



TRAFFIC IMPACT & PARKING STUDY AND TRANSPORTATION DEMAND MANAGEMENT OPTIONS REPORT

Proposed Mixed Use Development
16 & 18 King Street West
Stoney Creek, Hamilton, Ontario

Prepared for: A.J. Clarke and Associates Ltd.

May 2017





May 11, 2017

c/o A.J. Clarke and Associates Ltd.
25 Main Street West, Suite 300
Hamilton, ON L8P 1H1

Re: 16 & 18 King Street West, Stoney Creek, Hamilton, ON, Proposed Mixed Use Development – Traffic Impact Study and Parking Study and Transportation Demand Management Options Report

TRANS-PLAN is pleased to submit this Traffic Impact & Parking Study and Transportation Demand Management Options Report in support of the proposed mixed use development located at 16 and 18 King Street West in Stoney Creek, Hamilton. The proposed development is an eight-storey building, consisting of 62 residential units on floors two to eight and 222 sq.m. of GFA of commercial uses on the ground floor.

Our traffic impact study findings indicate that no road improvements, apart from the construction of the proposed site access, are required to accommodate the proposed development. Our analysis results note that exiting vehicles making left turns out of the site driveway may see a delay of slightly over a minute during the weekday PM peak hour, which is typical for traffic exiting onto an arterial road.

A field study of similar residential developments (apartments) near the subject site at King Street West were conducted by Trans-Plan to confirm that the proposed parking supply of 66 spaces, less than the City's By-law requirement, would be acceptable, given the site area context and opportunities to travel by transit and other non-auto modes to the site. Our parking study findings indicate that the proposed parking supply, provided at an approximate rate of 1.06 spaces per unit, would be adequate to support the development.

This report follows the City of Hamilton's "TDM for Development" Guidelines, dated June 2015. The plan includes a review of the proposed site plan, a checklist of TDM measures to be reviewed and/or applied, a conceptual layout drawing of existing and future active transportation (pedestrian and cycling) connections between the site and the surrounding roadways, and overall TDM recommendations.

Sincerely,



Anil Seegobin, P.Eng.
Partner, Engineer

Trans-Plan Transportation Inc.
Transportation Consultants



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Transmittal Letter

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1. INTRODUCTION

Trans-Plan has been retained by A. J. Clarke and Associates Ltd. to complete a Traffic Impact and Parking Study and Transportation Demand Management (TDM) Options Report for a proposed 8-storey residential building, with ground floor commercial space, located at 16 and 18 King Street West, Stoney Creek, Hamilton.

The traffic impact study includes the following:

- Review and assessment of the existing road network
- Review of existing and future active transportation connections in the study area to encourage non-auto modes of transportation
- Assessment of future background conditions based on anticipated traffic growth, area developments and planned transportation improvements in the study area
- Assessment of the impact of site-generated traffic on the adjacent roadway network under future background and total traffic conditions
- Determination of roadway and intersection improvements, as required, to accommodate the proposed development

The parking study includes the following:

- Review of the site parking requirements for the proposed land uses based on the City of Hamilton's Zoning By-law
- Parking review of other similar developments in the study area to note the existing parking supply, unit counts and site statistics, in comparison to the proposed development
- Review of the site area context such as transit use and amenities in the study area
- Review of Transportation Tomorrow Survey data to review existing auto ownership rates for apartment uses in the area
- Justification for the proposed parking supply of 66 parking spaces for the 62 residential units (provided at approximately 1.06 spaces per unit) based on our parking review

The TDM plan includes the following:

- A review of the existing and future study area for roadways with transit and active transportation facilities
- A review of the City's TDM guidelines to determine the TDM measures that would be appropriate for the planned development in terms of context, scale and land use
- A site plan review for the application of on-site TDM measures
- Determination of the estimated auto trip reduction for the site with the implementation of TDM measures

- A summary of recommended TDM measures for improving individuals' awareness of different travel options and to encourage a reduction in single-occupant vehicle travel to and from the site

Prior to commencing this study, Transportation and Planning staff at the City of Hamilton were provided a terms of reference detailing our proposed scope and methodology and comments received were incorporated. This report adheres to the City of Hamilton Traffic Impact Study Guidelines, dated July 2009 and follows the City of Hamilton's "TDM for Development" guidelines, dated June 2015.

2. SITE LOCATION

The site, shown in Figure 1, is located along the northeast quadrant of King Street West and 2nd Street North in Stoney Creek (Hamilton). The site is currently vacant and situated between a one-storey commercial building (with an optometry clinic and lawyers office) to the west and a three storey apartment building to the east.

Located in the vicinity of the site are a mix of single-detached homes, apartment buildings and commercial plazas. A number of retail, restaurant and commercial uses are situated along King Street West. The majority of uses within the interior roads connecting with King Street West are residential. Notable land uses include the Stoney Creek Recreation Centre, located approximately 300m west of the site and the Stoney Creek United Church, located approximately 100m east of the site. The R.L. Hyslop Elementary School is located approximately 200m south of the site, at the southern end of Lake Avenue South.

3. PROPOSED DEVELOPMENT

The site plan is shown in Figure 2. The subject site consists of an eight-storey mixed use building with 62 residential units (15 one-bedroom, 25 one-bedroom + den and 22 two-bedroom / two-bedroom + den units) on floors two through eight and 222 sq.m. of GFA of amenity commercial space on the ground floor.

A total of 66 parking spaces are provided through two levels of underground parking (19 residential spaces and 13 visitor spaces on Level 1 and 34 residential spaces on Level 2).

The site access is proposed to be located on the south side of the building, fronting on King Street West, with a full-moves configuration.

4. EXISTING ROAD CONDITIONS AND ACTIVE TRANSPORTATION NETWORK

4.1 Road Network

All roadways within the vicinity of the site are under the jurisdiction of the City of Hamilton. The boundary roadways located in the study area are described as follows:

King Street West is a minor arterial road that generally runs in an east-west direction and consists of two travel lanes: one in each direction, King Street West has a speed limit of 50 km/h in the vicinity of the site.

Lake Avenue Drive is a collector road that runs in a north-south direction with a speed limit of 40 km/h. It connects to residential areas and to Highway 8 north of the site.

1st Street and 2nd Street are local roads that run in a north-south direction with a speed limit of 40km/h. These local roads are for connections to residential areas and do not have direct connections to any arterial roads, other than King Street West.

King Street West and Lake Avenue Drive form a signalized intersection within the study area.

4.2 Traffic Counts

To determine existing operating conditions in the study area, Trans-Plan conducted a site visit and traffic observations along with Turning Movement Counts (TMCs) at the study area intersections. The traffic counts were conducted on a weekday between the hours of 7:00am and 9:30am in the morning and between the hours of 4:00pm and 6:30pm in the afternoon to capture the typical roadway peak periods. Table 1 provides a summary of the peak hours obtained for each intersection counted. TMC diagrams and current City of Hamilton signal timing plans are provided in Appendix A.

Table 1 – Intersection Turning Movement Count Details

Intersection	Date	Weekday AM Peak Hour	Weekday PM Peak Hour
King Street West and Lake Avenue	Wednesday April 26, 2017	8:00AM – 9:00AM	4:30PM – 5:30PM
King Street West and 1st Street	Wednesday April 26, 2017	8:00AM – 9:00AM	5:00PM – 6:00PM
King Street West and 2nd Street	Wednesday April 26, 2017	8:00AM – 9:00AM	4:45PM – 5:45PM

The existing traffic volumes along King Street West were reviewed for consistency of upstream and downstream traffic volumes and balanced between the intersections (by increasing the volumes), where required.

4.3 Transit Service

The area near the site is served by Hamilton Street Railway (HSR), which operates the following bus routes within the study area:

Route 58, Stoney Creek Local runs along King Street East and West between Centennial Parkway South and Queenston Road (where it loops around at Green Road). Route 58 connects with other major bus routes in Hamilton, such as Route 1 King (blue line) and Route 10 B-Line Express (red line), that operate along the major travel corridors of Queenston Road and Main Street East / West. The nearest bus stops are located on King Street West between 1st Street South and Lake Avenue Drive, approximately 60m east of the site.

Route 5, Delaware operates mainly along King Street East and West between Jones Street (just east of Lake Avenue) and Justine Avenue / Lawrence Road. East of Centennial Parkway, Route 5 shares the same bus stops along King Street as Route 58.

Service details for each transit route are provided in Table 2.

Table 2 – Study Area Transit Service

Route	No.	Nearest Bus Stop at Site	Approximate Service Times		Approximate Peak Service Frequency (min)		
			Weekdays	Weekends	AM	PM	SAT
Stoney Creek Local	58	King Street, West of Lake Avenue	06:22 – 00:37	08:17 – 00:07	20	30	30
Delaware	5	King Street, West of Lake Avenue	06:04 – 01:16	05:57 – 01:13	30	30	30

Source: Hamilton Street Railway Website

5. FUTURE BACKGROUND CONDITIONS & ROADWAY IMPROVEMENTS

Future background traffic volumes for a five-year horizon were determined based on a review of planned developments and future traffic volume growth in the study area. Planned roadway improvements are also reviewed in this section.

5.1 Background Growth Rate

To establish predicted growth in roadway traffic volumes in the study area, an analysis of historical traffic volume data was completed along King Street West, east of Lake Avenue Drive. Detailed analysis is shown in Appendix B and the results are as shown in Table 3.

Table 3 –Traffic Volume Growth on King Street West

Peak Hour	TMC, Year 2014			TMC, Year 2017		
	Eastbound	Westbound	Total	Eastbound	Westbound	Total
AM	519	641	1,160	472	589	1,061
PM	731	607	1,338	744	632	1,376
Total	1,250	1,248	2,498	1,216	1,221	2,437
Annual Growth						-0.8%

Given that the review of historical data was not conclusive (i.e. showing little or no growth); an annual growth rate of 1.0 percent per annum was conservatively applied to the through volumes along King Street West and the turning movements along Lake Avenue Drive.

5.2 Planned Background Developments

Based on a review of the City of Hamilton development applications map and a site visit of the study area, there are two other notable future developments in the area, in the planning stage, that are expected to occur within the planning horizon of our study. The future developments are described in Table 4.

Table 4 - Background Developments

No.	Location	Development Application Land Use Description
1	Lot adjacent 1 King Street East	Two-storey mixed use building
2	Southeast quadrant of Veterans Lane and Lake Avenue South	One-storey, 148 sq.m. pediatric clinic

Site trips were generated using the Institute of Transportation Engineers (ITE) Trip Generation manuals, 9th Edition (using residential and office trip rates for the development at 1 King Street East and using medical office uses for the development at Veterans Lane and Lake Avenue South). The above noted developments have been incorporated into our analysis of future background traffic conditions. Details, including trip generation tables and estimated site traffic assignment, are provided in Appendix B.

5.3 Planned Roadway and Transit Improvements

There are currently no planned roadway or transit improvements within the study area based on the City of Hamilton's Transportation Master Plan, dated 2007.

The City of Hamilton 10-year Local Transit Strategy mentions the Hamilton Light Rail Transit (LRT) with major construction slated for 2019-2024. The LRT is to be situated one major roadway north of the site, along Highway 8, which is approximately 1km north of the site. The proposed LRT may alleviate roadway traffic along King Street within the vicinity of the study area. However due to the proposed 2024 or later timing and not being along the study area roadway, the LRT is noted in our study, but to be conservative, no auto trip reductions (due to increased transit use) are provided in our analysis.

5.4 Planned Active Transportation Improvements

As per the City's Urban Official Plan and Transportation Master Plan, there are no planned active transportation improvements within the study area. According to City staff and the City's Cycling Master Plan, dated 2009, cycle lanes are identified along King Street West but are unable to be included due to the narrow road width in the vicinity of the subject site. The ultimate vision is to include cycle lanes along the entirety of King Street West but there are no plans in the immediate future.

Based on the review of background conditions, future background traffic volumes for the weekday AM and PM peak hours are shown in Figure 6.

6. SITE TRAFFIC

6.1 Trip Generation

Trips for the proposed residential development were generated using the Institute of Transportation Engineers (ITE) Trip Generation manuals, 9th Edition. Residential uses were generated based on ITE Land Use Code (LUC) 220 for residential apartment units and the ground floor commercial was based on LUC 814 for a retail use. An internal trip reduction was applied to the variety store land use as it is expected to be mainly a complimentary use for the residents within the building and mainly generate walk-in trips from the surrounding residential area. The site trip generation is provided in Table 5.

Table 5 – Site Trip Generation

Land Use		Size	AM Peak Hour			PM Peak Hour		
			In	Out	Total	In	Out	Total
Apartment	units:	62						
ITE Code 220		Distribution Equation	20%	80%	100%	65%	35%	100%
		Rate	0.11	0.44	0.55	0.55	0.29	0.84
		Trips	7	27	34	34	18	52
Variety Store	sq.ft.	2,390						
ITE Code 814		Distribution	50%	50%	100%	50%	50%	100%
		Rate	2.09	2.09	3.81	3.35	3.77	6.82
		Trips	5	5	10	8	9	17
Internal Trip Reduction		15%	1	1	2	1	2	3
Total New Trips			11	31	42	41	25	66

The subject site is expected to generate approximately 42 and 66 two-way trips in the weekday AM and PM peak hours, respectively.

6.2 Trip Distribution and Assignment

Site trips were distributed to the surrounding area using 2011 TTS data for residential uses. Details are provided in Appendix C.

The resulting trip distribution for residential trips, travelling from the study area to surrounding municipalities in the morning period and returning to the study area in the afternoon period, is shown below.

		N		
		45%		
W	47%		4%	E
		4%		
		S		

According to the above noted distribution, the majority of trips leaving Stoney Creek travel west and north to other areas within Hamilton, likely using Highway 8 and Red Hill Valley Parkway. Due to the majority of trips within Hamilton, site trips were then assigned to major travel routes in and around the study area and then to the site driveway based on existing travel patterns along King Street West. The site traffic assignment for the weekday AM and PM peak hours are shown in Figure 7.

7. FUTURE TOTAL TRAFFIC CONDITIONS

Site traffic volumes were added to the future background traffic volumes to obtain future total traffic volumes for the weekday AM and PM peak hours and is provided in Figure 8.

8. CAPACITY AND VEHICLE QUEUING ANALYSIS

A capacity and queuing analysis was performed for the study area intersections using Synchro and SimTraffic analysis software. The capacity and vehicle queuing results of the weekday AM and PM peak hours are shown in Table 6 and Table 7. Capacity Analysis and Queuing Sheets and Level of Service (LOS) Definitions are provided in Appendix D and Appendix E, respectively. The vehicle queuing analyses were completed based on Sim-Traffic simulation runs to determine whether queues would exceed available storage lengths of turn lanes or block upstream intersections.

According to the City of Hamilton Traffic Impact Study Guidelines, at signalized intersections, a volume to capacity (v/c) ratio of 0.85 or less is considered acceptable for through movements or shared through / turning movements. A v/c ratio of 0.90 is considered acceptable for exclusive turn lanes. At unsignalized intersections, an LOS of D or better is considered acceptable for individual movements. The results of the capacity analysis and queuing analysis are discussed in this section for each intersection:

King Street West & Lake Avenue

Under existing weekday AM peak hour conditions, the signalized intersection operates at an overall v/c ratio of 0.53 and an overall acceptable LOS of C. The westbound through / right movement operates at a v/c of 0.89 and an acceptable LOS of D, with average delays up to 40 seconds. All other movements operate at an acceptable LOS of B. During the weekday PM peak hour, the intersection operates at an overall v/c ratio of 0.71 and an acceptable LOS of C. The westbound through / right movement operates at a v/c of 0.93 and an acceptable LOS of D, with average delays up to 43 seconds. All other movements operate at an acceptable LOS of C or better.

Under future background and total conditions, minor signal timing adjustments were made to the signal splits while the cycle length of 110 remains unchanged.

During the weekday AM peak hour, with the signal timing adjustments, the intersection is expected to operate similarly to existing conditions at an overall v/c of 0.55 and an acceptable LOS of C. The westbound through / right movement is expected to operate at a v/c of 0.87 and an improved LOS of C, with average delays of up to 33 seconds. All other movements operate at an acceptable LOS of B. During the weekday PM peak hour, the intersection is expected to operate at an overall v/c ratio of 0.75 and an acceptable LOS of C. The westbound through / right movement is expected to operate at a v/c of 0.91 and an acceptable LOS of D, with delays up to 37 seconds. All other movements operate at an acceptable LOS of C or better.

The 95th percentile vehicle queue of the southbound right turn movement is expected to be approximately 24m and 43m during the weekday AM and PM peak hours, respectively, which may exceed the available storage length of 12m on occasion; however the existing 25m of taper length provides some additional length for vehicle storage during busier periods. It is noted that the subject site generates only approximately 1 and 4 vehicles during the weekday AM and PM peak hours, respectively, that are assigned to this southbound right turn movement.

Similarly, the eastbound left turn movement is expected to see queues of up to 34m, whereas the provided storage length is 23m; however, the additional taper length of 40m is expected to be adequate in provided room for up to two more vehicles to store during busier periods. Similarly, the northbound right lane is expected to exceed the provided storage length by up to one vehicle length, which could be contained

within a portion of the available taper length. The subject site is not expected to impact this turning movement directly.

Vehicle queues for the eastbound through / right movement may occasionally block the side street of 1st Street by one to two vehicle lengths on occasion. However 1st Street is a minor road with minimal traffic and vehicle queues along King Street are expected to clear after each cycle. The westbound through / right movement is expected to see queues of up to 136m during the weekday PM peak hour, which is similar to existing conditions.

King Street West & 1st Street

Under existing weekday AM and PM peak hour conditions, the northbound approach operate at an acceptable LOS of C and delays up to 23 seconds.

Under future conditions, during the weekday AM peak hour, the northbound approach is expected to operate similarly to existing conditions with an acceptable LOS of C. During the weekday PM peak hour, the northbound approach is expected to operate at an acceptable LOS of D with average delays up to 28 seconds.

The 95th percentile vehicle queues for side-street traffic are expected to be minimal with in approximate queue length of 9m.

King Street West & 2nd Street

Under existing weekday AM peak hour conditions, the northbound approach operates at an acceptable LOS of D with delays of 26 seconds. The southbound approach operates at an acceptable LOS of C. During weekday PM peak hour conditions, the northbound approach operates at an LOS of F with average delays up to 53 seconds and the southbound approach operates at an LOS of E with average delays up to 42 seconds.

Under future conditions, during the weekday AM peak hour, the northbound and southbound approaches are expected to operate similarly to existing conditions with an acceptable LOS of D and C, respectively. During weekday PM peak hour conditions, the northbound and southbound approaches are expected to operate at an LOS of F with delays up to 79 seconds (just over a one minute delay for traffic turning onto King Street West). With similar traffic operations during the future background and total conditions, the site generated traffic is not expected to notably impact these movements and the expected delays are typical for vehicles entering from a minor road onto an arterial road.

The 95th percentile vehicle queues for side-street traffic (on 2nd Street) are expected to be minimal, with an approximate queue length of up to 16m.

King Street West & Proposed Site Access

Under future total conditions, during the weekday AM peak hour, the site access is expected to operate at an acceptable LOS of D with delays up to 26 seconds. During the weekday PM peak hour, the site access is expected to operate at an LOS of F, with delays up to 82 seconds for exiting vehicles (just over a one-minute delay in the peak hours). However this type of delay is typical when exiting from a driveway access onto an arterial road (King Street West).

Under future total conditions, the 95th percentile vehicle queue length for the site access (exiting traffic) is expected to be approximately 17m during the peak hours, which would be contained within the driveway throat length provided by the site plan for the development.

Table 6 - Capacity Analysis Results

Intersection	Existing Traffic Conditions						Future Background Traffic Conditions						Future Total Traffic Conditions					
	AM Peak Hour			PM Peak Hour			AM Peak Hour			PM Peak Hour			AM Peak Hour			PM Peak Hour		
	V/C	Delay (sec.)	LOS	V/C	Delay (sec.)	LOS	V/C	Delay (sec.)	LOS	V/C	Delay (sec.)	LOS	V/C	Delay (sec.)	LOS	V/C	Delay (sec.)	LOS
King Street West & Lake Avenue Eastbound Left Eastbound Through / Right Westbound Left Westbound Through / Right Northbound Left / Through Northbound Right Southbound Left / Through Southbound Right	0.53	27	C	0.71	30	C	0.55	24	C	0.74	27	C	0.55	24	C	0.75	27	C
	0.38	18	B	0.43	20	C	0.43	17	B	0.51	20	C	0.45	17	B	0.54	22	C
	0.58	18	B	0.69	19	B	0.61	16	B	0.72	18	B	0.62	17	B	0.72	18	B
	0.06	18	B	0.01	16	B	0.06	15	B	0.01	14	B	0.06	15	B	0.01	13	B
	0.89	40	D	0.93	43	D	0.86	33	C	0.91	36	D	0.87	33	C	0.91	37	D
	0.13	18	B	0.14	22	C	0.14	18	B	0.16	22	C	0.14	18	B	0.16	23	C
King Street West & 1st Street Eastbound Through / Right Westbound Left / Through Northbound Left / Right	0	0	A	0	0	A	0	0	A	0	0	A	0	0	A	0	0	A
	0	0	A	0	0	A	0	0	A	0	0	A	0	0	A	0	0	A
	21	21	C	23	23	C	24	24	C	26	26	D	25	25	C	28	28	D
	1	1	A	3	3	A	1	1	A	3	3	A	1	1	A	3	3	A
King Street West & 2nd Street Eastbound Left / Through / Right Westbound Left / Through / Right Northbound Left / Through / Right Southbound Left / Through / Right	0	0	A	0	0	A	0	0	A	0	0	A	0	0	A	0	0	A
	26	26	D	53	53	F	30	30	D	73	73	F	30	30	D	79	79	F
	20	20	C	42	42	E	22	22	C	59	59	F	22	22	C	63	63	F
	0	0	A	0	0	A	0	0	A	0	0	A	0	0	A	0	0	A
King Street West & Proposed Site Access Eastbound Left / Through Westbound Through / Right Southbound Left / Right	0	0	A	0	0	A	0	0	A	0	0	A	0	0	A	0	0	A
	26	26	D	82	82	F	26	26	D	82	82	F	26	26	D	82	82	F
	0	0	A	0	0	A	0	0	A	0	0	A	0	0	A	0	0	A
	0	0	A	0	0	A	0	0	A	0	0	A	0	0	A	0	0	A

Table 7 - Vehicle Queue Analysis Results

Intersection Movement	Distance to Nearest Upstream Intersection (m)	95th Percentile Vehicle Queues									
		Existing Conditions		Future Background Conditions		Future Total Conditions					
		AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour				
King Street West & Lake Avenue											
Eastbound Left	23 [40]	25	38	49	31	30	34				
Eastbound Through / Right	80	70	88	83	86	78	93				
Westbound Left	16 [50]	25	3	25	4	9	5				
Westbound Through / Right	110	128	136	122	123	110	136				
Northbound Left / Through	200	29	26	27	37	22	28				
Northbound Right	7 [10]	16	11	15	14	14	15				
Southbound Left / Through	260	24	55	24	49	27	61				
Southbound Right	12 [25]	22	42	22	40	24	43				
King Street West & 1st Street											
Eastbound Through / Right	65	10	44	30	41	11	21				
Westbound Left / Through	80	8	45	9	53	20	56				
Northbound Left / Right	150	8	9	7	10	8	9				
King Street West & 2nd Street											
Eastbound Left / Through / Right	80	43	88	51	88	44	105				
Westbound Left / Through / Right	65	0	36	12	40	0	18				
Northbound Left / Through / Right	150	3	10	8	5	9	5				
Southbound Left / Through / Right	108	16	16	15	18	16	14				
King Street West & Proposed Site Access											
Eastbound Left / Through	30					10	35				
Westbound Through / Right	38					0	9				
Southbound Left / Right	-					17	17				

Note: Available Storage [Taper] Length of turn lane

9. PARKING STUDY

Trans-Plan completed this parking study for the site to review whether the proposed parking supply would be sufficient for the intended uses. A review of parking supplies at similar residential developments in the City of Hamilton were carried out as part of our review to establish appropriate parking rates.

9.1 Parking Supply and Requirements

A parking review based on the site plan was conducted. The proposed parking supply for the 62 residential unit development and commercial area is 66 spaces, provided at a rate of approximately 1.06 spaces per unit.

The Stoney Creek Zoning By-Law 3692-92, Section 4.10.9 (see Appendix F), was used to determine site parking requirements, as shown in Table 8.

Table 8 – Parking Requirements and Supply (Stoney Creek Zoning By-Law)

Use	Size	Parking Requirement		Parking Supply		Deficiency
		Rate (space / unit)	Spaces	Rate	Spaces	
Apartment Buildings	62 units	Resident: 1.00	62	1.06 spaces / room	66	-20
		Visitor: 0.25	16			
Commercial	222 sq.m.	1 space / 28 sq.m.	8			

Source: Stoney Creek Zoning By-Law 3692-92, Section 4.10.9

Based on the Stoney Creek Zoning By-Law, the parking requirement for the site is 86 spaces (62 residential spaces, 16 visitor spaces, and 8 commercial spaces). The proposed parking supply for the site is 66, resulting in a deficiency of 20 parking spaces.

Additionally, the City of Hamilton Zoning By-Law 05-200 suggests different minimum parking requirements separate from the Stoney Creek Zoning By-Law. Table 12 below compares the consolidated City of Hamilton parking requirements and supply for the residential development.

Table 9 - Parking Requirements and Supply (City of Hamilton Zoning By-Law)

Use	Size	Parking Requirement		Parking Supply		Deficiency
		Rate	Spaces	Rate	Spaces	
Residential	62 units	1 space / unit	62	1.06 spaces / room	66	-8
Commercial	222 sq.m.	1 space / 20sq.m	12			

Source: City of Hamilton Zoning By-Law No. 05-200, Section 5

The City of Hamilton Zoning By-Law requires 74 parking spaces for the site. The proposed parking supply is deficient by 8 parking spaces, which is less than the parking deficiency compared to the Stoney Creek Zoning By-Law parking requirements.

9.2 Apartment Auto Ownership Review

The proposed site is located in Ward 9 of the City of Hamilton. Using TTS data, the auto ownership per apartment type dwelling units within Ward 9 was determined for the years 2001, 2006 and 2011. Source information is provided in Appendix C and the results are summarized in Table 10.

Table 10 – Auto Ownership in the City of Hamilton, Ward 9

Area	Average Number of Vehicles Owned per Apartment Dwelling		
	2001 TTS Data	2006 TTS Data	2011 TTS Data
Ward 9 of the City of Hamilton	1.14	0.70	0.83

The results indicate that in Ward 9, where the site is situated, the auto ownership per apartment dwelling household is generally 0.83 vehicles per unit, which would result in an expected parking demand of 51 spaces for the site for the residential tenant uses. This demand is less than the City's Zoning By-law requirement of 62 spaces for residents.

9.3 Amenities in the Surrounding Study Area

Trans-Plan conducted a review of surrounding amenities within walking distance of the site that would be easily accessible to residents without the need for travel by auto, as summarized in Table 11.

Table 11 – Amenities in the Study Area

Amenity	Address	Distance from Subject Site (m)
Commercial		
Shoppers Drug Mart	1 King Street East	160
Tim Hortons	8 King Street East	170
Elm Grocery & Deli Plaza	1-44 King Street East	350
Office		
Barthmann Denture Clinic	11 King Street West	15
Optometry Clinic / Personal Injury Lawyer	20 King Street West	20
General Medical Practice	2 King Street West	50
Various Office Uses	8 King Street West	110
Village Green Denture Specialist	8 King Street East	170
Stoney Creek Post Office	38 King Street East	280
RBC Financial Group	42 King Street East	300
Other		
Cheyne Presbyterian Church	7 King Street West	80
Stoney Creek United Church	1 King Street West	100
R. L. Hyslop Elementary School	20 Lake Avenue South	200
Stoney Creek Recreation Centre	45 King Street West	300

Based on a review of the surrounding area, there are a variety of amenities within walking distance, at most 400m (six to seven minute walk), to accommodate residents without the need to utilize an automobile.

9.4 Proxy Sites for Residential Uses

To gain a better understanding of the parking demands for typical apartment buildings in Stoney Creek, Trans-Plan conducted parking reviews at various other apartment buildings near the subject site and King Street West. Trans-Plan reviewed various proxy apartments, which had similar features as the proposed apartment. Characteristics such as the number of units, provision of surface parking and similar number of storeys were considered in the selection of the site. Table 12 provides details of the reviewed proxy sites.

Table 12 - Proxy Site Comparison

Apartment Address	# of Storeys	# of Units	Percentage of Units Occupied	Parking Supply (Spaces)		
				Resident	Visitor	Details
Collingwood Manor, 28 King Street West	8	136	95-100%	149	0	Surface: 85 Underground: 64
Glenview, 32 King Street West	4	48	100%	43	0	Surface: 43
Access Midwives, 38 King Street West	8	64	90-95%	70	0	Surface: 70
Evelyn Court, 12 Mountain Avenue	9	144	90-95%	148	10	Surface: 158
Cherrywood, 2 Cherrywood Drive	7	112	100%	132	0	Surface: 132
The Elizabeth, 90 King Street East	9	90	100%	93	10	Surface: 37 Underground: 66
Robinson Tower, 100 King Street East	9	90	90-95%	93	10	Surface: 37 Underground: 66

The proxy sites have been in operation for a long period of time, hence the high occupancy rate. Discussion with the property managers resulted in the majority of the parking spaces being leased out. Visitor parking spaces were noted from the supply where indicated. The existing parking supplies and parking supply rates for the proxy sites reviewed are shown in Table 13.

Table 13 – Parking Supply and Parking Supply Rates

Sites (in Stoney Creek)	No. of Units	Parking Supply					
		(spaces)			rate (spaces per unit)		
		Res.	Visitor	Total	Res.	Visitor	Total
28 King Street West	136	149	0	149	1.10	0.00	1.10
32 King Street West	48	43	0	43	0.90	0.00	0.90
38 King Street West	64	70	0	70	1.09	0.00	1.09
12 Mountain Avenue	144	148	10	158	1.03	0.07	1.10
2 Cherrywood Drive	112	132	0	132	1.18	0.00	1.18
90 King Street East	90	93	10	103	1.03	0.11	1.14
100 King Street East	90	93	10	103	1.03	0.11	1.14
Average	98	104	4	108	1.05	0.04	1.09

For typical apartments, the average parking rate is approximately 1.09 spaces per unit, which is similar to the proposed parking rate for the subject site of 1.06 spaces per unit (66 spaces / 62 units). Based on this review, the underground parking supply of 66 spaces for residential and visitor uses is expected to be adequate for the site.

The visitor spaces could be for both visitors of the apartment uses and of the commercial component of the building. A review of visitor parking is discussed further in the next section.

9.5 On-Street Parking Review for Visitor Uses

The commercial area of the building is expected to function as a complimentary use to the residents and mainly serve the surrounding residential area (i.e. mainly generating walk trips rather than auto trips). If vehicle parking is required, there are nearby on-street parking spaces that could be utilized for short visits to the commercial area. Table 14 summarizes the on-street parking within walking distance of the subject site.

Table 14 – On-street Parking within the Study Area

Street Area	Approximate Parking Supply (spaces)	Approximate Walking Distance from Site	Time Restrictions
King Street West, from 2 nd Street to 1 st Street	18	Fronting the site	2 hours from 9am – 9pm; overnight parking allowed
1st Street South, east side, adjacent the Stoney Creek United Church	6	50m	None
2nd Street North, west side, adjacent Collingwood Manor, 28 King Street West	10	55m	None
Total Parking Supply:	34 spaces		

The available on-street parking supply in the immediate area (within 100m of the site) is approximately 34 spaces, which would be adequate to meet commercial parking demands (although it is assumed that trips to the commercial use would be mainly walk trips).

10. TRANSPORTATION DEMAND MANAGEMENT OPTIONS REPORT

Transportation Demand Management (TDM) measures include policies, programs, services and products that influence whether, why, when, where and how people travel. They work by shaping the economic and social factors behind personal travel decisions. TDM is not a substitute for investment in infrastructure but it complements investments in walking, cycling and transit facilities by making them more effective.

By improving individuals' awareness of different travel options, their understanding of how to use those options, and their willingness to try those options, TDM increases the likelihood that they will make informed choices.

10.1 TDM Infrastructure

10.1.1 Transit Services

As previously noted in Section 4.3 Transit Services, HSR transit services are provided by Routes 58 and 5, with service frequencies of a half hour or less during peak periods, and with connections to other higher-order transit services in Hamilton, such as Route 1 King (blue line) and Route 10 B-Line Express (red line), that operate along the major travel corridors of Queenston Road and Main Street East / West. The nearest bus stops are located on King Street West between 1st Street South and Lake Avenue Drive, approximately 60m east of the site.

10.1.2 Cycling & Pedestrian Connectivity

King Street West is a shared roadway for vehicles and cyclists. Signs are provided intermittently along King Street West, advising vehicles and cyclists to share the roadway. Sharrows (designated by pavement markings) are provided along Lake Avenue Drive to connect cyclists to Highway 8 and along King Street East, east of Lake Avenue. Posted signage is provided along King Street West advising vehicles and cyclists to share the road.

Future cycle lanes are identified along King Street West within the City's Cycling Master Plan, dated 2009. However due to the narrow road widths, the sharrows currently in place are being utilized. The ultimate vision is to include cycle lanes along the entirety of King Street West, similar to the cycle lanes provided on King Street East, west of Battlefield Drive, approximately 400m west of the site. There are currently no plans in the immediate future.

Sidewalks with a curb are provided along all study roadways to connect pedestrians to bus stops and other key areas.

10.1.3 Car Share and Bike Share

There are currently no car share services located in close proximity to the site. The nearest car share vehicle is located near the intersection of Quigley Drive and Greenhill Avenue, approximately 3km southwest of the site. Car share facilities are operated by the Community CarShare and Zip Car.

Bike share is operated by Social Bicycles (SoBi) Hamilton which is currently not operational in Stoney Creek.

10.2 TDM Initiatives for Consideration

Based on a review of the City of Hamilton's TDM Guidelines, the TDM measures reviewed for the subject site (and corresponding level of analysis applied) is consistent with a mixed use development with high density residential and commercial frontage.

A detailed list of all potential measures to be considered for the proposed development are provided in Appendix G, including our feedback as to whether the application of each measure being considered is feasible or not for the subject site. The measures that we propose to be carried forward are further summarized in Table 15.

Table 15 - Proposed TDM Measures for 16 & 18 King Street West, Stoney Creek, Hamilton

Category	TDM Initiative / Incentives	Initiatives to be Considered
Cycling	Visible, well-lit, short-term bicycle parking for visitors (above minimum provisions or recommendations)	✓
	Secure, indoor bicycle parking storage spaces for tenants/residents	✓
	Ensure development connects to bicycle network	✓
Walking	Safe, attractive and direct walkways for pedestrians linking building entrances with public sidewalks and with key destinations such as schools	✓
	Enhanced pedestrian amenities on-site (e.g., benches, landscaping, lighting)	✓
Transit	Enhance walking routes between main building entrance(s) and transit stops/stations	✓
Wayfinding and Travel Planning	Travel planning resources for residents (individualized marketing, active transportation maps, community resources)	✓
Education / Promotion, Incentives	Contribute to building a strong TDM brand	✓
	Include transit and active transportation maps, carshare memberships, and/or bikeshare memberships with new tenants	✓

10.3 Site Plan Review of TDM Measures

This section reviews how TDM measures could be incorporated on the site plan and provides a further understanding of the connectivity of the site to and from the pedestrian and cycling network and to and from the nearest transit stops. Figure 9 provides a map of the existing and future transportation connectivity regarding pedestrian sidewalks, cycle lanes, and bus stops.

10.3.1 Pedestrian & Transit Stop Connectivity

A proposed pedestrian connection is provided from the multiple entrances fronting the site (for residential and commercial uses) to allow pedestrians to easily access the provided sidewalks along King Street West which can then connect them to other areas within the study area such as the transit stops. The transit stops are located within 60m of the site, which is an approximate walk time of one minute (at an average walking speed of 1.0 m/s).

10.3.2 Cycle Connectivity

Bicycle parking on-site is recommended to encourage more people to cycle, especially for utilitarian purposes, would result in taking more cars off the road during peak hours, helping to reduce traffic congestion, and is more environmentally friendly.

The City of Hamilton's TDM Guidelines provides typical bicycle parking rates for the mixed use developments. In the Guidelines, long-term and short-term bicycle spaces are to be considered. Long-term spaces are generally rooms located within or a part of a building, exclusive for bicycle parking. Short-term spaces are designated areas for bicycle parking with racks/stands designed to lock the wheel and frame of a bicycle. Table 16 provides the typical range of bicycle parking requirements recommended by the TDM Guidelines.

Table 16 - Bicycle Parking Requirements

Land Use	Number of Units	Bicycle Parking Requirements (spaces per dwelling)		Bicycle Parking Spaces	
		Short-term	Long-term	Short-term	Long-term
Mixed Use	62	0.05 to 0.20	0.50 to 1.25	3 to 13	31 to 78

Note: Values are a range of typical bicycle parking requirements

As per the City's TDM guidelines, a minimum of 3 short-term bicycle parking spaces and 31 long-term bicycle parking spaces are recommended to serve the development.

Short-term bicycle parking spaces could be located near the outdoor amenity area at the northeast corner of the site. The site plan includes 38 storage lockers, provided within the two levels of underground parking.

10.4 Projected Trip Reductions for TDM Measures

The implementation of the TDM measures is expected to encourage a reduction in single-occupant auto trips to and from the site. This section provides an estimate of this possible resultant auto trip reduction.

Based on our traffic analysis, the site is expected to generate approximately 42 and 66 new two-way trips during the weekday AM and PM peak hour.

Based on the 2011 Transportation Tomorrow Survey data for Hamilton Ward 9 (See Appendix C), the 2011 transit mode split during the peak hour was five percent and the walking & cycling mode split was six percent.

The expected transit and walking / cycling auto trip percent reduction for non-auto travel was applied to the site trip generation, as shown in Table 17.

Table 17 - Auto Trip Reduction for TDM

Size		AM Peak Hour			PM Peak Hour		
		In	Out	Total	In	Out	Total
Auto Trips (vehicles)		11	31	42	41	25	66
Transit Trips	5%	0	-2	-2	-2	-1	-3
Walking / Cycling Trips	6%	-1	-2	-3	-2	-2	-4
Net Auto Trips		10	27	37	37	22	59

The estimated auto trip reduction is from 42 to 37 trips in the weekday AM peak hour and from 66 to 58 trips in the weekday PM peak hour, as a result of TDM initiatives.

11. SUMMARY AND RECOMMENDATIONS

Our Traffic Impact and Parking Study and TDM Options Report findings and recommendations for the proposed mixed use development located at 16 and 18 King Street West in Stoney Creek, Hamilton are provided as follows:

11.1 Summary of Traffic Impact Study

- The proposed development is an eight-storey mixed use development consisting of 62 residential units on floors two to eight and 222 sq.m. of commercial space on the ground floor. A parking supply of 66 spaces is proposed through two levels of underground parking.
- A review of active transportation in the study area shows sufficient transit connectivity and shared cycle lanes along King Street West.
- The intersection at King Street West and Lake Avenue is expected to operate well, similar to the existing conditions, with minor signal timing adjustments. Vehicle queues may slightly extend past the provided storage lengths but there is adequate taper to provide space for additional vehicles. During the weekday PM peak hour, the westbound through queues may extend past the adjacent signalized intersection on occasion; however, signal times were optimized and this occurrence is similar to existing conditions (with little or no impact created by site traffic).
- The site access (exiting traffic) is expected to operate at an LOS of F with delays up to 82 seconds; however, this delay is typical when exiting from a driveway onto an arterial road (King Street West).
- No further road improvements are required to support the proposed development, aside from construction of the site access.

11.2 Summary of Parking Study

- The proposed development has a proposed parking supply of 66 spaces, provided at an approximate rate of 1.06 spaces per unit.
- Based on the Stoney Creek Zoning By-law 3692-92, 86 parking spaces are required for the proposed development, resulting in a deficiency of 20 spaces.
- According to the consolidated City of Hamilton Zoning By-law 05-200, 74 parking spaces are required for the proposed development, resulting in a smaller deficiency of 8 spaces.

- A review of TTS data resulted in an auto ownership of approximately 0.83 vehicles per apartment dwelling unit which would result in an expected parking demand of 51 spaces for the site for the residential tenant uses.
- A review of local amenities within walking distance from the subject site was conducted. A variety of commercial and office uses (such as a Shoppers Drug Mart) are located within walking distance and are easily accessible to residents. Transit stops are also located only 60m away from the subject site to accommodate residents without the need to utilize an automobile.
- To gain a better understanding of parking demands for apartment buildings in Stoney Creek, a parking review of similar apartments was completed near King Street West. Based on the existing parking supply for the proxy site locations, the average parking rate is approximately 1.09 spaces per unit, which is similar proposed parking rate for the subject site of 1.06 spaces per unit.
- Various on-street parking opportunities near the proposed site are expected to be sufficient to accommodate parking for the commercial uses (although the commercial use is expected to mainly generate walk trips from the local area).

11.3 Summary of TDM Measures

- Provide at least 3 short-term bicycle parking spaces (cycle racks) in a well-lit area at the surface and provide at least 31 long-term bicycle parking spaces within the building or underground parking area.
- Pedestrian connections are provided on-site (at the building entrances), to connect residents and customers to the municipal sidewalk along King Street West.
- The site is currently served by the Hamilton Street Railway transit service through Route 5 and 58, with peak service frequencies of 20- to 30-minutes during the week. Transit-stops are provided within an acceptable distance of 60m from the site, just west of the intersection of King Street West and Lake Avenue. Routes 5 and 58 connect to higher order transit services, such as the Route 1 King (blue line) and the Route 10 B-Line (red line). The site is therefore adequately serviced by transit.
- The applicant would organize the distribution of resident packages (containing transit service schedules / maps, cycling routes / pedestrian trails maps and a list / description of available community services) to new tenants at such time as the building is first occupied. Information should also be displayed at a suitable location at the building entrance.

11.4 Recommendations

- The proposed site access is expected to operate acceptably in future conditions without any road improvements required to accommodate the development.
- The proposed parking supply of 66 spaces is expected to be sufficient for the proposed development for the resident, visitor and commercial uses.
- The above noted TDM measures in Section 11.3 would be applicable to the proposed development.

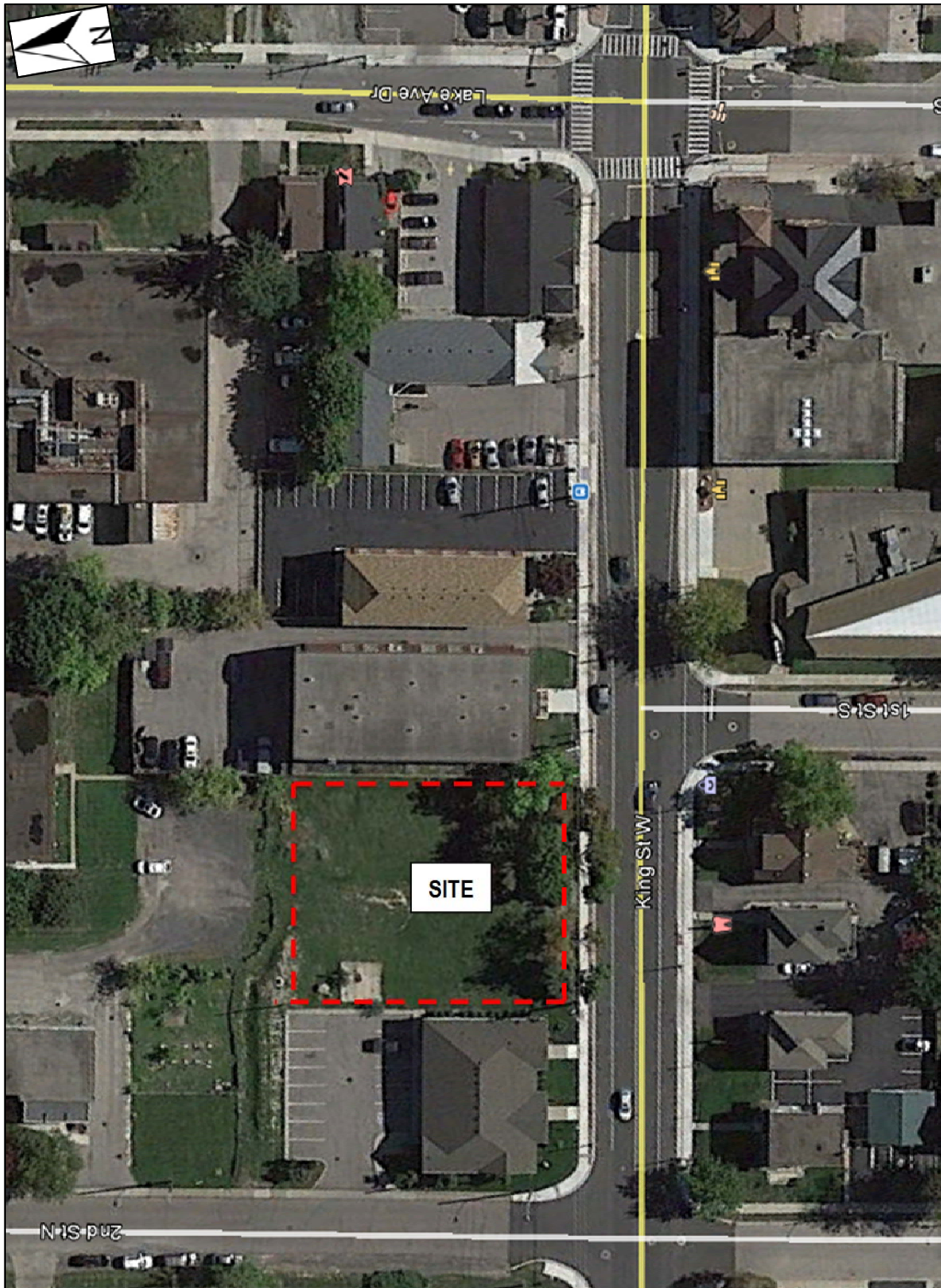
Respectfully submitted,



Anil Seegobin, P.Eng.
Partner, Engineer

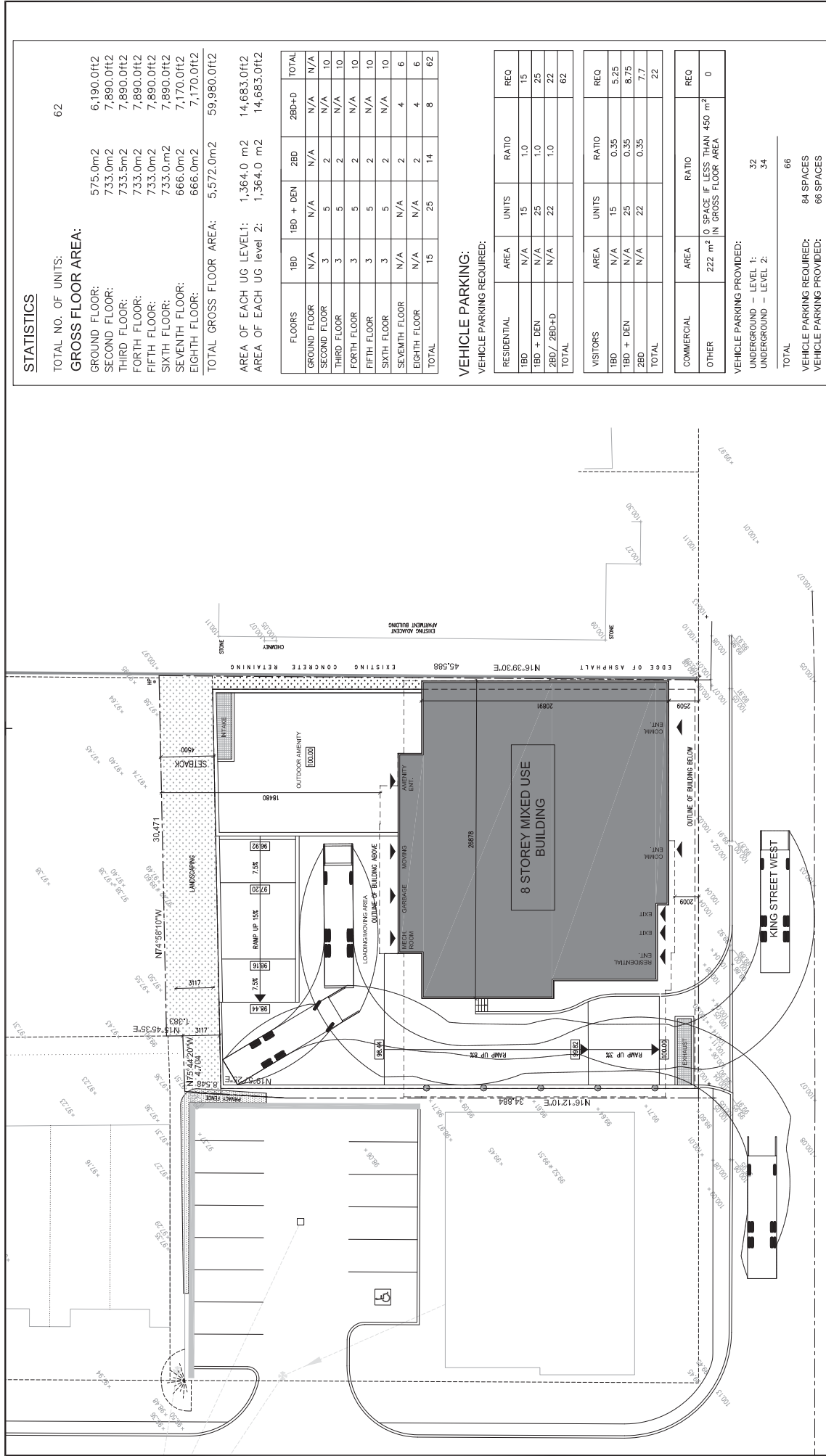
Trans-Plan Transportation Inc.
Transportation Consultants

Figure 1 – Site Location



Source : Google Earth

Figure 2 - Site Plan



STATISTICS

TOTAL NO. OF UNITS: 62
 GROSS FLOOR AREA:
 GROUND FLOOR: 6,190.0ft²
 SECOND FLOOR: 7,890.0ft²
 THIRD FLOOR: 7,890.0ft²
 FOURTH FLOOR: 7,890.0ft²
 FIFTH FLOOR: 7,890.0ft²
 SIXTH FLOOR: 7,890.0ft²
 SEVENTH FLOOR: 7,170.0ft²
 EIGHTH FLOOR: 666.0m²
 TOTAL GROSS FLOOR AREA: 5,572.0m²
 AREA OF EACH UG LEVEL 1: 1,364.0 m²
 AREA OF EACH UG LEVEL 2: 1,364.0 m²
 14,683.0ft²
 14,683.0ft²

FLOORS	1BD	1BD + DEN	2BD	2BD+D	TOTAL
GROUND FLOOR	N/A	N/A	N/A	N/A	N/A
SECOND FLOOR	3	5	2	N/A	10
THIRD FLOOR	3	5	2	N/A	10
FOURTH FLOOR	3	5	2	N/A	10
FIFTH FLOOR	3	5	2	N/A	10
SIXTH FLOOR	3	5	2	N/A	10
SEVENTH FLOOR	N/A	N/A	2	4	6
EIGHTH FLOOR	N/A	N/A	2	4	6
TOTAL	15	25	14	8	62

VEHICLE PARKING:

VEHICLE PARKING REQUIRED:

RESIDENTIAL	AREA	UNITS	RATIO	REQ
1BD	N/A	15	1.0	15
1BD + DEN	N/A	25	1.0	25
2BD / 2BD+D	N/A	22	1.0	22
TOTAL				62

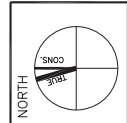
VISITORS	AREA	UNITS	RATIO	REQ
1BD	N/A	15	0.35	5.25
1BD + DEN	N/A	25	0.35	8.75
2BD	N/A	22	0.35	7.7
TOTAL				22

COMMERCIAL	AREA	RATIO	REQ
OTHER	222 m ²	0 SPACE IF LESS THAN 450 m ² IN GROSS FLOOR AREA	0

VEHICLE PARKING PROVIDED:
 UNDERGROUND - LEVEL 1: 32
 UNDERGROUND - LEVEL 2: 34

TOTAL: 66
 VEHICLE PARKING REQUIRED: 62 SPACES
 VEHICLE PARKING PROVIDED: 66 SPACES

NO.	REVISION/ISSUE	DATE
3	ISSUED FOR CLIENT REVIEW	MAR. 23, 2017
2	ISSUED FOR CLIENT REVIEW	FEB. 16, 2017
1	ISSUED FOR COORDINATION	FEB. 02, 2017



PROJECT/DRAWING TITLE

SITE PLAN
16-18 KING STREET WEST - STONEY CREEK

CLIENT NAME/LOGO

MM GREEN
STONEY CREEK INC.

Scale: 1:300
 Date: March 23, 2017
 Project No. 15128
 Drawing No. A010
 Drawn by: MF
 Checked by: RE

ICON

TRAFFIC IMPACT STUDY

Proposed Mixed Use Development

16 & 18 King Street West, Stoney Creek, Hamilton

Figure 3: Existing Study Area Roadway Characteristics

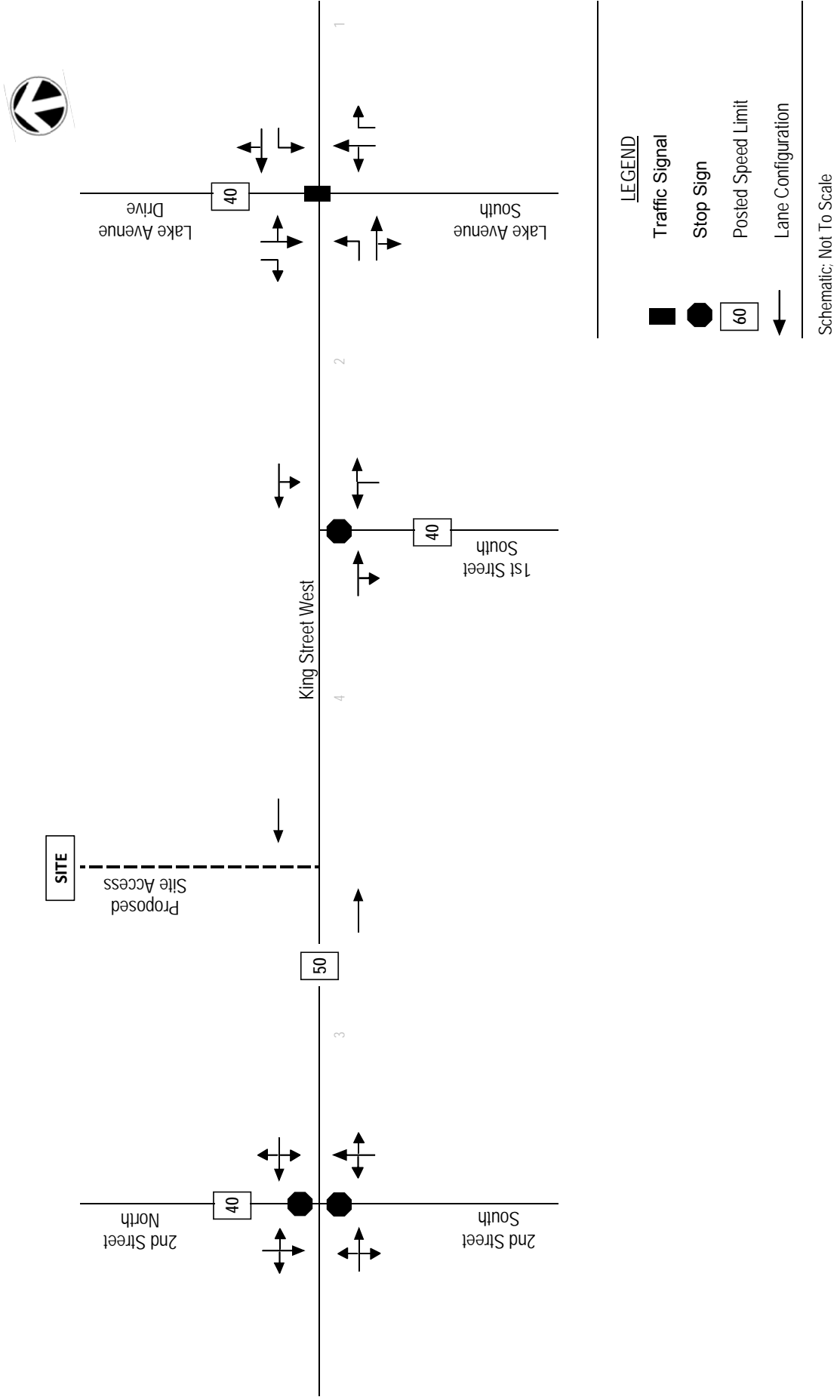


Figure 4: Existing Traffic Volumes, Weekday AM and PM Peak Hours

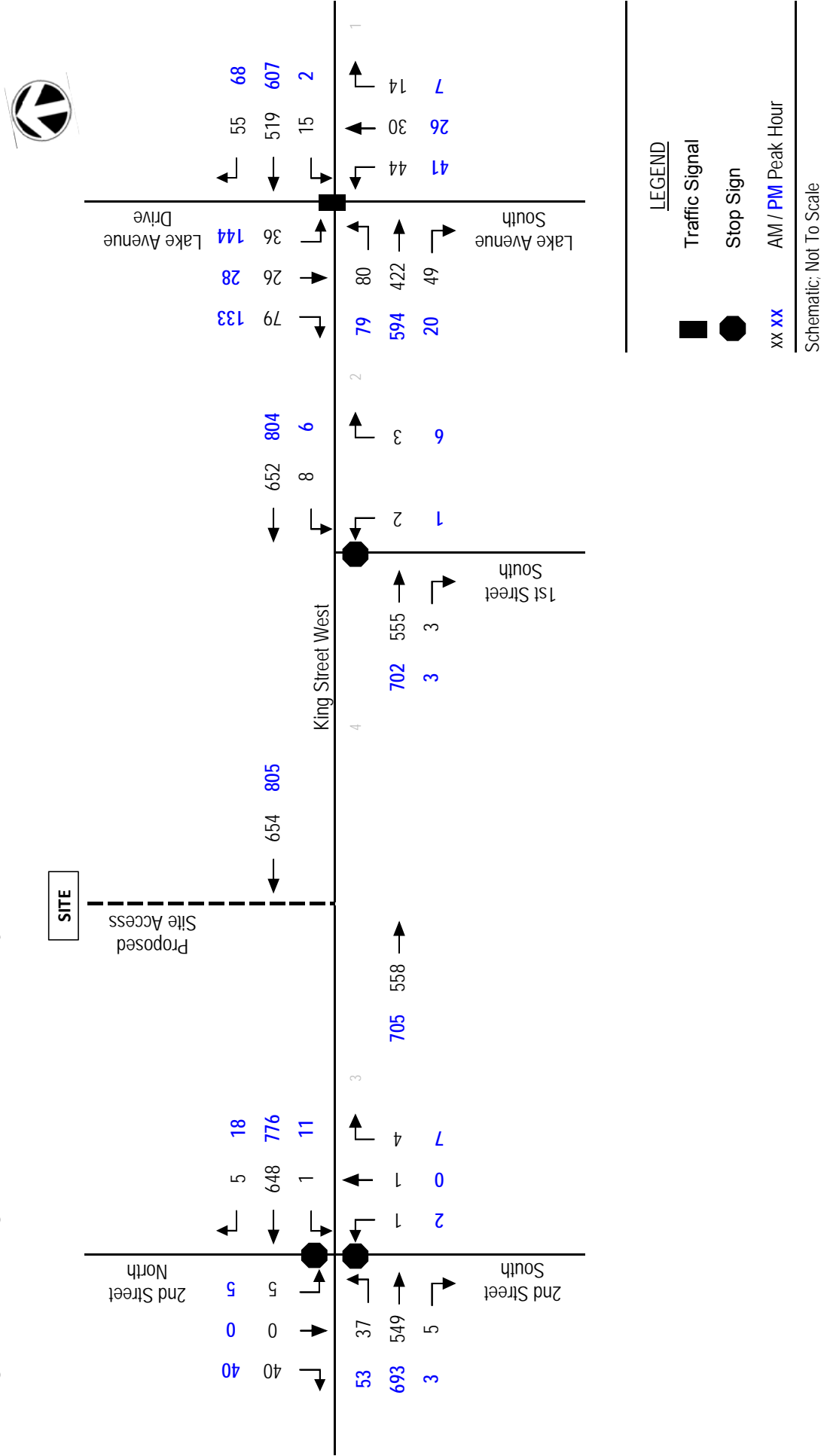


Figure 6: Future Background Traffic Volumes, Weekday AM and PM Peak Hours

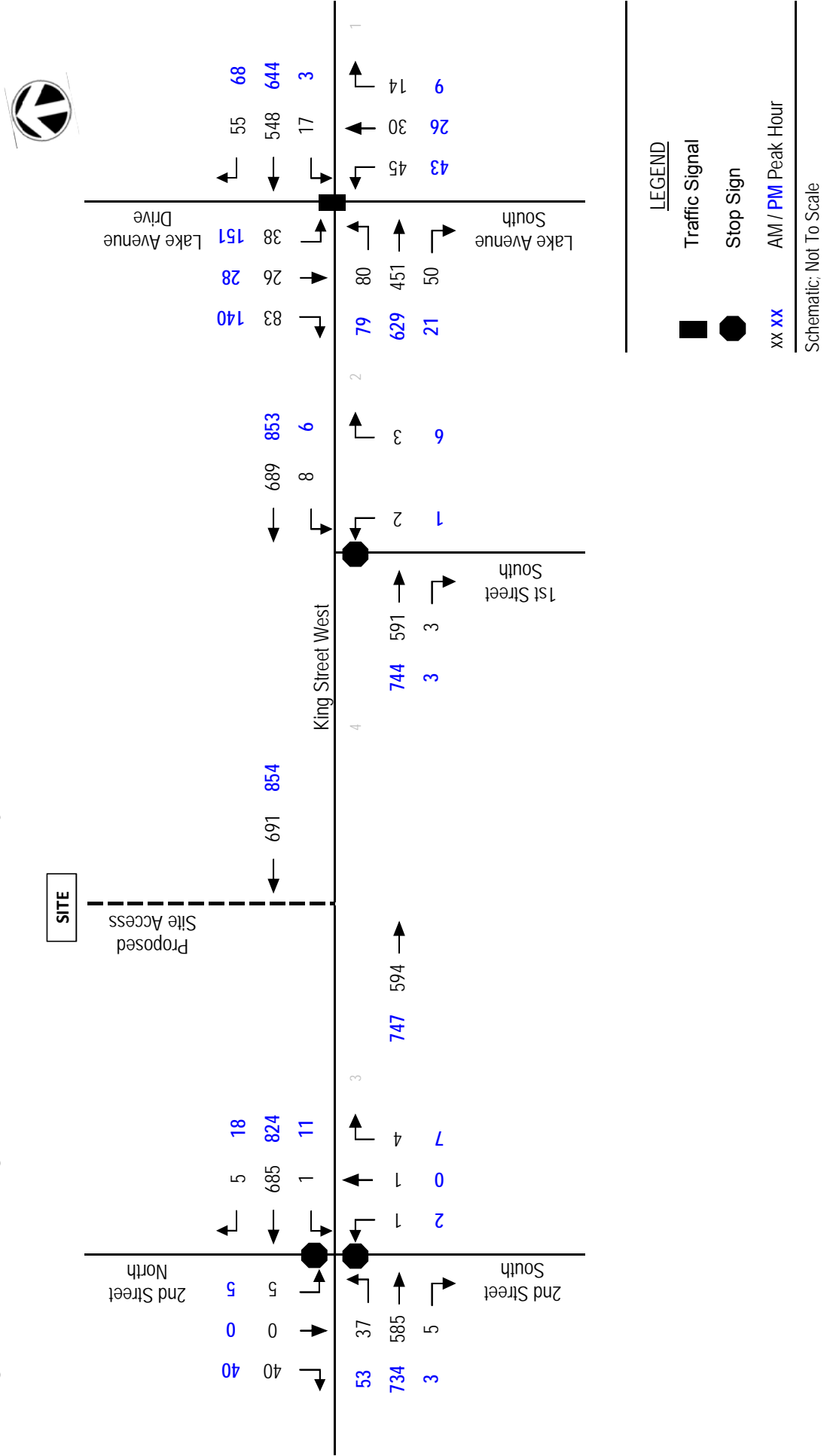
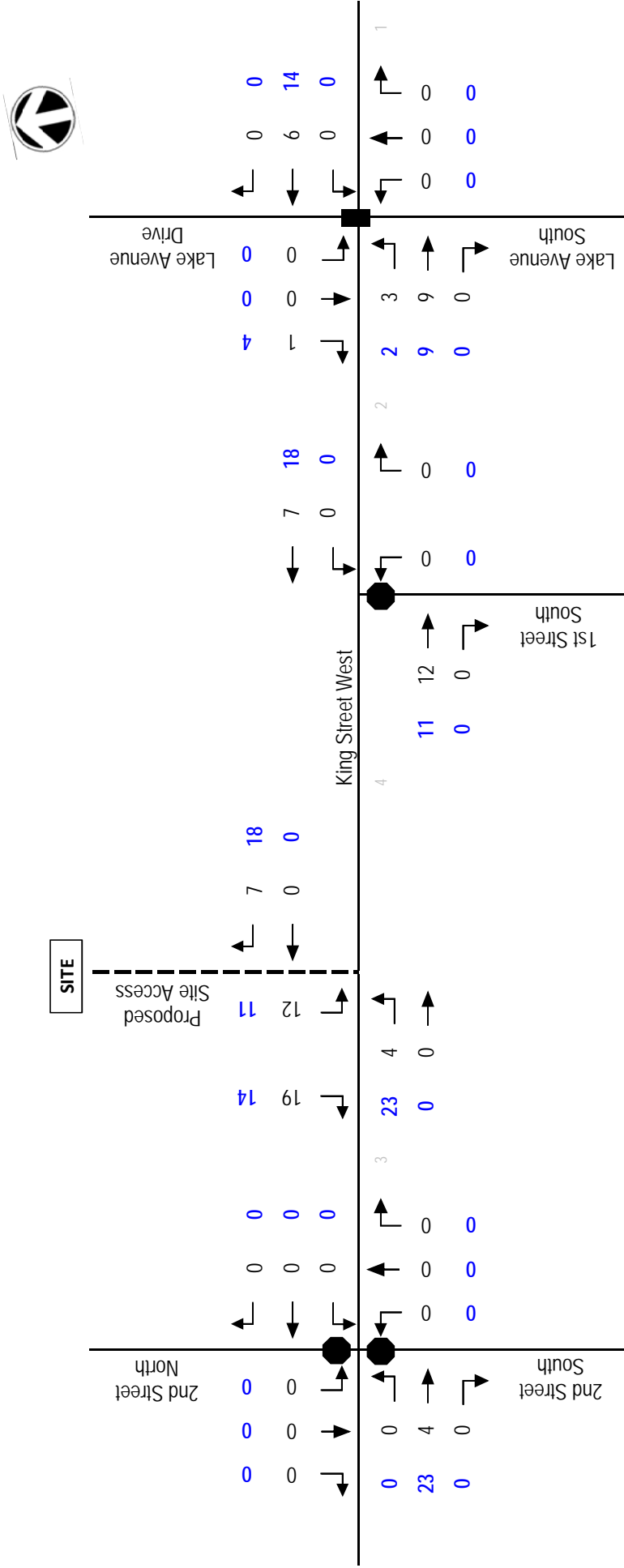




Figure 7: Site Traffic Assignment, Weekday AM and PM Peak Hours



LEGEND

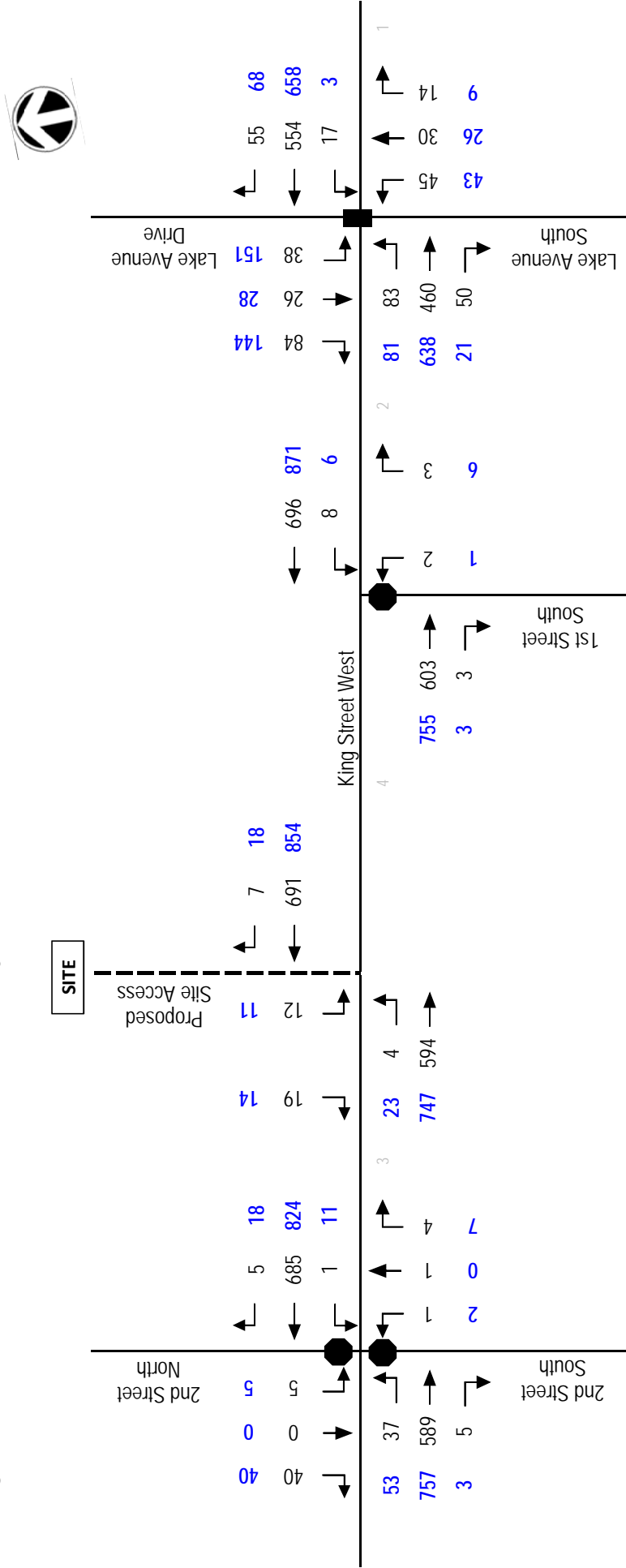
 Traffic Signal

 Stop Sign



xx xx AM / PM Peak Hour

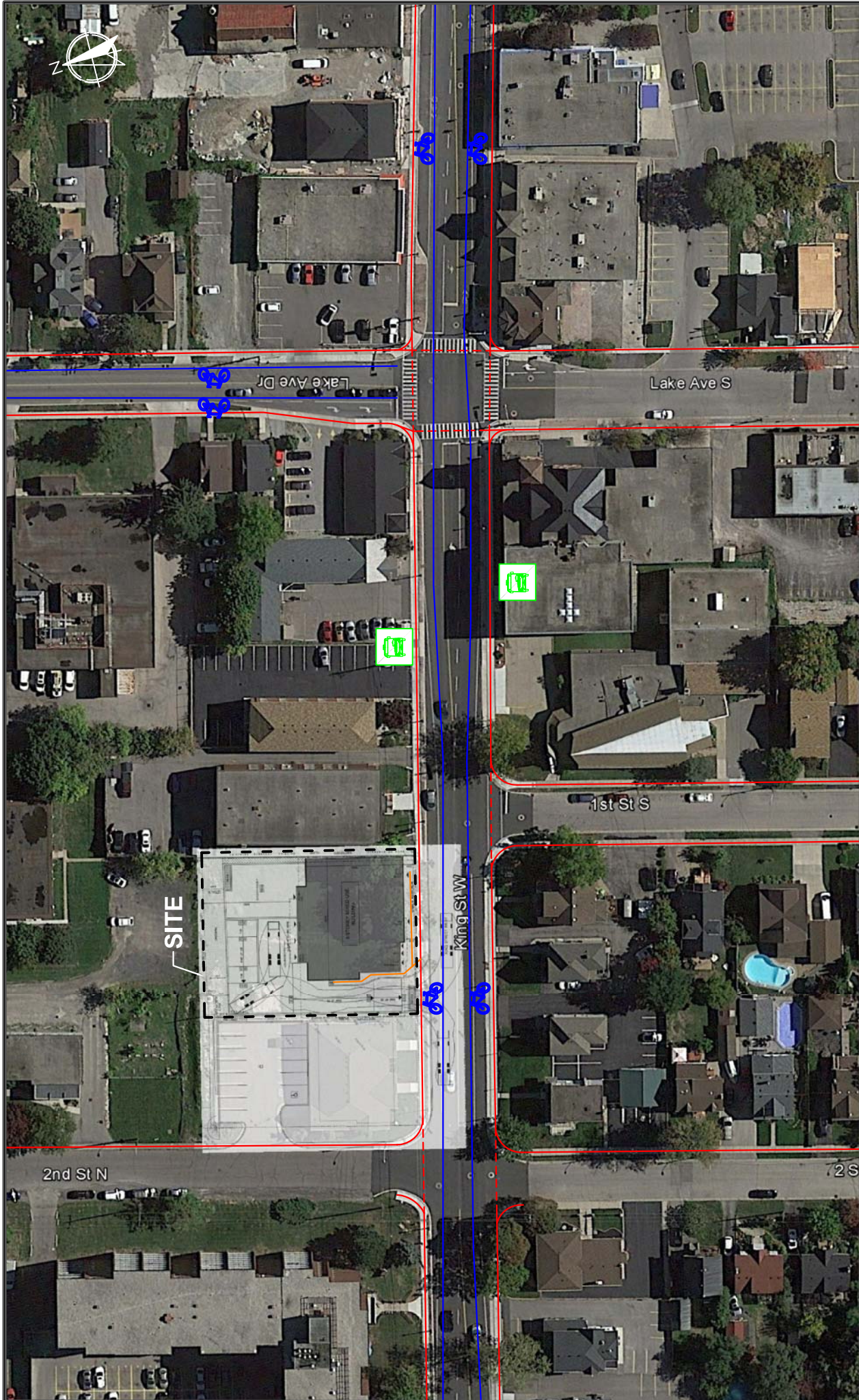
Schematic; Not To Scale

Figure 8: Future Total Traffic Volumes, Weekday AM and PM Peak Hours



LEGEND

-  Traffic Signal
 -  Stop Sign
 - xx xx** AM / PM Peak Hour
- Schematic; Not To Scale



Legend





	Existing Pedestrian Connections
	Future Pedestrian Connections
	Existing Shared Bicycle Lanes
	Existing HSR Transit Bus Stop

Figure 9
Active Transportation Connectivity Map
 PROPOSED MIXED USE DEVELOPMENT
 16 & 18 KING STREET WEST
 Stoney Creek, Hamilton, Ontario
 Source: Site Plan by ICON Architects
 N.T.S.

APPENDICES

Appendix A – Turning Movement Counts and Signal Timing Plans

Appendix B – Background Traffic Information

Appendix C – Transportation Tomorrow Survey Data

Appendix D – Capacity and Queue Analysis Sheets

Appendix E – Level of Service Definitions

Appendix F – City of Hamilton Parking Requirements

Appendix G – City of Hamilton's TDM Initiatives for Mixed Use Developments



APPENDIX A

Turning Movement Counts and Signal Timing Plans

Trans-Plan Transportation Inc.

Site ID Code:
 Intersection Location: King Street West at Lake Avenue
 Municipality: Stoney Creek, Hamilton, Ontario
 Count Date: Wednesday April 26, 2017
 Weather and Temperature: Cloudy
 Surveyor: TP

AM	NORTH APPROACH						EAST APPROACH						SOUTH APPROACH						WEST APPROACH						Grand Total			
	CAR		TRUCKS		CYCLISTS		Peds	Total	CAR		TRUCKS		CYCLISTS		Peds	Total	CAR		TRUCKS		CYCLISTS		Peds	Total				
	L	T	R	L	T	R			L	T	R	L	T	R			L	T	R	L	T	R				L	T	R
7:00	0	2	9	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	76	185	
7:15	8	0	9	1	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	91	221
7:30	8	2	24	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	91	221
7:45	10	2	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	152	328
8:00	8	3	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	152	328
8:15	7	3	26	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	147	315
8:30	9	9	21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	140	345
8:45	11	11	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	124	332
9:00	12	4	17	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	171	378
9:15	16	7	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	136	299
9:30	16	7	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	136	299
9:45	16	7	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	136	299
10:00	16	7	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	136	299
10:15	16	7	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	136	299
10:30	16	7	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	136	299
10:45	16	7	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	136	299
11:00	16	7	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	136	299
11:15	16	7	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	136	299
11:30	16	7	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	136	299
11:45	16	7	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	136	299
12:00	16	7	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	136	299
12:15	16	7	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	136	299
12:30	16	7	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	136	299
12:45	16	7	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	136	299
13:00	16	7	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	136	299
13:15	16	7	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	136	299
13:30	16	7	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	136	299
13:45	16	7	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	136	299
14:00	16	7	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	136	299
14:15	16	7	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	136	299
14:30	16	7	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	136	299
14:45	16	7	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	136	299
15:00	16	7	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	136	299
15:15	16	7	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	136	299
15:30	16	7	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	136	299
15:45	16	7	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	136	299
16:00	25	5	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	150	361
16:15	26	5	24	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	166	397
16:30	33	8	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	173	410
16:45	39	7	26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	174	396
17:00	33	5	31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	174	396
17:15	39	8	33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	166	418
17:30	40	7	26	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	181	456
17:45	26	9	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	174	391
18:00	21	4	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	175	390
18:15	15	6	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	137	324
18:30	15	6	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	139	309
18:45	15	6	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	139	309
19:00	15	6	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	139	309
19:15	15	6	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	139	309
19:30	15	6	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	139	309
19:45	15	6	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	139	309
20:00	15	6	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	139	309



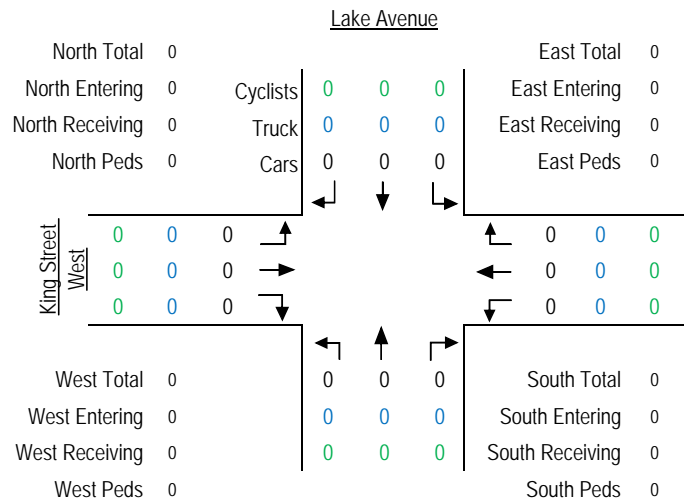
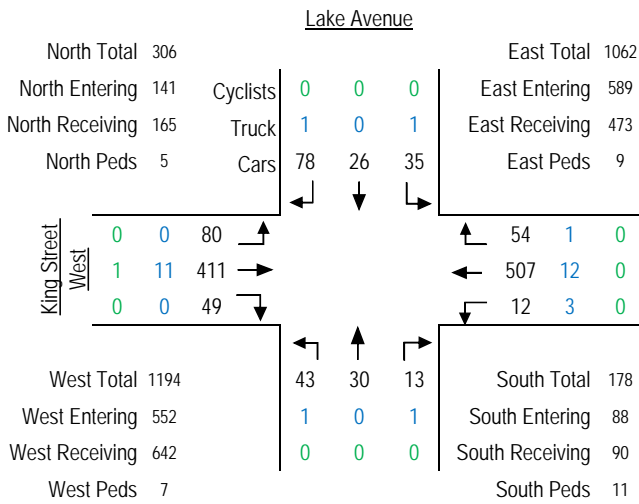
Turning Movement Count Diagram

Intersection: King Street West at Lake Avenue
 Municipality: Stoney Creek, Hamilton, Ontario

Count Times: 7:00am - 9:30am, 4:00pm - 6:30pm
 Date: Wednesday April 26, 2017

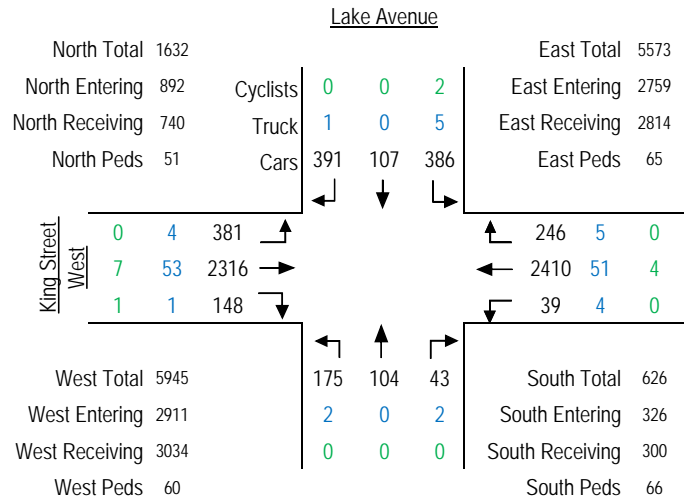
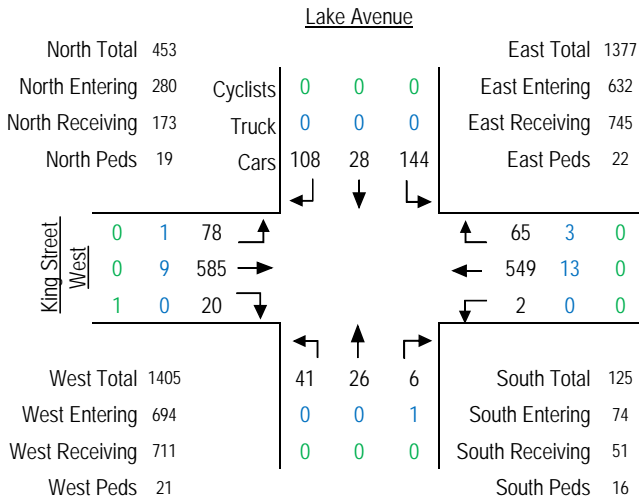
AM Peak Hour: 8:00 to 9:00

MD Peak Hour: - to -



PM Peak Hour: 16:30 to 17:30

Total 5-Hour Count





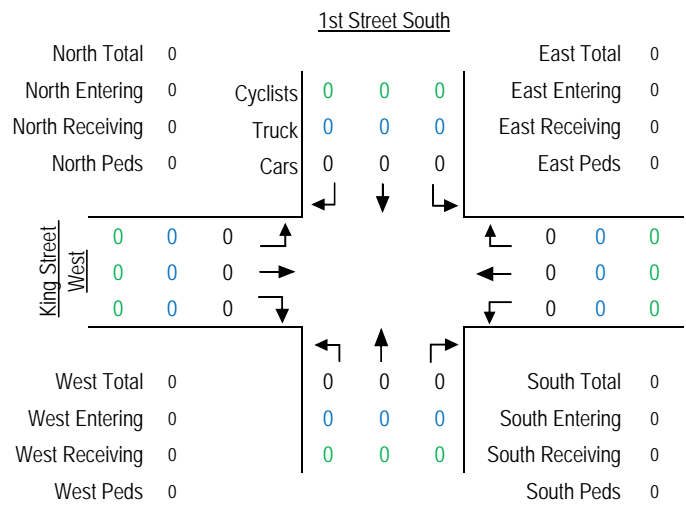
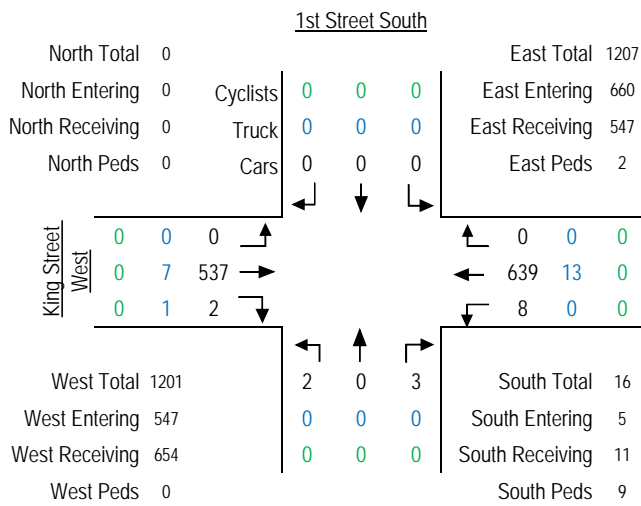
Turning Movement Count Diagram

Intersection: King Street West at 1st Street South
 Municipality: Stoney Creek, Hamilton, Ontario

Count Times: 7:00am - 9:30am, 4:00pm - 6:30pm
 Date: Wednesday April 26, 2017

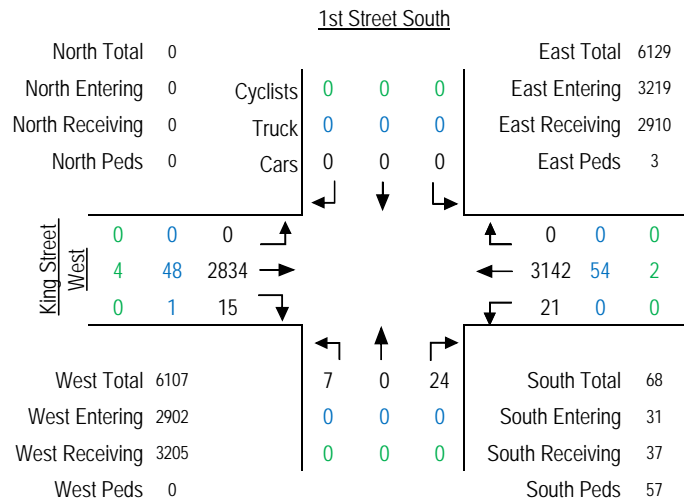
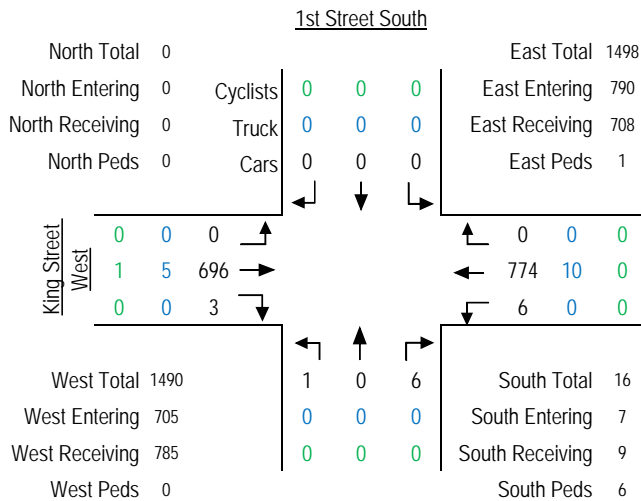
AM Peak Hour: 8:00 to 9:00

MD Peak Hour: - to -



PM Peak Hour: 17:00 to 18:00

Total 5-Hour Count





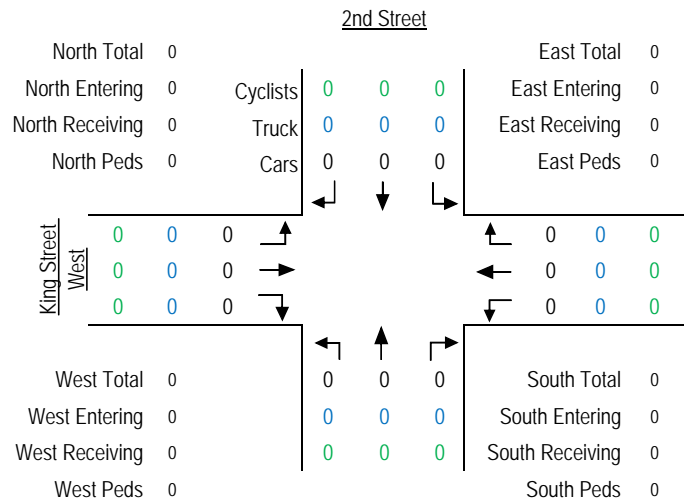
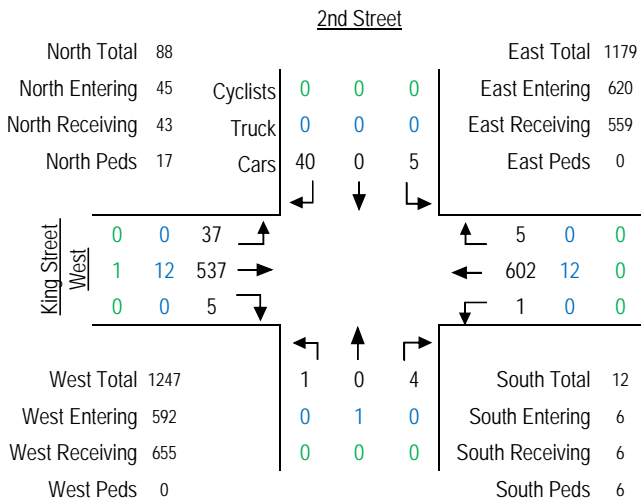
Turning Movement Count Diagram

Intersection: King Street West at 2nd Street
 Municipality: Stoney Creek, Hamilton, Ontario

Count Times: 7:00am - 9:30am, 4:00pm - 6:30pm
 Date: Wednesday April 26, 2017

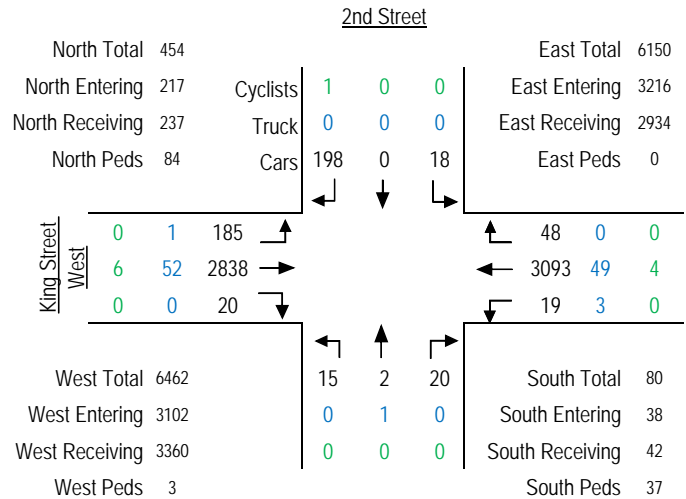
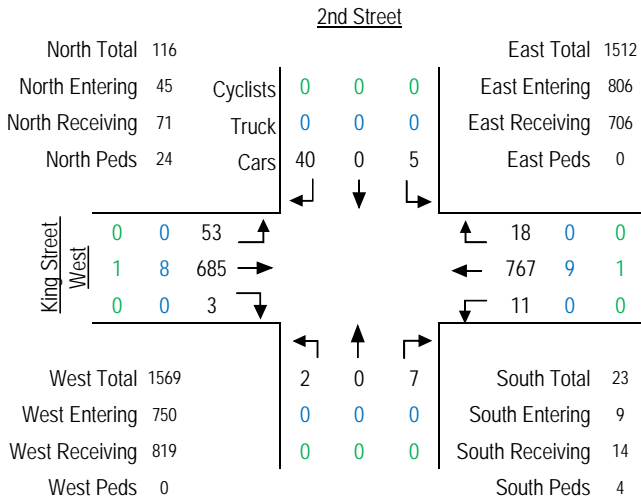
AM Peak Hour: 8:00 to 9:00

MD Peak Hour: - to -



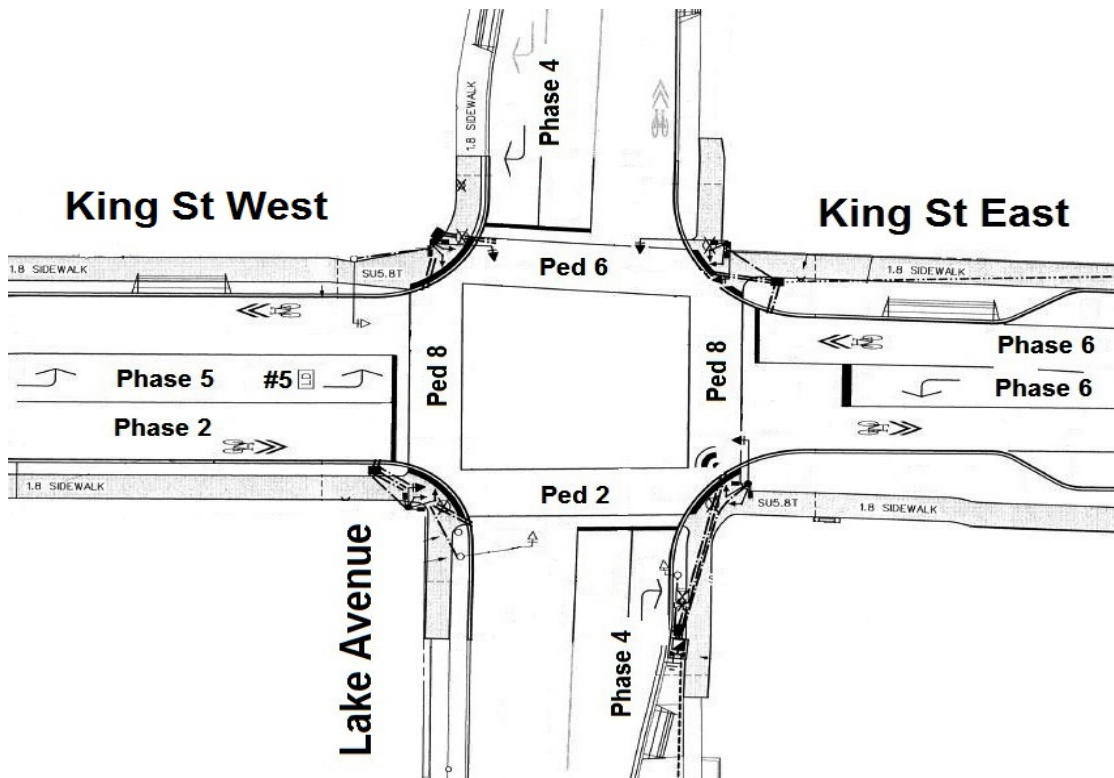
PM Peak Hour: 16:45 to 17:45

Total 5-Hour Count



City of Hamilton - Traffic Traffic Signal Controller Timing Data

Intersection: King St @ Lake Ave (Int# 106)	
Controller Type: 3000E	Page 1 of 16
Programmed By: MF	Installed By: MF
Date: July 24/15	Date: Dec 8/15



- φ1:
- φ2: King - EB, South Xwalk
- φ3: No Output - Timing for Advance Ped
- φ4: Lake - NB/SB (Vehicle Phase)
- φ5: King - EBLT
- φ6: King - WB, North Xwalk
- φ7:
- φ8: Lake - E/W Xwalks (Ped Phase)

Flash Operation: Red: King
 Red: Lake

CONTROLLER DATA

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
PHASE TIMES	Initial		10	2	10	5	10		10								
	Passage					2.0											
	Yellow		3.3	3.0	3.3	3.0	3.3		3.3								
	Red		2.1		2.0		2.1		2.0								
	Walk		12		0		12		18								
	Ped Cir		12		0		12		12								
	Max 1		55	3	40	15	55		40								
	Max 2																
	Mx 3 Lim																
	Mx 3 Adh																
	TBR																
	TTR																
Min Gap																	
All/Act																	
Max In																	

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
PHASE TIMES	Initial		10	2	10	5	10		10								
	Passage					2.0											
	Yellow		3.3	3.0	3.3	3.0	3.3		3.3								
	Red		2.1		2.0		2.1		2.0								
	Walk		12		0		12		18								
	Ped Cir		12		0		12		12								
	Max 1		55	3	40	15	55		40								
	Max 2																
	Mx 3 Lim																
	Mx 3 Adh																
	TBR																
	TTR																
Min Gap																	
All/Act																	
Max In																	



APPENDIX B

Background Traffic Information



	NORHTBOUND			EASTBOUND			WESTBOUND			Total
	LEFT	THROUGH	RIGHT	LEFT	THROUGH	RIGHT	LEFT	THROUGH	RIGHT	
7:00 AM	0	0	1	0	88	1	0	95	0	185
7:15 AM	1	0	3	0	107	2	1	118	0	232
7:30 AM	0	0	2	0	147	3	5	154	0	311
7:45 AM	0	0	0	0	152	4	10	160	0	326
8:00 AM	1	0	5	0	108	3	10	163	0	290
8:15 AM	1	0	0	0	123	4	7	145	0	280
8:30 AM	1	0	6	0	123	2	10	170	0	312
8:45 AM	2	0	2	0	126	8	21	142	0	301
9:00 AM	1	0	5	0	114	0	8	117	0	245
9:15 AM	3	0	4	0	121	2	16	91	0	237
9:30 AM	1	0	4	0	109	5	1	119	0	239
9:45 AM	2	0	6	0	109	5	7	114	0	243
1:30 PM	3	0	9	0	122	5	5	114	0	258
1:45 PM	3	0	6	0	144	5	9	127	0	294
2:00 PM	3	0	12	0	128	2	6	120	0	271
2:15 PM	2	0	7	0	129	1	4	115	0	258
2:30 PM	0	0	3	0	157	5	13	136	0	314
2:45 PM	2	0	5	0	151	3	10	149	0	320
3:00 PM	1	0	8	0	158	2	8	161	0	338
3:15 PM	1	0	9	0	188	3	13	155	0	369
4:00 PM	0	0	4	0	159	6	8	158	0	335
4:15 PM	1	0	2	0	160	3	7	148	0	321
4:30 PM	0	0	7	0	171	1	7	127	0	313
4:45 PM	1	0	11	0	172	1	12	151	0	348
5:00 PM	0	0	10	0	189	3	5	153	0	360
5:15 PM	2	0	12	0	174	1	8	159	0	356
5:30 PM	1	0	5	0	186	5	2	140	0	339
5:45 PM	2	0	5	0	158	4	7	125	0	301
6:00 PM	3	0	5	0	146	0	6	134	0	294
6:15 PM	1	0	3	0	146	4	3	119	0	276
6:30 PM	1	0	5	0	148	2	7	107	0	270
6:45 PM	6	0	6	0	144	4	1	110	0	271

AM Peak Hour	3	0	11	0	506	13	37	638	0
PM Peak Hour	4	0	38	0	721	10	27	603	0

Growth along King Street East, East of Lake Avenue

Peak Hour	TMC, Year 2014			TMC, Year 2017		
	Eastbound	Westbound	Total	Eastbound	Westbound	Total
AM	519	641	1,160	472	589	1,061
PM	731	607	1,338	744	632	1,376
Total	1,250	1,248	2,498	1,216	1,221	2,437
Annual Growth						-0.8%

Source 2014 traffic data obtained from the City of Hamilton, Turning Movement Count at King Street East & Elm Avenue
 2017 traffic data obtained by Trans-Plan, count conducted at King Street West & Lake Avenue

16 & 18 King Street West
Background Development Map



- 1 DA-12-001
Two-storey mixed use building

- 2 DA-14-070
1 storey, 148sq.m. medical building (pediatric clinic)



16 & 18 King Street West
Background Development Trip Generation



1. DA-12-001 2 storey mixed use building

Land Use	Size	AM Peak Hour			PM Peak Hour		
		In	Out	Total	In	Out	Total
General Office	Sq Ft. 2,500						
ITE Code 820	Distribution Equation Rate Trips	88% Ln(T)= 0.80Ln(X)+1.57 3.87 10	12% - 0.53 1	100% 4.40 11	17% - 0.25 1	83% - 1.24 3	100% 1.49 4
Apartment	Units: 12						
ITE Code 220	Distribution Equation Rate Trips	20% T = 0.49(X) + 3.73 0.17 2	80% - 0.67 8	100% 0.83 10	65% T = 0.55(X) + 17.65 1.30 16	35% - 0.70 8	100% 2.00 24
Total Trips		12	9	21	17	11	28

2. DA-14-070 148 sq.m medical clinic (pediatric)

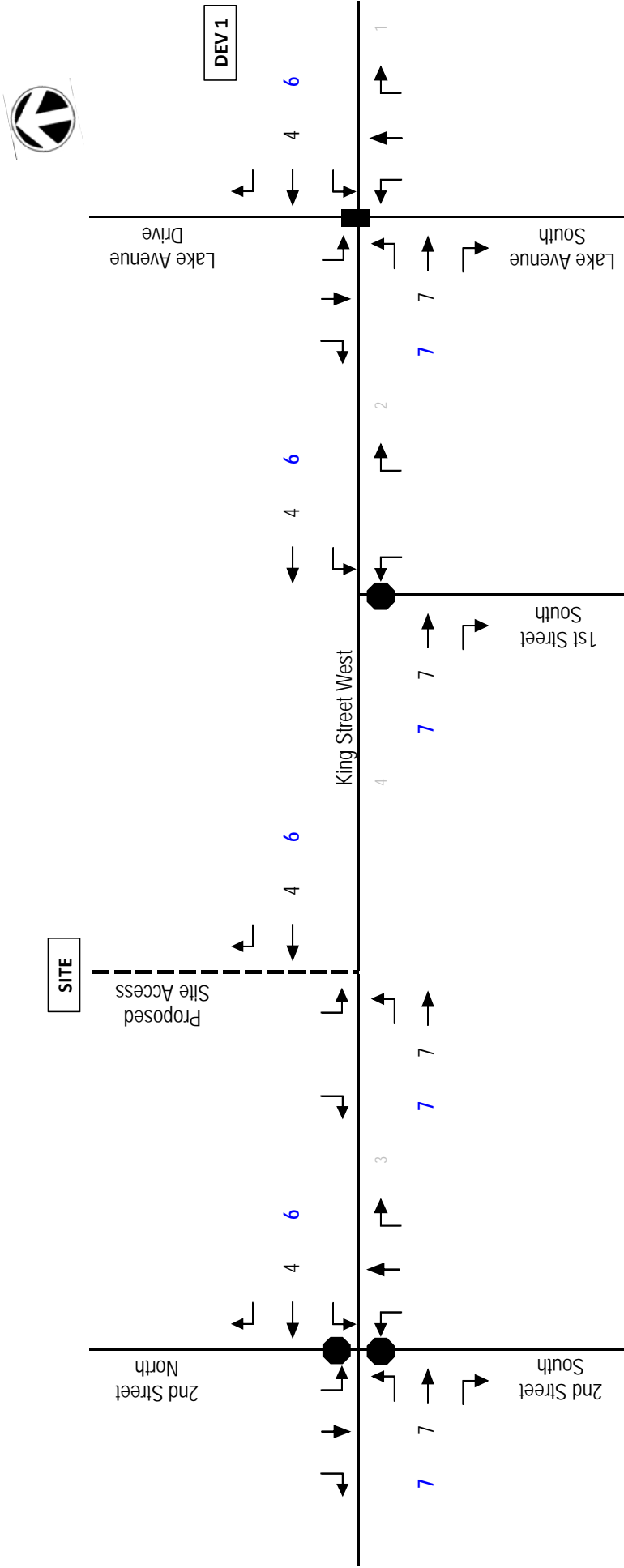
Land Use	Size	AM Peak Hour			PM Peak Hour		
		In	Out	Total	In	Out	Total
Medical-Dental Office	Sq Ft. 1,593						
ITE Code 820	Distribution Equation Rate Trips	79% - 1.86 3	21% n/a 0.63 1	100% - 2.49 4	28% - 1.06 2	72% n/a 2.51 4	100% - 3.57 6

TRAFFIC IMPACT STUDY



Proposed Mixed Use Development

16 & 18 King Street West, Stoney Creek, Hamilton

DEV 1 - 2-Storey Mixed-Use Building

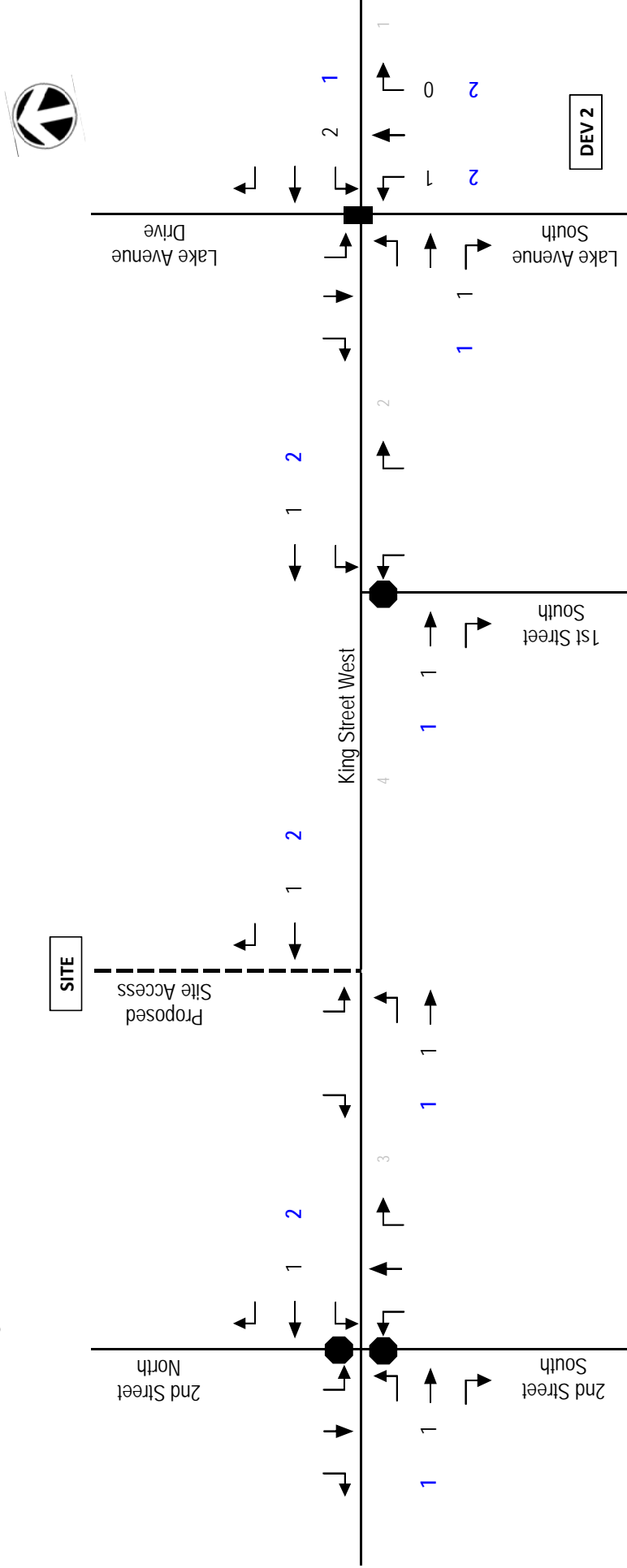


LEGEND



-  Traffic Signal
-  Stop Sign
- xx xx** AM / PM Peak Hour

Schematic; Not To Scale

DEV 2 - 1-Storey Pediatric Clinic



LEGEND

-  Traffic Signal
-  Stop Sign
- xx xx** AM / PM Peak Hour

Schematic; Not To Scale



APPENDIX C

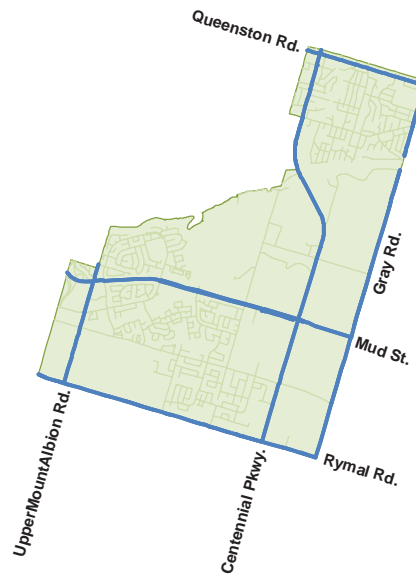
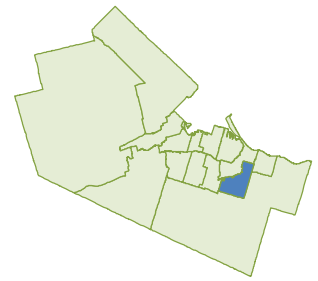
Transportation Tomorrow Survey Data

USER : TRANS-PLAN
 DATE : May 3 2017 (15:59:59)
 DATA : 2011 TTS V1.0 Trips
 TABLE : purp_orig (Home)
 FILTER 1 : ward_orig => 179
 FILTER 2 : purp_orig => Home
 FILTER 3 : start_time => 600-900
 ROW : pd_dest
 COLUMN : ward_orig

		N		
		45%		
W	48%		4%	E
		4%		
		S		

Destination Zone	No. of Trips from Ward 179	Percent of Trips from Ward 179	Location respect to site
PD 1 of Toronto	210	2%	N
PD 4 of Toronto	26	0%	N
PD 8 of Toronto	45	1%	N
PD 16 of Toronto	23	0%	N
Markham	26	0%	N
Vaughan	51	1%	N
Mississauga	214	2%	N
Milton	17	0%	N
Oakville	269	3%	N
Burlington	782	9%	N
Dundas	45	1%	W
Ancaster	223	3%	W
Hamilton			
171	528	6%	W
172	655	7%	W
173	490	6%	W
174	352	4%	N
175	1318	15%	N
176	775	9%	W
177	524	6%	W
178	488	6%	W
179	2839	Internal	
180	586	7%	N
181	290	3%	S
182	223	3%	W
183	45	1%	W
Grimsby	25	0%	E
Lincoln	42	0%	E
St Catharines	70	1%	E
Niagara Falls	68	1%	E
Welland	48	1%	E
West Lincoln	42	0%	E
North Dumfries	23	0%	W
Rest of Wellington	22	0%	S
Haldimand-Norfolk	42	0%	E
East Garafraxa	22	0%	N
Brantford	218	2%	W
Total	8827	100%	

CITY OF HAMILTON WARD 9



HOUSEHOLD CHARACTERISTICS

Households	Dwelling Type			Household Size					Number of Available Vehicles					Household Averages				
	House	Townhouse	Apartment	1	2	3	4	5+	0	1	2	3	4+	Trips/day (Household Average): Total number of trips by persons of age 11 and over divided by total number of households				
9,500	64%	16%	20%	18%	32%	18%	19%	13%	8%	37%	41%	10%	3%	2.8	1.3	1.9	1.6	6.0

POPULATION CHARACTERISTICS

Population	Age							Daily Trips per Person (age 11+)	Daily Work Trips per Worker	Population	Employment Type			Student	Licenced	Transit			
	0 - 10	11 - 15	16 - 25	26 - 45	46 - 64	65+	Median				Full Time	Part Time	At Home						
											Male								
											Female								
26,700	14%	7%	13%	27%	26%	13%	37.8	2.5	0.74	13,000	41%	6%	2%	22%	71%	7%			
											30%	10%	2%	22%	64%	7%			

TRIPS MADE BY RESIDENTS OF CITY OF HAMILTON - WARD 9

Time Period	Trips	% 24 hr	Trip Purpose				Mode of Travel							Median Trip Length (km)			
			HB-W	HB-S	HB-D	N-HB	Driver	Pass.	Transit	GO Train	Wlk & Cy	Other	Driver	Pass.	Transit	GO Train	
6-9 AM	12,700	22.0%	43%	24%	22%	12%	69%	11%	3%	2%	6%	9%	7.2	4.5	10.0	61.2	
24 Hours	57,700		27%	12%	44%	18%	70%	18%	3%	1%	4%	4%	5.5	4.3	9.2	61.2	

TRIPS TO CITY OF HAMILTON - WARD 9

Time Period	Trips	% 24 hr	Trip Purpose				Mode of Travel							Median Trip Length (km)			
			Work	School	Home	Other	Driver	Pass.	Transit	GO Train	Wlk & Cy	Other	Driver	Pass.	Transit	GO Train	
6-9 AM	8,000	15.7%	25%	38%	10%	27%	57%	14%	5%	*	12%	12%	3.8	1.6	3.6	*	
24 Hours	50,900		7%	7%	47%	40%	68%	19%	3%	0%	5%	4%	4.7	3.7	5.7	61.4	

2001, 2006 and 2011 TTS

City of Hamilton, Ward 179, Auto Ownership Data, Apartment Dwelling Types

DATA : 2001, 2006, 2011 TTS V1.0 Households

TABLE : n_vehicle (0)

TABLE : dwell_type (Apartment)

FILTER 1 : ward_hhld => 179

FILTER 2 : dwell_type => Apartment

ROW : ward_hhld

COLUMN : n_vehicle

Results

179

Number of Vehicles	Apartments	Average
0	20	0.00
1	80	0.57
2	40	0.57
3	0	0.00
4	0	0.00
Total	140	1.14

Number of Vehicles	Apartments	Average
0	1326	0.00
1	1869	0.54
2	201	0.12
3	18	0.02
4	22	0.03
Total	3436	0.70

Number of Vehicles	Apartments	Average
0	521	0.00
1	1168	0.62
2	197	0.21
3	0	0.00
4	0	0.00
Total	1886	0.83

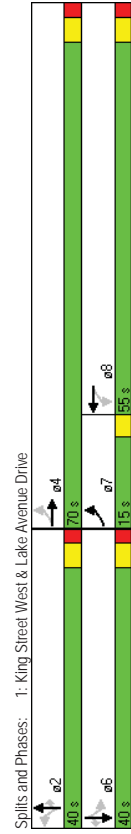


APPENDIX D

Capacity and Queue Analysis Sheets

Timings 5/05/2017
 1: King Street West & Lake Avenue Drive <Existing> AM Peak Hour

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBR
Lane Configurations	80	422	15	519	44	30	14	36
Volume (vph)	1900	1900	1900	1900	1900	1900	1900	1900
Turn Type	pm+pl	Perm	Perm	Perm	Perm	Perm	Perm	Perm
Protected Phases	7	4	8	8	2	2	6	6
Permitted Phases	7	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	5.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Minimum Split (s)	9.0	29.4	29.4	35.3	35.3	35.3	35.3	35.3
Total Split (s)	15.0	70.0	55.0	40.0	40.0	40.0	40.0	40.0
Total Split (%)	13.6%	63.6%	50.0%	50.0%	36.4%	36.4%	36.4%	36.4%
Yellow Time (s)	3.0	3.3	3.3	3.3	3.3	3.3	3.3	3.3
All-Red Time (s)	0.0	2.1	2.1	2.1	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	3.0	5.4	5.4	5.4	5.3	5.3	5.3	5.3
Lead/Lag	Lead	Lag	Lag	Lag	Yes	Yes	Yes	Yes
Lead-Lag Optimizer?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	Max	Max	Max	Max
Act Effct Green (s)	46.9	44.4	34.9	34.9	35.8	35.8	35.8	35.8
Actuated g/C Ratio	0.51	0.49	0.38	0.38	0.39	0.39	0.39	0.39
v/c Ratio	0.33	0.59	0.06	0.89	0.13	0.03	0.11	0.13
Control Delay	13.2	18.4	18.1	41.7	24.0	11.6	23.8	6.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	13.2	18.4	18.1	41.7	24.0	11.6	23.8	6.5
LOS	B	B	B	D	C	B	C	A
Approach Delay	17.7	41.1	41.1	22.1	C	C	14.1	B
Approach LOS	B	D	D	C	C	C	B	B



HCM Signalized Intersection Capacity Analysis 5/05/2017
 1: King Street West & Lake Avenue Drive <Existing> AM Peak Hour

Movement	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBR
Lane Configurations	80	422	15	519	44	30	14	36
Volume (vph)	1900	1900	1900	1900	1900	1900	1900	1900
Ideal Flow (vphpl)	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
Lane Width	3.0	5.4	5.4	5.4	5.4	5.3	5.3	5.3
Total Lost time (s)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	0.97	1.00	0.97
Frbp. ped/bikes	1.00	1.00	0.99	1.00	0.99	1.00	0.99	1.00
Frbp. ped/bikes	1.00	0.98	1.00	0.99	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	0.97	1.00	0.97	1.00
Satd. Flow (prot)	1770	1767	1636	1831	1799	1428	1797	1535
Flt Permitted	0.12	1.00	0.44	1.00	0.83	1.00	0.84	1.00
Satd. Flow (perm)	215	1767	750	1831	1537	1428	1548	1535
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	87	459	53	16	564	60	48	33
RTOR Reduction (vph)	0	5	0	0	4	0	0	9
RTOR Reduction (vph)	87	507	0	16	620	0	81	6
Conf. Ped. (#/hr)	5	11	11	11	5	7	9	9
Conf. Bikes (#/hr)	1							
Heavy Vehicles (%)	2%	3%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	6	0	0	0	0	0	0
Turn Type	pm+pl	Perm	Perm	Perm	Perm	Perm	Perm	Perm
Protected Phases	7	4	8	8	2	2	6	6
Permitted Phases	4	45.1	34.9	34.9	35.8	35.8	35.8	35.8
Actuated Green, G (s)	45.1	34.9	34.9	34.9	35.8	35.8	35.8	35.8
Effective Green, g (s)	0.49	0.49	0.38	0.38	0.39	0.39	0.39	0.39
Actuated g/C Ratio	3.0	5.4	5.4	5.4	5.3	5.3	5.3	5.3
Clearance Time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Vehicle Extension (s)	228	870	286	698	601	558	605	600
Lane Grp Cap (vph)	0.03	c0.29						
v/s Ratio Prot	0.16	0.02	0.02	0.02	0.13	0.01	0.04	0.02
v/s Ratio Perm	0.38	0.58	0.06	0.89	0.13	0.01	0.11	0.06
Uniform Delay, d1	17.1	16.6	17.9	26.5	17.9	17.1	17.8	17.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.1	1.0	0.1	13.2	0.5	0.0	0.4	0.2
Delay (s)	18.2	17.6	18.0	39.7	18.4	17.1	18.1	17.6
Level of Service	B	B	B	D	B	B	B	B
Approach Delay (s)	17.6	41.1	41.1	22.1	C	C	14.1	B
Approach LOS	B	D	D	C	C	C	B	B
Intersection Summary	HCM Average Control Delay: 27.0 HCM Level of Service: C							
HCM Volume to Capacity ratio	0.53							
Actuated Cycle Length (s)	91.6 Sum of lost time (s)							
Intersection Capacity Utilization	94.0% ICU Level of Service: F							
Analysis Period (min)	15							
c Critical Lane Group								

HCM Unsignalized Intersection Capacity Analysis
 2: King Street West & 1st Street South

HCM Unsignalized Intersection Capacity Analysis
 3: King Street West & 2nd Street North

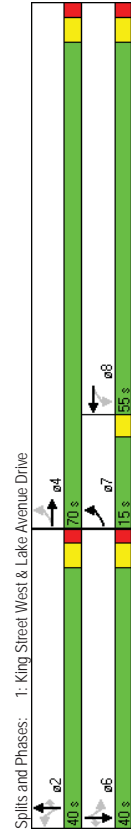
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	W					
Volume (veh/h)	555	3	8	652	2	3
Sign Control	Free	Free	Free	Stop	Stop	Stop
Grade	0%	0%	0%	0%	0%	0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	603	3	9	709	2	3
Pedestrians					9	
Lane Width (m)					3.6	
Walking Speed (m/s)					1.2	
Percent Blockage					1	
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)				91		
pX platoon unblocked					0.68	
vC conflicting volume		616			1340	614
vC1 stage 1 conf vol						
vC2 stage 2 conf vol		616			1265	614
vCu unblocked vol		4.1			6.4	6.2
IC single (s)						
IC 2 stage (s)		2.2			3.5	3.3
IF (s)		99			98	99
p0 queue free %		957			125	488
cM capacity (veh/h)						
Direction_Lane #	EB 1	WB 1	NB 1			
Volume Total	607	717	5			
Volume Left	0	9	2			
Volume Right	3	0	3			
cSH	1700	957	226			
Volume to Capacity	0.36	0.01	0.02			
Queue Length 95th (m)	0.0	0.2	0.4			
Control Delay (s)	0.0	0.2	21.3			
Lane LOS	A	A	C			
Approach Delay (s)	0.0	0.2	21.3			
Approach LOS			C			
Intersection Summary						
Average Delay	0.2					
Intersection Capacity Utilization	50.7%		ICU Level of Service		A	
Analysis Period (min)	15					

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		W										
Volume (veh/h)	37	549	5	1	648	5	1	1	4	5	0	40
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
Grade	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	40	597	5	1	704	5	1	1	4	5	0	43
Pedestrians								6			17	
Lane Width (m)								3.6			3.6	
Walking Speed (m/s)								1.2			1.2	
Percent Blockage								1			1	
Right turn flare (veh)												
Median type	None			None								
Median storage (veh)												
Upstream signal (m)					165							
pX platoon unblocked		0.68						0.68	0.68	0.68	0.68	0.68
vC conflicting volume		727			608			1439	1415	605	1411	1415
vC1 stage 1 conf vol												
vC2 stage 2 conf vol		369			608			1410	1375	605	1370	1375
vCu unblocked vol		4.1			4.1			7.1	6.5	6.2	7.1	6.5
IC single (s)												
IC 2 stage (s)		2.2			2.2			3.5	4.0	3.3	3.5	4.0
IF (s)		95			100			98	99	99	93	100
p0 queue free %		802			965			68	92	495	77	92
cM capacity (veh/h)												
Direction_Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	642	711	7	49								
Volume Left	40	1	1	5								
Volume Right	5	5	4	43								
cSH	802	965	178	296								
Volume to Capacity	0.05	0.00	0.04	0.16								
Queue Length 95th (m)	0.9	0.0	0.7	3.5								
Control Delay (s)	1.3	0.0	26.0	19.5								
Lane LOS	A	A	D	C								
Approach Delay (s)	1.3	0.0	26.0	19.5								
Approach LOS			D	C								
Intersection Summary												
Average Delay	1.4											
Intersection Capacity Utilization	68.3%			ICU Level of Service			C					
Analysis Period (min)	15											

Timings 5/05/2017
 1: King Street West & Lake Avenue Drive

HCM Signalized Intersection Capacity Analysis 5/05/2017
 1: King Street West & Lake Avenue Drive

EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBR
79	594	2	607	41	26	7	144
Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm
7	4	8	8	2	2	2	6
4	8	8	8	2	2	2	6
5.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
9.0	29.4	29.4	29.4	35.3	35.3	35.3	35.3
15.0	70.0	55.0	55.0	40.0	40.0	40.0	40.0
13.6%	63.6%	50.0%	50.0%	36.4%	36.4%	36.4%	36.4%
3.0	3.3	3.3	3.3	3.3	3.3	3.3	3.3
0.0	2.1	2.1	2.1	2.0	2.0	2.0	2.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3.0	5.4	5.4	5.4	5.3	5.3	5.3	5.3
Lead	Lag	Lag	Lag	Yes	Yes	Yes	Yes
None	None	None	None	Max	Max	Max	Max
54.5	52.1	42.8	42.8	35.5	35.5	35.5	35.5
0.55	0.53	0.43	0.43	0.36	0.36	0.36	0.36
0.37	0.70	0.01	0.01	0.14	0.02	0.40	0.24
13.9	20.9	16.0	16.0	26.6	14.1	30.5	9.6
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13.9	20.9	16.0	16.0	26.6	14.1	30.5	9.6
B	C	B	D	C	B	C	A
20.1	44.5	25.4	25.4	21.4	21.4	21.4	21.4
C	D	D	C	C	C	C	C



EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBR
79	594	2	607	41	26	7	144
1900	1900	1900	1900	1900	1900	1900	1900
3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
3.0	5.4	5.4	5.4	5.3	5.3	5.3	5.3
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1.00	1.00	0.99	1.00	0.98	1.00	1.00	0.97
1.00	1.00	1.00	0.98	1.00	0.97	1.00	0.85
0.95	1.00	0.95	1.00	0.97	1.00	0.96	1.00
1770	1806	1635	1824	1778	1396	1738	1498
0.09	1.00	0.30	1.00	0.77	1.00	0.71	1.00
163	1806	511	1824	1415	1396	1286	1498
0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
86	646	22	660	74	45	8	157
0	1	0	4	0	0	0	5
86	667	0	2	730	0	73	3
19	16	16	16	19	21	22	22
0	6	0	0	0	0	0	0
7	4	8	8	2	2	2	6
4	8	42.8	42.8	35.5	35.5	35.5	35.5
52.8	52.8	42.8	42.8	35.5	35.5	35.5	35.5
0.53	0.53	0.43	0.43	0.36	0.36	0.36	0.36
3.0	5.4	5.4	5.4	5.3	5.3	5.3	5.3
3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
201	963	221	789	507	501	461	537
0.03	c0.37	0.00	c0.40	0.05	0.00	c0.15	0.05
0.20	0.20	0.01	0.93	0.14	0.01	0.41	0.14
18.8	17.1	16.0	26.6	21.5	20.4	23.8	21.4
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1.5	2.2	0.0	16.5	0.6	0.0	2.6	0.5
20.3	19.3	16.0	43.1	22.1	20.4	26.5	22.0
C	B	B	D	C	C	C	C
19.4	B	43.0	D	21.9	C	24.5	C
B	B	D	D	C	C	C	C

EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBR
79	594	2	607	41	26	7	144
1900	1900	1900	1900	1900	1900	1900	1900
3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
3.0	5.4	5.4	5.4	5.3	5.3	5.3	5.3
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1.00	1.00	0.99	1.00	0.98	1.00	1.00	0.97
1.00	1.00	1.00	0.98	1.00	0.85	1.00	0.85
0.95	1.00	0.95	1.00	0.97	1.00	0.96	1.00
1770	1806	1635	1824	1778	1396	1738	1498
0.09	1.00	0.30	1.00	0.77	1.00	0.71	1.00
163	1806	511	1824	1415	1396	1286	1498
0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
86	646	22	660	74	45	8	157
0	1	0	4	0	0	0	5
86	667	0	2	730	0	73	3
19	16	16	16	19	21	22	22
0	6	0	0	0	0	0	0
7	4	8	8	2	2	2	6
4	8	42.8	42.8	35.5	35.5	35.5	35.5
52.8	52.8	42.8	42.8	35.5	35.5	35.5	35.5
0.53	0.53	0.43	0.43	0.36	0.36	0.36	0.36
3.0	5.4	5.4	5.4	5.3	5.3	5.3	5.3
3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
201	963	221	789	507	501	461	537
0.03	c0.37	0.00	c0.40	0.05	0.00	c0.15	0.05
0.20	0.20	0.01	0.93	0.14	0.01	0.41	0.14
18.8	17.1	16.0	26.6	21.5	20.4	23.8	21.4
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1.5	2.2	0.0	16.5	0.6	0.0	2.6	0.5
20.3	19.3	16.0	43.1	22.1	20.4	26.5	22.0
C	B	B	D	C	C	C	C
19.4	B	43.0	D	21.9	C	24.5	C
B	B	D	D	C	C	C	C

EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBR
79	594	2	607	41	26	7	144
1900	1900	1900	1900	1900	1900	1900	1900
3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
3.0	5.4	5.4	5.4	5.3	5.3	5.3	5.3
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1.00	1.00	0.99	1.00	0.98	1.00	1.00	0.97
1.00	1.00	1.00	0.98	1.00	0.85	1.00	0.85
0.95	1.00	0.95	1.00	0.97	1.00	0.96	1.00
1770	1806	1635	1824	1778	1396	1738	1498
0.09	1.00	0.30	1.00	0.77	1.00	0.71	1.00
163	1806	511	1824	1415	1396	1286	1498
0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
86	646	22	660	74	45	8	157
0	1	0	4	0	0	0	5
86	667	0	2	730	0	73	3
19	16	16	16	19	21	22	22
0	6	0	0	0	0	0	0
7	4	8	8	2	2	2	6
4	8	42.8	42.8	35.5	35.5	35.5	35.5
52.8	52.8	42.8	42.8	35.5	35.5	35.5	35.5
0.53	0.53	0.43	0.43	0.36	0.36	0.36	0.36
3.0	5.4	5.4	5.4	5.3	5.3	5.3	5.3
3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
201	963	221	789	507	501	461	537
0.03	c0.37	0.00	c0.40	0.05	0.00	c0.15	0.05
0.20	0.20	0.01	0.93	0.14	0.01	0.41	0.14
18.8	17.1	16.0	26.6	21.5	20.4	23.8	21.4
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1.5	2.2	0.0	16.5	0.6	0.0	2.6	0.5
20.3	19.3	16.0	43.1	22.1	20.4	26.5	22.0
C	B	B	D	C	C	C	C
19.4	B	43.0	D	21.9	C	24.5	C
B	B	D	D	C	C	C	C

EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBR
79	594	2	607	41	26	7	144
1900	1900	1900	1900	1900	1900	1900	1900
3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
3.0	5.4	5.4	5.4	5.3	5.3	5.3	5.3
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1.00	1.00	0.99	1.00	0.98	1.00	1.00	0.97
1.00	1.00	1.00	0.98	1.00	0.85	1.00	0.85
0.95	1.00	0.95	1.00	0.97	1.00	0.96	1.00
1770	1806	1635	1824	1778	1396	1738	1498
0.09	1.00	0.30	1.00	0.77	1.00	0.71	1.00
163	1806	511	1824	1415	1396	1286	1498
0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
86	646	22	660	74	45	8	157
0	1	0	4	0	0	0	5
86	667	0	2	730	0	73	3
19	16	16	16	19	21	22	22
0	6	0	0	0	0	0	0
7	4	8	8	2	2	2	6
4	8	42.8	42.8	35.5	35.5	35.5	35.5
52.8	52.8	42.8	42.8	35.5	35.5	35.5	35.5
0.53	0.53	0.43	0.43	0.36	0.36	0.36	0.36
3.0	5.4	5.4	5.4	5.3	5.3	5.3	5.3
3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
201	963	221	789	507	501	461	537
0.03	c0.37	0.00	c0.40	0.05	0.00	c0.	

HCM Unsignalized Intersection Capacity Analysis
 2: King Street West & 1st Street South

HCM Unsignalized Intersection Capacity Analysis
 3: King Street West & 2nd Street North

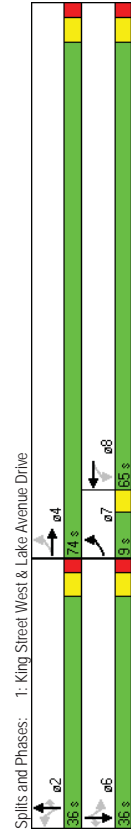
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	W					
Volume (veh/h)	702	3	6	804	1	6
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	763	3	7	874	1	7
Pedestrians					6	
Lane Width (m)					3.6	
Walking Speed (m/s)					1.2	
Percent Blockage					1	
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)				91		
pX platoon unblocked					0.61	
vC conflicting volume	772			1658		771
vC1 stage 1 conf vol						
vC2 stage 2 conf vol	772			1757		771
vCu unblocked vol	4.1			6.4		6.2
IC single (s)						
IC 2 stage (s)	2.2			3.5		3.3
IF (s)	99			98		98
p0 queue free %	839			57		398
cM capacity (veh/h)						
Direction_Lane #	EB 1	WB 1	NB 1			
Volume Total	766	880	8			
Volume Left	0	7	1			
Volume Right	3	0	7			
cSH	1700	839	214			
Volume to Capacity	0.45	0.01	0.04			
Queue Length 95th (m)	0.0	0.1	0.7			
Control Delay (s)	0.0	0.2	22.5			
Lane LOS	A	C	C			
Approach Delay (s)	0.0	0.2	22.5			
Approach LOS		C	C			
Intersection Summary						
Average Delay	0.2					
Intersection Capacity Utilization	57.1%		ICU Level of Service		B	
Analysis Period (min)	15					

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBR	
Lane Configurations		W										
Volume (veh/h)	53	693	3	11	776	18	2	0	7	5	40	
Sign Control	Free	Free		Free	Free	Free	Stop	Stop		Stop		
Grade	0%	0%		0%	0%	0%	0%	0%		0%		
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Hourly flow rate (vph)	58	753	3	12	843	20	2	0	8	5	43	
Pedestrians							4				24	
Lane Width (m)							3.6				3.6	
Walking Speed (m/s)							1.2				1.2	
Percent Blockage							0				2	
Right turn flare (veh)												
Median type	None			None								
Median storage (veh)												
Upstream signal (m)					165							
pX platoon unblocked	0.61						0.61	0.61		0.61	0.61	
vC conflicting volume	887			761			1795	1785	759	1779	877	
vC1 stage 1 conf vol												
vC2 stage 2 conf vol	501			761			1980	1965	759	1955	485	
vCu unblocked vol	4.1			4.1			7.1	6.5	6.2	7.1	6.5	
IC single (s)												
IC 2 stage (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	
IF (s)	91			99			90	100	98	79	100	
p0 queue free %	639			849			22	34	405	26	35	
cM capacity (veh/h)												
Direction_Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	814	875	10	49								
Volume Left	58	12	2	5								
Volume Right	3	20	8	43								
cSH	639	849	84	146								
Volume to Capacity	0.09	0.01	0.12	0.34								
Queue Length 95th (m)	1.8	0.3	2.3	8.2								
Control Delay (s)	2.5	0.4	53.3	41.8								
Lane LOS	A	A	F	E								
Approach Delay (s)	2.5	0.4	53.3	41.8								
Approach LOS		F	F	E								
Intersection Summary												
Average Delay	2.8											
Intersection Capacity Utilization	78.3%			ICU Level of Service			D					
Analysis Period (min)	15											

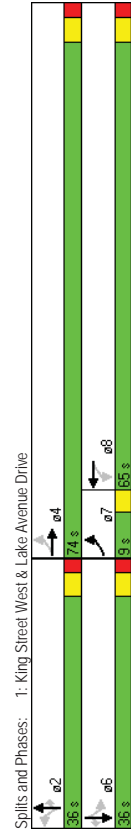
Timings 5/08/2017
 1: King Street West & Lake Avenue Drive

5/08/2017
 <Future Background> AM Peak Hour
 HCM Signalized Intersection Capacity Analysis
 1: King Street West & Lake Avenue Drive

EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBR
80	451	16	548	30	14	38	26
1900	1900	1900	1900	1900	1900	1900	1900
3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
3.0	5.4	5.4	5.4	5.3	5.3	5.3	5.3
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1.00	1.00	0.99	1.00	0.99	1.00	0.99	1.00
1.00	0.99	1.00	0.99	1.00	0.99	1.00	0.99
0.95	1.00	0.95	1.00	0.97	1.00	0.97	1.00
1770	1768	1638	1832	1799	1430	1797	1536
0.13	1.00	0.39	1.00	0.83	1.00	0.83	1.00
240	1768	672	1832	1532	1430	1538	1536
0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
87	490	54	17	596	60	49	33
0	5	0	0	4	0	0	9
87	539	0	17	652	0	82	6
5	11	11	11	5	7	9	9
2%	3%	2%	2%	2%	2%	2%	2%
0	6	0	0	0	0	0	0
7	4	8	8	2	2	6	6
42.4	42.4	34.9	34.9	31.6	31.6	31.6	31.6
42.4	42.4	34.9	34.9	31.6	31.6	31.6	31.6
0.50	0.50	0.41	0.41	0.37	0.37	0.37	0.37
3.0	5.4	5.4	5.4	5.3	5.3	5.3	5.3
3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
201	885	277	755	572	534	574	573
0.02	c0.30		c0.36				
0.19		0.03		0.05	0.00	0.04	0.02
0.43	0.61	0.06	0.86	0.14	0.01	0.12	0.06
15.7	15.2	15.0	22.7	17.6	16.7	17.4	17.0
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1.5	1.2	0.1	10.1	0.5	0.0	0.4	0.2
17.2	16.4	15.1	32.8	18.1	16.7	17.9	17.2
B	B	B	C	B	B	B	B
16.5		32.3		17.9		17.5	
B	B	C	C	B	B	B	B



EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBR
80	451	16	548	30	14	38	26
1900	1900	1900	1900	1900	1900	1900	1900
3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
3.0	5.4	5.4	5.4	5.3	5.3	5.3	5.3
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1.00	1.00	0.99	1.00	0.99	1.00	0.99	1.00
1.00	0.99	1.00	0.99	1.00	0.99	1.00	0.99
0.95	1.00	0.95	1.00	0.97	1.00	0.97	1.00
1770	1768	1638	1832	1799	1430	1797	1536
0.13	1.00	0.39	1.00	0.83	1.00	0.83	1.00
240	1768	672	1832	1532	1430	1538	1536
0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
87	490	54	17	596	60	49	33
0	5	0	0	4	0	0	9
87	539	0	17	652	0	82	6
5	11	11	11	5	7	9	9
2%	3%	2%	2%	2%	2%	2%	2%
0	6	0	0	0	0	0	0
7	4	8	8	2	2	6	6
42.4	42.4	34.9	34.9	31.6	31.6	31.6	31.6
42.4	42.4	34.9	34.9	31.6	31.6	31.6	31.6
0.50	0.50	0.41	0.41	0.37	0.37	0.37	0.37
3.0	5.4	5.4	5.4	5.3	5.3	5.3	5.3
3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
201	885	277	755	572	534	574	573
0.02	c0.30		c0.36				
0.19		0.03		0.05	0.00	0.04	0.02
0.43	0.61	0.06	0.86	0.14	0.01	0.12	0.06
15.7	15.2	15.0	22.7	17.6	16.7	17.4	17.0
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1.5	1.2	0.1	10.1	0.5	0.0	0.4	0.2
17.2	16.4	15.1	32.8	18.1	16.7	17.9	17.2
B	B	B	C	B	B	B	B
16.5		32.3		17.9		17.5	
B	B	C	C	B	B	B	B



HCM Unsignalized Intersection Capacity Analysis
 2: King Street West & 1st Street South

HCM Unsignalized Intersection Capacity Analysis
 3: King Street West & 2nd Street North

5/08/2017

<Future Background> AM Peak Hour

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	EB	EB	WB	WB	NB	NB
Volume (veh/h)	591	3	8	689	2	3
Sign Control	Free	Free	Free	Free	Stop	Stop
Grade	0%	0%	0%	0%	0%	0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	642	3	9	749	2	3
Pedestrians					9	
Lane Width (m)					3.6	
Walking Speed (m/s)					1.2	
Percent Blockage					1	
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)				91		0.67
pX platoon unblocked						
vC conflicting volume	655			655	1419	653
vC1 stage 1 conf vol						
vC2 stage 2 conf vol						
vCu unblocked vol	655			1380	653	
IC single (s)	4.1			6.4	6.2	
IC 2 stage (s)						
IF (s)	2.2			3.5	3.3	
p0 queue free %	99			98	99	
cM capacity (veh/h)	925			105	464	
Direction_Lane #	EB 1	WB 1	NB 1			
Volume Total	646	758	5			
Volume Left	0	9	2			
Volume Right	3	0	3			
cSH	1700	925	196			
Volume to Capacity	0.38	0.01	0.03			
Queue Length 95th (m)	0.0	0.2	0.5			
Control Delay (s)	0.0	0.3	23.9			
Lane LOS	A	A	C			
Approach Delay (s)	0.0	0.3	23.9			
Approach LOS			C			
Intersection Summary						
Average Delay			0.2			
Intersection Capacity Utilization			52.6%			A
Analysis Period (min)			15			

5/08/2017

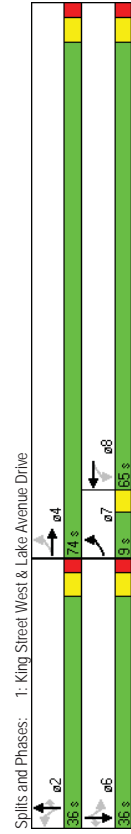
<Future Background> AM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBR	SBR
Lane Configurations	EB	EB	EB	WB	WB	WB	NB	NB	NB	NB	NB	NB
Volume (veh/h)	37	585	5	1	685	5	1	1	4	5	0	40
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
Grade	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	40	636	5	1	745	5	1	1	4	5	0	43
Pedestrians							6					17
Lane Width (m)							3.6					3.6
Walking Speed (m/s)							1.2					1.2
Percent Blockage							1					1
Right turn flare (veh)												
Median type	None				None							
Median storage (veh)												
Upstream signal (m)					165							
pX platoon unblocked	0.67											0.67
vC conflicting volume	767				647		1518	1494	645	1490	1494	764
vC1 stage 1 conf vol												
vC2 stage 2 conf vol												
vCu unblocked vol	409				647		1527	1491	645	1486	1491	405
IC single (s)	4.1				4.1		7.1	6.5	6.2	7.1	6.5	6.2
IC 2 stage (s)												
IF (s)	2.2				2.2		3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	95				100		98	99	99	91	100	90
cM capacity (veh/h)	762				934		55	77	470	63	77	428
Direction_Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	682	751	7	49								
Volume Left	40	1	1	5								
Volume Right	5	5	4	43								
cSH	762	934	151	260								
Volume to Capacity	0.05	0.00	0.04	0.19								
Queue Length 95th (m)	1.0	0.0	0.8	4.1								
Control Delay (s)	1.4	0.0	30.0	22.0								
Lane LOS	A	A	D	C								
Approach Delay (s)	1.4	0.0	30.0	22.0								
Approach LOS			D	C								
Intersection Summary												
Average Delay				1.5								
Intersection Capacity Utilization				70.3%								C
Analysis Period (min)				15								

Timings 5/08/2017
 1: King Street West & Lake Avenue Drive

5/08/2017
 <Future Background> PM Peak Hour
 HCM Signalized Intersection Capacity Analysis
 1: King Street West & Lake Avenue Drive

EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBR
79	629	3	644	43	26	9	151
pm+pt		Perm		Perm		Perm	
7	4	8	8	2	2	6	6
7	4	8	8	2	2	6	6
5.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
9.0	29.4	29.4	29.4	35.3	35.3	35.3	35.3
9.0	74.0	65.0	65.0	36.0	36.0	36.0	36.0
8.2%	67.3%	59.1%	59.1%	32.7%	32.7%	32.7%	32.7%
3.0	3.3	3.3	3.3	3.3	3.3	3.3	3.3
0.0	2.1	2.1	2.1	2.0	2.0	2.0	2.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3.0	5.4	5.4	5.4	5.3	5.3	5.3	5.3
Lead	Lag	Lag	Lag	Lag	Lag	Lag	Lag
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
None	None	None	None	Max	Max	Max	Max
52.6	50.1	43.3	43.3	31.7	31.7	31.7	31.7
0.57	0.54	0.47	0.47	0.34	0.34	0.34	0.34
0.43	0.72	0.01	0.90	0.16	0.02	0.45	0.26
14.6	19.8	12.3	37.1	27.9	14.8	32.4	11.5
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14.6	19.8	12.3	37.1	27.9	14.8	32.4	11.5
B	B	B	D	C	B	C	B
19.3	37.0	26.4	26.4	23.2	23.2	23.2	23.2
B	D	D	C	C	C	C	C



EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBR
79	629	3	644	43	26	9	151
1900	1900	1900	1900	1900	1900	1900	1900
3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
3.0	5.4	5.4	5.4	5.3	5.3	5.3	5.3
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1.00	1.00	0.99	1.00	0.98	1.00	1.00	0.97
1.00	1.00	1.00	0.99	1.00	0.97	1.00	0.85
0.95	1.00	0.95	1.00	0.97	1.00	0.96	1.00
1770	1806	1638	1826	1779	1399	1741	1501
0.09	1.00	0.26	1.00	0.76	1.00	0.71	1.00
166	1806	454	1826	1399	1399	476	1283
0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
86	684	23	700	74	47	28	10
0	1	0	4	0	0	7	0
86	706	0	3	770	0	75	3
19	16	16	16	19	21	22	22
0	6	0	0	0	0	0	0
7	4	8	8	2	2	6	6
50.8	50.8	43.3	43.3	31.7	31.7	31.7	31.7
50.8	50.8	43.3	43.3	31.7	31.7	31.7	31.7
0.55	0.55	0.46	0.46	0.34	0.34	0.34	0.34
3.0	5.4	5.4	5.4	5.3	5.3	5.3	5.3
3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
168	984	211	848	476	476	476	436
0.02	c0.39	0.01	c0.42	0.05	0.00	0.00	c0.15
0.26	0.26	0.01	0.26	0.16	0.01	0.44	0.16
0.51	0.72	0.01	0.91	0.16	0.01	0.23	0.16
17.7	15.8	13.4	23.1	21.4	20.3	23.9	21.5
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2.6	2.5	0.0	13.3	0.7	0.0	3.3	0.7
20.4	18.4	13.5	36.4	22.1	20.4	27.2	22.1
C	B	B	D	C	C	C	C
18.6	B	36.3	D	21.9	C	25.0	C
B	B	36.3	D	21.9	C	25.0	C

EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBR
79	629	3	644	43	26	9	151
1900	1900	1900	1900	1900	1900	1900	1900
3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
3.0	5.4	5.4	5.4	5.3	5.3	5.3	5.3
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1.00	1.00	0.99	1.00	0.98	1.00	1.00	0.97
1.00	1.00	1.00	0.99	1.00	0.97	1.00	0.85
0.95	1.00	0.95	1.00	0.97	1.00	0.96	1.00
1770	1806	1638	1826	1779	1399	1741	1501
0.09	1.00	0.26	1.00	0.76	1.00	0.71	1.00
166	1806	454	1826	1399	1399	476	1283
0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
86	684	23	700	74	47	28	10
0	1	0	4	0	0	7	0
86	706	0	3	770	0	75	3
19	16	16	16	19	21	22	22
0	6	0	0	0	0	0	0
7	4	8	8	2	2	6	6
50.8	50.8	43.3	43.3	31.7	31.7	31.7	31.7
50.8	50.8	43.3	43.3	31.7	31.7	31.7	31.7
0.55	0.55	0.46	0.46	0.34	0.34	0.34	0.34
3.0	5.4	5.4	5.4	5.3	5.3	5.3	5.3
3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
168	984	211	848	476	476	476	436
0.02	c0.39	0.01	c0.42	0.05	0.00	0.00	c0.15
0.26	0.26	0.01	0.26	0.16	0.01	0.44	0.16
0.51	0.72	0.01	0.91	0.16	0.01	0.23	0.16
17.7	15.8	13.4	23.1	21.4	20.3	23.9	21.5
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2.6	2.5	0.0	13.3	0.7	0.0	3.3	0.7
20.4	18.4	13.5	36.4	22.1	20.4	27.2	22.1
C	B	B	D	C	C	C	C
18.6	B	36.3	D	21.9	C	25.0	C
B	B	36.3	D	21.9	C	25.0	C

EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBR
79	629	3	644	43	26	9	151
1900	1900	1900	1900	1900	1900	1900	1900
3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
3.0	5.4	5.4	5.4	5.3	5.3	5.3	5.3
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1.00	1.00	0.99	1.00	0.98	1.00	1.00	0.97
1.00	1.00	1.00	0.99	1.00	0.97	1.00	0.85
0.95	1.00	0.95	1.00	0.97	1.00	0.96	1.00
1770	1806	1638	1826	1779	1399	1741	1501
0.09	1.00	0.26	1.00	0.76	1.00	0.71	1.00
166	1806	454	1826	1399	1399	476	1283
0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
86	684	23	700	74	47	28	10
0	1	0	4	0	0	7	0
86	706	0	3	770	0	75	3
19	16	16	16	19	21	22	22
0	6	0	0	0	0	0	0
7	4	8	8	2	2	6	6
50.8	50.8	43.3	43.3	31.7	31.7	31.7	31.7
50.8	50.8	43.3	43.3	31.7	31.7	31.7	31.7
0.55	0.55	0.46	0.46	0.34	0.34	0.34	0.34
3.0	5.4	5.4	5.4	5.3	5.3	5.3	5.3
3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
168	984	211	848	476	476	476	436
0.02	c0.39	0.01	c0.42	0.05	0.00	0.00	c0.15
0.26	0.26	0.01	0.26	0.16	0.01	0.44	0.16
0.51	0.72	0.01	0.91	0.16	0.01	0.23	0.16
17.7	15.8	13.4	23.1	21.4	20.3	23.9	21.5
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2.6	2.5	0.0	13.3	0.7	0.0	3.3	0.7
20.4	18.4	13.5	36.4	22.1	20.4	27.2	22.1
C	B	B	D	C	C	C	C
18.6	B	36.3	D	21.9	C	25.0	C
B	B	36.3	D	21.9	C	25.0	C

EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBR
79	629	3	644	43	26	9	151
1900	1900	1900	1900	1900	1900	1900	1900
3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
3.0	5.4	5.4	5.4	5.3	5.3	5.3	5.3
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1.00	1.00	0.99	1.00	0.98	1.00	1.00	0.97
1.00	1.00	1.00	0.99	1.00	0.97	1.00	0.85
0.95	1.00	0.95	1.00	0.97	1.00	0.96	1.00
1770	1806	1638	1826	1779	1399	1741	1501
0.09	1.00	0.26	1.00	0.76	1.00	0.71	1.00
166	1806	454	1826	1399	1399	476	1283
0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
86	684	23	700	74	47	28	10
0	1	0	4	0	0	7	0
86	706	0	3	770	0	75	3
19	16	16	16	19	21	22	22
0	6	0	0	0	0	0	0
7	4	8	8	2	2	6	6
50.8	50.8	43.3	43.3	31.7	31.7	31.7	31.7

HCM Unsignalized Intersection Capacity Analysis
 2: King Street West & 1st Street South

HCM Unsignalized Intersection Capacity Analysis
 3: King Street West & 2nd Street North

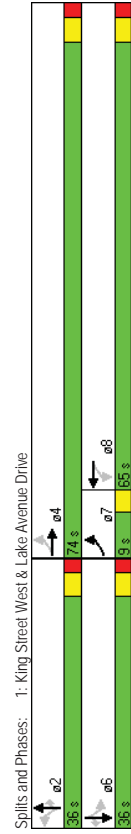
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	W					
Volume (veh/h)	744	3	6	853	1	6
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	809	3	7	927	1	7
Pedestrians					6	
Lane Width (m)					3.6	
Walking Speed (m/s)					1.2	
Percent Blockage					1	
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)				91		
pX platoon unblocked				0.60		
vC conflicting volume	818			1757		816
vC1 stage 1 conf vol						
vC2 stage 2 conf vol						
vCu unblocked vol	818			1928		816
IC single (s)	4.1			6.4		6.2
IC 2 stage (s)						
IF (s)	2.2			3.5		3.3
p0 queue free %	99			97		98
cM capacity (veh/h)	806			43		375
Direction_Lane #	EB 1	WB 1	NB 1	SB 1		
Volume Total	812	934	8			
Volume Left	0	7	1			
Volume Right	3	0	7			
cSH	1700	806	179			
Volume to Capacity	0.48	0.01	0.04			
Queue Length 95th (m)	0.0	0.1	0.8			
Control Delay (s)	0.0	0.2	26.0			
Lane LOS	A	A	D			
Approach Delay (s)	0.0	0.2	26.0			
Approach LOS	D	D	D			
Intersection Summary						
Average Delay	0.2		0.2		0.2	
Intersection Capacity Utilization	59.7%		59.7%		59.7%	
Analysis Period (min)	15		15		15	
ICU Level of Service	B		B		B	

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		W										
Volume (veh/h)	53	734	3	11	824	18	2	0	7	5	0	40
Sign Control	Free	Free		Free	Free	Free	Stop	Stop		Stop	Stop	
Grade	0%	0%		0%	0%	0%	0%	0%		0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	58	798	3	12	896	20	2	0	8	5	0	43
Pedestrians								4				24
Lane Width (m)								3.6				3.6
Walking Speed (m/s)								1.2				1.2
Percent Blockage								0				2
Right turn flare (veh)												
Median type	None			None								
Median storage (veh)												
Upstream signal (m)					165							
pX platoon unblocked	0.60						0.60	0.60		0.60	0.60	0.60
vC conflicting volume	939			805			1892	1882	803	1876	1874	929
vC1 stage 1 conf vol												
vC2 stage 2 conf vol	560			805			2156	2140	803	2130	2126	544
vCu unblocked vol	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
IC single (s)												
IC 2 stage (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
IF (s)	90			99			86	100	98	71	100	86
p0 queue free %	591			817			16	25	382	19	26	315
cM capacity (veh/h)	591			817			16	25	382	19	26	315
Direction_Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	859	927	10	49								
Volume Left	58	12	2	5								
Volume Right	3	20	8	43								
cSH	591	817	62	114								
Volume to Capacity	0.10	0.01	0.16	0.43								
Queue Length 95th (m)	1.9	0.3	3.1	11.1								
Control Delay (s)	2.8	0.4	73.0	58.7								
Lane LOS	A	A	F	F								
Approach Delay (s)	2.8	0.4	73.0	58.7								
Approach LOS	F	F	F	F								
Intersection Summary												
Average Delay	3.5			3.5			3.5			3.5		
Intersection Capacity Utilization	80.9%			80.9%			80.9%			80.9%		
Analysis Period (min)	15			15			15			15		
ICU Level of Service	D			D			D			D		

Timings
1: King Street West & Lake Avenue Drive

<Future Total> AM Peak Hour
5/08/2017

EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBR
83	460	16	554	30	14	38	84
pm+pl	Perm	Perm	Perm	Perm	Perm	Perm	Perm
7	4	8	8	2	2	6	6
7	4	8	8	2	2	6	6
5.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
9.0	29.4	29.4	29.4	35.3	35.3	35.3	35.3
9.0	74.0	65.0	65.0	36.0	36.0	36.0	36.0
8.2%	67.3%	59.1%	59.1%	32.7%	32.7%	32.7%	32.7%
3.0	3.3	3.3	3.3	3.3	3.3	3.3	3.3
0.0	2.1	2.1	2.1	2.0	2.0	2.0	2.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3.0	5.4	5.4	5.4	5.3	5.3	5.3	5.3
Lead	Lag	Lag	Lag	Lag	Lag	Lag	Lag
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
None	None	None	None	Max	Max	Max	Max
44.6	42.1	35.3	35.3	31.6	31.6	31.6	31.6
0.53	0.50	0.42	0.42	0.37	0.37	0.37	0.37
0.38	0.63	0.06	0.86	0.14	0.03	0.12	0.14
13.4	17.8	14.5	34.5	23.4	11.6	23.2	6.4
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13.4	17.8	14.5	34.5	23.4	11.6	23.2	6.4
B	B	B	C	C	B	C	A
B	17.1	34.0	21.6	C	C	13.6	B
Intersection Summary							
Cycle Length: 110							
Actuated Cycle Length: 84.7							
Natural Cycle: 80							
Control Type: Semi-Act-Uncoordinated							
Maximum v/c Ratio: 0.86							
Intersection Signal Delay: 24.3							
Intersection Capacity Utilization 95.9%							
Analysis Period (min) 15							



HCM Signalized Intersection Capacity Analysis
1: King Street West & Lake Avenue Drive

<Future Total> AM Peak Hour
5/08/2017

EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBR
83	460	16	554	30	14	38	84
1900	1900	1900	1900	1900	1900	1900	1900
3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
3.0	5.4	5.4	5.4	5.3	5.3	5.3	5.3
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1.00	1.00	0.99	1.00	0.99	1.00	0.99	1.00
1.00	0.99	1.00	0.99	1.00	0.85	1.00	0.85
0.95	1.00	0.95	1.00	0.97	1.00	0.97	1.00
1770	1769	1639	1833	1799	1430	1797	1536
0.13	1.00	0.38	1.00	0.83	1.00	0.83	1.00
236	1769	656	1833	1531	1430	1537	1536
0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
90	500	54	17	602	60	49	33
0	4	0	0	4	0	0	9
90	550	0	17	658	0	0	82
5	11	11	11	5	7	9	9
2%	3%	2%	2%	2%	2%	2%	2%
0	6	0	0	0	0	0	0
7	4	8	8	2	2	6	6
42.8	42.8	35.3	35.3	31.6	31.6	31.6	31.6
42.8	42.8	35.3	35.3	31.6	31.6	31.6	31.6
0.50	0.50	0.41	0.41	0.37	0.37	0.37	0.37
3.0	5.4	5.4	5.4	5.3	5.3	5.3	5.3
3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
200	890	272	760	569	531	571	570
0.02	c0.31	c0.36					
0.20		0.03	0.03	0.05	0.00	0.04	0.02
0.45	0.62	0.06	0.87	0.14	0.01	0.12	0.06
15.8	15.2	15.0	22.7	17.8	16.9	17.6	17.2
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1.6	1.3	0.1	10.1	0.5	0.0	0.4	0.2
17.4	16.5	15.1	32.9	18.3	16.9	18.0	17.4
B	B	B	C	B	B	B	B
16.7		32.4		18.1		17.7	
B	B	C	C	B	B	B	B
Intersection Summary							
HCM Average Control Delay 23.6 HCM Level of Service C							
HCM Volume to Capacity ratio 0.55							
Actuated Cycle Length (s) 85.1 Sum of lost time (s) 16.1							
Intersection Capacity Utilization 95.9% ICU Level of Service F							
Analysis Period (min) 15							
c Critical Lane Group							

HCM Unsignalized Intersection Capacity Analysis
 2: King Street West & 1st Street South

HCM Unsignalized Intersection Capacity Analysis
 3: King Street West & 2nd Street North

5/08/2017

<Future Total> AM Peak Hour

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	W					
Volume (veh/h)	603	3	8	696	2	3
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)	655	3	9	757	2	3
Pedestrians					9	
Lane Width (m)					3.6	
Walking Speed (m/s)					1.2	
Percent Blockage					1	
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)				91		
pX platoon unblocked					0.67	
vC conflicting volume		668			1440	666
vC1 stage 1 conf vol						
vC2 stage 2 conf vol		668			1410	666
vCu unblocked vol		4.1			6.4	6.2
IC single (s)						
IC 2 stage (s)		2.2			3.5	3.3
IF (s)		99			98	99
p0 queue free %		915			100	456
cM capacity (veh/h)						
Direction_Lane #	EB 1	WB 1	NB 1	SB 1		
Volume Total	659	765	5			
Volume Left	0	9	2			
Volume Right	3	0	3			
cSH	1700	915	188			
Volume to Capacity	0.39	0.01	0.03			
Queue Length 95th (m)	0.0	0.2	0.5			
Control Delay (s)	0.0	0.3	24.7			
Lane LOS	A	A	C			
Approach Delay (s)	0.0	0.3	24.7			
Approach LOS			C			
Intersection Summary						
Average Delay	0.2					
Intersection Capacity Utilization	53.0%		ICU Level of Service		A	
Analysis Period (min)	15					

5/08/2017

<Future Total> AM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		W										
Volume (veh/h)	37	589	5	1	685	5	1	1	4	5	0	40
Sign Control	Free	Free			Free		Stop		Stop		Stop	
Grade	0%				0%		0%		0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	40	640	5	1	745	5	1	1	4	5	0	43
Pedestrians							6				17	
Lane Width (m)							3.6				3.6	
Walking Speed (m/s)							1.2				1.2	
Percent Blockage							1				1	
Right turn flare (veh)												
Median type	None				None							
Median storage (veh)												
Upstream signal (m)					165							
pX platoon unblocked		0.68					0.68		0.68		0.68	
vC conflicting volume		767			652		1522		1499		649	1495
764												
vC1 stage 1 conf vol												
vC2 stage 2 conf vol		416			652		1533		1498		649	1492
412												
vCu unblocked vol		4.1			4.1		7.1		6.5		6.2	7.1
6.2												
IC single (s)												
IC 2 stage (s)		2.2			2.2		3.5		4.0		3.3	4.0
3.3												
IF (s)		95			100		98		99		99	100
90												
p0 queue free %		762			930		54		77		467	63
427												
cM capacity (veh/h)												
Direction_Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	686	751	7	49								
Volume Left	40	1	1	5								
Volume Right	5	5	4	43								
cSH	762	930	150	259								
Volume to Capacity	0.05	0.00	0.04	0.19								
Queue Length 95th (m)	1.0	0.0	0.8	4.1								
Control Delay (s)	1.4	0.0	30.1	22.1								
Lane LOS	A	A	D	C								
Approach Delay (s)	1.4	0.0	30.1	22.1								
Approach LOS			D	C								
Intersection Summary												
Average Delay	1.5											
Intersection Capacity Utilization	70.5%			ICU Level of Service			C					
Analysis Period (min)	15											

HCM Unsignalized Intersection Capacity Analysis
 4: King Street West & Proposed Site Access

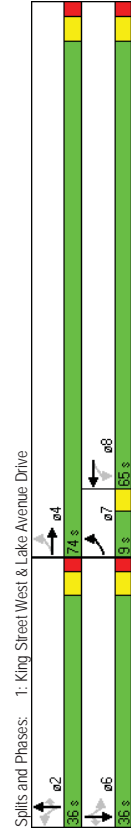
<Future Total> AM Peak Hour
 5/08/2017

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		4	594	691	7	12
Volume (veh/h)		4	594	691	7	12
Sign Control		Free	Free	Free	S/opp	S/opp
Grade		0%	0%	0%	0%	0%
Peak Hour Factor		0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)		4	646	751	8	13
Pedestrians						21
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None	None		
Median storage (veh)						
Upstream signal (m)			122			
pX platoon unblocked		0.67			0.67	0.67
vC conflicting volume		759			1409	755
vC1 stage 1 conf vol						
vC2 stage 2 conf vol						
vCu unblocked vol		390			1364	384
IC single (s)		4.1			6.4	6.2
IC 2 stage (s)						
IF (s)		2.2			3.5	3.3
p0 queue free %		99			88	95
cM capacity (veh/h)		780			108	443
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	650	759	34			
Volume Left	4	0	13			
Volume Right	0	8	21			
cSH	780	1700	201			
Volume to Capacity	0.01	0.45	0.17			
Queue Length 95th (m)	0.1	0.0	3.5			
Control Delay (s)	0.2	0.0	26.4			
Lane LOS	A	D	D			
Approach Delay (s)	0.2	0.0	26.4			
Approach LOS	D	D	D			
Intersection Summary						
Average Delay	0.7					
Intersection Capacity Utilization	46.8%					
ICU Level of Service	A					
Analysis Period (min)	15					

1: King Street West & Lake Avenue Drive

<Future Total> PM Peak Hour
 5/08/2017

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR		
Lane Configurations	81	638	3	658	43	26	9	151	28	144		
Volume (vph)	81	638	3	658	43	26	9	151	28	144		
Turn Type	pm+pt	Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm		
Protected Phases	7	4	8	8	2	2	2	6	6	6		
Permitted Phases	4		8	8	2	2	2	6	6	6		
Detector Phase	7	4	8	8	2	2	2	6	6	6		
Switch Phase												
Minimum Initial (s)	5.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0		
Minimum Split (s)	9.0	29.4	29.4	35.3	35.3	35.3	35.3	35.3	35.3	35.3		
Total Split (s)	9.0	74.0	65.0	65.0	36.0	36.0	36.0	36.0	36.0	36.0		
Total Split (%)	8.2%	67.3%	59.1%	59.1%	32.7%	32.7%	32.7%	32.7%	32.7%	32.7%		
Yellow Time (s)	3.0	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3		
All-Red Time (s)	0.0	2.1	2.1	2.1	2.0	2.0	2.0	2.0	2.0	2.0		
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
Total Lost Time (s)	3.0	5.4	5.4	5.4	5.3	5.3	5.3	5.3	5.3	5.3		
Lead/Lag	Lead	Lag	Lag	Lag	Lag	Lag	Lag	Lag	Lag	Lag		
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		
Recall Mode	None	None	None	None	None	None	None	None	None	None		
Act Effct Green (s)	53.6	51.1	44.3	44.3	31.7	31.7	31.7	31.7	31.7	31.7		
Actuated g/C Ratio	0.57	0.54	0.47	0.47	0.34	0.34	0.34	0.34	0.34	0.34		
v/c Ratio	0.45	0.73	0.01	0.91	0.16	0.02	0.02	0.45	0.27	0.27		
Control Delay	15.2	19.8	12.3	37.9	28.4	14.9	14.9	32.9	11.8	11.8		
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
Total Delay	15.2	19.8	12.3	37.9	28.4	14.9	14.9	32.9	11.8	11.8		
LOS	B	B	B	D	C	B	B	C	C	B		
Approach Delay	19.3			37.8			26.8			23.5		
Approach LOS	B			D			C			C		
Intersection Summary												
Cycle Length	110											
Actuated Cycle Length	93.8											
Natural Cycle	90											
Control Type	Semi Act-Uncoord											
Maximum v/c Ratio	0.91											
Intersection Signal Delay	27.6											
Intersection Capacity Utilization	102.3%											
Analysis Period (min)	15											



HCM Signalized Intersection Capacity Analysis
 1: King Street West & Lake Avenue Drive

<Future Total> PM Peak Hour
 5/08/2017

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	81	638	21	3	658	68	43	26	9	151	28	144
Volume (veh/h)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Ideal Flow (vphpl)	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
Lane Width	3.0	5.4	5.4	3.0	5.4	5.4	3.0	5.3	5.3	5.3	5.3	5.3
Total Lost time (s)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Lane Util. Factor	1.00	1.00	1.00	1.00	0.99	1.00	1.00	0.95	1.00	0.95	1.00	0.95
Frbp_psd/bikes	1.00	1.00	1.00	0.99	1.00	1.00	0.98	1.00	1.00	0.97	1.00	0.97
Frt	1.00	1.00	1.00	0.99	1.00	1.00	0.85	1.00	0.85	1.00	0.85	1.00
Flt Protected	0.95	1.00	0.95	1.00	0.99	1.00	0.97	1.00	0.96	1.00	0.96	1.00
Satd. Flow (prot)	1770	1806	1638	1827	1779	1398	1740	1501				
Flt Permitted	0.08	1.00	0.26	1.00	0.26	1.00	0.76	1.00	0.71	1.00		
Satd. Flow (perm)	158	1806	448	1827	1397	1398	1283	1501				
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	88	693	23	3	715	74	47	28	10	164	30	157
RTOR Reduction (vph)	0	1	0	0	4	0	0	0	0	7	0	0
Lane Group Flow (vph)	88	715	0	3	785	0	0	75	3	0	194	84
Conf. Peds. (#/hr)	19	16	16	16	19	21	22	22	22	22	21	21
Conf. Bikes (#/hr)	1											
Bus Blockages (#/hr)	0	6	0	0	0	0	0	0	0	0	0	0
Turn Type	pm-pt			Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm	Perm
Protected Phases	7	4			8		2				6	
Permitted Phases	4			8	44.3	44.3	2	31.6	31.6	2	6	31.6
Actuated Green, G (s)	51.8	51.8	44.3	44.3	44.3	44.3	31.6	31.6	31.6	31.6	31.6	31.6
Effective Green, g (s)	51.8	51.8	44.3	44.3	44.3	44.3	31.6	31.6	31.6	31.6	31.6	31.6
Actuated G/C Ratio	0.55	0.55	0.47	0.47	0.47	0.47	0.34	0.34	0.34	0.34	0.34	0.34
Clearance Time (s)	3.0	3.0	3.0	3.0	3.0	3.0	5.3	5.3	5.3	5.3	5.3	5.3
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap. (vph)	164	994	211	860	469	469	469	469	469	431	504	
v/s Ratio Prot	0.03	c0.40			c0.43							
v/s Ratio Perm	0.27				0.01		0.05	0.00	0.00	c0.15	0.06	
v/s Ratio	0.54	0.72	0.01	0.91	0.16	0.01	0.16	0.01	0.01	0.45	0.17	
Uniform Delay, d1	18.1	15.7	13.3	23.1	21.9	20.8	21.9	20.8	24.5	22.0		
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	3.4	2.5	0.0	13.9	0.7	0.0	0.7	0.0	3.4	0.7		
Delay (s)	21.5	18.3	13.3	37.0	22.7	20.8	22.7	20.8	27.8	22.7		
Level of Service	C	B	B	D	C	C	C	C	C	C	C	C
Approach Delay (s)	18.6			36.9			22.4		25.5			
Approach LOS	B			D			C		C			
Intersection Summary												
HCM Average Control Delay	27.1 HCM Level of Service C											
HCM Volume to Capacity ratio	0.75											
Actuated Cycle Length (s)	94.1 Sum of lost time (s) 16.1											
Intersection Capacity Utilization	102.3% ICU Level of Service G											
Analysis Period (min)	15											
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis
 2: King Street West & 1st Street South

<Future Total> PM Peak Hour
 5/08/2017

Movement	EBT	EBR	WBL	WBT	WBR	NBL	NBR
Lane Configurations	755	3	6	871	1	6	
Volume (veh/h)	Free	Free	Free	Free	Stop	0%	0%
Sign Control	0%	0%	0%	0%	0%	0%	0%
Grade	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Peak Hour Factor	821	3	7	947	1	7	
Hourly flow rate (vph)							
Pedestrians					6		
Lane Width (m)					3.6		
Walking Speed (m/s)					1.2		
Percent Blockage					1		
Right turn flare (veh)							
Median type	None			None			
Median storage (veh)							
Upstream signal (m)				91			
pX, platoon unblocked				0.59			
vC, conflicting volume				830	1788	828	
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol				830	1989	828	
IC, 2 stage (s)				4.1	6.4	6.2	
IF (s)				2.2	3.5	3.3	
p0 queue free %				99	97	98	
GM capacity (veh/h)				798	39	369	
Direction_Lane #	EB 1	WB 1	NB 1				
Volume Total	824	953	8				
Volume Left	0	7	1				
Volume Right	3	0	7				
cSH	1700	798	167				
Volume to Capacity	0.48	0.01	0.05				
Queue Length 95th (m)	0.0	0.1	0.9				
Control Delay (s)	0.0	0.2	21.6				
Lane LOS	A	D	D				
Approach Delay (s)	0.0	0.2	27.6				
Approach LOS	D	D	D				
Intersection Summary							
Average Delay	0.2						
Intersection Capacity Utilization	60.6%						
ICU Level of Service	B						
Analysis Period (min)	15						

HCM Unsignalized Intersection Capacity Analysis
 3: King Street West & 2nd Street North

HCM Unsignalized Intersection Capacity Analysis
 4: King Street West & Proposed Site Access

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	53	757	3	11	824	18	2	0	7	5	0	40
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
Grade	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	58	823	3	12	896	20	2	0	8	5	0	43
Pedestrians							4				24	
Lane Width (m)							3.6				3.6	
Walking Speed (m/s)							1.2				1.2	
Percent Blockage							0				2	
Right turn flare (veh)												
Median type							None					
Median storage (veh)												
Upstream signal (m)							165					
pX platoon unblocked	0.60						0.60	0.60	0.60	0.60	0.60	0.60
vC conflicting volume	939			830			1916	1907	828	1901	1899	929
vC1 stage 1 conf vol												
vC2 stage 2 conf vol												
vCu unblocked vol	558			830			2200	2184	828	2173	2170	541
IC single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
IC 2 stage (s)												
IF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	90			99			85	100	98	68	100	86
cM capacity (veh/h)	591			799			15	24	370	17	24	315
Direction_Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	884	927	10	49								
Volume Left	58	12	2	5								
Volume Right	3	20	8	43								
cSH	591	799	58	108								
Volume to Capacity	0.10	0.01	0.17	0.45								
Queue Length 95th (m)	1.9	0.3	3.3	11.8								
Control Delay (s)	2.8	0.4	78.8	63.4								
Lane LOS	A	A	F	F								
Approach Delay (s)	2.8	0.4	78.8	63.4								
Approach LOS	F	F	F	F								
Intersection Summary												
Average Delay							3.6					
Intersection Capacity Utilization							82.0%					E
Analysis Period (min)							15					

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SBL	SBT	SBR
Lane Configurations									
Volume (veh/h)	23	747	854	18	11	14			
Sign Control	Free	Free	Free	Free	Free	Stop			
Grade	0%	0%	0%	0%	0%	0%			
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92			
Hourly flow rate (vph)	25	812	928	20	12	15			
Pedestrians									
Lane Width (m)									
Walking Speed (m/s)									
Percent Blockage									
Right turn flare (veh)									
Median type							None		
Median storage (veh)									
Upstream signal (m)							125		
pX platoon unblocked	0.59						0.59	0.59	0.59
vC conflicting volume	948						1800	938	
vC1 stage 1 conf vol									
vC2 stage 2 conf vol									
vCu unblocked vol	561						2010	545	
IC single (s)	4.1						6.4	6.2	
IC 2 stage (s)									
IF (s)	2.2						3.5	3.3	
p0 queue free %	96						67	95	
cM capacity (veh/h)	594						37	317	
Direction_Lane #	EB 1	WB 1	SB 1						
Volume Total	837	948	27						
Volume Left	25	0	12						
Volume Right	0	20	15						
cSH	594	1700	72						
Volume to Capacity	0.04	0.56	0.38						
Queue Length 95th (m)	0.8	0.0	8.6						
Control Delay (s)	1.2	0.0	81.9						
Lane LOS	A	A	F						
Approach Delay (s)	1.2	0.0	81.9						
Approach LOS	F	F	F						
Intersection Summary									
Average Delay							1.8		
Intersection Capacity Utilization							67.9%		ICU Level of Service
Analysis Period (min)							15		C

Queuing and Blocking Report
<Existing> AM Peak Hour

5/08/2017

Intersection: 1: King Street West & Lake Avenue Drive

Movement	EB	EB	WB	WB	NB	NB	SB	SB
	L	TR	L	TR	LT	R	LT	R
Directions Served								
Maximum Queue (m)	32.1	72.1	65.8	118.7	34.5	15.8	27.8	28.6
Average Queue (m)	12.6	44.1	4.9	81.6	12.8	5.1	10.6	9.6
95th Queue (m)	25.4	69.6	24.6	127.6	29.4	15.6	23.6	22.0
Link Distance (m)	72.1	114.1	206.7				215.9	
Upstream Blk Time (%)	1	3						
Queuing Penalty (veh)	5	0						
Storage Bay Dist (m)	23.0	16.0			7.0		12.0	
Storage Blk Time (%)	1	20	0	37	26	2	7	8
Queuing Penalty (veh)	7	16	0	5	4	1	6	5

Intersection: 2: King Street West & 1st Street South

Movement	EB	WB	NB
	TR	LT	LR
Directions Served			
Maximum Queue (m)	28.1	15.7	9.3
Average Queue (m)	1.5	1.4	2.1
95th Queue (m)	10.4	7.7	8.4
Link Distance (m)	55.2	72.1	151.9
Upstream Blk Time (%)	1	0	
Queuing Penalty (veh)	5	3	
Storage Bay Dist (m)	23.0	16.0	
Storage Blk Time (%)	1	20	0
Queuing Penalty (veh)	7	16	0

Intersection: 3: King Street West & 2nd Street North

Movement	EB	NB	SB
	LTR	LR	LR
Directions Served			
Maximum Queue (m)	85.4	9.0	21.2
Average Queue (m)	10.9	0.3	8.4
95th Queue (m)	42.6	3.0	16.1
Link Distance (m)	80.9	158.6	220.1
Upstream Blk Time (%)	0		
Queuing Penalty (veh)	0		
Storage Bay Dist (m)	23.0	16.0	
Storage Blk Time (%)	1	20	0
Queuing Penalty (veh)	7	16	0

Network Summary

Network wide Queuing Penalty: 49

Queuing and Blocking Report
<Existing> PM Peak Hour

5/08/2017

Intersection: 1: King Street West & Lake Avenue Drive

Movement	EB	EB	WB	WB	NB	NB	SB	SB
	L	TR	L	TR	LT	R	LT	R
Directions Served								
Maximum Queue (m)	62.6	77.1	7.5	124.5	34.4	16.8	66.0	37.0
Average Queue (m)	16.0	53.7	0.2	106.7	13.5	2.0	32.6	24.3
95th Queue (m)	38.0	88.4	2.5	136.3	26.4	10.7	54.9	42.2
Link Distance (m)	72.1	114.1	206.7				215.9	
Upstream Blk Time (%)	5	11						
Queuing Penalty (veh)	33	0						
Storage Bay Dist (m)	23.0	16.0			7.0		12.0	
Storage Blk Time (%)	1	24	0	47	35	0	40	16
Queuing Penalty (veh)	6	19	1	2	0	53	28	

Intersection: 2: King Street West & 1st Street South

Movement	EB	WB	NB
	TR	LT	LR
Directions Served			
Maximum Queue (m)	60.4	72.1	15.1
Average Queue (m)	12.1	9.3	1.9
95th Queue (m)	44.4	44.8	8.7
Link Distance (m)	55.2	72.1	151.9
Upstream Blk Time (%)	1	0	
Queuing Penalty (veh)	5	3	
Storage Bay Dist (m)	23.0	16.0	
Storage Blk Time (%)	1	20	0
Queuing Penalty (veh)	7	16	0

Intersection: 3: King Street West & 2nd Street North

Movement	EB	WB	NB	SB
	LTR	LR	LR	LR
Directions Served				
Maximum Queue (m)	85.5	55.2	14.9	16.3
Average Queue (m)	33.7	9.4	2.8	8.3
95th Queue (m)	88.2	36.2	10.2	15.8
Link Distance (m)	80.9	55.2	158.6	220.1
Upstream Blk Time (%)	5	0		
Queuing Penalty (veh)	0	4		
Storage Bay Dist (m)	23.0	16.0		
Storage Blk Time (%)	1	20	0	0
Queuing Penalty (veh)	7	16	0	0

Network Summary

Network wide Queuing Penalty: 155

Intersection: 1: King Street West & Lake Avenue Drive

Movement	EB	EB	WB	WB	NB	NB	SB	SB
	L	TR	L	TR	LT	R	LT	R
Directions Served								
Maximum Queue (m)	62.7	76.4	66.0	119.1	28.7	15.6	27.8	22.1
Average Queue (m)	18.2	49.4	5.9	76.6	14.5	4.9	9.1	11.0
95th Queue (m)	49.0	83.0	25.3	122.0	26.7	15.0	24.0	21.7
Link Distance (m)	72.1	114.5	206.6				215.9	
Upstream Blk Time (%)	3	2						
Queuing Penalty (veh)	16	0						
Storage Bay Dist (m)	23.0	16.0	16.0	7.0	7.0	12.0	12.0	12.0
Storage Blk Time (%)	2	20	0	34	31	4	8	7
Queuing Penalty (veh)	12	16	0	5	4	3	7	4

Intersection: 2: King Street West & 1st Street South

Movement	EB	WB	NB	NB
	TR	LT	LR	LR
Directions Served				
Maximum Queue (m)	55.2	16.1	9.3	
Average Queue (m)	6.3	1.8	1.5	
95th Queue (m)	30.0	9.1	7.1	
Link Distance (m)	55.2	72.1	151.9	
Upstream Blk Time (%)	0			
Queuing Penalty (veh)	1			
Storage Bay Dist (m)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 3: King Street West & 2nd Street North

Movement	EB	WB	NB	SB
	LTR	LTR	LR	LR
Directions Served				
Maximum Queue (m)	85.4	34.8	15.5	15.4
Average Queue (m)	17.1	1.2	1.8	7.4
95th Queue (m)	50.9	11.5	8.1	14.8
Link Distance (m)	80.9	55.2	158.6	220.1
Upstream Blk Time (%)	1			
Queuing Penalty (veh)	0			
Storage Bay Dist (m)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Network Summary
 Network wide Queuing Penalty: 69

Intersection: 1: King Street West & Lake Avenue Drive

Movement	EB	EB	WB	WB	NB	NB	SB	SB
	L	TR	L	TR	LT	R	LT	R
Directions Served								
Maximum Queue (m)	62.6	76.6	7.4	116.5	60.3	17.0	54.3	37.0
Average Queue (m)	11.2	55.8	0.7	85.8	14.9	3.9	28.5	21.9
95th Queue (m)	30.9	87.3	3.8	122.8	37.0	14.3	49.3	39.7
Link Distance (m)	72.1	111.9	206.7				215.9	
Upstream Blk Time (%)	4	3						
Queuing Penalty (veh)	31	0						
Storage Bay Dist (m)	23.0	16.0	16.0	7.0	7.0	12.0	12.0	12.0
Storage Blk Time (%)	2	22	0	40	32	2	35	18
Queuing Penalty (veh)	11	17	1	3	1	49	33	33

Intersection: 2: King Street West & 1st Street South

Movement	EB	WB	NB	NB
	TR	LT	LR	LR
Directions Served				
Maximum Queue (m)	60.4	73.1	9.3	
Average Queue (m)	9.9	12.4	3.1	
95th Queue (m)	41.1	52.5	9.9	
Link Distance (m)	55.2	72.1	151.9	
Upstream Blk Time (%)	1	2		
Queuing Penalty (veh)	11	18		
Storage Bay Dist (m)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 3: King Street West & 2nd Street North

Movement	EB	WB	NB	SB
	LTR	LTR	LR	LR
Directions Served				
Maximum Queue (m)	85.1	56.0	9.3	21.3
Average Queue (m)	33.1	8.8	0.9	10.1
95th Queue (m)	88.3	39.8	5.3	18.1
Link Distance (m)	80.5	55.2	158.8	220.1
Upstream Blk Time (%)	5	2		
Queuing Penalty (veh)	0	16		
Storage Bay Dist (m)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Network Summary
 Network wide Queuing Penalty: 190

Queuing and Blocking Report
 <Future Total> AM Peak Hour

5/08/2017

Intersection: 1: King Street West & Lake Avenue Drive

Movement	EB	EB	WB	WB	NB	NB	SB	SB
	L	TR	L	TR	LT	R	LT	R
Directions Served								
Maximum Queue (m)	59.4	76.3	7.6	119.1	28.7	15.8	29.3	28.6
Average Queue (m)	12.5	53.7	3.3	73.2	10.5	4.4	12.7	10.2
95th Queue (m)	29.7	78.2	8.8	110.0	21.8	14.3	26.5	23.5
Link Distance (m)	72.1		114.5	206.6		215.9		
Upstream Blk Time (%)	1		1					
Queuing Penalty (veh)	6		0					
Storage Bay Dist (m)	23.0		16.0		7.0		12.0	
Storage Blk Time (%)	0	23		35	21	2	11	9
Queuing Penalty (veh)	1	19		6	3	2	9	6

Intersection: 2: King Street West & 1st Street South

Movement	EB	WB	NB
	TR	LT	LR
Directions Served			
Maximum Queue (m)	16.9	34.8	9.2
Average Queue (m)	2.4	3.8	2.0
95th Queue (m)	10.7	20.2	8.1
Link Distance (m)	10.0	72.1	151.9
Upstream Blk Time (%)	1		
Queuing Penalty (veh)	3		
Storage Bay Dist (m)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 3: King Street West & 2nd Street North

Movement	EB	NB	SB
	LTR	LR	LR
Directions Served			
Maximum Queue (m)	67.8	9.2	16.5
Average Queue (m)	12.6	2.4	8.5
95th Queue (m)	43.9	8.9	16.2
Link Distance (m)	80.9	158.6	220.3
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (m)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Queuing and Blocking Report
 <Future Total> AM Peak Hour

5/08/2017

Intersection: 4: King Street West & Proposed Site Access

Movement	EB	SB
	LT	LR
Directions Served		
Maximum Queue (m)	22.1	20.9
Average Queue (m)	1.4	6.9
95th Queue (m)	10.4	16.8
Link Distance (m)	28.2	16.3
Upstream Blk Time (%)	4	
Queuing Penalty (veh)	0	
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 55

Queuing and Blocking Report
<Future Total> PM Peak Hour

5/08/2017

Intersection: 1: King Street West & Lake Avenue Drive

Movement	EB	WB	WB	WB	NB	NB	SB	SB	SB
	L	TR	L	TR	LT	R	LT	R	
Directions Served									
Maximum Queue (m)	62.7	77.0	7.6	120.0	34.5	17.0	67.1	37.0	
Average Queue (m)	14.4	56.7	1.0	98.7	14.8	3.8	33.0	23.4	
95th Queue (m)	34.1	92.7	4.9	136.0	28.2	14.6	60.9	43.3	
Link Distance (m)	72.1	111.9	206.7				215.9		
Upstream Blk Time (%)	6	9							
Queuing Penalty (veh)	44	0							
Storage Bay Dist (m)	23.0	16.0			7.0		12.0		
Storage Blk Time (%)	2	21			41		39	22	
Queuing Penalty (veh)	15	17			1		56	40	

Intersection: 2: King Street West & 1st Street South

Movement	EB	WB	NB	NB
	TR	LT	LR	
Directions Served				
Maximum Queue (m)	26.1	74.3	9.3	
Average Queue (m)	7.8	12.8	2.6	
95th Queue (m)	21.4	55.7	9.3	
Link Distance (m)	13.8	72.1	151.9	
Upstream Blk Time (%)	5	3		
Queuing Penalty (veh)	39	28		
Storage Bay Dist (m)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 3: King Street West & 2nd Street North

Movement	EB	WB	NB	SB
	LTR	LR	LR	
Directions Served				
Maximum Queue (m)	90.9	288	9.3	16.5
Average Queue (m)	48.4	3.6	0.8	7.3
95th Queue (m)	104.6	18.1	4.8	14.4
Link Distance (m)	80.5	24.2	158.8	220.4
Upstream Blk Time (%)	10	2		
Queuing Penalty (veh)	0	16		
Storage Bay Dist (m)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Queuing and Blocking Report
<Future Total> PM Peak Hour

5/08/2017

Intersection: 4: King Street West & Proposed Site Access

Movement	EB	WB	SB	SB
	LT	TR	LR	
Directions Served				
Maximum Queue (m)	28.8	16.8	22.6	
Average Queue (m)	15.8	1.5	5.5	
95th Queue (m)	35.2	9.0	16.6	
Link Distance (m)	24.2	13.8	18.0	
Upstream Blk Time (%)	7	1	2	
Queuing Penalty (veh)	54	7	0	
Storage Bay Dist (m)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Network Summary

Network wide Queuing Penalty: 322



APPENDIX E

Level of Service Definitions

LEVEL OF SERVICE ANALYSIS AT SIGNALIZED INTERSECTIONS

To assist in clarifying the arithmetic analysis associated with traffic engineering, it is often useful to refer to “Level of Service”. The term Level of Service implies a qualitative measure of traffic flow at an intersection. It is dependent upon vehicle delay and vehicle queue lengths at the approaches. Specifically, Level of Service criteria are stated in terms of the average stopped delay per vehicle for a 15-minute analysis period. The following table describes the characteristics of each level:

<u>Level of Service</u>	<u>Features</u>	<u>Stopped Delay per Vehicle (sec)</u>
A	At this level of service, almost no signal phase is fully utilized by traffic. Very seldom does a vehicle wait longer than one red indication. The approach appears open, turning movements are easily made and drivers have freedom of operation.	≤ 5.0
B	At this level, an occasional signal phase is fully utilized and many phases approach full use. Many drivers begin to feel somewhat restricted within platoons of vehicles approaching the intersection.	> 5.0 and ≤ 15.0
C	At this level, the operation is stable though with more frequent fully utilized signal phases. Drivers feel more restricted and occasionally may have to wait more than one red signal indication, and queues may develop behind turning vehicles. This level is normally employed in urban intersection design.	> 15.0 and ≤ 25.0
D	At this level, the motorist experiences increasing restriction and instability of flow. There are substantial delays to approaching vehicles during short peaks within the peak period, but there are enough cycles with lower demand to permit occasional clearance of developing queues and prevent excessive backups.	> 25.0 and ≤ 40.0
E	At this level, capacity is reached. There are long queues of vehicles waiting upstream of the intersection and delays to vehicles may extend to several signal cycles.	> 40.0 and ≤ 60.0
F	At this level, saturation occurs, with vehicle demand exceeding the available capacity.	> 60.0

LEVEL OF SERVICE ANALYSIS AT UNSIGNALIZED INTERSECTIONS⁽¹⁾

The term "level of service" implies a qualitative measure of traffic flow at an intersection. It is dependent upon the vehicle delay and vehicle queue lengths at approaches. The level of service at unsignalized intersections is often related to the delay accumulated by flows on the minor streets, caused by all other conflicting movements. The following table describes the characteristics of each level.

Level of Service	Features
A	Little or no traffic delay occurs. Approaches appear open, turning movements are easily made, and drivers have freedom of operation.
B	Short traffic delays occur. Many drivers begin to feel somewhat restricted in terms of freedom of operation.
C	Average traffic delays occur. Operations are generally stable, but drivers emerging from the minor street may experience difficulty in completing their movement. This may occasionally impact on the stability of flow on the major street.
D	Long traffic delays occur. Motorists emerging from the minor street experience significant restriction and frustration. Drivers on the major street will experience congestion and delay as drivers emerging from the minor street interfere with the major through movements.
E	Very long traffic delays occur. Operations approach the capacity of the intersection.
F	Saturation occurs, with vehicle demand exceeding the available capacity. Very long traffic delays occur.

⁽¹⁾ Highway Capacity Manual - Special Report No. 209, Transportation Research Board, 1985.



APPENDIX F

City of Hamilton Parking Requirements

4.10.8 Calculation Of Required Spaces

- (a) Rounding - Where the calculation of parking space requirements in accordance with this By-law results in a fraction of a parking space being required for a lot, any fraction in excess of 0.5 shall be rounded up to the next whole number.
- (b) More than One Use - Except as expressly provided elsewhere in this By-law, where more than one type of use is located on a lot, the total number of parking spaces required for such lot shall be the sum of the parking space requirements for each separate use.
- (c) Where the number of parking spaces required in accordance with this By-law is based upon the “capacity” of a use, such capacity shall be equal to the design capacity of any building or structure pertaining to such use, as determined by the Building Code Act, R.S.O. 1990, c.B.13.

4.10.9 Schedule Of Minimum Parking Requirements

Except as specifically provided elsewhere in this By-law the parking standards as set out in the following Schedule shall be held to be the minimum.

USE	MINIMUM PARKING SPACES REQUIRED
APARTMENT BUILDINGS IN CENTRAL COMMERCIAL “CA1” ZONE AND CENTRAL COMMERCIAL “CA2” ZONE	1 PARKING SPACE FOR EACH DWELLING UNIT AND 0.25 VISITOR PARKING SPACES FOR EACH DWELLING UNIT
BANK AND FINANCIAL INSTITUTIONS	1 PARKING SPACE FOR EACH 15 SQ.M. OF GROSS FLOOR AREA OR PART THEREOF
BILLIARD PARLOURS	1 PARKING SPACE FOR EACH TABLE
BOWLING ALLEYS	4 PARKING SPACES FOR EACH ALLEY
BOARDING HOUSE TYPE “B”	1 PARKING SPACE FOR EACH 4 BEDS
BUSINESS, PROFESSIONAL AND MEDICAL OFFICES NOT LOCATED IN A SHOPPING CENTRE	1 PARKING SPACE FOR EACH 30 SQ.M. OR GROSS FLOOR AREA OR PART THEREOF
BUSINESS, COMMERCIAL OR TRADE SCHOOLS	1 PARKING SPACE FOR EACH 20 SQ.M. OF GROSS FLOOR AREA OR PART THEREOF
CAR WASHES (MANUAL OR SELF SERVE)	1.2 PARKING SPACE FOR EACH CAR WASH BAY PLUS 3 CAR STORAGE SPACES PER BAY WHICH MAY BE TANDEM PARKING SPACES
CAR WASHES (AUTOMATED)	1 PARKING SPACE PER BAY PLUS 4 CAR STORAGE SPACES PER BAY
COMMUNITY CENTRES	1 PARKING SPACE FOR EACH 10 SQ.M. OF GROSS FLOOR AREA OR PART THEREOF

PART 4**GENERAL PROVISIONS**

MOTOR VEHICLE SERVICE STATION	1 PARKING SPACE FOR EACH 23.3 SQ.M. OF GROSS FLOOR AREA OR PART THEREOF
NURSERY GARDEN CENTRES (By-Law 03-283)	1 PARKING SPACE FOR EACH 30 SQ.M. OF GROSS FLOOR AREA DEVOTED TO RETAIL SALES AND DISPLAY OF PRODUCTS AND/OR OFFICES; AND, 1 SPACE FOR EACH 100 SQ.M. OF GROSS FLOOR AREA, OR PART THEREOF USED FOR WAREHOUSING AND/OR WHOLESALING
NURSING HOMES	1 PARKING SPACE FOR EACH 4 BEDS
PERSONAL SERVICE SHOPS	1 PARKING SPACE FOR EACH 18.5 SQ.M. OF GROSS FLOOR AREA OR PART THEREOF
PLACES OF WORSHIP	1 PARKING SPACE FOR EACH 10 SQ.M. OF GROSS FLOOR AREA OR PART THEREOF
PLACES TO WHICH THE PUBLIC RESORT FOR RECREATION ENTERTAINMENT, AMUSEMENT, SPORTS OR EDUCATION	1 PARKING SPACE FOR EACH 13.3 SQ.M. OF GROSS FLOOR AREA OR PART THEREOF
PRIVATE OR COMMERCIAL CLUBS	1 PARKING SPACE FOR EACH 16.5 SQ.M. OF GROSS FLOOR AREA OR PART THEREOF
RENTAL OUTLETS	1 PARKING SPACE FOR EACH 20 SQ.M. OF GROSS FLOOR AREA OR PART THEREOF
RESTAURANTS - COVERED OUTDOOR PATIO IN CONJUNCTION WITH A RESTAURANT (By-law 4513-97)	1 PARKING SPACE FOR EACH 4 SEATS
RESTAURANTS - OUTDOOR PATIO IN CONJUNCTION WITH A RESTAURANT	NO ADDITIONAL PARKING IS REQUIRED
RESTAURANTS AND TAVERNS EXCEPT WHEN LOCATED IN A SHOPPING CENTRE	1 PARKING SPACE FOR EACH 4 SEATS
RETAIL LUMBER AND BUILDING SUPPLIES OUTLETS	1 PARKING SPACE FOR EACH 33.3 SQ.M. OF GROSS FLOOR AREA OR PART THEREOF WITH A MINIMUM OF 15 PARKING SPACES
RETAIL STORES NOT LOCATED IN A SHOPPING CENTRE OR OTHERWISE SPECIFIED WITHIN THIS BY-LAW (By-law 3863-93)	1 PARKING SPACE FOR EACH 28 SQ.M. OF GROSS FLOOR AREA OR PART THEREOF
SHOPPING CENTRES	1 PARKING SPACE FOR EACH 20.5 SQ.M. OF GROSS FLOOR AREA OR PART THEREOF
SHOWROOMS	1 PARKING SPACE FOR EACH 30 SQ.M. OF SHOWROOM FLOOR SPACE OR PART THEREOF
SINGLE DETACHED, DUPLEX, AND SEMI-DETACHED DWELLING UNITS	2 PARKING SPACES FOR EACH DWELLING, TANDEM PARKING IS PERMITTED
THEATRES	1 PARKING SPACE FOR EACH 6 SEATS
TOWNHOUSE, MAISONETTE (By-law 4770-98)	2 PARKING SPACES FOR EACH DWELLING UNIT

4.10.10 Parking Requirements for Cellars (By-law 5068-00)

Notwithstanding the definition of “floor area gross”, should any part of a cellar or sub-cellar be utilized as gross leasable floor area, said area shall be subject to the provisions of Subsection 4.10.9 “Schedule of Minimum Parking Requirements.

SECTION 5: PARKING

<u>Column 1</u>	<u>Column 2</u>
i. Residential Uses	
Single Detached Dwelling, Semi-Detached Dwelling, Duplex Dwelling Dwelling Unit	1 for each dwelling unit
Multiple Dwelling Street Townhouse Dwelling	1 for each dwelling unit, except where a dwelling unit is 50 square metres in gross floor area or less, in which case, parking shall be provided at a rate of 0.3 spaces for each such unit.
Residential Care Facility, Emergency Shelter, Corrections Residence, Lodging House, Retirement Home	1 for each 3 persons accommodated or designed for accommodation.
ii. Institutional	
Long Term Care Facility	1 for each 3 patient beds.
Day Nursery	i. 1 for each 125.0 square metres of gross floor area which accommodates such use. ii. Notwithstanding i. above, no parking shall be required where a Day Nursery is located within an Education Establishment. (By-law 07-321, November 14, 2007)
Social Services Establishment	1 for each 50.0 square metres of gross floor area which accommodates such use. (By-law 07-321, November 14, 2007)
iii. Educational Establishments (By-law 06-324, October 25, 2006) (By-law 14-238, September 10, 2014)	

SECTION 5: PARKING

	<p>floor area, which accommodates such use. (By-law 10-128, May 26, 2010)</p>
Motor Vehicle Service Station	<p>4 for each service bay (By-law 07-043, February 15, 2007)</p>
Marina	<p>1 for each boat slip</p>
Office	<p>1 for each 30 square metres of gross floor area, which accommodates such use. (By-law 07-043, February 15, 2007)</p>
Personal Services	<p>1 for each 16.0 square metres of gross floor area which accommodates such use. (By-law 10-128, May 26, 2010)</p>
Restaurant	<p>i) 1 for each 8.0 square metres of gross floor area which accommodates such use.</p>
	<p>ii) Notwithstanding i) above, where there are no seats provided for dining purposes, a minimum 3 spaces shall be required. (By-law 10-128, May 26, 2010)</p>
Retail	<p>1 for each 20.0 square metres of gross floor area which accommodates such use. (By-law 10-128, May 26, 2010)</p>
Transportation Depot	<p>1 for each 30.0 square metres of gross floor area which accommodates the Office component of the use. (By-law 10-128, May 26, 2010)</p>
Warehouse	<p>1 for each 30.0 square metres of gross floor area which accommodates the office component of the use. (By-law 10-128, May 26, 2010)</p>
Other Commercial Uses not	<p>1 for each 30 square metres of gross</p>



APPENDIX G

City of Hamilton's TDM Initiatives for Mixed Use
Developments

Transportation Demand Management Initiatives / Incentive Summary



Category	TDM Initiative / Incentives	Initiatives to be Considered	Description
Cycling	Visible, well-lit, short-term bicycle parking for visitors (above minimum provisions or recommendations)	✓	Provide well-lit short-term bicycle racks at the northwest corner of the site in the amenity area.
	Secure, indoor bicycle parking storage spaces for tenants/residents	✓	Storage to be provided through the lockers in the underground parking levels
	Provide end-of-trip amenities for employees (e.g. showers, change rooms, lockers)	N/A	Not likely due to the small space of the commercial area
	Ensure development connects to bicycle network	✓	King Street West and Lake Avenue provide shared cycle lanes, designated by pavement markings or posted signage
Walking	Safe, attractive and direct walkways for pedestrians linking building entrances with public sidewalks and with key destinations such as schools	✓	Safe and direct walkways for pedestrians within the site is to be provided and connect them to King Street West
	Enhanced pedestrian amenities on-site (e.g., benches, landscaping, lighting)	✓	Pedestrian amenities on site will be provided.
Transit	Enhance walking routes between main building entrance(s) and transit stops/stations	✓	Safe and direct walking routes from the site to the nearest transit stops are provided by connecting residents to the municipal sidewalks along King
	Provide weather-protected waiting areas	N/A	Currently not available at the bus stops near the subject site.
	Bicycle parking located at or near transit stops	N/A	
	Provision of transit information on-site and adjacent to stops/stations	N/A	Transit information packages should be provided directly to new home owners.
	Implement transit priority measures (queue jump lanes, traffic signal priority, bus only lanes)	N/A	Based on traffic analysis, priority measures are not required.
Parking	Provide no more than the minimum number of required spaces for residents and visitors	N/A	The site is expected to have an adequate parking supply based on a review of similar apartment developments near King Street West
	Reduced minimum parking requirements based on proximity to transit	N/A	
	Cash-in-lieu of parking to fund public parking or fund sustainable transportation	N/A	
	Shared parking with nearby developments or on-street spaces	N/A	
	Implement paid parking for employees and visitors	N/A	
	Reduced minimum parking requirements based on provision of dedicated carshare vehicle parking spaces	N/A	There are currently no car share services in close proximity of the site.
	Unbundle parking costs from unit costs	N/A	
Carpool	Preferential carpool parking spaces for employees	N/A	Not expected to have any carpool spaces for employees in the underground parking levels
Car Share / Bike Share	On-site carshare vehicle(s)	N/A	Currently not readily available in Stoney Creek. Nearest car share is approximately 3km away from the subject site.
	On-site bikeshare facility	N/A	
Wayfinding and Travel Planning	Travel planning resources for residents (individualized marketing, active transportation maps, community resources)	✓	Provide active transportation maps and a list / details of nearby community resources offered (i.e. medical care, public libraries, community centres, government services, etc.)
	Wayfinding signage to major destinations such as schools, public amenities, and commercial areas	N/A	A direct connection to King Street West has been provided.
Education / Promotion, Incentives	Contribute to building a strong TDM brand	✓	Provide transit maps / schedules and bicycle routes & pedestrian trail maps to new residents at closing.
	Include transit and active transportation maps, carshare memberships, and/or bikeshare memberships with new home/condo purchase	✓	
	Include discounted transit passes, carshare memberships, and/or bikeshare memberships with new home/condo purchase or commercial space purchase/rental	N/A	Transit passes for residents and employees may be an option to consider
	Membership in a Transportation Management Association (TMAs defined under "Education/Promotion and Incentives)	N/A	Possibility for the commercial land use

3.D Mixed Use (Residential and Commercial)

Category	TDM Initiative	Low density residential, commercial frontage	High density residential, commercial frontage	High density residential, large commercial
Cycling	Visible, well-lit, short-term bicycle parking for visitors and customers (above minimum provisions or recommendations)	●	●	●
	Secure, indoor bicycle parking storage spaces for residents and employees	○	●	●
	Provide end-of-trip amenities for employees (e.g. showers, change rooms, lockers)	○	○	●
Walking	Safe and attractive walkways for pedestrians linking building entrances with public sidewalks	●	●	●
	Enhanced pedestrian amenities on-site (benches, landscaping, lighting)	●	●	●
Transit	Enhance walking routes between main building entrance(s) and transit stops/stations	●	●	●
	Provide weather-protected waiting areas	●	●	●
	Bicycle parking located at or near transit stops	●	●	●
	Provision of transit information on-site and adjacent to stops/stations	●	●	●
Parking	Provide no more than the minimum number of required spaces for residents, employees, and visitors	●	●	●
	Reduced minimum parking requirements based on proximity to transit	●	●	●
	Implement paid parking for employees and visitors	●	●	●
	Unbundle parking costs from residential unit costs	●	●	●
	Shared parking with nearby developments or on-street spaces	○	●	●
	Cash-in-lieu of parking to fund public parking or fund sustainable transportation	-	●	●
Carpool	Reduced minimum parking requirements for dedicated car share vehicle parking spaces	-	●	●
	Preferential carpool parking spaces for employees	○	○	●
Carshare/ Bikeshare	On-site carshare vehicle(s)	-	●	●
	On-site bikeshare facility	-	●	●
Wayfinding and Travel Planning	Travel planning resources for residents and employees (individualized marketing, trip planning tools, active transportation maps, information resources)	-	●	●
	Wayfinding signage	-	●	●
Education/ Promotion, Incentives	Include discounted transit passes, carshare memberships, and/ or bikeshare memberships with new home/condo purchase or commercial space purchase/rental	●	●	●
	Membership in a Transportation Management Association (TMAs defined under "Education/Promotion and Incentives")	○	○	●
	Contribute to building a strong TDM brand	-	●	●

Legend: ○ Low Priority ● High Priority