.5	2.7
Control Delay (s)	2.2	2.3	106.6	15.6
Lane LOS	A	A	F	C
Approach Delay (s)	2.2	2.3	106.6	15.6
Approach LOS			F	C

Intersection Summary				
Average Delay			26.8	
Intersection Capacity Utilization			55.4%	ICU Level of Service
Analysis Period (min)			15	

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	54	851	10	1303	5	0	78	0
Future Volume (vph)	54	851	10	1303	5	0	78	0
Turn Type	pm+pt	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases	5	2		6		8		4
Permitted Phases	2		6		8		4	
Detector Phase	5	2	6	6	8	8	4	4
Switch Phase								
Minimum Initial (s)	6.0	8.0	8.0	8.0	8.0	8.0	5.0	5.0
Minimum Split (s)	16.0	68.0	52.0	52.0	32.0	32.0	22.5	22.5
Total Split (s)	16.0	68.0	52.0	52.0	32.0	32.0	32.0	32.0
Total Split (%)	16.0%	68.0%	52.0%	52.0%	32.0%	32.0%	32.0%	32.0%
Yellow Time (s)	3.0	4.0	4.0	4.0	4.0	4.0	3.5	3.5
All-Red Time (s)	0.0	3.0	3.0	3.0	3.0	3.0	1.0	1.0
Lost Time Adjust (s)	1.0	-3.0	0.0	-3.0		0.0		0.0
Total Lost Time (s)	4.0	4.0	7.0	4.0		7.0		4.5
Lead/Lag	Lead		Lag	Lag				
Lead-Lag Optimize?								
Recall Mode	None	C-Max	C-Max	C-Max	None	None	None	None
Act Effct Green (s)	78.2	78.2	67.6	70.6		10.8		13.3
Actuated g/C Ratio	0.78	0.78	0.68	0.71		0.11		0.13
v/c Ratio	0.21	0.32	0.03	0.59		0.04		0.65
Control Delay	4.9	3.8	7.7	9.6		0.4		33.9
Queue Delay	0.0	0.0	0.0	0.0		0.0		0.0
Total Delay	4.9	3.8	7.7	9.6		0.4		33.9
LOS	A	A	A	A		A		C
Approach Delay		3.8		9.5		0.4		33.9
Approach LOS		A		A		A		C

Intersection Summary			
Cycle Length: 100			
Actuated Cycle Length: 100			
Offset: 13 (13%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green			
Natural Cycle: 100			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.65			
Intersection Signal Delay: 9.0		Intersection LOS: A	
Intersection Capacity Utilization 63.7%		ICU Level of Service B	
Analysis Period (min) 15			

Splits and Phases: 4: Plains Rd & Cooke Blvd



Queues
4: Plains Rd & Cooke Blvd

Total PM
180222



Lane Group	EBL	EBT	WBL	WBT	NBT	SBT
Lane Group Flow (vph)	56	886	11	1445	9	167
v/c Ratio	0.21	0.32	0.03	0.59	0.04	0.65
Control Delay	4.9	3.8	7.7	9.6	0.4	33.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	4.9	3.8	7.7	9.6	0.4	33.9
Queue Length 50th (m)	1.8	19.6	0.7	66.9	0.0	17.8
Queue Length 95th (m)	6.0	37.7	3.3	114.3	0.0	37.6
Internal Link Dist (m)		136.0		176.0	26.0	326.1
Turn Bay Length (m)	40.0		15.0			
Base Capacity (vph)	362	2790	404	2458	371	454
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.15	0.32	0.03	0.59	0.02	0.37

Intersection Summary

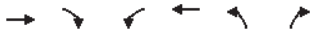
HCM Signalized Intersection Capacity Analysis
4: Plains Rd & Cooke Blvd

Total PM
180222



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	54	851	8	10	1303	99	5	0	4	78	0	84
Future Volume (vph)	54	851	8	10	1303	99	5	0	4	78	0	84
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.6	3.6	3.6	3.6	3.5	3.6	3.6	3.6	3.3	3.6	3.5
Total Lost time (s)	4.0	4.0		7.0	4.0			7.0			4.5	
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00			1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00			1.00			0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00			1.00	
Frt	1.00	1.00		1.00	0.99			0.94			0.93	
Flt Protected	0.95	1.00		0.95	1.00			0.97			0.98	
Satd. Flow (prot)	1745	3568		1770	3479			1704			1684	
Flt Permitted	0.13	1.00		0.32	1.00			0.72			0.84	
Satd. Flow (perm)	231	3568		598	3479			1256			1454	
Peak-hour factor, PHF	0.97	0.97	0.92	0.92	0.97	0.97	0.92	0.92	0.92	0.97	0.92	0.97
Adj. Flow (vph)	56	877	9	11	1343	102	5	0	4	80	0	87
RTOR Reduction (vph)	0	0	0	0	3	0	0	8	0	0	66	0
Lane Group Flow (vph)	56	886	0	11	1442	0	0	1	0	0	101	0
Confl. Peds. (#/hr)	5					5						4
Heavy Vehicles (%)	0%	1%	2%	2%	2%	8%	2%	2%	2%	3%	2%	0%
Turn Type	pm+pt	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases	5	2			6			8			4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)	75.2	75.2		67.0	67.0			10.8			13.3	
Effective Green, g (s)	74.2	78.2		67.0	70.0			10.8			13.3	
Actuated g/C Ratio	0.74	0.78		0.67	0.70			0.11			0.13	
Clearance Time (s)	3.0	7.0		7.0	7.0			7.0			4.5	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0			3.0	
Lane Grp Cap (vph)	234	2790		400	2435			135			193	
v/s Ratio Prot	0.01	c0.25			c0.41							
v/s Ratio Perm	0.17			0.02				0.00			c0.07	
v/c Ratio	0.24	0.32		0.03	0.59			0.01			0.52	
Uniform Delay, d1	6.3	3.2		5.5	7.7			39.8			40.4	
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Incremental Delay, d2	0.5	0.3		0.1	1.1			0.0			2.6	
Delay (s)	6.9	3.5		5.7	8.8			39.8			43.0	
Level of Service	A	A		A	A			D			D	
Approach Delay (s)		3.7			8.7			39.8			43.0	
Approach LOS		A			A			D			D	

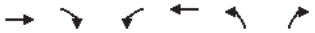
Intersection Summary				
HCM 2000 Control Delay	9.2	HCM 2000 Level of Service	A	
HCM 2000 Volume to Capacity ratio	0.59			
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	15.0	
Intersection Capacity Utilization	63.7%	ICU Level of Service	B	
Analysis Period (min)	15			
c Critical Lane Group				



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	101	29	0	399	19	0
Future Volume (Veh/h)	101	29	0	399	19	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	110	32	0	434	21	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)	320					
pX, platoon unblocked						
vC, conflicting volume			142		560	126
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			142		560	126
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		96	100
cM capacity (veh/h)			1453		493	930

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	142	434	21
Volume Left	0	0	21
Volume Right	32	0	0
cSH	1700	1453	493
Volume to Capacity	0.08	0.00	0.04
Queue Length 95th (m)	0.0	0.0	1.1
Control Delay (s)	0.0	0.0	12.6
Lane LOS			B
Approach Delay (s)	0.0	0.0	12.6
Approach LOS			B

Intersection Summary				
Average Delay		0.4		
Intersection Capacity Utilization		31.0%	ICU Level of Service	A
Analysis Period (min)		15		



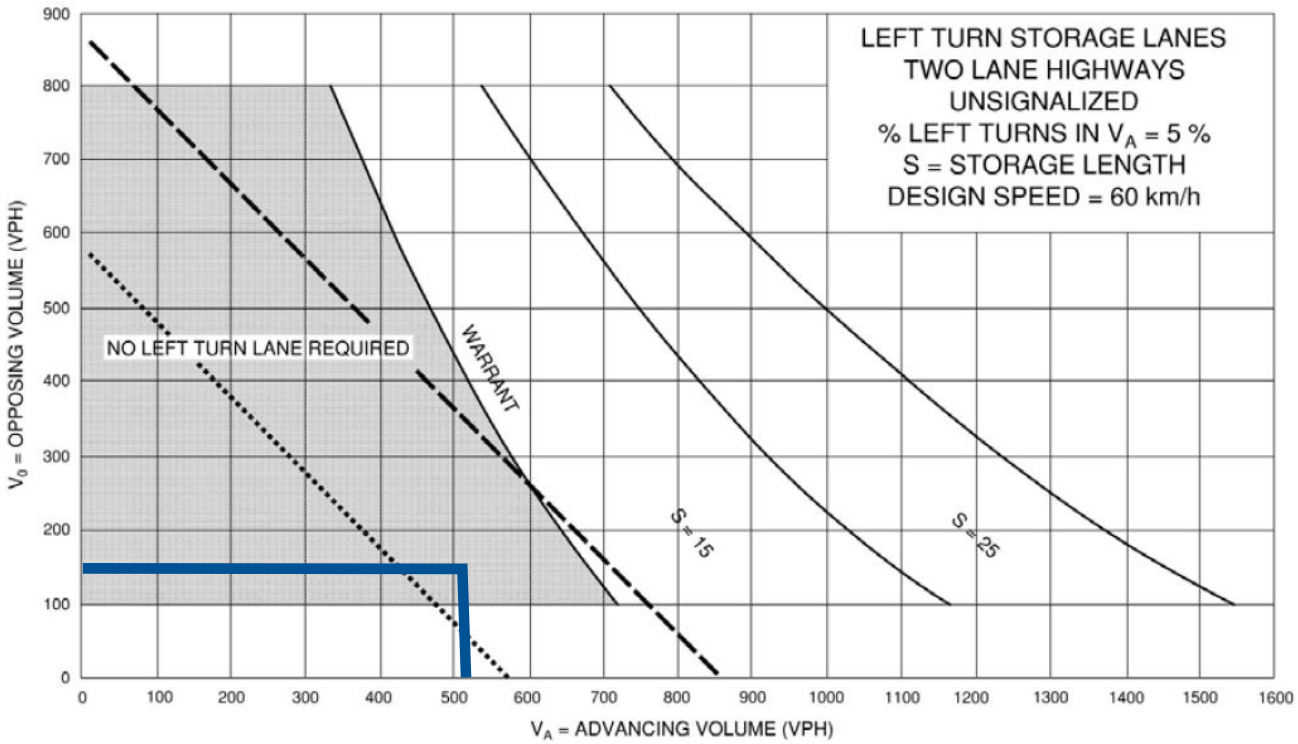
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	98	3	0	397	2	0
Future Volume (Veh/h)	98	3	0	397	2	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	107	3	0	432	2	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			110		540	108
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			110		540	108
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)			1493		506	951

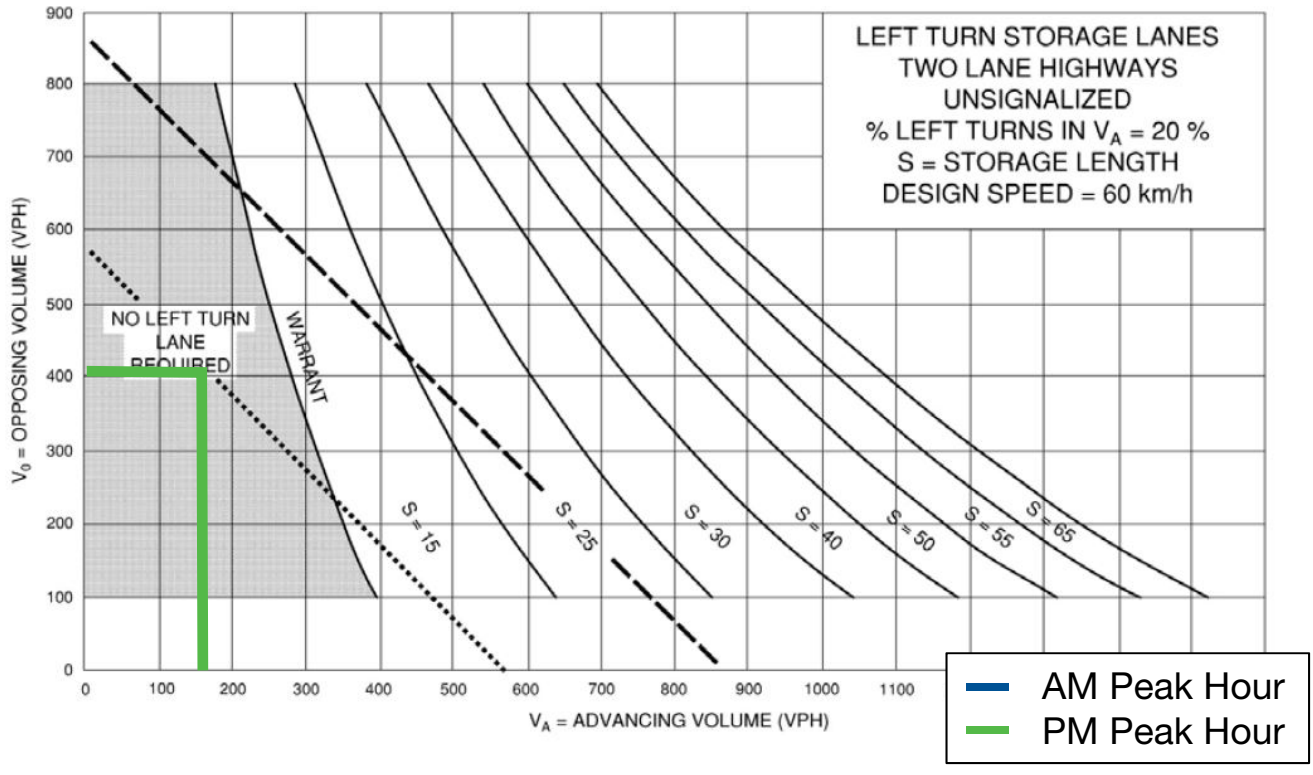
Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	110	432	2
Volume Left	0	0	2
Volume Right	3	0	0
cSH	1700	1493	506
Volume to Capacity	0.06	0.00	0.00
Queue Length 95th (m)	0.0	0.0	0.1
Control Delay (s)	0.0	0.0	12.1
Lane LOS			B
Approach Delay (s)	0.0	0.0	12.1
Approach LOS			B

Intersection Summary				
Average Delay		0.0		
Intersection Capacity Utilization		30.9%	ICU Level of Service	A
Analysis Period (min)		15		

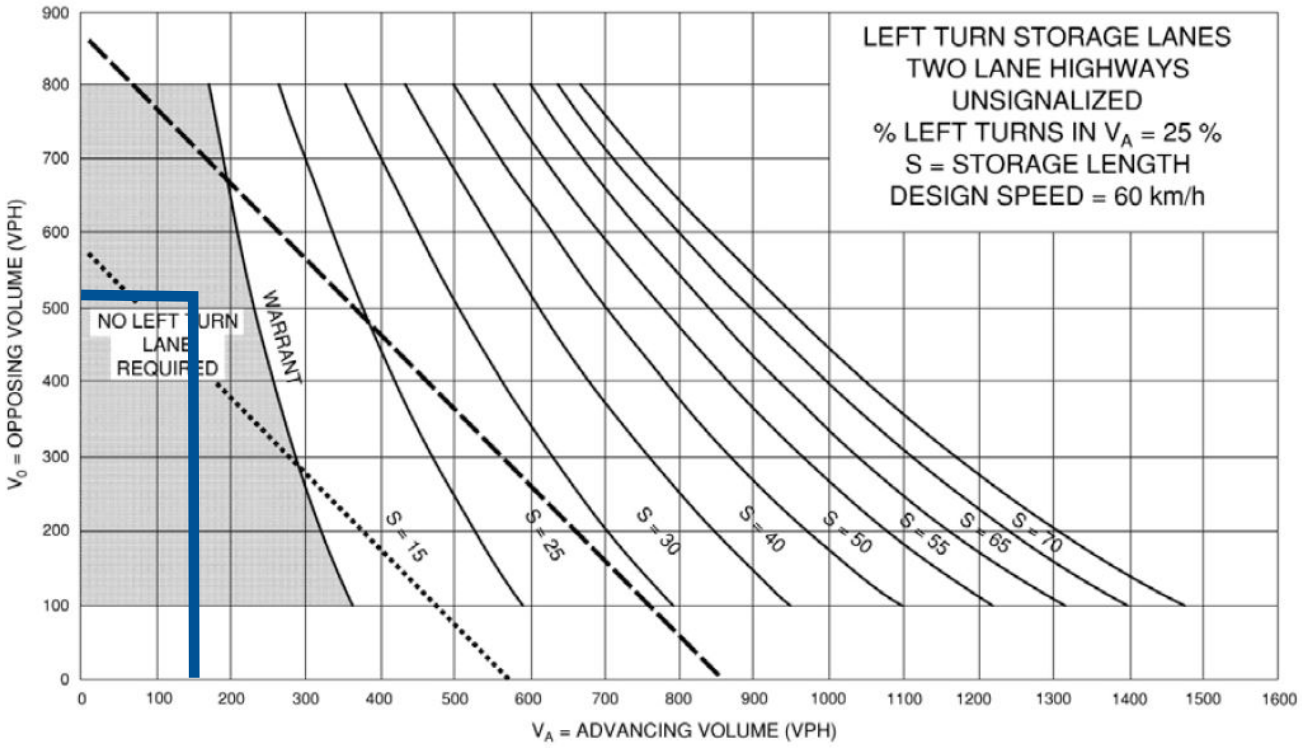
Appendix G

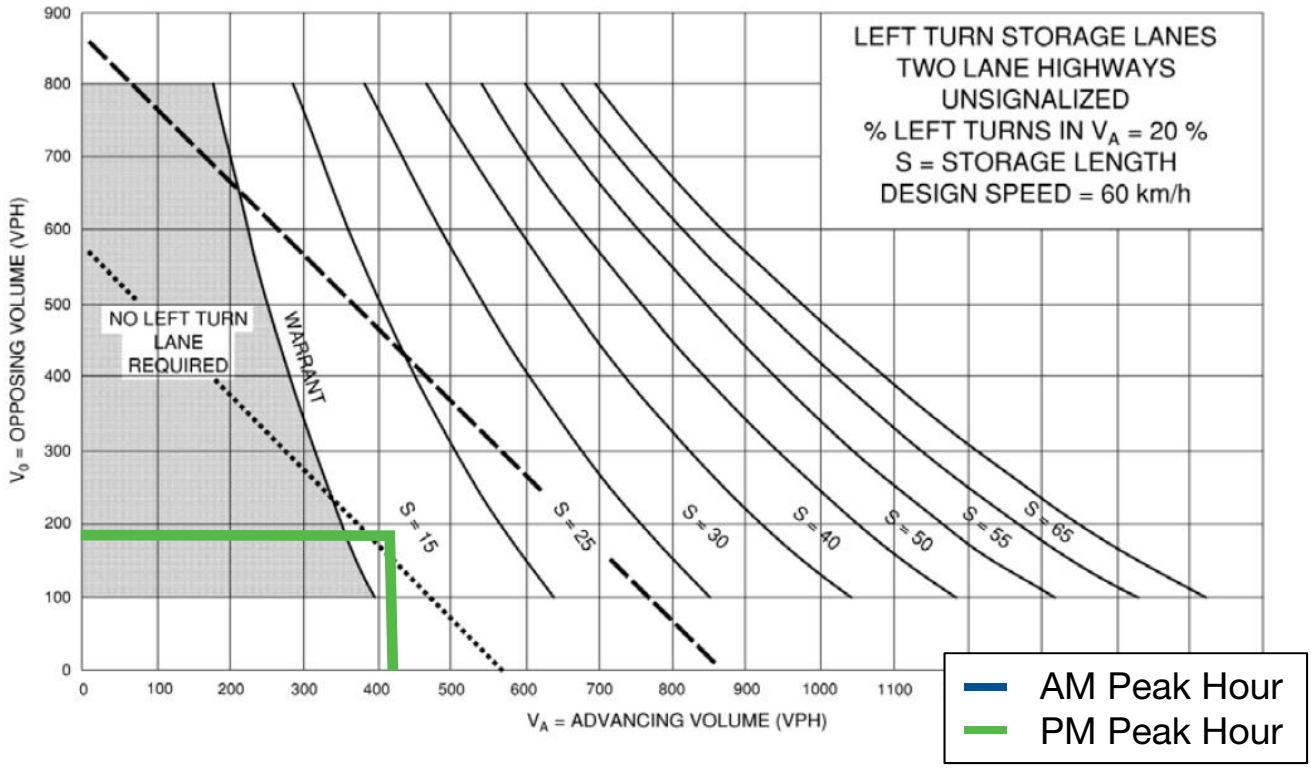
Left-Turn Lane Warrants



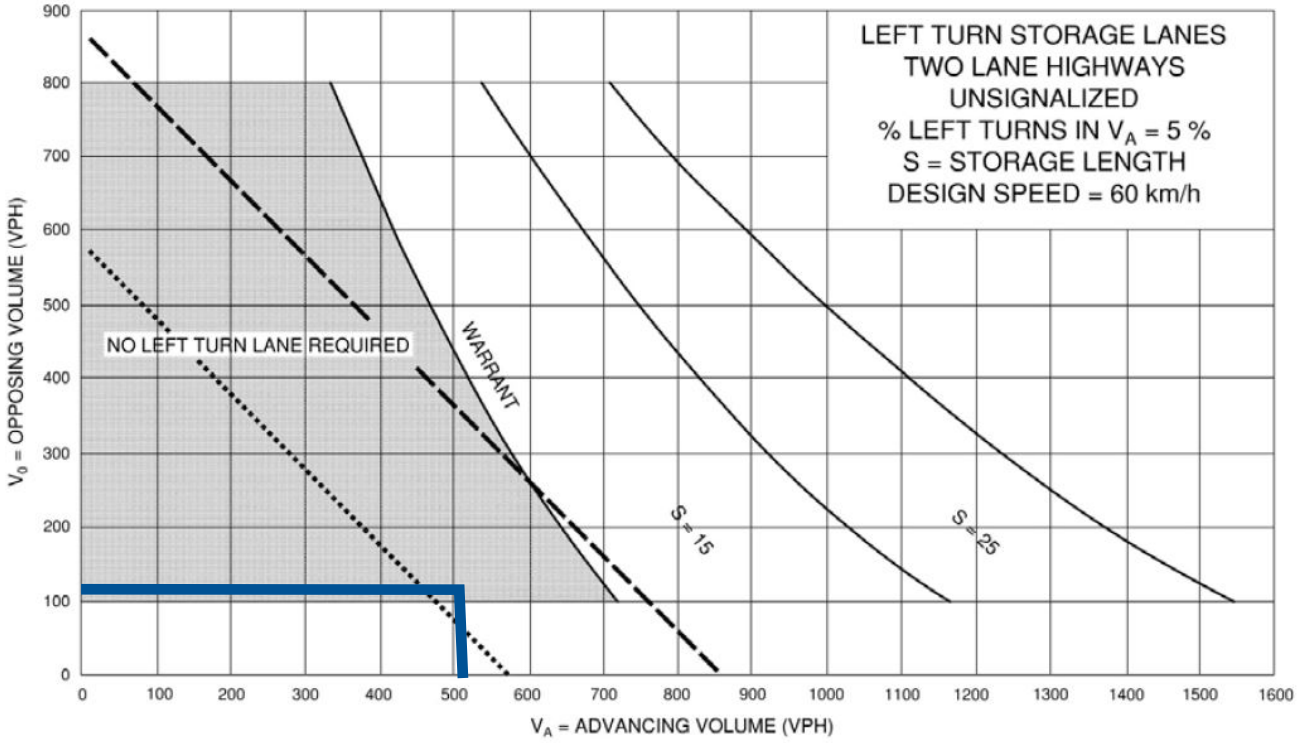


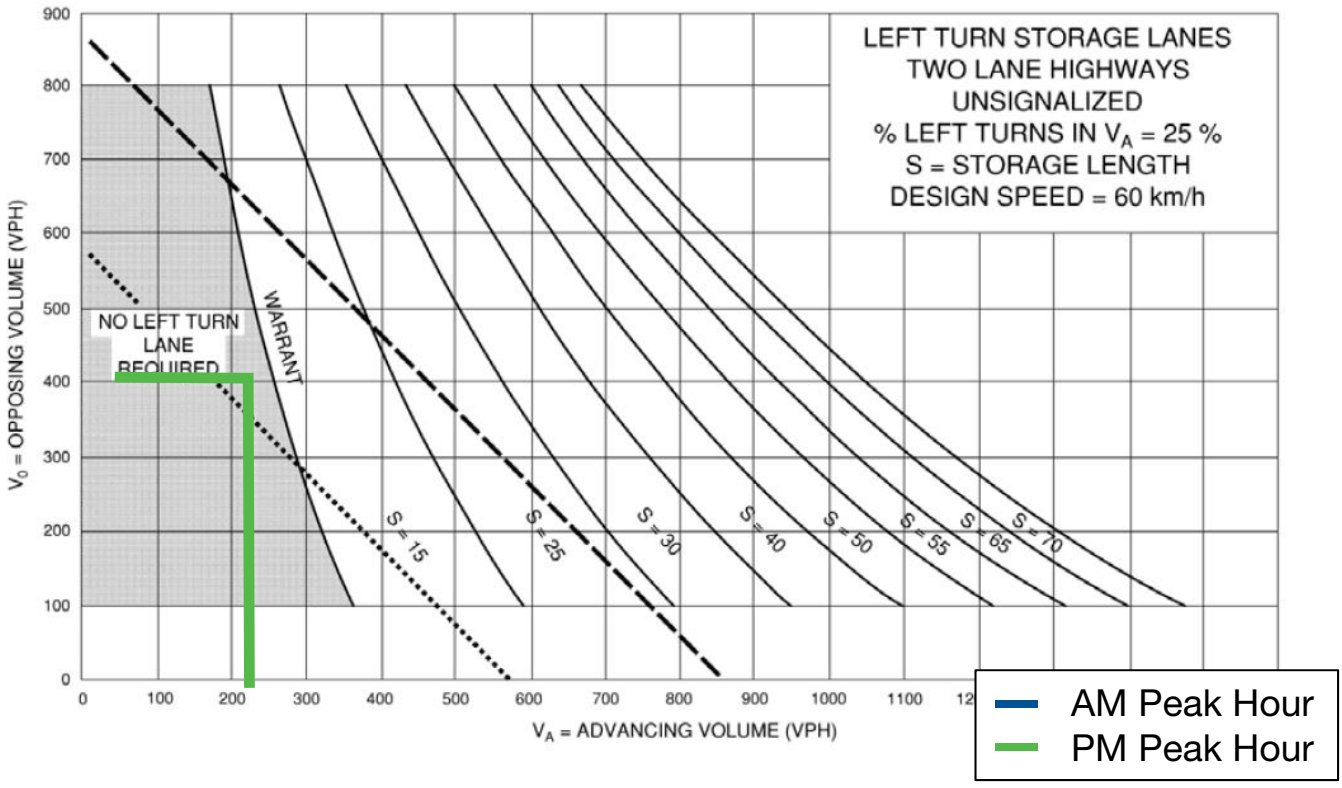
Location: Masonry Court & Cooke Boulevard
Direction: Eastbound Left-Turn
Horizon Year: Total Traffic



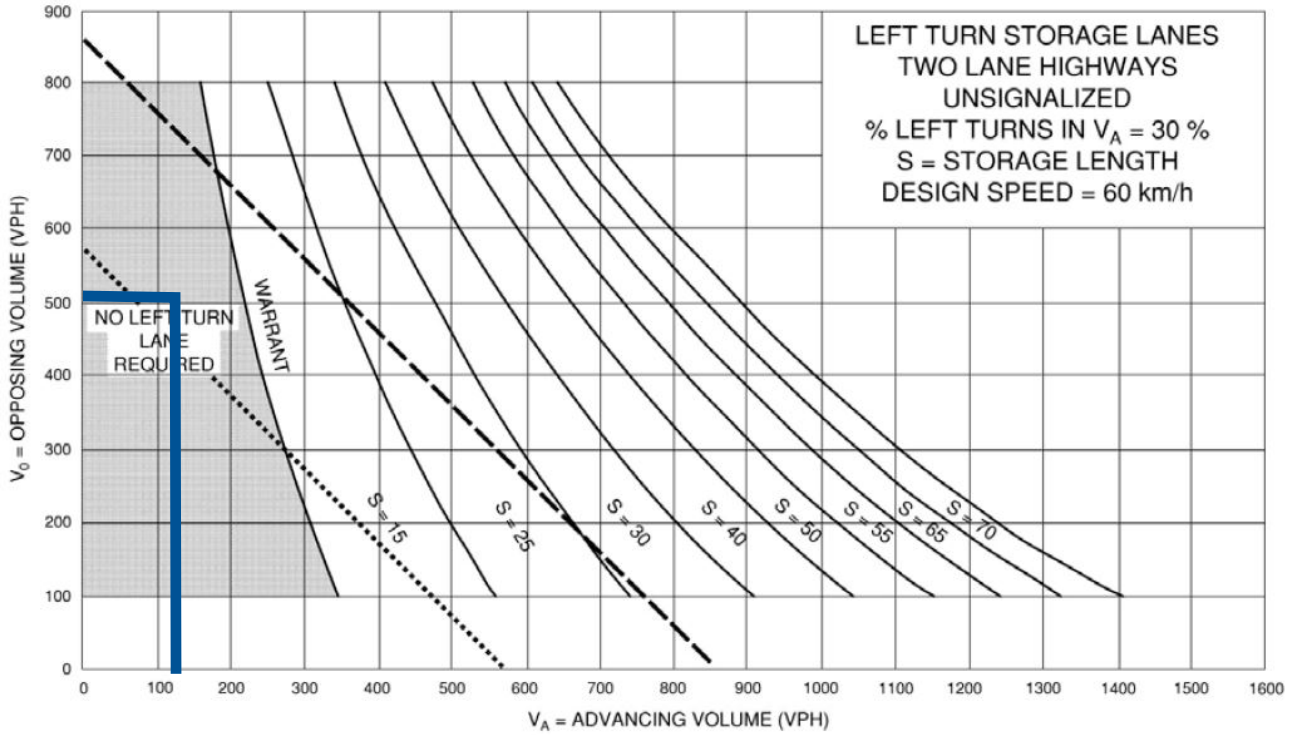


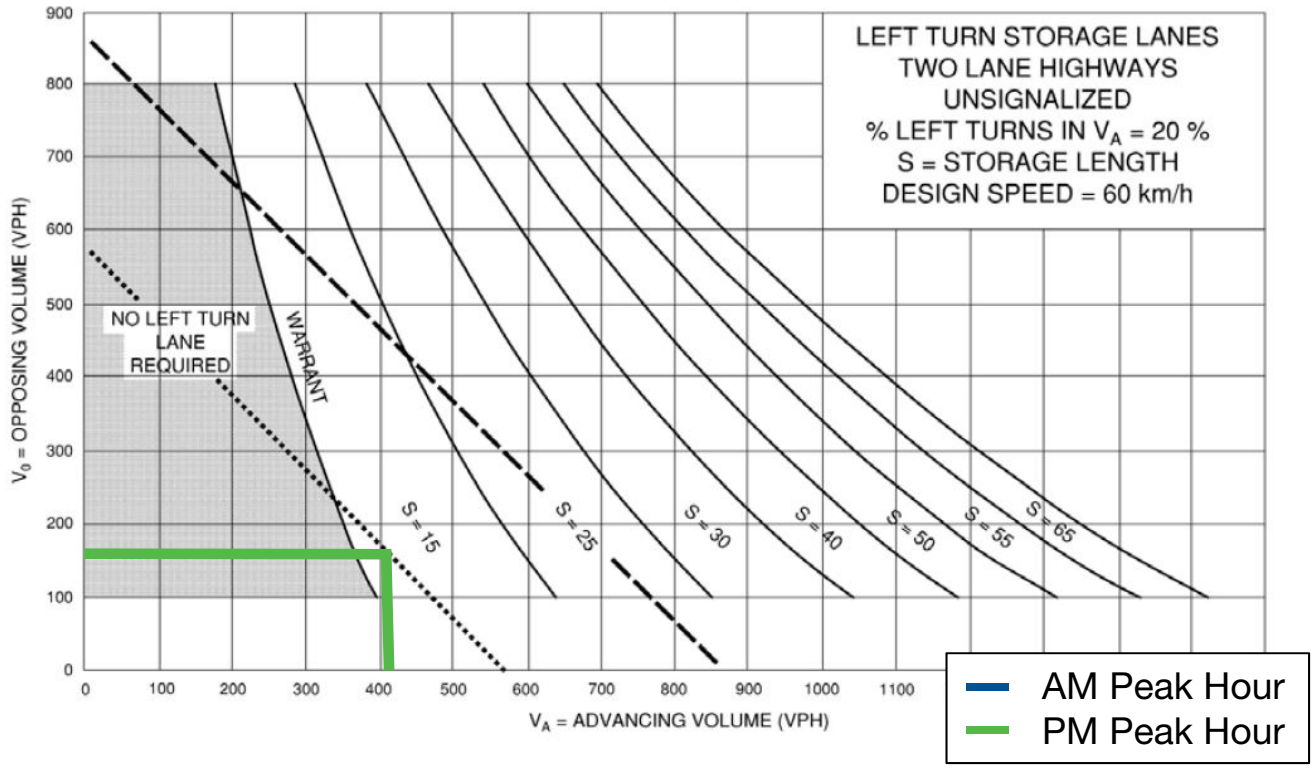
Location: Masonry Court & Cooke Boulevard
Direction: Westbound Left-Turn
Horizon Year: Total Traffic



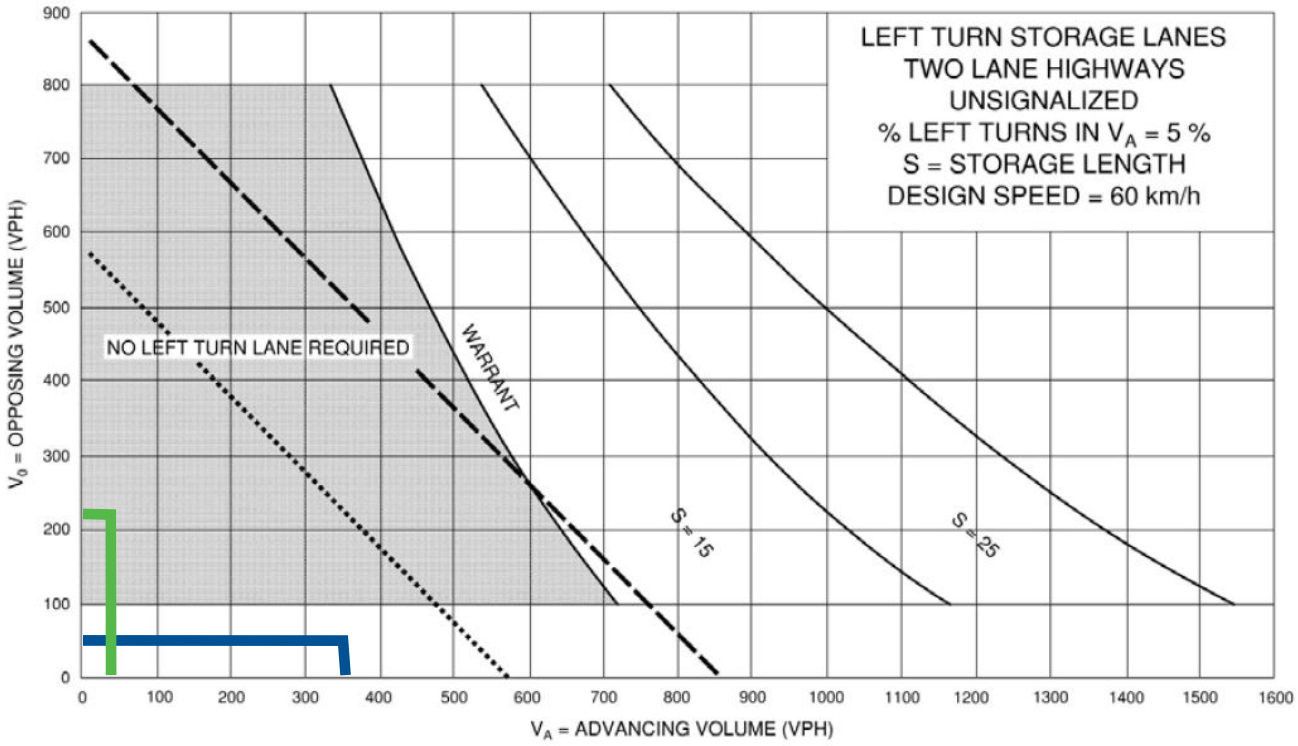


Location: Masonry Court & Cooke Boulevard
Direction: Eastbound Left-Turn
Horizon Year: Background Traffic



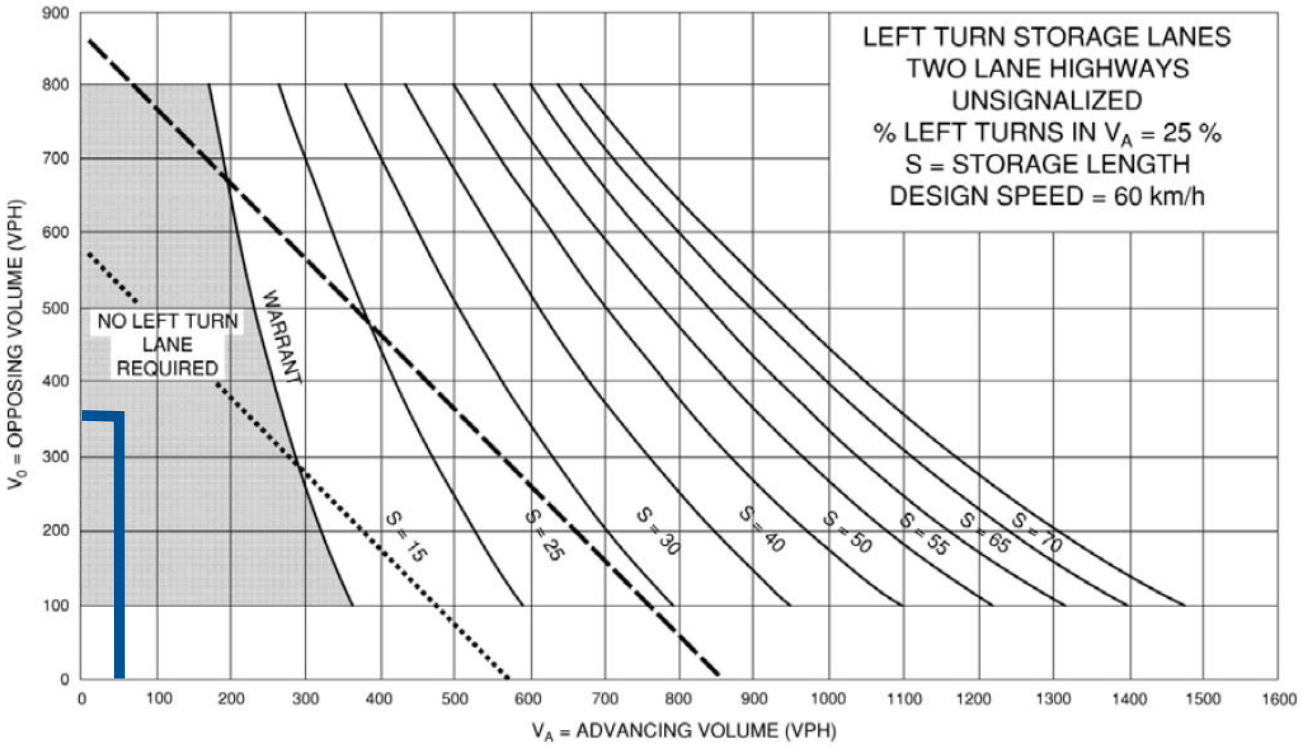


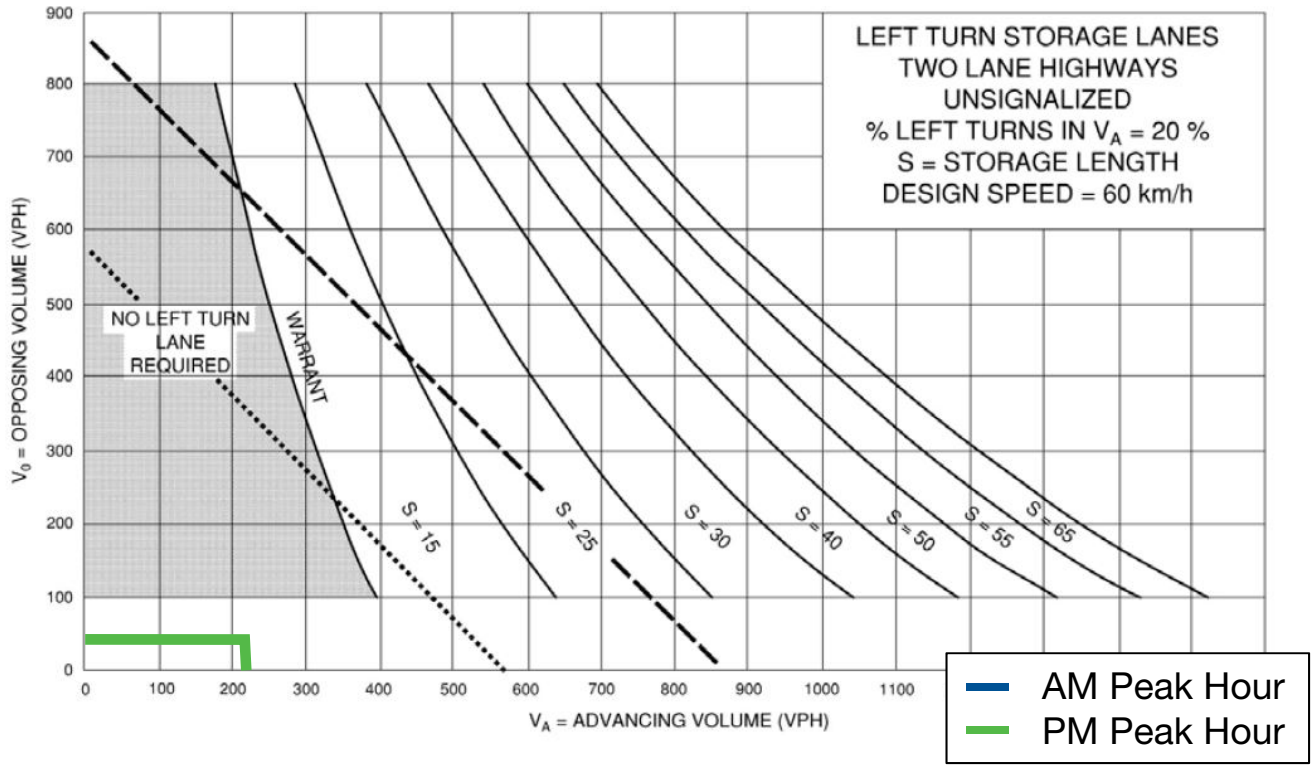
Location: Masonry Court & Cooke Boulevard
Direction: Westbound Left-Turn
Horizon Year: Background Traffic



AM Peak Hour
PM Peak Hour

Location: Masonry Court & Cooke Boulevard
Direction: Eastbound Left-Turn
Horizon Year: Existing Traffic





Location: Masonry Court & Cooke Boulevard
Direction: Westbound Left-Turn
Horizon Year: Existing Traffic

Appendix H

OTM Warrants

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

Horizon Year: Existing Traffic
Region/City/Township: City of Burlington/Halton Region

Major Street: Masonry Court
Minor Street: Cooke Boulevard
North/South: N

Number of Approach Lanes: 1
Tee Intersection? Y
Flow Conditions: Free

PM Forecast Only? N

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

Time Period	Major Street						Minor Street						Peds Crossing Main Road
	Masonry Court						Cooke Boulevard						
	Eastbound			Westbound			Northbound			Southbound			
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
AM Peak Hour	6	329	27	13	40	1	36	1	116	2	0	3	0
PM Peak Hour	2	32	8	46	176	1	114	0	9	1	1	7	0
Average Hourly Volume	**2**	**90**	**9**	**15**	**54**	**1**	**38**	**0**	**31**	**1**	**0**	**3**	**0**

Warrant 1 - Minimum Vehicular Volume

Warrant	AHV
1A - All	243
1B - Minor	73
2A - Major	170
2B - Cross	39

1A	Approach Lanes	1		2 or more		Average Hourly Volume
	Flow Conditions	Free	Restricted	Free	Restricted	
		X				
	All Approaches	480	720	600	900	243
					% Fulfilled	**50.6%**

1B	Approach Lanes	1		2 or more		Average Hourly Volume
	Flow Conditions	Free	Restricted	Free	Restricted	
		X				
	Minor Street Approaches	180	255	180	255	73
					% Fulfilled	**40.3%**

Warrant 2 - Delay To Cross Traffic

2A	Approach Lanes	1		2 or more		Average Hourly Volume
	Flow Conditions	Free	Restricted	Free	Restricted	
		X				
	Major Street Approaches	480	720	600	900	170
					% Fulfilled	**35.5%**

2B	Approach Lanes	1		2 or more		Average Hourly Volume
	Flow Conditions	Free	Restricted	Free	Restricted	
		X				
	Traffic Crossing Major Street	50	75	50	75	39
					% Fulfilled	**77.0%**

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

Horizon Year: Background Traffic
Region/City/Township: City of Burlington/Halton Region

Major Street: Masonry Court
Minor Street: Cooke Boulevard
North/South: N

Number of Approach Lanes: 1
Tee Intersection? Y
Flow Conditions: Free

PM Forecast Only? N

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

Time Period	Major Street: Masonry Court						Minor Street: Cooke Boulevard						Peds Crossing Main Road
	Eastbound			Westbound			Northbound			Southbound			
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
AM Peak Hour	12	455	38	32	87	1	96	4	162	2	18	41	0
PM Peak Hour	38	90	38	85	321	1	146	14	28	1	9	22	0
Average Hourly Volume	**13**	**136**	**19**	**29**	**102**	**1**	**61**	**5**	**48**	**1**	**7**	**16**	**0**

Warrant 1 - Minimum Vehicular Volume

Warrant	AHV
1A - All	435
1B - Minor	136
2A - Major	300
2B - Cross	68

1A	Approach Lanes	1		2 or more		Average Hourly Volume
	Flow Conditions	Free	Restricted	Free	Restricted	
		X				
	All Approaches	480	720	600	900	435
					% Fulfilled	**90.7%**

1B	Approach Lanes	1		2 or more		Average Hourly Volume
	Flow Conditions	Free	Restricted	Free	Restricted	
		X				
	Minor Street Approaches	180	255	180	255	136
					% Fulfilled	**75.4%**

Warrant 2 - Delay To Cross Traffic

2A	Approach Lanes	1		2 or more		Average Hourly Volume
	Flow Conditions	Free	Restricted	Free	Restricted	
		X				
	Major Street Approaches	480	720	600	900	300
					% Fulfilled	**62.4%**

2B	Approach Lanes	1		2 or more		Average Hourly Volume
	Flow Conditions	Free	Restricted	Free	Restricted	
		X				
	Traffic Crossing Major Street	50	75	50	75	68
					% Fulfilled	**136.0%**

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

Horizon Year: Total Traffic
Region/City/Township: City of Burlington/Halton Region

Major Street: Masonry Court
Minor Street: Cooke Boulevard
North/South: N

Number of Approach Lanes: 1
Tee Intersection? Y
Flow Conditions: Free

PM Forecast Only? N

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

Time Period	Major Street						Minor Street						Peds Crossing Main Road
	Masonry Court						Cooke Boulevard						
	Eastbound			Westbound			Northbound			Southbound			
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
AM Peak Hour	12	463	38	38	111	1	96	4	165	2	18	41	0
PM Peak Hour	38	115	38	90	337	1	146	14	35	1	9	22	0
Average Hourly Volume	**13**	**145**	**19**	**32**	**112**	**1**	**61**	**5**	**50**	**1**	**7**	**16**	**0**

Warrant 1 - Minimum Vehicular Volume

Warrant	AHV
1A - All	459
1B - Minor	138
2A - Major	321
2B - Cross	68

1A	Approach Lanes	1		2 or more		Average Hourly Volume
	Flow Conditions	Free	Restricted	Free	Restricted	
		X				
	All Approaches	480	720	600	900	459
					% Fulfilled	**95.6%**

1B	Approach Lanes	1		2 or more		Average Hourly Volume
	Flow Conditions	Free	Restricted	Free	Restricted	
		X				
	Minor Street Approaches	180	255	180	255	138
					% Fulfilled	**76.8%**

Warrant 2 - Delay To Cross Traffic

2A	Approach Lanes	1		2 or more		Average Hourly Volume
	Flow Conditions	Free	Restricted	Free	Restricted	
		X				
	Major Street Approaches	480	720	600	900	321
					% Fulfilled	**66.8%**

2B	Approach Lanes	1		2 or more		Average Hourly Volume
	Flow Conditions	Free	Restricted	Free	Restricted	
		X				
	Traffic Crossing Major Street	50	75	50	75	68
					% Fulfilled	**136.0%**