DILLON CONSULTING

KNL DEVELOPMENTS INC.

Kanata Lakes Plaza TIS

October 2017 Update

October 2017– 17-6323

October 6, 2017

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Attention: Marcel Dénommé,
Director of Land Development and Planning

RE: Kanata Lakes Plaza Updated TIS

Dear Mr. Dénommé:

Dillon Consulting Limited is pleased to provide you with the updated transportation impact study for the Kanata Lakes Plaza.

Please do not hesitate to contact the undersigned if you have any questions or comments.

Sincerely,

DILLON CONSULTING LIMITED

L. Douglas G

Doug Green, P. Eng.
Associate

Our file: 17-6323

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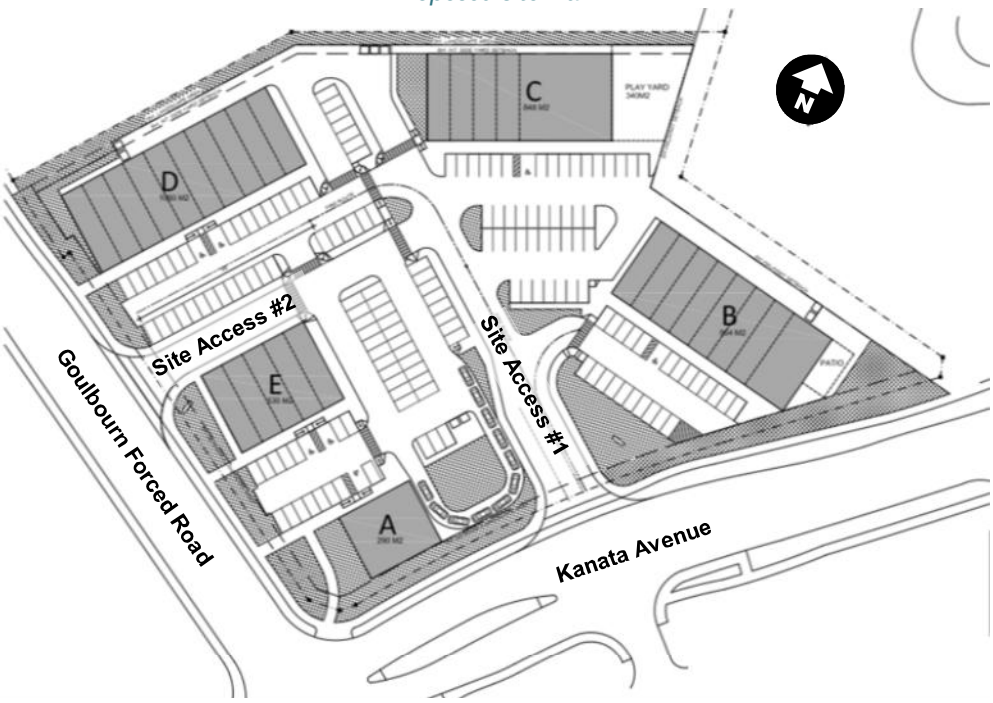
Executive Summary

KNL is proposing to develop a 39,634 ft^2 retail plaza on the northeast corner of the Kanata Avenue and Goulbourn Forced Road (GFR) intersection, in Kanata, ON. The proposed site plan provides full movements access to both Kanata Avenue and GFR. The proposed access to Kanata Avenue is located approximately 75m east of the Kanata Avenue intersection. The City of Ottawa has requested that the driveway location be reviewed. This transportation study has been undertaken as an update to the Kanata Avenue and Goulbourn Forced Road Commercial Development Transportation Impact Study, June 2013.

The proposed development consists of a Coffee/Donut Shop with a Drive-Thru and four other commercial retail buildings as illustrated below. The site is anticipated to be occupied in 2018.

Proposed Site Plan



Date: June 28, 2017

The site is expected to generate 35 and 18 eastbound left turn movements during the AM and PM peak hours respectively. The eastbound (shared left/through lane) and westbound movements at the Kanata Avenue Site Access #1 are anticipated to operate at LOS A, with turning movements from the All Saints Driveway and the site operating at LOS C or better. The intersection of Kanata Avenue and GFR is anticipated to operate at a LOS A.

The study concludes:

1) The adjacent Major Collector roadways and intersections adjacent to the site are adequate enough to accommodate the increased commercial development site;
2) Sidewalks, bicycle lanes, and transit infrastructure are in place to accommodate all modes of transport within the area;
3) The surrounding area is developing. The inclusion of a local retail node should increase pedestrian and cycling mode share while reducing the need for residents to drive to more regional centres; and,
4) The Kanata Avenue access location is appropriate. The risk of collision at the access is low and the location is in keeping with the Complete Street philosophy.

Immediate geometric modifications are not required. All intersections are expected to operate adequately to the 2023 horizon year. However, it is recommended that the Kanata Avenue site access is monitored over time to identify any safety issues that may manifest. These include:

a) cross traffic between Site Access #1 and the All Saints High School bus loop driveway. As a mitigation measure, a "No Through Movement" restriction could be implemented in the northbound and southbound directions at the driveways; and,
b) an eastbound collision issue at the site driveway. As a mitigating measure, an eastbound left turn lane could be implemented by modifying the existing median, as illustrated below.

Potential Eastbound Left Turn Design

1.0 INTRODUCTION

1.1 Purpose

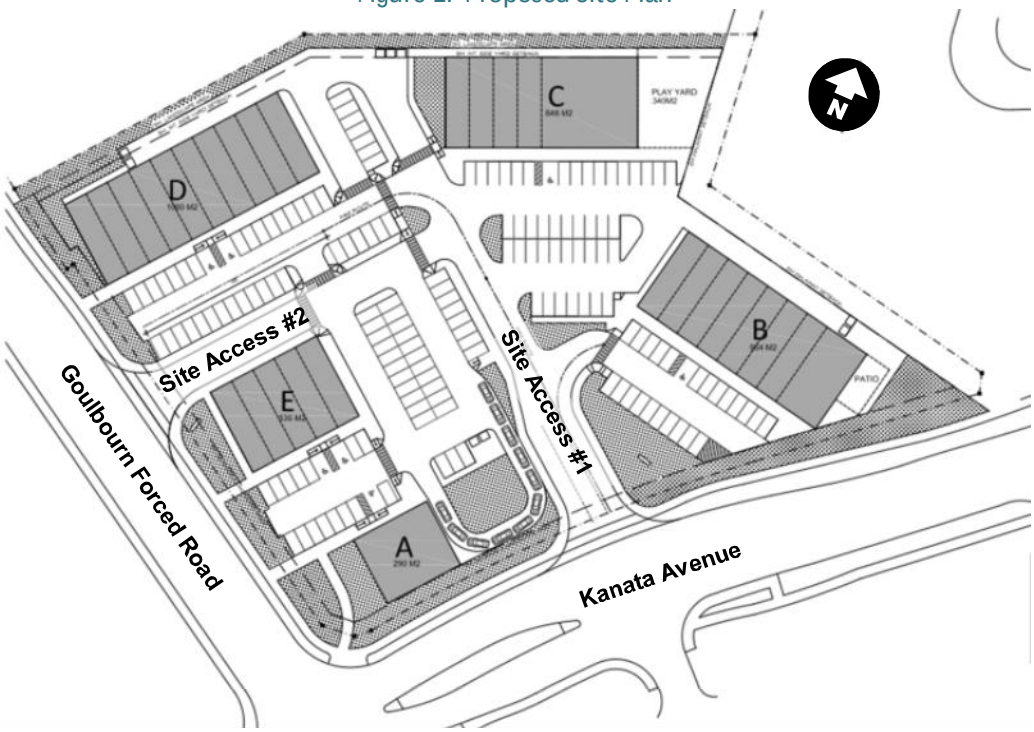
This report documents the transportation impacts and anticipated infrastructure requirements to accommodate the proposed development of a 39,634 ft^2 retail plaza with site access via Kanata Avenue and Goulbourn Forced Road (GFR). This report is in support of a site plan application at the northeast corner of Kanata Avenue and GFR and is an update to the transportation impact study completed by Dillon in June 2013.

1.2 Proposed Development

The development proposed by KNL consists of five standalone buildings totalling 39,634 ft^2 of retail space. The development proposal provides two full-movements access locations, one to GFR and one to Kanata Avenue.

The development is anticipated to be constructed and occupied by 2018. Figure 1 illustrates the proposed site plan. Table 1 indicates the proposed land use.

Figure 1: Proposed Site Plan



Date: June 28, 2017

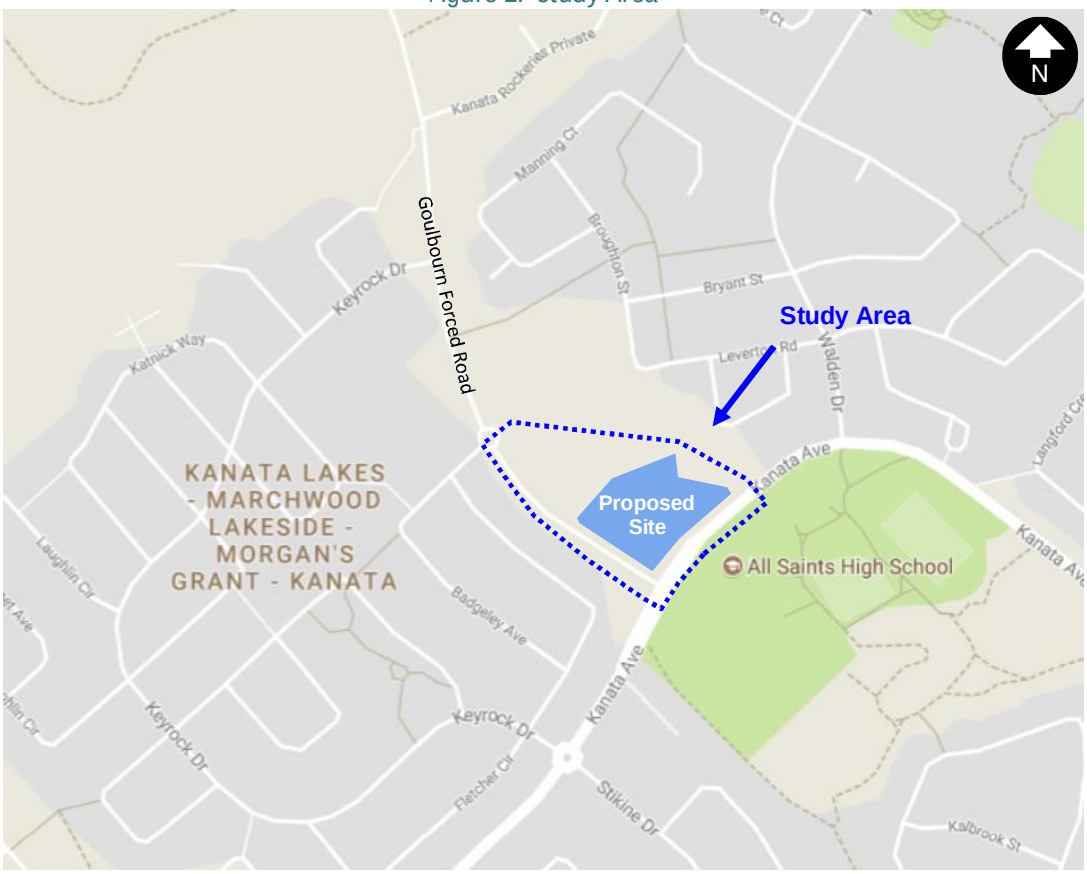
Table 1: Proposed Land Use

Building	Land Use Description	Square Metres	Square Feet
A	Coffee/Donut Shop with Drive-Through Window	290	3,122
B	Multi-Tenant Retail / Office / Personal Service	954	10,268
C	Multi-Tenant Retail / Office / Personal Service	848	9,128
D	Multi-Tenant Retail / Office / Personal Service	1,060	11,410
E	Multi-Tenant Retail / Office / Personal Service	530	5,705
	Total	3,682	39,633

1.3 Study Area

The subject site is located at the northeast corner of Kanata Avenue and GFR, in Kanata. The study area and site location are illustrated in Figure 2: Study Area

Figure 2: Study Area



Source: Google Maps, September 2017

2.0 SCOPE OF ANALYSIS

2.1 Study Horizons

The build out and occupancy of the proposed development is anticipated to occur in 2018. As such, the following horizon years were analyzed in this study:

Horizon Year 1: 2017 (Existing Traffic Operations)
Horizon Year 2: 2023 (Build out + 5 years)

2.2 Time Periods

The proposed development will have peak hour traffic flows similar to the peak traffic flows of the adjacent road network. As such, analysis was undertaken for the AM and PM peak weekday commuter hours.

2.3 General Parameters and Methods

As per the original 2013 TIS submission, this TIS has been prepared in accordance with the City of Ottawa's TIA Guidelines, October 2006.

The analysis was completed using Trafficware's *Synchro Software* version 8.0. For the two-way stop control and roundabout analysis, the *Highway Capacity Manual (HCM)* 2010 methodology was utilized; for the signalized intersection analysis, the HCM 2000 methodology was utilized since the HCM 2010 methodology does not provide overall intersection volume-to-capacity ratio as required by the City of Ottawa's TIA Guidelines.

3.0 EXISTING CONDITIONS

3.1 Road Network

Kanata Avenue and GFR are designated as Major Collector roads in the 2013 City of Ottawa Transportation Master Plan (TMP). Collector roads balance mobility and access to adjacent lands.

Kanata Avenue is a two-lane road that runs between Terry Fox Drive and the Highway 417 interchange at Castlefrank Road. Kanata Avenue has a posted speed limit of 40 km/hr in the vicinity of the study area. Kanata Avenue is undivided within the study area. An eastbound left turn lane and a westbound right turn lane are provided at the intersection of Kanata Avenue and GFR.

GFR has long been identified as a key north-south transportation spine for the Marchwood-Lakeside communities. GFR is a two-lane road between Kanata Avenue and the Terry Fox Drive/Innovation Drive intersection. GFR has a posted speed limit of 50 km/hr in the vicinity of the study area. A separate southbound left turn lane is provided at the intersection of Kanata Avenue and GFR.

Figure 3 illustrates the existing intersection geometry and traffic controls for the study area intersections.

3.2 Transit Network

The study area is serviced by two transit routes. Route 168 is a regular service route and route 268 is an express service route. Both routes pass directly in front of the study area. The routes are presented in Figure 4.

3.3 Pedestrian and Bicycle Facilities

There are existing sidewalks on both sides of Kanata Avenue and GFR within the study area. The Kanata Avenue / GFR intersection includes pedestrian push buttons and pedestrian signal count down timers. On road cycling lanes are provided on Kanata Avenue and along GFR north of Kanata Avenue to Keyrock Drive. North of Keyrock Drive, GFR is a narrow “forced” road with a rural cross-section without dedicated pedestrian or cycling facilities.

Figure 3: Existing Traffic Controls and Intersection Geometry

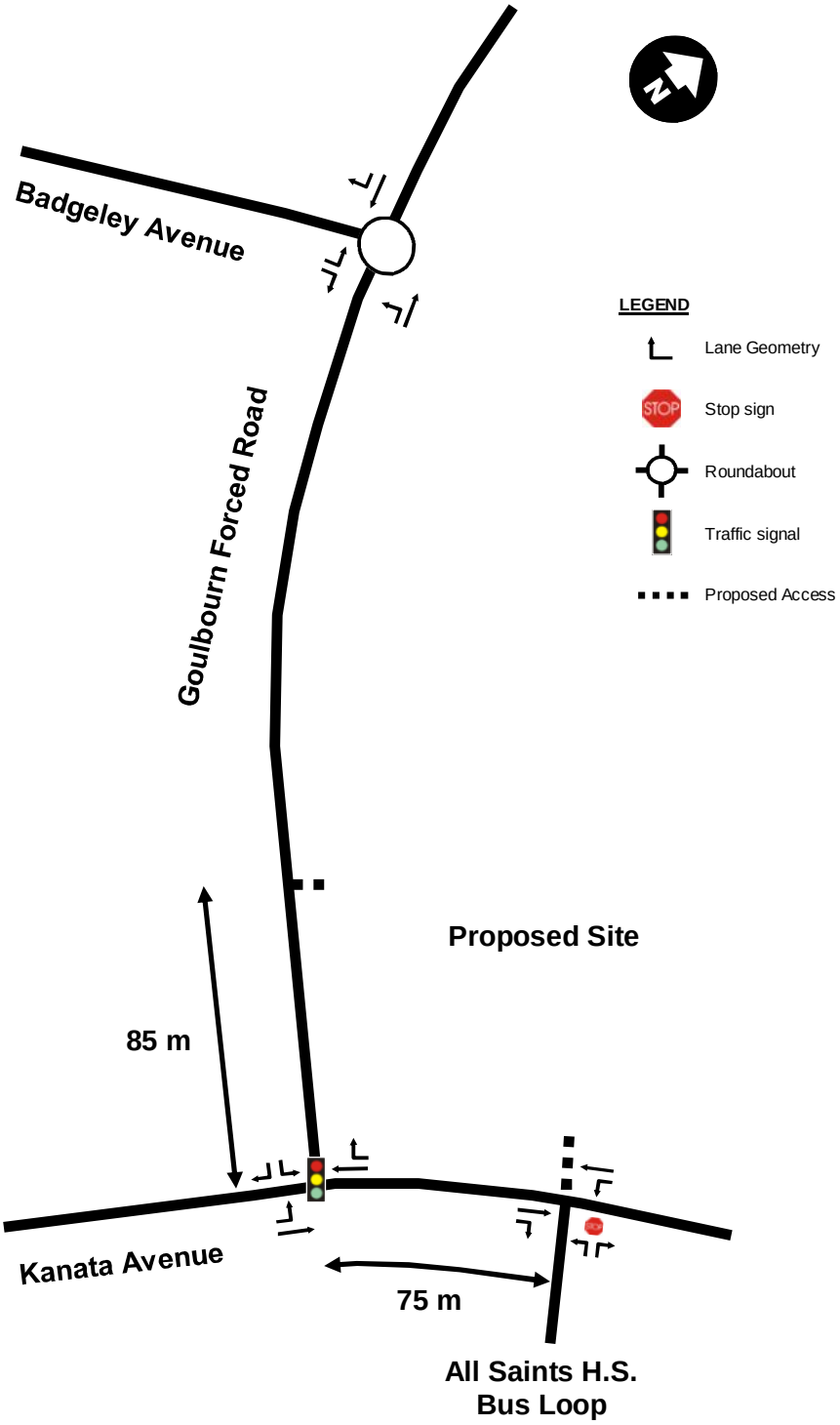
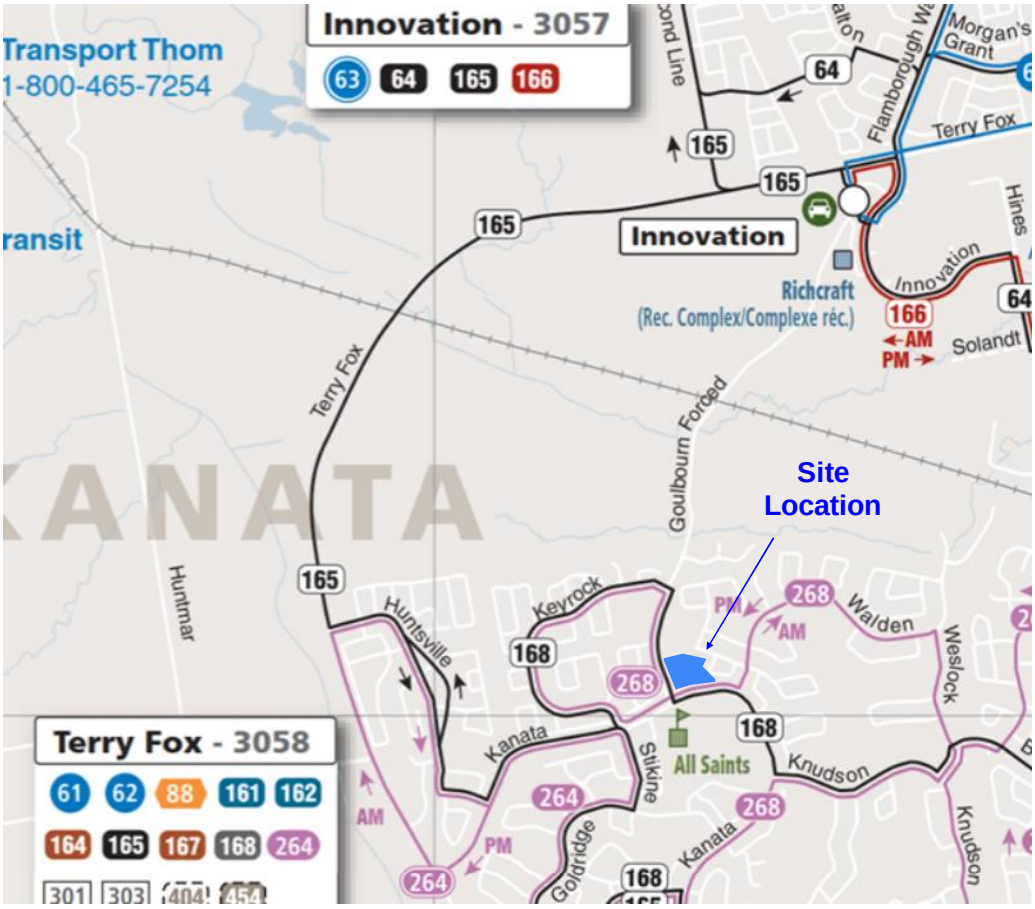


Figure 4: Existing Transit Routes



Source: OC Transpo System Map, September 2017

3.4 Existing Traffic Volumes

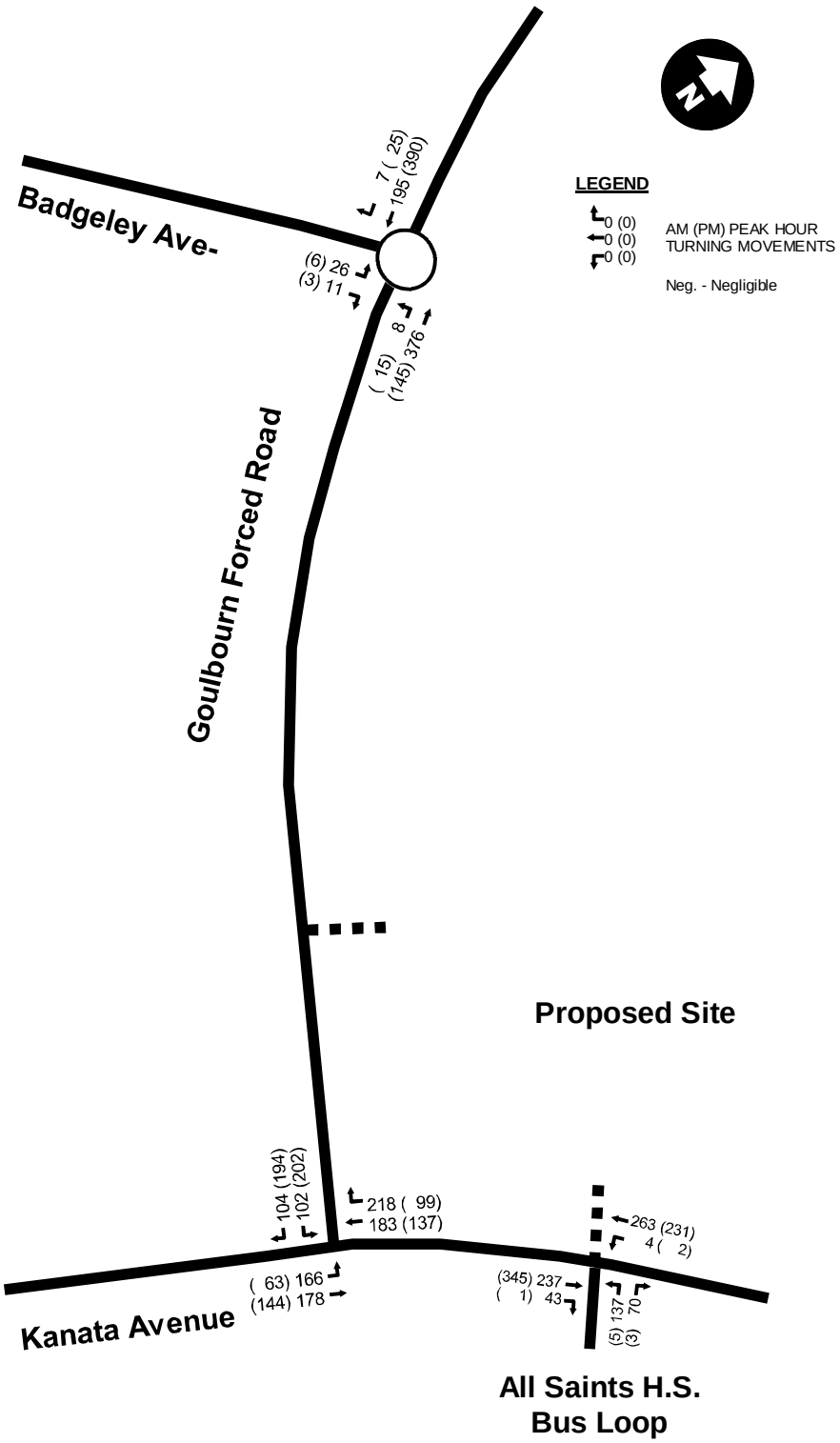
The intersections of GFR / Kanata Avenue and GFR / Badgeley Avenue were counted by Dillon in September 2017. Dillon staff observed the operation of the intersections during the traffic count periods and did not observe any unusual traffic operations.

Table 2 contains details of the traffic counts. Figure 5 shows the existing traffic volumes.

Table 2: Traffic Count Data and Sources

Intersection	Date of Count	Peak Periods	Origin
GFR and Kanata Avenue	Tuesday, September 12, 2017	AM and PM	Dillon
GFR and Badgeley Avenue	Tuesday, September 12, 2017	AM and PM	Dillon
Kanata Avenue and All Saints High School Bus Loop	Friday, September 15, 2017	AM and PM	Dillon

Figure 5: Existing Traffic Volumes



3.5 Existing Traffic Operations

Appendix A contains intersection Level of Service (LOS) definitions. Appendix B contains the Synchro intersection performance worksheets.

3.5.1 Kanata Avenue / GFR

Table 3 indicates the existing intersection operation of the Kanata Avenue / GFR intersection. The intersection operates very well with a LOS of A.

Table 3: Intersection Operations – Existing Traffic – Kanata Avenue / GFR

Peak Hour	LOS	Overall v/c	Delay (s)	v/c > 0.90
AM	A	0.36	6.7	None
PM	A	0.33	8.2	None

3.5.2 Kanata Avenue / All Saints Bus Loop Driveway

Table 4 indicates the existing Kanata Avenue / All Saints High School Bus Loop intersection operations. The intersection operates very well with a LOS of A.

Table 4: Intersection Operations – Existing Traffic – Kanata Avenue / All Saints H.S. Bus Loop

Movement	AM Peak Hour			PM Peak Hour		
	LOS	Delay (s)	Queue (veh.)	LOS	Delay (s)	Queue (veh.)
NBL	B	14.1	1.1	B	11.7	0.0
NBR	B	10.2	0.3	B	10.4	0.0
WBL	A	8.7	0.0	A	8.0	0.0

4.0 DEMAND FORECASTING

4.1 Site Trip Generation

The proposed development consists of five buildings with a total of 39,633 ft^2 of gross floor area. The Institute of Transportation Engineers (ITE) *Trip Generation Manual*, *8th Edition*, was utilized to estimate the number of vehicle trips generated for each building. Although tenants have not been identified, it has been assumed that a Coffee / Donut Shop with Drive-Through Window would be provided, with the remaining land use considered as Specialty Retail Centre.

Table 5 indicates the trip generation rates and directional split (inbound/outbound) for the two assumed land uses. Trip generation data was not available for the Specialty Retail Centre for the AM Peak Hour so the trip generation data for a Shopping Centre was used instead.

Table 5: ITE Auto Trip Generation Rates

ITE Code	Land Use Description	ITE Auto Trip Generation Rate (auto trips per 1,000 sq. **ft**. GFA)		Directional Split (Inbound/Outbound)	
		AM PeakHour	PM Peak Hour	AM Peak Hour	PM Peak Hour
937	Coffee/Donut Shop with Drive-Through Window	110.75	42.93	51% / 49%	50% / 50%
814	Specialty Retail Center	Not Available	2.71	None	44% / 56%
820	Shopping Centre	1.0	Not used	61% / 39%	Not used

Note: GFA means gross floor area.

Table 6 shows the site generated trips based on the ITE Trip Generation Rates. These are the 'base' values which do not include reductions to account for 'pass-by' trips and 'multi-purpose' trips which are discussed later.

Table 6: Base Site Generated Auto Trips by Building (ITE Mode Share)

Building	Assumed Land Use	AM Peak Hour			PM Peak Hour		
		In	Out	Total	In	Out	Total
A	Coffee/Donut Shop with Drive-Through Window	176	169	346	67	67	134
B	Speciality Retail Center	6	4	10	12	16	28
C	Speciality Retail Center	6	4	9	11	14	25
D	Speciality Retail Center	7	4	11	14	17	31
E	Speciality Retail Center	3	2	6	7	9	15
Total		199	184	382	111	122	233

The base site generated auto trips are calculated using trip generation rates from the ITE Trip Generation Manual. The ITE rates use data from a number of surveys taken around North America and do not necessarily reflect the trip making characteristics of the Kanata-Stittsville area. We have assumed that the ITE rates reflect a suburban location with higher auto mode share and lower alternative mode shares.

The ITE trip mode share is indicated in Table 7.

Table 7: ITE Trip Generation Mode Shares

Mode	Mode Share
Auto Driver	78%
Auto Passenger	15%
Transit	5%
Bicycle	1%
Pedestrian	1%

Table 8 indicates the base number of person trips anticipated to be generated by the development assuming the ITE Trip Generation Mode Shares discussed above.

Table 8: Base Site Generated Trips by Mode (ITE Mode Share)

	AM Peak Hour			PM Peak Hour		
	In	Out	Total	In	Out	Total
Auto Driver	199	184	382	111	122	233
Auto Passenger	38	35	74	21	24	45
Transit	13	12	25	7	8	15
Bicycle	3	2	5	1	2	3
Pedestrian	3	2	5	1	2	3
Total Person Trips	255	235	490	142	157	299

Table 9 presents the 2011 Ottawa TRANS O-D mode share for the Kanata-Stittsville district. Mode share was calculated as the average of the AM and PM peak hour mode shares for trips internal to the Kanata-Stittsville district. The 2011 Ottawa TRANS O-D survey results contain a category for 'other'. The 'other' trips have been added to auto driver and bicycle mode shares. As indicated, the Kanata-Stittsville auto driver share is lower than the assumed auto driver mode share in the ITE Trip Generation Manual.

Table 9: Kanata-Stittsville Average Mode Share within District

Mode	2011 TRANS O-D Adjusted Mode Share
Auto Driver	56%
Auto Passenger	20%
Transit	3%
Bicycle	5%
Pedestrian	16%
Other	0%

Table 10 indicates the base number of trips anticipated to be generated by the site for each travel mode based on the adjusted Kanata-Stittsville Mode Share.

Table 10: Base Site Generated Trips by Mode (Kanata-Stittsville Mode Share)

	AM Peak Hour			PM Peak Hour		
	In	Out	Total	In	Out	Total
Auto Driver	143	132	274	79	88	167
Auto Passenger	51	47	98	28	31	60
Transit	8	7	15	4	5	9
Bicycle	13	12	25	7	8	15
Pedestrian	40	38	78	23	25	48
Total Person Trips	255	235	490	142	157	299

Table 11 indicates the base number of auto trips anticipated to be generated by each building based on the Kanata-Stittsville mode shares.

Table 11: Base Site Generated Auto Trips by Building (Kanata-Stittsville Mode Share)

Building	AM Peak Hour			PM Peak Hour		
	In	Out	Total	In	Out	Total
A	127	122	248	48	48	96
B	4	3	7	9	11	20
C	4	3	7	8	10	18
D	5	3	8	10	12	22
E	2	2	4	5	6	11
Total	143	132	274	79	88	167

Of the trips generated by each land use, some trips will be 'pass-by' trips (i.e., a coffee/donut shop is unlikely to be the primary purpose of a trip). The ITE Trip Generation Manual was utilized to estimate the pass-by trip percentage.

The development consists of multiple buildings and land uses, therefore it has been assumed that some trips will visit another land use (i.e. multi-purpose), thus further reducing the overall trips to the site. Table 12 indicates the pass-by and multi-purpose trip reduction factors utilized to adjust the site generated auto trips.

Table 12: Pass-by and Multi-Purpose Trip Reduction Rates

Building	Assumed Land Use	Pass-by Trip Percentage	Multi-Purpose Trip Reduction
A	Coffee/Donut Shop with Drive-Through Window	50%	0%
B, C, D, E	Speciality Retail Center	15%	20%

Table 13 indicates the adjusted site generated auto trips separated by new and pass-by trips; the auto trips for buildings B, C, D, and E have been reduced by 20% to account for multi-purpose trips.

Table 13: Adjusted Site Generated Auto Trips by Building with New Trips and Pass-by Trips

Building	AM Peak Hour						PM Peak Hour					
	Total		New		Pass-By		Total		New		Pass-By	
	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out
A	127	122	65	60	62	62	48	48	24	24	24	24
B	4	2	3	2	0	0	7	9	6	8	1	1
C	3	2	3	2	0	0	6	8	5	7	1	1
D	4	3	4	2	0	0	8	10	6	9	1	1
E	2	1	2	1	0	0	4	5	3	4	1	1
Total	139	130	76	66	64	64	73	80	45	52	28	28

4.2 Trip Distribution & Assignment

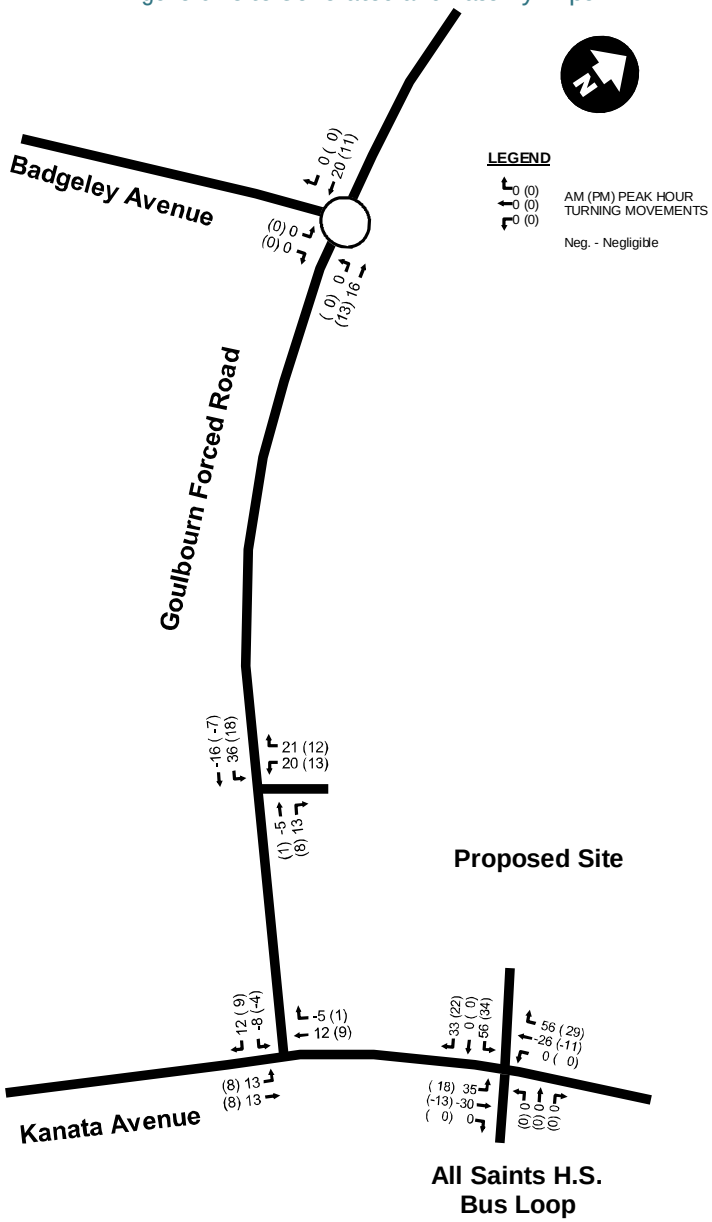
Dillon reviewed the existing turning movement characteristics within the study area and determined that approximately 40% of traffic is going to or from the east on Kanata Avenue, 35% is going to or from the west on Kanata Avenue and 25% is going to or from the north on GFR.

Table 14 provides a summary of the trip distribution assumed for this study.
Figure 6 illustrates the assignment of site traffic generated by the proposed development.

Table 14: Trip Distribution

Direction (to/from)	Distribution	Roads Facilitating Travel
East	40%	Kanata Avenue
West	35%	Kanata Avenue
North	25%	Goulbourn Forced Road
Total	100%	

Figure 6: Site Generated and Pass-By Trips



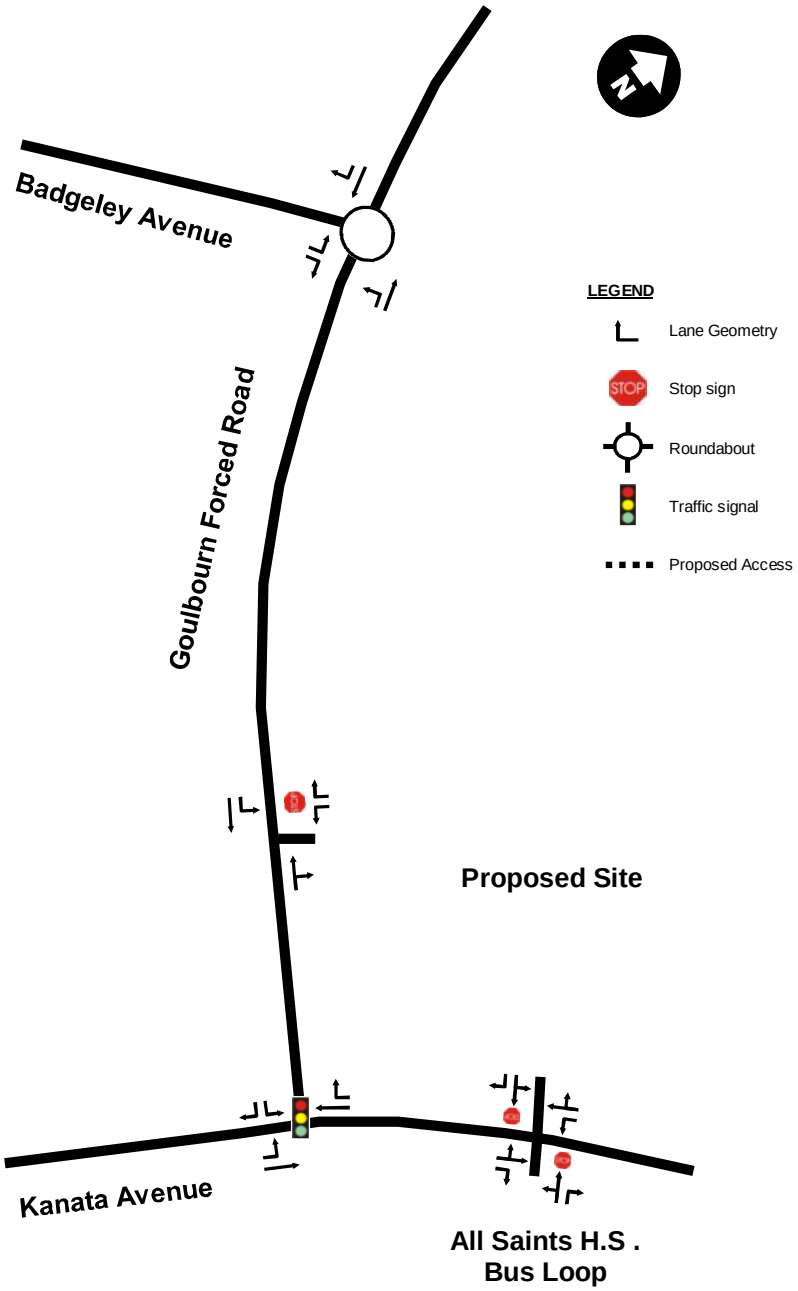
Note: Negative values are due to pass-by trips, i.e. vehicles that were previously traveling on the road network turn left into the new site.

5.0 FUTURE CONDITIONS

5.1 Road Network

The TMP indicates no planned roadway modifications within the study area road network. Figure 7 illustrates the 2023 assumed traffic control and lane geometry.

Figure 7: 2023 Assumed Traffic Control and Intersection Geometry



5.2 Transit Network

Chapter 5 of the TMP outlines the City's relevant policies regarding transit. The Innovation Park and Ride was recently completed at the intersection of Terry Fox Drive and Innovation Drive, with a planned future expansion; however, this is not anticipated to impact the site. The extension of light rail transit west to Kanata is also not expected to impact the site.

5.3 Pedestrian and Bicycle Facilities

The TMP states that the City requires the provision of sidewalks on both sides of arterial and collector roads in urban areas, and on new roads and reconstructed roads where physical constraints allow.

Kanata Avenue and the southern portion of GFR currently have sidewalks and on-road cycling lanes. No further improvements are anticipated with regards to pedestrian facilities.

5.4 Background Auto Volumes

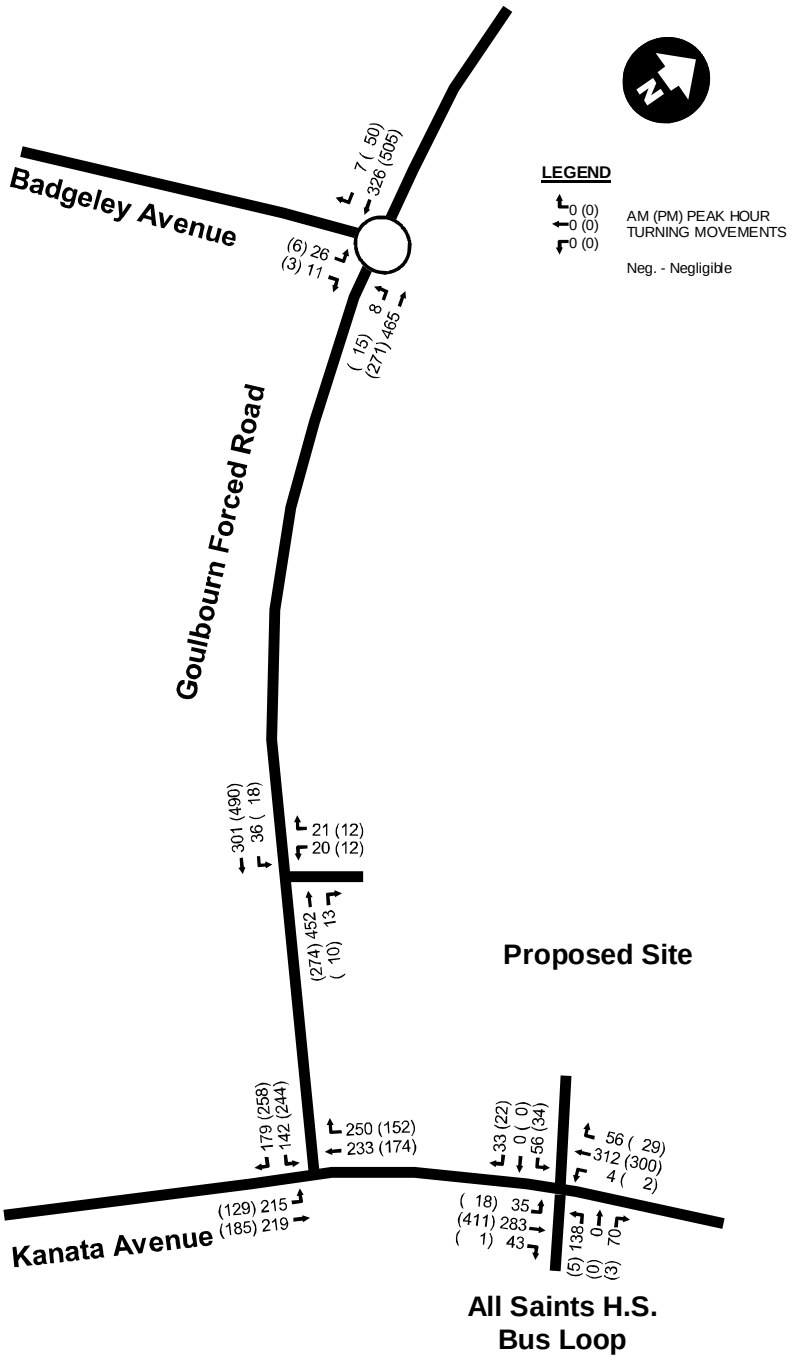
The proposed development is anticipated to be constructed and occupied in the year 2018. As per City of Ottawa TIA Guidelines, the analysis included an evaluation of traffic conditions five years post development, for the 2023 horizon year.

The 2023 traffic volumes were forecasted by applying a 2% annual compound growth rate to 2017 traffic volumes in addition to explicitly accounting for KNL Phase 9 site generated traffic as per Dillon's report, *Kanata North Phase 9 Transportation Impact Study, July 2014*.

5.5 2023 Total Auto Conditions

The 2023 total traffic condition represents site operations with the development in place. The traffic volumes were estimated by adding site generated traffic to the 2023 background traffic discussed in the previous section. Figure 8 illustrates total auto volumes for the 2023 time horizon.

Figure 8: 2023 Auto Volumes



The following sections discuss the performance of the study area intersections under 2023 total auto volumes. Detailed intersection performance worksheets are included in Appendix B.

5.5.1 Kanata Avenue / GFR

Table 15 indicates the 2023 traffic operations for the Kanata Avenue / GFR signalized intersection. The intersection operates at a LOS of A and, therefore, mitigation is not required.

Table 15: Intersection Operations – 2023 Traffic – Kanata Avenue / GFR

Peak Hour	LOS	Overall v/c	Delay (s)	v/c > 0.90
AM	A	0.48	8.3	None
PM	A	0.42	9.3	None

5.5.2 GFR / Site Access #2

Table 16 indicates the 2023 traffic operations for the GFR / Site Access #2 intersection. All turning movements operate at a LOS B or better and, therefore, mitigation is not required.

Table 16: Intersection Operations – 2023 Traffic – GFR / Site Access #2

Movement	AM Peak Hour			PM Peak Hour		
	LOS	Delay (s)	Queue (veh.)	LOS	Delay (s)	Queue (veh.)
WBL	B	13.9	0.2	B	13.6	0.1
WBR	B	11.5	0.1	A	9.9	0.1
SBL	A	8.5	0.1	A	7.9	0.0

5.5.3 Kanata Avenue / All Saints Bus Loop Driveway / Site Access #1

Table 17 indicates the 2023 traffic operations for the Kanata Avenue / All Saints Bus Loop Driveway / Site Access #1. All turning movements operate at a LOS of C or better and, therefore, mitigation is not required.

Table 17: Intersection Operations – 2023 Traffic – Kanata Avenue / All Saints H.S. Bus Loop Driveway / Site Access #1

Movement	AM Peak Hour			PM Peak Hour		
	LOS	Delay (s)	Queue (veh.)	LOS	Delay (s)	Queue (veh.)
NBLT	C	20.6	1.8	B	14.3	0.0
NBR	B	10.6	0.4	B	10.9	0.0
EBLT	A	0.9	0.1	A	0.3	0.0
WBL	A	8.9	0.0	A	8.2	0.0
SBLT	C	15.9	0.5	B	14.9	0.3
SBR	B	10.6	0.2	B	10.3	0.1

Note: NBLT means northbound left and through movements are shared

It should be noted that an eastbound left turn lane at the site access was not considered for the above analysis. The additional turn lane would reduce delay to eastbound through vehicles; however, it would result in a five lane cross-section which Dillon believes is not appropriate for a Collector roadway and it prioritizes vehicle movement above the safety and comfort of other modes of transportation. Given the location of the site directly across from a high school, it is especially important to create a safe and comfortable environment for pedestrians and cyclists.

As the above analysis shows, the intersection of Kanata Avenue and the All Saints High School Bus Loop / Site Access #1 will operate well without the eastbound left turn lane. The other study area intersections are also expected to operate well and therefore no mitigation is recommended.

6.0 KANATA AVENUE SITE ACCESS DESIGN

The City of Ottawa requested a detailed evaluation of the proposed site access opposite the All Saints High School Bus Loop driveway. The following have been considered:

- Traffic volume accessing the Kanata Avenue site driveway;
- Eastbound left turn conflicts with westbound lanes;
- Kanata Avenue / GFR westbound queue potential impacts on site driveway;
- Eastbound slip around safety concern;
- Safety of cross traffic between the Site and the All-Saints Driveway; and,
- Complete street philosophy.

6.1 Kanata Avenue Site Driveway Traffic Volume

The site is anticipated to generate 35 eastbound left turns from Kanata Avenue during the AM peak hour and 18 eastbound left turns during the PM peak hour. The eastbound left turn traffic volume is relatively low. The combined eastbound left and through lane delay is 0.9 seconds per vehicle. Therefore, an eastbound left turn lane is not needed to address auto capacity or delay issues.

6.2 Kanata Avenue / GFR Westbound Queue Conflict with Site Driveway

By the 2023 horizon year, the KNL Phases 7 and 9 are anticipated to be fully built-out. The westbound traffic queue at the Kanata Avenue / GFR intersection has been calculated by Synchro to extend 28 metres from the stop bar location. As such, the traffic queues at the intersection are not anticipated to block access to the site driveway during the peak commuter hours. Therefore, westbound queuing at the intersection will not impact the site access.

6.3 Eastbound Left Turn Safety Crossing Westbound Lanes

The proposed access is located within the westbound right turn taper to GFR. Eastbound left turning traffic are required to cross the westbound through, cycling and right turn lane, and must consider traffic in the westbound left turn lane to the All Saints High School Bus Loop. Kanata Avenue provides clear sightlines in the eastbound direction at the proposed site driveway, therefore, eastbound left turning traffic will have very good sight lines the majority of the time. The eastbound left turn sightlines will be obscured by the presence of westbound left turning vehicles; however, westbound left turn volume is very low (4 and 2 veh/h during the AM and PM peak hours, respectively), and risk of collision is low.

6.4 Safety of Cross Traffic between the Site and the All-Saints Driveway

City staff raised concern regarding vehicles traveling between the Kanata Avenue site driveway and the All Saints High School Bus Loop driveway. Given the proximity of these land uses, it is very likely that

most students would walk between the two land uses signals. Traffic volume between the school and the proposed site is expected to be very low. However, vehicles wishing to make these maneuvers will experience delays up to 28 seconds during peak hours. It is recommended that the Kanata Avenue site access is monitored over time to determine if cross traffic manifests into a collision issue. A "No Through Movement" restriction could be implemented in the northbound and southbound directions at the driveways if a safety concern manifests.

6.5 Eastbound Slip Around In Right Turn Lane

Kanata Avenue provides an eastbound right turn lane to the All Saints High School bus loop driveway, which is directly opposite the site access. City staff raised a potential concern regarding eastbound through traffic utilizing the eastbound right turn lane as a slip around, creating a conflict with westbound left-turning traffic into the school driveway.

The forecasted eastbound left turn traffic volumes (35 and 18 veh/h during the AM and PM peak hours) are low. The westbound left turns to the All Saints High School bus loop are very low (4 and 2 veh/h during the AM and PM peak hours, respectively). Queues and delays to eastbound left turn vehicles are low, anticipated to be 8 seconds per turning vehicle with queues of less than one vehicle. An eastbound through vehicle slipping around an eastbound left turning vehicle would be visible to a westbound left turning vehicle, and speeds will be low. Collision risk between westbound left turns and eastbound slip vehicles is expected to be low. It is recommended that the driveway operations are monitored and mitigations measures implemented should a collision issue manifest.

Figure 9 illustrates a potential eastbound left turn lane design with a short taper that can be implemented if a collision issue manifest.

Figure 9: Potential Eastbound Left Turn Design

6.6 Complete Street Philosophy

The City of Ottawa adopted a Complete Streets philosophy in 2015. The philosophy recognizes that street design must serve the residents that live, play, and learn within their neighbourhoods. The policy seeks to balance the quality of life for the adjacent neighbours over the movement of automobiles.

Kanata Avenue and GFR are both classified as collector roadways. In the past, these roadways have performed the function of moving cars through the corridor. There are a number of All-Way Stop controlled intersections along Kanata Avenue, indicating a history of neighbourhood concern regarding traffic volume and speed, as these intersections are now acting as traffic calming measures, in addition to providing traffic control.

The lane geometry of Kanata Avenue immediately east of the GFR intersection provides a westbound right turn lane, a cycling lane, and a through travel lane. In the eastbound direction, the roadway provides a through travel lane, a cycling lane and a right turn lane into the All Saints High School. The roadway cross-section, with the various turning lanes, is generally not in keeping with a residential collector roadway function. The turning lanes promote higher speed operation and higher traffic volumes, which are not in keeping with the residential character of the neighbourhood or the Complete Streets philosophy. Over the long term, the City should consider the operating environment of Kanata Avenue and consider designs that are more pedestrian and cycling friendly as compared to the existing wide roadway and auxiliary turn lane design. Also, the intersection of Kanata Avenue / GFR may be more appropriate as a roundabout, which is more in keeping with the Complete Street philosophy.

Kanata Avenue provides direct access to local streets, public parks, schools and commercial lands. The roadway supports high volumes of pedestrians, cyclists, and active modes users. The function of a collector roadway is to balance access and mobility, and travel speeds are intended to be kept low. As such, providing access to the site as proposed by KNL is in keeping with the Complete Street philosophy.

7.0 CONCLUSIONS AND RECOMMENDATIONS

The subject site is located on the northeast corner of the Goulbourn Forest Road and Kanata Avenue intersection in Kanata.

The proposed development is anticipated to be constructed and occupied by 2018 and consists of:

- A total development site of 39,634 ft^2 retail plaza; and,
- Five buildings with a variety of retail land uses.

7.1 Conclusions

1) The adjacent Major Collector roadways and intersections adjacent to the site are adequate to accommodate the increased commercial development site;
2) Sidewalks, bicycle lanes, and transit infrastructure are in place to accommodate all modes of transport within the area;
3) The surrounding area is developing. The inclusion of a local retail node should increase pedestrian and cycling mode share while reducing the need for residents to drive to more regional centres; and,
4) The Kanata Avenue access location is appropriate. The risk of collision at the access is low and the location is in keeping with the Complete Street philosophy.

7.2 Recommendations

1. It is recommended that the Kanata Avenue site access is monitored over time to identify any safety issues that may manifest, these include:
   a) cross traffic between the Site and the All Saints High School bus loop driveway manifests in a collision issue, a "No Through Movement" restriction could be implemented in the northbound and southbound directions at the driveways; and,
   b) an eastbound collision issue at the site driveway. As a mitigating measure, an eastbound left turn lane could be implemented by modifying the existing median, as illustrated in Figure 9.
2. Immediate geometric modifications are not required; all intersections are expected to operate adequately to the 2023 horizon year.

Appendix A

Level of Service Definitions

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.

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

LEVEL OF SERVICE DEFINITIONS

To assist in clarifying the arithmetic analysis associated with traffic engineering, it is often useful to refer to Level of Service (LOS). The term LOS implies a qualitative measure of traffic flow at an intersection. It is dependent upon vehicle delay and vehicle queue lengths at the approaches. The LOS is usually calculated in terms of the ratio between traffic volumes and approach capacity, or Volume to Capacity (V/C) ratio.

The City of Ottawa has adopted criteria that directly relate the V/C ratio of a signalized intersection to a LOS rating.

The following table describes the categories and characteristics of each level:

LOS	FEATURES	V/C RATIO
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.	0-0.60
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.	0.61-0.70
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.	0.71-0.80
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.	0.81-0.90
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.	0.91-1.00
F	At this level, saturation occurs, with vehicle demand exceeding the available capacity.	> 1.00

Appendix B

Detailed Synchro Reports

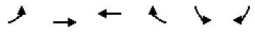
Intersection	
Int Delay, s/veh	3.6

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	237	43	4	263	138	70
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	150	250	-	0	60
Veh in Median Storage, #	0	-	-	0	1	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	6	47	75	3	20	7
Mvmt Flow	258	47	4	286	150	76

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	258	0	553	258
Stage 1	-	-	-	-	258	-
Stage 2	-	-	-	-	295	-
Critical Hdwy	-	-	4.85	-	6.6	6.27
Critical Hdwy Stg 1	-	-	-	-	5.6	-
Critical Hdwy Stg 2	-	-	-	-	5.6	-
Follow-up Hdwy	-	-	2.875	-	3.68	3.363
Pot Cap-1 Maneuver	-	-	979	-	465	769
Stage 1	-	-	-	-	745	-
Stage 2	-	-	-	-	716	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	979	-	463	769
Mov Cap-2 Maneuver	-	-	-	-	544	-
Stage 1	-	-	-	-	745	-
Stage 2	-	-	-	-	713	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.1	12.8
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	544	769	-	-	979	-
HCM Lane V/C Ratio	0.276	0.099	-	-	0.004	-
HCM Control Delay (s)	14.1	10.2	-	-	8.7	-
HCM Lane LOS	B	B	-	-	A	-
HCM 95th %tile Q(veh)	1.1	0.3	-	-	0	-



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	166	178	183	218	102	104
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1626	1534	1561	1441	1595	1469
Flt Permitted	0.62	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1054	1534	1561	1441	1595	1469
Peak-hour factor, PHF	0.80	0.80	0.80	0.80	0.80	0.80
Adj. Flow (vph)	208	222	229	272	128	130
RTOR Reduction (vph)	0	0	0	120	0	97
Lane Group Flow (vph)	208	222	229	152	128	33
Heavy Vehicles (%)	4%	16%	14%	5%	6%	3%
Turn Type	Perm	NA	NA	Perm	Perm	Perm
Protected Phases		2	6			
Permitted Phases	2			6	4	4
Actuated Green, G (s)	22.1	22.1	22.1	22.1	9.2	9.2
Effective Green, g (s)	23.6	23.6	23.6	23.6	10.7	10.7
Actuated g/C Ratio	0.56	0.56	0.56	0.56	0.25	0.25
Clearance Time (s)	5.5	5.5	5.5	5.5	5.5	5.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	588	855	870	803	403	371
v/s Ratio Prot		0.14	0.15			
v/s Ratio Perm	c0.20			0.11	c0.08	0.02
v/c Ratio	0.35	0.26	0.26	0.19	0.32	0.09
Uniform Delay, d1	5.1	4.8	4.8	4.6	12.8	12.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.4	0.2	0.2	0.1	0.5	0.1
Delay (s)	5.5	5.0	5.0	4.7	13.3	12.2
Level of Service	A	A	A	A	B	B
Approach Delay (s)		5.2	4.9		12.7	
Approach LOS		A	A		B	

Intersection Summary			
HCM 2000 Control Delay	6.7	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.36		
Actuated Cycle Length (s)	42.3	Sum of lost time (s)	9.5
Intersection Capacity Utilization	51.7%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Intersection	
Intersection Delay, s/veh	7.1
Intersection LOS	A

Approach	EB	NB	SB
Entry Lanes	1	1	1
Conflicting Circle Lanes	1	1	1
Adj Approach Flow, veh/h	44	451	237
Demand Flow Rate, veh/h	47	471	246
Vehicles Circulating, veh/h	238	33	11
Vehicles Exiting, veh/h	19	252	493
Follow-Up Headway, s	3.186	3.186	3.186
Ped Vol Crossing Leg, #/h	0	0	0
Ped Cap Adj	1.000	1.000	1.000
Approach Delay, s/veh	4.8	8.2	5.4
Approach LOS	A	A	A

Lane	Left	Left	Left
Designated Moves	LR	LT	TR
Assumed Moves	LR	LT	TR
RT Channelized			
Lane Util	1.000	1.000	1.000
Critical Headway, s	5.193	5.193	5.193
Entry Flow, veh/h	47	471	246
Cap Entry Lane, veh/h	891	1093	1118
Entry HV Adj Factor	0.936	0.958	0.963
Flow Entry, veh/h	44	451	237
Cap Entry, veh/h	834	1048	1076
V/C Ratio	0.053	0.431	0.220
Control Delay, s/veh	4.8	8.2	5.4
LOS	A	A	A
95th %tile Queue, veh	0	2	1

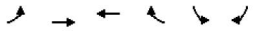
Intersection	
Int Delay, s/veh	0.2

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	345	1	2	231	5	3
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	150	250	-	0	60
Veh in Median Storage, #	0	-	-	0	1	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	1	0	0	4	0	0
Mvmt Flow	375	1	2	251	5	3

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	375	0	630	375
Stage 1	-	-	-	-	375	-
Stage 2	-	-	-	-	255	-
Critical Hdwy	-	-	4.1	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	-	-	2.2	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	1195	-	449	676
Stage 1	-	-	-	-	699	-
Stage 2	-	-	-	-	792	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1195	-	448	676
Mov Cap-2 Maneuver	-	-	-	-	541	-
Stage 1	-	-	-	-	699	-
Stage 2	-	-	-	-	791	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.1	11.2
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	541	676	-	-	1195	-
HCM Lane V/C Ratio	0.01	0.005	-	-	0.002	-
HCM Control Delay (s)	11.7	10.4	-	-	8	-
HCM Lane LOS	B	B	-	-	A	-
HCM 95th %tile Q(veh)	0	0	-	-	0	-



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	63	144	137	99	202	194
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1642	1762	1712	1469	1658	1469
Flt Permitted	0.65	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1122	1762	1712	1469	1658	1469
Peak-hour factor, PHF	0.80	0.80	0.80	0.80	0.80	0.80
Adj. Flow (vph)	79	180	171	124	252	242
RTOR Reduction (vph)	0	0	0	74	0	146
Lane Group Flow (vph)	79	180	171	50	252	96
Heavy Vehicles (%)	3%	1%	4%	3%	2%	3%
Turn Type	Perm	NA	NA	Perm	Perm	Perm
Protected Phases		2	6			
Permitted Phases	2			6	4	4
Actuated Green, G (s)	14.7	14.7	14.7	14.7	14.3	14.3
Effective Green, g (s)	16.2	16.2	16.2	16.2	15.8	15.8
Actuated g/C Ratio	0.40	0.40	0.40	0.40	0.40	0.40
Clearance Time (s)	5.5	5.5	5.5	5.5	5.5	5.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	454	713	693	594	654	580
v/s Ratio Prot		c0.10	0.10			
v/s Ratio Perm	0.07			0.03	c0.15	0.07
v/c Ratio	0.17	0.25	0.25	0.08	0.39	0.16
Uniform Delay, d1	7.6	7.9	7.9	7.3	8.6	7.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.2	0.2	0.2	0.1	0.4	0.1
Delay (s)	7.8	8.1	8.1	7.4	9.0	8.0
Level of Service	A	A	A	A	A	A
Approach Delay (s)		8.0	7.8		8.5	
Approach LOS		A	A		A	

Intersection Summary			
HCM 2000 Control Delay	8.2	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.33		
Actuated Cycle Length (s)	40.0	Sum of lost time (s)	9.5
Intersection Capacity Utilization	55.1%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Intersection	
Intersection Delay, s/veh	7.2
Intersection LOS	A

Approach	EB	NB	SB
Entry Lanes	1	1	1
Conflicting Circle Lanes	1	1	1
Adj Approach Flow, veh/h	11	189	488
Demand Flow Rate, veh/h	11	192	497
Vehicles Circulating, veh/h	468	7	18
Vehicles Exiting, veh/h	47	472	181
Follow-Up Headway, s	3.186	3.186	3.186
Ped Vol Crossing Leg, #/h	0	0	0
Ped Cap Adj	1.000	1.000	1.000
Approach Delay, s/veh	5.2	4.8	8.2
Approach LOS	A	A	A

Lane	Left	Left	Left
Designated Moves	LR	LT	TR
Assumed Moves	LR	LT	TR
RT Channelized			
Lane Util	1.000	1.000	1.000
Critical Headway, s	5.193	5.193	5.193
Entry Flow, veh/h	11	192	497
Cap Entry Lane, veh/h	708	1122	1110
Entry HV Adj Factor	1.000	0.982	0.982
Flow Entry, veh/h	11	189	488
Cap Entry, veh/h	708	1102	1089
V/C Ratio	0.016	0.171	0.448
Control Delay, s/veh	5.2	4.8	8.2
LOS	A	A	A
95th %tile Queue, veh	0	1	2

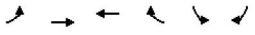
Intersection	
Int Delay, s/veh	5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	35	283	43	4	312	56	138	0	70	56	0	33
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	150	250	-	-	-	-	60	-	-	60
Veh in Median Storage, #	-	0	-	-	0	-	-	1	-	-	1	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	0	7	47	75	4	0	20	0	7	0	0	0
Mvmt Flow	38	308	47	4	339	61	150	0	76	61	0	36

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	400	0	0	308	0	0	762	793	308	762	762	370
Stage 1	-	-	-	-	-	-	384	384	-	378	378	-
Stage 2	-	-	-	-	-	-	378	409	-	384	384	-
Critical Hdwy	4.1	-	-	4.85	-	-	7.3	6.5	6.27	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.3	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.3	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.875	-	-	3.68	4	3.363	3.5	4	3.3
Pot Cap-1 Maneuver	1170	-	-	933	-	-	300	323	720	324	337	680
Stage 1	-	-	-	-	-	-	604	615	-	648	619	-
Stage 2	-	-	-	-	-	-	609	600	-	643	615	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1170	-	-	933	-	-	274	308	720	280	322	680
Mov Cap-2 Maneuver	-	-	-	-	-	-	379	402	-	392	421	-
Stage 1	-	-	-	-	-	-	579	590	-	621	616	-
Stage 2	-	-	-	-	-	-	574	597	-	551	590	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.8	0.1	17.2	13.9
HCM LOS			C	B

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	379	720	1170	-	-	933	-	-	392	680
HCM Lane V/C Ratio	0.396	0.106	0.033	-	-	0.005	-	-	0.155	0.053
HCM Control Delay (s)	20.6	10.6	8.2	0	-	8.9	-	-	15.9	10.6
HCM Lane LOS	C	B	A	A	-	A	-	-	C	B
HCM 95th %tile Q(veh)	1.8	0.4	0.1	-	-	0	-	-	0.5	0.2



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	215	219	233	250	142	179
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1626	1548	1589	1441	1610	1483
Flt Permitted	0.58	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	986	1548	1589	1441	1610	1483
Peak-hour factor, PHF	0.80	0.80	0.80	0.80	0.80	0.80
Adj. Flow (vph)	269	274	291	312	178	224
RTOR Reduction (vph)	0	0	0	146	0	157
Lane Group Flow (vph)	269	274	291	166	178	67
Heavy Vehicles (%)	4%	15%	12%	5%	5%	2%
Turn Type	Perm	NA	NA	Perm	Perm	Perm
Protected Phases		2	6			
Permitted Phases	2			6	4	4
Actuated Green, G (s)	23.6	23.6	23.6	23.6	12.5	12.5
Effective Green, g (s)	25.1	25.1	25.1	25.1	14.0	14.0
Actuated g/C Ratio	0.53	0.53	0.53	0.53	0.30	0.30
Clearance Time (s)	5.5	5.5	5.5	5.5	5.5	5.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	525	824	846	767	478	440
v/s Ratio Prot		0.18	0.18			
v/s Ratio Perm	c0.27			0.12	c0.11	0.04
v/c Ratio	0.51	0.33	0.34	0.22	0.37	0.15
Uniform Delay, d1	7.1	6.2	6.3	5.8	13.1	12.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.8	0.2	0.2	0.1	0.5	0.2
Delay (s)	7.9	6.5	6.5	6.0	13.6	12.3
Level of Service	A	A	A	A	B	B
Approach Delay (s)		7.2	6.2		12.9	
Approach LOS		A	A		B	

Intersection Summary			
HCM 2000 Control Delay	8.3	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.48		
Actuated Cycle Length (s)	47.1	Sum of lost time (s)	9.5
Intersection Capacity Utilization	51.7%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Intersection	
Int Delay, s/veh	1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	20	21	452	13	36	301
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	60	-	-	250	-
Veh in Median Storage, #	1	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	0	4	0	0	3
Mvmt Flow	22	23	491	14	39	327

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	903	498	0	0	505	0
Stage 1	498	-	-	-	-	-
Stage 2	405	-	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	310	576	-	-	1070	-
Stage 1	615	-	-	-	-	-
Stage 2	678	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	299	576	-	-	1070	-
Mov Cap-2 Maneuver	425	-	-	-	-	-
Stage 1	615	-	-	-	-	-
Stage 2	653	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	12.7	0	0.9
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	425	576	1070	-
HCM Lane V/C Ratio	-	-	0.051	0.04	0.037	-
HCM Control Delay (s)	-	-	13.9	11.5	8.5	-
HCM Lane LOS	-	-	B	B	A	-
HCM 95th %tile Q(veh)	-	-	0.2	0.1	0.1	-

Intersection	
Int Delay, s/veh	1.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	18	411	1	2	300	29	5	0	3	34	0	22
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	150	250	-	-	-	-	60	-	-	60
Veh in Median Storage, #	-	0	-	-	0	-	-	1	-	-	1	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	0	1	0	0	3	0	0	0	0	0	0	0
Mvmt Flow	20	447	1	2	326	32	5	0	3	37	0	24

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	358	0	0	447	0	0	832	848	447	832	832	342
Stage 1	-	-	-	-	-	-	486	486	-	346	346	-
Stage 2	-	-	-	-	-	-	346	362	-	486	486	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	1212	-	-	1124	-	-	291	301	616	291	307	705
Stage 1	-	-	-	-	-	-	566	554	-	674	639	-
Stage 2	-	-	-	-	-	-	674	629	-	566	554	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1212	-	-	1124	-	-	276	294	616	284	300	705
Mov Cap-2 Maneuver	-	-	-	-	-	-	394	395	-	401	402	-
Stage 1	-	-	-	-	-	-	554	542	-	659	638	-
Stage 2	-	-	-	-	-	-	650	628	-	551	542	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.3	0	13	13.1
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	394	616	1212	-	-	1124	-	-	401	705
HCM Lane V/C Ratio	0.014	0.005	0.016	-	-	0.002	-	-	0.092	0.034
HCM Control Delay (s)	14.3	10.9	8	0	-	8.2	-	-	14.9	10.3
HCM Lane LOS	B	B	A	A	-	A	-	-	B	B
HCM 95th %tile Q(veh)	0	0	0	-	-	0	-	-	0.3	0.1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	129	185	174	152	244	258
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1658	1762	1712	1483	1658	1483
Flt Permitted	0.62	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1085	1762	1712	1483	1658	1483
Peak-hour factor, PHF	0.80	0.80	0.80	0.80	0.80	0.80
Adj. Flow (vph)	161	231	218	190	305	322
RTOR Reduction (vph)	0	0	0	98	0	212
Lane Group Flow (vph)	161	231	218	92	305	110
Heavy Vehicles (%)	2%	1%	4%	2%	2%	2%
Turn Type	Perm	NA	NA	Perm	Perm	Perm
Protected Phases		2	6			
Permitted Phases	2			6	4	4
Actuated Green, G (s)	20.7	20.7	20.7	20.7	14.2	14.2
Effective Green, g (s)	22.2	22.2	22.2	22.2	15.7	15.7
Actuated g/C Ratio	0.48	0.48	0.48	0.48	0.34	0.34
Clearance Time (s)	5.5	5.5	5.5	5.5	5.5	5.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	524	852	828	717	567	507
v/s Ratio Prot		0.13	0.13			
v/s Ratio Perm	c0.15			0.06	c0.18	0.07
v/c Ratio	0.31	0.27	0.26	0.13	0.54	0.22
Uniform Delay, d1	7.2	7.0	7.0	6.5	12.2	10.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.3	0.2	0.2	0.1	1.0	0.2
Delay (s)	7.5	7.2	7.2	6.6	13.2	10.9
Level of Service	A	A	A	A	B	B
Approach Delay (s)		7.3	6.9		12.0	
Approach LOS		A	A		B	

Intersection Summary			
HCM 2000 Control Delay	9.3	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.42		
Actuated Cycle Length (s)	45.9	Sum of lost time (s)	9.5
Intersection Capacity Utilization	57.6%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Intersection	
Int Delay, s/veh	0.5

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	12	12	274	8	18	490
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	60	-	-	250	-
Veh in Median Storage, #	1	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	0	2	0	0	2
Mvmt Flow	13	13	298	9	20	533

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	874	302	0	0	307	0
Stage 1	302	-	-	-	-	-
Stage 2	572	-	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	323	742	-	-	1265	-
Stage 1	755	-	-	-	-	-
Stage 2	569	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	318	742	-	-	1265	-
Mov Cap-2 Maneuver	432	-	-	-	-	-
Stage 1	755	-	-	-	-	-
Stage 2	560	-	-	-	-	-

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

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	432	742	1265	-
HCM Lane V/C Ratio	-	-	0.03	0.018	0.015	-
HCM Control Delay (s)	-	-	13.6	9.9	7.9	-
HCM Lane LOS	-	-	B	A	A	-
HCM 95th %tile Q(veh)	-	-	0.1	0.1	0	-

Appendix C

TRANS 2011 O-D Survey Results for Kanata-Stittsville

Kanata - Stittsville

Demographic Characteristics

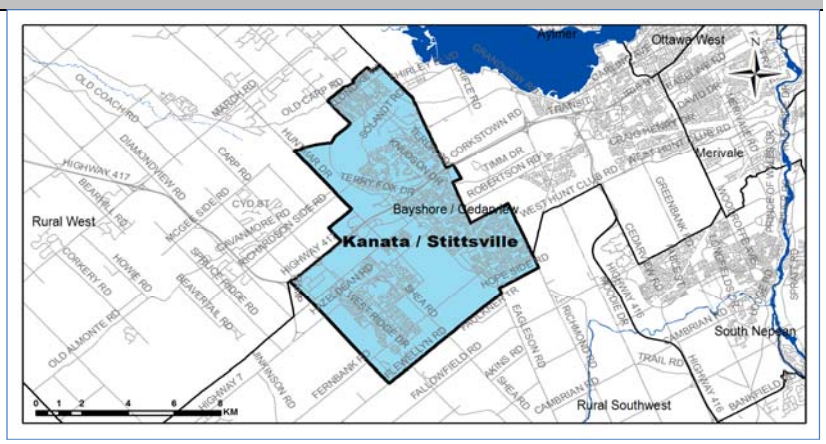
Population	105,210	Actively Travelled	83,460
Employed Population	49,640	Number of Vehicles	64,540
Households	38,010	Area (km^2)	82.6

Occupation

Status (age 5+)	Male	Female	Total
Full Time Employed	24,670	19,590	44,260
Part Time Employed	1,540	3,840	5,380
Student	13,630	13,410	27,040
Retiree	6,480	8,350	14,820
Unemployed	850	940	1,790
Homemaker	160	3,310	3,470
Other	350	1,010	1,360
Total:	47,690	50,440	98,120

Traveller Characteristics	Male	Female	Total
Transit Pass Holders	5,940	6,920	12,860
Licensed Drivers	36,280	36,790	73,070
Telecommuters	200	380	580
Trips made by residents	135,300	143,330	278,630

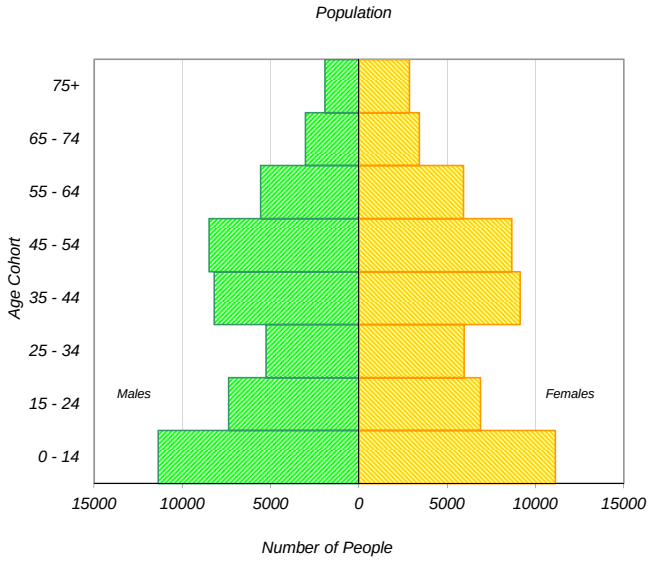
Selected Indicators	
Daily Trips per Person (age 5+)	2.84
Vehicles per Person	0.61
Number of Persons per Household	2.77
Daily Trips per Household	7.33
Vehicles per Household	1.70
Workers per Household	1.31
Population Density (Pop/km2)	1270

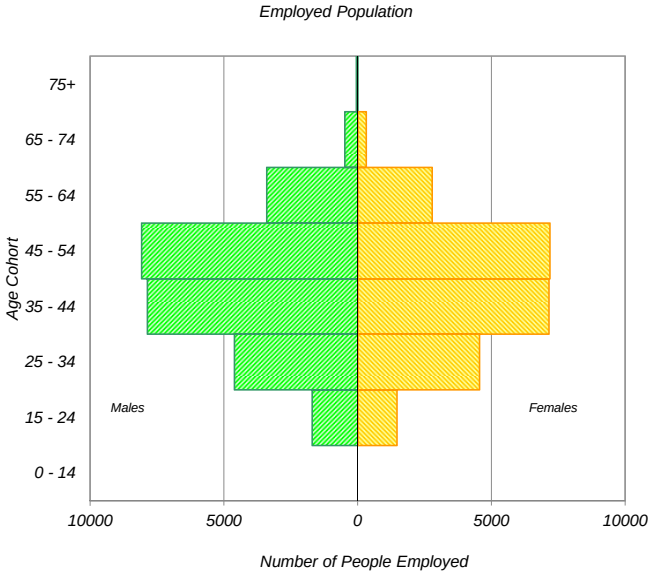


Household Size		
1 person	5,810	15%
2 persons	11,660	31%
3 persons	7,490	20%
4 persons	8,890	23%
5+ persons	4,160	11%
Total:	38,010	100%

Households by Vehicle Availability		
0 vehicles	1,050	3%
1 vehicle	14,090	37%
2 vehicles	19,110	50%
3 vehicles	3,000	8%
4+ vehicles	770	2%
Total:	38,010	100%

Households by Dwelling Type		
Single-detached	21,610	57%
Semi-detached	3,890	10%
Townhouse	10,550	28%
Apartment/Condo	1,960	5%
Total:	38,010	100%



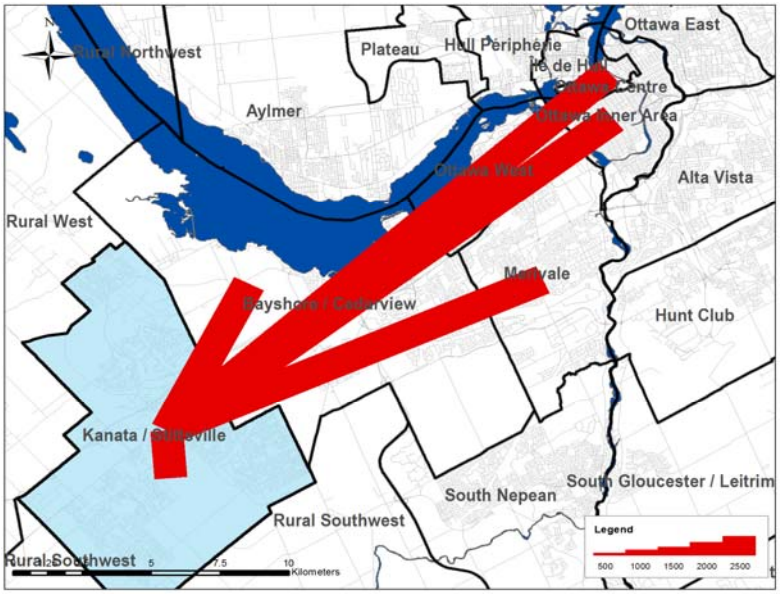


* In 2005 data was only collected for household members aged 11+ therefore these results cannot be compared to the 2011 data.

Travel Patterns

Top Five Destinations of Trips from Kanata - Stittsville

AM Peak Period



Summary of Trips to and from Kanata - Stittsville

AM Peak Period (6:30 - 8:59)	Destinations of Trips From District	% Total	Origins of Trips To District	% Total
Districts				
Ottawa Centre	4,560	8%	140	0%
Ottawa Inner Area	3,350	6%	970	2%
Ottawa East	660	1%	260	1%
Beacon Hill	280	0%	170	0%
Alta Vista	1,810	3%	660	1%
Hunt Club	490	1%	420	1%
Merivale	3,410	6%	1,200	3%
Ottawa West	2,020	4%	840	2%
Bayshore / Cedarview	5,010	9%	2,420	5%
Orléans	290	1%	500	1%
Rural East	100	0%	30	0%
Rural Southeast	50	0%	260	1%
South Gloucester / Leitrim	60	0%	140	0%
South Nepean	690	1%	1,800	4%
Rural Southwest	1,130	2%	1,850	4%
Kanata / Stittsvile	30,360	54%	30,360	66%
Rural West	1,050	2%	3,250	7%
Île de Hull	670	1%	30	0%
Hull Périphérie	160	0%	30	0%
Plateau	100	0%	230	0%
Aylmer	0	0%	190	0%
Rural Northwest	20	0%	60	0%
Pointe Gatineau	20	0%	80	0%
Gatineau Est	0	0%	60	0%
Rural Northeast	30	0%	50	0%
Buckingham / Masson-Angers	30	0%	10	0%
Ontario Sub-Total:	55,320	98%	45,270	98%
Québec Sub-Total:	1,030	2%	740	2%
Total:	56,350	100%	46,010	100%

Trips by Trip Purpose

24 Hours	From District		To District		Within District	
Work or related	27,180	29%	17,020	18%	14,550	9%
School	7,070	7%	2,500	3%	15,110	9%
Shopping	6,070	6%	9,150	10%	22,480	14%
Leisure	8,450	9%	10,590	11%	17,090	11%
Medical	2,520	3%	1,170	1%	2,660	2%
Pick-up / drive passenger	6,570	7%	5,470	6%	15,190	9%
Return Home	33,610	35%	45,620	48%	65,770	41%
Other	3,560	4%	3,590	4%	8,440	5%
Total:	95,030	100%	95,110	100%	161,290	100%

AM Peak (06:30 - 08:59)	From District		To District		Within District	
Work or related	18,030	69%	11,020	70%	7,430	24%
School	4,890	19%	2,280	15%	11,740	39%
Shopping	170	1%	320	2%	760	3%
Leisure	340	1%	400	3%	780	3%
Medical	330	1%	230	1%	350	1%
Pick-up / drive passenger	1,260	5%	580	4%	4,760	16%
Return Home	290	1%	380	2%	1,980	7%
Other	670	3%	430	3%	2,560	8%
Total:	25,980	100%	15,640	100%	30,360	100%

PM Peak (15:30 - 17:59)	From District		To District		Within District	
Work or related	390	2%	350	1%	930	2%
School	370	2%	0	0%	90	0%
Shopping	1,030	5%	1,910	7%	5,100	14%
Leisure	2,140	11%	3,080	11%	4,130	11%
Medical	230	1%	180	1%	400	1%
Pick-up / drive passenger	1,980	10%	1,980	7%	3,410	9%
Return Home	12,130	64%	20,550	71%	21,560	58%
Other	680	4%	860	3%	1,850	5%
Total:	18,950	100%	28,910	100%	37,470	100%

Peak Period (%)	Total:	% of 24 Hours	Within District (%)
24 Hours	351,430		46%
AM Peak Period	71,980	20%	42%
PM Peak Period	85,330	24%	44%

Trips by Primary Travel Mode

24 Hours	From District		To District		Within District	
Auto Driver	63,470	67%	63,830	67%	92,190	57%
Auto Passenger	15,220	16%	14,920	16%	31,880	20%
Transit	12,200	13%	12,270	13%	4,050	3%
Bicycle	360	0%	410	0%	960	1%
Walk	40	0%	50	0%	21,080	13%
Other	3,730	4%	3,660	4%	11,130	7%
Total:	95,020	100%	95,140	100%	161,290	100%

AM Peak (06:30 - 08:59)	From District		To District		Within District	
Auto Driver	15,360	59%	11,530	74%	13,630	45%
Auto Passenger	2,450	9%	1,160	7%	5,050	17%
Transit	6,230	24%	1,290	8%	1,210	4%
Bicycle	30	0%	80	1%	220	1%
Walk	0	0%	40	0%	5,730	19%
Other	1,900	7%	1,560	10%	4,510	15%
Total:	25,970	100%	15,660	100%	30,350	100%

PM Peak (15:30 - 17:59)	From District		To District		Within District	
Auto Driver	13,850	73%	17,660	61%	21,240	57%
Auto Passenger	3,240	17%	4,270	15%	8,570	23%
Transit	1,270	7%	5,980	21%	670	2%
Bicycle	40	0%	100	0%	260	1%
Walk	40	0%	0	0%	4,570	12%
Other	520	3%	910	3%	2,160	6%
Total:	18,960	100%	28,920	100%	37,470	100%

Avg Vehicle Occupancy	From District	To District	Within District
24 Hours	1.24	1.23	1.35
AM Peak Period	1.16	1.10	1.37
PM Peak Period	1.23	1.24	1.40

Transit Modal Split	From District	To District	Within District
24 Hours	13%	13%	3%
AM Peak Period	26%	9%	6%
PM Peak Period	7%	21%	2%