1140 Terry Fox Drive Transportation Impact Assessment

Final Report

February 19th, 2020

Prepared for:

SmartCentres

Prepared by:

Stantec Consulting Ltd.

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[1] professional in good standing, whose field of expertise is either transportation engineering or transportation planning.

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

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[1] 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

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1.0 SCREENING

1.1 SUMMARY OF DEVELOPMENT

Municipal Address	1140 Terry Fox Drive, City of Ottawa (Stittsville)
Description of Location	North-west corner of the Terry Fox Drive at Cope Drive intersection. The site is bound by Terry Fox Drive to the east, Cope Drive to the south, and vacant land to the west and north.
Land Use Classification	Commercial
Development Size (units)	N/A
Development Size (m^2)	1,886 m^2 GFA (20,300 ft^2 GFA)
Number of Accesses and Locations	One proposed right-in access from Terry Fox Drive (located 65m north of Cope Drive), one full-movement access from Cope Drive (located 150 west of Terry Fox Drive)
Phase of Development	1 Phase
Buildout Year	Assumed build-out and occupancy by 2020

If available, please attach a sketch of the development or site plan to this form.

1.2 TRIP GENERATION TRIGGER

Considering the Development's Land Use type and Size (as filled out in the previous section), please refer to the Trip Generation Trigger checks below.

Land Use Type	Minimum Development Size	Triggered
Single-family homes	40 units	✗
Townhomes or apartments	90 units	✗
Office	3,500 m^2	✗
Industrial	5,000 m^2	✗
Fast-food restaurant or coffee shop	100 m^2	✗
Destination retail	1,000 m^2	✓
Gas station or convenience market	75 m^2	✗

** If the development has a land use type other than what is presented in the table above, estimates of person-trip generation may be made based on average trip generation characteristics represented in the current edition of the Institute of Transportation Engineers (ITE) Trip Generation Manual.*

If the proposed development size is greater than the sizes identified above, the Trip Generation Trigger is satisfied.

1.3 LOCATION TRIGGERS

	Yes	No
Does the development propose a new driveway to a boundary street that is designated as part of the City's Transit Priority, Rapid Transit or Spine Bicycle Networks?	✓	
Is the development in a Design Priority Area (DPA) or Transit-oriented Development (TOD) zone? *		✗

**DPA and TOD are identified in the City of Ottawa Official Plan (DPA in Section 2.5.1 and Schedules A and B; TOD in Annex 6). See Chapter 4 for a list of City of Ottawa Planning and Engineering documents that support the completion of TIA).*

If any of the above questions were answered with 'Yes,' the Location Trigger is satisfied.

1.4 SAFETY TRIGGERS

	Yes	No
Are posted speed limits on a boundary street are 80 km/hr or greater?	✓	
Are there any horizontal/vertical curvatures on a boundary street limits sight lines at a proposed driveway?	✓	
Is the proposed driveway 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)?	✓	
Is the proposed driveway within auxiliary lanes of an intersection?	✓	
Does the proposed driveway make use of an existing median break that serves an existing site?		✗
Is there a documented history of traffic operations or safety concerns on the boundary streets within 500 m of the development?		✗
Does the development include a drive-thru facility?		✗

If any of the above questions were answered with 'Yes,' the Safety Trigger is satisfied.

1.5 SUMMARY

	Yes	No
Does the development satisfy the Trip Generation Trigger?	✓	
Does the development satisfy the Location Trigger?	✓	
Does the development satisfy the Safety Trigger?	✓	

If none of the triggers are satisfied, the TIA Study is complete. If one or more of the triggers is satisfied, the TIA Study must continue into the next stage (Screening and Scoping).

2.0 SCOPING

2.1 EXISTING AND PLANNED CONDITIONS

2.1.1 Proposed Development

SmartCentres is preparing a development application for Site Plan Control of a proposed development in the community of Stittsville in Ottawa, Ontario. The proposed development is located at the north-west corner of the Terry Fox Drive at Cope Drive intersection. The site is bound by Terry Fox Drive to the east, Cope Drive to the south, and vacant land / storm water management facilities to the west and north.

Figure 1 illustrates the location of the subject development. The subject site is currently zoned as a General Mixed-Use Zone (GM1) Zone; the purpose of the GM Zone, according to the City of Ottawa Zoning By-Law, is to:

- *Allow residential, commercial and institutional uses, or mixed-use development in the General Urban Area and in the Upper Town, Lowertown and Sandy Hill West Character Areas of the Central Area designations of the Official Plan;*
- *Limit commercial uses to individual occupancies or in groupings in well-defined areas such that they do not affect the development of the designated Traditional and Arterial Mainstreets as viable mixed-use areas;*
- *Permit uses that are often large and serve or draw from broader areas than the surrounding community and which may generate traffic, noise or other impacts provided the anticipated impacts are adequately mitigated or otherwise addressed; and*
- *Impose development standards that will ensure that the uses are compatible and complement surrounding land uses.*

The existing property is currently vacant. There is a proposed site access on Cope Drive, approximately 150m west of Terry Fox Drive. A new right-in only access is proposed on Terry Fox Drive, approximately 65m north of the intersection of Terry Fox Drive and Cope Drive. A total of 85 vehicle parking spaces will be provided as part of the proposed development in a surface parking lot.

The proposed development is anticipated to be built by 2020 and will be constructed in one phase.

Table 1 outlines the proposed land uses assumed for the analysis which were obtained from the *Institute of Transportation (ITE) Trip Generation Manual 10th Edition*.

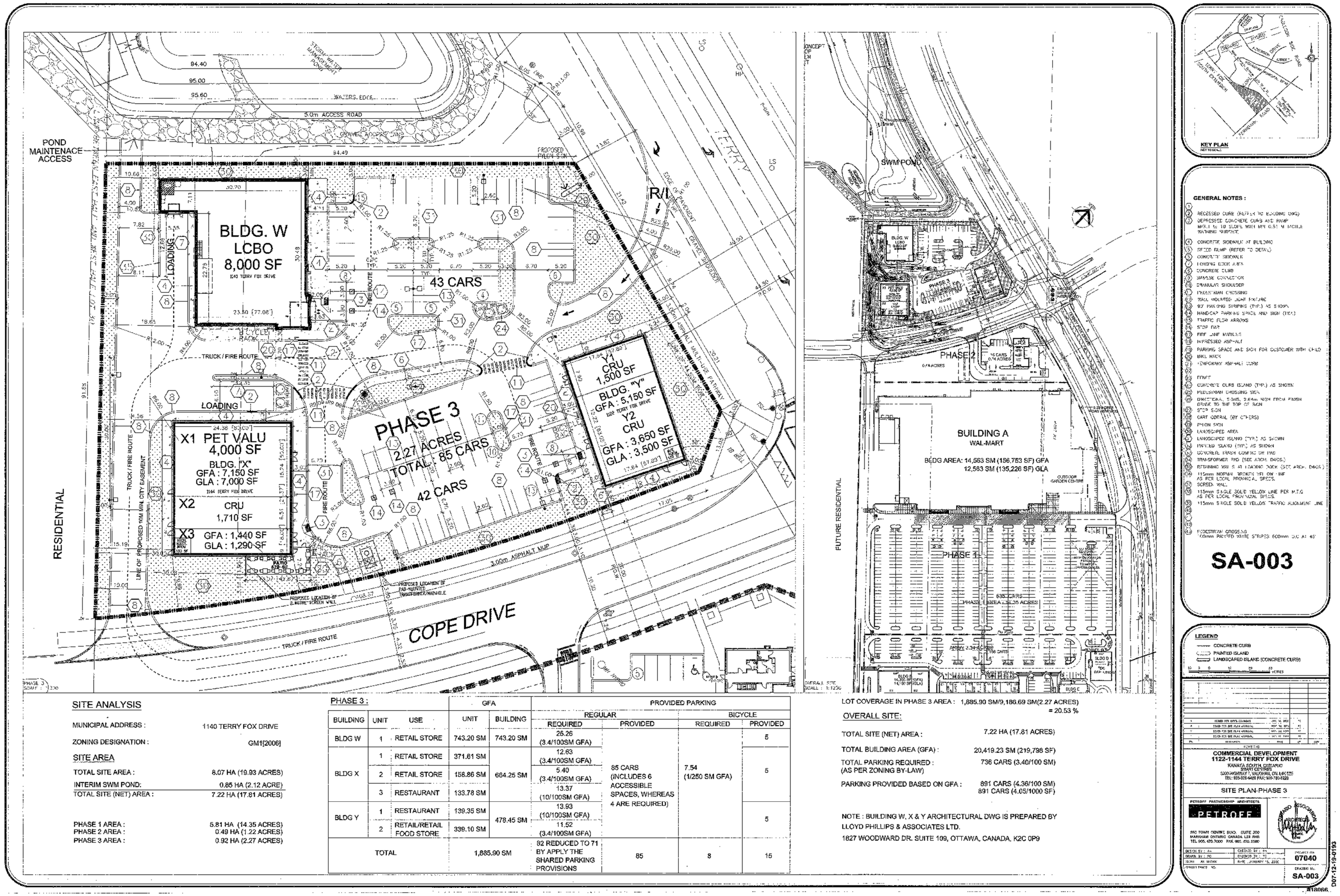
Figure 2 illustrates the proposed site plan.

Figure 1 - Site Location

Table 1 - Proposed Land Uses / Land Use Codes

Land Use	Size	Land Use Code (LUC)
LUC 820	20,300 ft^2 GFA	Shopping Centre

Figure 2 - Site Plan



2.1.2 Existing Conditions

2.1.2.1 Roads and Traffic Control

The roadways under consideration in the study area are described as follows:

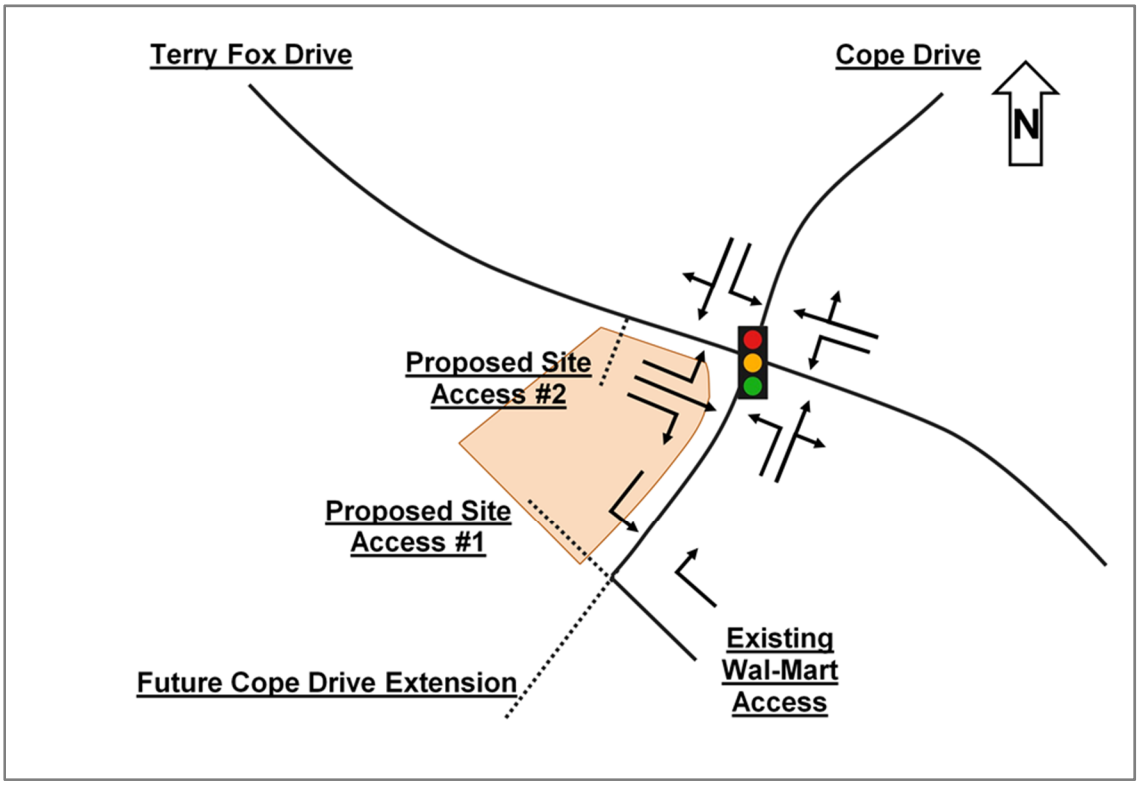
Terry Fox Drive — Within the vicinity of the subject site, Terry Fox Drive is a municipal two-lane undivided arterial roadway with a rural cross-section. There are left turn auxiliary lanes at each approach to the signalized intersection of Cope Drive and Terry Fox Drive and a right turn auxiliary lane on the north approach. The posted speed limit along Terry Fox Drive across the frontage of the subject site is 80 km/h. South of Cope Drive, there is an existing asphalt sidewalk on the west side of Terry Fox Drive. In addition, just north of the subject development, there is an existing pathway surrounding the stormwater management facility.

Cope Drive — West of Terry Fox Drive, Cope Drive is a municipal two-lane major collector road with a default speed limit of 50 km/h. Sidewalks are provided along both sides of the road, east of Terry Fox Drive, and on the south side of the road, west of Terry Fox Drive. Cope Drive currently terminates at the western limits of the subject site; however, it will be extended through into the adjacent residential development in the future. At the current terminus of Cope Drive, there is an access to Walmart located in the south-west quadrant of the Terry Fox Drive at Cope Drive intersection.

Along Cope Drive across from the subject development, there are two existing commercial accesses. Approximately 60m west of Terry Fox Drive, there is an access to a Jiffy Lube auto centre. Approximately 150m west of Terry Fox Drive, there is an access to the commercial development on the south side of Cope Drive. This commercial development contains a Walmart as well as several commercial retail units.

Figure 3 illustrates the existing lane configuration and traffic control.

Figure 3 - Existing Lane Configuration and Traffic Control



2.1.2.2 Walking and Cycling

As Terry Fox Drive has a rural cross-section, there are limited pedestrian facilities in the vicinity of the subject site. There are sidewalks on both sides of Cope Drive, east of Terry Fox Drive, however, there is only a sidewalk on the south side of Cope Drive, west of Terry Fox Drive. There is also an existing asphalt pathway on the west side of Terry Fox Drive, south of Cope Drive, and around the stormwater management facilities to the north of the subject development.

Currently, there are paved shoulders along both sides of Terry Fox Drive and Cope Drive, east of Terry Fox Drive, is considered a Suggested Cycling route. The City of Ottawa's Ultimate Cycling Plan indicates that both Terry Fox Drive and Cope Drive will be considered Spine Cycling routes and Terry Fox Drive will also be designated as a Cross-Town Bikeway. In addition, there is a planned pathway link on the west side of Terry Fox Drive from Cope Drive to just south of the Trans Canada Trail.

Figure 4 illustrates the existing and planned cycling and pedestrian facilities in the vicinity of the subject site.

Figure 4 - Cycling and Pedestrian Facilities

(Source: geoOttawa, accessed August 20th, 2019)

2.1.2.3 Transit

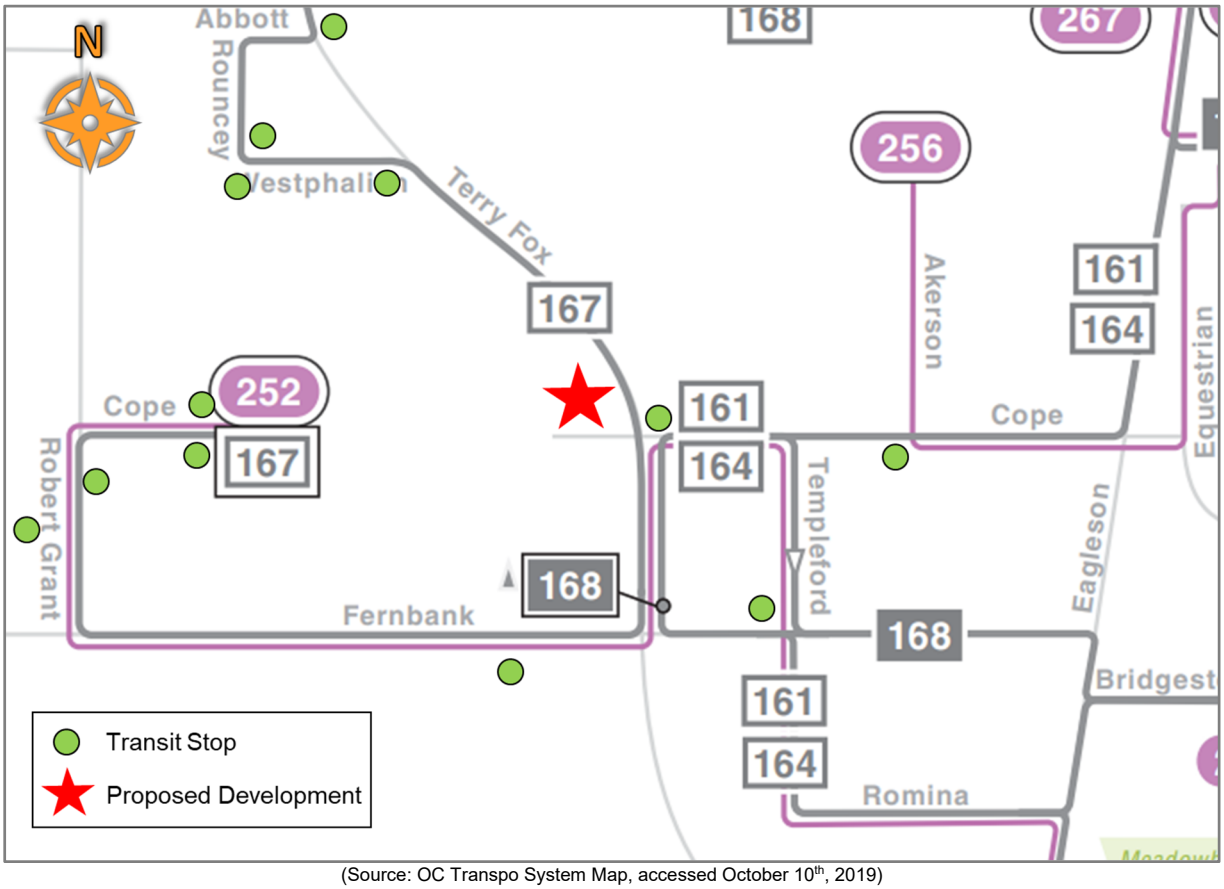
Transit service is currently provided in the immediate vicinity of the proposed development via the following routes:

Route 161	is a local limited service that runs between Bridlewood and Terry Fox Station that operates Monday to Friday.
Route 164	is a local route that runs between Hope Side and Terry Fox Station that operates only during operates weekday peak-periods.
Route 167	is a local route that runs between Blackstone and Terry Fox Station that operates only during operates weekday peak-periods.
Route 168	is a local route that runs between Bridlewood and Terry Fox Station that operates throughout the day, 7 days/week.
Route 252	Is a Connexion route going to Tunney's Pasture in the morning peak-period; returning in the afternoon.
Route 681	is a school route that runs between Bell High School and Kanata

There are two transit stops that are dedicated to routes 164, 168, and 681 that are provided within 400 meters of the subject site at the intersection of Terry Fox Drive and Fernbank Road.

Figure 5 illustrates nearby transit routes and bus stop locations.

Figure 5 - Study Area Transit Routes and Stops



(Source: OC Transpo System Map, accessed October 10th, 2019)

2.1.2.4 Traffic Management Measures

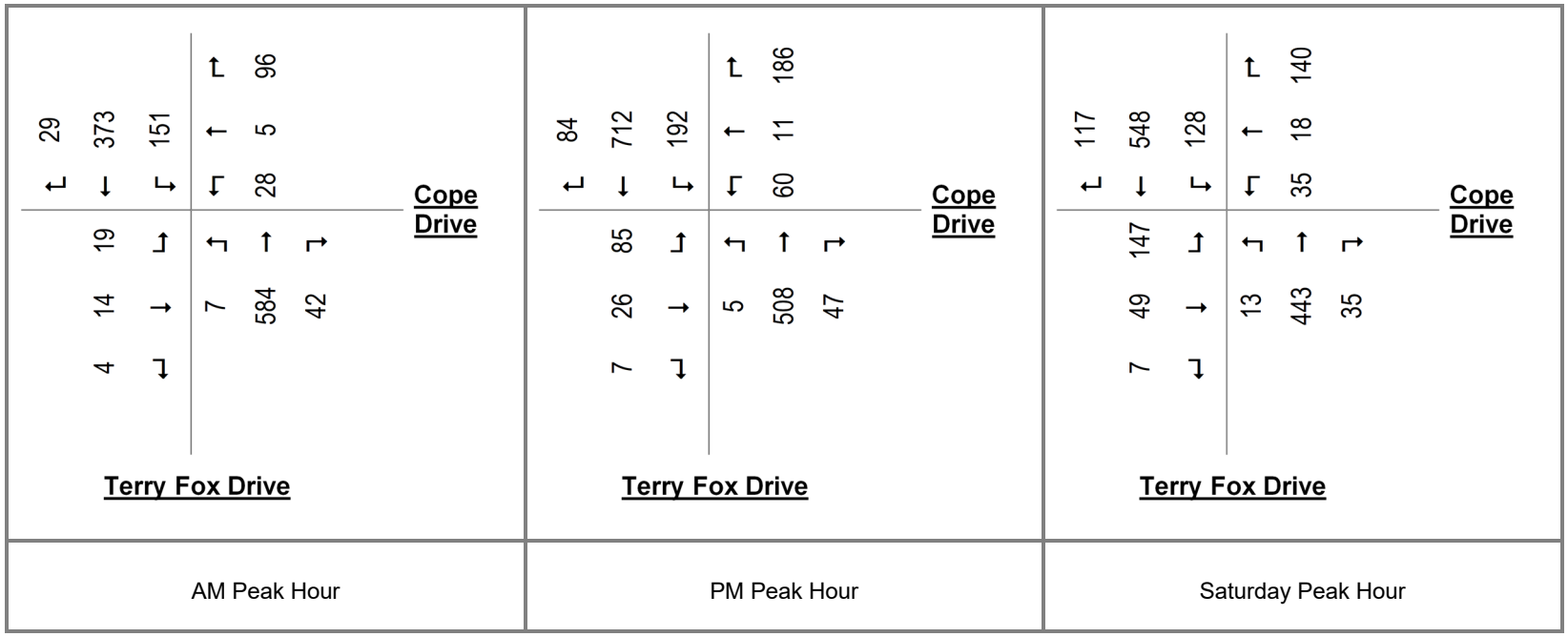
No traffic management measures are currently provided in the vicinity of the subject site.

2.1.2.5 Traffic Volumes

Existing turning movement counts for the Terry Fox Drive at Cope Drive intersection were collected from the City of Ottawa in August 2019. **Figure 6** illustrates the 2019 traffic volumes at the study area intersections.

Appendix A contains the traffic data and is provided for reference.

Figure 6 - 2019 Existing Traffic Volumes



2.1.2.6 Collision History

Collision data was provided by the City of Ottawa for the period January 2014 to December 2018 in the vicinity of the subject site during the five (5) year period.

Table 2 summarizes the collision class and impact types for each road segment and intersection in the study area.

Table 2 - Collision Summary

LOCATION	CLASS	IMPACT TYPE				
		Sideswipe	**Angle / Turning**	**Rear End**	**Single Vehicle**	**Other**
Terry Fox Drive between Cope Drive & Fernbank Road	Property Damage	1				1
	Non-Fatal Injury					
Terry Fox Drive between Cope Drive & Trans Canada Trail	Property Damage			19	2	1
	Non-Fatal Injury			6	1	
Cope Drive at Terry Fox Drive	Property Damage		10	8	2	
	Non-Fatal Injury		4	2		
Total	**Property Damage**	**1**	**10**	**27**	**4**	**1**
	Non-Fatal Injury		**4**	**8**	**1**	

Based on the collision data summarized in **Table 2** above it was found that the majority of the collisions resulted in property damage only (77%), which suggests that the collisions occurred at low enough speeds to not cause injury to people. The road segment of Terry Fox Drive, between the Trans Canada Trail and Cope Drive, experienced the highest number of collisions, with the majority of them being rear end collisions (86%). These rear end collisions were further reviewed to determine if there are any discernable patterns and can be seen in **Table 3** below.

Table 3 – Rear-End Impact Collisions on Terry Fox Drive Between the Trans Canada Trail and Cope Drive

		ENVIRONMENT		
		Clear	**Rain**	**Snow**
Surface Conditions	Dry	20		
	Wet		4	
	Loose Snow			1
Vehicle Direction	North	14	2	0
	South	6	2	1

The majority (71%) of the rear end type impact collisions on Terry Fox Drive, between the Trans Canada Trail and Cope Drive, occurred during clear environmental conditions and dry surface conditions. **Figure 7** is depicts the location of rear end collisions on Terry Fox Drive between the Trans Canada Trail and Cope Drive from the years 2014 to 2018.

Figure 7 - Location Breakdown of Rear End Collisions on Terry Fox Dr. between the Trans Canada Trail and Cope Dr. from 2014 to 2018

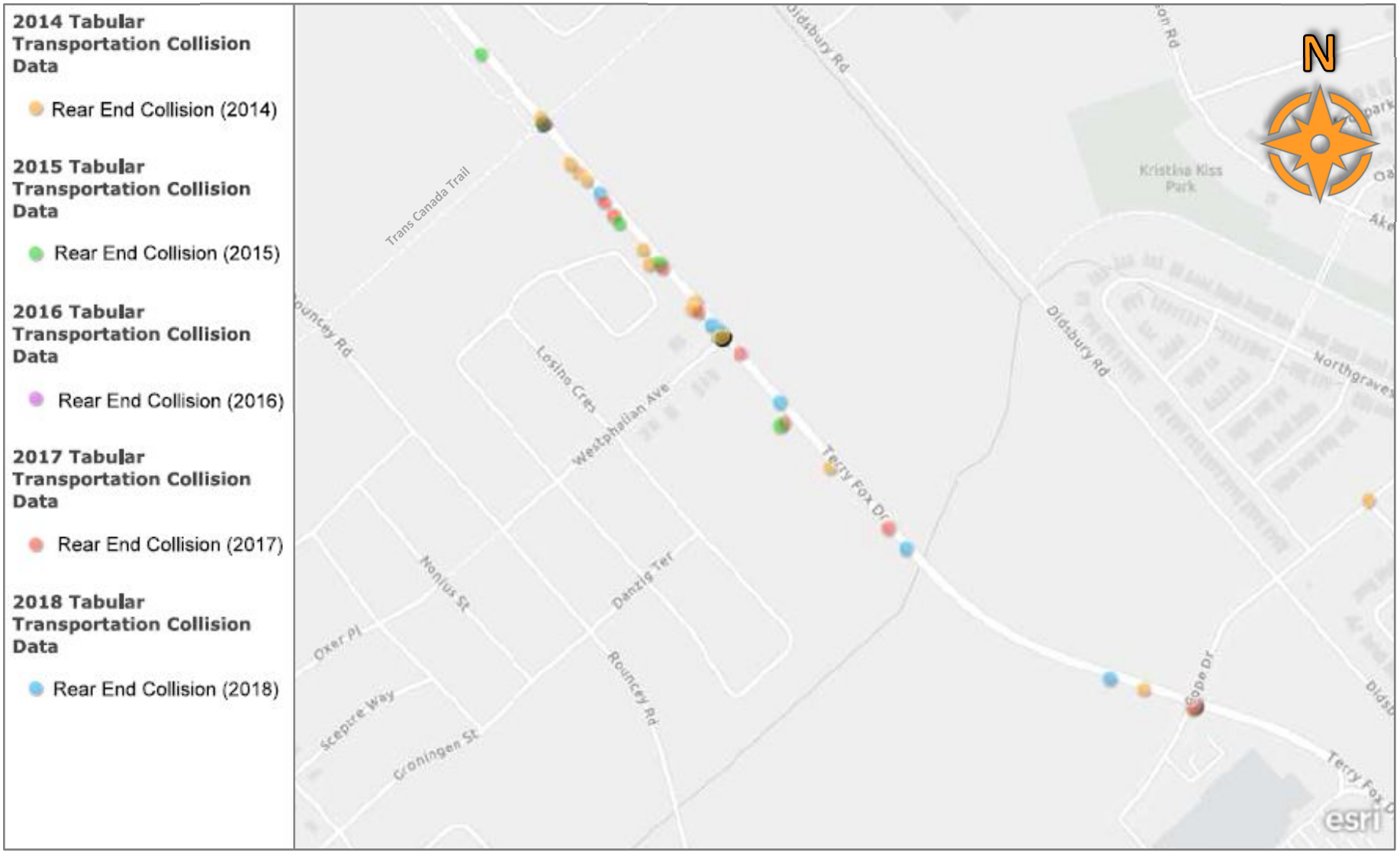


Table 4 provides a directional breakdown for rear-end collisions for the five-year period from 2014 to 2018. Twenty-five rear end collisions occurred along Terry Fox Drive between Cope Drive and the Trans Canada Trail with the majority of rear-end collisions of occurring in the northbound direction (64%).

Table 4 – Directional Breakdown of Rear-End Collisions along Terry Fox Drive

Location	Vehicle 1 Initial Direction	Vehicle 2 Initial Direction	No. of Rear-End Collisions
Terry Fox Dr between Cope Drive at Trans Canada Trail	North	North	16
	South	South	9

2.1.3 Planned Conditions

2.1.3.1 Road Network Modifications

A number of roadway and transit improvements are scheduled to occur within the vicinity of the subject development, as outlined in the City of Ottawa's 2013 Transportation Master Plan, and are summarized in **Table 5** below.

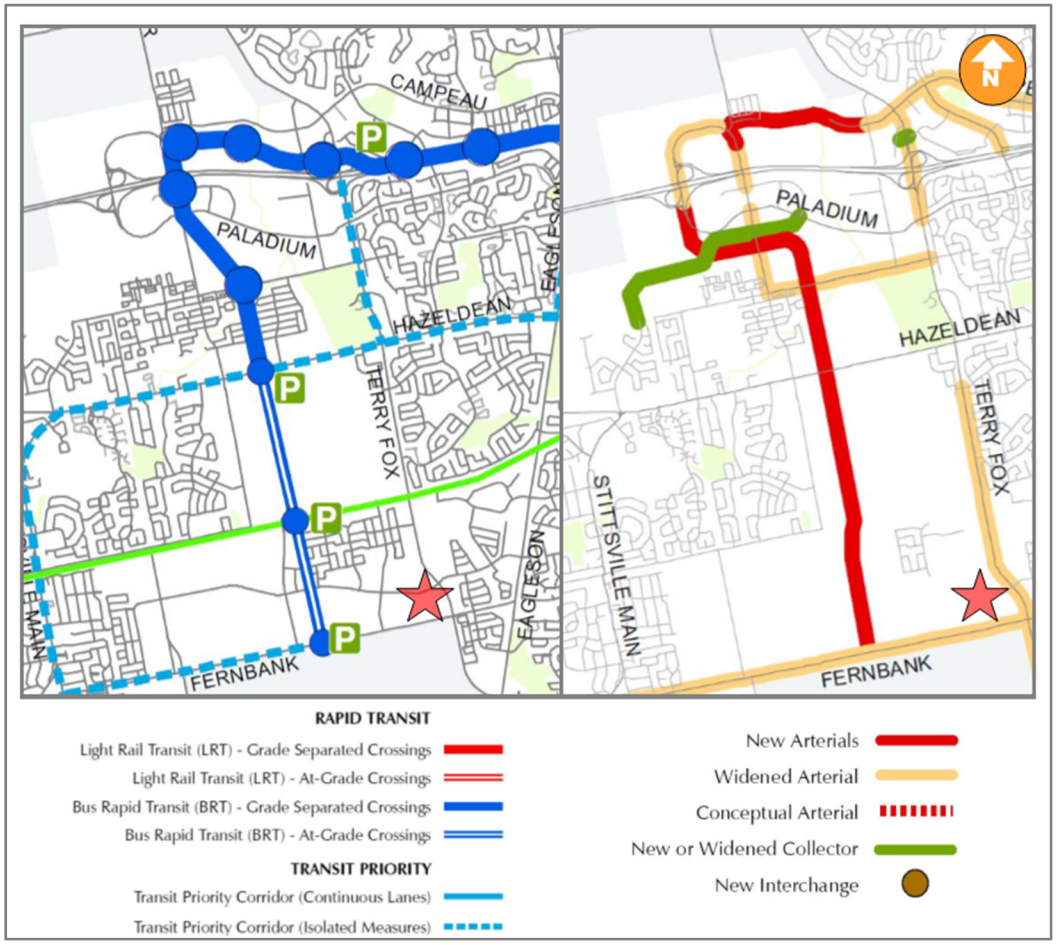
Table 5 - City of Ottawa Transportation Master Plan Projects

Project	Description	TMP Phase
Terry Fox Drive	Widened Arterial (from two to four lanes) between Winchester Drive and Eagleson Road to provide access to adjacent developments	Network Concept (post 2031)
Fernbank Road	Widened arterial (from two to four lanes) between Stittsville Main Street and Terry Fox Drive to accommodate increasing population and employment in Stittsville	Network Concept (post 2031)
Stittsville North-South Arterial	New two-lane road between Palladium Drive and Iber Road	Phase 2 (2020-2025)
	Transit signal priority and queue jump lanes at selected intersections.	Affordable Network (before 2031)
West Transitway Extension	Exclusive BRT between Fernbank Road and Eagleson Station.	Network Concept (post 2031)

Figure 8 illustrates roadway and transit improvements as outlined in the TMP.

Although the City's TMP calls for Bus Rapid Transit between Eagleson Station and Fernbank Road, based on the recently completed *Kanata Light Rail Transit Planning and Environmental Assessment Study (August 30, 2018)*, the West Transitway Extension will now include Light Rail Transit in place of Bus Rapid Transit between Eagleson Station and Hazeldean Station. Between Hazeldean Station and Fernbank Station, it will be Bus Rapid Transit as planned in the TMP.

Figure 8 - TMP Roadway and Transit Improvements



Source: City of Ottawa's Transportation Master Plan, November 2013.

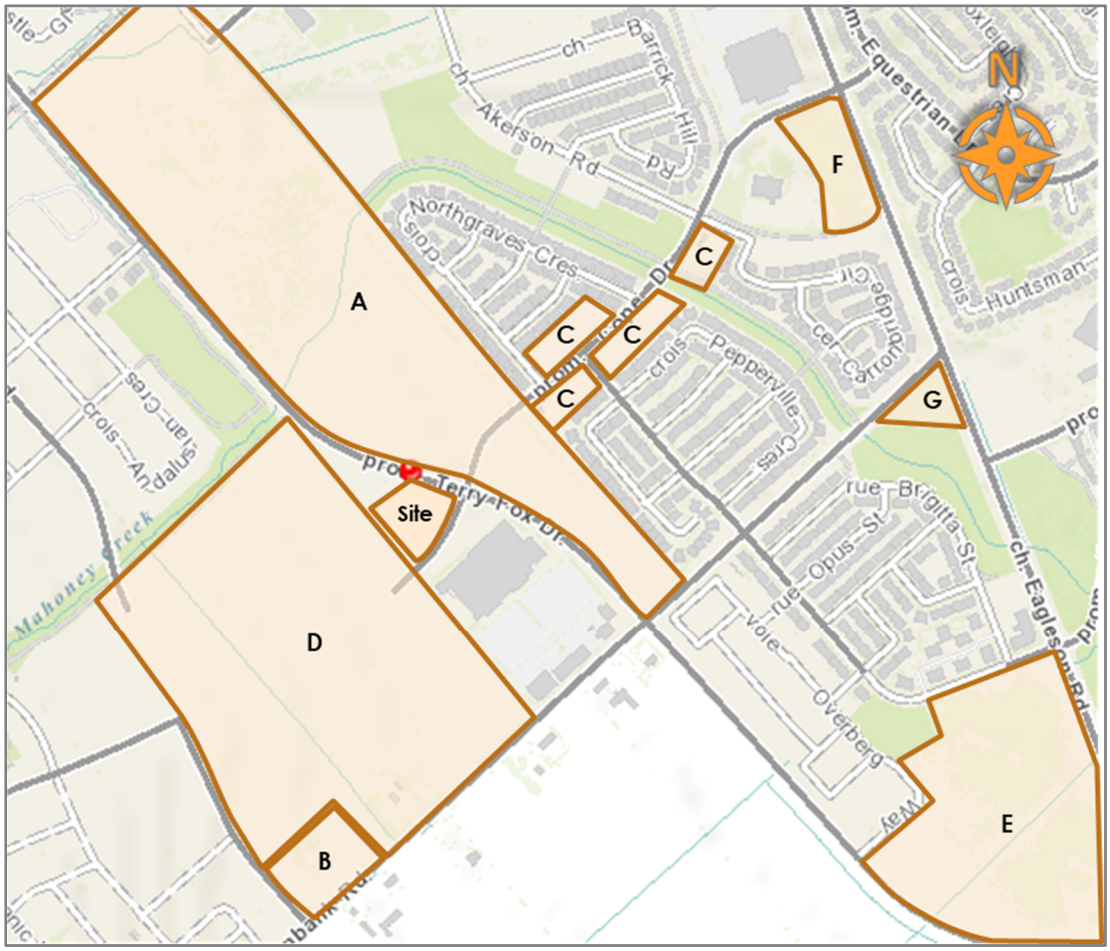
2.1.3.2 Future Background Developments

There are numerous developments scheduled to occur in the vicinity of the subject site as illustrated in **Figure 9** and described in **Table 6.**

Table 6 - Background Developments

Key Plan Reference	Development	Location	Description	Assumed Build-Out Year
A	Van Gaal Lands (5331 Fernbank Road, 1039 Terry Fox Drive)	Southeast quadrant of the Terry Fox Drive at Cope Drive intersection and east of Terry Fox Drive between the Monahan Drain and Cope Drive.	The present plans include a total gross leasable area 89,700 ft^2 of retail space, and a mixed-use development including 250 townhomes and 600,000 ft^2 of office space.	2025
B	5505 Fernbank Road 5441 Fernbank Road	Northeast quadrant of Fernbank Road and Rouncey Road intersection.	Residential development including 12 buildings containing 216 stacked back --to- back townhouse units.	2020
C	180 Cope Drive (Cope Lands)	North and south side of Cope Drive between Northgraves Crescent and Akerson Road.	Residential development including 260 high-rise condo units.	2020
D	5431 Fernbank Road (Blackstone Phases 4-8)	North of Fernbank Road between Rouncey Road and Terry Fox Drive.	Residential development including 420 single family homes, 375 townhomes, and 150 apartment units.	2025
E	866, 898 Eagleson Road	Bound by Terry Fox Drive, Eagleson Road, and Romina Street.	Residential development including 250 townhomes, 120 back-to-back units, and 34 semi-detached units.	2025
F	10 Cope Drive	Bound by Cope Drive, Eagleson Road and a multi-use path (MUP) extending from Carronbridge Circle to Eagleson Road.	Commercial development including a 3,620 m^2 grocery store, and 1,982 m^2 of additional retail (restaurant, dental/medical office etc.) with sizeable at grade parking (approximately 246 spaces).	2020
G	800 Eagleson Road	Northeast corner at the intersection of Fernbank Road and Eagleson Road.	Residential development proposed: 6 storey apartment development totaling 143 units.	2019

Figure 9 - Background Developments Key Plan



2.2 STUDY AREA AND TIME PERIODS

2.2.1 Study Area

The proposed study area is limited to the following intersections:

- Terry Fox Drive and Cope Drive;
- Terry Fox Drive and Site Access 2; and
- Cope Drive and Site Access 1.

2.2.2 Time Periods

The proposed scope of the transportation assessment includes the following analysis time periods:

- Weekday AM peak hour of roadway;
- Weekday PM peak hour of roadway; and
- Saturday peak hour of roadway.

2.2.3 Horizon Years

The scope of the transportation assessment proposes the following horizon years:

- 2019 existing conditions;
- 2020 total future conditions (site build-out); and
- 2025 total future conditions (5 years beyond build-out).

2.3 EXEMPTIONS REVIEW

Table 7 summarizes the Exemptions Review table from the City of Ottawa's *2017 Transportation Impact Assessment Guidelines*.

Table 7 - Exemptions Review

Module	Element	Exemption Considerations	Exempted?
Design Review Component			
4.1 Development Design	4.1.2 Circulation and Access	Only required for site plans	No
	4.1.3 New Street Networks	Only required for plans of subdivision	Yes
4.2 Parking	4.2.1 Parking Supply	Only required for site plans	No
	4.2.2 Spillover Parking	Only required for site plans where parking supply is 15% below unconstrained demand	Yes
Network Impact Component			
4.5 Transportation Demand Management	All Elements	Not required for site plans expected to have fewer than 60 employees and/or students on location at any given time	No
4.6 Neighbourhood Traffic Management	4.6.1 Adjacent Neighbourhoods	Only required when the development relies on local or collector streets for access and total volumes exceed ATM capacity thresholds	Yes
4.8 Network Concept		Only required when proposed development generates more than 200 person-trips during the peak hour in excess of the equivalent volume permitted by established zoning	Yes
4.9 Intersection Design	All Elements	Not required if site generation trigger is not met.	No

3.0 FORECASTING

The Step 3.0 – Forecasting section has been reviewed by the City of Ottawa and was subject to revision as per the comments prepared the City, dated September 30, 2019. The comment responses reflected are herein. Further detail can be found in **Appendix B.**

3.1 DEVELOPMENT GENERATED TRAVEL DEMAND

3.1.1 Trip Generation and Mode Shares

The *Institute of Transportation (ITE) Trip Generation Manual* (10th edition) was used to forecast the auto trip generation for the proposed site. The land use code 820 – Shopping Centre was found to be the most representative of the proposed land use.

Table 8 outlines the assumed land use and the associated trip generation rate.

As per the City of Ottawa's *2017 TIA Guidelines,* the auto trip generation rates of the proposed land use were converted to person trips using a conversion factor of 1.28.

Table 9 outlines development-generated person trips for the proposed site.

Table 8 - Land Use and Trip Generation Rates

LUC	Land Use	Size (1000's GFA)	Weekday AM Peak Hour			Weekday PM Peak Hour			Saturday Peak Hour		
			In	Out	Total	In	Out	Total	In	Out	Total
820	Shopping Centre	20.3	0.58	0.36	0.94	1.83	1.98	3.81	2.34	2.16	4.50

Table 9 - Person Trips

LUC	Land Use	Trip Conversion	Weekday AM Peak Hour			Weekday PM Peak Hour			Saturday Peak Hour		
			In	Out	Total	In	Out	Total	In	Out	Total
820	Shopping Centre	Auto Trips	12	8	20	38	41	79	48	44	92
		Conversion Factor	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28
		Person Trips	16	11	27	49	53	102	62	57	119

To reflect local travel characteristics, the person trips were assigned to the four primary modal shares (i.e. auto, passenger, transit, and active moves) according to the TRANS Committee's 2011 Origin-Destination (O-D) Survey for the Kanata / Stittsville District.

As the land uses in this proposed site are expected to serve more of a local function than a regional function, it is assumed that the mode share of trips generated by the subject development will reflect travel patterns of trips originating from the district in which it resides (i.e. the Kanata / Stittsville District).

The transit modal share, as per the O-D survey, ranges between 7%-26% for trips to and from the district, and between 2%-6% for trips within the district. Based on the local function of the proposed site, the transit modal share that is expected will closely resemble the 'within the district' transit modal share as outlined in the O-D survey. As such, the transit modal share was taken to be 5%.

The walking and cycling modal share within the district is 20% during the AM peak hour and 13% during the PM peak hour. However, recognizing that 39% of the trips surveyed within the district during the AM peak were school related trips, which are more likely to be walking, cycling, or 'other' trips (as it includes the school bus category), the PM peak mode share likely reflects the actual active trip generation that this development would generate. As such the walking and bicycle mode share was taken to be 15%.

The automobile driver share was taken to be 60% (rounded up from 57% during the PM peak) and the auto passenger share was taken to be 20%.

Table 10 outlines the anticipated trip generation potential of the proposed site by travel mode based on aforementioned assumed mode share targets.

Table 10 - Trips Generated by Travel Mode

LUC	Land Use	Trip Conversion		Weekday AM Peak Hour			Weekday PM Peak Hour			Saturday Peak Hour		
				In	Out	Total	In	Out	Total	In	Out	Total
820	Shopping Centre	Auto	60%	10	6	16	30	32	62	38	34	72
		Passenger	20%	3	2	5	10	11	21	12	11	23
		Transit	5%	1	1	2	2	2	4	3	3	6
		Walk / Bike	15%	2	2	4	7	8	15	9	9	18

3.1.2 Pass-By

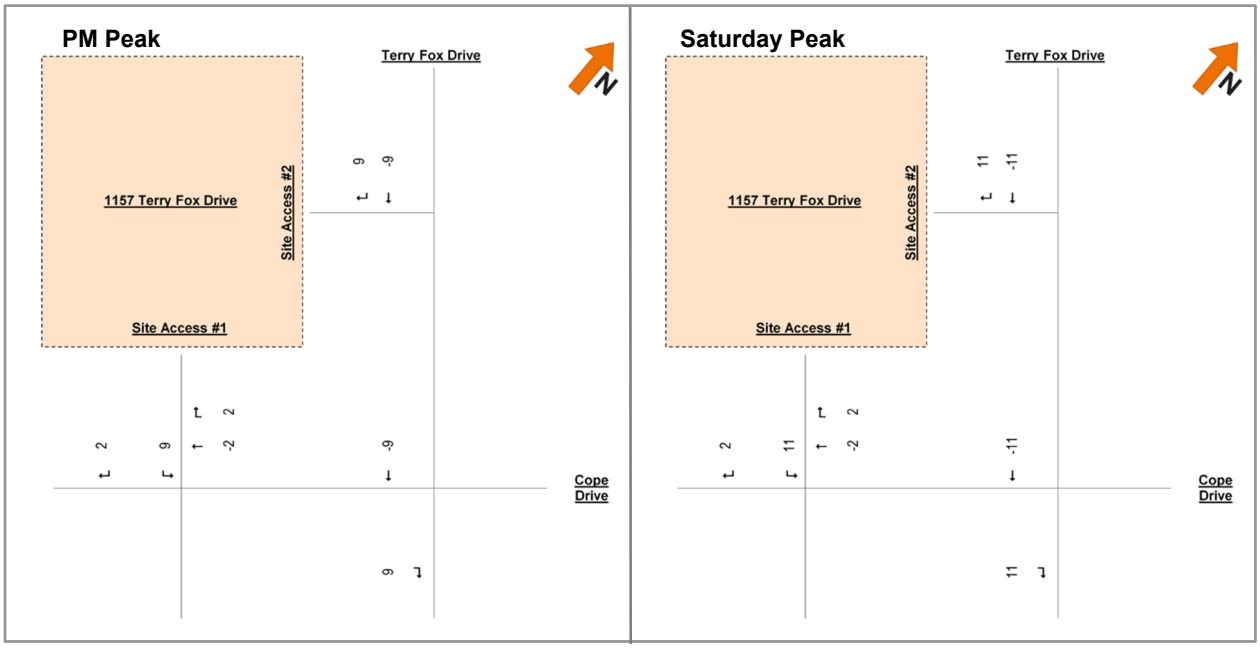
A portion of the auto trips generated by the proposed restaurant and commercial spaces will be 'pass-by' in nature. Pass-by trips are considered intermediate stops between an origin and a destination. They are site trips that are drawn from existing traffic volumes on the road network that are "passing-by" the site. While the total number of trips generated by a given development remains the same, the turning movements at study area intersections and site accesses require adjustments to reflect pass-by traffic. The rate of pass-by traffic is based on the specific land use and the various pass-by rates were obtained from the *ITE Trip Generation Manual*. A pass-by rate of 34% was used for the commercial land use. Due to the nature of the proposed land use, this pass-by rate was applied to the PM and Saturday peak hours only.

Table 11 outlines the pass-by and net new trips anticipated for the proposed development.
Figure 10 illustrates the pass-by trips the proposed site is anticipated to generate during the PM and Saturday peak hours.

Table 11 - Pass-By Trips

LUC	Land Use	Trip Conversion		Weekday AM Peak Hour			Weekday PM Peak Hour			Saturday Peak Hour		
				In	Out	Total	In	Out	Total	In	Out	Total
820	Shopping Centre	Auto Trips		9	6	16	30	32	62	38	34	72
		Pass-By	34%	0	0	0	11	11	21	13	13	25
		Net New Auto Trips		9	6	16	19	21	41	25	21	47

Figure 10 – Pass-By Trips



3.1.3 Trip Distribution

The proposed development will serve a local function in the Kanata / Stittsville District rather than a regional function prompting inter-zonal trips as would be assumed by examination of the TRANS Committee's 2011 Origin-Destination (O-D) Survey. As such all trips anticipated to visit the proposed site are expected to both originate from and remain in the Kanata / Stittsville District.

Table 12 provides a summary of the estimated distribution for the traffic generated by the proposed development.

Table 12 - Traffic Distribution Assumptions

Cardinal Direction		Via (to / from) Terry Fox Drive (North)	Terry Fox Drive (South)	Cope Drive (East)	Cope Drive (Future) (West)
North	0%				
East	0%				
South	0%				
West	0%				
Internal (Kanata / Stittsville)	100%	75%	3%	15%	7%
Total	**100%**	**75%**	**3%**	**15%**	**7%**

3.1.4 Trip Assignment

Site generated trips were assigned to the study area road network based on the trip distribution assumptions outlined in **Table 12**. New site trips are assigned to the road network and pass-by trips (as per **Figure 10**) were then added to develop the net new site trips generated by the proposed development.

Figure 11 outlines the site assignment assumptions.

Figure 12 illustrates the net site generated trips for the proposed development after accounting for pass-by trips, during the AM, PM and Saturday peak hours.

Figure 11 - Site Traffic Assignment

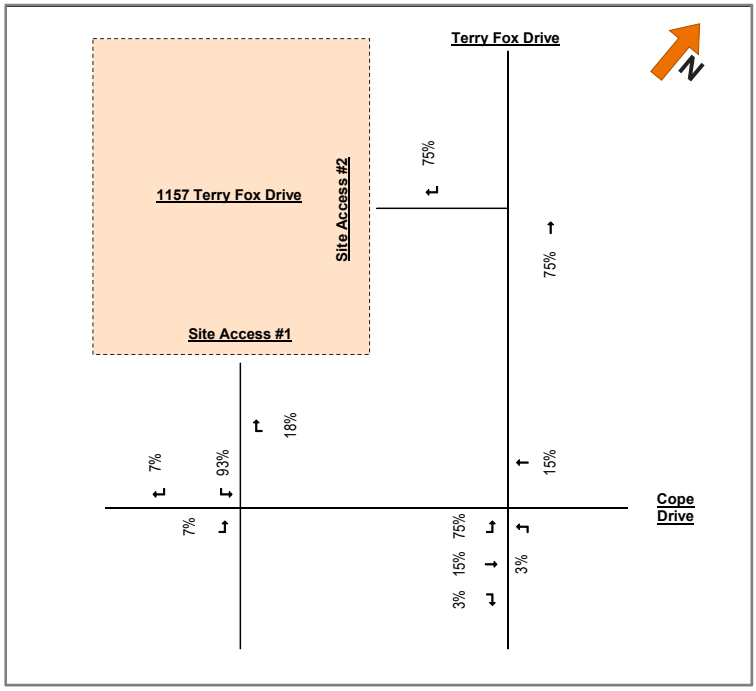
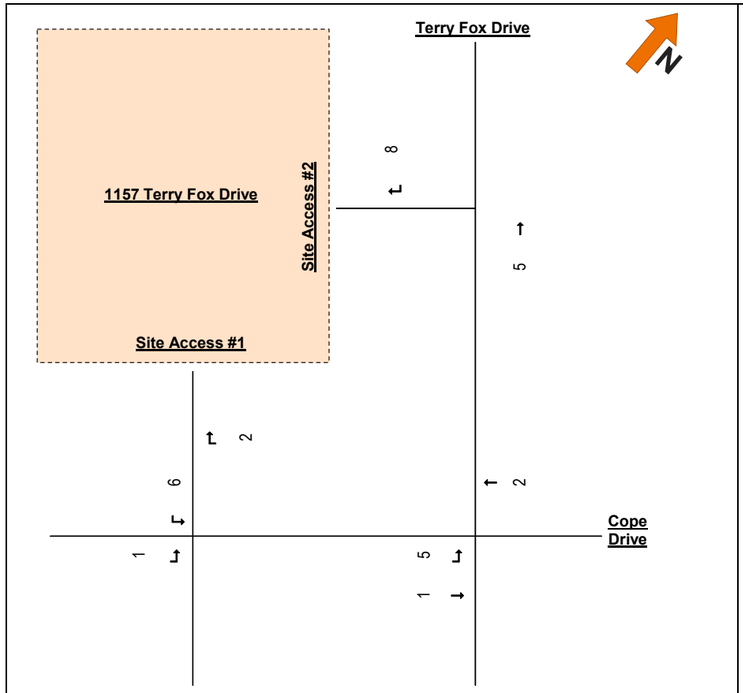
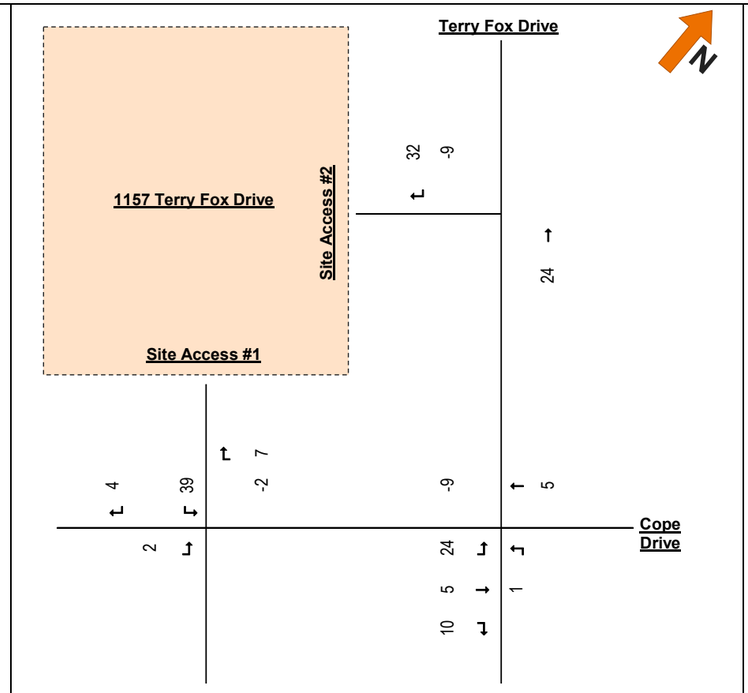


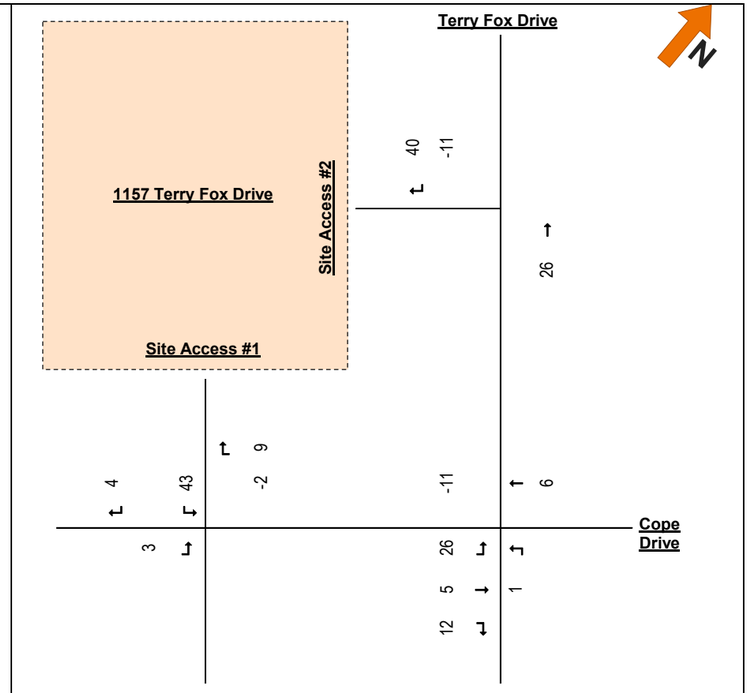
Figure 12 - Total Site Generated Traffic Volumes



AM Peak Hour



PM Peak Hour



Saturday Peak Hour

3.2 BACKGROUND NETWORK TRAVEL DEMAND

3.2.1 Transportation Network Plans

As outlined in **Table 5** in **section 2.1.3.1**, a number of road network projects are expected to occur within the vicinity of the proposed development. Through recent discussions with City of Ottawa staff, it is understood that the timelines for the roadway projects outlined in the City of Ottawa's *2013 Transportation Master Plan* have been pushed back one Phase (i.e. Phase 2 (2020 – 2025) projects are now Phase 3 (2026 -2031) projects, etc.). For this reason, it was assumed that there will not be any improvements to the roadway network in the vicinity of the subject site prior to the 2024 ultimate (+5 year) horizon.

In addition to the transportation infrastructure projects outlined in the TMP, the 2020 completion of the Blackstone South development will bring online the Cope Drive Extension westward into the future Blackstone community, as directed by the City of Ottawa. As the Cope Drive Extension connects all westward developments to Terry Fox Drive, the trips that are generated by these developments were carried through to Terry Fox Drive via the extension by incorporating the traffic volumes forecasted from the Blackstone South community into the subject study area as a background volumes. The effects of the Blackstone development and the extension of Cope Drive will be seen as part of the intersection analysis in **Section 4.9.**

3.2.2 Background Growth

The existing traffic counts were grown at a rate of 2% annually, non-compounding, to represent the 2020 and 2025 background traffic volumes. This growth rate is generally consistent with other studies that have been conducted in the area.

3.2.3 Other Developments

As outlined in **Section 2.1.3.2**, a number of background developments are planned within the vicinity of the subject site. Traffic volumes were obtained from traffic studies that were found on the City's development applications website and used to generate the background traffic volumes for the subject development.

Figure 13 below illustrates the traffic generated by the background developments at the study area intersections during the 2020 horizon year.

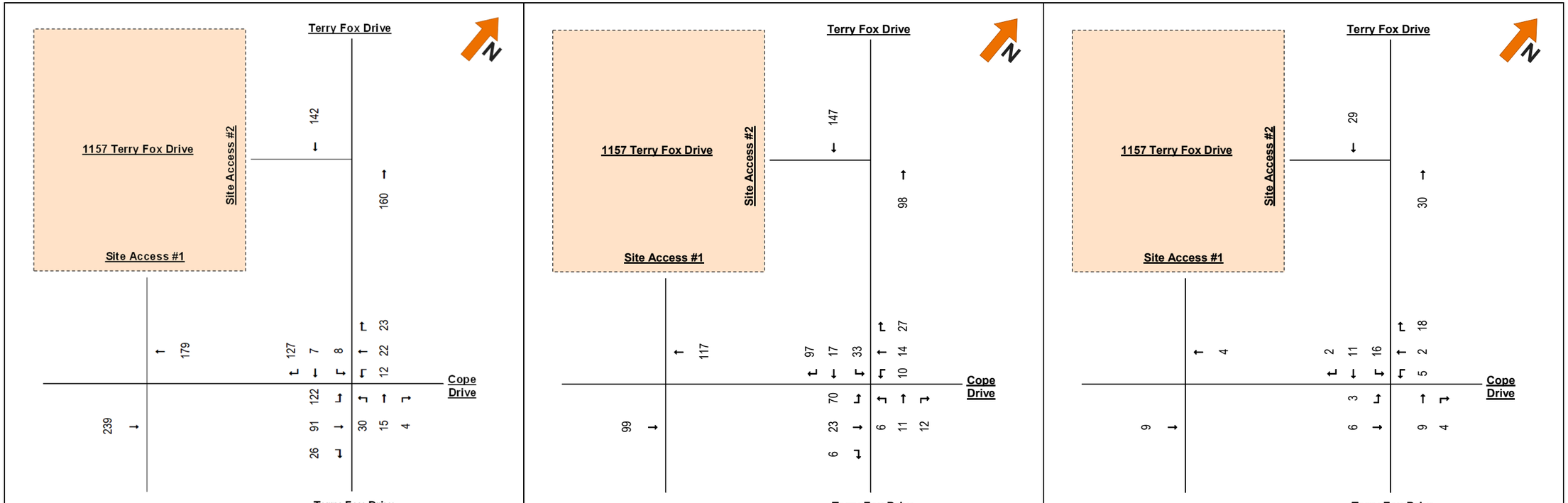
Figure 14 illustrates the traffic generated by the background developments at the study area intersection during the 2025 horizon year.

Appendix C contains the excerpts from the aforementioned traffic studies and is included for reference.

3.3 DEMAND RATIONALIZATION

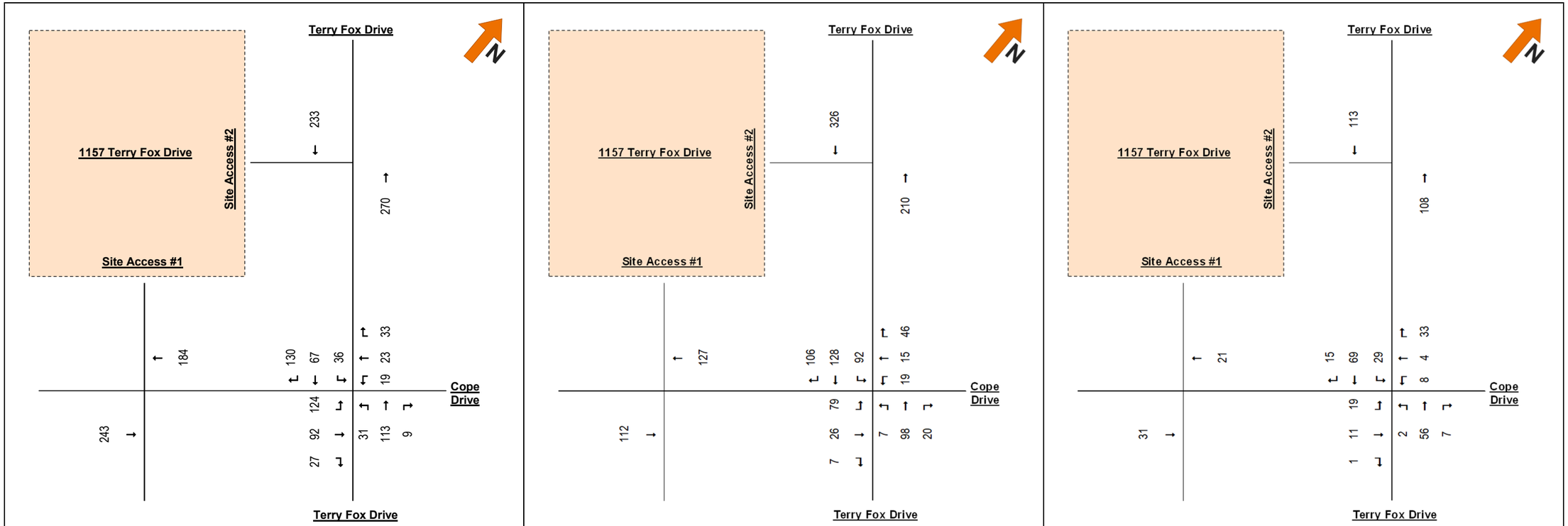
The proposed development is not anticipated to encounter any capacity restrictions that cannot be resolved through roadway improvements and therefore no demand rationalization is required.

Figure 13 - Background Development Traffic – 2020 Horizon Year



AM Peak Hour	PM Peak Hour	Saturday Peak Hour

Figure 14 - Background Development Traffic – 2025 Horizon Year



AM Peak Hour	PM Peak Hour	Saturday Peak Hour

4.0 STRATEGY

The Step 4.0 - Strategy section has been reviewed by the City of Ottawa and was subject to revision as per the comments prepared the City, dated November 27, 2019. The comment responses reflected are herein. Further detail can be found in **Appendix B.**

4.1 DEVELOPMENT DESIGN

4.1.1 Design for Sustainable Modes

Bicycle facilities: A total of 15 bicycle parking spaces are provided for the proposed development. These bicycle parking spaces are provided at the main entrances to the three buildings.

Pedestrian facilities: Pedestrian connections are included on the site plan which will connect the proposed buildings to the existing sidewalks along Terry Fox Drive and Cope Drive. The proposed site plan includes a 3.0m asphalt multi-use pathway (MUP) along the north side of Cope Drive and along the west side of Terry Fox Drive.

Parking areas: A total of 85 vehicle parking spaces are provided. This consists of 79 regular vehicle parking spaces, and 6 accessible parking spaces. The accessible parking spaces are provided adjacent to the entrances to the building.

Transit facilities: OC Transpo routes 161, 164, 167 and 168 are local routes that run between Terry Fox Station and various termini with stops within a five-minute walk radius centered on the proposed development. Route 252 is a Connexion peak directional route that runs between Fernbank and Tunney's Pasture station. Route 681 is a school route that runs between Bell High School and Kanata. There is a sidewalk on the west side of Terry Fox Drive and sidewalks on both sides of Cope Drive and Fernbank Road that facilitate pedestrian access to these transit stops. At the intersection of Terry Fox Drive and Fernbank Road, there are two transit stops that are serviced by routes 164, 168, and 681 that are attractively situated within 400 meters of the subject site.

4.1.2 Circulation and Access

The subject development proposes two site accesses. Site Access 1 is located on Cope Drive approximately 150m west of Terry Fox Drive and is proposed to operate as a full movements access with stop-control along the site access approach. Site Access 2 is located on Terry Fox Drive approximately 65m north of Cope Drive and is proposed to operate as a right-in only intersection.

Within the vicinity of the subject site, there are minimal existing pedestrian facilities. There is an existing sidewalk along the south side of Cope Drive across the Jiffy Lube property. There is an asphalt pathway along the west side of Terry Fox Drive, south of Cope Drive. There is also a pathway system around the existing stormwater management pond to the north of the subject site. As part of the subject development application, a 3.0m asphalt multi-use pathway is proposed along the Terry Fox frontage to connect to the existing pathway system around the stormwater management pond. In addition, a 3.0m asphalt multi-use pathway is proposed along the Cope Drive frontage. In addition, sidewalk connections are proposed that connect the proposed commercial buildings to the aforementioned pathways along Terry Fox Drive and Cope Drive.

4.1.3 New Street Networks

Not applicable; exempted during screening and scoping.

4.2 PARKING

4.2.1 Parking Supply

Auto Parking - As per City of Ottawa Zoning By-law 2008-250 (Sections 101 and 102), the minimum parking space requirement is 3.6 spaces per 100m^2 of shopping centre space (gross floor area). A minimum of 68 vehicle spaces is required for the proposed development.

The proposed site plan indicates there will be a total of 85 vehicle parking spaces provided, which meets the minimum requirements.

Bicycle Parking – As per City of Ottawa Zoning By-law 2008-250 (Section 111), the minimum bicycle parking rate of 1 bicycle parking space per 250m^2 of shopping centre space (gross floor area). A minimum of 8 bicycle parking spaces is required for the proposed development.

The proposed site plan indicates there will be 15 bicycle spaces provided, which meets the minimum requirements.

4.2.2 Spillover Parking

Not applicable; exempted during screening and scoping.

4.3 BOUNDARY STREET DESIGN

4.3.1 Design Concept

As outlined in the City of Ottawa's *Official Plan* Schedule B, Terry Fox Drive (arterial) and Cope Drive (collector) are within the 'General Urban Area' designation. With this designation, the MMLOS targets are prescribed in the City of Ottawa's *Multi-Modal Level of Service (MMLOS) Guidelines*.

Table 13 presents the MMLOS conditions for both roadway segments.

Appendix D contains the detailed MMLOS analysis.

Terry Fox Drive

Based on the aforementioned designation, the Pedestrian Level of Service (PLOS) target for Terry Fox Drive is C. The Ultimate Cycling Network from the City of Ottawa's *Transportation Master Plan* (2013) designates Terry Fox Drive as a spine cycling route and a cross-town bikeway. As the cross-town bikeway BLOS targets govern, Terry Fox Drive has a BLOS target of B. Transit service travelling along Terry Fox Drive currently operates within mixed traffic, and as such, the Transit Level of Service (TLOS) target is D. Terry Fox Drive is designated as truck route and therefore has a Truck Level of Service (TkLOS) target of D.

Due to the absence of any pedestrian facilities along Terry Fox Drive across the subject development and the high operating speed along Terry Fox Drive, the Pedestrian Level of Service (PLOS) target of C is not currently being met. The proposed site plan includes a 3.0m asphalt pathway along the west side of Terry Fox Drive which will connect to the existing pathway system around the stormwater management pond to the north of the subject site. Even with this asphalt pathway in place, the PLOS target will not be met. The speed limit on Terry Fox Drive would need to be reduced to 60 km/h in order to meet the PLOS target of C.

Due to the posted speed limit and the lack of dedicated cycling facilities along Terry Fox Drive, this roadway segment currently does not meet the Bicycle Level of Service (BLOS) target of B. Implementing a physically separated bicycle facility (cycle track or MUP) would allow the BLOS target to be met, however, this this would have financial and property impacts. Another potential solution to meet the BLOS target would be to implement curbside bike lanes while reducing the posted speed limit to 50 km/hr. If bicycle lanes are not feasible, reducing the speed limit to 40 km/hr while maintaining the mixed-use lanes would also allow the BLOS target to be met, however, reducing the speed limit by this amount would be unrealistic as this roadway is classified as an arterial.

Terry Fox Drive, across the frontage of the subject site, currently meets both the Transit and Truck Level of Service targets.

Cope Drive

Based on the aforementioned designation, the Pedestrian Level of Service (PLOS) target is C for Cope Drive. Cope Drive, west of Terry Fox Drive, is designated as a spine cycling route and therefore has a BLOS target of C. Cope Drive, across the frontage of the subject site, does not have any transit service nor is it a truck route, therefore, TLOS and TkLOS do not apply to this roadway segment.

There is currently a sidewalk and boulevard along the south side of Cope Drive across the frontage of the subject development. These two items allow Cope Drive to meet the Pedestrian Level of Service target under existing conditions. As part of the subject development, a 3.0m asphalt multi-use pathway will be included along the north side of Cope Drive across the frontage of the subject site. This will allow the PLOS target to continue to be met once the proposed site is built.

As Cope Drive does not have a posted speed limit, the default speed limit is 50 km/hr. As part of the development, a 3.0m asphalt multi-use pathway will be included along the north side of Cope Drive across the frontage of the subject site. This will allow the BLOS target to be met at build-out of the subject site.

As Cope Drive, across the frontage of the subject site, is not a transit route nor is it designated as a truck route, TLOS and TkLOS do not apply to this roadway segment.

Table 13 - Multi-Modal Level of Service Assessment - Roadway Segments

Roadway Segment / MMLOS Criteria	Terry Fox Drive Across Subject Site		Cope Drive Across Subject Site		Targets
	Existing	Build-Out	Existing	Build-Out	
PLOS	F	D	A	**	C
BLOS	F	**	E	A	B / C
TLOS	D	**	N/A	**	D / N/A
TkLOS	B	**	N/A	**	D / N/A

Notes: ** indicates no change between horizons
Target of B / C indicates the target is B for Terry Fox and C for Cope
N/A indicates the MMLOS criteria does not apply

4.4 ACCESS INTERSECTIONS DESIGN

4.4.1 Location and Design of Access

As mentioned in **Section 4.1.2**, the proposed site includes two site accesses. Site Access 1 is located on Cope Drive approximately 150m west of Terry Fox Drive and is proposed to operate as a full movement access with stop-control along the site access approach. Site Access 2 is located on Terry Fox Drive approximately 65m north of Cope Drive and is proposed to operate as a right-in only intersection.

Site Access 2 is proposed to be used by customers and staff only and will not be used for delivery vehicles nor is it part of the dedicated fire route. As such, Site Access 2 is was designed to be 4.0m wide, which can accommodate regular passenger vehicles. As outlined in Table 8.9.3 in the *Transportation Association of Canada's Geometric Design Guide for Canadian* Roads, the minimum clear throat length for a shopping centre of less than 25,000m^2 is 15m along an arterial road. The clear throat at this access is approximately 30m, which meets the minimum requirements. This access is located roughly 65m north of Cope Drive, which is as far north as it can be pushed while maintaining proper on-site internal circulation. This site access is proposed to operate as a right-in only access, serving only the southbound vehicles on Terry Fox Drive. The northbound left into this site access will be prohibited and illegal. The narrow width of this site access coupled with the angle of entry from Terry Fox Drive will help to prohibit motorists from making the illegal northbound left turn into this site access. Implementing "no left turn" signs (Rb-12) should be considered to reinforce the prohibited northbound left turn maneuver. Potential locations for these signs include on the east side of Terry Fox Drive, facing northbound traffic, at the intersection location and approximately 30m north of the intersection location and on the west side of Terry Fox Drive, facing northbound traffic, just north of the intersection.

4.4.2 Intersection Control

The existing intersection at Terry Fox Drive and Cope Drive is signalized with auxiliary left turn lanes in all directions. There is also a southbound right turn lane with a storage length of approximately 150m.

Site Access 1 is proposed to be located along Cope Drive, approximately 150m west of Terry Fox Drive. This access is proposed to be minor stop-controlled along the site access approach. Site Access 2 is proposed to be located along Terry Fox Drive, approximately 65m north of Cope Drive. This access is proposed to be a right-in only intersection.

Section 4.9 contains the intersection analysis and will confirm the above noted proposed intersection controls.

4.4.3 Intersection Design

Section 4.9.2 contains the detailed intersection and MMLOS analyses under all horizons.

4.5 TRANSPORTATION DEMAND MANAGEMENT

4.5.1 Context for TDM

The proposed development is currently owned by SmartCentres. The known tenants for the retail space include the LCBO and Pet Value. Tenants for commercial retail units: X2, X3, Y1 and Y2 are not yet known as per the Site Plan for Phase 3 prepared by Petroff Partnership Architects dated October 10, 2019. As outlined in **Section 3.1.1**, an auto mode share of 60% was used for the subject development.

As the proposed development is not anticipated to generate a substantial amount of vehicle traffic as compared to the traffic that is already on the boundary road network, this auto modal share is not anticipated to be an issue.

4.5.2 Need and Opportunity

In order to support the transit and active modal share targets outlined in **Table 10**, cycling and transit modes will need to be supported. This includes the provision of bicycle parking as well as ensuring convenient pedestrian connections are provided to sidewalk facilities leading to bus stop locations. These aforementioned facilities have been included on the site plan to support active modes and are discussed in greater detail in **Section 4.1.1**.

4.5.3 TDM Program

The City of Ottawa TDM Checklists were used to determine what TDM measures could be implemented based on the available information.

The TDM checklists are contained in **Appendix E.**

4.6 NEIGHBOURHOOD TRAFFIC MANAGEMENT

Not applicable; exempted during screening and scoping.

4.7 TRANSIT

4.7.1 Route Capacity

An assumed transit modal share of 5% was adopted for the proposed site. The forecasted transit trips for the proposed development is 2, 4, and 6 total transit trips during the AM, PM, and Saturday peak hours, respectively.

OC Transpo routes 161, 164, 167 and 168 are local routes that run between Terry Fox Station and various termini with stops within a five-minute walk radius centered on the proposed development. Route 252 is a Connexion peak directional route that runs between Fernbank and Tunney's Pasture station.

There is an asphalt pathway on the west side of Terry Fox Drive, south of Cope Drive, and sidewalks on both sides of Cope Drive, east of Terry Fox, and Fernbank Road that facilitate pedestrian access to these transit stops. In addition, the subject development is proposing to include additional 3.0m asphalt pathways along the Cope Drive and Terry Fox Drive frontages.

At the intersection of Terry Fox Drive and Fernbank Road, there are three transit stops which provide access to routes 161, 252, 164, 168, and 681 within 400 meters of the subject site. Route 681 is a school route that runs between Bell High School and Kanata and therefore will not likely be the primary route for transit users destined to the proposed site. **Table 14** provides the route type and headways during the peak hours for the aforementioned routes that are likely be the primary route for transit users destined to the proposed site.

Table 14 - Transit Headways and Associated Potential Seated Capacity

OC Transpo Route Number (Type)	Headways (minutes)			Potential Seated Capacity (persons)	
	AM Peak	PM Peak	Saturday Peak	Standard[1]	Articulated[1]
161 (Local)	20	30	N/A	120 (80) [-]	210 (140) [-]
164 (Local)	30	30	N/A	80 (80) [-]	140 (140) [-]
167 (Local)	60	30	N/A	40 (80) [-]	70 (140) [-]
168 (Local)	30	30	30	80 (80) [80]	140 (140) [140]
252 (Connexion peak directional route)	N/A	20	N/A	0 (120) [-]	0 (210) [-]
			Total Capacity	**320 (440) [80]**	**560 (770) [140]**

Notes:
1. Table format: AM (PM) [SAT]

Standard and articulated buses have seated capacities of 40 and 70 people; respectively. The proposed development is therefore anticipated to occupy 1% - 2% of the transit capacity during the weekday given the potential seated capacity shown in **Table 14**. As the site is forecasted to generate 39 new site trips during the Saturday peak, approximately 50% of the transit capacity would be occupied by the proposed development provided a standard bus is operated on Route 168.

4.7.2 Transit Priority

The proposed development will utilize the existing transit stops abutting the subject site and is therefore not expected to significantly impact the transit travel times of the existing routes or trigger the need for transit priority measures.

4.8 REVIEW OF NETWORK CONCEPT

Not applicable; exempted during screening and scoping.

4.9 INTERSECTION DESIGN

4.9.1 Intersection Control

The intersection controls for the three study area intersections were discussed in **Section 4.4.2** and the analysis of the signalized intersections can be seen in **Section 4.9.2**. The signal timing plan for the existing Terry Fox Drive and Cope Drive intersection was obtained from the City of Ottawa and incorporated into the analysis.

4.9.2 Intersection Design

An assessment of the study area intersections was undertaken to determine the operational characteristics of the study area intersections under the horizons identified in the Screening and Scoping report. Intersection operational analysis was facilitated by Synchro 10.0™ software package and the MMLOS analysis was completed for the signalized intersection for all modes and compared against the City of Ottawa's MMLOS targets.

4.9.2.1 2019 Existing Conditions

Intersection Capacity Analysis

Figure 6 illustrates 2019 existing AM, PM, and Saturday peak hour traffic volumes at the study area intersections.

Table 15 summarizes the results of the Synchro analysis under 2019 existing conditions. The eastbound left turn currently operates with a delay of 79 seconds during the PM peak hour; however, the movement's v/c ratio is below the 0.90 acceptable threshold. For the benefit of the main approach's operations, no mitigation measures are recommended. All other movements currently operate acceptably and therefore no improvements are required to supplement existing conditions.

Table 15 - 2019 Existing Intersection Operations

Intersection	Intersection Control	Approach / Movement		LOS	V/C	Delay (s)	Queue 95th (m)
Terry Fox Drive and Cope Drive	Signalized	EB	Left	A (D) [C]	0.19 (0.83) [0.74]	38.5 (79.0) [44.3]	10 (#35.6) [41.0]
			Through	A (A) [A]	0.10 (0.11) [0.16]	37.6 (36.4) [28.0]	8.8 (12.4) [15.1]
		WB	Left	A (A) [A]	0.32 (0.35) [0.15]	40.0 (38.7) [28.0]	13.2 (22.4) [11.7]
			Through / Right	A (A) [A]	0.11 (0.19) [0.16]	37.7 (37.0) [28.1]	15.5 (20.0) [16.2]
		NB	Left	A (A) [A]	0.01 (0.02) [0.03]	2.5 (9.8) [5.6]	1.3 (2.7) [3.6]
			Through / Right	A (B) [A]	0.55 (0.63) [0.46]	5.9 (18.0) [8.9]	70.9 (133.4) [76.8]
		SB	Left	A (A) [A]	0.34 (0.46) [0.30]	5.2 (8.9) [8.1]	18.5 (24.8) [24.2]
			Through / Right	A (B) [A]	0.33 (0.62) [0.53]	4.0 (9.8) [11.4]	33.2 (130.7) [94.2]
			Right	A (A) [A]	0.02 (0.06) [0.09]	2.5 (4.3) [5.8]	1.7 (5.0) [6.9]
		Overall Intersection		**A (C) [A]**	**0.52 (0.71) [0.58]**	**9.2 (18.9) [14.8]**	**- (-) [-]**

Notes:
1. Table format: AM (PM) [SAT]
2. v/c – represents the anticipated volume divided by the predicted capacity

Appendix F contains detailed intersection performance worksheets.

MMLOS – Terry Fox Drive and Cope Drive Intersection

Based on the Land-Use Designations for Terry Fox Drive and Cope Drive, the Pedestrian Level of Service (PLOS) target is C for the intersection. The Ultimate Cycling Network from the City of Ottawa's *Transportation Master Plan* (2013) designates Terry Fox Drive as a spine cycling route as well as a cross-town bikeway network whereas Cope Drive is solely designated as a spine cycling route. As the cross-town bikeway BLOS targets govern, the intersection of Terry Fox Drive and Cope Drive has a BLOS target of B. Transit service travelling along Terry Fox Drive currently operates within mixed traffic, and as such, the Transit Level of Service (TLOS) target is D. Terry Fox Drive is designated as truck route whereas Cope Drive is not, therefore, the TkLOS target of D will be adopted to reflect the designation of Terry Fox Drive.

The Pedestrian Level of Service (PLOS) at the intersection of Terry Fox Drive and Cope Drive is currently operating with a PLOS of E, which does not meet the desired target of C. Based on the MMLOS guidelines, intersection PLOS is largely influenced by the number of lanes pedestrians have to cross, cycle length, and effective walk time. Due to the nature of arterial roads, reducing the number of lanes along Terry Fox Drive is not a feasible option. In addition, reducing the cycle length to increase the time dedicated to pedestrians would be at the detriment of the vehicular level of service and is therefore not feasible.

The Bicycle Level of Service (BLOS) at the intersection is currently operating with a BLOS of F, which does not meet the desired target of B. Based on the MMLOS guidelines, intersection BLOS is influenced by the availability of dedicated cycling amenities, number of lanes cyclists must cross to negotiate a turn at intersections, and roadway operating speeds. Due to the nature of arterial roadways, the number of vehicle travel lanes is often more than one in each direction which increases the number of lanes cyclists must cross to navigate turning movements at the intersection. In addition, the posted speed limit is 80 km/h along Terry Fox Drive as is typical for arterial roadways. These two factors limit the potential improvements to BLOS at signalized arterial intersections. The combination of dedicated bicycle lanes along with the reduction in speed limit to 50 km/hr would allow the BLOS target of B to be met. Another possibility would be to implement a separated bicycle facility along Terry Fox Drive, which would also allow the BLOS target to be met, however, this may have property and financial constraints.

The transit level of service at the intersection is currently operating with a TLOS of E, which does not meet the targeted value of D. Based on the MMLOS guidelines, intersection TLOS is governed by the delay at the intersection. High delays at this intersection result in the assessed score and can be remediated by increasing the intersection capacity through road widening or providing signal priority for transit. As per the City's TMP, the widening of Terry Fox Drive is not within the 2031 Affordable Network.

The Truck Level of Service (TkLOS) at the intersection is currently operating with a TkLOS of E, which does not meet the target of D. Increasing the number of receiving lanes at the intersection would improve the TkLOS, however, it would have financial and spatial constraints.

Table 16 outlines the MMLOS conditions for the signalized intersection Terry Fox Drive and Cope Drive under 2019 existing conditions.

Appendix C contains the detailed MMLOS analysis for the 2019 existing intersection.

Table 16 - 2019 Existing Intersection MMLOS

Intersection	PLOS		BLOS		TLOS		TkLOS	
	Target	Actual	Target	Actual	Target	Actual	Target	Actual
Terry Fox Drive and Cope Drive	C	E	B	F	D	F	D	E

4.9.2.2 2020 Future Background Conditions

Intersection Capacity Analysis

Figure 15 – 2020 Future Background Traffic Volumes**Figure 15** illustrates the 2020 future background traffic volumes for the AM, PM, and Saturday peak hours at the study area intersection. **Table 15** summarizes the results of the Synchro analysis under 2020 future background conditions.

The eastbound left movement at the intersection of Terry Fox Drive at Cope Drive is projected to operate at or above capacity with significant delays under 2020 future background conditions during the PM peak hour. To mitigate delays for this movement, an extensive optimization exercise was performed taking into account the heavy traffic demand along Terry Fox Drive. It was found that a cycle duration of 90 seconds as compared to the existing 100 seconds improves the EBL delay to 67 seconds with a v/c ratio of 0.87. However, the 2025 horizon PM peak hour required a 100 seconds cycle length. In addition, it is noted that the 2020 analysis was performed using a Peak Hour Factor (PHF) of 1.0 which assumes that traffic arrival rate is closer to uniformly distributed. Therefore, the existing timing plans for the PM peak hour was maintained for the 2020 horizon analysis. All other movements are projected to operate acceptably under 2020 future background conditions.

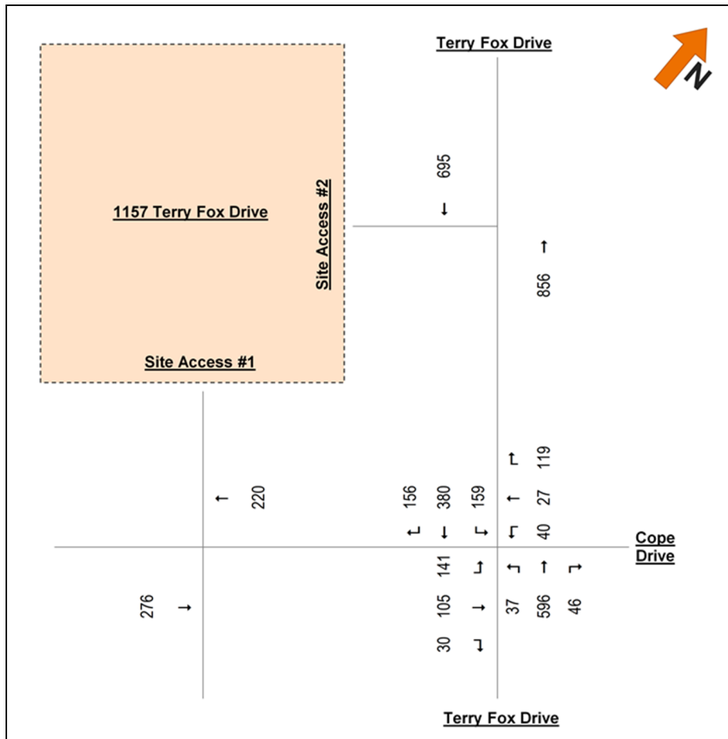
Appendix F contains detailed intersection performance worksheets.

Table 17 - 2020 Future Background Intersection Operations

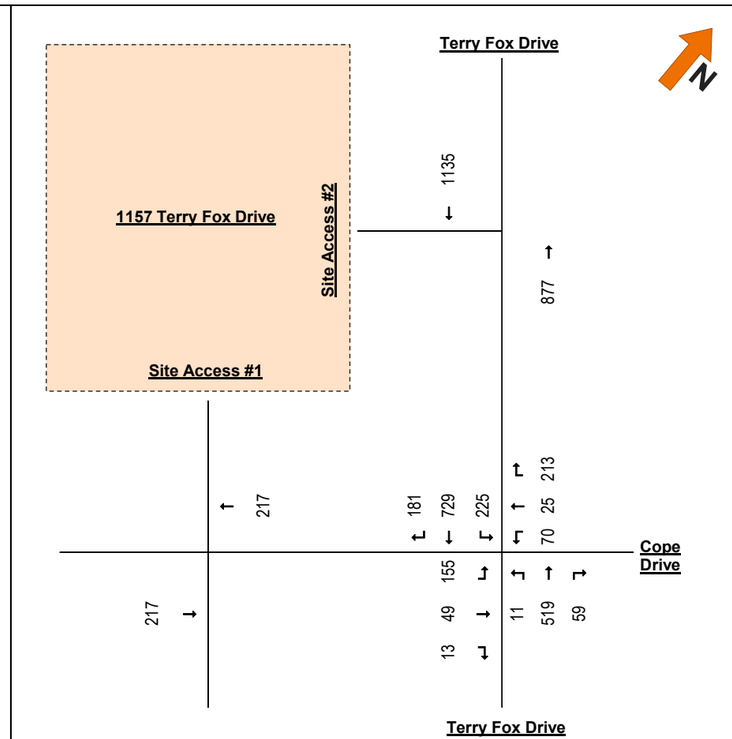
Intersection	Intersection Control	Approach / Movement		LOS	V/C	Delay (s)	Queue 95th (m)
Terry Fox Drive and Cope Drive	Signalized	EB	Left	B (E) [C]	0.68 (0.91) [0.72]	43.2 (80.9) [43.9]	38.7 (#58.0) [38.7]
			Through	A (A) [A]	0.39 (0.14) [0.16]	33.2 (31.9) [28.7]	31.4 (17.1) [15.5]
		WB	Left	A (A) [A]	0.23 (0.27) [0.16]	32.1 (33.3) [28.7]	13.5 (22.1) [12.2]
			Through / Right	A (A) [A]	0.17 (0.21) [0.17]	31.3 (32.6) [28.7]	17.6 (21.9) [16.7]
		NB	Left	A (A) [A]	0.06 (0.03) [0.03]	5.0 (11.8) [5.2]	6.3 (4.1) [3.2]
			Through / Right	A (B) [A]	0.57 (0.64) [0.42]	9.7 (20.7) [8.1]	101.3 (120.9) [66.0]
		SB	Left	A (A) [A]	0.37 (0.55) [0.28]	8.7 (11.8) [7.5]	28.4 (29.5) [22.8]
			Through / Right	A (B) [A]	0.34 (0.62) [0.48]	6.9 (12.3) [8.7]	48.8 (127.0) [79.6]
			Right	A (A) [A]	0.10 (0.12) [0.08]	5.2 (6.6) [5.4]	6.9 (7.7) [6.4]
		Overall Intersection		**A (C) [A]**	**0.59 (0.74) [0.53]**	**15.1 (22.0) [14.4]**	-

Notes:
1. Table format: AM (PM) [SAT]
2. v/c – represents the anticipated volume divided by the predicted capacity

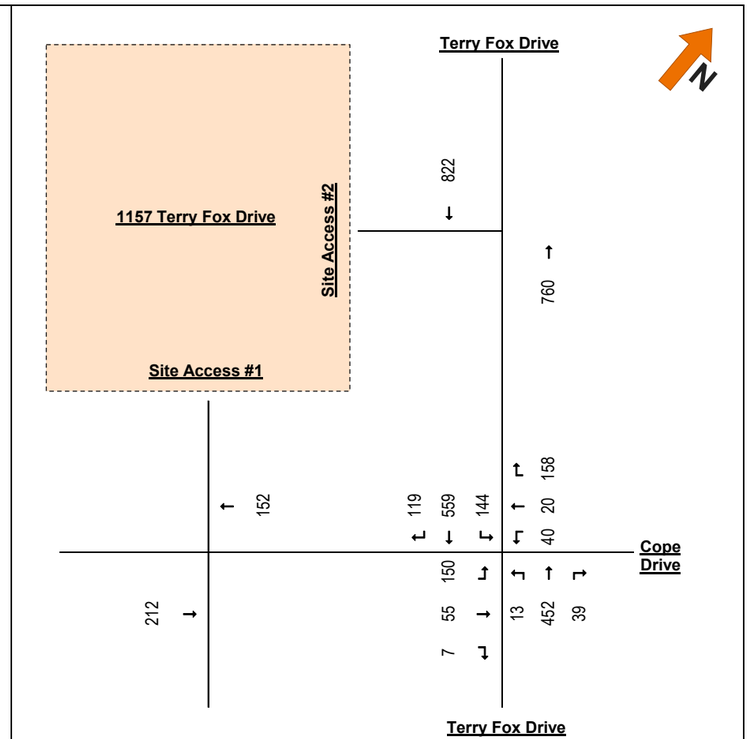
Figure 15 – 2020 Future Background Traffic Volumes



AM Peak Hour



PM Peak Hour



Saturday Peak Hour

MMLOS – Terry Fox Drive and Cope Drive Intersection

Based on the Land-Use Designations for Terry Fox Drive and Cope Drive, the Pedestrian Level of Service (PLOS) target is C for the intersection. The Ultimate Cycling Network from the City of Ottawa's *Transportation Master Plan* (2013) designates Terry Fox Drive as a spine cycling route as well as a cross-town bikeway network whereas Cope Drive is solely designated as a spine cycling route. As the cross-town bikeway BLOS targets govern, the intersection of Terry Fox Drive and Cope Drive has a BLOS target of B. Transit service travelling along both Terry Fox Drive and Cope Drive currently operate within mixed traffic, and as such, the Transit Level of Service (TLOS) target is D. Terry Fox Drive is designated as truck route whereas Cope Drive is not, therefore, the TkLOS target of D will be adopted to reflect the designation of Terry Fox Drive.

The Pedestrian Level of Service (PLOS) at the intersection of Terry Fox Drive and Cope Drive is will operate with a PLOS of E under 2020 Future Background conditions, which does not meet the desired target of C. Based on the MMLOS guidelines, intersection PLOS is largely influenced by the number of lanes pedestrians have to cross, cycle length, and effective walk time. Due to the nature of arterial roads, reducing the number of lanes along Terry Fox Drive is not a feasible option. In addition, reducing the cycle length to increase the time dedicated to pedestrians would be at the detriment of the vehicular level of service and is therefore not feasible.

The Bicycle Level of Service (BLOS) at the intersection is currently operating with a BLOS of F, which does not meet the desired target of B. Based on the MMLOS guidelines, intersection BLOS is influenced by the availability of dedicated cycling amenities, number of lanes cyclists must cross to negotiate a turn at intersections, and roadway operating speeds. Due to the nature of arterial roadways, the number of vehicle travel lanes is often more than one in each direction which increases the number of lanes cyclists must cross to navigate turning movements at the intersection. In addition, the posted speed limit is 80 km/h along Terry Fox Drive as is typical for arterial roadways. These two factors limit the potential improvements to BLOS at signalized arterial intersections. The combination of dedicated bicycle lanes along with the reduction in speed limit to 50 km/hr would allow the BLOS target of B to be met. Another possibility would be to implement a separated bicycle facility along Terry Fox Drive, which would also allow the BLOS target to be met, however, this may have property and financial constraints.

The transit level of service at the intersection is currently operating with a TLOS of E, which does not meet the targeted value of D. Based on the MMLOS guidelines, intersection TLOS is governed by the delay at the intersection. High delays at this intersection result in the assessed score and can be remediated by increasing the intersection capacity through road widening or providing signal priority for transit. As per the City's TMP, the widening of Terry Fox Drive is not within the 2031 Affordable Network.

The Truck Level of Service (TkLOS) at the intersection is currently operating with a TkLOS of E, which does not meet the target of D. Increasing the number of receiving lanes at the intersection would improve the TkLOS, however, it would have financial and spatial constraints.

Table 18 outlines the MMLOS conditions for the signalized intersection Terry Fox Drive and Cope Drive under 2020 Future Background conditions.

Appendix D contains the detailed MMLOS analysis for the 2020 Future Background conditions.

Table 18 - 2020 Future Background MMLOS

Intersection	PLOS		BLOS		TLOS		TkLOS	
	Target	Actual	Target	Actual	Target	Actual	Target	Actual
Terry Fox Drive and Cope Drive	C	E	B	F	D	E	D	E

4.9.2.3 2020 Total Future Conditions

Intersection Capacity Analysis

Figure 16 illustrates 2020 total future AM, PM, and Saturday peak hour traffic volumes at the study area intersections.

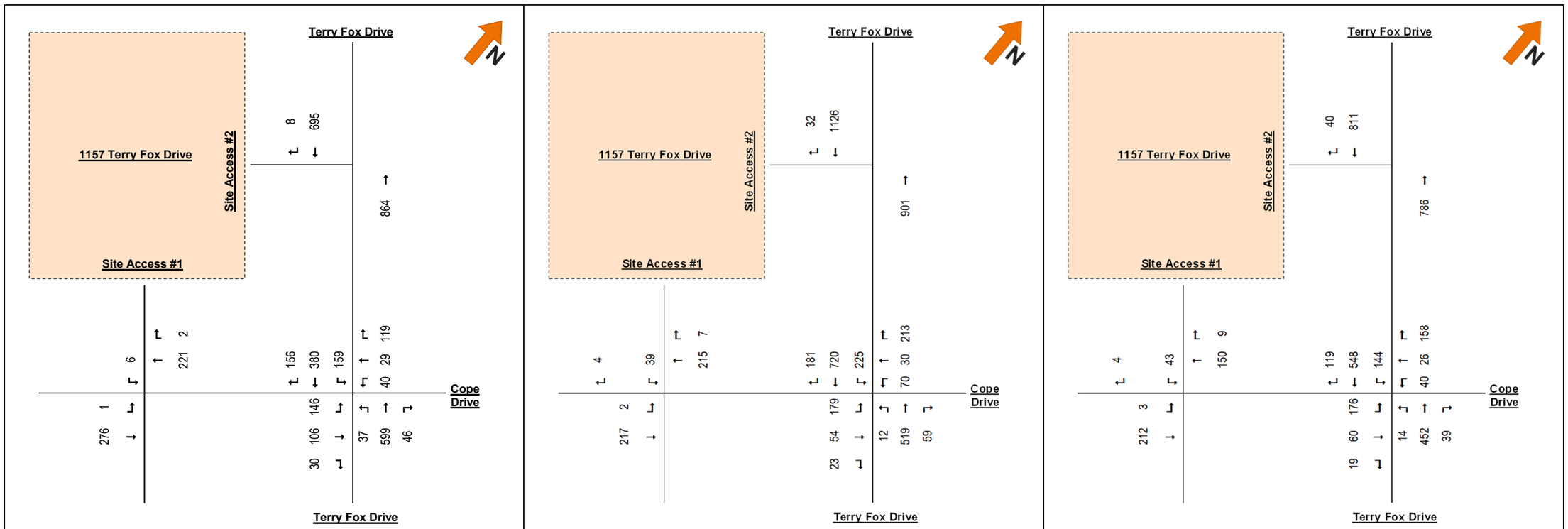
Table 19 summarizes the results of the Synchro analysis for the 2020 total future horizon. All study area intersections are anticipated to operate satisfactorily under 2020 total future conditions. As the intersection of Terry Fox Drive and Site Access 2 is a right-in only access with unobstructed flows, no Synchro analysis was performed on the intersection. The eastbound left turn movement at the Terry Fox Drive and Cope Drive intersection is projected to operate with a delay of approximately 83 seconds. As per HCM definition of LOS, this is considered as LOS F. However, since the delays as well as queues are not expected to be severe, no operational improvements were considered for the overall benefit of the major approaches' operations. **Appendix F** contains detailed intersection performance worksheets.

Table 19 - 2020 Total Future Intersection Operations

Intersection	Intersection Control	Approach / Movement		LOS	V/C	Delay (s)	Queue 95th (m)
Terry Fox Drive and Cope Drive	Signalized	EB	Left	B (E) [C]	0.69 (0.93) [0.78]	43.6 (83.1) [46.4]	39.6 (#69.7) [43.5]
			Through	A (A) [A]	0.38 (0.15) [0.17]	32.8 (30.3) [27.2]	31.2 (19.5) [16.5]
		WB	Left	A (A) [A]	0.23 (0.30) [0.18]	31.7 (31.9) [27.4]	13.4 (22.7) [11.9]
			Through / Right	A (A) [A]	0.18 (0.22) [0.18]	31.1 (30.9) [27.2]	17.8 (23.1) [16.7]
		NB	Left	A (A) [A]	0.06 (0.04) [0.03]	5.2 (12.7) [6.0]	6.5 (4.2) [3.7]
			Through / Right	A (B) [A]	0.58 (0.69) [0.47]	10.0 (23.4) [9.6]	103.2 (124.9) [75.3]
		SB	Left	A (A) [A]	0.48 (0.59) [0.29]	11.0 (13.9) [8.5]	40.8 (29.5) [25.3]
			Through	A (B) [A]	0.34 (0.68) [0.52]	7.1 (15.3) [10.4]	49.8 (134.9) [89.6]
			Right	A (A) [A]	0.10 (0.12) [0.08]	5.4 (7.4) [6.2]	7.0 (7.7) [7.0]
		Overall Intersection		**A (D) [A]**	**0.60 (0.81) [0.59]**	**15.4 (24.6) [16.1]**	**- (-) [-]**
Cope Drive and Site Access 1	Two-Way Stop Control	EB	Through / Left	A (A) [A]	0.00 (0.00) [0.00]	0.00 (0.1) [0.1]	0 (0) [0]
		WB	Through / Right	-	-	0 (0) [0]	- (-) [-]
		SB	Left / Right	A (A) [A]	0.01 (0.07) [0.07]	10.9 (11.6) [11.0]	0.2 (1.8) [1.8]
		Overall Intersection		**A (A) [A]**	**- (-) [-]**	**0.1 (1.1) [1.3]**	**- (-) [-]**

Notes:
1. Table format: AM (PM) [SAT]
2. v/c – represents the anticipated volume divided by the predicted capacity
95th percentile volume exceeds capacity; queue may be longer.

Figure 16 – 2020 Future Total Traffic Volumes



AM Peak Hour	PM Peak Hour	Saturday Peak Hour

MMLOS – Terry Fox Drive and Cope Drive Intersection

Based on the Land-Use Designations for Terry Fox Drive and Cope Drive, the Pedestrian Level of Service (PLOS) target is C for the intersection. The Ultimate Cycling Network from the City of Ottawa's *Transportation Master Plan* (2013) designates Terry Fox Drive as a spine cycling route as well as a cross-town bikeway network whereas Cope Drive is solely designated as a spine cycling route. As the cross-town bikeway BLOS targets govern, the intersection of Terry Fox Drive and Cope Drive has a BLOS target of B. Transit service travelling along both Terry Fox Drive and Cope Drive currently operate within mixed traffic, and as such, the Transit Level of Service (TLOS) target is D. Terry Fox Drive is designated as truck route whereas Cope Drive is not, therefore, the TkLOS target of D will be adopted to reflect the designation of Terry Fox Drive.

The Pedestrian Level of Service (PLOS) at the intersection of Terry Fox Drive and Cope Drive is anticipated to operate with a PLOS of E under 2020 Total Future conditions, which is below the desired target of C. Based on the MMLOS guidelines, intersection PLOS is largely influenced by the number of lanes pedestrians have to cross, cycle length, and effective walk time. Due to the nature of arterial roads, reducing the number of lanes along Terry Fox Drive is not a feasible option. In addition, reducing the cycle length to increase the time dedicated to pedestrians would be at the detriment of the vehicular level of service and is therefore not feasible.

The Bicycle Level of Service (BLOS) at the intersection is currently operating with a BLOS of F, which does not meet the desired target of B. Based on the MMLOS guidelines, intersection BLOS is influenced by the availability of dedicated cycling amenities, number of lanes cyclists must cross to negotiate a turn at intersections, and roadway operating speeds. Due to the nature of arterial roadways, the number of vehicle travel lanes is often more than one in each direction which increases the number of lanes cyclists must cross to navigate turning movements at the intersection. In addition, the posted speed limit is 80 km/h along Terry Fox Drive as is typical for arterial roadways. These two factors limit the potential improvements to BLOS at signalized arterial intersections. The combination of dedicated bicycle lanes along with the reduction in speed limit to 50 km/hr would allow the BLOS target of B to be met. Another possibility would be to implement a separated bicycle facility along Terry Fox Drive, which would also allow the BLOS target to be met, however, this may have property and financial constraints.

The transit level of service at the intersection is currently operating with a TLOS of F, which does not meet the targeted value of D. Based on the MMLOS guidelines, intersection TLOS is governed by the delay at the intersection. High delays at this intersection result in the assessed score and can be remediated by increasing the intersection capacity through road widening or providing signal priority for transit. As per the City's TMP, the widening of Terry Fox Drive is not within the 2031 Affordable Network.

The Truck Level of Service (TkLOS) at the intersection is currently operating with a TkLOS of E, which does not meet the target of D. Increasing the number of receiving lanes at the intersection would improve the TkLOS, however, it would have financial and spatial constraints.

Table 20 outlines the 2020 total future multi-modal level of service results.

Appendix D contains the detailed MMLOS analysis.

Table 20 - 2020 Total Future MMLOS

Intersection	PLOS		BLOS		TLOS		TkLOS	
	Target	Actual	Target	Actual	Target	Actual	Target	Actual
Terry Fox Drive and Cope Drive	C	E	B	F	D	F	D	E

4.9.2.4 2025 Ultimate Conditions

Intersection Capacity Analysis

Figure 17 illustrates 2025 ultimate AM, PM, and Saturday peak hour traffic volumes at the study area intersections.

Table 21 summarizes the results of the Synchro analysis for the 2025 ultimate horizon.

As the intersection of Terry Fox Drive and Site Access 2 is a right-in only access with unobstructed flows, no Synchro analysis was performed on the intersection. It should be noted that the southbound right turn 95th percentile queue at the Terry Fox Drive at Cope Drive intersection does not extend beyond the proposed Site Access 2 and is therefore not projected to block this future access.

The intersection of Terry Fox Drive at Cope Drive is projected to experience capacity constraints under 2025 ultimate conditions for the EBL and SBL movements. The optimization exercise investigated increasing the cycle length up to 130 seconds; however, the results indicated that the EBL is projected to operate close to capacity as most of the cycle time has to be assigned to serve the major through movements (Terry Fox Drive). Assigning more time to the east-west approaches is expected to result in major queueing along Terry Fox Drive that is projected to exceed 200 metres. Therefore, the cycle length of 100 seconds was maintained. To reduce friction between SBL and SBT queues, the SBL split was increased from 12 seconds to 14 seconds. Although the SBL has approximately 50 metres of storage, the taper has a total length of approximately 75 metres, of which 20 to 30 meters are wide enough to store additional left turn queueing. Therefore, the southbound through 95th percentile queue of approximately 70 metres at the intersection of Terry Fox Drive / Cope Drive intersection is expected to fully utilize the available storage and taper and occasionally block the southbound through traffic.

The widening of Terry Fox Drive would increase the capacity and thus improve the operations at this intersection. This roadway improvement is not included in the 'Affordable Network', as per the 2013 Transportation Master Plan. The city should consider advancing the timing of this roadway improvement project to accommodate the projected traffic volumes in the area.

The Cope Drive at Site Access 1 intersection is projected to operate acceptably under 2025 ultimate conditions. A signal warrant analysis was completed using the *Ontario Traffic Manual (OTM) Book 12 – Traffic Signals* and it was found that this intersection does not meet Justification 7 of the signal warrants under 2025 ultimate conditions.

Appendix F contains detailed intersection performance worksheets.

Appendix G contains the signal warrant worksheet.

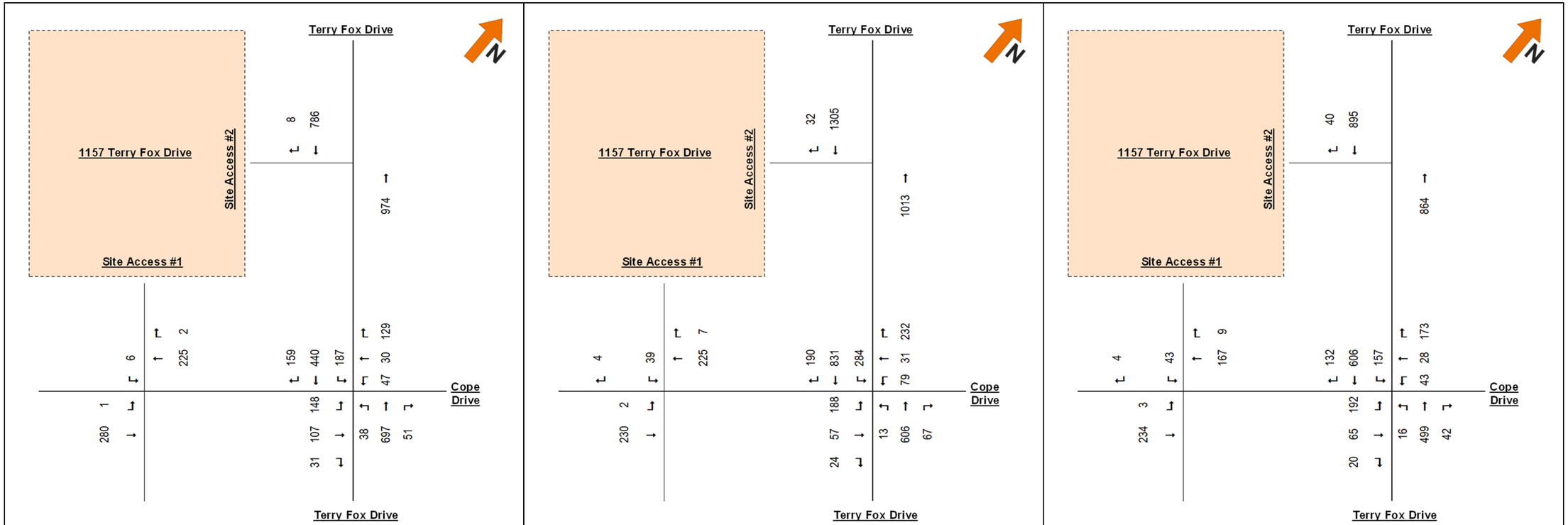
Table 21 – 2025 Ultimate Intersection Operations

Intersection	Intersection Control	Approach / Movement		LOS	V/C	Delay (s)	Queue 95th (m)
Terry Fox Drive and Cope Drive	Signalized	EB	Left	C (E) [D]	0.71 (0.95) [0.81]	45.0 (87.4) [48.3]	39.9 (#75.8) [46.8]
			Through	A (A) [A]	0.38 (0.15) [0.17]	32.5 (29.0) [25.9]	31.0 (20.3) [16.9]
		WB	Left	A (A) [A]	0.26 (0.31) [0.18]	31.8 (30.9) [26.1]	14.9 (25.1) [12.1]
			Through / Right	A (A) [A]	0.18 (0.23) [0.19]	30.8 (29.8) [26.0]	17.9 (24.2) [16.9]
		NB	Left	A (A) [A]	0.07 (0.06) [0.04]	5.4 (14.1) [6.7]	6.9 (4.7) [4.3]
			Through / Right	B (D) [A]	0.67 (0.83) [0.53]	12.2 (32.0) [11.4]	140.3 (#174.5) [91.9]
		SB	Left	B (E) [A]	0.68 (0.97) [0.37]	19.4 (61.2) [10.6]	#74.0 (#68.8) [31.2]
			Through	A (D) [A]	0.40 (0.81) [0.60]	7.8 (21.6) [12.6]	61.7 (#180.9) [111.2]
			Right	A (A) [A]	0.10 (0.13) [0.09]	5.5 (8.1) [6.9]	7.3 (7.8) [7.8]
		Overall Intersection		**B (F) [B]**	**0.69 (1.02) [0.66]**	**16.9 (33.7) [17.4]**	**- (-) [-]**
		Improvement: During PM Peak, increase SBL split to 14 seconds length.					
		EB	Left	C (E) [D]	0.71 (0.95) [0.81]	45.0 (87.4) [48.3]	39.9 (#75.8) [46.8]
			Through	A (A) [A]	0.38 (0.15) [0.17]	32.5 (29.0) [25.9]	31.0 (20.3) [16.9]
		WB	Left	A (A) [A]	0.26 (0.31) [0.18]	31.8 (30.9) [26.1]	14.9 (25.1) [12.1]
			Through / Right	A (A) [A]	0.18 (0.23) [0.19]	30.8 (29.8) [26.0]	17.9 (24.2) [16.9]
		NB	Left	A (A) [A]	0.07 (0.06) [0.04]	5.4 (15.1) [6.7]	6.9 (4.9) [4.3]
			Through / Right	B (D) [A]	0.67 (0.87) [0.53]	12.2 (36.6) [11.4]	140.3 (#181.6) [91.9]
		SB	Left	B (E) [A]	0.68 (0.93) [0.37]	19.4 (50.9) [10.6]	#74.0 (#66.3) [31.2]
			Through	A (D) [A]	0.40 (0.81) [0.60]	7.8 (21.6) [12.6]	61.7 (#180.9) [111.2]
			Right	A (A) [A]	0.10 (0.13) [0.09]	5.5 (8.1) [6.9]	7.3 (7.8) [7.8]
		Overall Intersection		**B (E) [B]**	**0.69 (0.99) [0.66]**	**16.9 (33.7) [17.4]**	**- (-) [-]**
Cope Drive and Site Access 1	Two-Way Stop Control	EB	Through / Left	A (A) [A]	0.00 (0.00) 0.00	0 (0.1) [0.1]	0 (0) [0]
		WB	Through / Right	A (A) [B]	-	0 (0) [0]	- (-) [-]
		SB	Left / Right	B (B) [B]	0.01 (0.07) [0.08]	11 (11.8) [11.4]	0.2 (1.8) [1.9]
		Overall Intersection		**A (A) [A]**	**A (A) [B]**	**0.1 (1) [1.2]**	**- (-) [-]**

Notes:
1. Table format: AM (PM) [SAT]
2. v/c – represents the anticipated volume divided by the predicted capacity

\# 95th percentile volume exceeds capacity; queue may be longer.

Figure 17 – 2025 Ultimate Traffic Volumes



AM Peak Hour	PM Peak Hour	Saturday Peak Hour

MMLOS - Terry Fox Drive and Cope Drive Intersection

Based on the Land-Use Designations for Terry Fox Drive and Cope Drive, the Pedestrian Level of Service (PLOS) target is C for the intersection. The Ultimate Cycling Network from the City of Ottawa's *Transportation Master Plan* (2013) designates Terry Fox Drive as a spine cycling route as well as a cross-town bikeway network whereas Cope Drive is solely designated as a spine cycling route. As the cross-town bikeway BLOS targets govern, the intersection of Terry Fox Drive and Cope Drive has a BLOS target of B. Transit service travelling along both Terry Fox Drive and Cope Drive currently operate within mixed traffic, and as such, the Transit Level of Service (TLOS) target is D. Terry Fox Drive is designated as truck route whereas Cope Drive is not, therefore, the TkLOS target of D will be adopted to reflect the designation of Terry Fox Drive.

The Pedestrian Level of Service (PLOS) at the intersection of Terry Fox Drive and Cope Drive is currently operating with a PLOS of E under 2025 Ultimate conditions, which does not meet the desired target of C. Based on the MMLOS guidelines, intersection PLOS is largely influenced by the number of lanes pedestrians have to cross, cycle length, and effective walk time. Due to the nature of arterial roads, reducing the number of lanes along Terry Fox Drive is not a feasible option. In addition, reducing the cycle length to increase the time dedicated to pedestrians would be at the detriment of the vehicular level of service and is therefore not feasible.

The Bicycle Level of Service (BLOS) at the intersection is currently operating with a BLOS of F, which is below the desired target of B. Based on the MMLOS guidelines, intersection BLOS is influenced by the availability of dedicated cycling amenities, number of lanes cyclists must cross to negotiate a turn at intersections, and roadway operating speeds. Due to the nature of arterial roadways, the number of vehicle travel lanes is often more than one in each direction which increases the number of lanes cyclists must cross to navigate turning movements at the intersection. In addition, the posted speed limit is 80 km/h along Terry Fox Drive as is typical for arterial roadways. These two factors limit the potential improvements to BLOS at signalized arterial intersections. The combination of dedicated bicycle lanes along with the reduction in speed limit to 50 km/hr would allow the BLOS target of B to be met. Another possibility would be to implement a separated bicycle facility along Terry Fox Drive, which would also allow the BLOS target to be met, however, this may have property and financial constraints.

The transit level of service at the intersection is currently operating with a TLOS of F, which does not meet the targeted value of D. Based on the MMLOS guidelines, intersection TLOS is governed by the delay at the intersection. High delays at this intersection result in the assessed score and can be remediated by increasing the intersection capacity through road widening or providing signal priority for transit. As per the City's TMP, the widening of Terry Fox Drive is not within the 2031 Affordable Network.

The Truck Level of Service (TkLOS) at the intersection is currently operating with a TkLOS of E, which meets the target of D. Increasing the number of receiving lanes at the intersection would improve the TkLOS, however, it would have financial and spatial constraints.

Table 16 outlines the 2025 ultimate multi-modal level of service results.

Appendix C contains the detailed MMLOS analysis.

Table 22 – 2025 Ultimate Intersection MMLOS

Intersection	PLOS		BLOS		TLOS		TkLOS	
	Target	Actual	Target	Actual	Target	Actual	Target	Actual
Terry Fox Drive and Cope Drive	C	E	B	F	D	F	D	E

5.0 CONCLUSION

This Transportation Impact Assessment (TIA) was prepared in support of a Site Plan Control application for a proposed development in the community of Stittsville in Ottawa, Ontario. The proposed development is located at the north-west corner of the Terry Fox Drive at Cope Drive intersection. The site is bound by Terry Fox Drive to the east, Cope Drive to the south, and vacant land / storm water management facilities to the west and north.

The proposed development is anticipated to generate 16, 41, and 47 two-way auto trips during the AM, PM, and Saturday peak hours, respectively. Development generated site trips are not anticipated to adversely impact traffic operations at all three study area intersections. The AM, PM, and Saturday peak hour traffic volumes were assessed at present, 2020, and 2025 horizons and the following can be concluded about the intersection performance:

2019 Existing Conditions

- All study area intersections currently operate acceptably and therefore no improvements are required to supplement existing conditions.

2020 Future Background

- Traffic volumes projected under 2020 future background conditions result in the operation of the Terry Fox Drive at Cope Drive at or above capacity with significant delays during the PM peak hour. The eastbound left movement is projected to operate at delays exceeding 80 seconds and a v/c ratio exceeding 0.90. However, after a detailed optimization exercise for this horizon as well as the total future and ultimate horizons, it was concluded that increasing the cycle length will result in deteriorated intersection performance either for the eastbound approach or the north-south approaches. Therefore, it is recommended to maintain the existing signal timing for the PM peak as the queues and delays for the eastbound left turn movement are not sever.

2020 Total Future

- All study area intersections are projected to operate acceptably under 2020 total future conditions with the above noted 2020 future background improvements. The eastbound left turn movement at the intersection of Terry Fox Drive at Cope Drive is projected to operate at delays exceeding 80 seconds and a v/c ratio exceeding 0.90. however, as stated above, existing signal timing plans were maintained through the analysis.

Ultimate Conditions

- The intersection of Terry Fox Drive at Cope Drive is projected to experience capacity constraints under 2025 ultimate conditions. Optimizing the signal split at an increased cycle length is expected to result in significant queueing along Terry Fox Drive unless more green time is assigned to the north-south movement. However, this would result in the poor performance of the eastbound approach. Therefore, the existing cycle length was maintained; however, the southbound left movement split was increased from 12 seconds to 14 seconds. It is also expected that southbound left queues may occasionally block the southbound through movement. Given the width of the lanes, southbound through traffic may be able to navigate around the left turning traffic.

- The Cope Drive at Site Access 1 intersection is projected to operate acceptably under 2025 ultimate conditions. A signal warrant analysis was undertaken at this intersection and it was found that signals are not warranted at the Cope Drive at Site Access 2 intersection under 2025 ultimate conditions.
- The widening of Terry Fox Drive would increase the capacity and thus improve the operations at the Terry Fox Drive at Cope Drive intersection. The city should consider advancing the timing of this roadway improvement project to accommodate the projected traffic volumes in the area despite its exclusion from the 'Affordable Network' in the 2013 Transportation Master Plan.

The Multi-Modal Level of Service (MMLOS) assessment for roadway segments found that the following improvements would allow the MMLOS targets to be met along Terry Fox Drive:

- Reducing the speed limit of Terry Fox Drive to 60 km/hr would allow the PLOS target to be met;
- Implementing a physically separated bicycle facility along Terry Fox Drive would allow the BLOS target to be met, however, this would have significant financial and spatial constraints; and,
- Implementing dedicated on-street bicycle lanes along Terry Fox Drive and reducing the speed limit to 40 km/hr would allow the BLOS target to be met, however, this would have spatial constraints; however, this reduction in speed limit is not feasible as it is an arterial roadway.

The Multi-Modal Level of Service (MMLOS) assessment for roadway segments found that the following improvements would allow the MMLOS targets to be met along Cope Drive:

- The 3.0m asphalt multi-use pathway proposed as part of the subject development will allow the PLOS and BLOS targets to be met.

The MMLOS assessment for the signalized intersection of Terry Fox Drive and Cope Drive found that the following improvements would allow the MMLOS targets to be met:

- Reducing the number of lanes pedestrians must cross would allow the PLOS targets to be met, however, due to the nature of arterial roads, reducing the number of lanes along Terry Fox Drive is not a feasible option.
- Reducing the cycle length to increase the time dedicated to pedestrians would allow the PLOS target to be met but is at the detriment of the vehicular level of service and is therefore not feasible.
- Reducing the number of lanes cyclists must negotiate at a turn at intersections in conjunction with reducing the posted speed limit to below 50 km/hr would allow the BLOS targets to be met, however, due to the nature of arterial roads, such reductions along Terry Fox Drive are not a feasible options.
- Implementing a separated bicycle facility along Terry Fox Drive would also allow the BLOS target to be met, however, this may have property and financial constraints.
- Road widening or providing signal priority for transit would reduce the overall intersection delay and allow the TLOS targets to be met. As per the City's TMP, the widening of Terry Fox Drive is not within the 2031 Affordable Network.

Based on the transportation evaluation presented in this study, the proposed development located at 1140 Terry Fox Drive can be supported and should be permitted to proceed from a transportation perspective.

APPENDICES

Appendix A TRAFFIC DATA

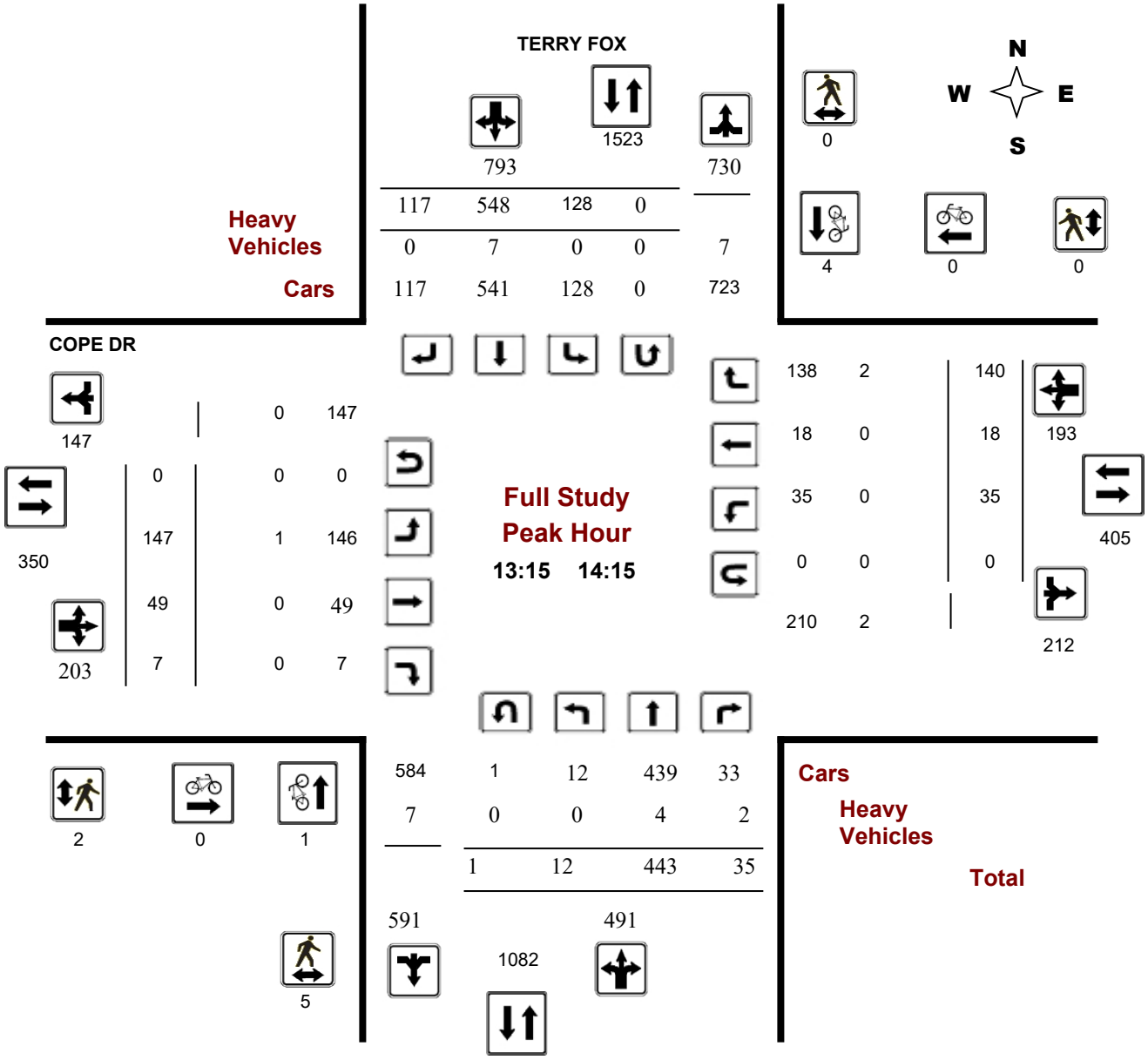
Transportation Services - Traffic Services

Turning Movement Count - Peak Hour Diagram

COPE DR @ TERRY FOX

Survey Date: Saturday, August 10, 2019 **WO No:** 38639

Start Time: 11:00 **Device:** Miovision



Comments

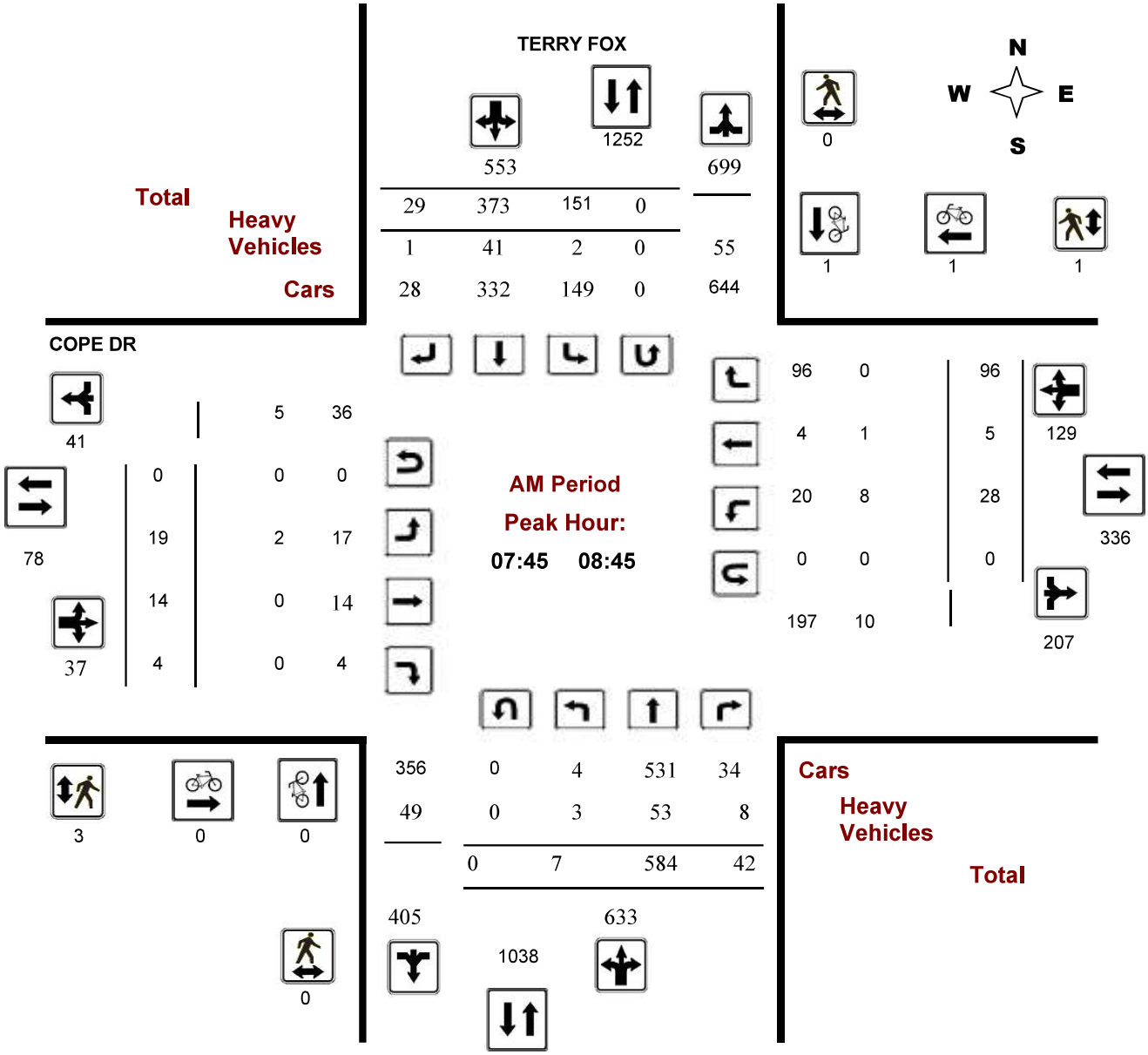
Transportation Services - Traffic Services

Turning Movement Count - Full Study Peak Hour Diagram

COPE DR @ TERRY FOX

Survey Date: Thursday, August 08, 2019 **WO No:** 38638

Start Time: 07:00 **Device:** Miovision



Comments

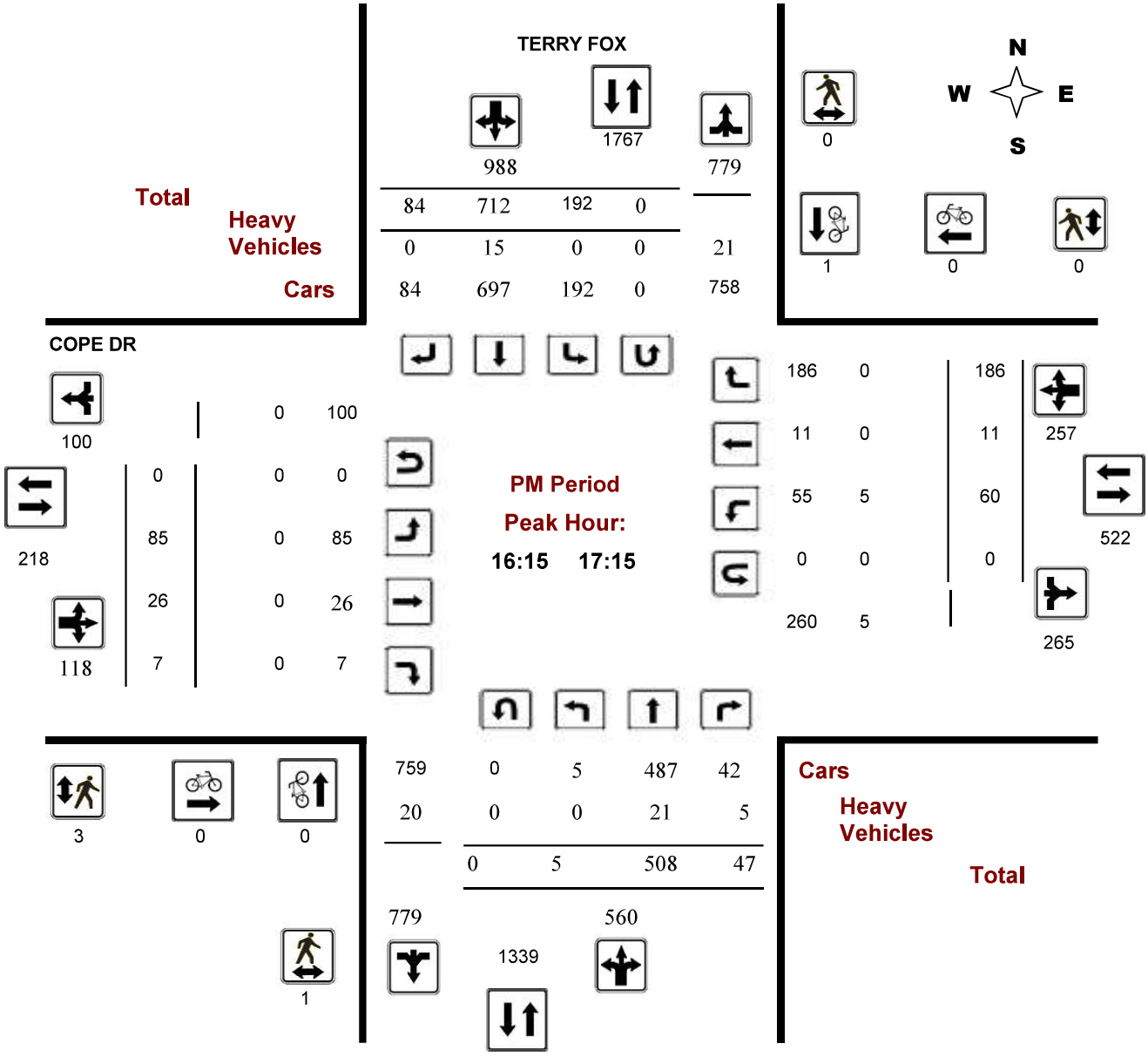
Transportation Services - Traffic Services

Turning Movement Count - Full Study Peak Hour Diagram

COPE DR @ TERRY FOX

Survey Date: Thursday, August 08, 2019 **WO No:** 38638

Start Time: 07:00 **Device:** Miovision



Comments

Appendix B COMMENT RESPONSE CORRESPONDENCE

From: Baggs, Rosanna
To: O"Grady, Lauren
Cc: Smadella, Karin; McCreight, Laurel; Paudel, Neeti
Subject: RE: 1140 Terry Fox Drive - Step 3
Date: Tuesday, October 8, 2019 9:11:05 AM

Hi Lauren,

Your comments are acceptable, please proceed.

Please note that Neeti will be assigned this file going forward; please direct all future correspondence to her.

Rosanna Baggs, C.E.T.
Project Manager, Infrastructure Approvals | GPRJ Approbation demandes infrastructure
Development Review West Branch | Dir Services d'exam des dem d'amgt
Tel |Tél. : 613-580- 2424 ext. | poste 26388

NOTICE: Friday October 18th will be my last day with the City of Ottawa. Please contact Mike Giampa (mike.giampa@ottawa.ca) after this date.

From: O'Grady, Lauren <Lauren.OGrady@stantec.com>
Sent: October 07, 2019 3:29 PM
To: Baggs, Rosanna <Rosanna.Baggs@ottawa.ca>
Cc: Smadella, Karin <Karin.Smadella@stantec.com>; McCreight, Laurel <Laurel.McCreight@ottawa.ca>
Subject: RE: 1140 Terry Fox Drive - Step 3

Hi Rosanna,

Please see my comment responses below in green.

Please let me know if you concur with these responses and if I can proceed with the Step 4 TIA.

Thank you,
Lauren

***** Vacation Alert: Please note I will be on vacation the week of October 14th *****

Lauren O'Grady P.Eng.
Transportation Engineer

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lauren.o'grady@stantec.com

Stantec
400 - 1331 Clyde Avenue
Ottawa ON K2C 3G4

From: Baggs, Rosanna <Rosanna.Baggs@ottawa.ca>
Sent: Monday, September 30, 2019 11:36 AM
To: O'Grady, Lauren <Lauren.OGrady@stantec.com>
Cc: Smadella, Karin <Karin.Smadella@stantec.com>; McCreight, Laurel <Laurel.McCreight@ottawa.ca>
Subject: RE: 1140 Terry Fox Drive - Step 3

Hi Lauren,

Please see the comments for the TIA Forecasting submission and comments related to the access on Terry Fox:

Transportation Engineering Services

1. Regarding Figure 2 (Site Plan): The proposed right-in access from Terry Fox Drive is not preferred. Further analysis may determine that a physical restriction is required to control the access. In addition, special attention is required for addressing the MUP crossing of this access. Discussions are underway between the City and Stantec regarding this access. The width of the access will be reduced (it does not need to accommodate WB-20s nor fire trucks) and it will also likely be pushed further north. A revised site plan is coming shortly and will be sent to Rosanna for comment.
2. Along the site frontage, ensure the north side of Cope Drive includes a 3.0m wide multi-use pathway (MUP) to match the Cope Drive cross-section proposed by the Blackstone Phases 4-8 development. Noted.
3. Along the site frontage, ensure the pathway on the west side of Terry Fox Drive is 3.0m wide to match the access/recreational pathways surrounding the storm water management pond to the north of the site. Noted.
4. Ensure Terry Fox Drive is protected for a 44.5m ultimate right-of-way per the City of Ottawa Official Plan. Noted.
5. 2.1.2.3: Include a description of Route 161. Amend Figure 5 to illustrate existing stops on Cope Drive east of Terry Fox Drive, and on Templeford Avenue. Noted. Section 2.1.2.3 will be revised as part of Step 4.

6. 2.1.2.6: Include a directional and location breakdown of rear end collisions on Terry Fox Drive between the Trans Canada Trail and Cope Drive. Noted. Section 2.1.2.6 will be revised as part of Step 4.
7. 2.1.3.2: In Figure 8, the extents of Blackstone Phases 4-8 (D) and the Van Gaal lands (E) are not accurate. Please revise this figure. Noted. Figure 8 will be revised as part of Step 4.
8. 2.2.1: Recommend including the following intersections: Terry Fox / Westphalian, Terry Fox / Fernbank, Cope / Templeford, Cope / Akerson, and Cope / Eagleson. The subject development is anticipated to generate under 50 vehicle trips during each of the AM, PM, and SAT peak hours. It can therefore be concluded that the volume of traffic that this development will add to the surrounding transportation network is considered negligible. These 50 vehicle trips going to / from the subject development will be watered down across these intersections. As such, adding these intersections to the subject analysis will not add any value and therefore we recommend not including these intersections as part of the subject TIA.
9. 3.1.2 Pass-By: PM pass-by 'In' trips in Table 10 do not match Figure 9. Likewise, Saturday 'Out' trips in Table 10 do not match Figure 9. Noted. These figures will be revised as part of Step 4.
10. 3.1.2: The report previously established that the proposed shopping centre is expected to serve a local rather than a regional function, therefore consider increasing the proportion of internal (Kanata/Stittsville) traffic at the trip distribution stage. Agreed, this was an error. The subject site will in fact serve a local function. As such, the distribution was revised to include 100% of the trips to / from the site within the Kanata / Stittsville district.
11. 3.1.3: Confirm net site generated traffic volumes for PM & Saturday peak hours; trips in/out of the site appear to be the total of new auto trips and pass-by trips (i.e. Row 1 + Row 2 of Table 10), which double counts pass-by trips. Figure 11 illustrates the total site generated trips, which is the summation of the new trips + pass-by trips.
12. 3.2.1: Elaborate on how the Cope Drive Extension will impact traffic volumes within the study area. Noted. Section 3.2.1 will be revised as part of Step 4.
13. 3.2.3 (and 2.1.3.2, where applicable): Include the developments at 10 Cope Drive and at 800 Eagleson Road. As per Figure 6 of the 10 Cope Drive TIA Strategy Report (April 27th, 2018), the proposed development at 10 Cope Drive is anticipated to generate a maximum of 23 and 28 vehicles during the AM and PM peak hours at the Terry Fox Drive at Cope Drive intersection. Despite these volumes being quite low as compared to the existing volumes at this intersection, they were added to the subject TIA as background development traffic. Regarding the development located at 800 Eagleson Road, Figure 13 of the *800 Eagleson Road Transportation Impact Assessment (March 29, 2019)*, there are 3 and 1 vehicle(s) during the AM and PM peak hours that would affect the subject study area intersections. As such, this development is considered negligible and was therefore excluded from the background development traffic.
14. Clarify why the second to last paragraph of Section 3.2.3 assumes numerous developments will not be completed prior to the 2025 horizon year despite all listed developments having estimated completion dates of 2025 or earlier. Noted. Section 3.2.3 was revised.
15. Confirm 5331 Fernbank Road (Terry Fox Drive and Cope Drive Commercial Shopping Development TIA by Stantec) is not double counted, as this development is also included as part of the Van Gaal lands Community Transportation Study (by Parsons). Noted. These volumes were in fact double counted. The background development volumes will be revised as part of Step 4.

Traffic Signal Operations

1. The right-in access may become problematic or accident prone when Cope is fully connected and the southbound right-turn volumes increase substantially. This access is currently undergoing review (refer to comment response from TES #1 above) and wil be circulated to City Staff shortly.
2. Cope Drive and Terry Fox Drive intersection currently has a relatively small physical footprint. Signal timing will continue to favour the heavier vehicle flows on Terry Fox Drive. Adding this development may trigger the need for additional lanes and/or widening. Noted. The intersection analysis will be conducted as part of Step 4 and will verify what the requirements are.

Development Review Transportation Engineering Services

1. The right-in only access on Terry Fox is not preferred. Due to the width requirement to accommodate WB20 turning movements, the size of the access may encourage unsafe north bound left turns if a physical barrier is not installed. No entry/left turn signage would have low compliance. Determine if it is in deed necessary to accommodate WB20 and/or required for fire route purposes. Consider alternate site design to accommodate delivery vehicles. Refer to comment response from TES #1 above.

Rosanna Baggs, C.E.T.
Project Manager, Infrastructure Approvals | GPRJ Approbation demandes infrastructure
Development Review West Branch | Dir Services d'exam des dem d'amgt
Tel |Tél. : 613-580- 2424 ext. | poste 26388

From: O'Grady, Lauren <Lauren.OGrady@stantec.com>
Sent: September 17, 2019 4:25 PM
To: Baggs, Rosanna <Rosanna.Baggs@ottawa.ca>
Cc: Smadella, Karin <Karin.Smadella@stantec.com>
Subject: 1140 Terry Fox Drive - Step 3

Hi Rosanna,

Please see attached the Step 3 TIA for SmartCentres' proposed site located at 1140 Terry Fox Drive (I had previously been calling it 1157 Terry Fox Drive, which Kathy corrected me on in her latest email).

Please let me know if you have any questions or comments or if I can proceed with Step 4.

Thank you,

Lauren O'Grady P.Eng.
Transportation Engineer

Direct: 613-784-2264
lauren.o'grady@stantec.com

Stantec
400 - 1331 Clyde Avenue
Ottawa ON K2C 3G4

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Stantec

Memo

To:	Neeti Paudel 110 Laurier Avenue West, 4th Floor Ottawa, ON K1P 1J1	From:	Lauren O'Grady, P.Eng. 400 – 1331 Clyde Avenue Ottawa, ON K2C 3G4
File:	1140 Terry Fox Drive	Date:	January 21, 2020

Reference: 160401317 – 1140 Terry Fox Drive

In October 2019 Stantec Consulting Ltd. (Stantec) prepared the *1140 Terry Fox Drive Transportation Impact Assessment Strategy Report* on behalf of SmartCentres for a proposed commercial development located in the Stittsville Community in the City of Ottawa. In November 2019 Stantec received comments from the City of Ottawa. **Table 1** below includes the comments from the City of Ottawa along with the accompanying responses by Stantec.

City of Ottawa Comment		Stantec Response
Transportation Engineering Services		
1	Terry Fox is designated as a cross town bikeway and access should be controlled to provide safe travel for cycling. If the access on Terry Fox Drive cannot be removed from the site plan, provide a raised entrance crossing of the MUP to ensure slow speeds through the access. In addition, straighten the access so that it intersects at 90 degrees and tighten the corner radius to slow vehicles down.	The MUP will be raised across the Site Access to Terry Fox Drive. Through discussions with the City, it was determined that the most appropriate location for this site access is to be as far north from Cope Drive as possible. While considering internal site circulation, the site access as shown is as far north as possible. Straightening the access to a 90-degree angle with Terry Fox would bring it closer to Cope Drive, which is not ideal. Shifting the entire access further north to intersect at a 90-degrees with Terry Fox is also not ideal as it would hinder the internal site circulation. It is recommended to leave the access as is, which was agreed upon by the City as part of the approvals process.
2	Describe how deliveries and service to building Y will be accommodated.	The loading for Building Y will be front loaded typically by smaller delivery trucks / cube vans after regular business hours, which is typical for CRU users of this size. It is not anticipated to cause disruption to site functionality. This is further supported by the excess in parking, which serves to meet leasing demands, and to also accommodate outlier circumstances where loading / service vehicles access the site during business hours.
3	Correct the future segment BLOS on Cope Drive.	Noted. This will be corrected in the Step 5 TIA.
4	Include all access parameters including clear throat length in section 4.4.	Noted. Clear throat length will be provided in the Step 5 TIA.

Reference: **160401317 – 1140 Terry Fox Drive**

5	Include signalized intersection warrant analysis to demonstrate that signals are not required at site access 2.	Noted. The signal warrant will be included in the Step 5 TIA for the Cope Drive at Site Access 2 intersection. It was found that signals are not warranted at the Cope Drive at Site Access 2 intersection.
6	Consider registering the site on Ottawaridematch.com in the absence of TDM Measures. This is a free option that may reduce trips to the development through employee carpooling.	It should be noted that based on the size of the proposed development, there will not likely be a substantial number of employees on site at any given time. The rideshare information will be passed on to the developer for consideration.
Traffic Signal Operations		
7	Our comments from September 2019 have not been addressed: ...Signal timing will continue to favour the heavier vehicle flows on Terry Fox...	The traffic demand on the northbound and southbound approaches of the intersection is high, which is mainly attributed to the overall background development growth in the area. The signal timing plans have been reviewed and optimized to accommodate traffic demands to the best degree possible. It is recommended to keep existing signal timing plans across the study horizons as increasing the cycle length results in poor performance for either traffic on Terry Fox Drive or the eastbound left turn movement. For the ultimate conditions, it is recommended to increase the southbound left protected portion of the phase by 2 seconds, taken from the northbound approach split time.
8	The proposed solution is the introduction of a permitted-protected eastbound left-turn (EBLT), which is not accepted. Although with this solution EBLT, will have decreased queuing, north, south, and west movements will have increased queuing. Level of service will decrease for northbound and southbound vehicles.	The signal timing was revisited. The eastbound left protected / permissive phasing was removed. Instead, east and west approaches are recommended to operate using the existing signal timing plan.
9	The Synchro analysis is somewhat deficient in terms of: recall mode, all-way stop for Terry Fox Drive at site access and incorrect southbound left-turn storage length.	The Sycnhro models were revisited and Site Access 1 was removed as it is a right in access only and in theory will have a delay of 0 seconds unless obstructed by upstream queueing. The Synchro southbound left turn storage at the intersection of Terry Fox Drive at Cope Drive were updated to reflect 50 metres storage and 75 metres taper. The Synchro optimization was reviewed in detail and a re-optimization exercise was performed. City signal timing plans were maintained for all horizon years except for the 2025 total future horizon. The only recommended timing improvement is increasing the southbound left turn split by two seconds taken from the northbound approach split time. Generally, increasing the cycle length is expected to result in poor performance for either the eastbound left turn or the Terry Fox Drive through

Reference: **160401317 – 1140 Terry Fox Drive**

		traffic. Maintaining a 100 seconds was found to provide a better balance.
10	Clarify what is meant by 'Permissive Right-Turns' in Table 17.	This was an error. It should have stated “protected – permissive left turn”. This will be corrected in the Step 5 TIA.
Traffic Signal Design		
11	No comments to this TIA for this circulation. Traffic Signal Design and Specification reserves the right to make future comments based on subsequent submissions.	Noted.
12	Future considerations: Since there are proposed changes to the existing roadway geometry within the vicinity of existing TCS the City of Ottawa Traffic Signal Design and Specification Unit is required to complete a review as per impact to the existing traffic signal plant. If the proposed geometry modifications are approved for installation and RMA approved, please forward an approved geometry detail design drawings (dwg digital format in NAD 83 coordinates) including base mapping, existing and new underground utilities/sewers, new/existing catch basins locations, Turn-Radius Modeling for approved vehicles and approved pavement markings drawings in separate files for detail review/assessment. Please send all digital (CADD) design files to Peter.Grajcar@ottawa.ca 613-580-2424 ext. 23035.	Noted.
Street Lighting		
13	If the proposed TIA is approved, please contact Barrie Forrester 613-580-2424 ext. 23332 (Barrie.Forrester@ottawa.ca) to setup cost recovery for Street Lighting review/coordination.	Noted.
14	Please advise the developer of the following: Full roadway lighting as per City of Ottawa policy is required. Send streetlight design including point by point light calculations for review and approval to the assigned Street Lighting Coordinator. The developer will be 100% responsible for all associated street light costs. PO or payment must be setup with the City of Ottawa Street Light Group prior to any sub-division review/approval will be completed. City Street Lighting will require commencement of work notification so that we can inspect construction at all stages.	Noted. Streetlights currently exist along the south side of Cope Drive, fronting the subject site. The TIA is to support a private site plan application for which a photometric drawing was prepared and included as part of the site plan control package.

Reference: **160401317 – 1140 Terry Fox Drive**

	Upon completion we require as-builts in both e-format (Microstation and dwg) and hard copy (1:500 scale). Once received, we advise Hydro that the City will accept the energy charges. With that authorization (plus an ESA certificate obtained by the developer or his electrical contractor) Hydro will then energize. Any queries such as required light levels or approved materials can be directed to the assigned Street Lighting Project Coordinator	
Transit Services		
15	The site plan in the report shows a 3.0m asphalt MUP will be constructed on the north side of Cope, whereas the attached site plan indicates a 3.0m concrete sidewalk. Please update.	The 3.0m MUP on the north side of cope drive will be asphalt.
16	Section 4.1.1 & 4.7.1 - Route 252 terminates at Tunney's Pasture, and no longer travels to Mackenzie King Station.	Noted. This will be corrected in the Step 5 TIA.

We trust that the above addresses the City's outstanding comments and concerns. Should you have any further questions or concerns related to the above please feel free to contact the undersigned.

Regards,

Stantec Consulting Ltd.

Lauren O'Grady P.Eng.
Transportation Engineer
Phone: 613-784-2264
lauren.o'grady@stantec.com

Appendix C BACKGROUND TRAFFIC VOLUMES

Figure 6: 'New' Site-Generated Traffic

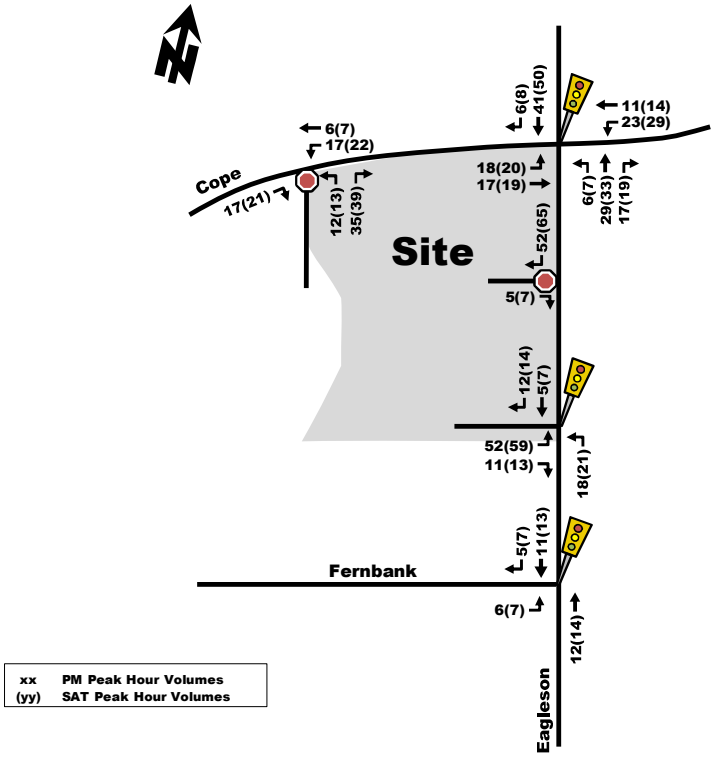
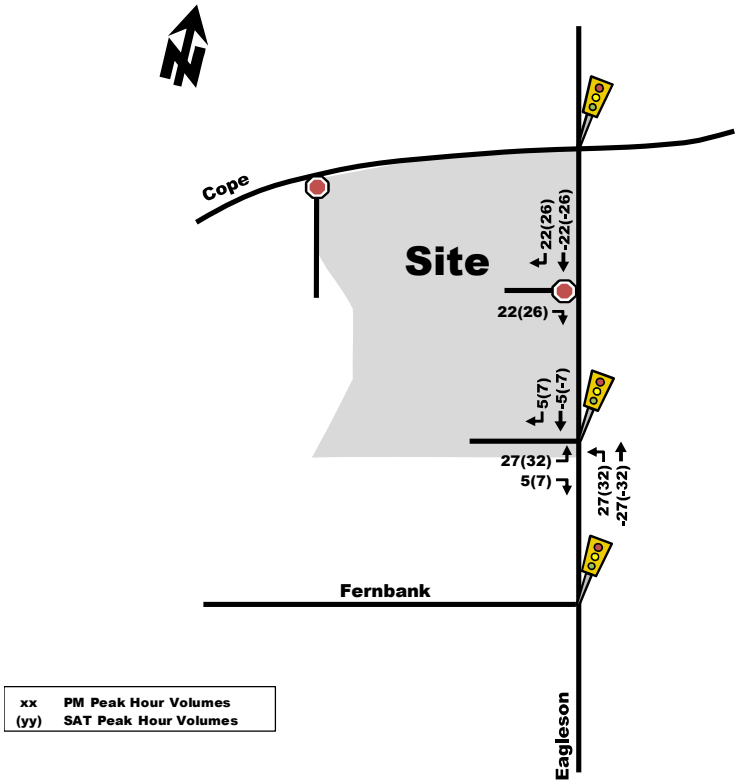
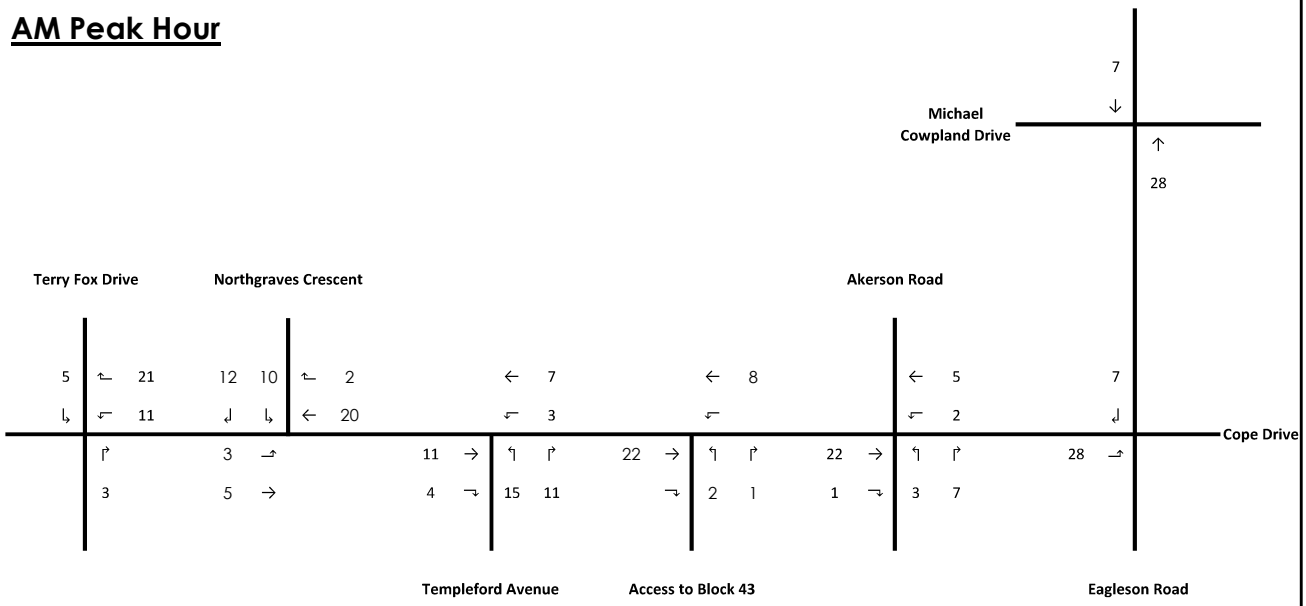


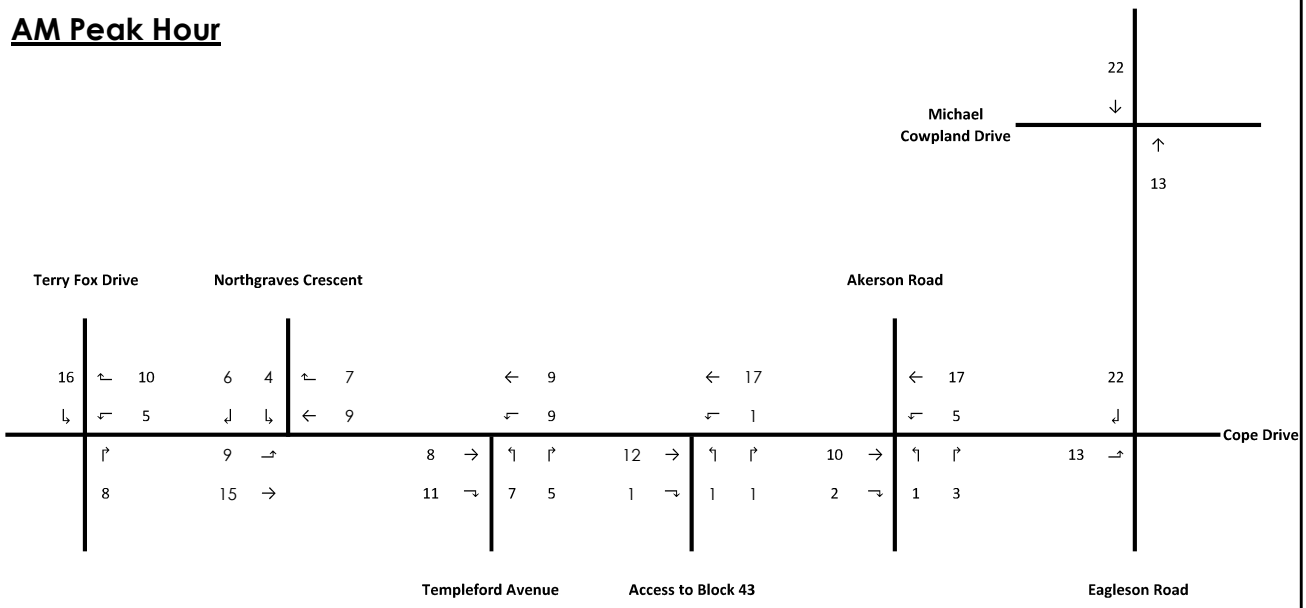
Figure 7: 'Pass-by' Site-Generated Traffic



AM Peak Hour



AM Peak Hour



Stantec Consulting Ltd.
1331 Clyde Avenue, Suite 400
Ottawa, ON, Canada K2C 3G4
Tel: (613) 722-4420
www.stantec.com

Thomas Cavanagh Construction Ltd.
Cope Drive Lands TIS
Figure 8
Total Development Site Trips

The vehicle trip assignment for the peak hour vehicle trips are shown in the following figure.

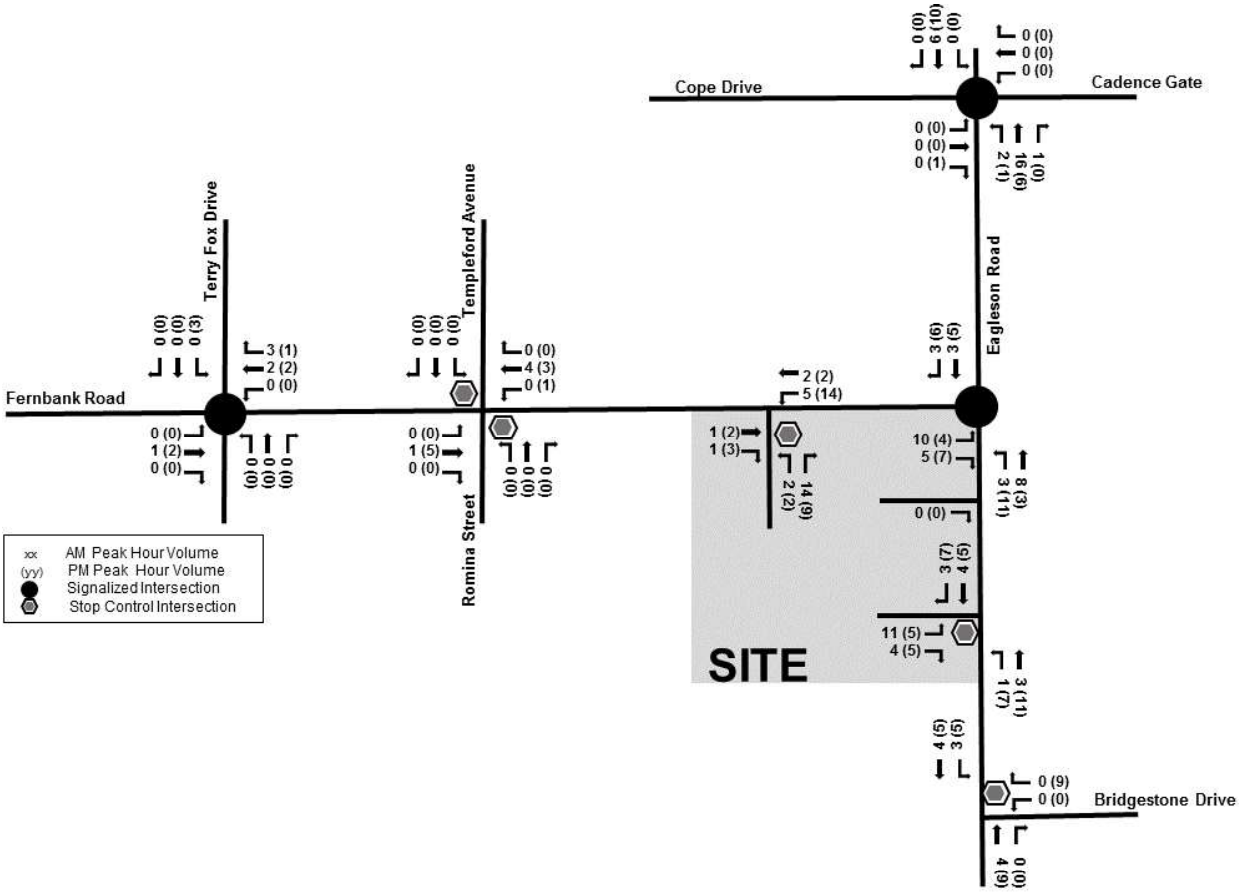


Figure 13. Trip Assignment

10 BACKGROUND NETWORK TRAFFIC

10.1 CHANGES TO THE BACKGROUND TRANSPORTATION NETWORK

The City of Ottawa's Transportation Master Plan (2013) identifies a future road widening of Eagleson Road within our study area as part of the Affordable Network Phase 2 (2020-2025). However, the Environmental Assessment process for these road improvements have not been initiated and are considered to be beyond the future planning horizon of this TIA (2025).

There are no other road projects identified along the border streets in our study area. Furthermore, neither the Ottawa Pedestrian Plan (2013) nor the Ottawa Cycling Plan (2013) identify connectivity or infrastructure improvements along Fernbank Road or Eagleson Road in our study area.

Figure 4: Site Generated Traffic Volumes

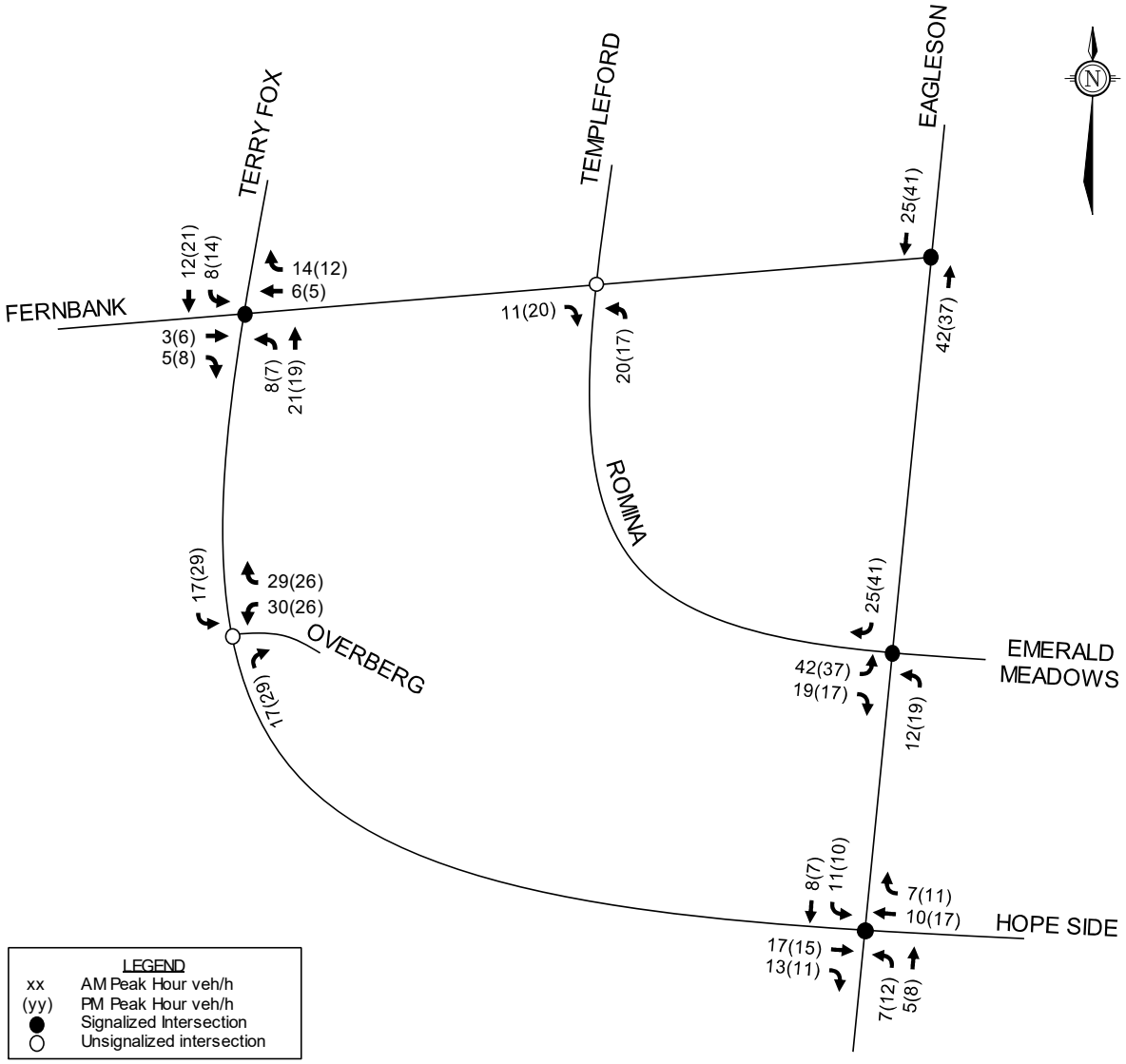


Figure 7: Future Background Traffic (2030)

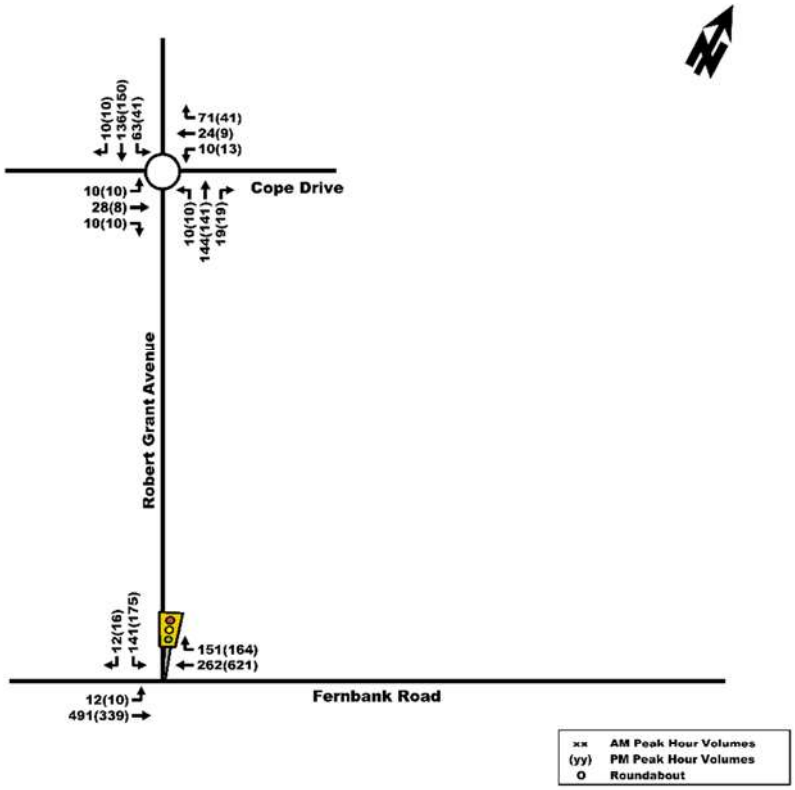
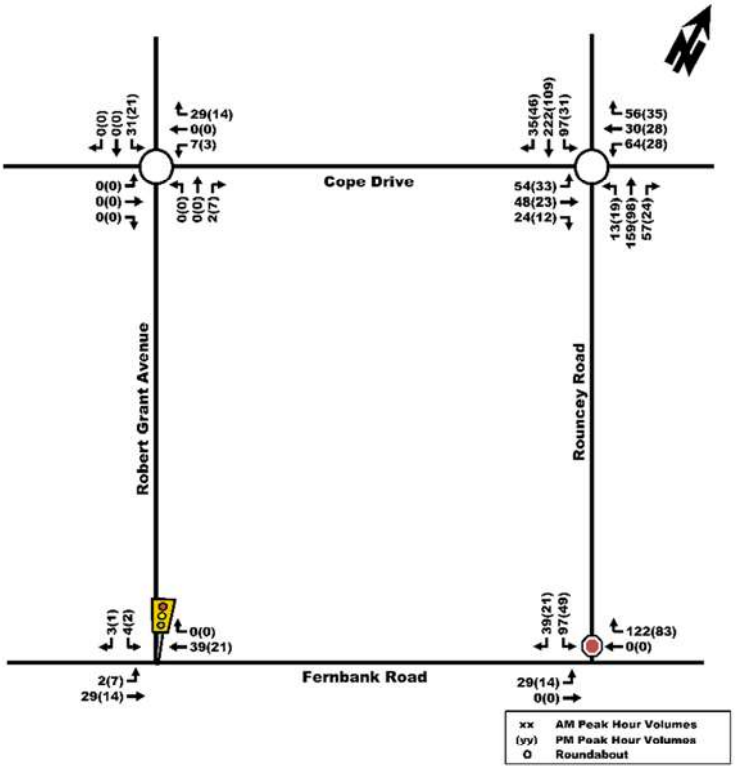
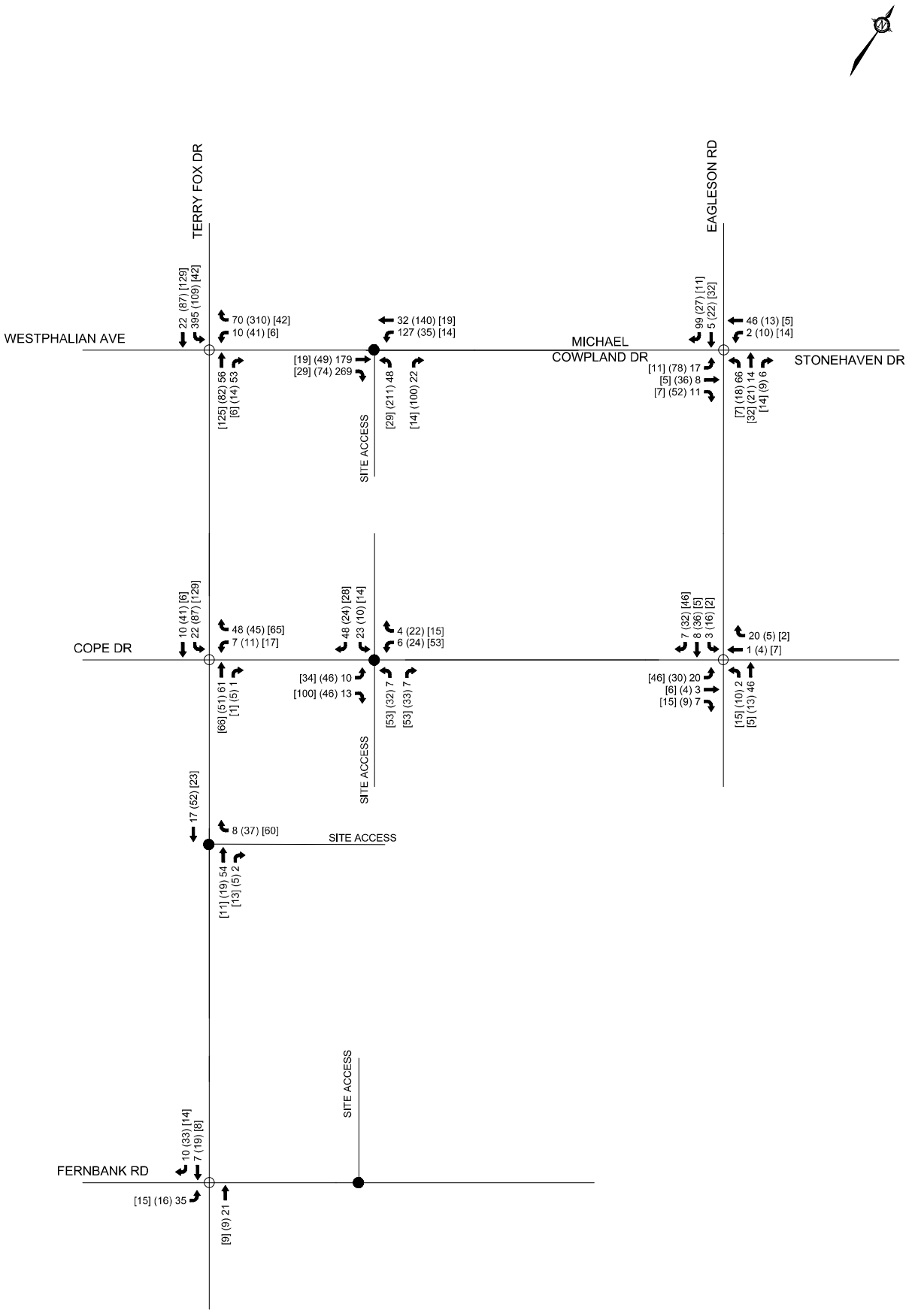


Figure 8: Site Generated Traffic Volumes (Full Build-Out)





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LEGEND

- ● Unsignalized Intersection
- ○ Signalized Intersection

xx VPH AM Peak Hour
(xx) VPH PM Peak Hour
[xx] VPH SATURDAY Peak Hour

VAN GAAL LANDS

PRIMARY SITE GENERATED VEHICLE TRIPS

AUG 2015 115004 FIGURE 8

C:\Temp\AcPublish_4424\Traffic Figures.dwg, Figure 8, Aug 28, 2015 - 8:42am, mfang

SHT11X17.DWG - 279mmX432mm

Appendix D MULTI-MODAL LEVEL OF SERVICE ASSESSMENT

Multi-Modal Level of Service - Intersections Form

Consultant	**Stantec**	**Project**	**1140 Terry Fox**
Scenario	**2019 Existing**	**Date**	**1-Oct-19**
Comments			

INTERSECTIONS		Terry Fox Drive at Cope Drive			
	Crossing Side	**NORTH**	**SOUTH**	**EAST**	**WEST**
Pedestrian	Lanes	4	4	3	3
	Median	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m
	Conflicting Left Turns	Permissive	Permissive	Permissive	Permissive
	Conflicting Right Turns	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control
	Right Turns on Red (RToR) ?	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed
	Ped Signal Leading Interval?	No	No	No	No
	Right Turn Channel	No Channel	No Channel	No Channel	No Channel
	Corner Radius	15-25m	15-25m	10-15m	15-25m
	Crosswalk Type	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings
	PETSI Score	**51**	**51**	**70**	**68**
	Ped. Exposure to Traffic LoS	**D**	**D**	**C**	**C**
	Cycle Length	90	100	100	100
	Effective Walk Time	12	12	7	7
	Average Pedestrian Delay	**34**	**39**	**43**	**43**
	Pedestrian Delay LoS	**D**	**D**	**E**	**E**
	Level of Service	**D**	**D**	**E**	**E**
		E			
	Approach From	**NORTH**	**SOUTH**	**EAST**	**WEST**
Bicycle	Bicycle Lane Arrangement on Approach	Mixed Traffic	Pocket Bike Lane	Mixed Traffic	Mixed Traffic
	IF Dedicated Right Turn Lane, THEN Right Turn Configuration, ELSE <blank>		Bike lane shifts to the left of right turn		
	Dedicated Right Turning Speed		> 30 km/h		
	Cyclist Through Movement		**F**		
	Separated or Mixed Traffic	**Mixed Traffic**	**Separated**	**Mixed Traffic**	**Mixed Traffic**
	Left Turn Approach	One lane crossed	≥ 2 lanes crossed	No lane crossed	No lane crossed
	Operating Speed	≥ 60 km/h	≥ 60 km/h	> 40 to ≤ 50 km/h	> 40 to ≤ 50 km/h
	Left Turning Cyclist	**F**	**F**	**B**	**B**
	Level of Service	**F**	**F**	**B**	**B**
		F			
Transit	Average Signal Delay	≤ 20 sec	≤ 10 sec	> 40 sec	≤ 40 sec
	Level of Service	**C**	**B**	**F**	**E**
		F			
Truck	Effective Corner Radius	> 15 m	10 - 15 m	10 - 15 m	> 15 m
	Number of Receiving Lanes on Departure from Intersection	1	1	1	1
	Level of Service	**C**	**E**	**E**	**C**
		E			
Auto	Volume to Capacity Ratio	0.71 - 0.80			
	Level of Service	**C**			

Consultant	**Stantec**	**Project**	**1140 Terry Fox**
Scenario	**2020 Future Background**	**Date**	**1-Oct-19**
Comments			

INTERSECTIONS		Terry Fox Drive at Cope Drive			
	Crossing Side	**NORTH**	**SOUTH**	**EAST**	**WEST**
Pedestrian	Lanes	4	4	3	3
	Median	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m
	Conflicting Left Turns	Permissive	Permissive	Permissive	Permissive
	Conflicting Right Turns	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control
	Right Turns on Red (RToR) ?	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed
	Ped Signal Leading Interval?	No	No	No	No
	Right Turn Channel	No Channel	No Channel	No Channel	No Channel
	Corner Radius	15-25m	15-25m	10-15m	15-25m
	Crosswalk Type	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings
	PETSI Score	**51**	**51**	**70**	**68**
	Ped. Exposure to Traffic LoS	**D**	**D**	**C**	**C**
	Cycle Length	120	120	120	120
	Effective Walk Time	7	7	34	34
	Average Pedestrian Delay	**53**	**53**	**31**	**31**
	Pedestrian Delay LoS	**E**	**E**	**D**	**D**
	Level of Service	**E**	**E**	**D**	**D**
		E			
	Approach From	**NORTH**	**SOUTH**	**EAST**	**WEST**
Bicycle	Bicycle Lane Arrangement on Approach	Mixed Traffic	Pocket Bike Lane	Mixed Traffic	Mixed Traffic
	IF Dedicated Right Turn Lane, THEN Right Turn Configuration, ELSE <blank>		Bike lane shifts to the left of right turn		
	Dedicated Right Turning Speed		> 30 km/h		
	Cyclist Through Movement		**F**		
	Separated or Mixed Traffic	**Mixed Traffic**	**Separated**	**Mixed Traffic**	**Mixed Traffic**
	Left Turn Approach	One lane crossed	≥ 2 lanes crossed	No lane crossed	No lane crossed
	Operating Speed	≥ 60 km/h	≥ 60 km/h	> 40 to ≤ 50 km/h	> 40 to ≤ 50 km/h
	Left Turning Cyclist	**F**	**F**	**B**	**B**
	Level of Service	**F**	**F**	**B**	**B**
		F			
Transit	Average Signal Delay	≤ 40 sec	≤ 30 sec	≤ 40 sec	≤ 40 sec
	Level of Service	**E**	**D**	**E**	**E**
		E			
Truck	Effective Corner Radius	> 15 m	10 - 15 m	10 - 15 m	> 15 m
	Number of Receiving Lanes on Departure from Intersection	1	1	1	1
	Level of Service	**C**	**E**	**E**	**C**
		E			
Auto	Volume to Capacity Ratio	0.71 - 0.80			
	Level of Service	**C**			

Multi-Modal Level of Service - Intersections Form

Consultant	**Stantec**	**Project**	**1140 Terry Fox**
Scenario	**2020 Total Future**	**Date**	**1-Oct-19**
Comments			

INTERSECTIONS		Terry Fox Drive at Cope Drive			
	Crossing Side	**NORTH**	**SOUTH**	**EAST**	**WEST**
Pedestrian	Lanes	4	4	3	3
	Median	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m
	Conflicting Left Turns	Permissive	Permissive	Permissive	Permissive
	Conflicting Right Turns	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control
	Right Turns on Red (RToR) ?	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed
	Ped Signal Leading Interval?	No	No	No	No
	Right Turn Channel	No Channel	No Channel	No Channel	No Channel
	Corner Radius	15-25m	15-25m	10-15m	15-25m
	Crosswalk Type	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings
	PETSI Score	**51**	**51**	**70**	**68**
	Ped. Exposure to Traffic LoS	**D**	**D**	**C**	**C**
	Cycle Length	120	120	120	120
	Effective Walk Time	7	7	34	34
	Average Pedestrian Delay	**53**	**53**	**31**	**31**
	Pedestrian Delay LoS	**E**	**E**	**D**	**D**
	Level of Service	**E**	**E**	**D**	**D**
		E			
	Approach From	**NORTH**	**SOUTH**	**EAST**	**WEST**
Bicycle	Bicycle Lane Arrangement on Approach	Mixed Traffic	Pocket Bike Lane	Mixed Traffic	Mixed Traffic
	IF Dedicated Right Turn Lane, THEN Right Turn Configuration, ELSE <blank>		Bike lane shifts to the left of right turn		
	Dedicated Right Turning Speed		> 30 km/h		
	Cyclist Through Movement		**F**		
	Separated or Mixed Traffic	**Mixed Traffic**	**Separated**	**Mixed Traffic**	**Mixed Traffic**
	Left Turn Approach	One lane crossed	≥ 2 lanes crossed	No lane crossed	No lane crossed
	Operating Speed	≥ 60 km/h	≥ 60 km/h	> 40 to ≤ 50 km/h	> 40 to ≤ 50 km/h
	Left Turning Cyclist	**F**	**F**	**B**	**B**
	Level of Service	**F**	**F**	**B**	**B**
		F			
Transit	Average Signal Delay	> 40 sec	> 40 sec	> 40 sec	≤ 30 sec
	Level of Service	**F**	**F**	**F**	**D**
		F			
Truck	Effective Corner Radius	> 15 m	10 - 15 m	10 - 15 m	> 15 m
	Number of Receiving Lanes on Departure from Intersection	1	1	1	1
	Level of Service	**C**	**E**	**E**	**C**
		E			
Auto	Volume to Capacity Ratio	0.81 - 0.90			
	Level of Service	**D**			

Multi-Modal Level of Service - Intersections Form

Consultant	**Stantec**	**Project**	**1140 Terry Fox**
Scenario	**2025 Ultimate**	**Date**	**1-Oct-19**
Comments			

INTERSECTIONS		Terry Fox Drive at Cope Drive			
	Crossing Side	**NORTH**	**SOUTH**	**EAST**	**WEST**
Pedestrian	Lanes	4	4	3	3
	Median	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m
	Conflicting Left Turns	Permissive	Permissive	Permissive	Permissive
	Conflicting Right Turns	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control
	Right Turns on Red (RToR) ?	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed
	Ped Signal Leading Interval?	No	No	No	No
	Right Turn Channel	No Channel	No Channel	No Channel	No Channel
	Corner Radius	15-25m	15-25m	10-15m	15-25m
	Crosswalk Type	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings
	PETSI Score	**51**	**51**	**70**	**68**
	Ped. Exposure to Traffic LoS	**D**	**D**	**C**	**C**
	Cycle Length	120	120	120	120
	Effective Walk Time	7	7	34	34
	Average Pedestrian Delay	**53**	**53**	**31**	**31**
	Pedestrian Delay LoS	**E**	**E**	**D**	**D**
	Level of Service	**E**	**E**	**D**	**D**
		E			
	Approach From	**NORTH**	**SOUTH**	**EAST**	**WEST**
Bicycle	Bicycle Lane Arrangement on Approach	Mixed Traffic	Pocket Bike Lane	Mixed Traffic	Mixed Traffic
	IF Dedicated Right Turn Lane, THEN Right Turn Configuration, ELSE <blank>		Bike lane shifts to the left of right turn		
	Dedicated Right Turning Speed		> 30 km/h		
	Cyclist Through Movement		**F**		
	Separated or Mixed Traffic	**Mixed Traffic**	**Separated**	**Mixed Traffic**	**Mixed Traffic**
	Left Turn Approach	One lane crossed	≥ 2 lanes crossed	No lane crossed	No lane crossed
	Operating Speed	≥ 60 km/h	≥ 60 km/h	> 40 to ≤ 50 km/h	> 40 to ≤ 50 km/h
	Left Turning Cyclist	**F**	**F**	**B**	**B**
	Level of Service	**F**	**F**	**B**	**B**
		F			
Transit	Average Signal Delay	> 40 sec	> 40 sec	> 40 sec	> 40 sec
	Level of Service	**F**	**F**	**F**	**F**
		F			
Truck	Effective Corner Radius	> 15 m	10 - 15 m	10 - 15 m	> 15 m
	Number of Receiving Lanes on Departure from Intersection	1	1	1	1
	Level of Service	**C**	**E**	**E**	**C**
		E			
Auto	Volume to Capacity Ratio	> 1.00			
	Level of Service	**F**			

Multi-Modal Level of Service - Segments Form

Consultant	**Stantec**	**Project**	**1140 Terry Fox**
Scenario	**2019 Existing**	**Date**	**9-Oct-19**

SEGMENTS		Terry Fox Drive along PL	Cope Drive along PL
Pedestrian	Sidewalk Width	no sidewalk	≥ 2 m
	Boulevard Width	n/a	> 2 m
	Avg Daily Curb Lane Traffic Volume	> 3000	≤ 3000
	Operating Speed	> 60 km/h	> 50 to 60 km/h
	On-Street Parking	no	no
	Exposure to Traffic PLoS	**F**	**A**
	Level of Service	**F**	**A**
Bicycle	Type of Cycling Facility	Mixed Traffic	Mixed Traffic
	Number of Travel Lanes	2-3 lanes total	2-3 lanes total
	Operating Speed	≥ 60 km/h	≥ 50 to 60 km/h
	# of Lanes & Operating Speed LoS	**F**	**E**
	Bike Lane (+ Parking Lane) Width		~~≥ 1.8 m~~
	Bike Lane Width LoS	**-**	**~~A~~**
	Bike Lane Blockages		~~Rare~~
	Blockage LoS	**-**	**~~A~~**
	Level of Service	**F**	**E**
Transit	Facility Type	Mixed Traffic	
	Friction or Ratio Transit:Posted Speed	Vt/Vp ≥ 0.8	
	Level of Service	**D**	**-**
Truck	Truck Lane Width	> 3.7 m	
	Travel Lanes per Direction	1	
	Level of Service	**B**	**-**

Multi-Modal Level of Service - Segments Form

Consultant	**Stantec**	**Project**	**1140 Terry Fox**
Scenario	**Build-Out**	**Date**	**28-Nov-19**

SEGMENTS		Terry Fox Drive along PL	Cope Drive along PL
Pedestrian	Sidewalk Width Boulevard Width	≥ 2 m > 2 m	≥ 2 m > 2 m
	Avg Daily Curb Lane Traffic Volume	> 3000	≤ 3000
	Operating Speed On-Street Parking	> 60 km/h no	> 50 to 60 km/h no
	Exposure to Traffic PLoS	**D**	**A**
	Level of Service	**D**	**A**
Bicycle	Type of Cycling Facility	Mixed Traffic	Physically Separated
	Number of Travel Lanes	2-3 lanes total	
	Operating Speed	≤ 40 km/h	
	# of Lanes & Operating Speed LoS	**B**	**-**
	Bike Lane (+ Parking Lane) Width		
	Bike Lane Width LoS	**-**	**-**
	Bike Lane Blockages		
	Blockage LoS	**-**	**-**
	Level of Service	**B**	**A**
Transit	Facility Type	Mixed Traffic	Mixed Traffic
	Friction or Ratio Transit:Posted Speed	Vt/Vp ≥ 0.8	Vt/Vp ≥ 0.8
	Level of Service	**D**	**D**
Truck	Truck Lane Width	> 3.7 m	
	Travel Lanes per Direction	1	
	Level of Service	**B**	**-**

Appendix E TRANSPORTATION DEMAND MANAGEMENT CHECKLIST

TDM-Supportive Development Design and Infrastructure Checklist:
Non-Residential Developments (office, institutional, retail or industrial)

Legend

REQUIRED	The Official Plan or Zoning By-law provides related guidance that must be followed
BASIC	The measure is generally feasible and effective, and in most cases would benefit the development and its users
BETTER	The measure could maximize support for users of sustainable modes, and optimize development performance

		TDM-supportive design & infrastructure measures: *Non-residential developments*	Check if completed & add descriptions, explanations or plan/drawing references
	1.	**WALKING & CYCLING: ROUTES**	
	1.1	**Building location & access points**	
BASIC	1.1.1	Locate building close to the street, and do not locate parking areas between the street and building entrances	☐
BASIC	1.1.2	Locate building entrances in order to minimize walking distances to sidewalks and transit stops/stations	☐
BASIC	1.1.3	Locate building doors and windows to ensure visibility of pedestrians from the building, for their security and comfort	☐
	1.2	**Facilities for walking & cycling**	
REQUIRED	1.2.1	Provide convenient, direct access to stations or major stops along rapid transit routes within 600 metres; minimize walking distances from buildings to rapid transit; provide pedestrian-friendly, weather-protected (where possible) environment between rapid transit accesses and building entrances; ensure quality linkages from sidewalks through building entrances to integrated stops/stations *(see Official Plan policy 4.3.3)*	☑
REQUIRED	1.2.2	Provide safe, direct and attractive pedestrian access from public sidewalks to building entrances through such measures as: reducing distances between public sidewalks and major building entrances; providing walkways from public streets to major building entrances; within a site, providing walkways along the front of adjoining buildings, between adjacent buildings, and connecting areas where people may congregate, such as courtyards and transit stops; and providing weather protection through canopies, colonnades, and other design elements wherever possible *(see Official Plan policy 4.3.12)*	☑

		TDM-supportive design & infrastructure measures: *Non-residential developments*	Check if completed & add descriptions, explanations or plan/drawing references
REQUIRED	1.2.3	Provide sidewalks of smooth, well-drained walking surfaces of contrasting materials or treatments to differentiate pedestrian areas from vehicle areas, and provide marked pedestrian crosswalks at intersection sidewalks *(see Official Plan policy 4.3.10)*	☑
REQUIRED	1.2.4	Make sidewalks and open space areas easily accessible through features such as gradual grade transition, depressed curbs at street corners and convenient access to extra-wide parking spaces and ramps *(see Official Plan policy 4.3.10)*	☑
REQUIRED	1.2.5	Include adequately spaced inter-block/street cycling and pedestrian connections to facilitate travel by active transportation. Provide links to the existing or planned network of public sidewalks, multi-use pathways and on-road cycle routes. Where public sidewalks and multi-use pathways intersect with roads, consider providing traffic control devices to give priority to cyclists and pedestrians *(see Official Plan policy 4.3.11)*	☑
BASIC	1.2.6	Provide safe, direct and attractive walking routes from building entrances to nearby transit stops	☑
BASIC	1.2.7	Ensure that walking routes to transit stops are secure, visible, lighted, shaded and wind-protected wherever possible	☐
BASIC	1.2.8	Design roads used for access or circulation by cyclists using a target operating speed of no more than 30 km/h, or provide a separated cycling facility	☐
	1.3	**Amenities for walking & cycling**	
BASIC	1.3.1	Provide lighting, landscaping and benches along walking and cycling routes between building entrances and streets, sidewalks and trails	☐
BASIC	1.3.2	Provide wayfinding signage for site access (where required, e.g. when multiple buildings or entrances exist) and egress (where warranted, such as when directions to reach transit stops/stations, trails or other common destinations are not obvious)	☐

		TDM-supportive design & infrastructure measures: *Non-residential developments*	Check if completed & add descriptions, explanations or plan/drawing references
	2.	**WALKING & CYCLING: END-OF-TRIP FACILITIES**	
	2.1	**Bicycle parking**	
REQUIRED	2.1.1	Provide bicycle parking in highly visible and lighted areas, sheltered from the weather wherever possible *(see Official Plan policy 4.3.6)*	☑
REQUIRED	2.1.2	Provide the number of bicycle parking spaces specified for various land uses in different parts of Ottawa; provide convenient access to main entrances or well-used areas *(see Zoning By-law Section 111)*	☑
REQUIRED	2.1.3	Ensure that bicycle parking spaces and access aisles meet minimum dimensions; that no more than 50% of spaces are vertical spaces; and that parking racks are securely anchored *(see Zoning By-law Section 111)*	☑
BASIC	2.1.4	Provide bicycle parking spaces equivalent to the expected number of commuter cyclists (assuming the cycling mode share target is met), plus the expected peak number of customer/visitor cyclists	☐
BETTER	2.1.5	Provide bicycle parking spaces equivalent to the expected number of commuter and customer/visitor cyclists, plus an additional buffer (e.g. 25 percent extra) to encourage other cyclists and ensure adequate capacity in peak cycling season	☐
	2.2	**Secure bicycle parking**	
REQUIRED	2.2.1	Where more than 50 bicycle parking spaces are provided for a single office building, locate at least 25% of spaces within a building/structure, a secure area (e.g. supervised parking lot or enclosure) or bicycle lockers *(see Zoning By-law Section 111)*	☑ Not Applicable. No office space is proposed in this development.
BETTER	2.2.2	Provide secure bicycle parking spaces equivalent to the expected number of commuter cyclists (assuming the cycling mode share target is met)	☐
	2.3	**Shower & change facilities**	
BASIC	2.3.1	Provide shower and change facilities for the use of active commuters	☐
BETTER	2.3.2	In addition to shower and change facilities, provide dedicated lockers, grooming stations, drying racks and laundry facilities for the use of active commuters	☐
	2.4	**Bicycle repair station**	
BETTER	2.4.1	Provide a permanent bike repair station, with commonly used tools and an air pump, adjacent to the main bicycle parking area (or secure bicycle parking area, if provided)	☐

		TDM-supportive design & infrastructure measures: *Non-residential developments*	Check if completed & add descriptions, explanations or plan/drawing references
	3.	**TRANSIT**	
	3.1	**Customer amenities**	
BASIC	3.1.1	Provide shelters, lighting and benches at any on-site transit stops	☐
BASIC	3.1.2	Where the site abuts an off-site transit stop and insufficient space exists for a transit shelter in the public right-of-way, protect land for a shelter and/or install a shelter	☐
BETTER	3.1.3	Provide a secure and comfortable interior waiting area by integrating any on-site transit stops into the building	☐
	4.	**RIDESHARING**	
	4.1	**Pick-up & drop-off facilities**	
BASIC	4.1.1	Provide a designated area for carpool drivers (plus taxis and ride-hailing services) to drop off or pick up passengers without using fire lanes or other no-stopping zones	☐
	4.2	**Carpool parking**	
BASIC	4.2.1	Provide signed parking spaces for carpools in a priority location close to a major building entrance, sufficient in number to accommodate the mode share target for carpools	☐
BETTER	4.2.2	At large developments, provide spaces for carpools in a separate, access-controlled parking area to simplify enforcement	☐
	5.	**CARSHARING & BIKESHARING**	
	5.1	**Carshare parking spaces**	
BETTER	5.1.1	Provide carshare parking spaces in permitted non-residential zones, occupying either required or provided parking spaces *(see Zoning By-law Section 94)*	☐
	5.2	**Bikeshare station location**	
BETTER	5.2.1	Provide a designated bikeshare station area near a major building entrance, preferably lighted and sheltered with a direct walkway connection	☐

		TDM-supportive design & infrastructure measures: *Non-residential developments*	Check if completed & add descriptions, explanations or plan/drawing references
	6.	**PARKING**	
	6.1	**Number of parking spaces**	
REQUIRED	6.1.1	Do not provide more parking than permitted by zoning, nor less than required by zoning, unless a variance is being applied for	☑
BASIC	6.1.2	Provide parking for long-term and short-term users that is consistent with mode share targets, considering the potential for visitors to use off-site public parking	☐
BASIC	6.1.3	Where a site features more than one use, provide shared parking and reduce the cumulative number of parking spaces accordingly *(see Zoning By-law Section 104)*	☐
BETTER	6.1.4	Reduce the minimum number of parking spaces required by zoning by one space for each 13 square metres of gross floor area provided as shower rooms, change rooms, locker rooms and other facilities for cyclists in conjunction with bicycle parking *(see Zoning By-law Section 111)*	☐
	6.2	**Separate long-term & short-term parking areas**	
BETTER	6.2.1	Separate short-term and long-term parking areas using signage or physical barriers, to permit access controls and simplify enforcement (i.e. to discourage employees from parking in visitor spaces, and vice versa)	☐
	7.	**OTHER**	
	7.1	**On-site amenities to minimize off-site trips**	
BETTER	7.1.1	Provide on-site amenities to minimize mid-day or mid-commute errands	☐

TDM Measures Checklist:
Non-Residential Developments (office, institutional, retail or industrial)

Legend

BASIC — The measure is generally feasible and effective, and in most cases would benefit the development and its users

BETTER — The measure could maximize support for users of sustainable modes, and optimize development performance

★ — The measure is one of the most dependably effective tools to encourage the use of sustainable modes

		TDM measures: *Non-residential developments*	Check if proposed & add descriptions
	1.	**TDM PROGRAM MANAGEMENT**	
	1.1	**Program coordinator**	
BASIC ★	1.1.1	Designate an internal coordinator, or contract with an external coordinator	☐
	1.2	**Travel surveys**	
BETTER	1.2.1	Conduct periodic surveys to identify travel-related behaviours, attitudes, challenges and solutions, and to track progress	☐
	2.	**WALKING AND CYCLING**	
	2.1	**Information on walking/cycling routes & destinations**	
BASIC	2.1.1	Display local area maps with walking/cycling access routes and key destinations at major entrances	☐
	2.2	**Bicycle skills training**	
		Commuter travel	
BETTER ★	2.2.1	Offer on-site cycling courses for commuters, or subsidize off-site courses	☐
	2.3	**Valet bike parking**	
		Visitor travel	
BETTER	2.3.1	Offer secure valet bike parking during public events when demand exceeds fixed supply (e.g. for festivals, concerts, games)	☐

			TDM measures: *Non-residential developments*	Check if proposed & add descriptions
		3.	**TRANSIT**	
		3.1	**Transit information**	
BASIC		3.1.1	Display relevant transit schedules and route maps at entrances	☐
BASIC		3.1.2	Provide online links to OC Transpo and STO information	☐
BETTER		3.1.3	Provide real-time arrival information display at entrances	☐
		3.2	**Transit fare incentives**	
			Commuter travel	
BETTER		3.2.1	Offer preloaded PRESTO cards to encourage commuters to use transit	☐
BETTER	★	3.2.2	Subsidize or reimburse monthly transit pass purchases by employees	☐
			Visitor travel	
BETTER		3.2.3	Arrange inclusion of same-day transit fare in price of tickets (e.g. for festivals, concerts, games)	☐
		3.3	**Enhanced public transit service**	
			Commuter travel	
BETTER		3.3.1	Contract with OC Transpo to provide enhanced transit services (e.g. for shift changes, weekends)	☐
			Visitor travel	
BETTER		3.3.2	Contract with OC Transpo to provide enhanced transit services (e.g. for festivals, concerts, games)	☐
		3.4	**Private transit service**	
			Commuter travel	
BETTER		3.4.1	Provide shuttle service when OC Transpo cannot offer sufficient quality or capacity to serve demand (e.g. for shift changes, weekends)	☐
			Visitor travel	
BETTER		3.4.2	Provide shuttle service when OC Transpo cannot offer sufficient quality or capacity to serve demand (e.g. for festivals, concerts, games)	☐

			TDM measures: *Non-residential developments*	Check if proposed & add descriptions
		4.	**RIDESHARING**	
		4.1	**Ridematching service**	
			Commuter travel	
BASIC	★	4.1.1	Provide a dedicated ridematching portal at OttawaRideMatch.com	☐
		4.2	**Carpool parking price incentives**	
			Commuter travel	
BETTER		4.2.1	Provide discounts on parking costs for registered carpools	☐
		4.3	**Vanpool service**	
			Commuter travel	
BETTER		4.3.1	Provide a vanpooling service for long-distance commuters	☐
		5.	**CARSHARING & BIKESHARING**	
		5.1	**Bikeshare stations & memberships**	
BETTER		5.1.1	Contract with provider to install on-site bikeshare station for use by commuters and visitors	☐
			Commuter travel	
BETTER		5.1.2	Provide employees with bikeshare memberships for local business travel	☐
		5.2	**Carshare vehicles & memberships**	
			Commuter travel	
BETTER		5.2.1	Contract with provider to install on-site carshare vehicles and promote their use by tenants	☐
BETTER		5.2.2	Provide employees with carshare memberships for local business travel	☐
		6.	**PARKING**	
		6.1	**Priced parking**	
			Commuter travel	
BASIC	★	6.1.1	Charge for long-term parking (daily, weekly, monthly)	☐
BASIC		6.1.2	Unbundle parking cost from lease rates at multi-tenant sites	☐
			Visitor travel	
BETTER		6.1.3	Charge for short-term parking (hourly)	☐

		TDM measures: *Non-residential developments*	Check if proposed & add descriptions
		7. TDM MARKETING & COMMUNICATIONS	
		7.1 Multimodal travel information	
		Commuter travel	
BASIC	★	7.1.1 Provide a multimodal travel option information package to new/relocating employees and students	☐
		Visitor travel	
BETTER	★	7.1.2 Include multimodal travel option information in invitations or advertising that attract visitors or customers (e.g. for festivals, concerts, games)	☐
		7.2 Personalized trip planning	
		Commuter travel	
BETTER	★	7.2.1 Offer personalized trip planning to new/relocating employees	☐
		7.3 Promotions	
		Commuter travel	
BETTER		7.3.1 Deliver promotions and incentives to maintain awareness, build understanding, and encourage trial of sustainable modes	☐
		8. OTHER INCENTIVES & AMENITIES	
		8.1 Emergency ride home	
		Commuter travel	
BETTER	★	8.1.1 Provide emergency ride home service to non-driving commuters	☐
		8.2 Alternative work arrangements	
		Commuter travel	
BASIC	★	8.2.1 Encourage flexible work hours	☐
BETTER		8.2.2 Encourage compressed workweeks	☐
BETTER	★	8.2.3 Encourage telework	☐
		8.3 Local business travel options	
		Commuter travel	
BASIC	★	8.3.1 Provide local business travel options that minimize the need for employees to bring a personal car to work	☐
		8.4 Commuter incentives	
		Commuter travel	
BETTER		8.4.1 Offer employees a taxable, mode-neutral commuting allowance	☐
		8.5 On-site amenities	
		Commuter travel	
BETTER		8.5.1 Provide on-site amenities/services to minimize mid-day or mid-commute errands	☐

Appendix F INTERSECTION PERFORMANCE WORKSHEETS

Appendix F Intersection Performance Worksheets
February 19, 2020

2019 Existing Conditions

Queues
1: Terry Fox Drive & Cope Drive

12/03/2019

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	21	20	31	113	8	696	168	414	32
v/c Ratio	0.15	0.10	0.26	0.42	0.01	0.53	0.33	0.31	0.03
Control Delay	38.4	31.6	41.9	13.6	3.1	6.3	5.9	4.3	1.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	38.4	31.6	41.9	13.6	3.1	6.3	5.9	4.3	1.0
Queue Length 50th (m)	3.4	2.5	5.0	1.0	0.3	41.5	8.0	19.4	0.0
Queue Length 95th (m)	10.0	8.8	13.2	15.5	1.3	70.9	18.5	33.2	1.7
Internal Link Dist (m)		120.8		121.3		174.8		266.2	
Turn Bay Length (m)	37.5		45.0		60.0		50.0		150.0
Base Capacity (vph)	356	518	312	531	737	1321	512	1316	1214
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.06	0.04	0.10	0.21	0.01	0.53	0.33	0.31	0.03

Intersection Summary

HCM Signalized Intersection Capacity Analysis
1: Terry Fox Drive & Cope Drive

12/03/2019

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	19	14	4	28	5	96	7	584	42	151	373	29
Future Volume (vph)	19	14	4	28	5	96	7	584	42	151	373	29
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	6.2	6.2		6.2	6.2		6.4	6.4		6.4	6.4	6.4
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.97		1.00	0.86		1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1662	1731		1340	1531		1695	1660		1695	1655	1517
Flt Permitted	0.68	1.00		0.74	1.00		0.52	1.00		0.36	1.00	1.00
Satd. Flow (perm)	1197	1731		1050	1531		927	1660		644	1655	1517
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	21	16	4	31	6	107	8	649	47	168	414	32
RTOR Reduction (vph)	0	4	0	0	97	0	0	2	0	0	0	7
Lane Group Flow (vph)	21	16	0	31	16	0	8	694	0	168	414	25
Heavy Vehicles (%)	4%	2%	2%	29%	2%	2%	2%	9%	2%	2%	10%	2%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	Perm
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		6
Actuated Green, G (s)	8.4	8.4		8.4	8.4		69.0	69.0		69.0	69.0	69.0
Effective Green, g (s)	8.4	8.4		8.4	8.4		69.0	69.0		69.0	69.0	69.0
Actuated g/C Ratio	0.09	0.09		0.09	0.09		0.77	0.77		0.77	0.77	0.77
Clearance Time (s)	6.2	6.2		6.2	6.2		6.4	6.4		6.4	6.4	6.4
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	111	161		98	142		710	1272		493	1268	1163
v/s Ratio Prot		0.01			0.01			c0.42			0.25	
v/s Ratio Perm	0.02			c0.03			0.01			0.26		0.02
v/c Ratio	0.19	0.10		0.32	0.11		0.01	0.55		0.34	0.33	0.02
Uniform Delay, d1	37.7	37.3		38.1	37.4		2.5	4.2		3.3	3.3	2.5
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.8	0.3		1.9	0.4		0.0	1.7		1.9	0.7	0.0
Delay (s)	38.5	37.6		40.0	37.7		2.5	5.9		5.2	4.0	2.5
Level of Service	D	D		D	D		A	A		A	A	A
Approach Delay (s)		38.1			38.2			5.9			4.2	
Approach LOS		D			D			A			A	

Intersection Summary				
HCM 2000 Control Delay	9.2	HCM 2000 Level of Service	A	
HCM 2000 Volume to Capacity ratio	0.52			
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.6	
Intersection Capacity Utilization	68.1%	ICU Level of Service	C	
Analysis Period (min)	15			
c Critical Lane Group				

Queues
1: Terry Fox Drive & Cope Drive

12/03/2019

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	94	37	67	219	6	616	213	791	93
v/c Ratio	0.83	0.13	0.35	0.53	0.02	0.63	0.46	0.62	0.08
Control Delay	88.1	28.9	40.8	10.8	12.8	20.0	8.8	10.9	1.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	88.1	28.9	40.8	10.8	12.8	20.0	8.8	10.9	1.5
Queue Length 50th (m)	18.0	4.9	11.8	2.0	0.5	75.7	11.2	65.6	0.0
Queue Length 95th (m)	#35.6	12.4	22.4	20.0	2.7	133.4	24.8	130.7	5.0
Internal Link Dist (m)		120.8		121.3		174.8		266.2	
Turn Bay Length (m)	37.5		45.0		60.0		50.0		150.0
Base Capacity (vph)	193	468	328	561	365	972	461	1278	1113
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.49	0.08	0.20	0.39	0.02	0.63	0.46	0.62	0.08

Intersection Summary

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

HCM Signalized Intersection Capacity Analysis
1: Terry Fox Drive & Cope Drive

12/03/2019

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	85	26	7	60	11	186	5	508	47	192	712	84
Future Volume (vph)	85	26	7	60	11	186	5	508	47	192	712	84
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	6.2	6.2		6.2	6.2		6.4	6.4		6.4	6.4	6.4
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.97		1.00	0.86		1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1695	1726		1586	1531		1695	1731		1695	1784	1517
Flt Permitted	0.40	1.00		0.73	1.00		0.37	1.00		0.27	1.00	1.00
Satd. Flow (perm)	722	1726		1224	1531		652	1731		488	1784	1517
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	94	29	8	67	12	207	6	564	52	213	791	93
RTOR Reduction (vph)	0	7	0	0	175	0	0	3	0	0	0	26
Lane Group Flow (vph)	94	30	0	67	44	0	6	613	0	213	791	67
Heavy Vehicles (%)	2%	2%	2%	9%	2%	2%	2%	4%	2%	2%	2%	2%
Turn Type	Perm	NA		Perm	NA		Perm	NA		pm+pt	NA	Perm
Protected Phases		4			8			2		1	6	
Permitted Phases	4			8			2			6		6
Actuated Green, G (s)	15.7	15.7		15.7	15.7		56.1	56.1		71.7	71.7	71.7
Effective Green, g (s)	15.7	15.7		15.7	15.7		56.1	56.1		71.7	71.7	71.7
Actuated g/C Ratio	0.16	0.16		0.16	0.16		0.56	0.56		0.72	0.72	0.72
Clearance Time (s)	6.2	6.2		6.2	6.2		6.4	6.4		6.4	6.4	6.4
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	113	270		192	240		365	971		460	1279	1087
v/s Ratio Prot		0.02			0.03			0.35		0.04	c0.44	
v/s Ratio Perm	c0.13			0.05			0.01			0.29		0.04
v/c Ratio	0.83	0.11		0.35	0.19		0.02	0.63		0.46	0.62	0.06
Uniform Delay, d1	40.9	36.2		37.6	36.6		9.7	14.9		8.2	7.2	4.2
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	38.1	0.2		1.1	0.4		0.1	3.1		0.7	2.3	0.1
Delay (s)	79.0	36.4		38.7	37.0		9.8	18.0		8.9	9.4	4.3
Level of Service	E	D		D	D		A	B		A	A	A
Approach Delay (s)		67.0			37.4			18.0			8.9	
Approach LOS		E			D			B			A	

Intersection Summary				
HCM 2000 Control Delay	18.9	HCM 2000 Level of Service	B	
HCM 2000 Volume to Capacity ratio	0.71			
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	19.0	
Intersection Capacity Utilization	85.8%	ICU Level of Service	E	
Analysis Period (min)	15			
c Critical Lane Group				

Queues
1: Terry Fox Drive & Cope Drive 12/03/2019

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	163	62	39	176	14	531	142	609	130
v/c Ratio	0.74	0.17	0.15	0.40	0.03	0.46	0.30	0.53	0.13
Control Delay	50.3	23.6	26.3	8.7	7.8	10.3	10.2	11.4	2.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	50.3	23.6	26.3	8.7	7.8	10.3	10.2	11.4	2.0
Queue Length 50th (m)	25.0	7.3	5.3	2.6	0.7	38.0	8.9	46.9	0.0
Queue Length 95th (m)	41.0	15.1	11.7	16.2	3.6	76.8	24.2	94.2	6.9
Internal Link Dist (m)		120.8		121.3		174.8		266.2	
Turn Bay Length (m)	37.5		45.0		60.0		50.0		150.0
Base Capacity (vph)	365	598	433	627	419	1143	477	1153	1026
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.45	0.10	0.09	0.28	0.03	0.46	0.30	0.53	0.13

Intersection Summary

HCM Signalized Intersection Capacity Analysis
1: Terry Fox Drive & Cope Drive 12/03/2019

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	147	49	7	35	18	140	13	443	35	128	548	117
Future Volume (vph)	147	49	7	35	18	140	13	443	35	128	548	117
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	6.2	6.2		6.2	6.2		6.4	6.4		6.4	6.4	6.4
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.98		1.00	0.87		1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1695	1750		1695	1547		1695	1765		1695	1784	1517
Flt Permitted	0.60	1.00		0.72	1.00		0.36	1.00		0.41	1.00	1.00
Satd. Flow (perm)	1078	1750		1279	1547		649	1765		739	1784	1517
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	163	54	8	39	20	156	14	492	39	142	609	130
RTOR Reduction (vph)	0	6	0	0	124	0	0	2	0	0	0	46
Lane Group Flow (vph)	163	56	0	39	52	0	14	529	0	142	609	84
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	Perm
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		6
Actuated Green, G (s)	17.4	17.4		17.4	17.4		55.0	55.0		55.0	55.0	55.0
Effective Green, g (s)	17.4	17.4		17.4	17.4		55.0	55.0		55.0	55.0	55.0
Actuated g/C Ratio	0.20	0.20		0.20	0.20		0.65	0.65		0.65	0.65	0.65
Clearance Time (s)	6.2	6.2		6.2	6.2		6.4	6.4		6.4	6.4	6.4
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	220	358		261	316		419	1142		478	1154	981
v/s Ratio Prot		0.03			0.03			0.30			c0.34	
v/s Ratio Perm	c0.15			0.03			0.02			0.19		0.06
v/c Ratio	0.74	0.16		0.15	0.16		0.03	0.46		0.30	0.53	0.09
Uniform Delay, d1	31.7	27.8		27.7	27.8		5.4	7.6		6.6	8.0	5.6
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	12.6	0.2		0.3	0.2		0.1	1.4		1.6	1.7	0.2
Delay (s)	44.3	28.0		28.0	28.1		5.6	8.9		8.1	9.8	5.8
Level of Service	D	C		C	C		A	A		A	A	A
Approach Delay (s)		39.8			28.1			8.8			8.9	
Approach LOS		D			C			A			A	

Intersection Summary					
HCM 2000 Control Delay	14.8	HCM 2000 Level of Service	B		
HCM 2000 Volume to Capacity ratio	0.58				
Actuated Cycle Length (s)	85.0	Sum of lost time (s)	12.6		
Intersection Capacity Utilization	74.3%	ICU Level of Service	D		
Analysis Period (min)	15				

c Critical Lane Group

2020 Future Background

Queues
1: Terry Fox Drive & Cope Drive

12/03/2019

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	141	135	40	146	37	645	159	380	156
v/c Ratio	0.68	0.41	0.23	0.38	0.06	0.57	0.37	0.34	0.14
Control Delay	49.9	31.0	32.5	11.3	6.6	11.2	10.8	8.0	1.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	49.9	31.0	32.5	11.3	6.6	11.2	10.8	8.0	1.6
Queue Length 50th (m)	23.1	18.3	6.0	3.9	1.9	50.2	10.3	23.8	0.0
Queue Length 95th (m)	38.7	31.4	13.5	17.6	6.3	101.3	28.4	48.8	6.9
Internal Link Dist (m)		106.2		121.3		174.8		232.2	
Turn Bay Length (m)	37.5		45.0		60.0		50.0		150.0
Base Capacity (vph)	339	524	281	550	633	1126	425	1121	1078
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.42	0.26	0.14	0.27	0.06	0.57	0.37	0.34	0.14

Intersection Summary

HCM Signalized Intersection Capacity Analysis
1: Terry Fox Drive & Cope Drive

12/03/2019

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	141	105	30	40	27	119	37	599	46	159	380	156
Future Volume (vph)	141	105	30	40	27	119	37	599	46	159	380	156
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	6.2	6.2		6.2	6.2		6.4	6.4		6.4	6.4	6.4
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.97		1.00	0.88		1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1662	1725		1340	1566		1695	1659		1695	1655	1517
Flt Permitted	0.65	1.00		0.67	1.00		0.52	1.00		0.35	1.00	1.00
Satd. Flow (perm)	1141	1725		946	1566		935	1659		629	1655	1517
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	141	105	30	40	27	119	37	599	46	159	380	156
RTOR Reduction (vph)	0	13	0	0	97	0	0	2	0	0	0	50
Lane Group Flow (vph)	141	122	0	40	49	0	37	643	0	159	380	106
Heavy Vehicles (%)	4%	2%	2%	29%	2%	2%	2%	9%	2%	2%	10%	2%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	Perm
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		6
Actuated Green, G (s)	16.4	16.4		16.4	16.4		61.0	61.0		61.0	61.0	61.0
Effective Green, g (s)	16.4	16.4		16.4	16.4		61.0	61.0		61.0	61.0	61.0
Actuated g/C Ratio	0.18	0.18		0.18	0.18		0.68	0.68		0.68	0.68	0.68
Clearance Time (s)	6.2	6.2		6.2	6.2		6.4	6.4		6.4	6.4	6.4
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	207	314		172	285		633	1124		426	1121	1028
v/s Ratio Prot		0.07			0.03			c0.39			0.23	
v/s Ratio Perm	c0.12			0.04			0.04			0.25		0.07
v/c Ratio	0.68	0.39		0.23	0.17		0.06	0.57		0.37	0.34	0.10
Uniform Delay, d1	34.4	32.4		31.4	31.1		4.9	7.6		6.3	6.1	5.0
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	8.9	0.8		0.7	0.3		0.2	2.1		2.5	0.8	0.2
Delay (s)	43.2	33.2		32.1	31.3		5.0	9.7		8.7	6.9	5.2
Level of Service	D	C		C	C		A	A		A	A	A
Approach Delay (s)		38.3			31.5			9.5			6.9	
Approach LOS		D			C			A			A	

Intersection Summary				
HCM 2000 Control Delay	15.1	HCM 2000 Level of Service	B	
HCM 2000 Volume to Capacity ratio	0.59			
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.6	
Intersection Capacity Utilization	84.1%	ICU Level of Service	E	
Analysis Period (min)	15			
c Critical Lane Group				

Queues
1: Terry Fox Drive & Cope Drive

12/03/2019

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	155	62	70	238	11	578	225	729	181
v/c Ratio	0.91	0.16	0.27	0.48	0.03	0.64	0.55	0.62	0.17
Control Delay	85.9	25.2	33.4	9.3	13.9	22.1	14.0	14.0	1.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	85.9	25.2	33.4	9.3	13.9	22.1	14.0	14.0	1.7
Queue Length 50th (m)	28.9	7.6	11.2	3.8	1.1	81.9	16.2	76.9	0.0
Queue Length 95th (m)	#58.0	17.1	22.1	21.9	4.1	120.9	29.5	127.0	7.7
Internal Link Dist (m)		120.8		121.3		174.8		266.2	
Turn Bay Length (m)	37.5		45.0		60.0		50.0		150.0
Base Capacity (vph)	213	472	320	569	340	903	411	1175	1061
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.73	0.13	0.22	0.42	0.03	0.64	0.55	0.62	0.17

Intersection Summary

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

HCM Signalized Intersection Capacity Analysis
1: Terry Fox Drive & Cope Drive

12/03/2019

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	155	49	13	70	25	213	11	519	59	225	729	181
Future Volume (vph)	155	49	13	70	25	213	11	519	59	225	729	181
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	6.2	6.2		6.2	6.2		6.4	6.4		6.4	6.4	6.4
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.97		1.00	0.87		1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1695	1728		1586	1545		1695	1727		1695	1784	1517
Flt Permitted	0.45	1.00		0.72	1.00		0.37	1.00		0.27	1.00	1.00
Satd. Flow (perm)	798	1728		1196	1545		653	1727		488	1784	1517
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	155	49	13	70	25	213	11	519	59	225	729	181
RTOR Reduction (vph)	0	10	0	0	167	0	0	4	0	0	0	62
Lane Group Flow (vph)	155	52	0	70	71	0	11	574	0	225	729	119
Heavy Vehicles (%)	2%	2%	2%	9%	2%	2%	2%	4%	2%	2%	2%	2%
Turn Type	Perm	NA		Perm	NA		Perm	NA		pm+pt	NA	Perm
Protected Phases		4			8			2		1	6	
Permitted Phases	4			8			2			6		6
Actuated Green, G (s)	21.5	21.5		21.5	21.5		52.1	52.1		65.9	65.9	65.9
Effective Green, g (s)	21.5	21.5		21.5	21.5		52.1	52.1		65.9	65.9	65.9
Actuated g/C Ratio	0.22	0.22		0.22	0.22		0.52	0.52		0.66	0.66	0.66
Clearance Time (s)	6.2	6.2		6.2	6.2		6.4	6.4		6.4	6.4	6.4
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	171	371		257	332		340	899		410	1175	999
v/s Ratio Prot		0.03			0.05			0.33		0.04	c0.41	
v/s Ratio Perm	c0.19			0.06			0.02			0.32		0.08
v/c Ratio	0.91	0.14		0.27	0.21		0.03	0.64		0.55	0.62	0.12
Uniform Delay, d1	38.3	31.8		32.7	32.3		11.7	17.2		10.3	9.8	6.3
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	42.6	0.2		0.6	0.3		0.2	3.5		1.5	2.5	0.2
Delay (s)	80.9	31.9		33.3	32.6		11.8	20.7		11.8	12.3	6.6
Level of Service	F	C		C	C		B	C		B	B	A
Approach Delay (s)		66.9			32.8			20.5			11.3	
Approach LOS		E			C			C			B	

Intersection Summary				
HCM 2000 Control Delay	22.0	HCM 2000 Level of Service	C	
HCM 2000 Volume to Capacity ratio	0.74			
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	19.0	
Intersection Capacity Utilization	91.1%	ICU Level of Service	F	
Analysis Period (min)	15			
c Critical Lane Group				

Queues
1: Terry Fox Drive & Cope Drive

12/03/2019

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	150	62	40	178	13	491	144	559	119
v/c Ratio	0.73	0.18	0.16	0.41	0.03	0.42	0.28	0.48	0.11
Control Delay	51.0	24.9	27.4	9.1	7.2	9.2	9.2	10.1	1.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	51.0	24.9	27.4	9.1	7.2	9.2	9.2	10.1	1.9
Queue Length 50th (m)	23.1	7.5	5.5	2.7	0.7	32.4	8.6	39.6	0.0
Queue Length 95th (m)	38.7	15.5	12.2	16.7	3.2	66.0	22.8	79.6	6.4
Internal Link Dist (m)		120.8		121.3		174.8		266.2	
Turn Bay Length (m)	37.5		45.0		60.0		50.0		150.0
Base Capacity (vph)	359	598	433	628	468	1160	521	1171	1037
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.42	0.10	0.09	0.28	0.03	0.42	0.28	0.48	0.11

Intersection Summary

HCM Signalized Intersection Capacity Analysis
1: Terry Fox Drive & Cope Drive

12/03/2019

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	150	55	7	40	20	158	13	452	39	144	559	119
Future Volume (vph)	150	55	7	40	20	158	13	452	39	144	559	119
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	6.2	6.2		6.2	6.2		6.4	6.4		6.4	6.4	6.4
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.98		1.00	0.87		1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1695	1754		1695	1547		1695	1763		1695	1784	1517
Flt Permitted	0.59	1.00		0.72	1.00		0.40	1.00		0.44	1.00	1.00
Satd. Flow (perm)	1060	1754		1279	1547		713	1763		793	1784	1517
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	150	55	7	40	20	158	13	452	39	144	559	119
RTOR Reduction (vph)	0	6	0	0	127	0	0	3	0	0	0	41
Lane Group Flow (vph)	150	56	0	40	51	0	13	488	0	144	559	78
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	Perm
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		6
Actuated Green, G (s)	16.6	16.6		16.6	16.6		55.8	55.8		55.8	55.8	55.8
Effective Green, g (s)	16.6	16.6		16.6	16.6		55.8	55.8		55.8	55.8	55.8
Actuated g/C Ratio	0.20	0.20		0.20	0.20		0.66	0.66		0.66	0.66	0.66
Clearance Time (s)	6.2	6.2		6.2	6.2		6.4	6.4		6.4	6.4	6.4
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	207	342		249	302		468	1157		520	1171	995
v/s Ratio Prot		0.03			0.03			0.28			c0.31	
v/s Ratio Perm	c0.14			0.03			0.02			0.18		0.05
v/c Ratio	0.72	0.16		0.16	0.17		0.03	0.42		0.28	0.48	0.08
Uniform Delay, d1	32.1	28.4		28.4	28.5		5.1	6.9		6.1	7.3	5.3
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	11.9	0.2		0.3	0.3		0.1	1.1		1.3	1.4	0.2
Delay (s)	43.9	28.7		28.7	28.7		5.2	8.1		7.5	8.7	5.4
Level of Service	D	C		C	C		A	A		A	A	A
Approach Delay (s)		39.5			28.7			8.0			8.0	
Approach LOS		D			C			A			A	

Intersection Summary			
HCM 2000 Control Delay	14.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	85.0	Sum of lost time (s)	12.6
Intersection Capacity Utilization	77.2%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

2020 Total Future Conditions

Queues
1: Terry Fox Drive & Cope Drive

12/03/2019

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	146	136	40	148	37	645	201	380	156
v/c Ratio	0.69	0.41	0.23	0.38	0.06	0.58	0.48	0.34	0.15
Control Delay	50.2	30.5	31.9	11.3	6.8	11.5	13.4	8.2	1.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	50.2	30.5	31.9	11.3	6.8	11.5	13.4	8.2	1.6
Queue Length 50th (m)	23.8	18.4	5.9	4.2	1.9	51.0	14.5	24.2	0.0
Queue Length 95th (m)	39.6	31.2	13.4	17.8	6.5	103.2	40.8	49.8	7.0
Internal Link Dist (m)		106.2		121.3		174.8		253.0	
Turn Bay Length (m)	37.5		45.0		60.0		50.0		150.0
Base Capacity (vph)	338	524	281	550	628	1120	421	1115	1073
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.43	0.26	0.14	0.27	0.06	0.58	0.48	0.34	0.15

Intersection Summary

HCM Signalized Intersection Capacity Analysis
1: Terry Fox Drive & Cope Drive

12/03/2019

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	146	106	30	40	29	119	37	599	46	201	380	156
Future Volume (vph)	146	106	30	40	29	119	37	599	46	201	380	156
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	6.2	6.2		6.2	6.2		6.4	6.4		6.4	6.4	6.4
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.97		1.00	0.88		1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1662	1725		1340	1569		1695	1659		1695	1655	1517
Flt Permitted	0.65	1.00		0.67	1.00		0.52	1.00		0.35	1.00	1.00
Satd. Flow (perm)	1135	1725		945	1569		934	1659		625	1655	1517
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	146	106	30	40	29	119	37	599	46	201	380	156
RTOR Reduction (vph)	0	13	0	0	97	0	0	2	0	0	0	51
Lane Group Flow (vph)	146	123	0	40	51	0	37	643	0	201	380	105
Heavy Vehicles (%)	4%	2%	2%	29%	2%	2%	2%	9%	2%	2%	10%	2%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	Perm
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		6
Actuated Green, G (s)	16.8	16.8		16.8	16.8		60.6	60.6		60.6	60.6	60.6
Effective Green, g (s)	16.8	16.8		16.8	16.8		60.6	60.6		60.6	60.6	60.6
Actuated g/C Ratio	0.19	0.19		0.19	0.19		0.67	0.67		0.67	0.67	0.67
Clearance Time (s)	6.2	6.2		6.2	6.2		6.4	6.4		6.4	6.4	6.4
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	211	322		176	292		628	1117		420	1114	1021
v/s Ratio Prot		0.07			0.03			c0.39			0.23	
v/s Ratio Perm	c0.13			0.04			0.04			0.32		0.07
v/c Ratio	0.69	0.38		0.23	0.18		0.06	0.58		0.48	0.34	0.10
Uniform Delay, d1	34.2	32.1		31.1	30.8		5.0	7.8		7.1	6.2	5.2
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	9.4	0.8		0.7	0.3		0.2	2.2		3.9	0.8	0.2
Delay (s)	43.6	32.8		31.7	31.1		5.2	10.0		11.0	7.1	5.4
Level of Service	D	C		C	C		A	A		B	A	A
Approach Delay (s)		38.4			31.2			9.7			7.8	
Approach LOS		D			C			A			A	

Intersection Summary				
HCM 2000 Control Delay	15.4	HCM 2000 Level of Service	B	
HCM 2000 Volume to Capacity ratio	0.60			
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.6	
Intersection Capacity Utilization	86.9%	ICU Level of Service	E	
Analysis Period (min)	15			
c Critical Lane Group				

HCM Unsignalized Intersection Capacity Analysis
2: Cope Drive & Site Access 1

12/03/2019

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	1	276	2	221	6	0
Future Volume (Veh/h)	1	276	2	221	6	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	1	276	2	221	6	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)			130			
pX, platoon unblocked						
vC, conflicting volume	223				390	112
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	223				390	112
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				99	100
cM capacity (veh/h)	1346				613	940

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	277	223	6
Volume Left	1	0	6
Volume Right	0	221	0
cSH	1346	1700	613
Volume to Capacity	0.00	0.13	0.01
Queue Length 95th (m)	0.0	0.0	0.2
Control Delay (s)	0.0	0.0	10.9
Lane LOS	A		B
Approach Delay (s)	0.0	0.0	10.9
Approach LOS			B

Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	26.2%	ICU Level of Service	A
Analysis Period (min)	15		

Queues
1: Terry Fox Drive & Cope Drive

12/05/2019

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	179	77	70	243	12	578	225	720	181
v/c Ratio	0.93	0.18	0.30	0.46	0.04	0.69	0.59	0.69	0.18
Control Delay	87.2	22.6	33.4	9.1	14.1	24.6	16.3	16.9	1.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	87.2	22.6	33.4	9.1	14.1	24.6	16.3	16.9	1.7
Queue Length 50th (m)	32.6	8.2	10.7	4.4	1.2	83.8	18.3	89.9	0.0
Queue Length 95th (m)	#69.7	19.5	22.7	23.1	4.2	124.9	29.5	134.9	7.7
Internal Link Dist (m)		106.2		121.3		174.8		222.1	
Turn Bay Length (m)	37.5		45.0		60.0		50.0		150.0
Base Capacity (vph)	216	472	267	571	319	838	380	1051	1030
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.83	0.16	0.26	0.43	0.04	0.69	0.59	0.69	0.18

Intersection Summary

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

HCM Signalized Intersection Capacity Analysis
1: Terry Fox Drive & Cope Drive 12/05/2019

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	179	54	23	70	30	213	12	519	59	225	720	181
Future Volume (vph)	179	54	23	70	30	213	12	519	59	225	720	181
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	6.2	6.2		6.2	6.2		6.4	6.4		6.4	6.4	6.4
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.96		1.00	0.87		1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1662	1704		1340	1550		1695	1655		1695	1655	1517
Flt Permitted	0.46	1.00		0.71	1.00		0.35	1.00		0.26	1.00	1.00
Satd. Flow (perm)	809	1704		997	1550		633	1655		469	1655	1517
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	179	54	23	70	30	213	12	519	59	225	720	181
RTOR Reduction (vph)	0	16	0	0	162	0	0	4	0	0	0	66
Lane Group Flow (vph)	179	61	0	70	81	0	12	574	0	225	720	115
Heavy Vehicles (%)	4%	2%	2%	29%	2%	2%	2%	9%	2%	2%	10%	2%
Turn Type	Perm	NA		Perm	NA		Perm	NA		pm+pt	NA	Perm
Protected Phases		4			8			2		1	6	
Permitted Phases	4			8			2			6		6
Actuated Green, G (s)	23.8	23.8		23.8	23.8		50.5	50.5		63.6	63.6	63.6
Effective Green, g (s)	23.8	23.8		23.8	23.8		50.5	50.5		63.6	63.6	63.6
Actuated g/C Ratio	0.24	0.24		0.24	0.24		0.50	0.50		0.64	0.64	0.64
Clearance Time (s)	6.2	6.2		6.2	6.2		6.4	6.4		6.4	6.4	6.4
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	192	405		237	368		319	835		380	1052	964
v/s Ratio Prot		0.04			0.05			0.35		0.04	c0.44	
v/s Ratio Perm	c0.22			0.07			0.02			0.34		0.08
v/c Ratio	0.93	0.15		0.30	0.22		0.04	0.69		0.59	0.68	0.12
Uniform Delay, d1	37.3	30.1		31.2	30.6		12.5	18.8		11.5	11.7	7.2
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	45.8	0.2		0.7	0.3		0.2	4.6		2.5	3.6	0.3
Delay (s)	83.1	30.3		31.9	30.9		12.7	23.4		13.9	15.3	7.4
Level of Service	F	C		C	C		B	C		B	B	A
Approach Delay (s)		67.2			31.2			23.1			13.8	
Approach LOS		E			C			C			B	

Intersection Summary				
HCM 2000 Control Delay	24.6	HCM 2000 Level of Service	C	
HCM 2000 Volume to Capacity ratio	0.81			
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	19.0	
Intersection Capacity Utilization	103.7%	ICU Level of Service	G	
Analysis Period (min)	15			
c Critical Lane Group				

HCM Unsignalized Intersection Capacity Analysis
2: Cope Drive & Site Access 1 12/05/2019

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	2	217	215	7	39	4
Future Volume (Veh/h)	2	217	215	7	39	4
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	2	217	215	7	39	4
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)			130			
pX, platoon unblocked						
vC, conflicting volume	222				440	218
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	222				440	218
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				93	100
cM capacity (veh/h)	1347				574	821

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	219	222	43
Volume Left	2	0	39
Volume Right	0	7	4
cSH	1347	1700	591
Volume to Capacity	0.00	0.13	0.07
Queue Length 95th (m)	0.0	0.0	1.8
Control Delay (s)	0.1	0.0	11.6
Lane LOS	A		B
Approach Delay (s)	0.1	0.0	11.6
Approach LOS			B

Intersection Summary				
Average Delay	1.1			
Intersection Capacity Utilization	23.7%	ICU Level of Service	A	
Analysis Period (min)	15			

Queues
1: Terry Fox Drive & Cope Drive 12/03/2019

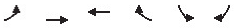
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	176	79	40	184	14	491	144	548	119
v/c Ratio	0.77	0.20	0.18	0.40	0.03	0.47	0.29	0.52	0.12
Control Delay	52.1	20.4	26.1	8.5	8.4	11.2	10.8	12.3	2.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	52.1	20.4	26.1	8.5	8.4	11.2	10.8	12.3	2.2
Queue Length 50th (m)	26.9	7.9	5.3	3.4	0.8	36.6	9.5	44.0	0.0
Queue Length 95th (m)	43.5	16.5	11.9	16.7	3.7	75.3	25.3	89.6	7.0
Internal Link Dist (m)		106.2		121.3		174.8		218.5	
Turn Bay Length (m)	37.5		45.0		60.0		50.0		150.0
Base Capacity (vph)	352	595	337	630	447	1051	492	1046	1003
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.50	0.13	0.12	0.29	0.03	0.47	0.29	0.52	0.12

Intersection Summary

HCM Signalized Intersection Capacity Analysis
1: Terry Fox Drive & Cope Drive 12/03/2019

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	176	60	19	40	26	158	14	452	39	144	548	119
Future Volume (vph)	176	60	19	40	26	158	14	452	39	144	548	119
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	6.2	6.2		6.2	6.2		6.4	6.4		6.4	6.4	6.4
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.96		1.00	0.87		1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1662	1720		1340	1554		1695	1658		1695	1655	1517
Flt Permitted	0.59	1.00		0.71	1.00		0.40	1.00		0.44	1.00	1.00
Satd. Flow (perm)	1040	1720		996	1554		709	1658		779	1655	1517
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	176	60	19	40	26	158	14	452	39	144	548	119
RTOR Reduction (vph)	0	15	0	0	123	0	0	3	0	0	0	44
Lane Group Flow (vph)	176	64	0	40	61	0	14	488	0	144	548	75
Heavy Vehicles (%)	4%	2%	2%	29%	2%	2%	2%	9%	2%	2%	10%	2%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	Perm
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		6
Actuated Green, G (s)	18.6	18.6		18.6	18.6		53.8	53.8		53.8	53.8	53.8
Effective Green, g (s)	18.6	18.6		18.6	18.6		53.8	53.8		53.8	53.8	53.8
Actuated g/C Ratio	0.22	0.22		0.22	0.22		0.63	0.63		0.63	0.63	0.63
Clearance Time (s)	6.2	6.2		6.2	6.2		6.4	6.4		6.4	6.4	6.4
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	227	376		217	340		448	1049		493	1047	960
v/s Ratio Prot		0.04			0.04			0.29			c0.33	
v/s Ratio Perm	c0.17			0.04			0.02			0.18		0.05
v/c Ratio	0.78	0.17		0.18	0.18		0.03	0.47		0.29	0.52	0.08
Uniform Delay, d1	31.2	26.9		27.0	27.0		5.8	8.1		7.0	8.6	6.0
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	15.2	0.2		0.4	0.3		0.1	1.5		1.5	1.9	0.2
Delay (s)	46.4	27.2		27.4	27.2		6.0	9.6		8.5	10.4	6.2
Level of Service	D	C		C	C		A	A		A	B	A
Approach Delay (s)		40.4			27.3			9.5			9.5	
Approach LOS		D			C			A			A	

Intersection Summary				
HCM 2000 Control Delay	16.1	HCM 2000 Level of Service	B	
HCM 2000 Volume to Capacity ratio	0.59			
Actuated Cycle Length (s)	85.0	Sum of lost time (s)	12.6	
Intersection Capacity Utilization	79.1%	ICU Level of Service	D	
Analysis Period (min)	15			
c Critical Lane Group				



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	3	212	150	9	43	4
Future Volume (Veh/h)	3	212	150	9	43	4
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	3	212	150	9	43	4
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)			130			
pX, platoon unblocked						
vC, conflicting volume	159				372	154
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	159				372	154
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				93	100
cM capacity (veh/h)	1420				627	891

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	215	159	47
Volume Left	3	0	43
Volume Right	0	9	4
cSH	1420	1700	643
Volume to Capacity	0.00	0.09	0.07
Queue Length 95th (m)	0.0	0.0	1.8
Control Delay (s)	0.1	0.0	11.0
Lane LOS	A		B
Approach Delay (s)	0.1	0.0	11.0
Approach LOS			B

Intersection Summary			
Average Delay	1.3		
Intersection Capacity Utilization	24.3%	ICU Level of Service	A
Analysis Period (min)	15		

2025 Ultimate Conditions

Queues
1: Terry Fox Drive & Cope Drive

12/03/2019

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	148	138	47	159	38	748	233	440	159
v/c Ratio	0.71	0.40	0.26	0.39	0.07	0.67	0.68	0.40	0.15
Control Delay	51.7	29.8	32.3	10.9	7.2	14.2	24.4	9.1	1.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	51.7	29.8	32.3	10.9	7.2	14.2	24.4	9.1	1.7
Queue Length 50th (m)	24.3	18.4	7.0	4.4	2.0	66.9	21.1	29.8	0.0
Queue Length 95th (m)	39.9	31.0	14.9	17.9	6.9	140.3	#74.0	61.7	7.3
Internal Link Dist (m)		106.2		121.3		174.8		218.1	
Turn Bay Length (m)	37.5		45.0		60.0		50.0		150.0
Base Capacity (vph)	325	525	281	557	572	1113	343	1107	1067
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.46	0.26	0.17	0.29	0.07	0.67	0.68	0.40	0.15

Intersection Summary

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

HCM Signalized Intersection Capacity Analysis
1: Terry Fox Drive & Cope Drive

12/03/2019

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	148	107	31	47	30	129	38	697	51	233	440	159
Future Volume (vph)	148	107	31	47	30	129	38	697	51	233	440	159
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	6.2	6.2		6.2	6.2		6.4	6.4		6.4	6.4	6.4
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.97		1.00	0.88		1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1662	1724		1340	1567		1695	1660		1695	1655	1517
Flt Permitted	0.62	1.00		0.67	1.00		0.48	1.00		0.29	1.00	1.00
Satd. Flow (perm)	1091	1724		944	1567		857	1660		513	1655	1517
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	148	107	31	47	30	129	38	697	51	233	440	159
RTOR Reduction (vph)	0	14	0	0	104	0	0	2	0	0	0	53
Lane Group Flow (vph)	148	124	0	47	55	0	38	746	0	233	440	106
Heavy Vehicles (%)	4%	2%	2%	29%	2%	2%	2%	9%	2%	2%	10%	2%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	Perm
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		6
Actuated Green, G (s)	17.2	17.2		17.2	17.2		60.2	60.2		60.2	60.2	60.2
Effective Green, g (s)	17.2	17.2		17.2	17.2		60.2	60.2		60.2	60.2	60.2
Actuated g/C Ratio	0.19	0.19		0.19	0.19		0.67	0.67		0.67	0.67	0.67
Clearance Time (s)	6.2	6.2		6.2	6.2		6.4	6.4		6.4	6.4	6.4
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	208	329		180	299		573	1110		343	1107	1014
v/s Ratio Prot		0.07			0.03			0.45			0.27	
v/s Ratio Perm	c0.14			0.05			0.04			c0.45		0.07
v/c Ratio	0.71	0.38		0.26	0.18		0.07	0.67		0.68	0.40	0.10
Uniform Delay, d1	34.1	31.7		31.0	30.5		5.2	9.0		9.0	6.7	5.3
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	10.9	0.7		0.8	0.3		0.2	3.2		10.4	1.1	0.2
Delay (s)	45.0	32.5		31.8	30.8		5.4	12.2		19.4	7.8	5.5
Level of Service	D	C		C	C		A	B		B	A	A
Approach Delay (s)		38.9			31.0			11.9			10.6	
Approach LOS		D			C			B			B	

Intersection Summary

HCM 2000 Control Delay	16.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.6
Intersection Capacity Utilization	95.3%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
2: Cope Drive & Site Access 1

12/03/2019

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	1	280	2	225	6	0
Future Volume (Veh/h)	1	280	2	225	6	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	1	280	2	225	6	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)			130			
pX, platoon unblocked						
vC, conflicting volume	227				396	114
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	227				396	114
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				99	100
cM capacity (veh/h)	1341				608	938

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	281	227	6
Volume Left	1	0	6
Volume Right	0	225	0
cSH	1341	1700	608
Volume to Capacity	0.00	0.13	0.01
Queue Length 95th (m)	0.0	0.0	0.2
Control Delay (s)	0.0	0.0	11.0
Lane LOS	A		B
Approach Delay (s)	0.0	0.0	11.0
Approach LOS			B

Intersection Summary

Average Delay	0.1		
Intersection Capacity Utilization	26.4%	ICU Level of Service	A
Analysis Period (min)	15		

Queues
1: Terry Fox Drive & Cope Drive

12/05/2019

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	188	81	79	263	13	673	284	831	190
v/c Ratio	0.95	0.18	0.31	0.46	0.06	0.83	0.97	0.81	0.19
Control Delay	90.8	22.5	33.4	8.7	14.6	32.9	62.4	23.2	1.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	90.8	22.5	33.4	8.7	14.6	32.9	62.4	23.2	1.7
Queue Length 50th (m)	35.2	8.8	12.2	4.5	1.3	107.5	~26.5	118.0	0.0
Queue Length 95th (m)	#75.8	20.3	25.1	24.2	4.7	#174.5	#68.8	#180.9	7.8
Internal Link Dist (m)		106.2		121.3		174.8		202.0	
Turn Bay Length (m)	37.5		45.0		60.0		50.0		150.0
Base Capacity (vph)	208	472	266	584	224	808	294	1024	1011
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.90	0.17	0.30	0.45	0.06	0.83	0.97	0.81	0.19

Intersection Summary

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

HCM Signalized Intersection Capacity Analysis
1: Terry Fox Drive & Cope Drive 12/05/2019

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	188	57	24	79	31	232	13	606	67	284	831	190
Future Volume (vph)	188	57	24	79	31	232	13	606	67	284	831	190
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	6.2	6.2		6.2	6.2		6.4	6.4		6.4	6.4	6.4
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.96		1.00	0.87		1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1662	1705		1340	1548		1695	1655		1695	1655	1517
Flt Permitted	0.44	1.00		0.70	1.00		0.26	1.00		0.18	1.00	1.00
Satd. Flow (perm)	776	1705		994	1548		462	1655		323	1655	1517
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	188	57	24	79	31	232	13	606	67	284	831	190
RTOR Reduction (vph)	0	16	0	0	173	0	0	4	0	0	0	72
Lane Group Flow (vph)	188	65	0	79	90	0	13	669	0	284	831	118
Heavy Vehicles (%)	4%	2%	2%	29%	2%	2%	2%	9%	2%	2%	10%	2%
Turn Type	Perm	NA		Perm	NA		Perm	NA		pm+pt	NA	Perm
Protected Phases		4			8			2		1	6	
Permitted Phases	4			8			2			6		6
Actuated Green, G (s)	25.5	25.5		25.5	25.5		48.6	48.6		61.9	61.9	61.9
Effective Green, g (s)	25.5	25.5		25.5	25.5		48.6	48.6		61.9	61.9	61.9
Actuated g/C Ratio	0.26	0.26		0.26	0.26		0.49	0.49		0.62	0.62	0.62
Clearance Time (s)	6.2	6.2		6.2	6.2		6.4	6.4		6.4	6.4	6.4
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	197	434		253	394		224	804		294	1024	939
v/s Ratio Prot		0.04			0.06			0.40		0.07	c0.50	
v/s Ratio Perm	c0.24			0.08			0.03			c0.53		0.08
v/c Ratio	0.95	0.15		0.31	0.23		0.06	0.83		0.97	0.81	0.13
Uniform Delay, d1	36.7	28.9		30.2	29.5		13.6	22.2		18.4	14.6	7.9
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	50.7	0.2		0.7	0.3		0.5	9.8		42.8	7.0	0.3
Delay (s)	87.4	29.0		30.9	29.8		14.1	32.0		61.2	21.6	8.1
Level of Service	F	C		C	C		B	C		E	C	A
Approach Delay (s)		69.8			30.0			31.6			28.2	
Approach LOS		E			C			C			C	

Intersection Summary				
HCM 2000 Control Delay	33.7	HCM 2000 Level of Service	C	
HCM 2000 Volume to Capacity ratio	1.02			
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	19.0	
Intersection Capacity Utilization	111.7%	ICU Level of Service	H	
Analysis Period (min)	15			
c Critical Lane Group				

HCM Unsignalized Intersection Capacity Analysis
2: Cope Drive & Site Access 2 12/05/2019

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	2	230	225	7	39	4
Future Volume (Veh/h)	2	230	225	7	39	4
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	2	230	225	7	39	4
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)			130			
pX, platoon unblocked						
vC, conflicting volume	232				462	228
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	232				462	228
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				93	100
cM capacity (veh/h)	1336				557	811

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	232	232	43
Volume Left	2	0	39
Volume Right	0	7	4
cSH	1336	1700	573
Volume to Capacity	0.00	0.14	0.07
Queue Length 95th (m)	0.0	0.0	1.8
Control Delay (s)	0.1	0.0	11.8
Lane LOS	A		B
Approach Delay (s)	0.1	0.0	11.8
Approach LOS			B

Intersection Summary			
Average Delay	1.0		
Intersection Capacity Utilization	24.5%	ICU Level of Service	A
Analysis Period (min)	15		

Queues
1: Terry Fox Drive & Cope Drive 12/03/2019

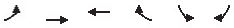
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	192	85	43	201	16	541	157	606	132
v/c Ratio	0.80	0.20	0.18	0.40	0.04	0.53	0.37	0.60	0.13
Control Delay	53.7	19.1	24.7	7.8	9.5	13.3	13.4	14.9	2.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	53.7	19.1	24.7	7.8	9.5	13.3	13.4	14.9	2.3
Queue Length 50th (m)	29.3	8.3	5.6	3.5	1.0	45.4	11.6	55.0	0.0
Queue Length 95th (m)	46.8	16.9	12.1	16.9	4.3	91.9	31.2	111.2	7.8
Internal Link Dist (m)		106.2		121.3		174.8		209.6	
Turn Bay Length (m)	37.5		45.0		60.0		50.0		150.0
Base Capacity (vph)	338	596	335	640	381	1018	430	1013	980
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.57	0.14	0.13	0.31	0.04	0.53	0.37	0.60	0.13

Intersection Summary

HCM Signalized Intersection Capacity Analysis
1: Terry Fox Drive & Cope Drive 12/03/2019

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	192	65	20	43	28	173	16	499	42	157	606	132
Future Volume (vph)	192	65	20	43	28	173	16	499	42	157	606	132
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	6.2	6.2		6.2	6.2		6.4	6.4		6.4	6.4	6.4
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.96		1.00	0.87		1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1662	1721		1340	1554		1695	1659		1695	1655	1517
Flt Permitted	0.57	1.00		0.70	1.00		0.35	1.00		0.39	1.00	1.00
Satd. Flow (perm)	1000	1721		990	1554		623	1659		702	1655	1517
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	192	65	20	43	28	173	16	499	42	157	606	132
RTOR Reduction (vph)	0	15	0	0	132	0	0	3	0	0	0	51
Lane Group Flow (vph)	192	70	0	43	69	0	16	538	0	157	606	81
Heavy Vehicles (%)	4%	2%	2%	29%	2%	2%	2%	9%	2%	2%	10%	2%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	Perm
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		6
Actuated Green, G (s)	20.3	20.3		20.3	20.3		52.1	52.1		52.1	52.1	52.1
Effective Green, g (s)	20.3	20.3		20.3	20.3		52.1	52.1		52.1	52.1	52.1
Actuated g/C Ratio	0.24	0.24		0.24	0.24		0.61	0.61		0.61	0.61	0.61
Clearance Time (s)	6.2	6.2		6.2	6.2		6.4	6.4		6.4	6.4	6.4
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	238	411		236	371		381	1016		430	1014	929
v/s Ratio Prot		0.04			0.04			0.32			c0.37	
v/s Ratio Perm	c0.19			0.04			0.03			0.22		0.05
v/c Ratio	0.81	0.17		0.18	0.19		0.04	0.53		0.37	0.60	0.09
Uniform Delay, d1	30.5	25.7		25.7	25.8		6.5	9.4		8.2	10.0	6.7
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	17.8	0.2		0.4	0.2		0.2	2.0		2.4	2.6	0.2
Delay (s)	48.3	25.9		26.1	26.0		6.7	11.4		10.6	12.6	6.9
Level of Service	D	C		C	C		A	B		B	B	A
Approach Delay (s)		41.4			26.0			11.3			11.4	
Approach LOS		D			C			B			B	

Intersection Summary				
HCM 2000 Control Delay	17.4	HCM 2000 Level of Service	B	
HCM 2000 Volume to Capacity ratio	0.66			
Actuated Cycle Length (s)	85.0	Sum of lost time (s)	12.6	
Intersection Capacity Utilization	84.6%	ICU Level of Service	E	
Analysis Period (min)	15			
c Critical Lane Group				



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	3	234	167	9	43	4
Future Volume (Veh/h)	3	234	167	9	43	4
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	3	234	167	9	43	4
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)			130			
pX, platoon unblocked						
vC, conflicting volume	176				412	172
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	176				412	172
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				93	100
cM capacity (veh/h)	1400				595	872

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	237	176	47
Volume Left	3	0	43
Volume Right	0	9	4
cSH	1400	1700	612
Volume to Capacity	0.00	0.10	0.08
Queue Length 95th (m)	0.0	0.0	1.9
Control Delay (s)	0.1	0.0	11.4
Lane LOS	A		B
Approach Delay (s)	0.1	0.0	11.4
Approach LOS			B

Intersection Summary			
Average Delay		1.2	
Intersection Capacity Utilization		25.5%	ICU Level of Service A
Analysis Period (min)		15	

2025 Ultimate Conditions – Mitigation Measures

Queues
1: Terry Fox Drive & Cope Drive

12/05/2019

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	188	81	79	263	13	673	284	831	190
v/c Ratio	0.95	0.18	0.31	0.46	0.06	0.87	0.93	0.81	0.19
Control Delay	90.8	22.5	33.4	8.7	15.7	37.7	52.2	23.2	1.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	90.8	22.5	33.4	8.7	15.7	37.7	52.2	23.2	1.7
Queue Length 50th (m)	35.2	8.8	12.2	4.5	1.4	112.4	~24.3	118.0	0.0
Queue Length 95th (m)	#75.8	20.3	25.1	24.2	4.9	#181.6	#66.3	#180.9	7.8
Internal Link Dist (m)		106.2		121.3		174.8		202.0	
Turn Bay Length (m)	37.5		45.0		60.0		50.0		150.0
Base Capacity (vph)	208	472	266	584	224	774	305	1024	1011
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.90	0.17	0.30	0.45	0.06	0.87	0.93	0.81	0.19

Intersection Summary

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

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

HCM Signalized Intersection Capacity Analysis
1: Terry Fox Drive & Cope Drive

12/05/2019

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	188	57	24	79	31	232	13	606	67	284	831	190
Future Volume (vph)	188	57	24	79	31	232	13	606	67	284	831	190
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	6.2	6.2		6.2	6.2		6.4	6.4		6.4	6.4	6.4
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.96		1.00	0.87		1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1662	1705		1340	1548		1695	1655		1695	1655	1517
Flt Permitted	0.44	1.00		0.70	1.00		0.27	1.00		0.16	1.00	1.00
Satd. Flow (perm)	776	1705		994	1548		482	1655		291	1655	1517
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	188	57	24	79	31	232	13	606	67	284	831	190
RTOR Reduction (vph)	0	16	0	0	173	0	0	4	0	0	0	72
Lane Group Flow (vph)	188	65	0	79	90	0	13	669	0	284	831	118
Heavy Vehicles (%)	4%	2%	2%	29%	2%	2%	2%	9%	2%	2%	10%	2%
Turn Type	Perm	NA		Perm	NA		Perm	NA		pm+pt	NA	Perm
Protected Phases		4			8			2		1	6	
Permitted Phases	4			8			2			6		6
Actuated Green, G (s)	25.5	25.5		25.5	25.5		46.6	46.6		61.9	61.9	61.9
Effective Green, g (s)	25.5	25.5		25.5	25.5		46.6	46.6		61.9	61.9	61.9
Actuated g/C Ratio	0.26	0.26		0.26	0.26		0.47	0.47		0.62	0.62	0.62
Clearance Time (s)	6.2	6.2		6.2	6.2		6.4	6.4		6.4	6.4	6.4
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	197	434		253	394		224	771		305	1024	939
v/s Ratio Prot		0.04			0.06			0.40		0.08	c0.50	
v/s Ratio Perm	c0.24			0.08			0.03			c0.49		0.08
v/c Ratio	0.95	0.15		0.31	0.23		0.06	0.87		0.93	0.81	0.13
Uniform Delay, d1	36.7	28.9		30.2	29.5		14.7	23.9		17.0	14.6	7.9
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	50.7	0.2		0.7	0.3		0.5	12.7		33.9	7.0	0.3
Delay (s)	87.4	29.0		30.9	29.8		15.1	36.6		50.9	21.6	8.1
Level of Service	F	C		C	C		B	D		D	C	A
Approach Delay (s)		69.8			30.0			36.2			26.0	
Approach LOS		E			C			D			C	

Intersection Summary

HCM 2000 Control Delay	33.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.99		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	19.0
Intersection Capacity Utilization	111.7%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
2: Cope Drive & Site Access 1

12/05/2019

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	2	230	225	7	39	4
Future Volume (Veh/h)	2	230	225	7	39	4
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	2	230	225	7	39	4
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)			130			
pX, platoon unblocked						
vC, conflicting volume	232				462	228
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	232				462	228
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				93	100
cM capacity (veh/h)	1336				557	811

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	232	232	43
Volume Left	2	0	39
Volume Right	0	7	4
cSH	1336	1700	573
Volume to Capacity	0.00	0.14	0.07
Queue Length 95th (m)	0.0	0.0	1.8
Control Delay (s)	0.1	0.0	11.8
Lane LOS	A		B
Approach Delay (s)	0.1	0.0	11.8
Approach LOS			B

Intersection Summary

Average Delay	1.0		
Intersection Capacity Utilization	24.5%	ICU Level of Service	A
Analysis Period (min)	15		

Appendix G SIGNAL WARRANTS

Intersection:	Site Access 1 at Cope Drive
Major Street:	East-West — Lanes: 1
Minor Street:	North-South — Lanes: 1
Urban/Rural:	Urban
Legs:	3
New/Existing Intersection:	New
Scenario:	2025 Ultimate

	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
AmPHV	1	280	0	0	225	2	6	0	0	0	0	1029
PmPHV	2	230	0	0	225	7	39	0	4	0	0	639
AHV	1	128	0	0	113	2	11	0	1	0	0	417

Justification #7

Justification	Description	Minimum Requirement		Minimum		Compliance		Entire %	Signal
		1 Lane Highway		2 or More Lanes		Sectional			
		Free Flow	Restr. Flow	Free Flow	Restr. Flow	Numerical	%		
1. Minimum Vehicular Volume	A. Vehicle volume, all approaches (average hour)	720	1080	900	1350	794	73%	73%	No
	B. Vehicle volume, along minor streets (average hour)	180	255	180	255	365	143%		
2. Delay to Cross Traffic	A. Vehicle volumes, major street (average hour)	480	420	900	1350	429	102%	102%	No
	B. Combined vehicle and pedestrian volume crossing artery from minor streets (average hour)	75	112.5	180	255	128	114%		

Notes:

1. Refer to OTM Book 12, pg 92, March 2012
2. Lowest section percentage governs justification
3. Average hourly volumes estiamted from peak hour volumes, AHV = PHV/2 or (AM + PM) / 4