September 2018

5969 Fernbank Road

TIA Strategy Report, Revision 2

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TIA Strategy Report

prepared for:
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September 19, 2018

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Strategy Report

1. INTRODUCTION

The screening form was submitted in conjunction with the Scoping Report for review and confirmation of the need for a Transportation Impact Assessment (TIA). The Trip Generation, Location, and Safety triggers were met based on the unit count, proposed new driveway on a "Spine" cycling route, and proximity to the Fernbank/Shea roundabout. The following Strategy Report will provide the demand rationalization, development design, boundary street design and intersection design. The Screening Form and Correspondence are provided in Appendix A.

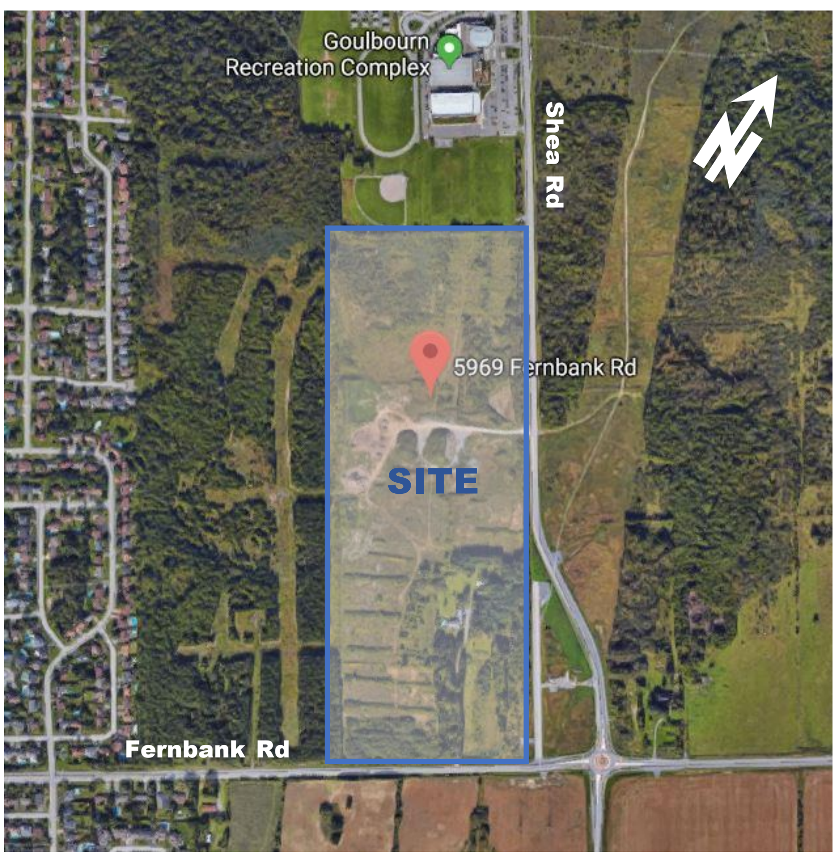
2. DESCRIPTION OF PROPOSED DEVELOPMENT

2.1. PROPOSED DEVELOPMENT

The proposed development is located in Stittsville. The subdivision is in Ward 6 and the site's local context is illustrated in Figure 1.

The development will include 357 units, consisting of 238 townhomes and 119 single family homes, and the estimated date of occupancy is 2020. The subdivision will have three accesses, two on Shea Road and one on Fernbank Road. for Stages 1 and 2. This development requires a plan of subdivision and zoning amendment as it is currently a Rural Countryside Zone. The site plan is illustrated in Figure 2.

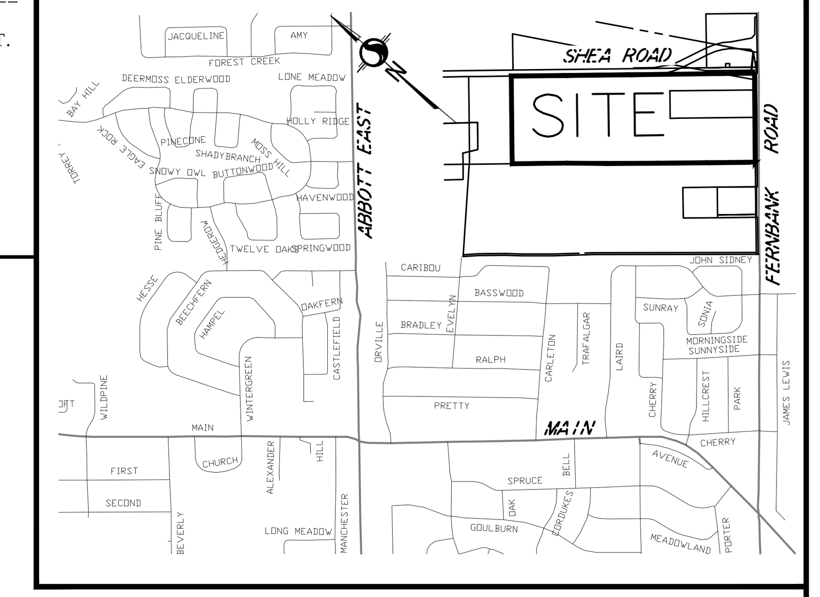
Figure 1: Local Context

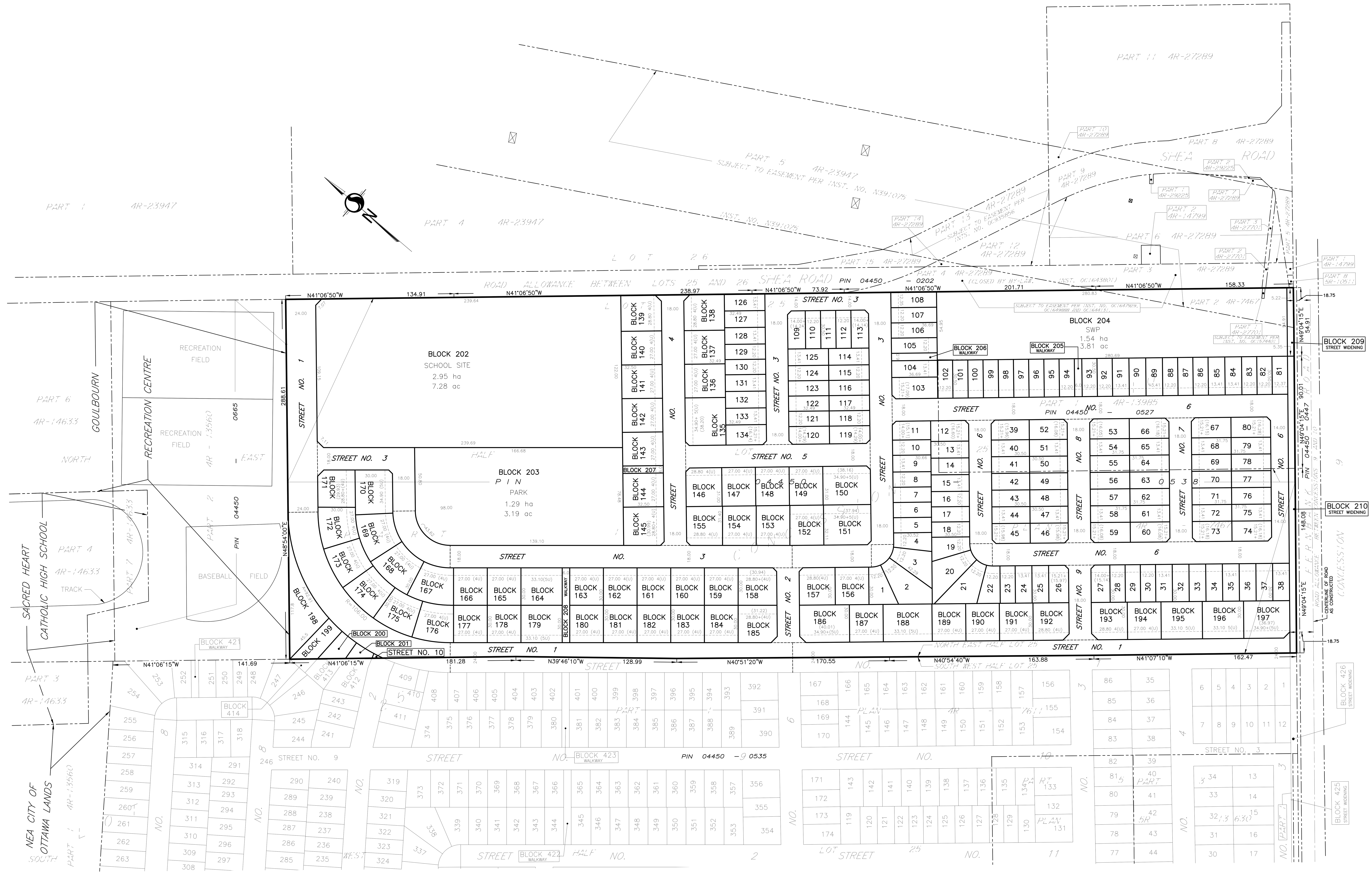


SUBJECT TO THE CONDITIONS, IF ANY, SET FORTH IN OUR LETTER DATED ______________________20____ THIS DRAFT PLAN IS APPROVED BY THE CITY OF OTTAWA UNDER SECTION 51 OF THE PLANNING ACT. THIS____DAY OF______________,20___.

DERRICK MOODIE, MANAGER
DEVELOPMENT REVIEW-WEST
PLANNING, INFRASTRUCTURE AND ECONOMIC DEVELOPMENT DEPARTMENT, CITY OF OTTAWA

KEY PLAN
(NOT TO SCALE)





DRAFT PLAN OF SUBDIVISION OF

PART OF THE NORTH EAST HALF OF LOT 25 CONCESSION 10

(GEOGRAPHIC TOWNSHIP OF GOULBOURN)

CITY OF OTTAWA

Scale 1:1500

20 0 20 40 60 80 100 METRES

METRIC CONVERSION

DISTANCES AND COORDINATES SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048

SCHEDULE OF LAND USE			
LOT/BLOCK	USE	UNITS	AREA (Ha/ac)
1 TO 134 AND 198 TO 201	SINGLES	138	6.01/14.84
135 TO 197	TOWNS	263	4.75/11.75
202	SCHOOL		2.95/7.28
203	PARK		1.29/3.19
204	SWP		1.54/3.81
205 TO 208	WALKWAY		0.10/0.24
209 AND 210	STREET WIDENING		0.16/0.38
STREETS			6.73/16.64
TOTAL		401	23.53/58.13

INFORMATION: REQUIRED UNDER SECTION 51 (17) OF THE PLANNING ACT R.S.O. 1990

a. SEE PLAN
b. SEE PLAN
c. SEE PLAN
d. SEE PROPOSED LAND USE SCHEDULE (ABOVE)
e. SEE PLAN
f. SEE PLAN
g. SEE PLAN
h. CITY WATER AVAILABLE
i. SEE SOIL REPORT
j. SEE TOPOGRAPHICAL INFORMATION
k. ALL CITY SERVICES AVAILABLE
l. TWO EASEMENTS REGISTERED AS N391075 IN FAVOUR ONTARIO HYDRO, DESCRIBED AS PART 2, 4R-7467 AND OC1574401 IN FAVOUR OF HYDRO OTTAWA LIMITED, DESCRIBED AS PART 1,4R-27701.

OWNER'S CERTIFICATE

I HEREBY AUTHORIZE STANTEC GEOMATICS LTD. TO SUBMIT THIS DRAFT PLAN OF SUBDIVISION ON MY BEHALF

DATE

JEFFERY CAVANAGH
1384341 ONTARIO LIMITED

SURVEYOR'S CERTIFICATE

I HEREBY CERTIFY THAT THE BOUNDARIES OF THE SUBJECT LANDS AND THEIR RELATIONSHIP TO ADJOINING LANDS HAVE BEEN ACCURATELY AND CORRECTLY SHOWN.

DATE

BRIAN J. WEBSTER
ONTARIO LAND SURVEYOR

NOTE:
THE PLAN DATA IS COMPILED FROM OFFICE RECORDS OF STANTEC GEOMATICS LTD. AND HAS NOT BEEN VERIFIED BY FIELD MEASUREMENTS. ALL DISTANCES ARE APPROXIMATE, TO BE VERIFIED BY FINAL REGISTERED PLAN(S).

Stantec Geomatics Ltd.
CANADA LANDS SURVEYORS
ONTARIO LAND SURVEYORS
1331 CLYDE AVENUE, SUITE 400
OTTAWA, ONTARIO, K2C 3G4
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stantec.com

DRAWN: CEC	CHECKED: FP	PM: FP	FIELD: N/A	PROJECT No.: 161613510-131

3. EXISTING CONDITIONS

3.1. AREA ROAD NETWORK

Fernbank Road is an east-west arterial road, under the City of Ottawa's jurisdiction, that runs between Dwyer Hill Road and Eagleson Road. Fernbank Road has a two-lane undivided rural cross-section with paved shoulders. The posted speed limit is 60km/h east of Hartsmere Drive and 40km/h west of Hartsmere Drive.

Shea Road is a two-lane north-south collector road north of Fernbank (OP Schedule E). The posted speed limit is 60km/h. Shea Road has a rural cross-section with paved shoulders north of Fernbank Road and gravel shoulders south of Fernbank Road. Shea Road was realigned east of its former alignment and a roundabout was added for traffic control at the intersection with Fernbank Road.

On Fernbank Road there are six private residential driveways on the south side of the roadway within 200m west of the proposed site access.

On Shea Road there is one existing driveway within 200m of the proposed site access which provides access to the Goulburn Recreation Complex.

3.2. PEDESTRIAN AND CYCLING NETWORK

Sidewalks are not provided within the immediate study area. The closest sidewalks are located near the residential area west of Shea Road, on Fernbank Road at Hartsmere Road. A major pathway connection terminates at the roundabout at the intersection of Fernbank and Shea Roads which originates at the Trans Canada Trail. The Ottawa Pedestrian Plan (2013) does not identify any extension to this pathway.

The City of Ottawa's 2013 Cycling Plan identifies Shea Road as a local route north of Fernbank Road and Fernbank Road is a Spine or City-Wide cycling route. Cycling facilities include paved shoulders provided from the Goulbourn Complex south on Shea Road to the roundabout with Fernbank Road.

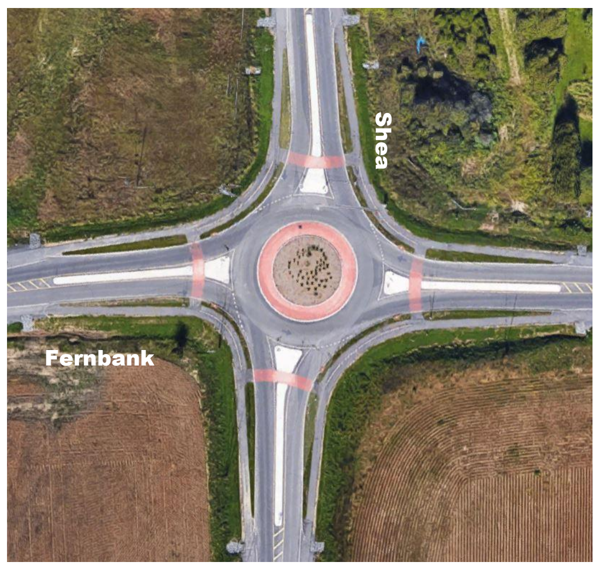
3.3. TRANSIT NETWORK

OC Transpo Routes #61 and #262 run along Fernbank Road, Routes #61 and #62 run along Shea Road. No transit stops are located within the immediate study area. The closest transit stop on Fernbank is located at Liard Street and on Shea Road the Goulbourn Complex is the last stop. Figure 3 illustrates the current system map.

Figure 3: Area Transit Network

3.4. EXISTING STUDY AREA INTERSECTION

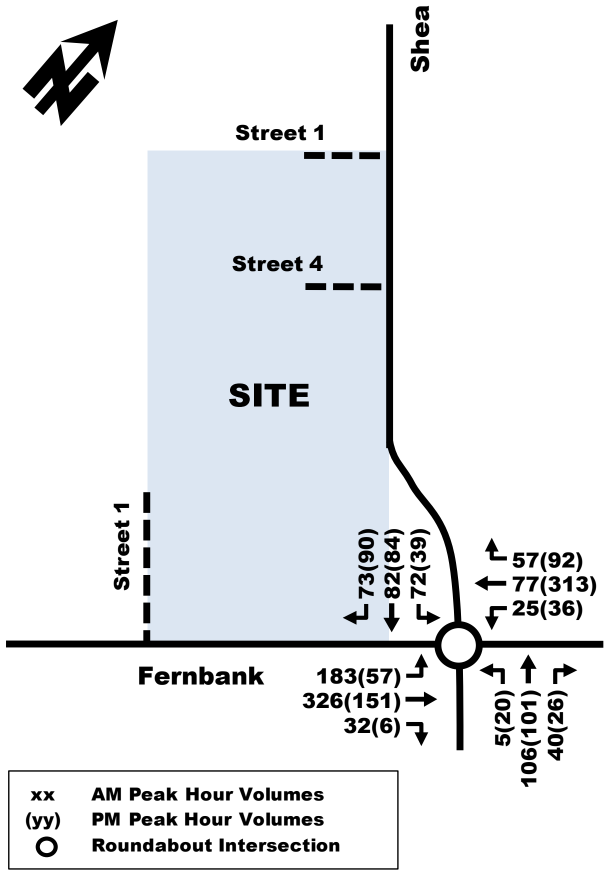
Fernbank/Shea
The Fernbank/Shea intersection is a four-legged, single lane roundabout intersection. All approaches consist of a single approach lane. All movements are permitted at this location.



3.5. EXISTING INTERSECTION VOLUMES

The existing peak hour traffic volumes (illustrated in Figure 4 below) were collected by a subconsultant of Parsons in 2016. The resulting peak hour and full traffic volume counts are included as Appendix B.

Figure 4: Existing Peak Hour Traffic Volumes



3.6. EXISTING ROAD SAFETY CONDITIONS

Collision history for the study area intersection (2015 to 2016, inclusive) was obtained from the City of Ottawa. As the roundabout at Fernbank Road and Shea Road was reconstructed in 2015, collisions prior to 2015 are not related to the current intersection design and are therefore irrelevant. Most collisions (81% or 17 collisions) involved only property damage, indicating low impact speeds, and 14% (or three collisions) involved personal injuries. The primary causes of collisions cited by police include: single vehicle (other) (43% or nine collisions), angle (19% or four collisions), and sideswipe (14% or three collisions each) type collisions.

A standard unit of measure for assessing collisions at an intersection is based on the number collisions per million entering vehicles (MEV). At the Fernbank/Shea roundabout intersection, reported collisions have historically take place at a rate of 0.40/MEV.

It is noteworthy that within the five-years of recorded collision data there was one collision that involved a pedestrian (non-fatal injuries), none involving cyclists and five involving wild animals. The source collision data as provided by the City of Ottawa and related analysis is provided as Appendix C.

4. PLANNED CONDITIONS

4.1. PLANNED STUDY AREA TRANSPORTATION NETWORK CHANGES

Fernbank Road is identified as a transit priority corridor with isolated measures (City of Ottawa Transportation Master Plan (TMP) 2013, Ultimate Network) and widening has been proposed in the Network Concept Map 10 (TMP). In addition, three Park-and-Rides are identified along Robert Grant Avenue from Fernbank Road to Abbott Street E in the 2031 Affordable Network and Network Concept plans.

Shea Road has been identified for resurfacing as part of the Planned Construction Program (2017-2021) as outlined on the City's website[1].

4.2. OTHER AREA DEVELOPMENTS

6015-6041 Fernbank Road
Tartan Land Consultants is proposing the construction of a residential subdivision comprised of 285 single-family detached homes and 296 semi-detached units located at the above address, directly west of the subject development. The Transportation Brief (prepared by Delcan) projected approximately 400 veh/h during the peak hours.

5897 Fernbank Road
Farmhouse Investment Inc. is proposing the construction of a retail development comprised of four single-storey buildings located at the above address, directly east of the subject development. The Transportation Impact Study (prepared by Parsons) projected approximately 60 veh/h and 230 veh/h during the AM and PM peak hours, respectively.

5960 Fernbank Road
A commercial development consisting of a 40,000-sq. ft. grocery store, 19,250-sq. ft. retail building, and a 5,900-sq. ft. restaurant is being proposed at the above address, directly south of the subject development. The Transportation Impact Study (prepared by Parsons) projected approximately 160 veh/h and 400 veh/h during the AM and PM peak hours, respectively.

5970 Fernbank Road
Tartan Group of Companies is proposing the construction of a residential subdivision comprised of 329 single-family detached homes, 230 townhomes/semi-detached units and 172 apartments located at the above address, directly south of the subject development. The Transportation Impact Study (prepared by IBI Group) projected approximately 430 veh/h and 540 veh/h during the AM and PM peak hours, respectively.

5786 Fernbank Road
A subdivision development consisting of 126 single dwelling units, 63 private road townhouse units, three street townhouse units, and an elementary school are being proposed at the above address, located east of the subject development. The Transportation Brief (prepared by Novatech) projected approximately 175 veh/h during the peak hours. It is anticipated that this development will primarily be westbound and northbound, and will therefore, not have a significant impact the Study Area intersections.

5. TIME PERIODS

The weekday morning and afternoon peak hours are considered the appropriate time periods for operational analysis for this residential development.

[1] https://ottawa.ca/en/city-hall/planning-and-development/construction-and-infrastructure-projects/planned-construction

6. HORIZON YEARS

The expected build-out date for the proposed development is assumed to be 2020. Depending on the growth rate of the study area, the horizon year 2025 will be assessed for 5-years beyond site build out.

7. EXEMPTIONS REVIEW

Based on the foregoing analysis and review of the existing conditions in Step 2, the Scoping Report, it is recommended that, if required, any future work within the context of this TIA excludes the following modules and elements summarized in Table 1.

Table 1: Exemptions Review Summary

Module	Element	Exemption Consideration
4.1 Development Design	4.1.2 Circulation and Access	Not required for applications involving plans of site plans
4.2 Parking	All elements	Not required for applications involving plans of subdivision
4.6 Neighbourhood Traffic Management	All elements	The proposed development has direct access to the arterial road network

8. DEVELOPMENT GENERATED TRAVEL DEMAND

8.1. TRIP GENERATION

Appropriate trip generation rates for the proposed development consisting of 263 townhomes and 138 single family homes was obtained from the City's 2009 TRANS Trip Generation – Residential Trip Rates. These rates are summarized in Table 2.

Table 2: 2009 TRANS Trip Generation Rates

Land Use	ITE Land Use Code	Trip Rates	
		AM Peak	PM Peak
Single-detached Dwellings	ITE 210	T = 0.70(du)	T = 0.90(du)
Semi-detached/Townhomes	ITE 224	T = 0.54(du)	T = 0.71(du)

Notes: T = Average Vehicle Trip Ends
du = Dwelling units
X = 1000 ft² Gross Floor Area
Specialty Retail AM Peak is assumed to be 50% of the PM Peak

Using the TRANS Trip Generation rates for the residential component of the site, the total amount of vehicle trips generated by the proposed development was projected. The results are summarized in Table 3.

Table 3: Projected Vehicle Trip Generation – TRANS Model

Land Use	Area	AM Peak (Veh/h)			PM Peak (Veh/h)		
		In	Out	Total	In	Out	Total
Single-detached Dwellings	138 units	28	69	97	76	48	124
Semi-detached/Townhomes	263 units	41	101	142	115	72	187
Total Vehicle Trips		**69**	**170**	**239**	**191**	**120**	**311**

As shown in Table 3, a total of approximately 240 veh/h and 310 veh/h are projected to travel to/from the proposed development during the weekday morning and afternoon commuter peak hours, respectively. Using the TRANS Auto Trips projected in Table 3 and the mode share percentages outline in Table 3.13 of the TRANS Trip Generation Study, the modal shares for the single-detached and semi-detached/townhomes land uses within the proposed development are summarized in Table 4 and Table 5, respectively. The total site trip generation is summarized in Table 6.

Table 4: TRANS Model Site Trip Generation – Single-detached Dwellings

Travel Mode	Mode Share	AM Peak (Person Trips/h)			Mode Share	PM Peak (Person Trips/h)		
		In	Out	Total		In	Out	Total
Auto Driver	55%	28	69	97	64%	76	48	124
Auto Passenger	11%	5	14	19	11%	13	8	21
Transit	25%	12	32	44	19%	22	15	37
Non-motorized	9%	4	12	16	6%	7	5	12
Total Person Trips	**100%**	**49**	**127**	**176**	**100%**	**118**	**76**	**194**

Table 5: TRANS Model Site Trip Generation – Semi-detached/Townhomes

Travel Mode	Mode Share	AM Peak (Person Trips/h)			Mode Share	PM Peak (Person Trips/h)		
		In	Out	Total		In	Out	Total
Auto Driver	55%	41	101	142	61%	115	72	187
Auto Passenger	10%	7	18	25	11%	20	13	33
Transit	27%	20	50	70	22%	42	26	68
Non-motorized	8%	6	15	21	6%	11	8	19
Total Person Trips	**100%**	**74**	**184**	**258**	**100%**	**188**	**119**	**307**

Table 6: TRANS Model Site Trip Generation – Total Site Generation

Travel Mode	AM Peak (Person Trips/h)			PM Peak (Person Trips/h)		
	In	Out	Total	In	Out	Total
Auto Driver	69	170	239	191	120	311
Auto Passenger	12	32	44	33	21	54
Transit	32	82	114	64	41	105
Non-motorized	10	27	37	18	13	31
Total Person Trips	**123**	**311**	**434**	**306**	**195**	**501**
Total 'New' Auto Trips	**69**	**170**	**239**	**191**	**120**	**311**

As shown in Table 6, based on the TRANS Trip Generation method, the proposed site is projected to generate approximately 435 to 500 person-trips per hour during the weekday commuter peak hours. The increase in two-way transit trips is estimated to be 105 to 115 persons per hour, and the increase in bike/walk trips is approximately 30 to 40 persons per hour.

8.1.1. MODE SHARES

Given the planned transportation network within the vicinity of the site does not provide any significant non-auto transportation improvements, there is no rationale that the future modal splits will be different than existing.

8.2. TRIP DISTRIBUTION

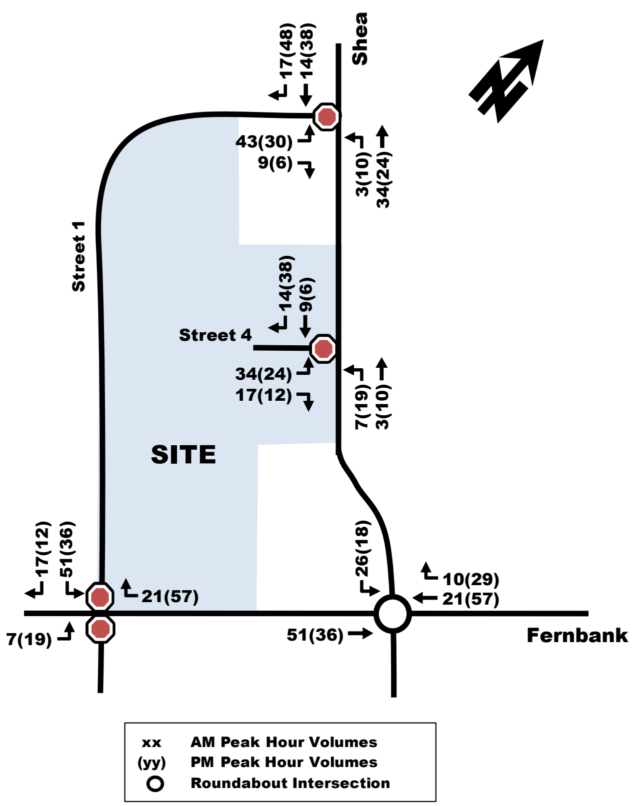
Traffic distribution was based on the site's connectivity to the existing road network and our knowledge of the surrounding area. The resultant distribution is outlined as follows:

- 90% to/from the northeast; and
- 10% to/from the west.

8.3. TRIP ASSIGNMENT

Based on these distributions, total 'new' site-generated trips to/from the proposed development are assigned to study area intersections and are illustrated as Figure 5.

Figure 5: Total 'New' Site-Generated Traffic Volumes



9. BACKGROUND NETWORK TRAVEL DEMANDS

The following background traffic growth through the Fernbank/Stittsville Main intersection (summarized in Table 7) was calculated based on historical traffic count data (years 2006, 2008, 2009, and 2011) provided by the City of Ottawa. Detailed background traffic growth analysis is included as Appendix D.

Table 7: Fernbank/Stittsville Main Historical Background Growth (2006 – 2011)

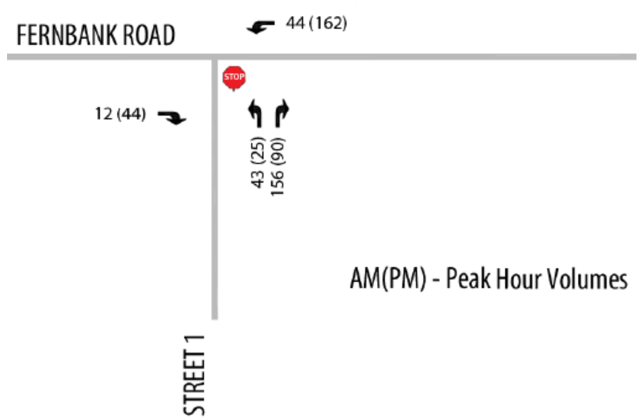
Time Period	Percent Annual Change				
	North Leg	South Leg	East Leg	West Leg	Overall
8 hrs	1.12%	0.99%	6.64%	7.76%	**2.90%**
AM Peak	1.00%	0.77%	12.07%	7.26%	**3.84%**
PM Peak	1.04%	1.59%	21.46%	12.07%	**6.65%**

As shown in Table 7, the Fernbank/Stittsville Main intersection has experienced an approximate 3% to 6% annual increase in vehicle traffic within recent years (calculated as a weighted average). A 3% per annum growth factor was applied to existing traffic volumes along Fernbank Road and Shea Road to obtain background traffic volumes for the 2020 built-out horizon year and 2025 (5-years beyond site build-out).

9.1. OTHER AREA DEVELOPMENT

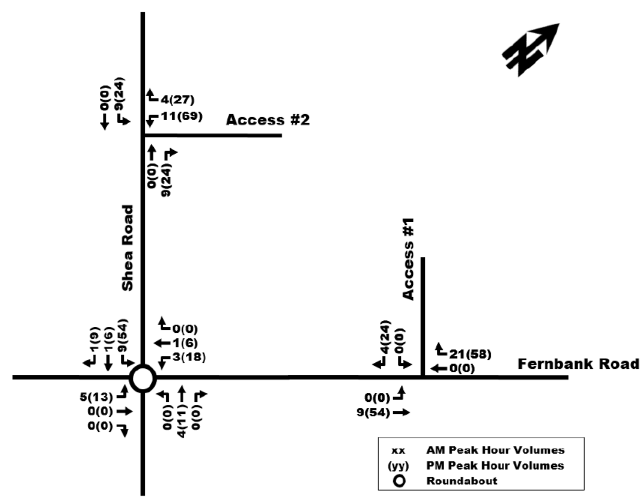
The additional traffic associated with the surrounding developments mentioned above in Section 4.2 is shown below in Figure 6, Figure 7, Figure 8 and Figure 9. These trips will be included in the background traffic analysis (Section 10.1) and total projected traffic analysis (Section 15). The trips associated with the 5786 Fernbank Road development have not been included because it is anticipated that this development will primarily be westbound and northbound, and will therefore, not have a significant impact on the Study Area intersections. As a conservative estimate of the build-out of the area it has been assumed that all of the developments would occur by the 2020 horizon.

Figure 6: 5970 Fernbank Projected Turning Movements



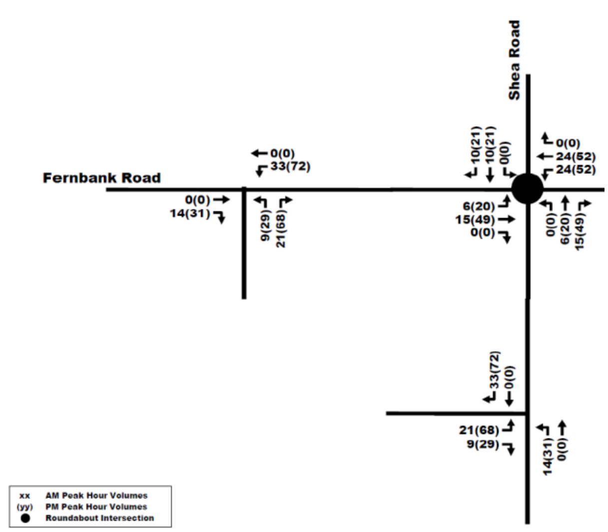
Source: Austin Shih, IBI Group

Figure 7: 5897 Fernbank Projected Turning Movements



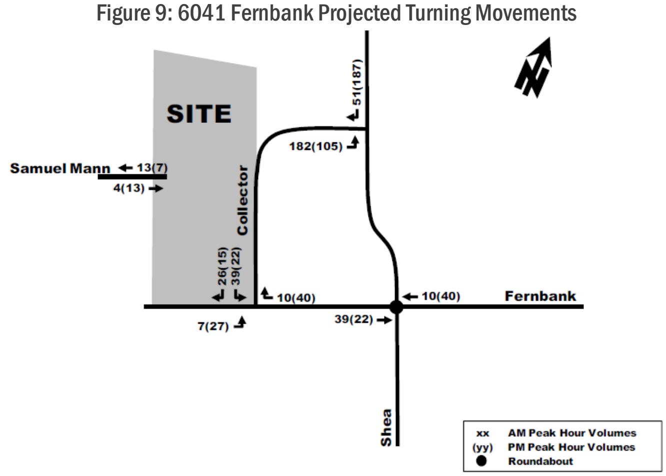
Source: 5897 Fernbank Road Commercial Development TIS, Parsons

Figure 8: 5960 Fernbank Projected Turning Movements



Source: 5960 Fernbank Road Commercial Development TIS, Parsons

Figure 9: 6041 Fernbank Projected Turning Movements



Source: 6041 Fernbank Road Transportation Brief, Delcan

9.2. FUTURE BACKGROUND TRAFFIC VOLUMES

A 3% background growth rate and adding he background development traffic volumes have been added to the existing traffic volumes. The resultant 2020 and 2025 background traffic volumes are depicted as Figure 10 and Figure 11, respectively.

Figure 10: 2020 Background Traffic Volumes

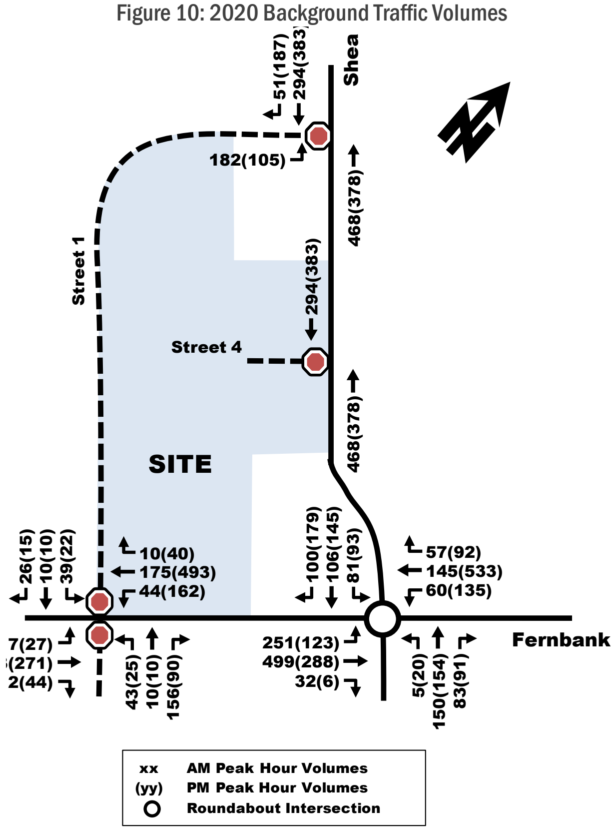
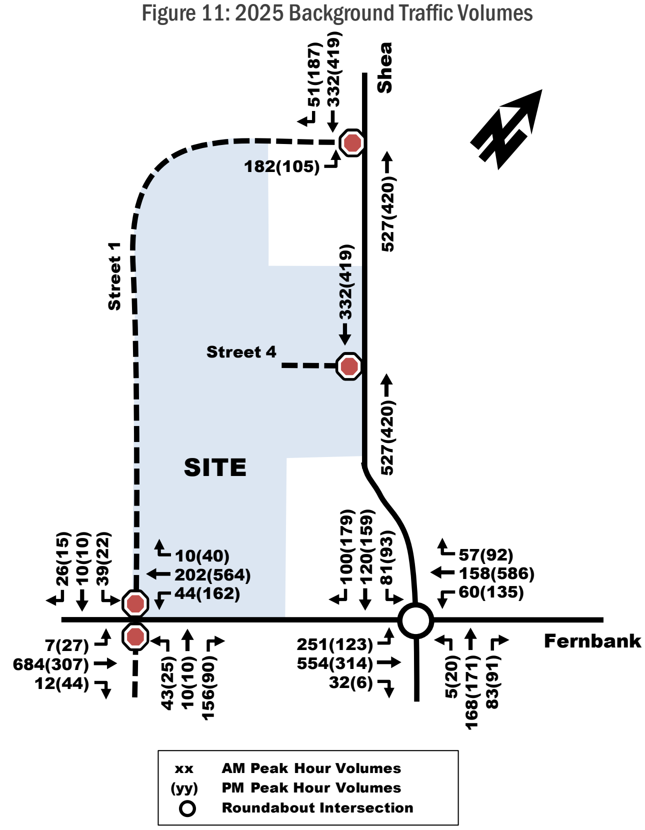


Figure 11: 2025 Background Traffic Volumes



10. DEMAND RATIONALIZATION

10.1. DESCRIPTION OF CAPACITY ISSUES

10.1.1. 2020 FUTURE BACKGROUND CONDITIONS

The 2020 background peak hour traffic volumes (illustrated in Figure 10) have been generated from the existing turning movement counts and the application of the growth rates discussed in Section 9. The background operations are summarized in Table 8 and the detailed SIDRA worksheets are provided in Appendix E.

Table 8: 2020 Background Traffic Operations

Intersection	Weekday AM Peak (PM Peak)				
	Critical Movement			Intersection 'as a whole'	
	LoS	max. v/c or avg. delay (s)	Movement	Delay (s)	LoS
Fernbank/Shea (Roundabout)	E(E)	36.3(41.2)	EB(WB)	23.8(28.1)	C(D)
Note: Analysis of signalized intersections assumes a PHF of 0.95 and a saturation flow rate of 1800 veh/h/lane.					

The roundabout intersection of Fernbank Road and Shea Road, with the addition of the background developments, is projected to operate poorly. The projected background growth accounts for a large amount of development, that would have to be constructed at a rapid pace in order for this level of delay to occur. This intersection should be monitored as developments are constructed to determine when upgrades are required. The Transportation Master Plan 2031 Network Concept shows Fernbank Road as a Widened Arterial; however, this upgrade is not included in the 2031 Affordable Network. This upgrade has not been analyzed as part of this study.

10.1.2. 2025 FUTURE BACKGROUND CONDITIONS

The 2025 background peak hour traffic volumes (illustrated in Figure 11) have been generated from the existing turning movement counts and the application of the growth rates discussed in Section 9. The background operations are summarized in Table 9 and the detailed SIDRA worksheets are provided in Appendix E.

Table 9: 2025 Background Traffic Operations

Intersection	Weekday AM Peak (PM Peak)				
	Critical Movement			Intersection 'as a whole'	
	LoS	max. v/c or avg. delay (s)	Movement	Delay (s)	LoS
Fernbank/Shea (Roundabout)	F(F)	52.8(61.0)	EB(WB)	33.0(38.2)	D(E)
Note: Analysis of signalized intersections assumes a PHF of 0.95 and a saturation flow rate of 1800 veh/h/lane.					

Similar to the 2020 future background conditions, the roundabout intersection of Fernbank Road and Shea Road, with the addition of the background developments, is projected to operate poorly. The projected background growth accounts for a large amount of development, that would have to be constructed at a rapid pace in order for this level of delay to occur. This intersection should be monitored as developments are constructed to determine when upgrades are required. The Transportation Master Plan 2031 Network Concept shows Fernbank Road as a Widened Arterial; however, this upgrade is not included in the 2031 Affordable Network. This upgrade has not been analyzed as part of this study.

11. DEVELOPMENT DESIGN

11.1. DESIGN FOR SUSTAINABLE MODES

Vehicle and Bicycle Parking
Off-road driveways are proposed for each residential unit. Bicycle parking will be available in each residential unit.

Transit Amenities
Transit service within the vicinity of the site are OC Transpo Routes #61 and #262 along Fernbank Road and the #61 and #62 along Shea Road. No transit stops are located within the immediate study area. The closest transit stop on Fernbank is located at Liard Street and on Shea Road the Goulbourn Complex is the last stop.

Pedestrian Routes and Facilities
The Fernbank CDP outlines the integration of sidewalks along both sides of arterials and collector roadways within the Fernbank Community. Sidewalks will also be provided along one or both sides of local streets.

11.2. NEW STREETS NETWORK

The proposed new roadways will be designated as a collector roadway (Street 1) and a local roadway (Street 4). Collector and local roadways should have less than 300 veh/h and 100 veh/h during the peak hours, respectively. Given the distribution of the development traffic, the projected amount of traffic is less than 100 veh/h during peak hours, which is appropriate for a local roadway.

12. BOUNDARY STREET DESIGN

The boundary streets for the development are Fernbank Road, Shea Road and Street 1. At this time, there has not been any complete street concepts prepared for the boundary streets. The existing roadway's geometry consists of the following features:

- Fernbank Road:
  - 1 vehicle travel lane in each direction;
  - Paved shoulders; and,
  - More than 3,000 vehicles per day along Fernbank Road.
- Shea Road:
  - 1 vehicle travel lane in each direction;
  - Paved shoulders; and,
  - More than 3,000 vehicles per day along Shea Road.
- Street 1 (assumed):
  - 1 vehicle travel lane in each direction; and,
  - Less than 3,000 vehicles per day along Street 1.

The multi-modal level of service analysis for the subject road segments adjacent to the site is summarized in Table 8 with detail analysis provided in Appendix F.

Table 10: MMLOS – Boundary Street Segments

Road Segment	Level of Service					
	Pedestrian		Bicycle (BLoS)		Transit (TLoS)	
	PLoS	Target	BLoS	Target	TLoS	Target
Fernbank Road	F	A	F	C	-	-
Shea Road	F	A	F	B	D	D
Street 1	-	A	-	B	-	-

Given the development's location to the Stittsville BRT Station, the target levels of service for pedestrians and cyclists are high ('A' to 'C'). As shown Table 8, the transit level of service is met with regards to the isolated transit measures planned for Shea Road.

With regard to pedestrians, the high traffic volumes and absent facilities result in low level of service for pedestrians. Providing a 2m boulevard between and 2m sidewalk would improve the level of service at most to a PLoS 'D' on both Fernbank Road and Shea Road as both roadways are signed at 60 km/h and experience greater than 3,000 vehicles per day. As this area is developed, pedestrian facilities should be considered along these roadways and future collector roadways.

With regard to cyclists, there are currently no dedicated cycling facilities along boundary street and as such, cyclists share the roadway with vehicles. Providing dedicated bicycle lanes would improve the level of service to BLoS 'C', meeting the target for Fernbank Road. However, as Shea Road is classified as a local route and collector roadway, physically separated bike facilities are required to meet the target BLoS.

With regard to Street 1 proposed through the subdivision, it is recommended that a minimum sidewalk width of 1.8m with minimum boulevard width of 2m be considered to achieve a PLoS 'A'. Providing a 1.8m curbside bike lane on Street 1 would achieve a BLoS 'A', exceeding the target level of service. However, it is understood that the existing multi-use pathway on Cope Drive will continue on Street 1, on the north side of the roadway.

Based on the MMLoS Guidelines, the elements suggested within the guidelines to achieve the targets are identified above. These elements are not a recommendation of elements to be implemented but are only provided as a reference to the extent of modifications required to reach MMLoS targets.

13. ACCESS INTERSECTION DESIGN

13.1. LOCATION AND DESIGN OF ACCESS

Fernbank Road Access
Vehicle access for the development is proposed via Fernbank Road, with a new driveway connection approximately 525m west of the Fernbank/Shea intersection.

Shea Road Access
A total of two vehicle accesses for the development are proposed via Shea Road, with a new driveway connection recommended on Shea Road. The new intersections would be located approximately 515m and 800m north of the Fernbank/Shea intersection.

13.2. INTERSECTION CONTROL

Fernbank/Street 1
The MTO Traffic Signal Warrant procedure has been undertaken using the projected traffic volumes, shown in Figure 13 2025 Projected Traffic Volumes. Using the projected volumes, it was found that traffic control signals were not found to be warranted by 2025. However, it was noted that the warrant was close to being met, all sections were at least 76% met. Additionally, this location has been identified for signalization as part of the Development Charges By-law. To determine if this intersection should be considered for signalization, a sensitivity analysis has been conducted. Two additional scenarios have been considered.

The first scenario involves the north-south volumes across Fernbank Road through the subject intersection. For the purposes of the operational analysis a nominal volume is assigned to these movements, in this case 10 vehicles per hour(vph). This volume was adjusted to 40 vph in each peak hour. With this small adjustment to the traffic assumptions, and the traffic volumes, the traffic signal was found to be warranted.

The second scenario considers a redistribution of the traffic associated with the adjacent development. The Traffic Brief for 6041 Fernbank Road assumes that most of the traffic will use the Shea Road at Street 1 intersection. This scenario examined how much of the traffic would have to be redirected from the Shea Road access to the Fernbank Access, before the traffic control signal would be met. It was found that if 50% of the traffic generated by 6041 Fernbank Road, that was previously using the Shea Road access, instead used the Fernbank Road access, traffic control signals at the Fernbank Road Access would be warranted.

The sensitivity analysis showed that there are several scenarios under which traffic control signals would be warranted. Traffic projections are based on historical data and approximate the future traffic conditions. The Synchro analysis presented in Section 16, show that the northbound and southbound approaches of the Fernbank access will experience high delays in the 2025 horizon. As the intersection is projected to operate poorly during the 2025 horizon, and the sensitivity analysis has shown that small variations in the traffic projections would trigger the signal warrant, the signalized intersection is needed at the Fernbank Road access. Appendix G contains the traffic warrants for the 2025 horizon volumes and the sensitivity tests.

Due to the proximity of the intersection to the adjacent roundabout at Fernbank and Shea, and the fact that a signal has been determined to be needed (based on the sensitivity analysis), the City of Ottawa's Roundabout Screening Tool has been applied to determine if a roundabout may be suitable at the subject intersection. It was found that a roundabout could be suitable at the subject intersection. Additionally, there is an adjacent intersection (Fernbank Road at Shea Road) that is controlled by a roundabout, which would lead to this being a more suitable location for a roundabout.

The signal warrants and the roundabout screening tool have been included in Appendix G.

Shea/Street 1

Based on the projected vehicle volumes, STOP control on the minor approach (site) only is recommended.

Shea/Street 4

Based on the projected vehicle volumes, STOP control on the minor approach (site) only is recommended.

13.3. INTERSECTION DESIGN

Fernbank/Street 1

Fernbank at Street 1 is proposed as an unsignalized intersection with STOP control provided on Street 1. The proposed cross-section of the north and southbound approaches on Street 1 is a single shared lane. The proposed cross section of the east and westbound approaches on Fernbank Road is a single left-turn lane and a shared through-right turn lane.

Based on the projected volumes, the westbound left-turn lane is warranted for the horizon year 2020 however the eastbound left-turn lane is not warranted until five years after site build-out in 2025. To ensure proper sightlines and efficient construction, both the east and westbound left-turn lanes are recommended to be constructed for the horizon year 2020. See Appendix G for the left-turn lane warrant and storage length calculations for this intersection.

Storage length of auxiliary lanes are determined using Geometric Design Guide for Canadian Roads, Chapter 9 - Intersections (TAC 2017).

The minimum storage can be determined using equation 9.14.

$$S = \frac{NL}{30}$$

Where:
S = Storage length (m)
N = Design volume of turning vehicles (v/h)
L = Length (m) occupied by each vehicle

Using the largest anticipated projected volumes (PM peak, 2025 Future Total) for the eastbound left-turn at Fernbank Road and Street 1, the calculated minimum storage length is approximately 10m; however, the minimum safety storage requirement for this design is 15m (Section 9.17.2.2). Additionally, this auxiliary left-turn lane will require an appropriate taper length; which, can be calculated using Table 9.17.1

Shea/Street 1

Shea Road at Street 1 is proposed as a stop-controlled t-intersection on the minor leg (Street 1). The proposed cross-section of each approach is a single shared lane.

Shea/Street 4

Shea Road at Street 4 is proposed as a stop-controlled t-intersection on the minor leg (Street 4). The proposed cross-section of each approach is a single shared lane.

14. TRANSIT

Total "new" two-way transit trips are approximately 97 (28 in, 69 out) and 83 (50 in, 33 out) persons/h in the AM and PM peaks, respectively. During the AM peak, this represents approximately 51-125% of a single bus (55 passengers), approximately 37-92% of an articulated bus (75 passengers), and approximately 31-77% of a double decker bus (90 passengers).

Based on the projected new transit trips, articulated and double decker buses would the most appropriate buses to service the proposed residential development. Furthermore, new transit stops should be implemented along Shea Road south of Abbott Street E and on Fernbank Road east of Liard Street as there are no existing stops adjacent to the development.

15. INTERSECTION DESIGN

15.1. TOTAL PROJECTED 2020 CONDITIONS

The total projected 2020 traffic volumes were derived by superimposing the site-generated traffic volumes and 5970 Fernbank generated traffic volumes on background 2020 traffic volumes (as per the Forecasting Report). The resulting total projected 2020 traffic volumes are illustrated in Figure 12. Table 11 provides a summary of the total projected 2020 operations at the study area intersections The Synchro and SIDRA model output of total projected 2020 conditions is provided within Appendix H.

Figure 12: 2020 Projected Traffic Volumes

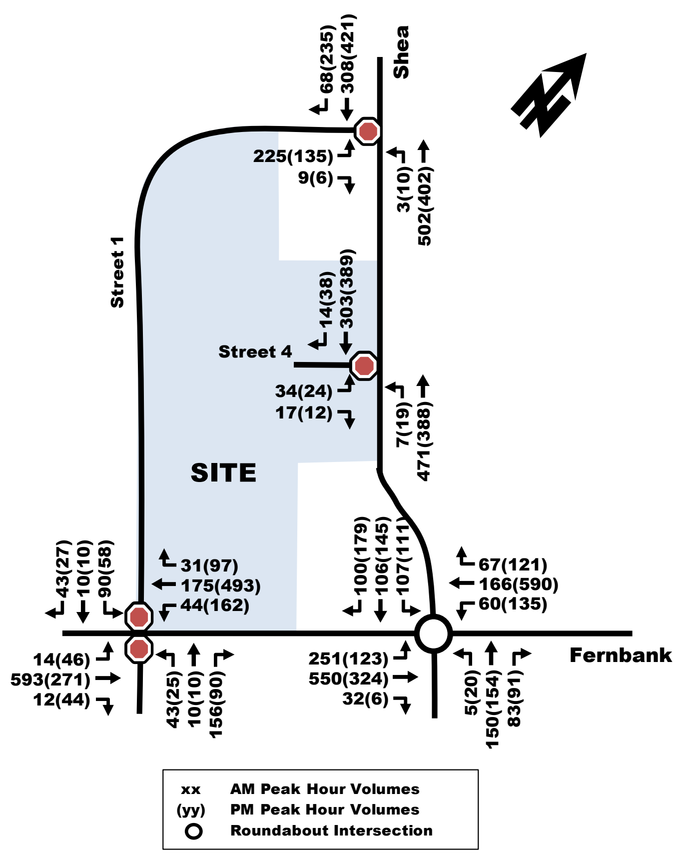


Table 11: Total Projected 2020 Performance at Study Area Intersections

Intersection	Weekday AM Peak (PM Peak)				
	Critical Movement			Intersection 'as a whole'	
	LoS	max. v/c or avg. delay (s)	Movement	Delay (s)	LoS
Roundabout					
Fernbank/Shea	F(F)	55.0(67.1)	EB(WB)	33.6(41.3)	D(E)
Stop-Controlled on Minor Street					
Fernbank/Street 1	F(F)	113.8(123.7)	SB(SB)	18.9(12.8)	C(B)
Shea/Street 1	E(D)	46.6(33.9)	EB(EB)	9.8(4.1)	A(A)
Shea/Street 4	C(C)	15.2(15.6)	EB(EB)	1.0(0.9)	A(A)
Note: Analysis of signalized intersections assumes a PHF of 0.95 and a saturation flow rate of 1800 veh/h/lane.					

With the addition of traffic from the full build-out of the proposed site, the overall intersection LOS for the Roundabout at Fernbank Road and Shea Road, similar to the 2020 future background operational analysis, will continue to operate 'as a whole' with a poor LOS 'E' during the PM peak hour.

The intersection of Fernbank Road at Street 1 is projected to operate with a reasonable LOS during both peak hours. However, the critical southbound movement is projected to operate with very high delays, and LOS 'F'. Mitigation measures for these deficiencies will be further explored in Section 15.2, below.

Both of the proposed Shea Road accesses area projected to operate at an overall LOS 'A'.

15.2. TOTAL PROJECTED 2025 CONDITIONS

The total projected 2025 traffic volumes were derived by superimposing the site-generated traffic volumes and 5970 Fernbank generated traffic volumes on background 2025 traffic volumes (as per the Forecasting Report). The resulting total projected 2025 traffic volumes are illustrated in Figure 13. Table 12 provides a summary of the total projected 2025 operations at the study area intersections. The SYNCHRO model output of total projected 2025 conditions is provided within Appendix H.

Figure 13: 2025 Projected Traffic Volumes

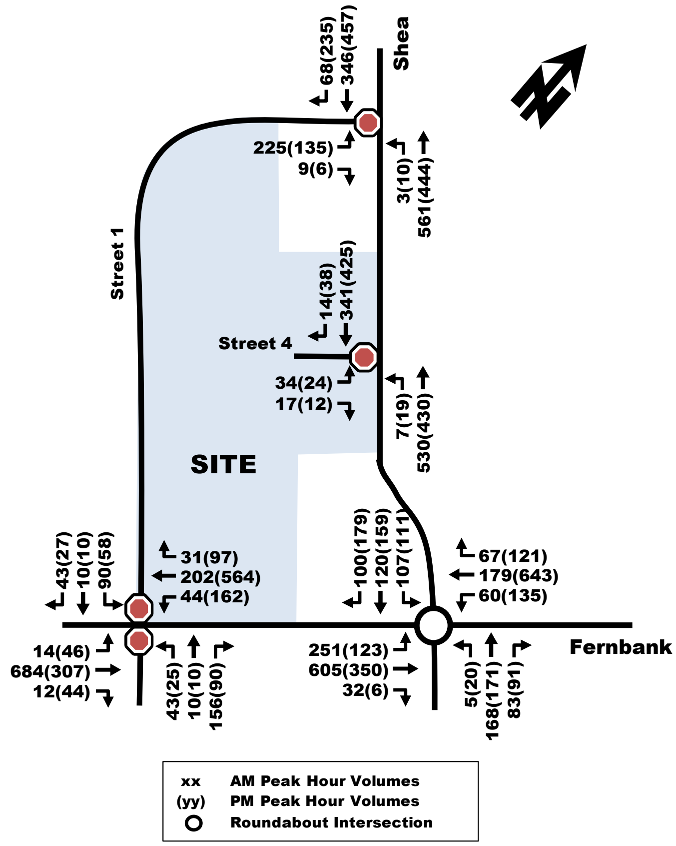


Table 12: Total Projected 2025 Performance at Study Area Intersections

Intersection	Weekday AM Peak (PM Peak)				
	Critical Movement			Intersection 'as a whole'	
	LoS	max. v/c or avg. delay (s)	Movement	Delay (s)	LoS
Roundabout					
Fernbank/Shea	F(F)	79.7(95.9)	WB(EB)	46.4(54.6)	E(F)
Stop-Controlled on Minor Street					
Fernbank/Street 1	F(F)	223.1(195.5)	SB(SB)	30.9(17.3)	D(C)
Shea/Street 1	F(E)	70.1(41.8)	EB(EB)	13.5(4.7)	B(A)
Shea/Street 4	C(C)	16.8(16.9)	EB(EB)	1.0(0.9)	A(A)
Note: Analysis of signalized intersections assumes a PHF of 0.95 and a saturation flow rate of 1800 veh/h/lane.					

The intersection of Shea Road at Fernbank Road is projected to continue to operate poorly with the addition of the site traffic. This is primarily caused by the high levels of background growth in and surrounding the Study Area.

The intersection of Fernbank Road and Street 1 is projected to continue to operate with high delays. As discussed in Section 13.2, an MTO Signal Warrant procedure and sensitivity analysis has been undertaken to examine the need for signals at the subject intersection. Based on the sensitivity analysis, it has been determined that signals could become warranted at the Street 1 intersection with Fernbank Road. Table 13 below summarizes the operational analysis with the inclusion of a traffic control signal and the warranted left turn lanes (eastbound and westbound).

Table 13: Total Projected 2025 Performance at Study Area Intersections

Intersection	Weekday AM Peak (PM Peak)					
	Critical Movement			Intersection 'as a whole'		
	LoS	max. v/c or avg. delay (s)	Movement	Delay (s)	LoS	v/c
Signalized						
Fernbank/Street 1	D(C)	0.81(0.76)	EBT(WBT)	14.9(11.7)	B(B)	0.67(0.63)
Note: Analysis of signalized intersections assumes a PHF of 0.95 and a saturation flow rate of 1800 veh/h/lane.						

As shown Table 13, the performance of the Fernbank/Street 1 improves significantly when the intersection is signalized. The intersection performance increases from a 'F' to 'B' with regard to the intersection 'as a whole' and from a 'F' to a 'D' with regard to critical movements.

As shown in Section 13.2 a roundabout should be considered at the intersection of Fernbank Road and Street 1. Table 14 summarizes the operational analysis with a roundabout control at the intersection of Fernbank Road and Street 1.

Table 14: Total Projected 2025 Performance at Study Area Intersections

Intersection	Weekday AM Peak (PM Peak)				
	Critical Movement			Intersection 'as a whole'	
	LoS	max. v/c or avg. delay (s)	Movement	Delay (s)	LoS
Roundabout					
Fernbank/Street 1	C(C)	18.0(21.2)	WBT(EBT)	13.8(16.1)	B(C)
Note: Analysis of signalized intersections assumes a PHF of 0.95 and a saturation flow rate of 1800 veh/h/lane.					

As shown in Table 14, a roundabout controlled intersection at Fernbank Road and Street 1 is projected to operate well, with an overall LOS 'C' during the PM peak hour.

16. CONCLUSIONS

Based on the results summarized herein the following conclusions are offered:

Proposed Site

- The development will include 401 units, consisting of 263 townhomes, and 138 single family homes;
- The proposed development will consist of one phase, with an estimated date of occupancy in 2020;
- The proposed development is projected to generate 'new' two-way vehicle volumes of approximately 240 and 210 trips during the weekday morning and afternoon peak hours, respectively; and,
- The accesses to the development will include a proposed new connection to Fernbank Road and two new connections to Shea Road.

Background Conditions

- Due to the large amount of background development, as well as the conservative 3% background growth rate, the roundabout at the intersection of Fernbank Road and Shea Road is projected to operate with poor LOS and high delays on the eastbound and westbound through movements.

Projected Conditions

- The Fernbank/Shea intersection is projected to operate similarly to the background conditions. No improvements are recommended at this intersection as a result of the site generated traffic.

- The Shea/Street 1 and Shea/Street 4 intersections are projected to operate at a level of service ‘B’ or better during peak periods.
- The unsignalized Fernbank/Street 1 intersection is projected to experience increasing delays on the southbound approach, with a level of service ‘E’ during the 2020 horizon and a level of service ‘F’ during the 2025 horizon. A signal or a roundabout is recommended at this intersection to improve performance and decrease delays to the southbound movement. An RMA will be required for the design and construction of this intersection.
- At the Fernbank/Street 1 intersection, west and eastbound left-turn turn lanes will be warranted in the 2020 horizon year.
- While this study has considered traffic control signals or a roundabout at the intersection of Street 1 and Fernbank Road, the MTO Signal Warrant has not been met by the projected traffic. Therefore, an eastbound left turn lane should be provided for access to 5969 Fernbank Road. The functional design will show the extent and type of roadway modifications required to accommodate the eastbound left turn lane. This study has determined that a 15m storage length, plus appropriate taper length should be provided.

Site Plan

- Cycling facilities will be required along the collector roads within the development, and along the boundary roads of Fernbank Road and Shea Road. These facilities may be on-street facilities but will need separation from on-street parking.
- Pedestrian facilities will include a single sidewalk along local roads, and two sidewalks on collector roads. A minimum boulevard width of 2m is required to reach MMLoS targets.
- To provide appropriate transit service, additional transit stops are required on Fernbank Road and Shea Road adjacent to the development. Adding additional articulated and double-decker buses will ensure that new transit trips can be accommodated.

Based on the foregoing conclusions, the proposed development is recommended to proceed form a transportation perspective.

Prepared By:

Rani Nahas, E.I.T
Transportation Analyst

Reviewed By:

LICENSED PROFESSIONAL ENGINEER
M. A. BAKER
2018-09-19
PROVINCE OF ONTARIO

Mark Baker, P.Eng.
Senior Transportation Engineer

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P: +1 613.738.4160 | www.parsons.com

7 August 2018

City of Ottawa
Development Review Services
110 Laurier Avenue West
Ottawa, ON K1P 1J1

Attention: Rosanna Baggs

Dear Rosanna:

Re: 5969 Fernbank Road
Transportation Impact Assessment – Addendum #1

This Addendum has been prepared to address the comments received from the City of Ottawa, dated July 6th, 2018, with corresponding responses from Parsons.

1.1. TRAFFIC SIGNALS

Comment 1: *Before excavating please call Ont1CALL (1-800-400-2255) for underground locates.*

Response 1: Noted, proponent to be informed.

Comment 2: *No comments with initial TIS for this circulation. Traffic Signal Design & Specification reserves the right to make future comments based on subsequent submissions.*

Response 2: Noted.

Comment 3: *Future considerations:*

- If there are any future proposed changes in the existing roadway geometry that require signalizing of an intersection or changing an existing signalized intersection, the City of Ottawa Traffic Operations Unit is required to complete a traffic signal plant design.
- If the proposed traffic signals are warranted/approved for installation and RMA approved please forward an approved geometric detail design drawing (dwg digital format in NAD 83 coordinates) including base mapping, existing and new underground utilities, and approved pavement markings drawing for detail traffic plant design lay out. Please send all digital (CADD) design files to Peter.Grajcar@ottawa.ca 613-580-2424 extension 23035.

Response 3: Noted, proponent to be informed.

1.2. STREET LIGHTING

Comment 4: *No Comments to this TIA for this circulation. Street Lighting Asset Management Group reserves the right to make comments based on subsequent submissions. Please ensure the Street Lighting group receives the proposed site plan as there is street lighting plant within the ROW*

Response 4: Noted, proponent to be informed.

1.3. OC TRANSPO

Comment 5: No comments. Be advised that there is a possibility of implementing transit service through this project in the future.

Response 5: Noted, proponent to be informed.

1.4. TRAFFIC ENGINEERING

Comment 6: *Minimum left-turn storage length is traditionally 37.5 m plus appropriate taper.*

Response 6: Noted, proponent to be informed.

1.5. TRANSPORTATION ENGINEERING SERVICES

Comment 7: *As per the recommendation in the TIA, a separated bicycle facility is required along Shea Road to reach the BLOS target. The cycling facility should connect to the existing bike lanes to the north towards Abbott Street and pathway to the south at the roundabout.*

Response 7: Noted, proponent to be informed. In the CDP bike lanes are recommended for Shea Road. Given the planned 24m ROW, a cross-section will need to be developed to balance the road width, cycling facilities, pedestrian facilities, and boulevard requirements such as trees and utilities.

Comment 8: *Provide cycling facility on Street 1 as recommended in the TIA to reach the bicycle level of service target. Fernbank Road and Street 1 are identified as a spine route in the ultimate cycling network.*

Response 8: Noted, proponent to be informed. As per response 7, a ROW will have to be developed to accommodate the stated ROW elements.

Comment 9: *Street 1 is a continuation of Cope Drive and we recommend the approved cross section east of Robert Grant Road.*

Response 9: Noted. The approved cross-section is a 26m and Street 1 is a 24m ROW. Therefore, the cross-section will not be continuous west of Shea Road.

Comment 10: *Provide pedestrian facilities as recommended in the TIA to improve the pedestrian level of service along the frontage of Shea Road and Street 1.*

Response 10: Noted, proponent to be informed. As per response 7, a ROW will have to be developed to accommodate the stated ROW elements.

Comment 11: *Confirm proposed pedestrian and cycling facilities recommendations with the City prior to submitting functional design plans (as described in 2017 TIA Guidelines).*

Response 11: Noted, proponent to be informed.

Comment 12: *There are more than 3,000 vehicles per day along Shea Road currently which exceeds the recommended threshold of 2,500 vehicles a day for a collector road. The development volume will be adding to the existing volumes. Provide measures to mitigate the traffic impact on this collector road.*

Response 12: TAC outlines the typical daily traffic volumes for rural collectors and urban collectors as up to 5,000 vehicles and 8,000 vehicles per day, respectively (Tables 2.6.4 and 2.6.5). It is unclear why the TIA Guidelines threshold for collector roadways is 2,500 vehicles per day – half of the typical traffic experienced on a collector roadway. Furthermore, as the existing daily traffic is already above the City's limit outlined in the TIA, it should already be flagged to undergo the area traffic management process.

Within the Fernbank CDP, the progression of the road network has not been addressed, but a relevant statement concerning transit may provide some guidance on this issue. The excerpt from Section 7.6 is as follows:

> "During the initial development of Phase 1, when development is limited to along the North/South Arterial and in the southeast section of the community, transit service will be provided along the arterial and collector roadways as they are phased into the development. Until a more continuous collector roadway is developed, an interim route may provide linkages within Kanata that may not be maintained in the ultimate route network."[1]

Our interpretation of this statement is that while the Fernbank community is developing, the transit network may need to use alternate routes that are not envisioned in the ultimate plan. While not carried over to the road network, this philosophy is directly applicable to the build-out of the collector road network. At this point in time, Shea Road is being used as the main north-south collector roadway. As the surrounding development is built, traffic will be more evenly distributed and as such, Shea Road may ultimately experience lower average daily traffic volumes.

Comment 13: *MMLOS is required for intersections.*

Response 13: As stated in the *Multi-Modal Level of Service (MMLoS) Guidelines*, Section 1.3: "Only signalized intersections are considered for the intersection LOS measures." The study area intersections for this TIA include the roundabout Fernbank/Shea intersection and unsignalized Shea/Street 1, Shea/Street 4, and Fernbank/Street 1 intersections (signal warrants not met by build-out year for site accesses). With the RMA for the Fernbank/Street 1 intersection being completed by IBI Group, it is recommended that the City monitor this intersection as the area is built out for further control (e.g. a roundabout) at this location.

Comment 14: *Clarify the MTO warrant sheets in Appendix G for Fernbank/Street 1 intersection. The preference is to provide a roundabout rather than a traffic signal. Confirm funding for the new intersection requirements with Ann Selfe.*

Response 14: The warrants used in Appendix G for the Fernbank/Street 1 in are based on methodology outlined in the OTM Book 12, Justification 7 – Projected Volumes.

Regarding funding for the new intersection requirements, Tartan Land has agreed to construct the intersection in relation to the 5970 Fernbank Road Development. See attached email for reference.

Comment 15: *The proposed road works will require an RMA report to be completed by the development at 5970 Fernbank Road.*

Response 15: Noted, proponent to be informed.

Comment 16: *Remove the error on the street labelling in Table 7.*

Response 16: The corrected table is below.

[1] Section 7.6, https://ottawa.ca/en/city-hall/planning-and-development/community-plans-and-design-guidelines/community-plans-and-studies/community-design-plans/fernbank-community-design-plan#7-6-interim-transit-service; Accessed 11-Jul-2018

Table 1: Fernbank/Stittsville Main Historical Background Growth (2006 – 2011)

Time Period	Percent Annual Change				
	North Leg	South Leg	East Leg	West Leg	Overall
8 hrs	1.12%	0.99%	6.64%	7.76%	**2.90%**
AM Peak	1.00%	0.77%	12.07%	7.26%	**3.84%**
PM Peak	1.04%	1.59%	21.46%	12.07%	**6.65%**

1.6. TRANSPORTATION ENGINEERING SERVICES

Comment 17: *Section 13.3 – the first sentence states that Fernbank at Street 1 is proposed as a fully signalized intersection, this statement should be revised as section 13.2 notes that based on standard conditions they are not warranted.*

Response 17: The corrected text is provided below.

Fernbank/Street 1
Fernbank at Street 1 is proposed as an unsignalized intersection with STOP control provided on Street 1. The proposed cross-section of the north and southbound approaches on Street 1 is a single shared lane. The proposed cross section of the east and westbound approaches on Fernbank Road is a single left-turn lane and a shared through-right turn lane.

Sincerely,

Rani Nahas, EIT
Traffic Analyst

Andrew Harte, P. Eng.
Transportation Engineer

Appendix A

Screening Form

City of Ottawa 2017 TIA Guidelines

TIA Screening Form

Date	8/3/2017
Project	5969 Fernbank Road
Project Number	476654 - 01000

Results of Screening	Yes/No
Development Satisfies the Trip Generation Trigger	Yes
Development Satisfies the Location Trigger	Yes
Development Satisfies the Safety Trigger	Yes

Module 1.1 - Description of Proposed Development	
Municipal Address	5969 Fernbank Road
Description of location	GOULBOURN CON 10 PT LOT 25;RP 4R7467 PART 2 PT PART 1
Land Use	Residential
Development Size	119 Single Detached Homes / 238 Semi-detached & Townhouse
Number of Accesses and Locations	Three; Two on Shea Road and one on Fernbank Road (Shared with adjacent landowner)
Development Phasing	N/A
Buildout Year	Assumed 2020
Sketch Plan / Site Plan	See attached

Module 1.2 - Trip Generation Trigger		
Land Use Type	Single-Family Homes	Townhomes or Apartments
Development Size	119	238
Trip Generation Trigger Met?	Yes	Yes

Module 1.3 - Location Triggers	
Development Proposes a new driveway to a boundary street that is designated as part of the City's Transit Priority, Rapid Transit, or Spine Bicycle Networks (See Sheet 3)	Yes
Development is in a Design Priority Area (DPA) or Transit-oriented Development (TOD) zone. (See Sheet 3)	No
Location Trigger Met?	Yes

Module 1.4 - Safety Triggers		
Posted Speed Limit on any boundary road	<80	km/h
Horizontal / Vertical Curvature on a boundary street limits sight lines at a proposed driveway	No	
A proposed driveway is within the area of influence of an adjacent traffic signal or roundabout (i.e. within 300 m of intersection in rural conditions, or within 150 m of intersection in urban/ suburban conditions) or within auxiliary lanes of an intersection;	Yes	
A proposed driveway makes use of an existing median break that serves an existing site	No	
There is a documented history of traffic operations or safety concerns on the boundary streets within 500 m of the development	No	
The development includes a drive-thru facility	No	
Safety Trigger Met?	Yes	

TIA Plan Reports

On 14 June 2017, the Council of the City of Ottawa adopted new Transportation Impact Assessment (TIA) Guidelines. In adopting the guidelines, Council established a requirement for those preparing and delivering transportation impact assessments and reports to sign a letter of certification.

Individuals submitting TIA reports will be responsible for all aspects of development-related transportation assessment and reporting, and undertaking such work, in accordance and compliance with the City of Ottawa's Official Plan, the Transportation Master Plan and the Transportation Impact Assessment (2017) Guidelines.

By submitting the attached TIA report (and any associated documents) and signing this document, the individual acknowledges that s/he meets the four criteria listed below.

CERTIFICATION

1. I have reviewed and have a sound understanding of the objectives, needs and requirements of the City of Ottawa's Official Plan, Transportation Master Plan and the Transportation Impact Assessment (2017) Guidelines;
2. I have a sound knowledge of industry standard practice with respect to the preparation of transportation impact assessment reports, including multi modal level of service review;
3. I have substantial experience (more than 5 years) in undertaking and delivering transportation impact studies (analysis, reporting and geometric design) with strong background knowledge in transportation planning, engineering or traffic operations; and
4. I am either a licensed[1] or registered[2] professional in good standing, whose field of expertise [check √ appropriate field(s)] is either transportation engineering √ or transportation planning □.

[1,2] **License of registration body that oversees the profession is required to have a code of conduct and ethics guidelines that will ensure appropriate conduct and representation for transportation planning and/or transportation engineering works.**

Dated at ___Markham______this __18__ day of _May___________________, 2018.
(City)

Name: _________Mark Crockford____________________________________
(Please Print)

Professional Title: _________Professional Engineer________________________________

Signature of Individual certifier that s/he meets the above four criteria

LICENSED PROFESSIONAL ENGINEER
M. B. CROCKFORD
100152912
18-May-18
PROVINCE OF ONTARIO

Office Contact Information (Please Print)
Address: 625 Cochrane Drive, Suite 500
City / Postal Code: L3R 9R9
Telephone / Extension: 1 647.457.5866
E-Mail Address: Mark.Crockford@Parsons.com

Appendix B

Traffic Data

ACCURATE TRUSTED TRAFFIC DATA

Turning Movement Count

Summary Report Including AM/PM Peak Hours, PHF, AADT and Expansion Factors

Automobiles, Taxis, Light Trucks, Vans, SUV's, Motorcycles, Heavy Trucks, Buses, and School Buses

Fernbank Road and Shea Road (Roundabout) — Stittsville, ON

Survey Date: Tuesday, 22 March 2016 **Start Time:** 0700 **AADT Factor:** 1.0

Weather: Cloudy/Partly Cloudy **Survey Duration:** 8 Hrs. **Survey Hours:** 0700-1000, 1130-1330 & 1500-1800

	Fernbank Road					Fernbank Road						Shea Road					Shea Road					
	Eastbound					Westbound						Northbound					Southbound					
Time Period	LT	ST	RT	UT	E/B Tot	LT	ST	RT	UT	W/B Tot	Street Total	LT	ST	RT	UT	N/B Tot	LT	ST	RT	UT	S/B Tot	Street Total	Grand Total
0700-0800	130	308	33	1	**472**	23	61	44	0	**128**	**600**	7	91	33	0	**131**	59	72	39	0	**170**	**301**	**901**
0800-0900	103	265	20	0	**388**	15	104	51	1	**171**	**559**	5	81	39	0	**125**	69	59	75	0	**203**	**328**	**887**
0900-1000	50	226	13	0	**289**	11	94	52	0	**157**	**446**	6	58	40	0	**104**	39	33	36	0	**108**	**212**	**658**
1130-1230	25	109	2	0	**136**	33	96	40	0	**169**	**305**	11	41	27	0	**79**	47	35	43	0	**125**	**204**	**509**
1230-1330	27	128	8	0	**163**	15	117	49	0	**181**	**344**	5	39	13	0	**57**	30	33	36	1	**100**	**157**	**501**
1500-1600	45	130	12	0	**187**	37	247	72	0	**356**	**543**	14	53	27	0	**94**	49	69	68	0	**186**	**280**	**823**
1600-1700	55	156	14	0	**225**	32	306	116	1	**455**	**680**	15	91	28	0	**134**	39	86	74	0	**199**	**333**	**1013**
1700-1800	51	158	5	0	**214**	35	289	94	0	**418**	**632**	23	90	22	0	**135**	59	80	86	0	**225**	**360**	**992**
Totals	**486**	**1480**	**107**	**1**	**2074**	**201**	**1314**	**518**	**2**	**2035**	**4109**	**86**	**544**	**229**	**0**	**859**	**391**	**467**	**457**	**1**	**1316**	**2175**	**6284**

Equivalent 12 & 24-hour Vehicle Volumes Including the Annual Average Daily Traffic (AADT) Factor Applicable to the Day and Month of the Turning Movement Count

➡ Expansion factors are applied exclusively to standard 8-hour turning movement counts ⬅

Equivalent 12-hour vehicle volumes. These volumes are calculated by multiplying the 8-hour totals by the 8 ➡12 expansion factor of 1.39

Equ. 12 Hr	676	2057	149	1	**2883**	279	1826	720	3	**2829**	**5712**	120	756	318	0	**1194**	543	649	635	1	**1829**	**3023**	**8735**

Average daily 12-hour vehicle volumes. These volumes are calculated by multiplying the equivalent 12-hour totals by the AADT factor of: 1.0

AADT 12-hr	676	2057	149	1	**2883**	279	1826	720	3	**2829**	**5712**	120	756	318	0	**1194**	543	649	635	1	**1829**	**3023**	**8735**

24-Hour AADT. These volumes are calculated by multiplying the average daily 12-hour vehicle volumes by the 12 ➡24 expansion factor of 1.31

AADT 24 Hr	885	2695	195	2	**3777**	366	2393	943	4	**3706**	**7482**	157	991	417	0	**1564**	712	850	832	2	**2396**	**3960**	**11443**

AM Peak Hour Factor ➡ 0.81

AM Peak Hr	LT	ST	RT	UT	TOT	LT	ST	RT	UT	TOT	S.TOT	LT	ST	RT	UT	TOT	LT	ST	RT	UT	TOT	S.TOT	G.TOT
0715-0815	183	326	32	0	**541**	25	77	57	1	**160**	**701**	5	106	40	0	**151**	72	82	73	0	**227**	**378**	**1079**

PM Peak Hour Factor ➡ 0.96

PM Peak Hr	LT	ST	RT	UT	TOT	LT	ST	RT	UT	TOT	S.TOT	LT	ST	RT	UT	TOT	LT	ST	RT	UT	TOT	S.TOT	G.TOT
1630-1730	57	151	6	0	**214**	36	313	92	0	**441**	**655**	20	101	26	0	**147**	39	84	90	0	**213**	**360**	**1015**

Comments

Schools in session. This intersection is a roundabout.

Notes:

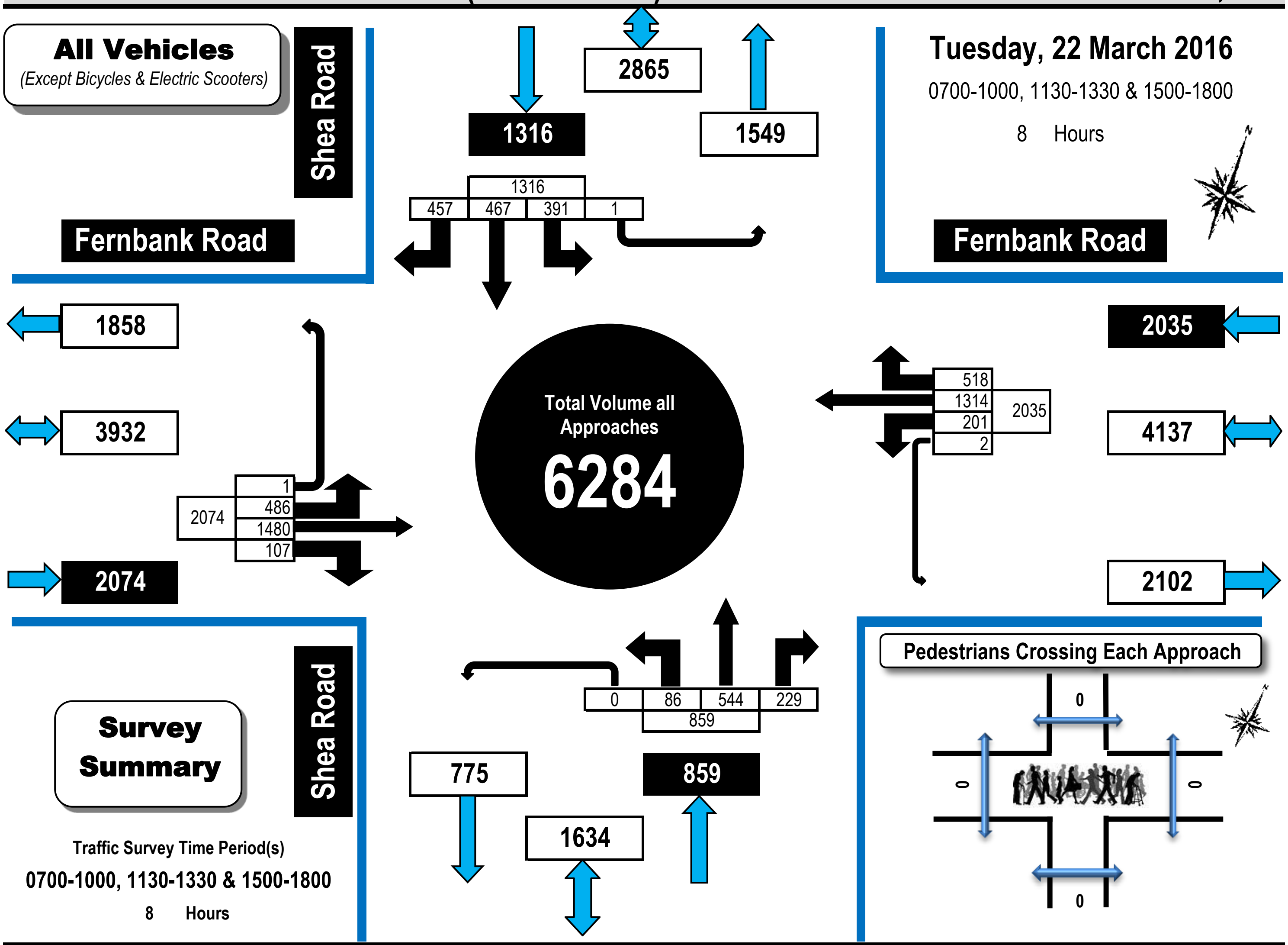
1. Includes all vehicle types except bicycles and electric scooters.
2. Expansion factors are not applied to turning movement counts if they are less than 8-hours in duration.
3. When expansion and AADT factors are applied, the results will differ slightly due to rounding.

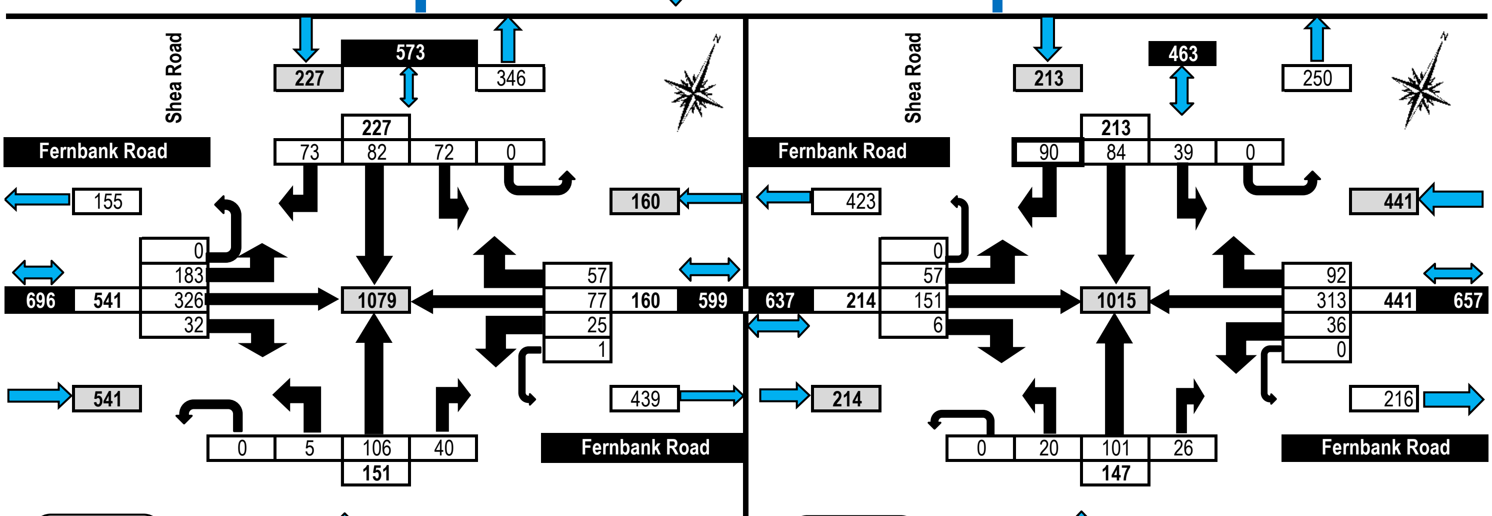
Disclaimer:

Turning Movement Count
Summary, AM and PM Peak Hour Flow Diagrams

Automobiles, Taxis, Light Trucks, Vans, SUV's, Motorcycles, Heavy Trucks, Buses, and School Buses

Fernbank Road and Shea Road (Roundabout) — Stittsville, ON





Summary - AM Peak Hr.	
Peak Hr.	0715-0815
Volume	1079
% of Total	17.2%
PHF	0.81

Summary - PM Peak Hr.	
Peak Hr.	1630-1730
Volume	1015
% of Total	16.2%
PHF	0.96

Appendix C

City of Ottawa Collision Data

Total Area

Classification of Accident	Rear End	Turning Movement	Sideswipe	Angle	Approaching	Single Vehicle (other)	Single vehicle (Unattended vehicle)	Other	Total	
P.D. only	2	1	2	4	0	6	2	0	17	81%
Non-fatal injury	0	0	0	0	0	3	0	0	3	14%
Non reportable	0	0	1	0	0	0	0	0	1	5%
Total	**2**	**1**	**3**	**4**	**0**	**9**	**2**	**0**	**21**	100%
	#4 or 10%	#6 or 5%	#3 or 14%	#2 or 19%	#7 or 0%	#1 or 43%	#4 or 10%	#7 or 0%		

FERNBANK RD, LIARD ST to SHEA RD

Years	Total # Collisions	24 Hr AADT Veh Volume	Days	Collisions/MEV
2012-2013	3	n/a	730	**n/a**

Classification of Accident	Rear End	Turning Movement	Sideswipe	Angle	Approaching	Single Vehicle (other)	Single vehicle (Unattended vehicle)	Other	Total	
P.D. only	0	0	0	0	0	3	0	0	3	100%
Non-fatal injury	0	0	0	0	0	0	0	0	0	0%
Non reportable	0	0	0	0	0	0	0	0	0	0%
Total	**0**	**0**	**0**	**0**	**0**	**3**	**0**	**0**	**3**	100%
	0%	0%	0%	0%	0%	100%	0%	0%		

SHEA RD, ABBOTT ST to FERNBANK RD

Years	Total # Collisions	24 Hr AADT Veh Volume	Days	Collisions/MEV
2012-2013	13	n/a	730	**n/a**

Classification of Accident	Rear End	Turning Movement	Sideswipe	Angle	Approaching	Single Vehicle (other)	Single vehicle (Unattended vehicle)	Other	Total	
P.D. only	1	1	2	1	0	3	2	0	10	77%
Non-fatal injury	0	0	0	0	0	2	0	0	2	15%
Non reportable	0	0	1	0	0	0	0	0	1	8%
Total	**1**	**1**	**3**	**1**	**0**	**5**	**2**	**0**	**13**	100%
	8%	8%	23%	8%	0%	38%	15%	0%		

FERNBANK RD / SHEA RD

Years	Total # Collisions	24 Hr AADT Veh Volume	Days	Collisions/MEV
2014-2016	5	11,443	1095	**0.40**

Classification of Accident	Rear End	Turning Movement	Sideswipe	Angle	Approaching	Single Vehicle (other)	Single vehicle (Unattended vehicle)	Other	Total	
P.D. only	1	0	0	3	0	0	0	0	4	80%
Non-fatal injury	0	0	0	0	0	1	0	0	1	20%
Non reportable	0	0	0	0	0	0	0	0	0	0%
Total	**1**	**0**	**0**	**3**	**0**	**1**	**0**	**0**	**5**	100%
	20%	0%	0%	60%	0%	20%	0%	0%		

Appendix D

Background Traffic Growth

Fernbank / Stittsville Main
8 hrs

Year	Date	North Leg		South Leg		East Leg		West Leg		Total
		SB	NB	NB	SB	WB	EB	EB	WB	
2006	Tuesday 2 May	2184	2262	1991	1995	662	543	521	558	10716
2008	Wednesday 9 July	1651	1850	1524	1614	1146	824	675	808	10092
2009	Tuesday 12 May	1929	2027	1747	1878	754	658	679	546	10218
2011	Tuesday 21 June	2316	2278	2012	2067	908	942	852	801	12176

North Leg

Year	Counts				% Change			
	NB	*SB*	*NB+SB*	*INT*	*NB*	*SB*	*NB+SB*	*INT*
2006	2262	2184	4446	10716				
2008	1850	1651	3501	10092	-18.2%	-24.4%	-21.3%	-5.8%
2009	2027	1929	3956	10218	9.6%	16.8%	13.0%	1.2%
2011	2278	2316	4594	12176	12.4%	20.1%	16.1%	19.2%

	Year			
Regression Estimate	2006	2080	1930	4009
Regression Estimate	2011	2129	2110	4239
Average Annual Change		**0.47%**	**1.80%**	**1.12%**

West Leg

Year	Counts				% Change			
	EB	*WB*	*EB+WB*	*INT*	*EB*	*WB*	*EB+WB*	*INT*
2006	521	558	1079	10716				
2008	675	808	1483	10092	29.6%	44.8%	37.4%	-5.8%
2009	679	546	1225	10218	0.6%	-32.4%	-17.4%	1.2%
2011	852	801	1653	12176	25.5%	46.7%	34.9%	19.2%

	Year			
Regression Estimate	2006	522	587	1109
Regression Estimate	2011	841	770	1611
Average Annual Change		**10.01%**	**5.59%**	**7.76%**

East Leg

Year	Counts				% Change			
	EB	*WB*	*EB+WB*	*INT*	*EB*	*WB*	*EB+WB*	*INT*
2006	543	662	1205	10716				
2008	824	1146	1970	10092	51.7%	73.1%	63.5%	-5.8%
2009	658	754	1412	10218	-20.1%	-34.2%	-28.3%	1.2%
2011	942	908	1850	12176	43.2%	20.4%	31.0%	19.2%

	Year			
Regression Estimate	2006	566	787	1353
Regression Estimate	2011	918	948	1866
Average Annual Change		**10.15%**	**3.80%**	**6.64%**

South Leg

Year	Counts				% Change			
	NB	*SB*	*NB+SB*	*INT*	*NB*	*SB*	*NB+SB*	*INT*
2006	1991	1995	3986	10716				
2008	1524	1614	3138	10092	-23.5%	-19.1%	-21.3%	-5.8%
2009	1747	1878	3625	10218	14.6%	16.4%	15.5%	1.2%
2011	2012	2067	4079	12176	15.2%	10.1%	12.5%	19.2%

	Year			
Regression Estimate	2006	1787	1829	3615
Regression Estimate	2011	1850	1949	3799
Average Annual Change		**0.70%**	**1.28%**	**0.99%**

Fernbank / Stittsville Main
<u>**AM Peak**</u>

Year	Date	North Leg		South Leg		East Leg		West Leg		Total
		SB	NB	NB	SB	WB	EB	EB	WB	
2006	Tuesday 2 May	277	307	313	259	60	100	81	65	1462
2008	Wednesday 9 July	166	257	238	149	104	124	123	101	1262
2009	Tuesday 12 May	293	295	287	263	66	174	140	54	1572
2011	Tuesday 21 June	271	308	316	244	83	207	171	52	1652

North Leg

Year	Counts				% Change			
	NB	*SB*	*NB+SB*	*INT*	*NB*	*SB*	*NB+SB*	*INT*
2006	307	277	584	1462				
2008	257	166	423	1262	-16.3%	-40.1%	-27.6%	-13.7%
2009	295	293	588	1572	14.8%	76.5%	39.0%	24.6%
2011	308	271	579	1652	4.4%	-7.5%	-1.5%	5.1%

Regression Estimate	2006	288	242	530
Regression Estimate	2011	296	261	557
Average Annual Change		**0.57%**	**1.49%**	**1.00%**

West Leg

Year	Counts				% Change			
	EB	*WB*	*EB+WB*	*INT*	*EB*	*WB*	*EB+WB*	*INT*
2006	81	65	146	1462				
2008	123	101	224	1262	51.9%	55.4%	53.4%	-13.7%
2009	140	54	194	1572	13.8%	-46.5%	-13.4%	24.6%
2011	171	52	223	1652	22.1%	-3.7%	14.9%	5.1%

Regression Estimate	2006	84	79	163
Regression Estimate	2011	174	57	231
Average Annual Change		**15.68%**	**-6.19%**	**7.26%**

East Leg

Year	Counts				% Change			
	EB	*WB*	*EB+WB*	*INT*	*EB*	*WB*	*EB+WB*	*INT*
2006	100	60	160	1462				
2008	124	104	228	1262	24.0%	73.3%	42.5%	-13.7%
2009	174	66	240	1572	40.3%	-36.5%	5.3%	24.6%
2011	207	83	290	1652	19.0%	25.8%	20.8%	5.1%

Regression Estimate	2006	95	71	166
Regression Estimate	2011	208	86	293
Average Annual Change		**16.91%**	**3.87%**	**12.07%**

South Leg

Year	Counts				% Change			
	NB	*SB*	*NB+SB*	*INT*	*NB*	*SB*	*NB+SB*	*INT*
2006	313	259	572	1462				
2008	238	149	387	1262	-24.0%	-42.5%	-32.3%	-13.7%
2009	287	263	550	1572	20.6%	76.5%	42.1%	24.6%
2011	316	244	560	1652	10.1%	-7.2%	1.8%	5.1%

Regression Estimate	2006	282	225	507
Regression Estimate	2011	295	233	527
Average Annual Change		**0.86%**	**0.66%**	**0.77%**

Fernbank / Stittsville Main
PM Peak

Year	Date	North Leg		South Leg		East Leg		West Leg		Total
		SB	NB	NB	SB	WB	EB	EB	WB	
2006	Tuesday 2 May	357	349	304	322	10	72	64	92	1570
2008	Wednesday 9 July	378	379	313	343	266	128	74	181	2062
2009	Tuesday 12 May	293	304	253	264	155	91	65	107	1532
2011	Tuesday 21 June	403	373	311	394	239	128	121	179	2148

North Leg

Year	Counts				% Change			
	NB	*SB*	*NB+SB*	*INT*	*NB*	*SB*	*NB+SB*	*INT*
2006	349	357	706	1570				
2008	379	378	757	2062	8.6%	5.9%	7.2%	31.3%
2009	304	293	597	1532	-19.8%	-22.5%	-21.1%	-25.7%
2011	373	403	776	2148	22.7%	37.5%	30.0%	40.2%

	Year	NB	SB	NB+SB
Regression Estimate	2006	347	344	691
Regression Estimate	2011	356	372	727
Average Annual Change		**0.49%**	**1.57%**	**1.04%**

West Leg

Year	Counts				% Change			
	EB	*WB*	*EB+WB*	*INT*	*EB*	*WB*	*EB+WB*	*INT*
2006	64	92	156	1570				
2008	74	181	255	2062	15.6%	96.7%	63.5%	31.3%
2009	65	107	172	1532	-12.2%	-40.9%	-32.5%	-25.7%
2011	121	179	300	2148	86.2%	67.3%	74.4%	40.2%

	Year	EB	WB	EB+WB
Regression Estimate	2006	54	105	160
Regression Estimate	2011	108	174	282
Average Annual Change		**14.58%**	**10.68%**	**12.07%**

East Leg

Year	Counts				% Change			
	EB	*WB*	*EB+WB*	*INT*	*EB*	*WB*	*EB+WB*	*INT*
2006	72	10	82	1570				
2008	128	266	394	2062	77.8%	2560.0%	380.5%	31.3%
2009	91	155	246	1532	-28.9%	-41.7%	-37.6%	-25.7%
2011	128	239	367	2148	40.7%	54.2%	49.2%	40.2%

	Year	EB	WB	EB+WB
Regression Estimate	2006	81	68	149
Regression Estimate	2011	128	267	395
Average Annual Change		**9.50%**	**31.42%**	**21.46%**

South Leg

Year	Counts				% Change			
	NB	*SB*	*NB+SB*	*INT*	*NB*	*SB*	*NB+SB*	*INT*
2006	304	322	626	1570				
2008	313	343	656	2062	3.0%	6.5%	4.8%	31.3%
2009	253	264	517	1532	-19.2%	-23.0%	-21.2%	-25.7%
2011	311	394	705	2148	22.9%	49.2%	36.4%	40.2%

	Year	NB	SB	NB+SB
Regression Estimate	2006	298	304	601
Regression Estimate	2011	293	358	651
Average Annual Change		**-0.33%**	**3.33%**	**1.59%**

Appendix E

SIDRA Background Traffic Analysis

MOVEMENT SUMMARY

Site: FB2020AM

AM Peak Period
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Shea South Leg											
3	L2	5	3.0	0.511	18.1	LOS C	2.3	18.0	0.73	0.81	45.0
8	T1	150	3.0	0.511	18.1	LOS C	2.3	18.0	0.73	0.81	45.0
18	R2	83	3.0	0.511	18.1	LOS C	2.3	18.0	0.73	0.81	44.0
Approach		238	3.0	0.511	18.1	LOS C	2.3	18.0	0.73	0.81	44.6
East: Fernbank East Leg											
1	L2	60	3.0	0.363	9.6	LOS A	1.5	11.7	0.55	0.54	49.5
6	T1	145	3.0	0.363	9.6	LOS A	1.5	11.7	0.55	0.54	49.4
16	R2	57	3.0	0.363	9.6	LOS A	1.5	11.7	0.55	0.54	48.3
Approach		262	3.0	0.363	9.6	LOS A	1.5	11.7	0.55	0.54	49.2
North: Shea North Leg											
7	L2	81	3.0	0.325	7.6	LOS A	1.4	10.9	0.41	0.31	50.6
4	T1	106	3.0	0.325	7.6	LOS A	1.4	10.9	0.41	0.31	50.6
14	R2	100	3.0	0.325	7.6	LOS A	1.4	10.9	0.41	0.31	49.3
Approach		287	3.0	0.325	7.6	LOS A	1.4	10.9	0.41	0.31	50.1
West: Fernbank West Leg											
5	L2	251	3.0	0.919	36.3	LOS E	17.1	133.3	1.00	1.17	36.5
2	T1	499	3.0	0.919	36.3	LOS E	17.1	133.3	1.00	1.17	36.5
12	R2	32	3.0	0.919	36.3	LOS E	17.1	133.3	1.00	1.17	35.8
Approach		782	3.0	0.919	36.3	LOS E	17.1	133.3	1.00	1.17	36.4
All Vehicles		1569	3.0	0.919	23.8	LOS C	17.1	133.3	0.78	0.85	41.4

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: US HCM 2010.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: FB2020PM

PM Peak Period
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Shea South Leg											
3	L2	20	3.0	0.406	11.3	LOS B	1.8	13.9	0.61	0.64	48.9
8	T1	154	3.0	0.406	11.3	LOS B	1.8	13.9	0.61	0.64	48.8
18	R2	91	3.0	0.406	11.3	LOS B	1.8	13.9	0.61	0.64	47.7
Approach		265	3.0	0.406	11.3	LOS B	1.8	13.9	0.61	0.64	48.4
East: Fernbank East Leg											
1	L2	135	3.0	0.941	41.2	LOS E	18.2	142.1	1.00	1.33	35.0
6	T1	533	3.0	0.941	41.2	LOS E	18.2	142.1	1.00	1.33	35.0
16	R2	92	3.0	0.941	41.2	LOS E	18.2	142.1	1.00	1.33	34.4
Approach		760	3.0	0.941	41.2	LOS E	18.2	142.1	1.00	1.33	34.9
North: Shea North Leg											
7	L2	93	3.0	0.772	29.6	LOS D	5.7	44.2	0.84	1.04	39.1
4	T1	145	3.0	0.772	29.6	LOS D	5.7	44.2	0.84	1.04	39.1
14	R2	179	3.0	0.772	29.6	LOS D	5.7	44.2	0.84	1.04	38.3
Approach		417	3.0	0.772	29.6	LOS D	5.7	44.2	0.84	1.04	38.8
West: Fernbank West Leg											
5	L2	123	3.0	0.558	13.5	LOS B	3.3	25.7	0.65	0.69	46.9
2	T1	288	3.0	0.558	13.5	LOS B	3.3	25.7	0.65	0.69	46.9
12	R2	6	3.0	0.558	13.5	LOS B	3.3	25.7	0.65	0.69	45.8
Approach		417	3.0	0.558	13.5	LOS B	3.3	25.7	0.65	0.69	46.9
All Vehicles		1859	3.0	0.941	28.1	LOS D	18.2	142.1	0.83	1.02	39.6

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: US HCM 2010.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SIDRA INTERSECTION 6

MOVEMENT SUMMARY

Site: FB2025AM

AM Peak Hour
Fernbank/Shea Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Shea South Leg											
3	L2	5	3.0	0.581	21.8	LOS C	2.8	21.8	0.77	0.88	43.1
8	T1	168	3.0	0.581	21.8	LOS C	2.8	21.8	0.77	0.88	43.0
18	R2	83	3.0	0.581	21.8	LOS C	2.8	21.8	0.77	0.88	42.1
Approach		256	3.0	0.581	21.8	LOS C	2.8	21.8	0.77	0.88	42.7
East: Fernbank East Leg											
1	L2	60	3.0	0.388	10.2	LOS B	1.7	13.1	0.57	0.58	49.2
6	T1	158	3.0	0.388	10.2	LOS B	1.7	13.1	0.57	0.58	49.1
16	R2	57	3.0	0.388	10.2	LOS B	1.7	13.1	0.57	0.58	47.9
Approach		275	3.0	0.388	10.2	LOS B	1.7	13.1	0.57	0.58	48.9
North: Shea North Leg											
7	L2	81	3.0	0.345	8.0	LOS A	1.5	11.8	0.43	0.34	50.4
4	T1	120	3.0	0.345	8.0	LOS A	1.5	11.8	0.43	0.34	50.4
14	R2	100	3.0	0.345	8.0	LOS A	1.5	11.8	0.43	0.34	49.1
Approach		301	3.0	0.345	8.0	LOS A	1.5	11.8	0.43	0.34	50.0
West: Fernbank West Leg											
5	L2	251	3.0	0.998	52.8	LOS F	28.2	219.9	1.00	1.49	31.5
2	T1	554	3.0	0.998	52.8	LOS F	28.2	219.9	1.00	1.49	31.5
12	R2	32	3.0	0.998	52.8	LOS F	28.2	219.9	1.00	1.49	31.0
Approach		837	3.0	0.998	52.8	LOS F	28.2	219.9	1.00	1.49	31.4
All Vehicles		1669	3.0	0.998	33.0	LOS D	28.2	219.9	0.79	1.04	37.7

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: US HCM 2010.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: FB2025PM

PM Peak Hour
Fernbank/Shea Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Shea South Leg											
3	L2	20	3.0	0.444	12.3	LOS B	2.1	16.0	0.64	0.67	48.3
8	T1	171	3.0	0.444	12.3	LOS B	2.1	16.0	0.64	0.67	48.2
18	R2	91	3.0	0.444	12.3	LOS B	2.1	16.0	0.64	0.67	47.0
Approach		282	3.0	0.444	12.3	LOS B	2.1	16.0	0.64	0.67	47.8
East: Fernbank East Leg											
1	L2	135	3.0	1.024	61.0	LOS F	31.0	241.5	1.00	1.76	29.6
6	T1	586	3.0	1.024	61.0	LOS F	31.0	241.5	1.00	1.76	29.5
16	R2	92	3.0	1.024	61.0	LOS F	31.0	241.5	1.00	1.76	29.1
Approach		813	3.0	1.024	61.0	LOS F	31.0	241.5	1.00	1.76	29.5
North: Shea North Leg											
7	L2	93	3.0	0.828	36.2	LOS E	6.8	53.0	0.88	1.14	36.6
4	T1	159	3.0	0.828	36.2	LOS E	6.8	53.0	0.88	1.14	36.5
14	R2	179	3.0	0.828	36.2	LOS E	6.8	53.0	0.88	1.14	35.9
Approach		431	3.0	0.828	36.2	LOS E	6.8	53.0	0.88	1.14	36.3
West: Fernbank West Leg											
5	L2	123	3.0	0.600	14.9	LOS B	3.8	29.7	0.68	0.74	46.2
2	T1	314	3.0	0.600	14.9	LOS B	3.8	29.7	0.68	0.74	46.1
12	R2	6	3.0	0.600	14.9	LOS B	3.8	29.7	0.68	0.74	45.1
Approach		443	3.0	0.600	14.9	LOS B	3.8	29.7	0.68	0.74	46.1
All Vehicles		1969	3.0	1.024	38.2	LOS E	31.0	241.5	0.85	1.24	35.8

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: US HCM 2010.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SIDRA INTERSECTION 6

Appendix F

MMLOS Analysis

Multi-Modal Level of Service - Segments Form

Consultant	**PARSONS**	**Project**	**476654-01000**
Scenario	**5969 Fernbank**	**Date**	
Comments			

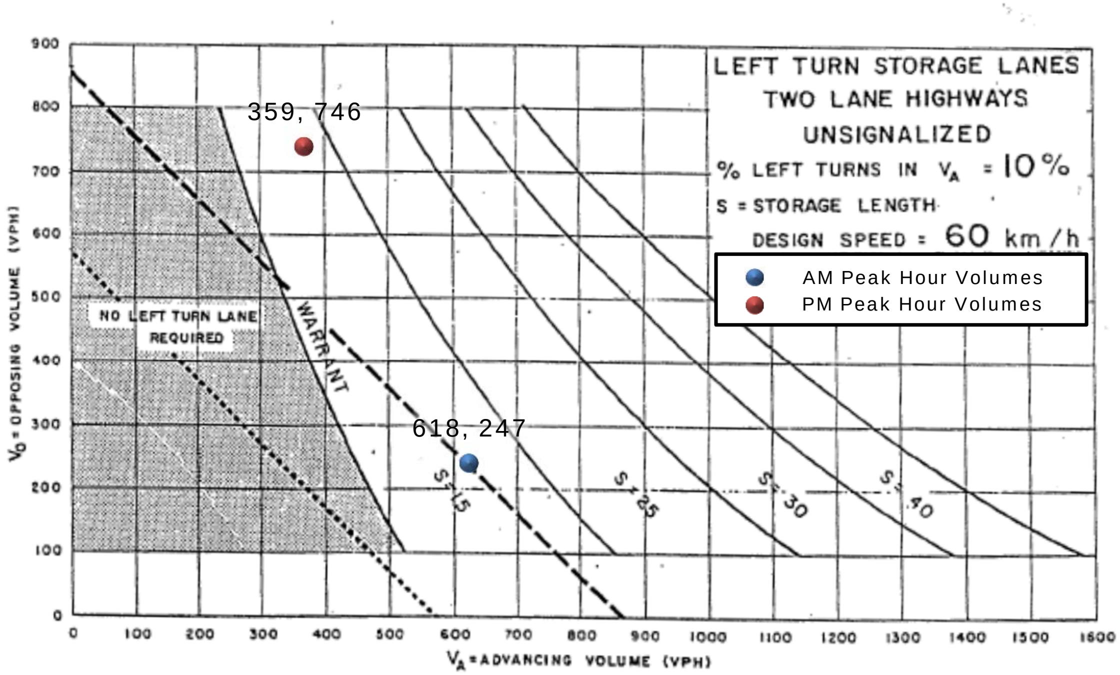
SEGMENTS		Street A	Fernbank (Existing) 1	Shea (Existing) 2	Fernbank (Future) 3	Shea (Future) 4	Street 1 (Future) 5	Section 6	Section 7	Section 8	Section 9
Pedestrian	Sidewalk Width Boulevard Width	-	no sidewalk n/a	no sidewalk n/a	≥ 2 m > 2 m	≥ 2 m > 2 m	1.8 m > 2 m				
	Avg Daily Curb Lane Traffic Volume		> 3000	> 3000	> 3000	> 3000	≤ 3000				
	Operating Speed On-Street Parking		> 60 km/h no	> 60 km/h no	> 60 km/h no	> 60 km/h no	> 30 to 50 km/h no				
	Exposure to Traffic PLoS		**F**	**F**	**D**	**D**	**A**	-	-	-	-
	Effective Sidewalk Width										
	Pedestrian Volume										
	Crowding PLoS		-	-	-	-	-	-	-	-	-
	Level of Service		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Bicycle	Type of Cycling Facility	**F**	Mixed Traffic	Mixed Traffic	Curbside Bike Lane	Physically Separated	Curbside Bike Lane				
	Number of Travel Lanes		≤ 2 (no centreline)	≤ 2 (no centreline)	≤ 1 each direction	~~≤ 1 each direction~~	≤ 1 each direction				
	Operating Speed		≥ 60 km/h	≥ 60 km/h	>50 to 70 km/h		≤ 50 km/h				
	# of Lanes & Operating Speed LoS		**F**	**F**	**C**	-	**A**	-	-	-	-
	Bike Lane (+ Parking Lane) Width				≥1.5 to <1.8 m		≥ 1.8 m				
	Bike Lane Width LoS		-	-	**B**	-	**A**	-	-	-	-
	Bike Lane Blockages				Rare		Rare				
	Blockage LoS		-	-	**A**	-	**A**	-	-	-	-
	Median Refuge Width (no median = < 1.8 m)		< 1.8 m refuge	< 1.8 m refuge	< 1.8 m refuge		< 1.8 m refuge				
	No. of Lanes at Unsignalized Crossing		≤ 3 lanes	≤ 3 lanes	≤ 3 lanes		≤ 3 lanes				
	Sidestreet Operating Speed		>40 to 50 km/h	>40 to 50 km/h	>40 to 50 km/h		≤ 40 km/h				
	Unsignalized Crossing - Lowest LoS		**B**	**B**	**B**	**A**	**A**	-	-	-	-
	Level of Service		**F**	**F**	**C**	**A**	**A**	**-**	**-**	**-**	**-**
Transit	Facility Type	**D**		Mixed Traffic							
	Friction or Ratio Transit:Posted Speed			Vt/Vp ≥ 0.8							
	Level of Service		**-**	**D**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Truck	Truck Lane Width	**-**									
	Travel Lanes per Direction										
	Level of Service		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

Appendix G

Warrants

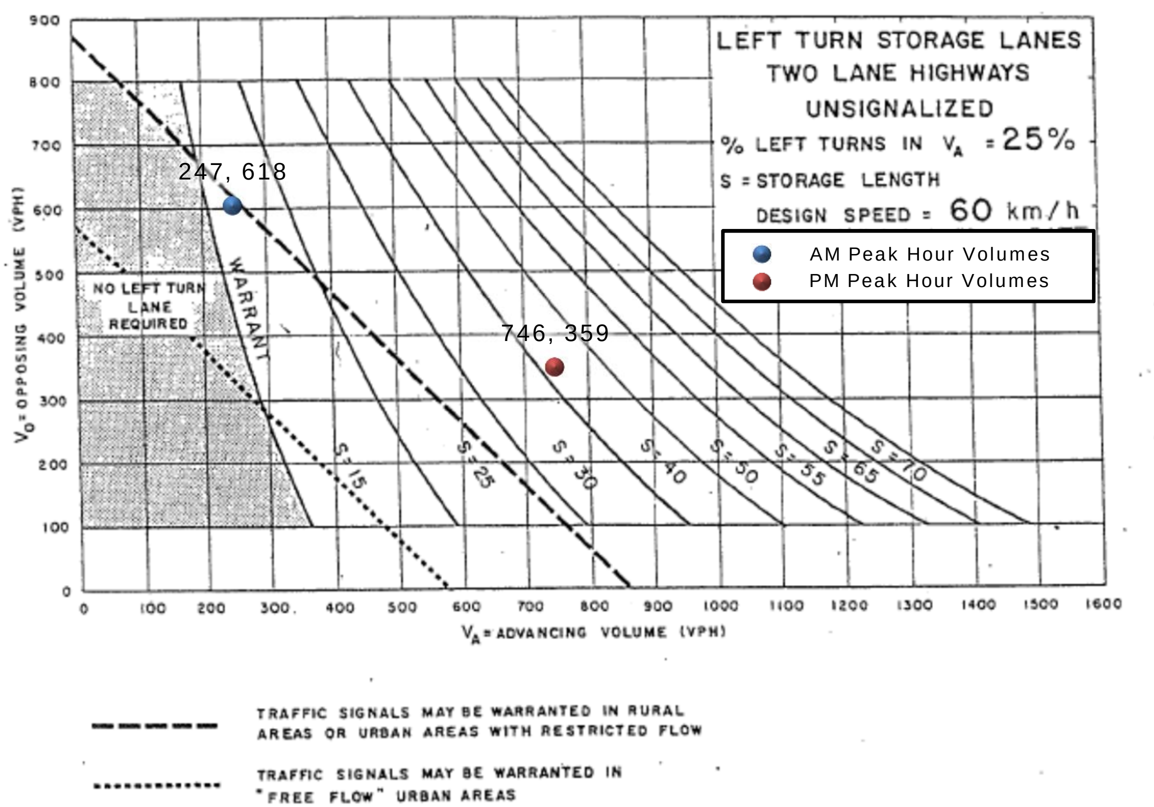
	Design Speed	Advancing Traffic Volume (V_A)		Opposing Traffic Volume (V_O)		Left Turn Traffic Volume (V_L)		% of Left Turning Traffic		Warrant Left Turn Lane
		AM	PM	AM	PM	AM	PM	AM	PM	
Total Projected 2020 volumes										
Fernbank/Street 1	60	618	359	247	746	13	44	2%	12%	Yes

Peak	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
							Warrant?					
AM	43	10	156	84	10	41	13	593	12	44	175	28
PM	25	10	90	54	10	26	44	271	44	162	493	91



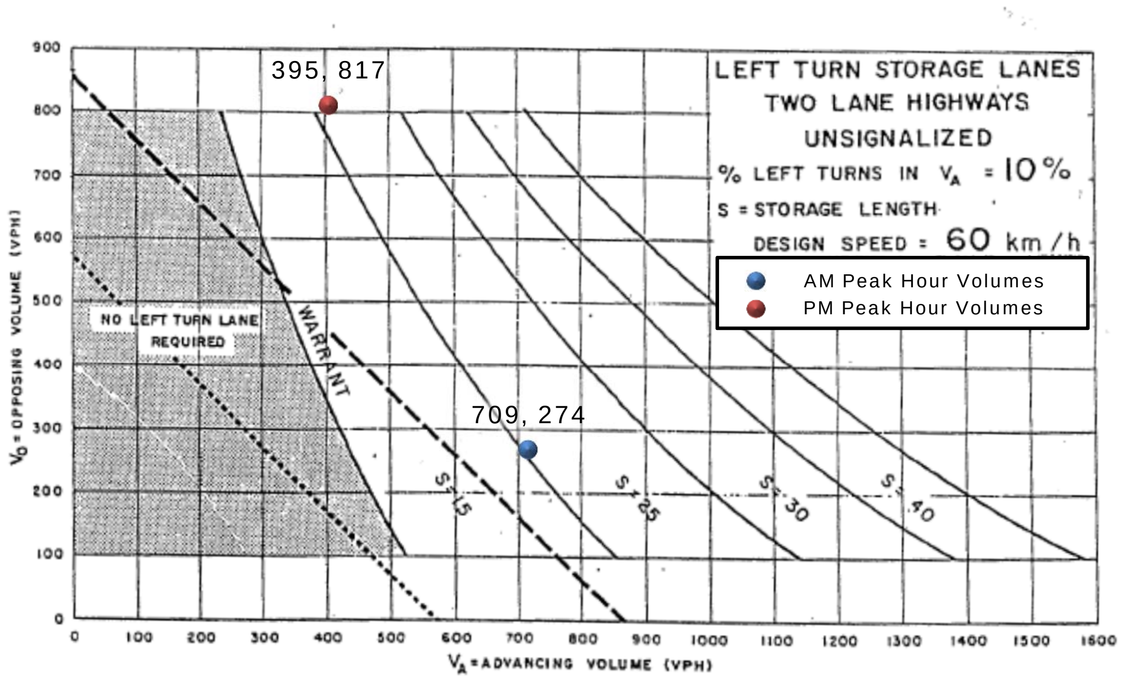
	Design Speed	Advancing Traffic Volume (V_A)		Opposing Traffic Volume (V_O)		Left Turn Traffic Volume (V_L)		% of Left Turning Traffic		Warrant Left Turn Lane
		AM	PM	AM	PM	AM	PM	AM	PM	
Total Projected 2020 volumes										
Fernbank/Street 1	60	247	746	618	359	44	162	18%	22%	Yes

Peak	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL Warrant?	WBT	WBR
AM	43	10	156	84	10	41	13	593	12	44	175	28
PM	25	10	90	54	10	26	44	271	44	162	493	91



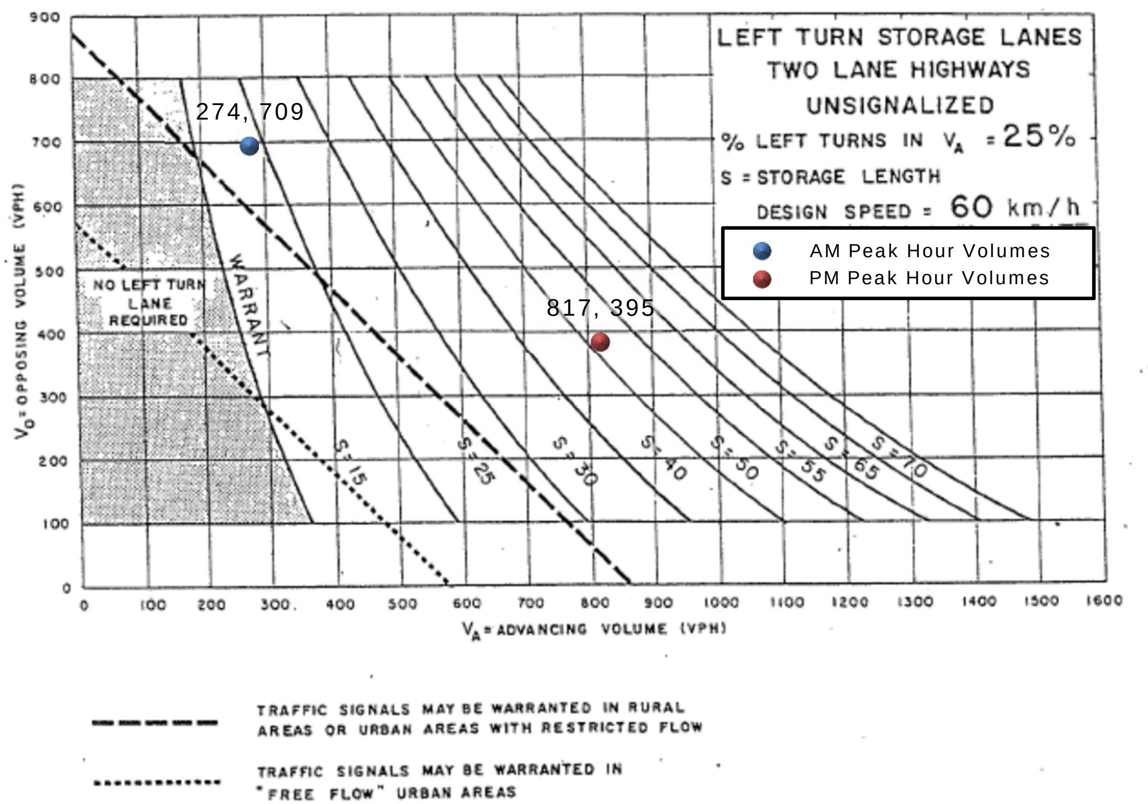
	Design Speed	Advancing Traffic Volume (V_A)		Opposing Traffic Volume (V_O)		Left Turn Traffic Volume (V_L)		% of Left Turning Traffic		Warrant Left Turn Lane
		AM	PM	AM	PM	AM	PM	AM	PM	
Total Projected 2025 volumes										
Fernbank/Street 1	60	709	395	274	817	13	44	2%	11%	Yes

Peak	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
							Warrant?					
AM	43	10	156	84	10	41	13	684	12	44	202	28
PM	25	10	90	54	10	26	44	307	44	162	564	91



	Design Speed	Advancing Traffic Volume (V_A)		Opposing Traffic Volume (V_O)		Left Turn Traffic Volume (V_L)		% of Left Turning Traffic		Warrant Left Turn Lane
		AM	PM	AM	PM	AM	PM	AM	PM	
Total Projected 2025 volumes										
Fernbank/Street 1	60	274	817	709	395	44	162	16%	20%	Yes

Peak	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
										Warrant?		
AM	43	10	156	84	10	41	13	684	12	44	202	28
PM	25	10	90	54	10	26	44	307	44	162	564	91



Fernbank/Street 1 - (peak hour signal warrant, 2025 total projected volumes)

Signal Warrant		Description		Minimum Requirement for Two Lane Roadways	Compliance		
				Restricted Flow - Operating Speed Less Than 70 km/h	Sectional %	Entire %	Warrant
Intersection	1. Minimum Vehicular Volume	(1) A	Vehicle Volume, All Approaches for Each of the Heaviest 8 Hours of on Average Day, and	720	96%	83%	**83% No**
		(4) B	Vehicle Volume, Along Minor Streets for Each of the Same 8 Hours	170	83%		
	2. Delay to Cross Traffic	(1) A	Vehicle Volume, Along Major Street for Each of the Heaviest 8 Hours of an Average Day, and	720	76%	76%	
		(2) B	Combined Vehicle and Pedestrian Volume Crossing the Major Street for Each of the Same 8 Hours	75	76%		

Notes

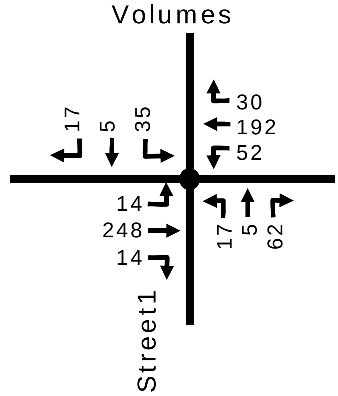
1 *Vehicle Volume Warrants (1A), (2A) and (5B) for Roadways Having Two or More Moving Lanes in one Direction Should Be 25% Higher Than Values Given Above* **No**

2 *For Definition of Crossing Volume Refer to Note 4 on the Signal Warrant Analysis Form B2.03.08*

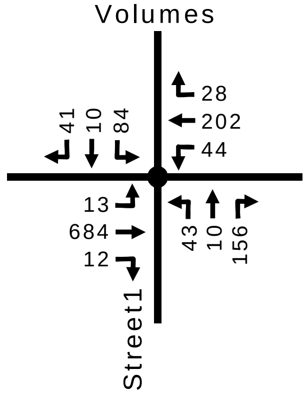
3 *The Lowest Sectional Percentage Governs the Entire Warrant*

4 *For "T" Intersections the Warrant Values for Minor Street Should be Increased by 50% (Warrant 1B only)* **No**

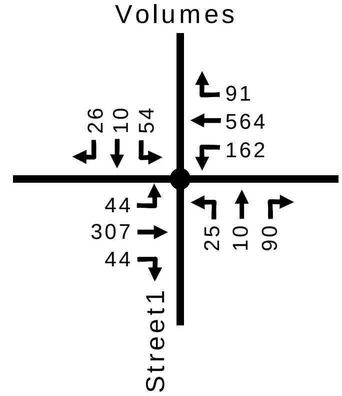
Average 8 Hour Volumes



AM Peak Hour Volumes



PM Peak Hour Volumes



SENSITIVITY ANALYSIS #1

Fernbank/Street 1 - (peak hour signal warrant, 2025 total projected volumes)

Signal Warrant		Description		Minimum Requirement for Two Lane Roadways: Restricted Flow - Operating Speed Less Than 70 km/h	Compliance: Sectional %	Compliance: Entire %	Compliance: Warrant
Intersection	1. Minimum Vehicular Volume	(1) A	Vehicle Volume, All Approaches for Each of the Heaviest 8 Hours of on Average Day, and	720	100%	100%	**100% Yes**
		(4) B	Vehicle Volume, Along Minor Streets for Each of the Same 8 Hours	170	101%		
	2. Delay to Cross Traffic	(1) A	Vehicle Volume, Along Major Street for Each of the Heaviest 8 Hours of an Average Day, and	720	76%	76%	
		(2) B	Combined Vehicle and Pedestrian Volume Crossing the Major Street for Each of the Same 8 Hours	75	96%		

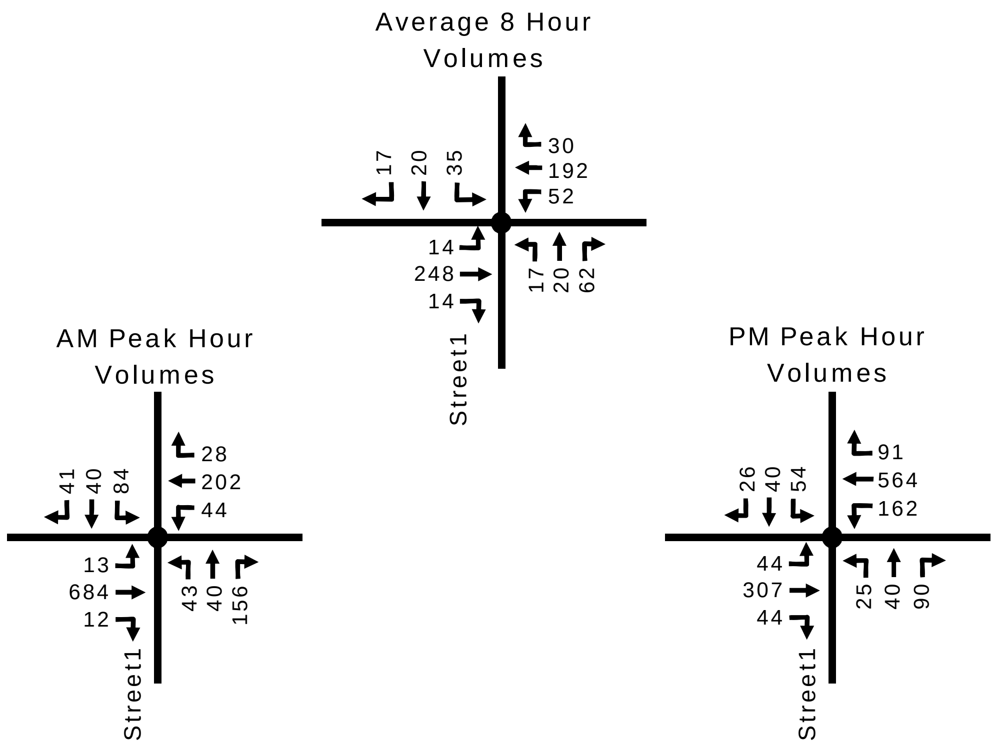
Notes

1 *Vehicle Volume Warrants (1A), (2A) and (5B) for Roadways Having Two or More Moving Lanes in one Direction Should Be 25% Higher Than Values Given Above* **No**

2 *For Definition of Crossing Volume Refer to Note 4 on the Signal Warrant Analysis Form B2.03.08*

3 *The Lowest Sectional Percentage Governs the Entire Warrant*

4 *For "T" Intersections the Warrant Values for Minor Street Should be Increased by 50% (Warrant 1B only)* **No**



SENSITIVITY ANALYSIS #2

Fernbank / Street 1 - (peak hour signal warrant, 2025 total projected volumes)

Signal Warrant		Description		Minimum Requirement for Two Lane Roadways	Compliance		
				Restricted Flow - Operating Speed Less Than 70 km/h	Sectional %	Entire %	Warrant
Intersection	1. Minimum Vehicular Volume	(1) A	Vehicle Volume, All Approaches for Each of the Heaviest 8 Hours of on Average Day, and	720	101%	101%	**100% Yes**
		(4) B	Vehicle Volume, Along Minor Streets for Each of the Same 8 Hours	170	104%		
	2. Delay to Cross Traffic	(1) A	Vehicle Volume, Along Major Street for Each of the Heaviest 8 Hours of an Average Day, and	720	76%	76%	
		(2) B	Combined Vehicle and Pedestrian Volume <u>Crossing</u> the Major Street for Each of the Same 8 Hours	75	124%		

Notes

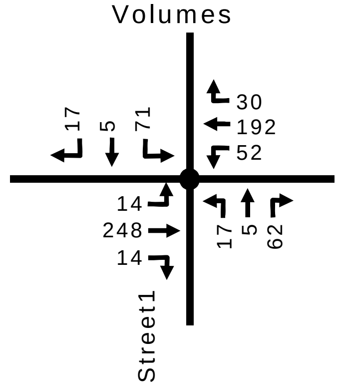
1 *Vehicle Volume Warrants (1A), (2A) and (5B) for Roadways Having Two or More Moving Lanes in one Direction Should Be 25% Higher Than Values Given Above* **No**

2 *For Definition of Crossing Volume Refer to Note 4 on the Signal Warrant Analysis Form B2.03.08*

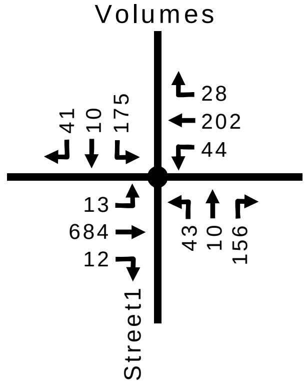
3 *The Lowest Sectional Percentage Governs the Entire Warrant*

4 *For "T" Intersections the Warrant Values for Minor Street Should be Increased by 50% (Warrant 1B only)* **No**

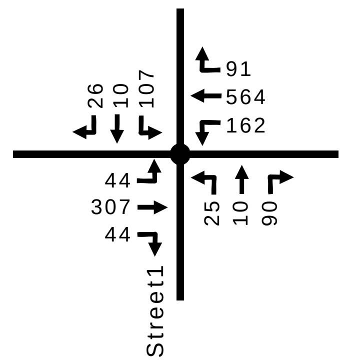
Average 8 Hour Volumes



AM Peak Hour Volumes



PM Peak Hour Volumes

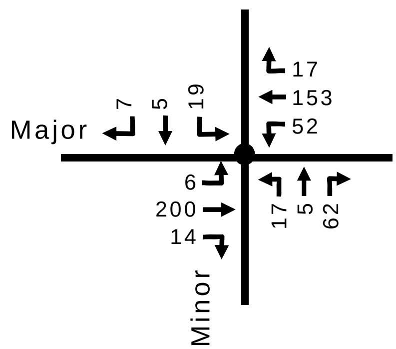


Fernbank/Street 1 - 2020 Total Projected Volumes

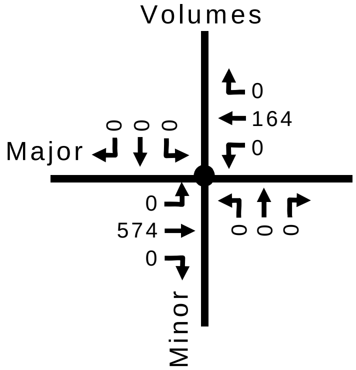
AWSC Warrant		Description		Minimum Requirement for a four-leg intersection	Compliance		
					Sectional %	Entire %	Warrant
Intersection	1. Minimum Volume Criterion	A	Vehicle Volume, All Approaches for Each of the Heaviest 8 Hours of on Average Day, <u>or</u>	200	279%	48%	**No**
		B	Vehicle Volume, All Approaches for the Heaviest Peak Hour, <u>and</u>	350	211%		
		C	Vehicle and pedestrian Volume, Along Minor Streets for Each of the Same 8 Hours, <u>and</u>	80	144%		
		D	The volume split between the major and minor streets	65/35	48%		
	2. Minimum Collision Criterion	A	Vehicle Volume, Along Major Street for Each of the Heaviest 8 Hours of an Average Day, and	9	0%	0%	

Note: ***0*** *preventable by AWSC collisions (i.e. right angle and turning movement collisions) were reported during a 3 year time period*

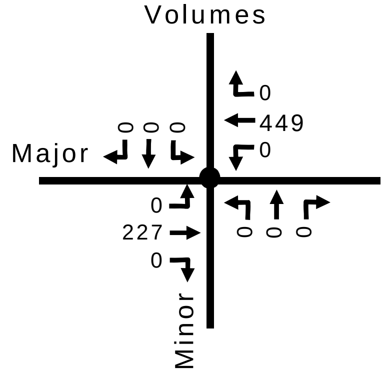
Average 8 Hour Volumes



AM Peak Hour Volumes



PM Peak Hour Volumes

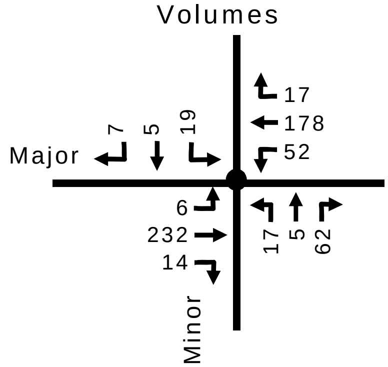


Fernbank / Street 1 - 2025 Total Projected Volumes

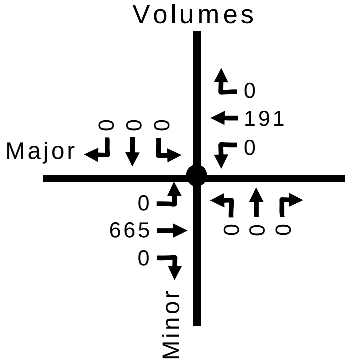
AWSC Warrant		Description		Minimum Requirement for a four-leg intersection	Compliance: Sectional %	Compliance: Entire %	Compliance: Warrant
Intersection	1. Minimum Volume Criterion	A	Vehicle Volume, All Approaches for Each of the Heaviest 8 Hours of on Average Day, <u>or</u>	200	307%	43%	No
		B	Vehicle Volume, All Approaches for the Heaviest Peak Hour, <u>and</u>	350	245%		
		C	Vehicle and pedestrian Volume, Along Minor Streets for Each of the Same 8 Hours, <u>and</u>	80	144%		
		D	The volume split between the major and minor streets	65/35	43%		
	2. Minimum Collision Criterion	A	Vehicle Volume, Along Major Street for Each of the Heaviest 8 Hours of an Average Day, and	9	0%	0%	

Note: ***0*** *preventable by AWSC collisions (i.e. right angle and turning movement collisions) were reported during a 3 year time period*

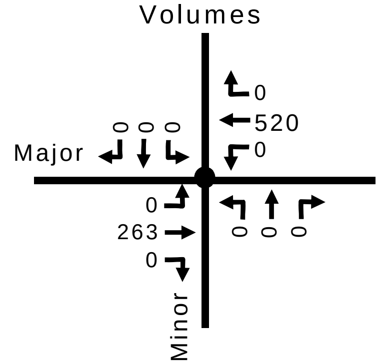
Average 8 Hour Volumes



AM Peak Hour Volumes



PM Peak Hour Volumes



City of Ottawa
Roundabout Initial Feasibility Screening Tool

The intent of this screening tool is to provide a relatively quick assessment of the feasibility of a roundabout at a particular intersection in comparison to other appropriate forms of traffic control or road modifications including all-way stop control, traffic signals, auxiliary lanes, etc. The intended outcome of this tool is to provide enough information to assist staff in deciding whether or not to proceed with an Intersection Control Study to investigate the feasibility of a roundabout in more detail.

1	Project Name:	5969 Fernbank Road Strategy Report
2	Intersection:	Fernbank/Street 1
3	Location and Description of Intersection: Lane configuration, total or approach AADT, distance to nearby intersection(s), etc. Attach or sketch a diagram and include existing and/or horizon-year turning movements. If an existing intersection then indicate type of control.	Located approximately 550m west of the Fernbank/Shea roundabout intersection
4	What traditional modifications are proposed? All-way stop control, traffic signals, auxiliary lanes, etc. Attach or sketch a diagram if necessary.	A traffic signal is also being explored.
5	What size of roundabout is being considered? Describe, and attach a Roundabout Traffic Flow Worksheet.	
6	Why is a roundabout being considered?	To reduce projected delays at the Fernbank/Street 1 intersection

7 Are there contra-indications for a roundabout?

If "Yes" is indicated for one or more of the contra-indications then a roundabout may be problematic at the subject intersection. That is not to say that a roundabout is not possible, just that there may be difficulties or high costs.

No.	Contra-Indication	Outcome
1	Is there insufficient property at the intersection (i.e. less than 44 metres diameter if considering a single-lane roundabout, and less than 60 metres if considering a two-lane roundabout) or property constraints that would require demolition of adjacent structures?	Yes ☐ No ✓
2	Are there any instances where stopping sight distance (SSD) of a roundabout yield line may not be attainable (i.e. the intersection is on a crest vertical curve)?	Yes ☐ No ✓
3	Is there an existing uncontrolled approach with a grade in excess of 4 percent?	Yes ☐ No ✓
4	Is the intersection located within a coordinated signal system?	Yes ☐ No ✓
5	Is there a closely-spaced traffic signal or railway crossing that could not be controlled with a nearby roundabout?	Yes ☐ No ✓
6	Are significant differences in directional flows or any situations of sudden high demand expected?	Yes ☐ No ✓
7	Are there known visually-impaired pedestrians that cross this intersection?	Yes ☐ No ✓

8 Are there suitability factors for a roundabout?

If "Yes" is indicated for two or more of the suitability factors then a roundabout should be technically feasible at the subject intersection.

No.	Suitability Factor	Outcome
1	Does the intersection currently experience an average collision frequency of more than 1.5 injury crashes per year, or a collision rate in excess of 1injury crash per 1 million vehicles entering (MVE)?	Yes ☐ No ✓
2	Has there been a fatal crash at the intersection in the last 10 years?	Yes ☐ No ✓
3	Are capacity problems currently being experienced, or expected in the future?	Yes ✓ No ☐
4	Are traffic signals warranted, or expected to be warranted in the future?	Yes ✓ No ☐
5	Does the intersection have more than 4 legs, or unusual geometry?	Yes ☐ No ✓
6	Will planned modifications to the intersection require that nearby structures be widened (i.e. to accommodate left-turn lanes)?	Yes ☐ No ✓
7	Is the intersection located at a transition between rural and urban environments (i.e. an urban boundary) such that a roundabout could act as a means of speed transition?	Yes ✓ No ☐

9	Conclusions/recommendation whether to proceed with an Intersection Control Study:	A roundabout should technically be feasible due to the projected traffic issues and signal warrant. SIDRA analysis to be completed.

Appendix H

Synchro and SIDRA Total Projected Traffic Analysis

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	14	593	12	44	175	31	43	10	156	90	10	43
Future Volume (Veh/h)	14	593	12	44	175	31	43	10	156	90	10	43
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	15	624	13	46	184	33	45	11	164	95	11	45
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	217			637			987	970	630	1116	960	200
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	217			637			987	970	630	1116	960	200
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			95			77	95	66	15	95	95
cM capacity (veh/h)	1353			947			198	238	481	112	242	840

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1
Volume Total	15	637	46	217	220	151
Volume Left	15	0	46	0	45	95
Volume Right	0	13	0	33	164	45
cSH	1353	1700	947	1700	358	160
Volume to Capacity	0.01	0.37	0.05	0.13	0.61	0.94
Queue Length 95th (m)	0.3	0.0	1.2	0.0	29.7	53.2
Control Delay (s)	7.7	0.0	9.0	0.0	29.8	113.8
Lane LOS	A		A		D	F
Approach Delay (s)	0.2		1.6		29.8	113.8
Approach LOS					D	F

Intersection Summary			
Average Delay	18.9		
Intersection Capacity Utilization	66.8%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	225	9	3	502	308	68
Future Volume (Veh/h)	225	9	3	502	308	68
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	237	9	3	528	324	72
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	894	360	396			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	894	360	396			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	24	99	100			
cM capacity (veh/h)	311	684	1163			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	246	531	396
Volume Left	237	3	0
Volume Right	9	0	72
cSH	317	1163	1700
Volume to Capacity	0.78	0.00	0.23
Queue Length 95th (m)	46.6	0.1	0.0
Control Delay (s)	46.6	0.1	0.0
Lane LOS	E	A	
Approach Delay (s)	46.6	0.1	0.0
Approach LOS	E		

Intersection Summary			
Average Delay	9.8		
Intersection Capacity Utilization	50.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	34	17	7	471	303	14
Future Volume (Veh/h)	34	17	7	471	303	14
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	36	18	7	496	319	15
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	836	326	334			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	836	326	334			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	89	97	99			
cM capacity (veh/h)	335	715	1225			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	54	503	334
Volume Left	36	7	0
Volume Right	18	0	15
cSH	407	1225	1700
Volume to Capacity	0.13	0.01	0.20
Queue Length 95th (m)	3.5	0.1	0.0
Control Delay (s)	15.2	0.2	0.0
Lane LOS	C	A	
Approach Delay (s)	15.2	0.2	0.0
Approach LOS	C		

Intersection Summary			
Average Delay	1.0		
Intersection Capacity Utilization	42.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	46	271	44	162	493	97	25	10	90	58	10	27
Future Volume (Veh/h)	46	271	44	162	493	97	25	10	90	58	10	27
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	48	285	46	171	519	102	26	11	95	61	11	28
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	621			331			1298	1367	308	1394	1339	570
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	621			331			1298	1367	308	1394	1339	570
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	95			86			75	91	87	27	91	95
cM capacity (veh/h)	960			1228			105	120	732	83	125	521

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1
Volume Total	48	331	171	621	132	100
Volume Left	48	0	171	0	26	61
Volume Right	0	46	0	102	95	28
cSH	960	1700	1228	1700	282	114
Volume to Capacity	0.05	0.19	0.14	0.37	0.47	0.88
Queue Length 95th (m)	1.2	0.0	3.7	0.0	17.8	40.3
Control Delay (s)	8.9	0.0	8.4	0.0	28.5	123.7
Lane LOS	A		A		D	F
Approach Delay (s)	1.1		1.8		28.5	123.7
Approach LOS					D	F

Intersection Summary			
Average Delay	12.8		
Intersection Capacity Utilization	59.3%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	135	6	10	402	421	235
Future Volume (Veh/h)	135	6	10	402	421	235
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	142	6	11	423	443	247
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1012	566	690			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1012	566	690			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	46	99	99			
cM capacity (veh/h)	262	523	905			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	148	434	690
Volume Left	142	11	0
Volume Right	6	0	247
cSH	267	905	1700
Volume to Capacity	0.55	0.01	0.41
Queue Length 95th (m)	23.4	0.3	0.0
Control Delay (s)	33.9	0.4	0.0
Lane LOS	D	A	
Approach Delay (s)	33.9	0.4	0.0
Approach LOS	D		

Intersection Summary			
Average Delay	4.1		
Intersection Capacity Utilization	53.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	24	12	19	388	389	38
Future Volume (Veh/h)	24	12	19	388	389	38
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	25	13	20	408	409	40
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	877	429	449			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	877	429	449			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	92	98	98			
cM capacity (veh/h)	313	626	1111			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	38	428	449
Volume Left	25	20	0
Volume Right	13	0	40
cSH	378	1111	1700
Volume to Capacity	0.10	0.02	0.26
Queue Length 95th (m)	2.5	0.4	0.0
Control Delay (s)	15.6	0.6	0.0
Lane LOS	C	A	
Approach Delay (s)	15.6	0.6	0.0
Approach LOS	C		

Intersection Summary			
Average Delay	0.9		
Intersection Capacity Utilization	47.9%	ICU Level of Service	A
Analysis Period (min)	15		

MOVEMENT SUMMARY

Site: 1 [FT2020AM]

AM Peak Period
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Shea South Leg											
3	L2	5	3.0	0.550	20.8	LOS C	2.5	19.7	0.77	0.86	43.6
8	T1	150	3.0	0.550	20.8	LOS C	2.5	19.7	0.77	0.86	43.5
18	R2	83	3.0	0.550	20.8	LOS C	2.5	19.7	0.77	0.86	42.6
Approach		238	3.0	0.550	20.8	LOS C	2.5	19.7	0.77	0.86	43.2
East: Fernbank East Leg											
1	L2	60	3.0	0.405	10.4	LOS B	1.8	14.1	0.57	0.58	49.1
6	T1	166	3.0	0.405	10.4	LOS B	1.8	14.1	0.57	0.58	49.0
16	R2	67	3.0	0.405	10.4	LOS B	1.8	14.1	0.57	0.58	47.9
Approach		293	3.0	0.405	10.4	LOS B	1.8	14.1	0.57	0.58	48.8
North: Shea North Leg											
7	L2	107	3.0	0.362	8.3	LOS A	1.6	12.6	0.44	0.35	50.0
4	T1	106	3.0	0.362	8.3	LOS A	1.6	12.6	0.44	0.35	49.9
14	R2	100	3.0	0.362	8.3	LOS A	1.6	12.6	0.44	0.35	48.7
Approach		313	3.0	0.362	8.3	LOS A	1.6	12.6	0.44	0.35	49.6
West: Fernbank West Leg											
5	L2	251	3.0	1.006	55.0	LOS F	30.0	234.0	1.00	1.56	30.9
2	T1	550	3.0	1.006	55.0	LOS F	30.0	234.0	1.00	1.56	30.9
12	R2	32	3.0	1.006	55.0	LOS F	30.0	234.0	1.00	1.56	30.4
Approach		833	3.0	1.006	55.0	LOS F	30.0	234.0	1.00	1.56	30.9
All Vehicles		1677	3.0	1.006	33.6	LOS D	30.0	234.0	0.79	1.07	37.4

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: US HCM 2010.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 1 [FT2020PM]

PM Peak Period
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Shea South Leg											
3	L2	20	3.0	0.429	12.3	LOS B	1.9	15.0	0.64	0.67	48.3
8	T1	154	3.0	0.429	12.3	LOS B	1.9	15.0	0.64	0.67	48.2
18	R2	91	3.0	0.429	12.3	LOS B	1.9	15.0	0.64	0.67	47.1
Approach		265	3.0	0.429	12.3	LOS B	1.9	15.0	0.64	0.67	47.8
East: Fernbank East Leg											
1	L2	135	3.0	1.047	67.1	LOS F	36.2	281.8	1.00	1.88	28.2
6	T1	590	3.0	1.047	67.1	LOS F	36.2	281.8	1.00	1.88	28.2
16	R2	121	3.0	1.047	67.1	LOS F	36.2	281.8	1.00	1.88	27.8
Approach		846	3.0	1.047	67.1	LOS F	36.2	281.8	1.00	1.88	28.1
North: Shea North Leg											
7	L2	111	3.0	0.826	35.6	LOS E	6.8	53.0	0.88	1.13	36.7
4	T1	145	3.0	0.826	35.6	LOS E	6.8	53.0	0.88	1.13	36.7
14	R2	179	3.0	0.826	35.6	LOS E	6.8	53.0	0.88	1.13	36.0
Approach		435	3.0	0.826	35.6	LOS E	6.8	53.0	0.88	1.13	36.4
West: Fernbank West Leg											
5	L2	123	3.0	0.614	15.4	LOS C	4.0	31.3	0.69	0.76	45.9
2	T1	324	3.0	0.614	15.4	LOS C	4.0	31.3	0.69	0.76	45.9
12	R2	6	3.0	0.614	15.4	LOS C	4.0	31.3	0.69	0.76	44.8
Approach		453	3.0	0.614	15.4	LOS C	4.0	31.3	0.69	0.76	45.9
All Vehicles		1999	3.0	1.047	41.3	LOS E	36.2	281.8	0.86	1.30	34.8

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: US HCM 2010.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	14	684	12	44	202	31	43	10	156	90	10	43
Future Volume (Veh/h)	14	684	12	44	202	31	43	10	156	90	10	43
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	15	720	13	46	213	33	45	11	164	95	11	45
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	246			733			1112	1094	726	1241	1084	230
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	246			733			1112	1094	726	1241	1084	230
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			95			72	95	61	0	95	94
cM capacity (veh/h)	1320			872			160	200	424	85	203	810

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1
Volume Total	15	733	46	246	220	151
Volume Left	15	0	46	0	45	95
Volume Right	0	13	0	33	164	45
cSH	1320	1700	872	1700	305	123
Volume to Capacity	0.01	0.43	0.05	0.14	0.72	1.23
Queue Length 95th (m)	0.3	0.0	1.3	0.0	39.7	72.1
Control Delay (s)	7.8	0.0	9.4	0.0	42.3	223.1
Lane LOS	A		A		E	F
Approach Delay (s)	0.2		1.5		42.3	223.1
Approach LOS					E	F

Intersection Summary			
Average Delay	30.9		
Intersection Capacity Utilization	67.0%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	225	9	3	561	346	68
Future Volume (Veh/h)	225	9	3	561	346	68
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	237	9	3	591	364	72
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	997	400	436			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	997	400	436			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	12	99	100			
cM capacity (veh/h)	270	650	1124			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	246	594	436
Volume Left	237	3	0
Volume Right	9	0	72
cSH	276	1124	1700
Volume to Capacity	0.89	0.00	0.26
Queue Length 95th (m)	60.2	0.1	0.0
Control Delay (s)	70.1	0.1	0.0
Lane LOS	F	A	
Approach Delay (s)	70.1	0.1	0.0
Approach LOS	F		

Intersection Summary			
Average Delay	13.5		
Intersection Capacity Utilization	54.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	34	17	7	530	341	14
Future Volume (Veh/h)	34	17	7	530	341	14
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	36	18	7	558	359	15
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	938	366	374			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	938	366	374			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	88	97	99			
cM capacity (veh/h)	291	679	1184			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	54	565	374
Volume Left	36	7	0
Volume Right	18	0	15
cSH	360	1184	1700
Volume to Capacity	0.15	0.01	0.22
Queue Length 95th (m)	4.0	0.1	0.0
Control Delay (s)	16.8	0.2	0.0
Lane LOS	C	A	
Approach Delay (s)	16.8	0.2	0.0
Approach LOS	C		

Intersection Summary			
Average Delay	1.0		
Intersection Capacity Utilization	45.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	46	307	44	162	564	97	25	10	90	58	10	27
Future Volume (Veh/h)	46	307	44	162	564	97	25	10	90	58	10	27
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	48	323	46	171	594	102	26	11	95	61	11	28
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	696			369			1412	1480	346	1506	1452	645
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	696			369			1412	1480	346	1506	1452	645
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	95			86			70	89	86	10	90	94
cM capacity (veh/h)	900			1190			86	102	697	67	106	472

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1
Volume Total	48	369	171	696	132	100
Volume Left	48	0	171	0	26	61
Volume Right	0	46	0	102	95	28
cSH	900	1700	1190	1700	241	94
Volume to Capacity	0.05	0.22	0.14	0.41	0.55	1.07
Queue Length 95th (m)	1.3	0.0	3.8	0.0	22.6	49.7
Control Delay (s)	9.2	0.0	8.5	0.0	36.6	195.5
Lane LOS	A		A		E	F
Approach Delay (s)	1.1		1.7		36.6	195.5
Approach LOS					E	F

Intersection Summary			
Average Delay	17.3		
Intersection Capacity Utilization	63.2%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	135	6	10	444	457	235
Future Volume (Veh/h)	135	6	10	444	457	235
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	142	6	11	467	481	247
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1094	604	728			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1094	604	728			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	39	99	99			
cM capacity (veh/h)	234	498	876			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	148	478	728
Volume Left	142	11	0
Volume Right	6	0	247
cSH	239	876	1700
Volume to Capacity	0.62	0.01	0.43
Queue Length 95th (m)	28.0	0.3	0.0
Control Delay (s)	41.8	0.4	0.0
Lane LOS	E	A	
Approach Delay (s)	41.8	0.4	0.0
Approach LOS	E		

Intersection Summary			
Average Delay	4.7		
Intersection Capacity Utilization	55.5%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	24	12	19	430	425	38
Future Volume (Veh/h)	24	12	19	430	425	38
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	25	13	20	453	447	40
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	960	467	487			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	960	467	487			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	91	98	98			
cM capacity (veh/h)	279	596	1076			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	38	473	487
Volume Left	25	20	0
Volume Right	13	0	40
cSH	341	1076	1700
Volume to Capacity	0.11	0.02	0.29
Queue Length 95th (m)	2.8	0.4	0.0
Control Delay (s)	16.9	0.6	0.0
Lane LOS	C	A	
Approach Delay (s)	16.9	0.6	0.0
Approach LOS	C		

Intersection Summary			
Average Delay	0.9		
Intersection Capacity Utilization	50.2%	ICU Level of Service	A
Analysis Period (min)	15		

MOVEMENT SUMMARY

Site: 1 [FT2025AM]

AM Peak Hour
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Shea South Leg											
3	L2	5	3.0	0.586	22.2	LOS C	2.8	22.0	0.78	0.88	42.9
8	T1	168	3.0	0.586	22.2	LOS C	2.8	22.0	0.78	0.88	42.8
18	R2	83	3.0	0.586	22.2	LOS C	2.8	22.0	0.78	0.88	41.9
Approach		256	3.0	0.586	22.2	LOS C	2.8	22.0	0.78	0.88	42.6
East: Fernbank East Leg											
1	L2	60	3.0	0.423	10.7	LOS B	1.9	15.1	0.58	0.59	48.9
6	T1	179	3.0	0.423	10.7	LOS B	1.9	15.1	0.58	0.59	48.9
16	R2	67	3.0	0.423	10.7	LOS B	1.9	15.1	0.58	0.59	47.7
Approach		306	3.0	0.423	10.7	LOS B	1.9	15.1	0.58	0.59	48.6
North: Shea North Leg											
7	L2	107	3.0	0.383	8.7	LOS A	1.7	13.5	0.46	0.38	49.8
4	T1	120	3.0	0.383	8.7	LOS A	1.7	13.5	0.46	0.38	49.7
14	R2	100	3.0	0.383	8.7	LOS A	1.7	13.5	0.46	0.38	48.5
Approach		327	3.0	0.383	8.7	LOS A	1.7	13.5	0.46	0.38	49.3
West: Fernbank West Leg											
5	L2	251	3.0	1.088	79.7	LOS F	45.3	353.3	1.00	2.15	25.7
2	T1	605	3.0	1.088	79.7	LOS F	45.3	353.3	1.00	2.15	25.7
12	R2	32	3.0	1.088	79.7	LOS F	45.3	353.3	1.00	2.15	25.4
Approach		888	3.0	1.088	79.7	LOS F	45.3	353.3	1.00	2.15	25.7
All Vehicles		1777	3.0	1.088	46.4	LOS E	45.3	353.3	0.80	1.37	33.2

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: US HCM 2010.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 1 [FT2025PM]

PM Peak Hour
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Shea South Leg											
3	L2	20	3.0	0.469	13.5	LOS B	2.2	17.2	0.66	0.71	47.5
8	T1	171	3.0	0.469	13.5	LOS B	2.2	17.2	0.66	0.71	47.5
18	R2	91	3.0	0.469	13.5	LOS B	2.2	17.2	0.66	0.71	46.4
Approach		282	3.0	0.469	13.5	LOS B	2.2	17.2	0.66	0.71	47.1
East: Fernbank East Leg											
1	L2	135	3.0	1.132	95.9	LOS F	53.4	416.3	1.00	2.54	23.2
6	T1	643	3.0	1.132	95.9	LOS F	53.4	416.3	1.00	2.54	23.2
16	R2	121	3.0	1.132	95.9	LOS F	53.4	416.3	1.00	2.54	22.9
Approach		899	3.0	1.132	95.9	LOS F	53.4	416.3	1.00	2.54	23.1
North: Shea North Leg											
7	L2	111	3.0	0.848	38.2	LOS E	7.5	58.1	0.89	1.18	35.9
4	T1	159	3.0	0.848	38.2	LOS E	7.5	58.1	0.89	1.18	35.8
14	R2	179	3.0	0.848	38.2	LOS E	7.5	58.1	0.89	1.18	35.2
Approach		449	3.0	0.848	38.2	LOS E	7.5	58.1	0.89	1.18	35.6
West: Fernbank West Leg											
5	L2	123	3.0	0.652	16.9	LOS C	4.6	35.8	0.72	0.80	45.2
2	T1	350	3.0	0.652	16.9	LOS C	4.6	35.8	0.72	0.80	45.1
12	R2	6	3.0	0.652	16.9	LOS C	4.6	35.8	0.72	0.80	44.1
Approach		479	3.0	0.652	16.9	LOS C	4.6	35.8	0.72	0.80	45.1
All Vehicles		2109	3.0	1.132	54.6	LOS F	53.4	416.3	0.87	1.61	31.0

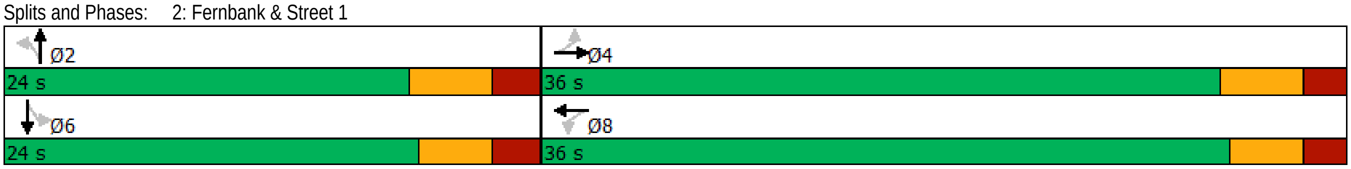
Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: US HCM 2010.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	14	684	44	202	43	10	90	10
Future Volume (vph)	14	684	44	202	43	10	90	10
Lane Group Flow (vph)	15	733	46	246	0	220	0	151
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Minimum Split (s)	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0
Total Split (s)	36.0	36.0	36.0	36.0	24.0	24.0	24.0	24.0
Total Split (%)	60.0%	60.0%	60.0%	60.0%	40.0%	40.0%	40.0%	40.0%
Yellow Time (s)	3.7	3.7	3.3	3.3	3.7	3.7	3.3	3.3
All-Red Time (s)	2.0	2.0	2.0	2.0	2.2	2.2	2.2	2.2
Lost Time Adjust (s)	0.0	0.0	0.0	0.0		0.0		0.0
Total Lost Time (s)	5.7	5.7	5.3	5.3		5.9		5.5
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	Min	Min	Min	Min
Act Effct Green (s)	24.1	24.1	24.5	24.5		11.6		12.1
Actuated g/C Ratio	0.51	0.51	0.51	0.51		0.24		0.25
v/c Ratio	0.03	0.81	0.22	0.27		0.46		0.44
Control Delay	6.2	19.1	9.8	6.9		9.6		17.9
Queue Delay	0.0	0.0	0.0	0.0		0.0		0.0
Total Delay	6.2	19.1	9.8	6.9		9.6		17.9
LOS	A	B	A	A		A		B
Approach Delay		18.9		7.3		9.6		17.9
Approach LOS		B		A		A		B
Queue Length 50th (m)	0.5	41.0	1.7	8.4		3.9		8.2
Queue Length 95th (m)	2.9	#116.4	7.8	22.1		18.4		22.8
Internal Link Dist (m)		109.2		519.5		92.1		83.6
Turn Bay Length (m)	15.0		15.0					
Base Capacity (vph)	706	1162	265	1163		662		520
Starvation Cap Reductn	0	0	0	0		0		0
Spillback Cap Reductn	0	0	0	0		0		0
Storage Cap Reductn	0	0	0	0		0		0
Reduced v/c Ratio	0.02	0.63	0.17	0.21		0.33		0.29

Intersection Summary

Cycle Length: 60
Actuated Cycle Length: 47.7
Natural Cycle: 60
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.81
Intersection Signal Delay: 14.9 Intersection LOS: B
Intersection Capacity Utilization 69.7% ICU Level of Service C
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 2: Fernbank & Street 1



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	46	307	162	564	25	10	58	10
Future Volume (vph)	46	307	162	564	25	10	58	10
Lane Group Flow (vph)	48	369	171	696	0	132	0	100
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Minimum Split (s)	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0
Total Split (s)	46.0	46.0	46.0	46.0	24.0	24.0	24.0	24.0
Total Split (%)	65.7%	65.7%	65.7%	65.7%	34.3%	34.3%	34.3%	34.3%
Yellow Time (s)	3.7	3.7	3.3	3.3	3.7	3.7	3.3	3.3
All-Red Time (s)	2.0	2.0	2.0	2.0	2.2	2.2	2.2	2.2
Lost Time Adjust (s)	0.0	0.0	0.0	0.0		0.0		0.0
Total Lost Time (s)	5.7	5.7	5.3	5.3		5.9		5.5
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	Min	Min	Min	Min
Act Effct Green (s)	24.3	24.3	24.7	24.7		11.0		11.4
Actuated g/C Ratio	0.51	0.51	0.52	0.52		0.23		0.24
v/c Ratio	0.20	0.41	0.34	0.76		0.32		0.31
Control Delay	8.1	7.8	8.2	14.4		10.5		17.2
Queue Delay	0.0	0.0	0.0	0.0		0.0		0.0
Total Delay	8.1	7.8	8.2	14.4		10.5		17.2
LOS	A	A	A	B		B		B
Approach Delay		7.8		13.1		10.5		17.2
Approach LOS		A		B		B		B
Queue Length 50th (m)	1.8	14.5	6.7	35.7		2.3		4.7
Queue Length 95th (m)	6.7	31.4	17.5	75.9		16.2		19.3
Internal Link Dist (m)		109.2		519.5		92.1		83.6
Turn Bay Length (m)	15.0		15.0					
Base Capacity (vph)	395	1510	834	1516		645		532
Starvation Cap Reductn	0	0	0	0		0		0
Spillback Cap Reductn	0	0	0	0		0		0
Storage Cap Reductn	0	0	0	0		0		0
Reduced v/c Ratio	0.12	0.24	0.21	0.46		0.20		0.19

Intersection Summary

Cycle Length: 70
Actuated Cycle Length: 47.4
Natural Cycle: 60
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.76
Intersection Signal Delay: 11.7 Intersection LOS: B
Intersection Capacity Utilization 72.0% ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 2: Fernbank & Street 1

MOVEMENT SUMMARY

Site: [Fernbank/Street 1 AM]

AM Peak Hour
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Street 1											
3	L2	43	3.0	0.429	15.0	LOS B	1.8	14.0	0.69	0.74	46.2
8	T1	10	3.0	0.429	15.0	LOS B	1.8	14.0	0.69	0.74	46.1
18	R2	156	3.0	0.429	15.0	LOS B	1.8	14.0	0.69	0.74	45.1
Approach		209	3.0	0.429	15.0	LOS B	1.8	14.0	0.69	0.74	45.4
East: Fernbank East Leg											
1	L2	44	3.0	0.271	6.2	LOS A	1.2	9.1	0.21	0.10	52.1
6	T1	202	3.0	0.271	6.2	LOS A	1.2	9.1	0.21	0.10	52.1
16	R2	31	3.0	0.271	6.2	LOS A	1.2	9.1	0.21	0.10	50.7
Approach		277	3.0	0.271	6.2	LOS A	1.2	9.1	0.21	0.10	51.9
North: Street 1											
7	L2	90	3.0	0.176	6.2	LOS A	0.6	5.0	0.41	0.33	50.4
4	T1	10	3.0	0.176	6.2	LOS A	0.6	5.0	0.41	0.33	50.4
14	R2	43	3.0	0.176	6.2	LOS A	0.6	5.0	0.41	0.33	49.1
Approach		143	3.0	0.176	6.2	LOS A	0.6	5.0	0.41	0.33	50.0
West: Fernbank West Leg											
5	L2	14	3.0	0.751	18.0	LOS C	7.6	58.9	0.67	0.51	45.1
2	T1	684	3.0	0.751	18.0	LOS C	7.6	58.9	0.67	0.51	45.1
12	R2	12	3.0	0.751	18.0	LOS C	7.6	58.9	0.67	0.51	44.1
Approach		710	3.0	0.751	18.0	LOS C	7.6	58.9	0.67	0.51	45.0
All Vehicles		1339	3.0	0.751	13.8	LOS B	7.6	58.9	0.55	0.44	46.9

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: US HCM 2010.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 1 [Fernbank/Street 1 PM]

PM Peak Hour
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Street 1											
3	L2	25	3.0	0.174	6.9	LOS A	0.6	4.8	0.48	0.44	51.4
8	T1	10	3.0	0.174	6.9	LOS A	0.6	4.8	0.48	0.44	51.3
18	R2	90	3.0	0.174	6.9	LOS A	0.6	4.8	0.48	0.44	50.0
Approach		125	3.0	0.174	6.9	LOS A	0.6	4.8	0.48	0.44	50.4
East: Fernbank East Leg											
1	L2	162	3.0	0.815	21.2	LOS C	9.8	76.1	0.66	0.39	43.0
6	T1	564	3.0	0.815	21.2	LOS C	9.8	76.1	0.66	0.39	43.0
16	R2	97	3.0	0.815	21.2	LOS C	9.8	76.1	0.66	0.39	42.1
Approach		823	3.0	0.815	21.2	LOS C	9.8	76.1	0.66	0.39	42.9
North: Street 1											
7	L2	58	3.0	0.188	9.7	LOS A	0.6	4.9	0.60	0.60	48.3
4	T1	10	3.0	0.188	9.7	LOS A	0.6	4.9	0.60	0.60	48.2
14	R2	27	3.0	0.188	9.7	LOS A	0.6	4.9	0.60	0.60	47.1
Approach		95	3.0	0.188	9.7	LOS A	0.6	4.9	0.60	0.60	47.9
West: Fernbank West Leg											
5	L2	46	3.0	0.459	9.9	LOS A	2.3	17.7	0.49	0.40	49.7
2	T1	307	3.0	0.459	9.9	LOS A	2.3	17.7	0.49	0.40	49.6
12	R2	44	3.0	0.459	9.9	LOS A	2.3	17.7	0.49	0.40	48.4
Approach		397	3.0	0.459	9.9	LOS A	2.3	17.7	0.49	0.40	49.5
All Vehicles		1440	3.0	0.815	16.1	LOS C	9.8	76.1	0.60	0.41	45.4

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: US HCM 2010.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.