

# TIA ANALYSIS REPORT (STEP 4): RESIDENTIAL DEVELOPMENT AT 147 LANGSTAFF DRIVE



Project No.: OCP-19-0025

Prepared for:

Ms. Alison Stirling  
The Stirling Group

Prepared by:

McIntosh Perry Consulting Engineers Ltd.  
115 Walgreen Road  
Carp, ON  
K0A 1L0

## TABLE OF CONTENTS

<b>1.0</b>	<b>SCREENING FORM .....</b>	<b>1</b>
1.1	<i>Trip Generation Triggers .....</i>	1
1.2	<i>Location Triggers .....</i>	1
1.3	<i>Safety Triggers.....</i>	1
<b>2.0</b>	<b>DESCRIPTION OF PROPOSED DEVELOPMENT .....</b>	<b>2</b>
<b>3.0</b>	<b>EXISTING CONDITIONS .....</b>	<b>3</b>
3.1	<i>Roadways .....</i>	3
3.2	<i>Study Area Intersections .....</i>	3
3.3	<i>Existing Pedestrian and Cycling Facilities.....</i>	5
3.4	<i>Existing Transit System .....</i>	6
3.5	<i>Existing Driveways .....</i>	7
3.6	<i>Collision History .....</i>	8
3.7	<i>Traffic Volume .....</i>	10
<b>4.0</b>	<b>PLANNED CONDITIONS.....</b>	<b>12</b>
<b>5.0</b>	<b>STUDY AREA .....</b>	<b>12</b>
<b>6.0</b>	<b>TIME PERIODS .....</b>	<b>12</b>
<b>7.0</b>	<b>HORIZON YEARS .....</b>	<b>12</b>
<b>8.0</b>	<b>EXEMPTIONS REVIEW.....</b>	<b>13</b>
<b>9.0</b>	<b>DEVELOPMENT GENERATED TRAFFIC.....</b>	<b>13</b>
9.1	<i>Trip Generation.....</i>	13
9.1.1	<i>Trip Generation Rates .....</i>	13
9.1.2	<i>Mode Shares .....</i>	14
9.2	<i>Trip Distribution.....</i>	16
9.3	<i>Trip Assignment.....</i>	19
<b>10.0</b>	<b>BACKGROUND NETWORK TRAFFIC.....</b>	<b>21</b>
10.1	<i>Changes to the Background Transportation Network .....</i>	21
10.2	<i>General Background Growth Rates .....</i>	21
10.3	<i>Other Area Development .....</i>	21

<b>11.0 DEMAND RATIONALIZATION .....</b>	<b>21</b>
11.1 Intersection Capacity Analysis Methodology .....	21
11.2 Description of Capacity Issue (s).....	22
11.3 Adjustment to Development Generated Demands.....	28
11.4 Adjustments to Background Network Demands .....	28
<b>12.0 DEVELOPMENT DESIGN .....</b>	<b>28</b>
12.1 Design for Sustainable Modes.....	28
12.2 New Street Networks .....	29
<b>13.0 BOUNDARY STREETS .....</b>	<b>30</b>
13.1 Mobility.....	30
13.1.1 Pedestrian Level of Service (PLOS).....	30
13.1.2 Bicycle Level of Service (BLOS) .....	30
13.1.3 Transit Level of Service (TLOS).....	30
13.1.4 Truck Level of Service (TkLOS) .....	31
13.1.5 Vehicular Level of Service (LOS).....	31
13.2 Road Safety .....	31
13.3 Neighborhood Traffic Management .....	31
<b>14.0 TRANSPORTATION DEMAND MANAGEMENT .....</b>	<b>32</b>
14.1 Context for TDM .....	32
14.2 Need and Opportunity .....	32
14.3 TDM Program .....	32
<b>15.0 ACCESS INTERSECTIONS .....</b>	<b>33</b>
15.1 Location and Design of Access .....	33
15.2 Intersection Control .....	33
15.3 Intersection Design .....	33
<b>16.0 TRANSIT.....</b>	<b>33</b>
16.1 Route Capacity .....	33
16.2 Transit Priority.....	34
<b>17.0 INTERSECTION DESIGN .....</b>	<b>34</b>

17.1	Intersection Control .....	34
17.2	Intersection Design .....	34
17.2.1	Intersection Pedestrian Level of Service (PLOS) .....	34
17.2.2	Intersection Bicycle Level of Service (BLOS) .....	34
17.2.3	Intersection Transit Level of Service (TLOS) .....	35
17.2.4	Intersection Truck Level of Service (TkLOS).....	35
<b>18.0</b>	<b>SUMMARY OF IMPROVEMENTS INDICATED AND MODIFICATION OPTIONS .....</b>	<b>35</b>

## LIST OF TABLES

Table 1.1:	Person-Trips for Inverness Homes
Table 3.6.1:	Collisions by Location and Year
Table 3.6.2:	Highlighted Collision Data
Table 3.7.1:	Origin Destination Survey Travel Mode Percentages
Table 9.1.1.1:	Person-Trips for Inverness Homes
Table 9.1.2.1:	Trips by Primary Travel Mode – AM
Table 9.1.2.2:	Trips by Primary Travel Mode – PM
Table 9.1.2.3:	Future Mode Share Targets for the Development
Table 9.1.2.4:	Projected Trips by Primary Travel Mode - AM
Table 9.1.2.5:	Projected Trips by Primary Travel Mode - AM
Table 11.1.1:	Level of Service vs. Volume to Capacity Ratio
Table 11.2.1:	Intersection Operation, Existing Conditions (2019)
Table 11.2.2:	Intersection Operation, Background Growth (2023)
Table 11.2.3:	Intersection Operation, Background Growth (2028)
Table 11.2.4:	Intersection Operation, Total Traffic (2023)
Table 11.2.4:	Intersection Operation, Total Traffic (2028)
Table 13.1.5.1:	Vehicular Level of Service (LOS) by Approach

## **LIST OF FIGURES**

- Figure 2.1: 147 Langstaff Drive surrounding Area (Courtesy of Google Earth)
- Figure 3.2.1: Study area intersections (Courtesy of Google Earth)
- Figure 3.3.1: Pedestrian and Cycling Facilities in the study area (Background c/o Google Earth)
- Figure 3.4.1: Bus stops near the Site Development
- Figure 3.5.1: Existing Driveways within the vicinity of the proposed Site (Courtesy of Google Earth)
- Figure 3.6.1: Illustration of the three corridors analyzed (Background courtesy of Google Earth)
- Figure 3.7.1: Existing (2019) Traffic Volumes
- Figure 9.2.1: Trip Distribution Network for trips going IN to the development
- Figure 9.2.2: Trip Distribution Network for trips going OUT of the development
- Figure 9.3.1: Development-Generated Vehicle Demand
- Figure 12.1.1: Site plan layout separation

## **LIST OF APPENDICES**

- Appendix A: TIA Screening Form
- Appendix B: Site Plan
- Appendix C: City of Ottawa Traffic Data
- Appendix D: Traffic Volume Figures
- Appendix E: Synchro Reports
- Appendix F: Bus Route
- Appendix G: TDM Checklist

## 1.0 SCREENING FORM

The following section describes the initial assessment of the proposed development with respect to the Traffic Impact Assessment (TIA) Screening Form and will provide reasoning for potential triggers. The TIA screening form has been attached in [Appendix A](#).

### 1.1 Trip Generation Triggers

Trip generation was calculated based on data from the Institute of Transportation Engineers (ITE) Trip Generation Manual, 10th Edition. The development is expected to have an overall area of approximately 81,000 m<sup>2</sup> containing 108 apartment units and 84 townhome units. As shown below in [Table 1.1](#), it is estimated that the site will generate a total of 112 person-trips during the AM peak hour and 125 person-trips during the PM peak hour. For the Mid-rise apartments, a 26% IN and 74% OUT distribution of the person-trips was used for the AM peak and a 61% IN and 39% OUT for the PM peak hour. For the attached town homes, a 23% IN and 77% OUT distribution of the person-trips was used for the AM peak and a 63% IN and 37% OUT for the PM peak hour. Based on Module 1.2, from the Transportation Impact Assessment Guidelines (2017), since the development is expected to generate more than 60 person-trips during its peak hour; the criteria for the trip generation trigger is satisfied.

**Table 1.1: Person-Trips for Inverness Homes**

ITE Land Use	Unit of Measure	Quantity	Rate		AM Peak Hour			PM Peak Hour		
			AM	PM	In	Out	Total	In	Out	Total
Mid-rise apartments (Code 223)	Dwelling Units	114	0.35	0.41	14	38	52	37	23	60
Semi-detached dwellings, townhouses, rowhouses (Code 224)	Dwelling Units	75	0.62	0.67	14	46	60	41	24	65
Development Totals:					112			125		
* Rates shown are recommended trip generation rates for residential land uses as per "TRANS Trip Generation Residential Rates report" prepared by McCormick Rankin Corp. (August, 2009)										
* Directional splits are published within ITE Trip Generation 10th Edition										
*A factor of 1.28 has been applied to convert into person-trips (City of Ottawa factor)										

### 1.2 Location Triggers

The development is in a Designated Village Design Priority Area (DPA) as seen in Section 2.5.1, Schedule A, and Annex 6 of the City of Ottawa Official Plan. The proposed new driveways will not be located on a boundary street that is designed as part of the Transit Priority, Rapid Transit, or Spline Bicycle Network as reported in the City of Ottawa Transportation Master Plan (2013). Because of the development in a Designated Village DPA, the criteria for the location trigger is met.

### 1.3 Safety Triggers

Langstaff Road has a posted speed limit of 40 km/h within the vicinity of the development and does not have horizontal or vertical curvature at the proposed site access points. None of the safety triggers were satisfied.



## 2.0 DESCRIPTION OF PROPOSED DEVELOPMENT

The proposed development is located at 147 Langstaff Road, between the intersection of Donald B. Munro Drive and Juanita Avenue. The site development area is designated as a “Village” area as per the City of Ottawa Official Plan. The site has three (3) proposed access points with the southern most access point located approximately 175 m from the intersection of Donald B. Munro Drive and Langstaff Drive. The remaining two access points are located approximately 50 m and 270 m from the southern most access point, respectively. Refer to [Figure 2.1](#) below for a map of the existing site.



*Figure 2.1: 147 Langstaff Drive surrounding Area (Courtesy of Google Earth)*

The site will consist of 108 apartments and 84 townhomes as well as a parkland and a clubhouse which will be available to only the residents of the complex. The residential development is expected to have a lot area of approximately of 81,000 m<sup>2</sup> (8.1 ha). There is no current structure on the development site. Site Plans have been attached in [Appendix B](#) for reference.

The proposed development is in an area designated as a Village in Schedule A of the City of Ottawa Official Plan. In accordance with Section 3.7.1 of the Official Plan, permitted developments include residential, retail, and commercial service facilities, restaurants, offices and personal service establishments light industrial uses, institutional services, places of worship, and public open space.

## **3.0 EXISTING CONDITIONS**

The following outlines the existing site characteristics and a summary of the expected development transportation conditions.

### **3.1 Roadways**

- As obtained from the City of Ottawa Official Plan, Annex 1 – Road Classification and Rights-of-Way; Langstaff Drive is designated as a collector village roadway with a protected right-of-way of 26 m. Cavanagh Drive and Frances Colbert Avenue are designated as local streets with a protected right-of-way of 20 m. Donald B. Munro Drive is designated as a collector village roadway with a protected right-of-way of 16 m and 23 m west and east of Langstaff Drive respectively. Carp Road is a designated as an arterial village road with a protected right-of-way of 23 m.
- Langstaff Drive is a two-lane undivided village collector roadway that runs north-south from Donald B. Munro Drive in the south to Juanita Avenue in the north. The roadway has a posted speed limit of 40 km/h due to a public school located on the road. Vertical centreline treatments are installed as a traffic calming measure in order to reduce speeds on the road in the vicinity of the school. A pedestrian sidewalk is provided on the east side only.
- Donald B. Munro Drive is a two-lane undivided village collector roadway that runs east-west from Thomas Argue Road in the west to March Road in the east. The posted speed limit within the vicinity of the project is 40 km/hr and has several private entrances along the roadway. Pedestrian sidewalks are provided on both sides to the west of Langstaff Drive and only on the south side east of Langstaff Drive.
- Carp Road is a two-lane undivided village arterial roadway that runs north-south from Craig Side Road in the north to Stittsville Main Street in the south. Within the vicinity of the project, the roadway has a posted speed limit of 50 km/h with several residential and commercial private entrances. Pedestrian sidewalks are provided on both the east and west side of the road. On-street parking is available north of Donald B. Munro Drive.
- Cavanagh Drive and Frances Colbert Avenue are two-lane local streets with a posted speed limit of 40 km/h. The roads serve residential communities. The roads do not provide pedestrian sidewalks.

### **3.2 Study Area Intersections**

For the purpose of the scoping report it is expected that the study area will include the Carp Road and Donald B. Munro Drive intersection, Carp Road and Juanita Avenue, Donald B. Munro Drive and Langstaff Drive intersection, Langstaff Drive and Cavanagh Drive intersection, and Langstaff Drive and Frances Colbert Avenue intersection. Below is a description of the five above noted intersections while **Figure 3.2.1** provide a visual reference.



1. The intersection of Carp Road and Donald B. Munro Drive is a four-leg All-Way Stop Controlled (AWSC) intersection. The following is a description of the lane configuration:
  - The north approach has one shared left-through-right turn lane;
  - The south approach has one shared left-through-right turn lane;
  - The east approach has one shared left-through-right turn lane;
  - The west approach has one shared left-through-right turn lane.
2. The intersection of Donald B. Munro Drive and Langstaff Drive is a four-leg All-Way Stop Controlled (AWSC) intersection with a slight offset in the intersection alignment. This is due to Langstaff Drive and Deugo Street being mis-aligned in the east west direction. The following is a description of the lane configuration:
  - The north approach has one shared left-through-right turn lane;
  - The south approach has one shared left-through-right turn lane;
  - The east approach has one shared left-through-right turn lane;
  - The west approach has one shared left-through-right turn lane.
3. The intersection of Langstaff Drive and Cavanagh Drive is a T-intersection with only Cavanagh Drive stop controlled. The following is a description of the lane configuration:
  - The north approach has one shared left-through turn lane;
  - The south approach has one shared through-right turn lane;
  - The east approach has one shared left-right turn lane.
4. The intersection of Langstaff Drive and Frances Colbert Avenue is a T-intersection with only Frances Colbert Avenue stop controlled. The following is a description of the lane configuration:
  - The north approach has one shared left-through turn lane;
  - The south approach has one shared through-right turn lane;
  - The east approach has one shared left-right turn lane.
5. The intersection of Carp Road and Juanita Avenue is a T-intersection with only Juanita Avenue stop controlled. The following is a description of the lane configuration:
  - The north approach has one shared left-through turn lane;

- The south approach has one shared through-right turn lane;
- The east approach has one shared left-right turn lane.



*Figure 3.2.1: Study area intersections (Courtesy of Google Earth)*

### **3.3 Existing Pedestrian and Cycling Facilities**

Currently, there are a number of pedestrian and cycling related facilities in the study area, they are illustrated in [Figure 3.3.1](#). As illustrated, there are scenic entry routes for cyclists within the vicinity of the proposed site in which the vehicles are expected to share the road. Pedestrian Sidewalks are provided on both sides of the roadway along Donald B. Munro Drive and Carp Road and only on the east side along Langstaff Drive as shown in [Figure 3.3.1](#).

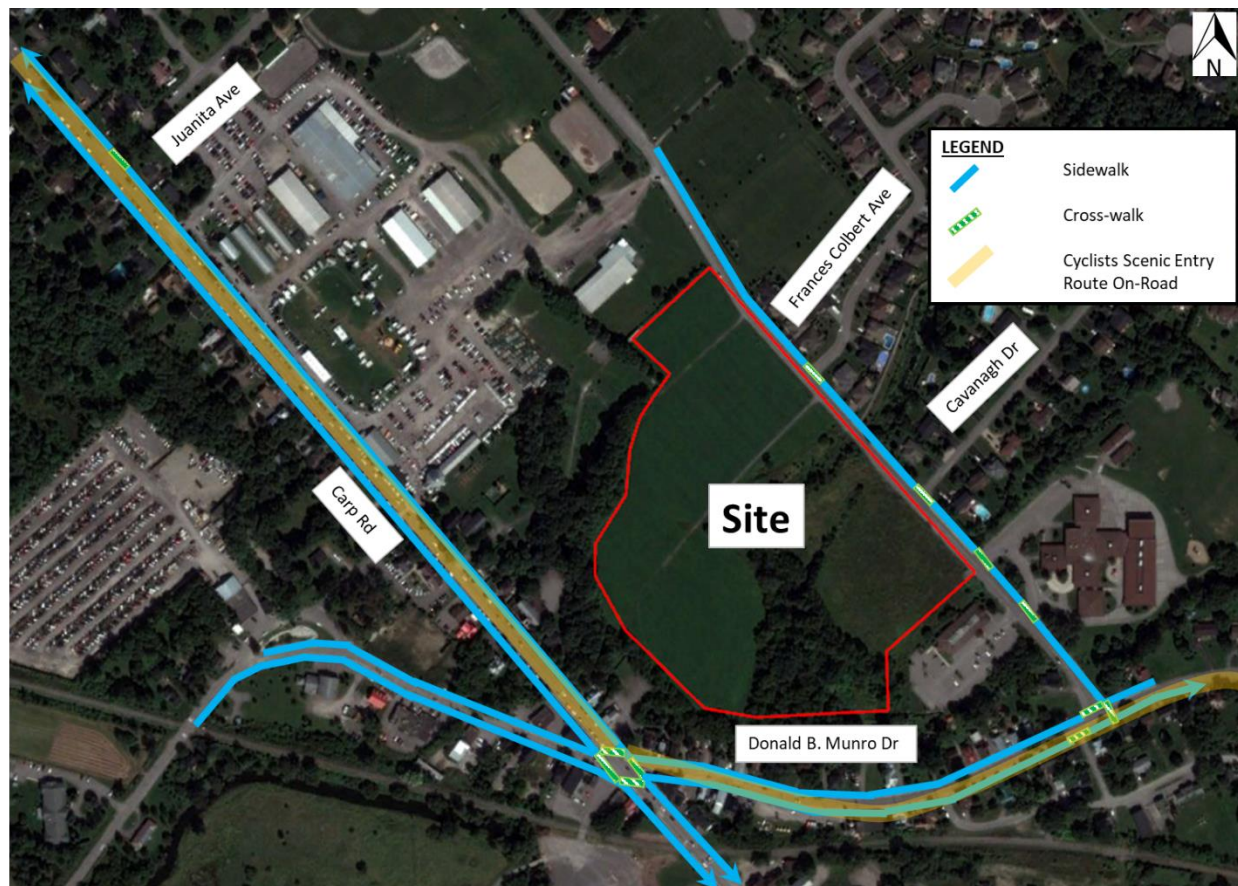


Figure 3.3.1: Pedestrian and Cycling Facilities in the study area (Background c/o Google Earth)

### 3.4 Existing Transit System

Currently, there is one bus route 303 with limited service (operates on Wednesday only) that operates near the surrounding area of the development site. [Figure 3.4.1](#) identifies the bus stops within the vicinity of the site. The main means of travel would be via private automobile, Ride-share service, or Taxi to get to the destination. The full bus route can be found in [Appendix F](#).

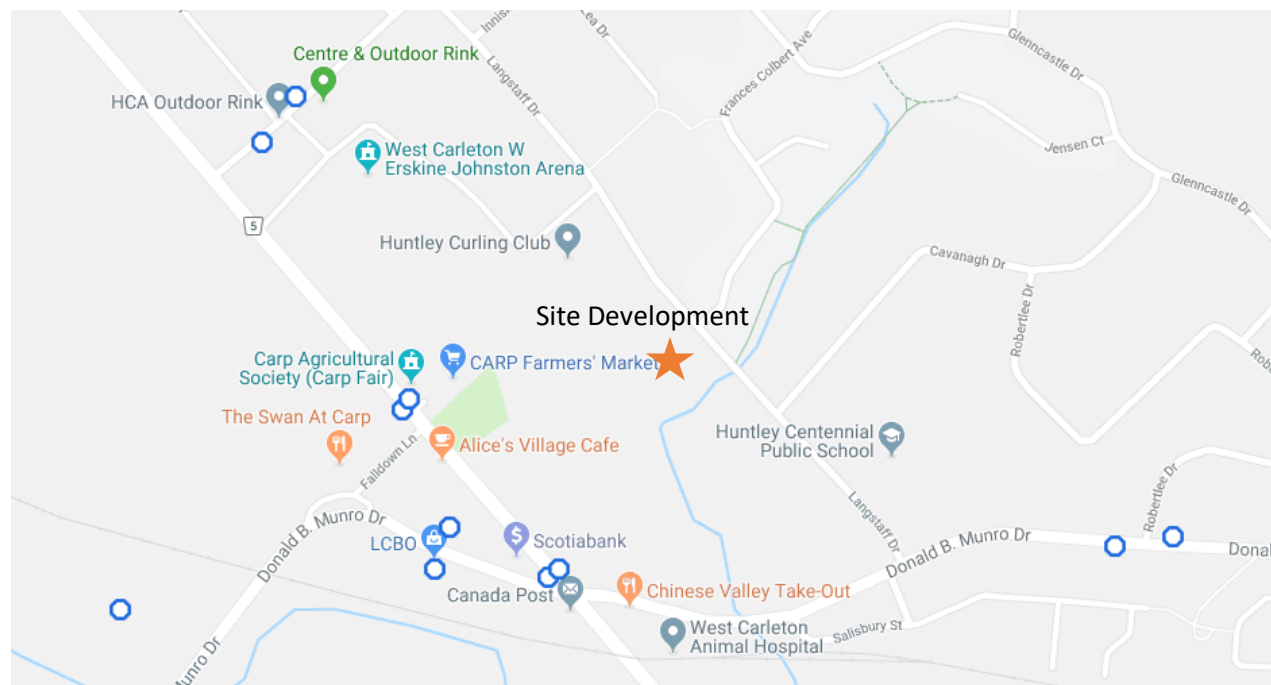


Figure 3.4.1: Bus stops near the Site Development

### 3.5 Existing Driveways

The following are existing driveways within 200 m to the proposed development site. Figure 3.5.1 provides a visual reference.

- There are some private driveways of residential households across the site on Langstaff Drive.
- North of the northern most limit of the proposed site, at  $\pm 90$  m is an entrance that provides access to several facilities including Huntley Curling Club, Carp Agricultural Society, and a Sports Arena.
- Adjacent to the south of the southern most limit of the proposed site, at  $\pm 45$  m is an entrance to a Medical Dental Centre.
- Across the south limit of the proposed site is an access point to a public school.



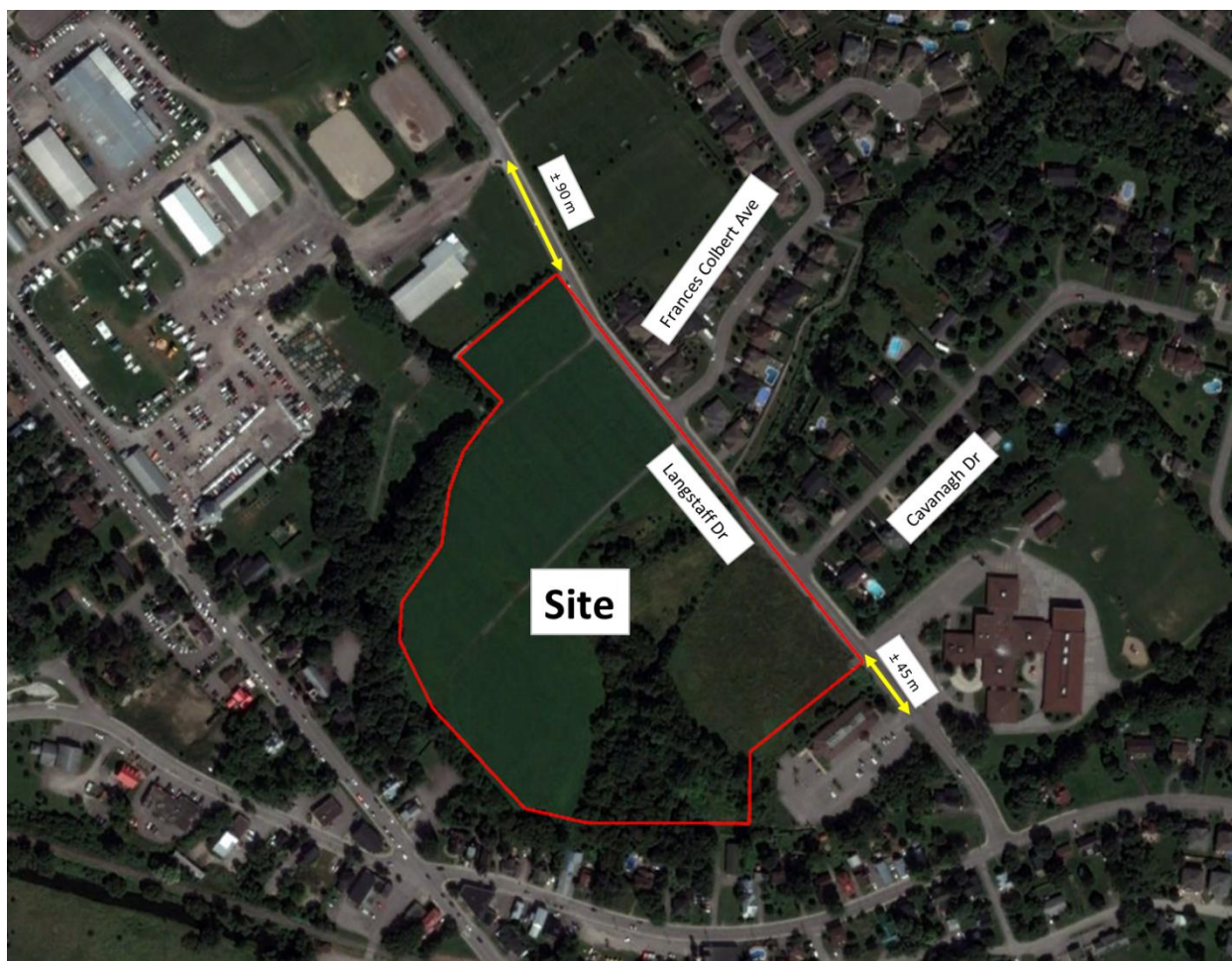


Figure 3.5.1: Existing Driveways within the vicinity of the proposed Site (Courtesy of Google Earth)

### 3.6 Collision History

The 2014, 2015, 2016, 2017 and 2018 collision data was reviewed with regards to collision severity, road surface, light condition, collision classification, and impact type. The summarized findings of the collision data can be found in [Table 3.6.1](#) and [Table 3.6.2](#). The collision analysis was broken down into three segments; Carp Road corridor, Langstaff Drive corridor, and Donald B. Munro Drive corridor. This provides a better collision history analysis within the vicinity of the proposed site. An illustration of the three corridors is presented in [Figure 3.6.1](#).

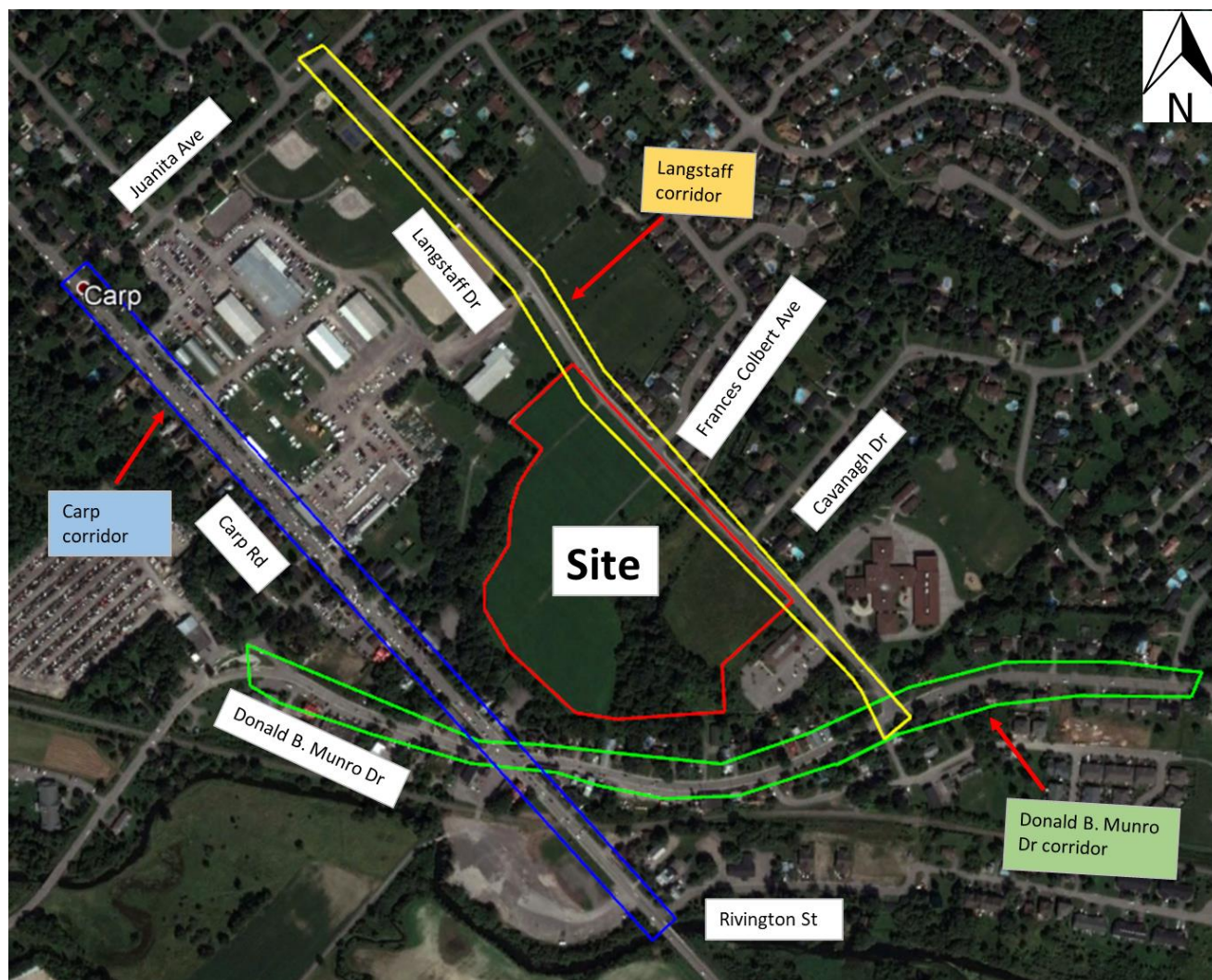


Figure 3.6.1: Illustration of the three corridors analyzed (Background courtesy of Google Earth)

Findings of the collision data analysis are as follows:

- There were a total of 22 collisions within the vicinity of the proposed site. The highest number of collisions occurred at the intersection of Carp Road and Donald B. Munro Drive with 8 collisions followed by the midblock segment between Rivington St and Juanita Avenue along Carp Road with 7 collisions. The Langstaff corridor did not have any collisions over the course of 5 years from 2014 to 2018.
- The most common type of collision in terms of classification was property damage only (PD) with the segments analyzed yielding 62% or higher.
- Out of the total 22 collisions, 17 occurred in daylight conditions.
- The most frequent impact type was 'angle' within the vicinity of the proposed site with 9 collisions followed by Single Motor Vehicle (SMV) with 6 collisions.



**Table 3.6.1: Collisions by Location and Year**

Year	Number Of Collisions						
	Carp Rd @ Donald B. Munro Dr	Carp Rd @ Rivington St	Carp Rd @ Juanita Ave	Carp Rd between Rivington St to Juanita Ave	Donald B. Munro Dr @ Robert Lee Dr	Donald B. Munro Dr between Falldown Ln to Robert Lee Dr	Langstaff Dr between Donald B. Munro Dr to Juanita Ave
2014	3	0	0	2	0	0	0
2015	2	2	0	3	1	0	0
2016	2	0	0	1	0	0	0
2017	1	1	1	1	0	1	0
2018	0	0	0	0	0	1	0
Total	8	3	1	7	1	2	0

**Table 3.6.2: Highlighted Collision Data**

		Carp Rd @ Donald B. Munro Dr	Carp Rd @ Rivington St	Carp Rd @ Juanita Ave	Carp Rd between Rivington St to Juanita Ave	Donald B. Munro Dr @ Robert Lee Dr	Donald B. Munro Dr between Falldown Ln to Robert Lee Dr
Number of Collisions		8	3	1	7	1	2
Collisions Classification	P.D. Only	62%	67%	100%	86%	100%	100%
	Injury	38%	33%	0%	14%	0%	0%
Road Surface	Dry	88%	33%	100%	86%	0%	50%
	Wet	0%	0%	0%	0%	100%	0%
	*Winter Conditions	12%	67%	0%	14%	0%	50%
Light Conditions	Daylight	88%	67%	0%	86%	100%	50%
	Dark	12%	33%	100%	0%	0%	50%
	Dawn	0%	0%	0%	0%	0%	0%
	Dusk	0%	0%	0%	14%	0%	0%
Impact Type	Rear End	25%	0%	0%	14%	0%	0%
	Angle	50%	67%	100%	14%	100%	0%
	Turning Movement	25%	0%	0%	29%	0%	0%
	Sideswipe	0%	0%	0%	0%	0%	0%
	SMV Other	0%	33%	0%	43%	0%	100%

\*Winter Conditions includes Ice and loose snow,

### 3.7 Traffic Volume

The traffic data provided by the City of Ottawa included Turning Movement Counts (TMC) at the intersections of Carp Road and Donald B. Munro Drive and Carp Road and Juanita Avenue which were conducted in April 2019. The remaining three intersections TMCs were recorded by MP surveyors in August 2019. Figure 3.7.1 below, illustrates the 2019 AM and PM peak hour vehicle volumes. The AM and PM peak hour for the intersection of Langstaff Drive and Frances Colbert Avenue and Langstaff Drive and Cavanagh Drive was from 7:45 – 8:45 AM and 4:30 – 5:30 PM respectively. At the intersection of Langstaff Drive and Donald B. Munro Drive the AM and PM peak was from 8:00 – 9:00 AM and 4:00 – 5:00 PM respectively. At the intersection of Donald B. Munro Drive and Carp Road the AM peak was from 7:30 – 8:30 AM and the PM peak was from 4:30 – 5:30 PM respectively.

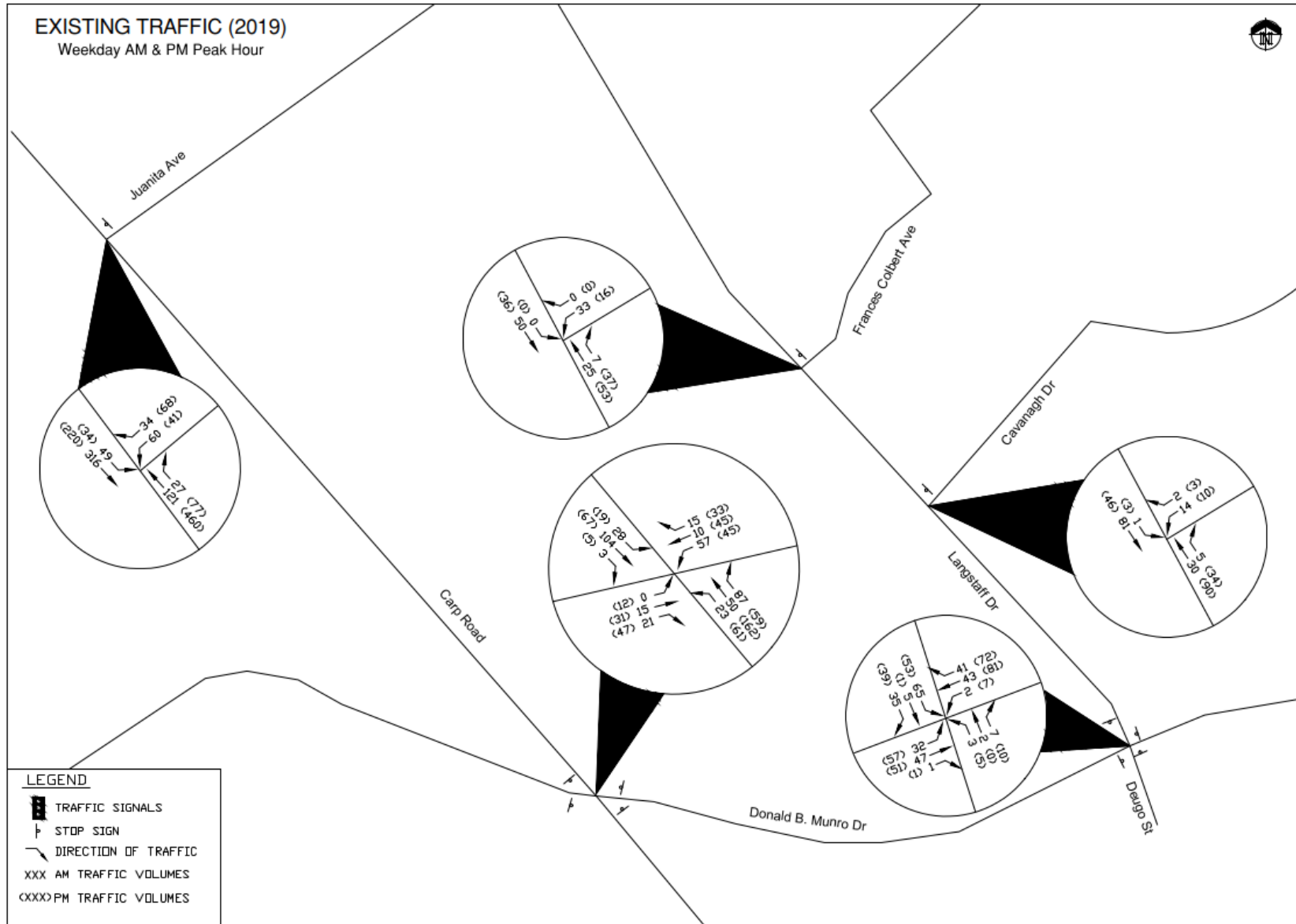


Figure 3.7.1: Existing (2019) Traffic Volumes

Table 3.7.1 below, shows the expected travel mode percentages based on the most recent Capital Region Origin-Destination survey which was conducted in the fall of 2011 for the Rural West Trans District and can be found in Appendix C.

**Table 3.7.1: Origin Destination Survey Travel Mode Percentages**

% of Person Trips		
Travel Mode	AM Peak (6:30 - 8:59)	PM Peak (15:30 - 17:59)
Auto Driver	60%	71%
Auto Passenger	10%	17%
Transit	5%	3%
Bicycle	0%	0%
Walk	1%	1%
Other	24%	8%

## 4.0 PLANNED CONDITIONS

Currently there is a registered agreement for a Site Plan Control application located at 150 and 170 Salisbury street south of the proposed site development. The developer would like to accommodate development of 15 townhouse units, with one run of seven (7) units & two separate runs of four (4) units each. The units will be three storeys tall. Units will have range of gross floor areas between 150 m<sup>2</sup> and 168 m<sup>2</sup>. The units will be served by 30 parking spaces contained within garages and on driveways.

## 5.0 STUDY AREA

The study area for the purposes of this report, is expected to be the intersections of Carp Road and Donald B. Munro Drive, Carp Road and Juanita Avenue, Donald B. Munro Drive and Langstaff Drive, Langstaff Drive and Cavanagh Drive, and Langstaff Drive and Frances Colbert Avenue.

## 6.0 TIME PERIODS

For the purposes of the operational analysis, both morning and afternoon peak hours will be considered for background travel demand and development-generated trips. Travel demand will be limited to Langstaff Drive as it is the only adjacent roadway. Time periods for the analysis will be determined as part of the pre consultation process.

## 7.0 HORIZON YEARS

At the time of writing, the occupancy and full build-out are anticipated to occur in 2023. As such, the horizon years analyzed will include 2023 (build-out year) and 2028 (build-out year + 5 years).

## 8.0 EXEMPTIONS REVIEW

Table 4 of Section 2.3 in the Transportation Impact Assessment Guidelines (2017) lists several possible exemptions that would reduce the scope of the TIA study.

- Section 4.1.2 concerning circulation and access is not expected to be included in the TIS study as the development site is a subdivision.
- Section 4.2 concerning parking is not expected to be included in the TIS as it is not required for a subdivision plan.
- Section 4.6 is exempt even though Langstaff Drive is classified as a collector street, the total volume on the road does not exceed the capacity threshold of 300 vph for collector roads as specified per guidelines.
- Section 4.8 concerning network concept is not expected to be included in the TIS study. Based on ITE Trip Generation Manual, it is expected the site will generate 102 and 125 person-trips during the AM and PM peak hour, respectively. As such the proposed development will not generate 200 person-trips in excess of the equivalent volume permitted by established by zoning.

## 9.0 DEVELOPMENT GENERATED TRAFFIC

### 9.1 Trip Generation

#### 9.1.1 Trip Generation Rates

Trip generation was calculated in accordance with the “TRANS Trip Generation Residential Trip Rates” completed by McCormick Rankin Corporation for the City of Ottawa (August 2009) and Institute of Transportation Engineers (ITE) Trip Generation Manual, 10th Edition. The City of Ottawa TIS Guidelines (2017) recommends that when using ITE Trip Generation Manual, assume 10% non-auto mode share and an average vehicle occupancy of 1.15. As such, a factor of 1.28 was applied to the site generated trips in order to estimate the total site generated person-trips. As stated previously in [Section 1.1](#), the estimated site generated person-trips will be a total of 116 person-trips during the AM peak hour conditions and 130 person-trips during the PM peak hour conditions.

**Table 9.1.1.1: Person-Trips for Inverness Homes**

ITE Land Use	Unit of Measure	Quantity	Rate		AM Peak Hour			PM Peak Hour		
			AM	PM	In	Out	Total	In	Out	Total
Mid-rise apartments (Code 223)	Dwelling Units	114	0.35	0.41	14	38	52	37	23	60
Semi-detached dwellings, townhouses, rowhouses (Code 224)	Dwelling Units	75	0.62	0.67	14	46	60	41	24	65
Development Totals:					112			125		
* Rates shown are recommended trip generation rates for residential land uses as per "TRANS Trip Generation Residential Rates report" prepared by McCormick Rankin Corp. (August, 2009)										
* Directional splits are published within ITE Trip Generation 10th Edition										
*A factor of 1.28 has been applied to convert into person-trips (City of Ottawa factor)										

### 9.1.2 Mode Shares

The most recent National Capital Region (NCR) Origin-Destination Survey was conducted in Fall of 2011 and can be found in [Appendix C. Table 9.1.2.1](#) and [Table 9.1.2.2](#) below, displays the trips by primary travel mode from/within the NCR during the AM and to/within the NCR during the PM peak hour.

**Table 9.1.2.1: Trips by Primary Travel Mode – AM**

Travel Mode	AM Peak (06:30 - 08:59)			
	% of Person Trips	Person Trips		
		In	Out	Total
Auto Driver	57%	16	48	64
Auto Passenger	10%	3	9	12
Transit	6%	2	5	7
Bicycle	0%	0	0	0
Walk	1%	0	1	1
Other	25%	7	21	28

**Table 9.1.2.2: Trips by Primary Travel Mode – PM**

Travel Mode	PM Peak (15:30 - 17:59)			
	% of Person Trips	Person Trips		
		In	Out	Total
Auto Driver	68%	53	32	84
Auto Passenger	17%	13	8	21
Transit	4%	3	2	5
Bicycle	0%	0	0	0
Walk	2%	1	1	2
Other	10%	8	5	12

As stated previously in this report, the expected build out year is 2023. There is no regular City transit network within the vicinity of the development. Since the development is a townhouse/mid-rise multi family housing, it is expected that attendees would mainly use a car to reach the development. As such the future mode shares are expected to be as follows:

**Table 9.1.2.3: Future Mode Share Targets for the Development**

Travel Mode	Mode Share Target		Rationale
	AM	PM	
Auto Driver	60%	70%	Auto Driver person trips are expected to slightly increase due to the nature of the development
Auto Passenger	11%	18%	% of auto passenger person trips is expected to slightly increase due to more guests and/or family trips
Transit	2%	2%	% of Transit person trips is expected to decrease due to limited transit service
Bicycle	1%	2%	% of bicycle person trips is expected to increase slightly due to the nature and location of the development
Walk	5%	6%	% of walking person trips is expected to increase slightly due to the nature and location of the development as well as school within the vicinity of the development
Other	21%	2%	% of other person trips is expected to change due to more auto trips as a result of the development

Based on the future mode share targets, [Table 9.1.2.4](#) and [Table 9.1.2.5](#) have been updated with the projected development-generated trips for the year 2028 (5-years after the build out year of 2023).

**Table 9.1.2.4: Projected Trips by Primary Travel Mode - AM**

Travel Mode	AM Peak (06:30 - 08:59)			
	% of Person Trips	Person Trips		
		In	Out	Total
Auto Driver	60%	17	50	67
Auto Passenger	11%	3	9	12
Transit	2%	1	2	3
Bicycle	1%	0	1	1
Walk	5%	1	4	5
Other	21%	6	18	24



**Table 9.1.2.5: Projected Trips by Primary Travel Mode - AM**

Travel Mode	PM Peak (15:30 - 17:59)			
	% of Person Trips	Person Trips		
		In	Out	Total
Auto Driver	70%	55	33	88
Auto Passenger	18%	14	8	22
Transit	2%	2	1	3
Bicycle	2%	2	1	3
Walk	6%	5	3	8
Other	2%	2	1	3

No trip reduction factors have been assigned to the proposed development. Currently the site is not in use and due to the nature of the development, it is not expected to generate any pass-by vehicle trips.

## 9.2 Trip Distribution

A number of assumptions were made to better represent the distribution of trips to and from the development. The assumptions were based on the turning movement counts received from the City of Ottawa, and site visits performed by MP during both the AM and PM peak hour. All traffic data provided by the City of Ottawa can be found [Appendix C](#).

It was observed that during the peak hours, no substantial queuing developed along any of the approaches of the study intersections. Due to the complexity of the number of entrances for the site development which spans across two other local intersections (Frances Colbert Avenue and Cavanagh Drive). The distribution has been split into two diagrams, one for the vehicles going IN to the development and the other going OUT of the development as shown in [Figure 9.2.1](#) and [Figure 9.2.2](#) respectively.

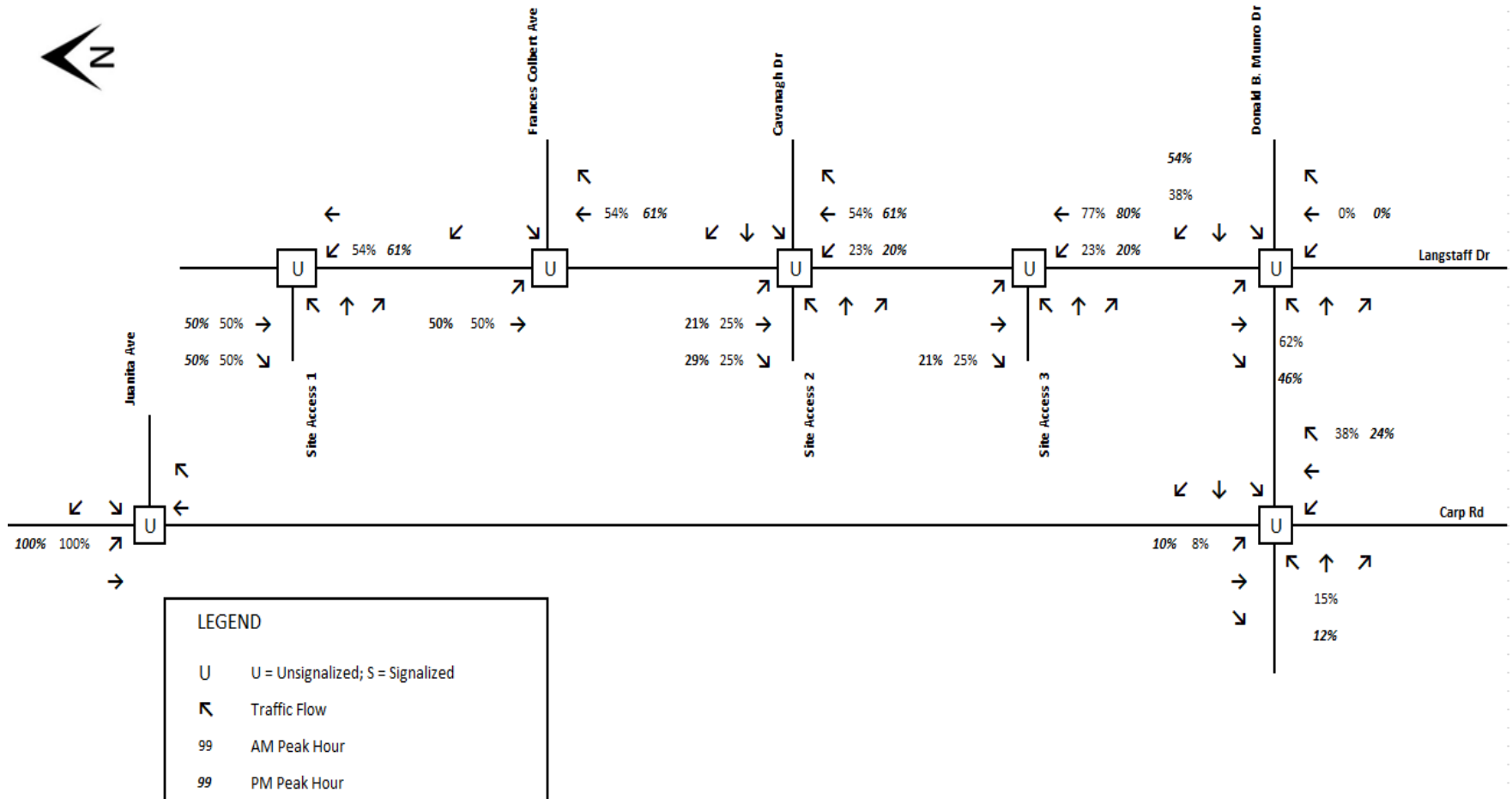


Figure 9.2.1: Trip Distribution Network for trips going IN to the development

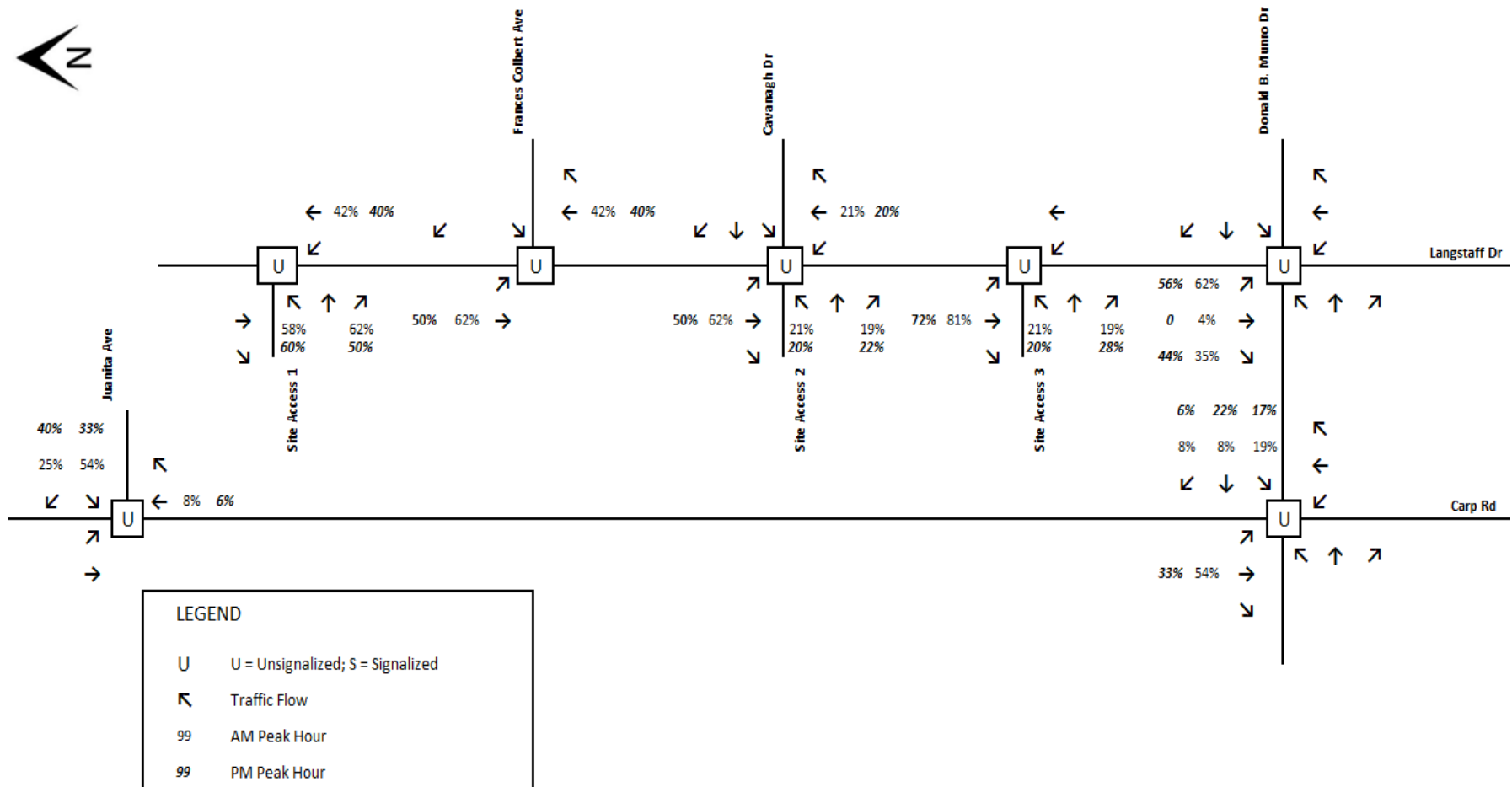


Figure 9.2.2: Trip Distribution Network for trips going OUT of the development

### **9.3 Trip Assignment**

The trips generated by the proposed development were assigned to the transportation network to reflect the traffic patterns shown in the turning movement counts. **Figure 9.3.1** below shows development-generated vehicle demands applied to the surrounding transportation network. It should be noted that it was assumed that 80 % of the development generated trips travelling northbound on Langstaff Drive will end up going towards the intersection of Carp Road and Juanita Avenue. All trip assignment figures can be found in **Appendix D**.

[section intentionally left blank]



## **10.0 BACKGROUND NETWORK TRAFFIC**

MP received turning movement counts from the City of Ottawa taken at the intersections of Carp Road and Donald B. Munro Drive and Carp Road and Juanita Avenue on Tuesday, April 2<sup>nd</sup>, 2019. Additionally, MP performed TMC counts at the intersections of Langstaff Drive and Frances Colbert Avenue, Langstaff Drive and Cavanagh Drive, and Langstaff Drive and Donald B. Munro Drive during both the AM and PM peak hours on Thursday, August 15<sup>th</sup>, 2019. The traffic volumes for the AM and PM peak were applied to the network and balanced accordingly.

### **10.1 Changes to the Background Transportation Network**

As stated previously in this report, the only significant change expected to the transportation network including the road and transit route component is the slight increase in trips of automobiles and auto passengers. It is expected that the network will experience a slight increase in vehicles due to the development attracting guests visiting people living in the area as well as the flat increase in vehicles of people living in the development. This is expected to occur during the build out year of 2023. It was estimated previously, that an increase in approximately 3% in automobile drivers and auto passengers was appropriate. Additionally, the bicycle travel mode will slightly increase due to the nature of the development and the transit travel mode is expected to slightly decrease due to limited service and no future improvements within the vicinity of the development.

### **10.2 General Background Growth Rates**

To project the traffic volume to the future years, a 1.0 % annual background growth rate was applied. The growth rate was calculated based on the Trans OD-survey for the Rural West region. The population change was compared for 2005 and 2011 Trans OD-survey and the growth rate was found to be 1.0%. This growth rate is appropriate for the development as it is located in the rural subarea of the City of Ottawa.

### **10.3 Other Area Development**

Currently there are two registered agreement for a Site Plan Control application located at 150 and 170 Salisbury street south of the proposed site development as explained in [Section 4.0](#). It is assumed that traffic generated from the two planned developments within the vicinity of the site are considered as part of the 1.0% background growth rate.

## **11.0 DEMAND RATIONALIZATION**

### **11.1 Intersection Capacity Analysis Methodology**

Analysis of traffic operations were performed in accordance with The City of Ottawa's TIA Guidelines (2017) and MMLOS Guidelines. Level of Service (LOS) descriptions for the analysis are provided below in Table 11.1.1. All existing and projected traffic operations were modelled in Synchro 10.



**Table 11.1.1: Level of Service vs. Volume to Capacity Ratio**

Level of Service	Volume to Capacity Ratio
A	0 to 0.60
B	0.61 to 0.70
C	0.71 to 0.80
D	0.81 to 0.90
E	0.91 to 1.00
F	>1.00

Volume to Capacity (V/C) ratios were analyzed for all signalized intersections overall as well as by individual movements. For unsignalized intersections with a LOS of F, the capacity was based on gap analysis.

All Synchro 10 parameters were taken in accordance with Appendix C: Synchro Analysis Parameters of the City of Ottawa TIA Guidelines (2017).

## **11.2 Description of Capacity Issue (s)**

The background traffic auto demands and the total traffic auto demands can be found in [Appendix D](#). Synchro 10 reports for all analysis periods can be found in [Appendix E](#).

[section intentionally left blank]

Table 11.2.1 below, shows the traffic operations analysis summary for the existing 2018 background traffic. All movements are expected to operate at a LOS A. It should be noted that the midblock imbalance based on the TMC provided by the City of Ottawa which were recorded on April 2, 2019 along Carp Rd from Donald B. Munro Dr and Juanita Ave was found to be high. An explanation for this imbalance may be the high development between the two intersections. There are a number of residential houses along Carp Road as well as a multi-storey condo. Additionally, there are some commercial and recreational facilities. While still higher than expected for this area, this provides a possible explanation for the imbalance observed.

**Table 11.2.1: Intersection Operation, Existing Conditions (2019)**

Intersection/Approach	AM Peak Hour		PM Peak Hour	
	LOS	V/C Ratio	LOS	V/C Ratio
<b>Langstaff Dr &amp; Donald B. Munro Dr</b>	A		A	
Northbound	A	0.02	A	0.02
Southbound	A	0.14	A	0.13
Westbound	A	0.11	A	0.2
Eastbound	A	0.17	A	0.15
<b>Langstaff Dr &amp; Frances Colbert Ave</b>	A		A	
Northbound	A	0.05	A	0.06
Southbound	A	0	A	0
Westbound	A	0.04	A	0.03
<b>Langstaff Dr &amp; Cavanagh Dr</b>	A		A	
Northbound	A	0.06	A	0.08
Southbound	A	0	A	0
Westbound	A	0.02	A	0.02
Eastbound	-	-	-	-
<b>Carp Rd &amp; Donald B. Munro Dr</b>	A		A	
Northbound	A	0.2	A	0.39
Southbound	A	0.18	A	0.14
Westbound	A	0.12	A	0.18
Eastbound	A	0.05	A	0.13
<b>Carp Rd &amp; Juanita Ave</b>	A		A	
Northbound	A	0.09	A	0.34
Southbound	A	0.04	A	0.04
Westbound	A	0.19	A	0.28

Table 11.2.2 below, is a summary of the operating conditions during the build-out year of 2023 with only the background growth applied. All movements are expected to be operating well with a LOS A.

**Table 11.2.2: Intersection Operation, Background Growth (2023)**

Intersection/Approach	AM Peak Hour		PM Peak Hour	
	LOS	V/C Ratio	LOS	V/C Ratio
<b>Langstaff Dr &amp; Donald B. Munro Dr</b>	A		A	
Northbound	A	0.02	A	0.02
Southbound	A	0.15	A	0.14
Westbound	A	0.12	A	0.21
Eastbound	A	0.19	A	0.16
<b>Langstaff Dr &amp; Frances Colbert Ave</b>	A		A	
Northbound	A	0.06	A	0.06
Southbound	A	0	A	0
Westbound	A	0.05	A	0.03
<b>Langstaff Dr &amp; Cavanagh Dr</b>	A		A	
Northbound	A	0.06	A	0.08
Southbound	A	0	A	0
Westbound	A	0.02	A	0.03
<b>Carp Rd &amp; Donald B. Munro Dr</b>	A		A	
Northbound	A	0.22	A	0.42
Southbound	A	0.2	A	0.15
Westbound	A	0.13	A	0.2
Eastbound	A	0.05	A	0.14
<b>Carp Rd &amp; Juanita Ave</b>	A		A	
Northbound	A	0.1	A	0.37
Southbound	A	0.04	A	0.04
Westbound	A	0.22	A	0.32

[section intentionally left blank]

Table 11.2.3 below, is a summary of the operating conditions during the future horizon year of 2028 with only the background growth applied. All movements are expected to operate at a LOS A.

**Table 11.2.3: Intersection Operation, Background Growth (2028)**

Intersection/Approach	AM Peak Hour		PM Peak Hour	
	LOS	V/C Ratio	LOS	V/C Ratio
<b>Langstaff Dr &amp; Donald B. Munro Dr</b>	A		A	
Northbound	A	0.02	A	0.02
Southbound	A	0.16	A	0.14
Westbound	A	0.12	A	0.23
Eastbound	A	0.2	A	0.17
<b>Langstaff Dr &amp; Frances Colbert Ave</b>	A		A	
Northbound	A	0.06	A	0.07
Southbound	A	0	A	0
Westbound	A	0.05	A	0.03
<b>Langstaff Dr &amp; Cavanagh Dr</b>	A		A	
Northbound	A	0.07	A	0.09
Southbound	A	0	A	0
Westbound	A	0.02	A	0.03
<b>Carp Rd &amp; Donald B. Munro Dr</b>	A		A	
Northbound	A	0.23	A	0.45
Southbound	A	0.21	A	0.16
Westbound	A	0.14	A	0.21
Eastbound	A	0.06	A	0.15
<b>Carp Rd &amp; Juanita Ave</b>	A		A	
Northbound	A	0.11	A	0.39
Southbound	A	0.04	A	0.04
Westbound	A	0.24	A	0.35

[section intentionally left blank]

Table 11.2.4 below, is a summary of the operating conditions during the build-out year of 2023 with both the site-generated traffic and background growth applied. All movements are expected to operate at a LOS A.

**Table 11.2.4: Intersection Operation, Total Traffic (2023)**

Intersection/Approach	AM Peak Hour		PM Peak Hour	
	LOS	V/C Ratio	LOS	V/C Ratio
<b>Langstaff Dr &amp; Donald B. Munro Dr</b>	A		A	
Northbound	A	0.02	A	0.02
Southbound	A	0.19	A	0.16
Westbound	A	0.13	A	0.24
Eastbound	A	0.2	A	0.19
<b>Langstaff Dr &amp; Site Access 1</b>	A		A	
Northbound	A	0.01	A	0.02
Southbound	A	0.04	A	0.05
Eastbound	A	0.04	A	0.02
<b>Langstaff Dr &amp; Frances Colbert Ave</b>	A		A	
Northbound	A	0.07	A	0.08
Southbound	A	0	A	0
Westbound	A	0.05	A	0.04
<b>Langstaff Dr &amp; Cavanagh Dr</b>	A		A	
Northbound	A	0	A	0.01
Southbound	A	0	A	0
Westbound	A	0.03	A	0.03
Eastbound	A	0.01	A	0.01
<b>Langstaff Dr &amp; Site Access 3</b>	A		A	
Northbound	A	0	A	0.01
Southbound	A	0.09	A	0.07
Eastbound	A	0.01	A	0.01
<b>Carp Rd &amp; Donald B. Munro Dr</b>	A		A	
Northbound	A	0.23	A	0.44
Southbound	A	0.22	A	0.16
Westbound	A	0.14	A	0.22
Eastbound	A	0.06	A	0.15
<b>Carp Rd &amp; Juanita Ave</b>	A		A	
Northbound	A	0.1	A	0.37
Southbound	A	0.05	A	0.06
Westbound	A	0.26	A	0.36

Table 11.2.5 below, is a summary of the operating conditions during future horizon year of 2028 with both the site-generated traffic and background growth applied. All movements are expected to operate at a LOS A.

**Table 11.2.4: Intersection Operation, Total Traffic (2028)**

Intersection/Approach	AM Peak Hour		PM Peak Hour	
	LOS	V/C Ratio	LOS	V/C Ratio
<b>Langstaff Dr &amp; Donald B. Munro Dr</b>	A		A	
Northbound	A	0.02	A	0.02
Southbound	A	0.2	A	0.17
Westbound	A	0.13	A	0.26
Eastbound	A	0.21	A	0.2
<b>Langstaff Dr &amp; Site Access 1</b>	A		A	
Northbound	A	0.01	A	0.02
Southbound	A	0.04	A	0.05
Eastbound	A	0.04	A	0.02
<b>Langstaff Dr &amp; Frances Colbert Ave</b>	A		A	
Northbound	A	0.07	A	0.09
Southbound	A	0	A	0
Westbound	A	0.05	A	0.04
<b>Langstaff Dr &amp; Cavanagh Dr</b>	A		A	
Northbound	A	0	A	0.01
Southbound	A	0	A	0
Westbound	B	0.03	A	0.03
Eastbound	A	0.02	A	0.01
<b>Langstaff Dr &amp; Site Access 3</b>	A		A	
Northbound	A	0	A	0.01
Southbound	A	0.09	A	0.08
Eastbound	A	0.02	A	0.01
<b>Carp Rd &amp; Donald B. Munro Dr</b>	A		A	
Northbound	A	0.24	A	0.47
Southbound	A	0.23	A	0.18
Westbound	A	0.15	A	0.23
Eastbound	A	0.06	A	0.16
<b>Carp Rd &amp; Juanita Ave</b>	A		A	
Northbound	A	0.11	A	0.39
Southbound	A	0.05	A	0.06
Westbound	A	0.29	A	0.4



From the analysis and comparison of background and total traffic for the future horizon year of 2023 and 2028, the change in traffic operations observed is negligible. All the movements are expected to operate at a LOS A during all scenarios which indicates traffic operations within the vicinity of the site can be expected to operate at acceptable levels of service. As such, the development-generated traffic demand is expected to have very little impact on the study network intersections. Additionally, the three site entrances are operating well at a LOS A in the both the build-out year and horizon year.

### **11.3 Adjustment to Development Generated Demands**

At this time, no adjustments are expected to be applied to the development generated demands. In the AM and PM peak hours all movements of the study intersections and site entrances are expected to operate at a LOS A during the 2023 and 2028 total traffic scenarios. As such, the site generated motorists are not expected to adjust their travel patterns.

### **11.4 Adjustments to Background Network Demands**

Due to the rural nature of the study area, background motorists are not expected to adjust their travel times, routes, or modes. As stated in [Section 11.2](#), the study intersections reviewed as part of this TIA are currently operating at a LOS A during both the 2023 and 2028 total traffic scenarios.

## **12.0 DEVELOPMENT DESIGN**

This section will review the proposed development and its transportation network elements in order to ensure that a safe and efficient design has been proposed that will encourage walking, cycling, and transit use. The City of Ottawa's TDM-supportive Development Design and Infrastructure checklist has been completed and attached in [Appendix G](#) for reference. The TDM-supportive Development Design and Infrastructure checklist outlines the TDM elements expected to be included in the proposed development.

### **12.1 Design for Sustainable Modes**

The proposed development is expected to have a surface parking lot as well as underground parking spots for the mid-rise apartment buildings. According to the site plan, there will be a total of 83 underground spaces, 53 surface parking spaces, and 58 bicycle stalls provided for the all three mid-rise apartments. It is anticipated that this will provide adequate bicycle parking spaces for the projected peak hour volume of cyclists.

As described in [Section 3.4](#), there are multiple transit stops within the vicinity of the development site with bus stops on Juanita Ave, Carp Rd, and Donald B. Munro Dr. The development is split into two sections due to a small stream running through the development site with two proposed pedestrian crossings provided over the creek. The north and south section are approximately 400m and 360m respectively from the transit stop due to the multi-use pathway provided that provides a connection between the proposed development and the intersection of Carp Rd and Donald B. Munro Dr. The site plan with labels is shown below in [Figure 12.1.1](#). It should also be noted that there is currently only one bus route in the area of the subject site (Route 303), which operates on a limited schedule.



Figure 12.1.1: Site plan layout separation

## 12.2 New Street Networks

It is anticipated that there will be two new streets for the subject site as shown previously in Figure 12.1.1. Both of the new streets are expected to be dead end streets, preventing the possibility of cut through traffic in the sub-division. Additionally, the land features greenspace area with a parkland provided for the residents living in the subdivision. It is expected that trees will be planted along the street in consistent pattern throughout the site. The subdivision is connected to the intersection of Carp Road and Donald B. Munro Drive

via a Multi-use pathway encouraging travel by sustainable modes with bus stops located at the intersection as well as providing connection to on-road bicycle facilities.

## **13.0 BOUNDARY STREETS**

This section will examine the design elements of the noted boundary streets and their ability to accommodate the proposed development as well as their alignment with the City of Ottawa's Complete Streets policy and urban design objectives.

The boundary street for this development is Langstaff Drive. At this time, the City has not prepared a complete street concept for this street.

### **13.1 Mobility**

#### ***13.1.1 Pedestrian Level of Service (PLOS)***

Langstaff Drive currently has a 2.0m sidewalk on the east side of the road with a posted speed limit of 40 km/h within the vicinity of the subject site as noted in [Section 3.1](#). Historical Average Annual Daily Traffic (AADT) was not available for this segment of Langstaff Drive, however based on available data from TMCS completed as part of this investigation it was determined that Langstaff Drive has an AADT/lane less than 3000 veh/day. On-street parking is not permitted in the vicinity of the planned development site.

Upon review of Exhibit 4 of the City of Ottawa's Multi-Modal Level of Service (MMLOS) Guidelines, Langstaff Drive has a PLOS of B.

#### ***13.1.2 Bicycle Level of Service (BLOS)***

Langstaff Drive currently does not have any designated bike lanes. As, such Exhibit 11, of the MMLOS guidelines states that for mixed traffic, the BLOS is dependant on the number of travel lanes, travel speed, and lane separation for unsignalized roadway segments. The segment of Langstaff Drive located along the proposed development has a BLOS of A since Langstaff Drive has two travel lanes and a posted speed of 40 km/h.

#### ***13.1.3 Transit Level of Service (TLOS)***

This segment of Langstaff Drive is a mixed traffic facility and currently does not have any dedicated transit lanes. While the TLOS methodology employed by the City of Ottawa's MMLOS Guidelines is intended primarily for corridors with existing or planned rapid transit or transit priority measures, this segment of Langstaff Drive can be evaluated as it is serviced by a regular bus route. Parking / driveway friction is minimal within the vicinity of the subject site and can be considered low for the purposes of this evaluation.

Upon review of Exhibit 15 of the City of Ottawa's MMLOS Guidelines, this segment of Langstaff Drive has a TLOS of D.

#### 13.1.4 Truck Level of Service (TkLOS)

This segment of Colonnade Road currently has two travel lanes (one in each direction) with a curb lane width of approximately 3.3m at its narrowest point.

Upon review of Exhibit 20 of the City of Ottawa's MMLOS Guidelines, this segment of Colonnade Road has a TkLOS of D.

#### 13.1.5 Vehicular Level of Service (LOS)

The vehicular LOS and associated volume to capacity (v/c) ratio for study area intersections is presented in [Section 11.2](#). The segment LOS for the boundary street was taken as the critical v/c ratios for the northbound and southbound movements at the intersections of Langstaff Drive and Frances Colbert Avenue and Langstaff Drive and Donald B. Munro Drive, respectively. A summary of the approach v/c and associated LOS for all analysis periods, as determined per City of Ottawa TIA Guidelines (2017), are presented in [Table 13.1.5.1](#). Detailed analysis reports are presented in [Appendix E](#).

**Table 13.1.5.1: Vehicular Level of Service (LOS) by Approach**

Analysis Period	Approach	AM Peak Hour		PM Peak Hour	
		LOS	v/c Ratio	LOS	v/c Ratio
Existing Conditions (2019)	NB	A	0.05	A	0.06
	SB	A	0.14	A	0.13
Background Conditions (2023)	NB	A	0.06	A	0.06
	SB	A	0.16	A	0.14
Background Conditions (2028)	NB	A	0.06	A	0.07
	SB	A	0.17	A	0.14
Total Traffic (2023)	NB	A	0.07	A	0.08
	SB	A	0.19	A	0.16
Total Traffic (2028)	NB	A	0.07	A	0.09
	SB	A	0.2	A	0.17

As shown, all approaches are anticipated to operate at acceptable levels of service throughout the 2028 horizon year.

### 13.2 Road Safety

Available collision data within the study area was reviewed and is presented in [Section 3.6](#). No road safety concerns were identified on boundary streets or within the study area. As City of Ottawa collision records do not indicate direction of travel for vehicles involved, collision diagrams are not feasible.

### 13.3 Neighborhood Traffic Management

Available background data suggests that there are no known operational concerns on boundary streets.



## **14.0 TRANSPORTATION DEMAND MANAGEMENT**

This section will identify any post occupancy TDM program measures that could benefit the developments proposed design and infrastructure elements.

### **14.1 Context for TDM**

Previous sections of this report outlined trip generation and distribution for multiple travel modes. As stated, the mode shares were estimated based on the multiple factors such as existing Traffic Assessment Zone (TAZ) studies and knowledge of surrounding transit and pedestrian facilities. The expected mode shares for the proposed development are not expected to differ much from the TAZ study conducted for the area containing the subject site.

As stated previously, the proposed development is in a Designated Village DPA.

### **14.2 Need and Opportunity**

Currently Langstaff Drive is expected to be operating well with all the movements expected to operate at a LOS of A in the future horizon year of 2028. Langstaff Drive within the vicinity of the subject site has a PLOS, BLOS, and TLOS of B, A, and D respectively. As such, implementing TDM measures, it is unlikely that it would be enough to achieve higher sustainable mode share targets by reducing vehicle trips since the traffic operation are operating well. Additionally, the village nature of the area surrounding the development site in a rural area may encourage higher sustainable modes from recreational trips by utilizing the multi-use pathway from the development to the intersection of Carp Road and Donald B. Munro Drive.

The proposed development is not expected to have a significant number of visitors. Instead, it is likely most occupants will be residents who will have to commute on a daily basis. Many of the ride sharing services provided elsewhere in the City of Ottawa would not be beneficial for long term commuting. As such, the greatest improvement to the MMLOS would be to encourage public transit and providing service throughout the week rather than a limited service.

### **14.3 TDM Program**

The City of Ottawa's TDM Measures Checklist has been attached in [Appendix G](#) for reference. The checklist outlines if any TDM measures would be beneficial in increasing alternate modes of transportation other than vehicle driver. However, due to the location of the proposed subject site and the lack of available transit, many of the TDM measures are not applicable or would have minimal impacts. The TDM measure that is provided by the proposed development which is expected to lessen the impacts on the transportation network is bicycle stalls. This would encourage the residents of mid-rise apartments to cycle to nearby stores and recreational facilities as well as the employees that manage the club house and parkland within the subdivision to cycle to work. Another TDM measure that will encourage sustainable modes is the multi-use pathway connecting the sub-division to the intersection of Carp Road and Donald B. Munro Drive with most of the trips expected to be recreational.

## **15.0 ACCESS INTERSECTIONS**

This section will examine design elements of the proposed development's access points and assess their alignment with the City of Ottawa's Complete Streets philosophy, MMLOS Guidelines and urban design objectives.

### **15.1 Location and Design of Access**

The proposed development is anticipated to have three full-move accesses with all of them located on Langstaff Drive. The southern two entrances (Access 2 and 3) near the intersection of Langstaff Drive and Cavanagh Drive are expected to serve the southern development section whereas the Access 1 is expected to serve only the northern section as shown previously in [Figure 12.1.1](#). It is not anticipated that the design parameters of the existing access will change.

### **15.2 Intersection Control**

In consideration of existing and projected volumes of traffic anticipated to utilize the site accesses, stop control at the minor approach (site driveway) is recommended. No other traffic control measures are warranted at the proposed site accesses.

### **15.3 Intersection Design**

The proposed site accesses were analyzed under existing, background and total future traffic conditions in [Section 11.2](#). No concerns were noted with regards to approach LOS at the existing site access, which is anticipated to continue operating at LOS A through to the 2028 horizon year.

As the site accesses will not be signalized, the MMLOS for all modes at the intersection of Langstaff Drive and the site entrances will be the same as that for the boundary road segment presented in [Section 13.0](#).

## **16.0 TRANSIT**

This section will review the potential impacts of the proposed development on existing and planned transit networks and services in order to ensure TLOS is not negatively impacted.

### **16.1 Route Capacity**

As noted in [Section 9.1.2](#), it is anticipated that the proposed development will generate approximately 3 transit trips in both the AM and PM peak hours, respectively. It is expected that the relatively low number of development-generated transit trips can be accommodated by the existing transit routes and is not anticipated to result in any requirements for additional transit capacity. Further, it is not anticipated that the existing transit routes will require modification as a result of the proposed development.

## **16.2 Transit Priority**

As noted in [Section 3.4](#), the area of the subject site is serviced by one bus route, Route 303 which operates only on Wednesdays for a limited time. It is expected that the relatively low number of development-generated transit trips can be accommodated and is not anticipated that any additional transit trips will result in impacts to travel time.

As noted previously, the site will have three (3) accesses on Langstaff Drive. Two of the accesses will serve the southern section of the development whereas one of the access will serve the northern section. It is not anticipated that the addition of three development driveways on Langstaff Drive will impact transit travel times.

## **17.0 INTERSECTION DESIGN**

This section will determine the design elements of study area intersections required to accommodate the proposed development, ensuring they are consistent with the City of Ottawa's Complete Streets philosophy and MMLOS Practices.

### **17.1 Intersection Control**

The five study area intersections are currently either two-way stop controlled or all-way stop controlled, and are anticipated to operate at acceptable levels of service through to the 2028 horizon year. As such, no adjustments to the existing intersection controls are recommended.

### **17.2 Intersection Design**

#### ***17.2.1 Intersection Pedestrian Level of Service (PLOS)***

The Pedestrian Level of Service (PLOS) for study area intersections is determined using the City of Ottawa's Multi-Modal Level of Service Guidelines. However, since all the study area intersections are stop controlled, the Pedestrian Exposure to Traffic at Signalized Intersection (PETSI) (Exhibit 5), PETSI Evaluation Table (Exhibit 6), and Pedestrian Delay Evaluation Table (Exhibit 7) is not applicable.

#### ***17.2.2 Intersection Bicycle Level of Service (BLOS)***

The Bicycle Level of Service (BLOS) for study area intersections was determined in accordance with the City of Ottawa's Multi-Modal Level of Service Guidelines.

All of the study area intersections are unsignalized with no median refuge and cross-sections of two lanes (one lane in each direction) at each approach. As noted previously in [Section 3.1](#), Langstaff Drive, Cavanagh Drive, Frances Colbert Avenue, and Donald B. Munro Drive have a posted speed limit of 40 km/h whereas Carp Road has a speed limit of 50 km/h. Based on Exhibit 11 of the City of Ottawa's MMLOS guidelines for unsignalized crossing with no median refuge, Langstaff Drive, Cavanagh Drive, Frances Colbert Avenue, and Donald B. Munro Drive is expected to have BLOS of A while Carp Road is expected to have a BLOS of B.

### *17.2.3 Intersection Transit Level of Service (TLOS)*

TLOS for intersection is only applicable for signalized intersection based on Exhibit 16 of the City of Ottawa's Multi-Modal Level of Service (MMLOS) Guidelines. Therefore, the TLOS at the study area intersections is not applicable as all the intersections are unsignalized.

### *17.2.4 Intersection Truck Level of Service (TkLOS)*

TkLOS for intersection is only applicable for signalized intersection based on Exhibit 21 of the City of Ottawa's Multi-Modal Level of Service (MMLOS) Guidelines. Therefore, the TkLOS at the study area intersections is not applicable as all the intersections are unsignalized.

## **18.0 SUMMARY OF IMPROVEMENTS INDICATED AND MODIFICATION OPTIONS**

The TIA Strategy Report evaluated the proposed development and its expected impact on the existing transportation network. Based on the analysis presented, the area of the subject site is currently operating at acceptable levels of service and is anticipated to continue operating at acceptable levels of service through to the 2028 horizon year based on projected traffic growth, site generated traffic and mode share targets.

The proposed development site plan meets or exceeds the City's minimum By-Law requirements for both vehicle and bicycle parking spaces. Further, direct links to the surrounding pedestrian network are provided and the proposed multi-use pathway to the southwest of the development provides a connection to the intersection of Carp Road and Donald B. Munro Drive. No issues with respect to site circulation or truck turning movements are noted.

Upon review of boundary streets, the pedestrian and cycling facilities are anticipated to operate at PLOS and BLOS of B and A, respectively. There is no transit priority present in the study area, however based on mixed traffic conditions the boundary street is anticipated to operate at a TLOS of D. No issues with transit service capacity are noted for the existing or projected conditions. No improvements are recommended to address existing MMLOS for the adjacent study area intersections.



Prepared by,

Reviewed by,

**Talha Yousafzai, EIT**

Transportation and Traffic Engineering Intern

[t.yousafzai@mcintoshperry.com](mailto:t.yousafzai@mcintoshperry.com)

289.319.1043

**Alex Siciliano, P.Eng**

Project Engineer

[a.siciliano@mcintoshperry.com](mailto:a.siciliano@mcintoshperry.com)

613.903.4428

Submitted by,

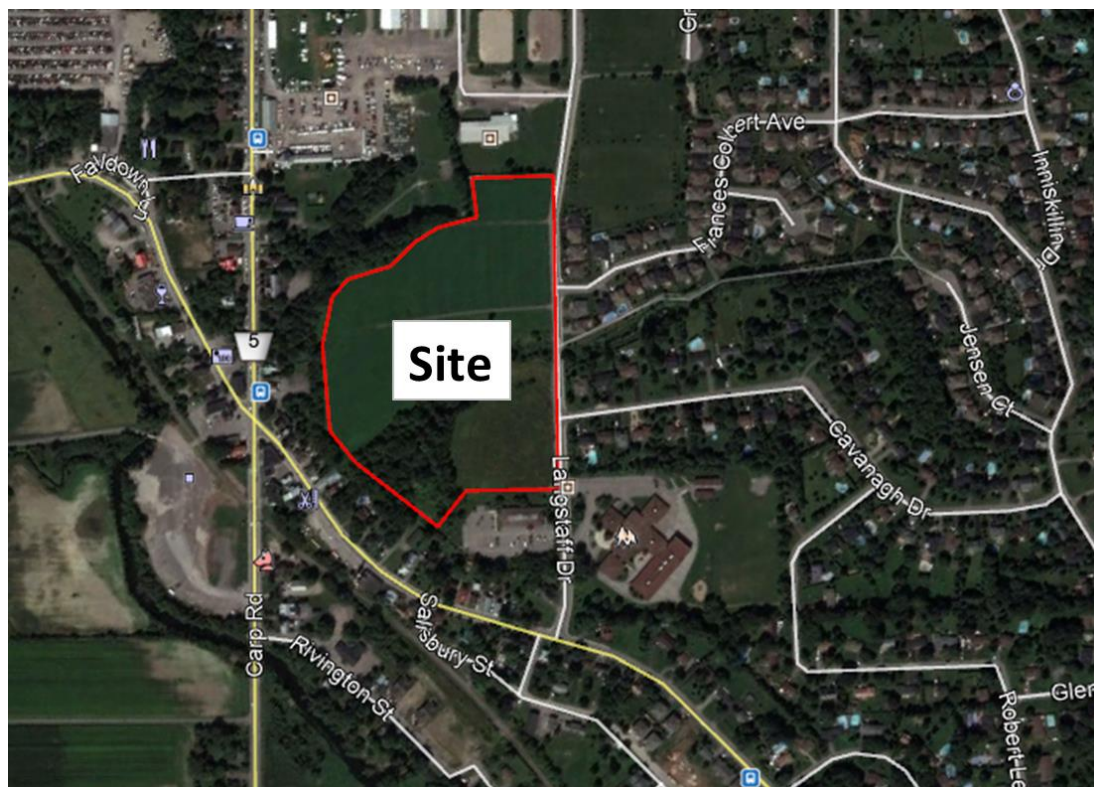
**Thomas Gryz, M.A.Sc., P.Eng**

Transportation and Traffic Engineer

[t.gryz@mcintoshperry.com](mailto:t.gryz@mcintoshperry.com)

613.903.5772

# TIA ANALYSIS REPORT: RESIDENTIAL DEVELOPMENT AT 147 LANGSTAFF ROAD



## APPENDIX A – TIA SCREENING FORM

## City of Ottawa 2017 TIA Guidelines Screening Form

### 1. Description of Proposed Development

Municipal Address	<b>147 Langstaff Drive</b>
Description of Location	<b>Langstaff Drive at Donald B. Munro Drive</b>
Land Use Classification	<b>Residential</b>
Development Size (units)	<b>192 units (108 Apartments + 84 Townhomes)</b>
Development Size (m <sup>2</sup> )	<b>8.1 ha</b>
Number of Accesses and Locations	<b>3 on Langstaff Drive</b>
Phase of Development	<b>1</b>
Buildout Year	<b>2023</b>

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

### 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
Single-family homes	40 units
Townhomes or apartments	90 units
Office	3,500 m <sup>2</sup>
Industrial	5,000 m <sup>2</sup>
Fast-food restaurant or coffee shop	100 m <sup>2</sup>
Destination retail	1,000 m <sup>2</sup>
Gas station or convenience market	75 m <sup>2</sup>

*\* 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.**

### 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?		NO
Is the development in a Design Priority Area (DPA) or Transit-oriented Development (TOD) zone?*	YES**	

\*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).

\*\* Designated Village DPA

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

### 4. Safety Triggers

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

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

### 5. Summary

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

*Transportation Impact Assessment Screening Form*

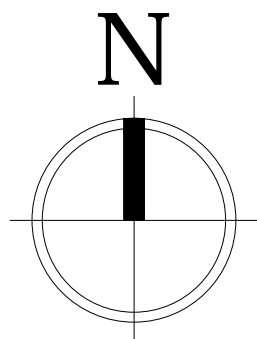
If none of the triggers are satisfied, the TIA Study is complete. If one or more of the triggers is satisfied, the TIA Study must continue into the next stage (Screening and Scoping).

# TIA ANALYSIS REPORT: RESIDENTIAL DEVELOPMENT AT 147 LANGSTAFF ROAD

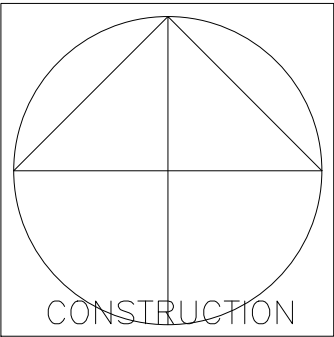
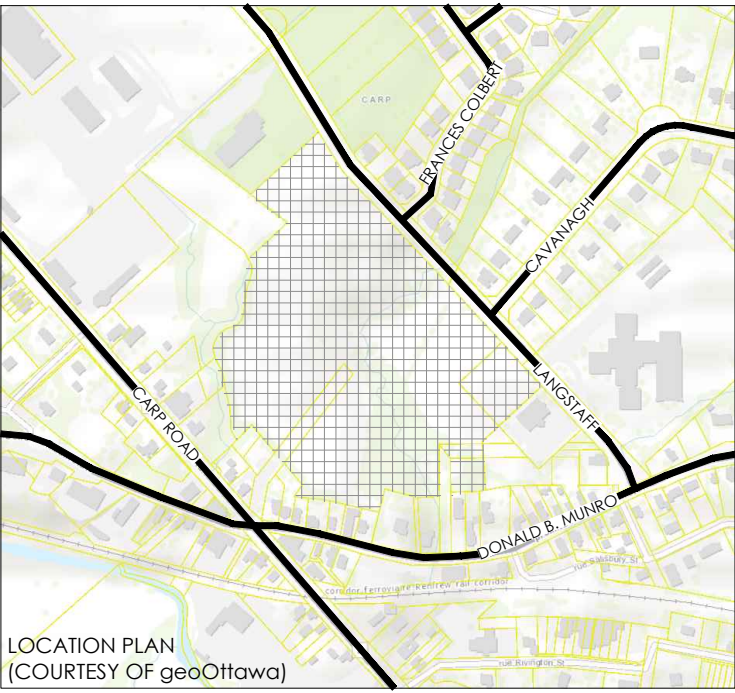



## APPENDIX B – SITE PLAN





NO.	REVISION	DATE
1	ISSUED FOR REVIEW	NOV. 14/19





**Vandenberg & Wildeboer**  
ARCHITECTS

www.vandenberg-wildeboer.com Telephone: 613.387.0144 Facsimile: 613.371.8828 malcolm@vandenberg-wildeboer.com  
\*THE OLD STONE LODGE - 160 RABBITCREEK WAY - OTTAWA, CANADA - K1H 8P9\*

PROJECT TITLE  
**LANGSTAFF RESIDENTIAL**  
147 LANGSTAFF DRIVE, CARP, ON K0A 1L0

DRAWING TITLE  
**SITE PLAN**

DESIGNED BY: MALCOLM WILDEBOER  
DRAWN BY: SC, JN  
START DATE: JUNE, 2019  
SCALE: AS SHOWN  
PROJECT NO. 1916

drawing No.  
**A001**



# TIA ANALYSIS REPORT: RESIDENTIAL DEVELOPMENT AT 147 LANGSTAFF ROAD



## APPENDIX C – CITY OF OTTAWA TRAFFIC DATA



# Rural West

## Demographic Characteristics

Population	24,960	Actively Travelled	19,280
Employed Population	12,280	Number of Vehicles	18,930
Households	8,750	Area (km <sup>2</sup> )	744.4

Occupation Status (age 5+)	Male	Female	Total
Full Time Employed	6,190	4,610	10,800
Part Time Employed	480	990	1,470
Student	2,720	2,970	5,680
Retiree	1,920	1,900	3,820
Unemployed	300	150	450
Homemaker	60	970	1,030
Other	260	140	390
Total:	11,920	11,730	23,660

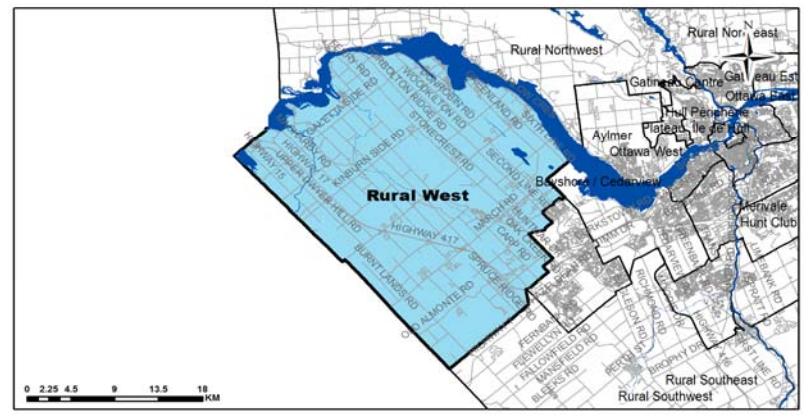
Traveller Characteristics	Male	Female	Total
Transit Pass Holders	620	550	1,170

Licensed Drivers	9,590	9,180	18,770
------------------	-------	-------	--------

Telecommuters	90	100	190
---------------	----	-----	-----

Trips made by residents	28,240	31,610	59,850
-------------------------	--------	--------	--------

Selected Indicators	
Daily Trips per Person (age 5+)	2.53
Vehicles per Person	0.76
Number of Persons per Household	2.85
Daily Trips per Household	6.84
Vehicles per Household	2.16
Workers per Household	1.40
Population Density (Pop/km <sup>2</sup> )	30

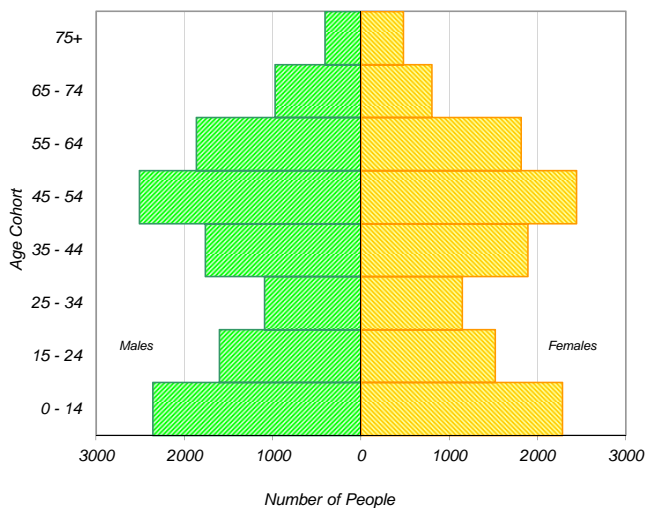


Household Size		
1 person	1,280	15%
2 persons	3,330	38%
3 persons	1,520	17%
4 persons	1,800	21%
5+ persons	820	9%
Total:	8,750	100%

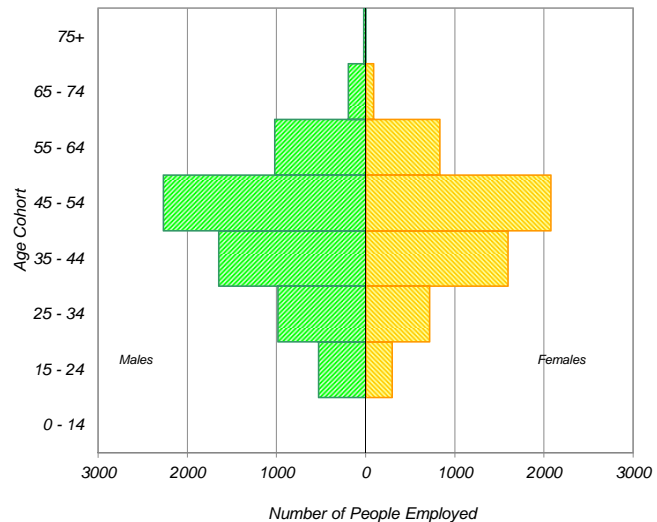
Households by Vehicle Availability		
0 vehicles	90	1%
1 vehicle	1,820	21%
2 vehicles	4,540	52%
3 vehicles	1,530	17%
4+ vehicles	770	9%
Total:	8,750	100%

Households by Dwelling Type		
Single-detached	8,330	95%
Semi-detached	160	2%
Townhouse	170	2%
Apartment/Condo	90	1%
Total:	8,750	100%

Population



Employed Population

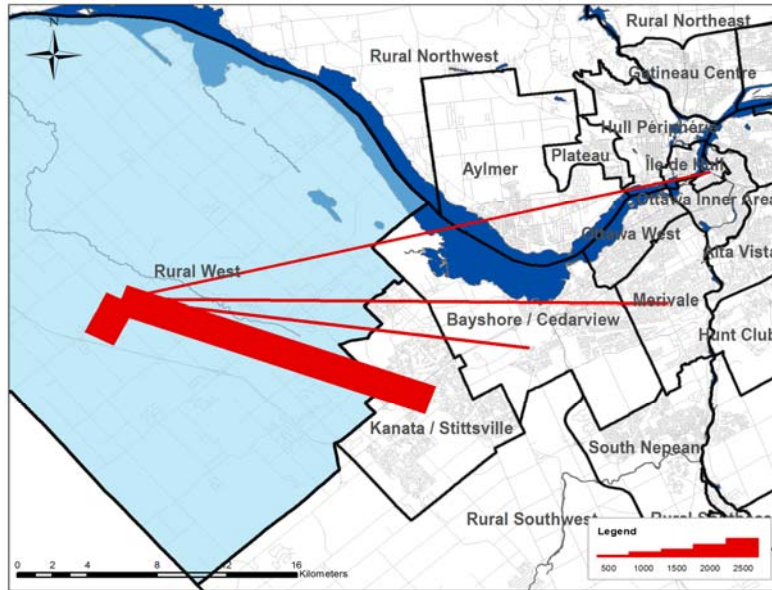


\* In 2005 data was only collected for household members aged 11+ therefore these results cannot be compared to the 2011 data.

## Travel Patterns

### Top Five Destinations of Trips from Rural West

#### AM Peak Period



### Summary of Trips to and from Rural West

#### AM Peak Period (6:30 - 8:59)

Districts	Destinations of Trips From		Origins of Trips To	
	District	% Total	District	% Total
Ottawa Centre	430	4%	0	0%
Ottawa Inner Area	380	4%	0	0%
Ottawa East	80	1%	90	1%
Beacon Hill	70	1%	40	1%
Alta Vista	180	2%	20	0%
Hunt Club	80	1%	60	1%
Merivale	720	7%	70	1%
Ottawa West	170	2%	70	1%
Bayshore / Cedarview	760	7%	380	6%
Orléans	0	0%	70	1%
Rural East	0	0%	0	0%
Rural Southeast	20	0%	0	0%
South Gloucester / Leirtrim	60	1%	40	1%
South Nepean	30	0%	80	1%
Rural Southwest	160	2%	80	1%
Kanata / Stittsville	3,250	31%	1,050	17%
Rural West	4,020	38%	4,020	65%
Île de Hull	140	1%	0	0%
Hull Périphérie	50	0%	0	0%
Plateau	0	0%	0	0%
Aylmer	0	0%	50	1%
Rural Northwest	10	0%	0	0%
Pointe Gatineau	20	0%	10	0%
Gatineau Est	0	0%	20	0%
Rural Northeast	0	0%	0	0%
Buckingham / Masson-Angers	0	0%	0	0%
Ontario Sub-Total:	10,410	98%	6,090	99%
Québec Sub-Total:	220	2%	80	1%
Total:	10,630	100%	6,170	100%

### Trips by Trip Purpose

24 Hours	From District		To District		Within District	
Work or related	6,640	32%	2,300	11%	1,860	12%
School	1,930	9%	460	2%	2,220	14%
Shopping	2,930	14%	220	1%	750	5%
Leisure	2,240	11%	1,440	7%	1,310	8%
Medical	680	3%	150	1%	420	3%
Pick-up / drive passenger	1,610	8%	800	4%	1,400	9%
Return Home	3,570	17%	14,860	72%	6,720	43%
Other	1,080	5%	370	2%	880	6%
Total:	20,680	100%	20,600	100%	15,560	100%

AM Peak (06:30 - 08:59)	From District		To District		Within District	
Work or related	4,090	62%	1,410	65%	1,140	28%
School	1,480	22%	420	19%	2,010	50%
Shopping	130	2%	0	0%	90	2%
Leisure	110	2%	40	2%	40	1%
Medical	120	2%	30	1%	0	0%
Pick-up / drive passenger	460	7%	50	2%	430	11%
Return Home	0	0%	150	7%	170	4%
Other	230	3%	60	3%	140	3%
Total:	6,620	100%	2,160	100%	4,020	100%

PM Peak (15:30 - 17:59)	From District		To District		Within District	
Work or related	40	1%	30	0%	50	1%
School	40	1%	0	0%	0	0%
Shopping	550	17%	30	0%	140	4%
Leisure	510	16%	290	4%	510	14%
Medical	170	5%	40	1%	0	0%
Pick-up / drive passenger	360	11%	360	5%	430	12%
Return Home	1,380	42%	5,950	88%	2,310	63%
Other	200	6%	40	1%	230	6%
Total:	3,250	100%	6,740	100%	3,670	100%

Peak Period (%)	Total:	% of 24 Hours	Within District (%)
24 Hours	56,840		27%
AM Peak Period	12,800	23%	31%
PM Peak Period	13,660	24%	27%

### Trips by Primary Travel Mode

24 Hours	From District		To District		Within District	
Auto Driver	15,110	73%	15,000	73%	8,640	55%
Auto Passenger	3,170	15%	3,310	16%	2,320	15%
Transit	790	4%	680	3%	0	0%
Bicycle	190	1%	180	1%	50	0%
Walk	0	0%	0	0%	720	5%
Other	1,430	7%	1,430	7%	3,840	25%
Total:	20,690	100%	20,600	100%	15,570	100%

AM Peak (06:30 - 08:59)	From District		To District		Within District	
Auto Driver	4,400	67%	1,570	73%	1,670	42%
Auto Passenger	610	9%	180	8%	490	12%
Transit	650	10%	0	0%	0	0%
Bicycle	0	0%	0	0%	0	0%
Walk	0	0%	0	0%	140	3%
Other	950	14%	400	19%	1,720	43%
Total:	6,610	100%	2,150	100%	4,020	100%

PM Peak (15:30 - 17:59)	From District		To District		Within District	
Auto Driver	2,590	80%	5,070	75%	1,960	54%
Auto Passenger	540	17%	850	13%	870	24%
Transit	0	0%	450	7%	0	0%
Bicycle	10	0%	0	0%	20	1%
Walk	0	0%	0	0%	180	5%
Other	100	3%	370	5%	630	17%
Total:	3,240	100%	6,740	100%	3,660	100%

Avg Vehicle Occupancy	From District		To District		Within District	
24 Hours	1.21		1.22		1.27	
AM Peak Period	1.14		1.11		1.29	
PM Peak Period	1.21		1.17		1.44	

Transit Modal Split	From District		To District		Within District	
24 Hours	4%		4%		0%	
AM Peak Period	11%		0%		0%	
PM Peak Period	0%		7%		0%	

## Turning Movement Count - Peak Hour Diagram

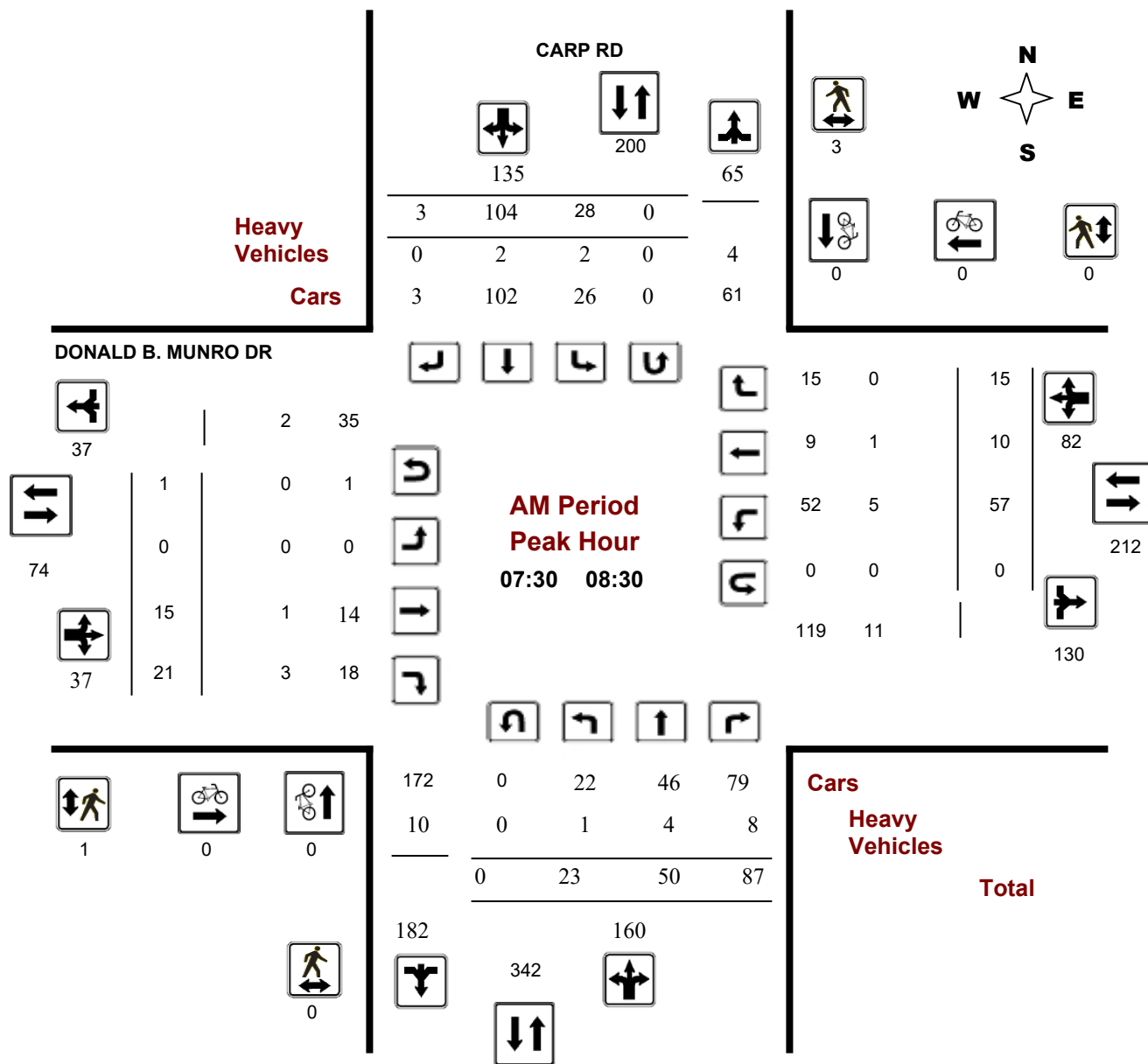
### CARP RD @ DONALD B. MUNRO DR

**Survey Date:** Tuesday, April 02, 2019

**Start Time:** 07:00

**WO No:** 38471

**Device:** Miovision



## Turning Movement Count - Peak Hour Diagram

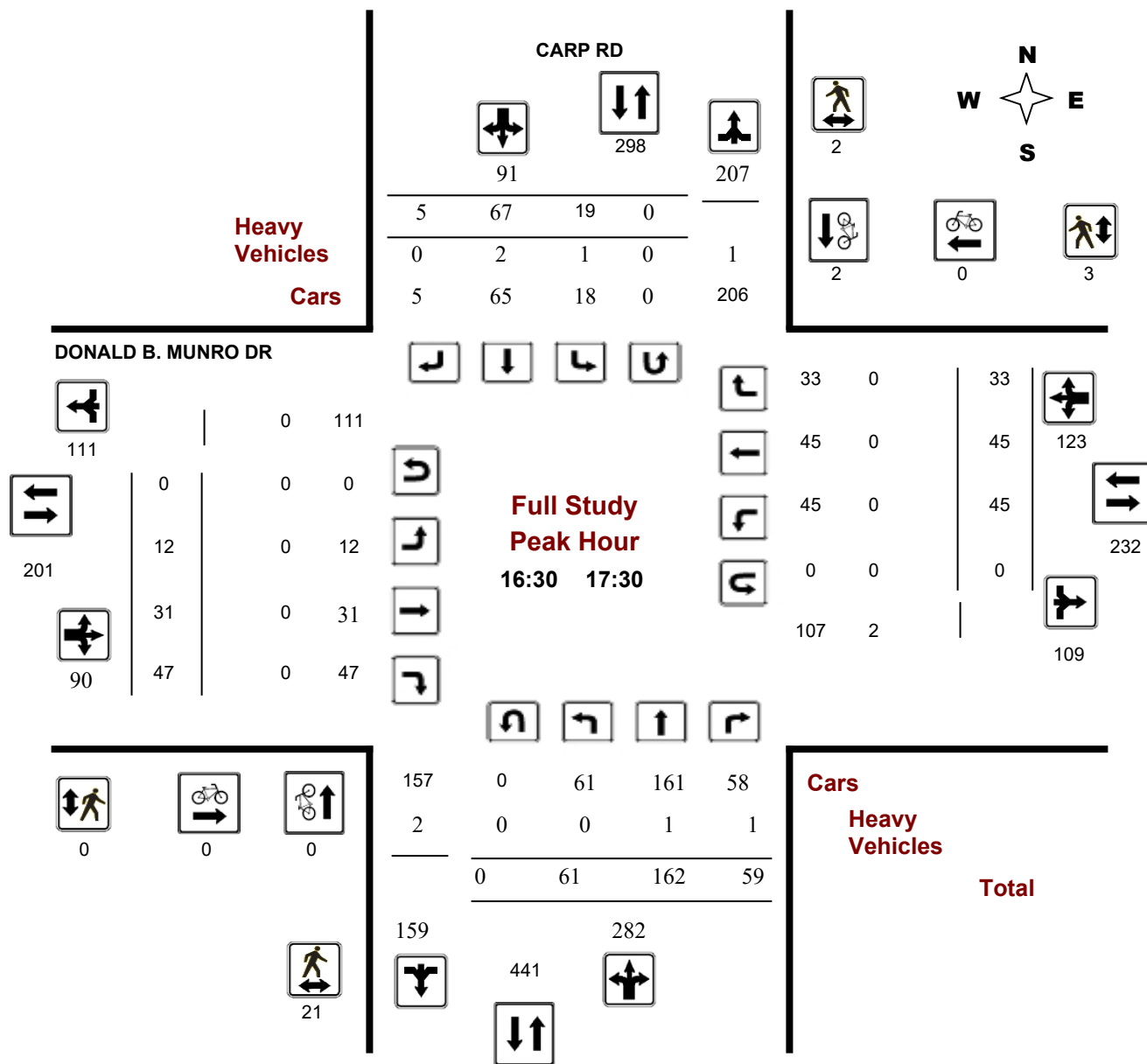
### CARP RD @ DONALD B. MUNRO DR

**Survey Date:** Tuesday, April 02, 2019

**Start Time:** 07:00

**WO No:** 38471

**Device:** Miovision



**Comments**

## Turning Movement Count - Peak Hour Diagram

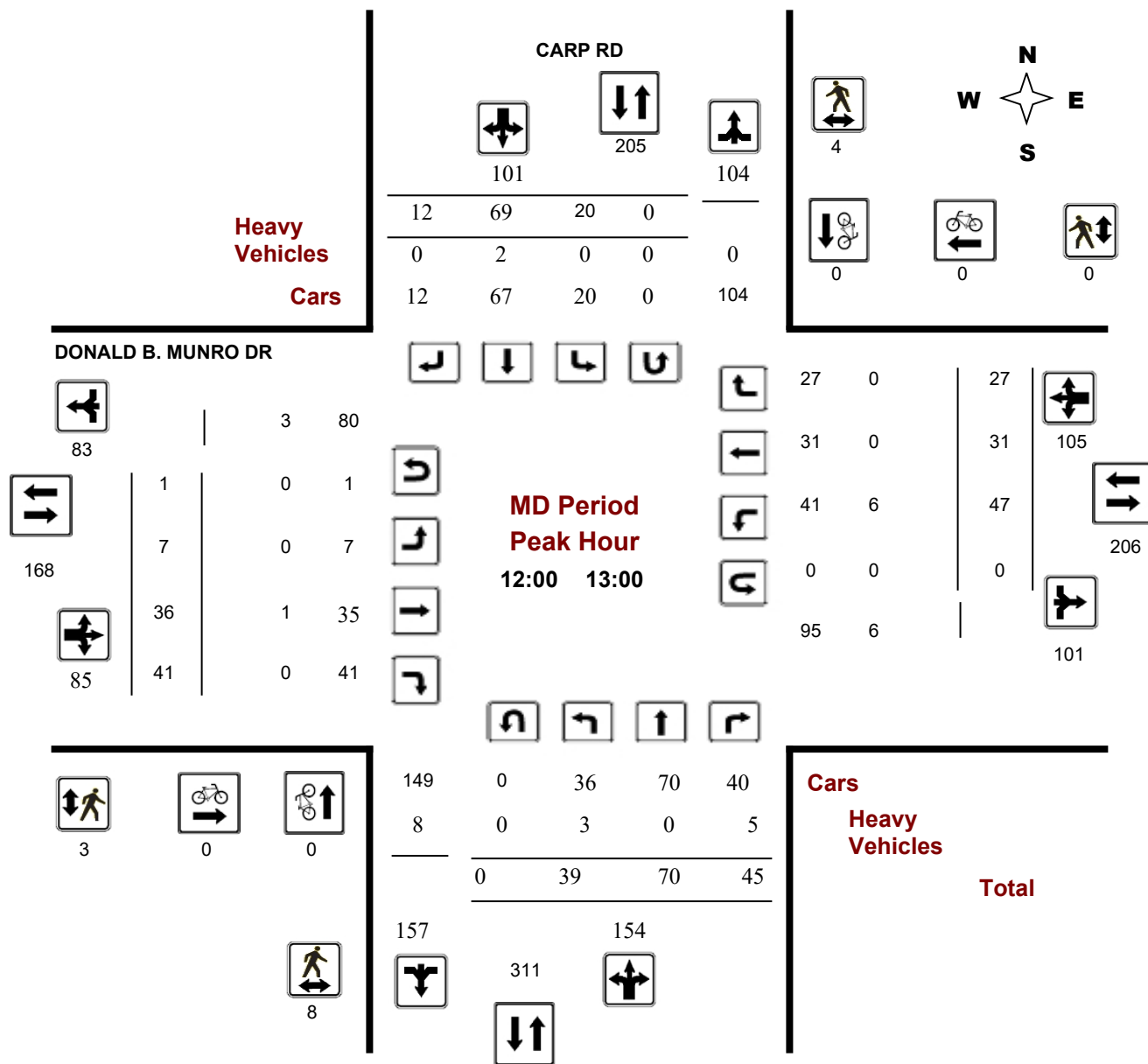
### CARP RD @ DONALD B. MUNRO DR

**Survey Date:** Tuesday, April 02, 2019

**Start Time:** 07:00

**WO No:** 38471

**Device:** Miovision



## Turning Movement Count - Peak Hour Diagram

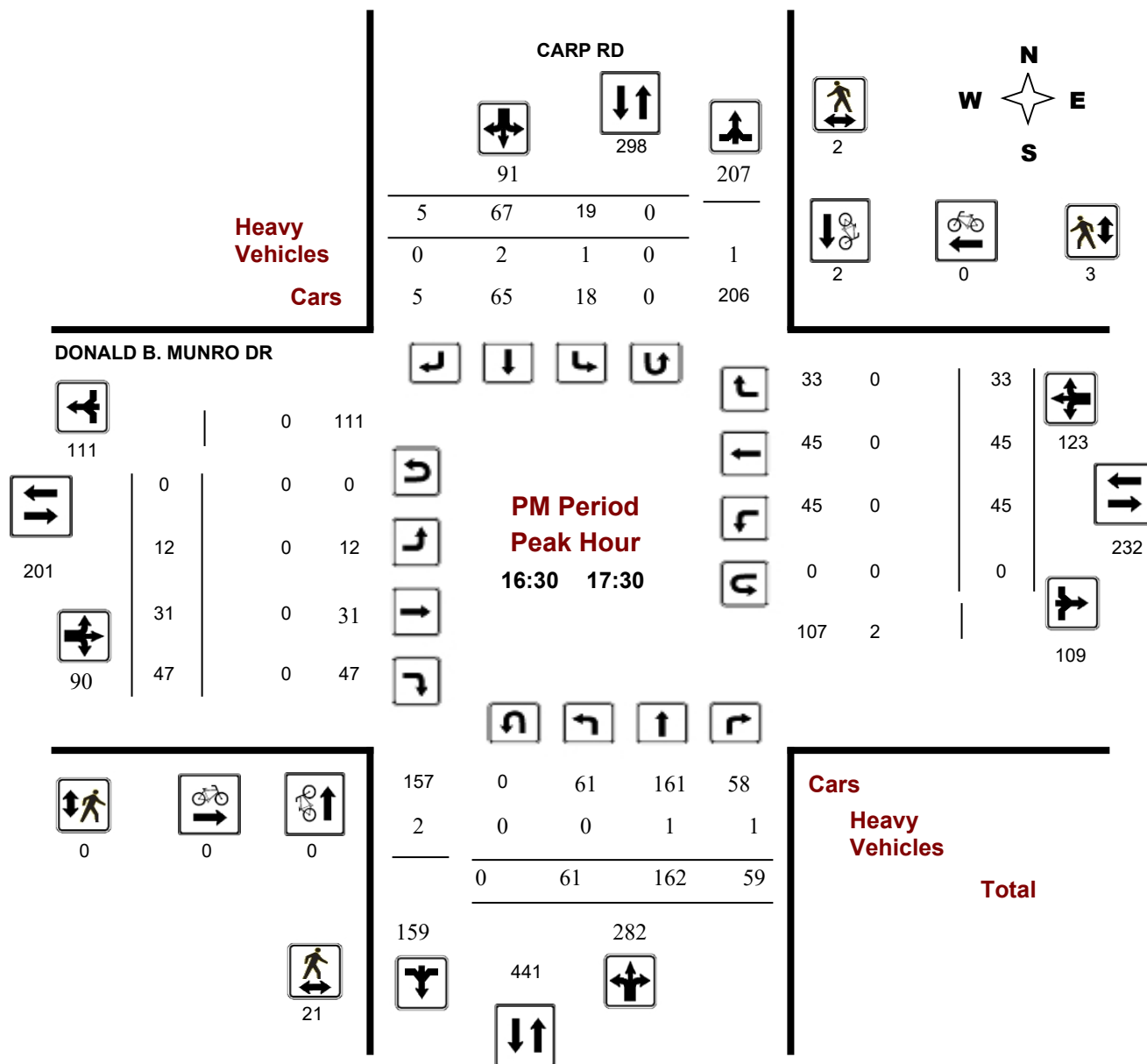
**CARP RD @ DONALD B. MUNRO DR**

**Survey Date:** Tuesday, April 02, 2019

**Start Time:** 07:00

**WO No:** 38471

**Device:** Miovision



## Comments



# Transportation Services - Traffic Services

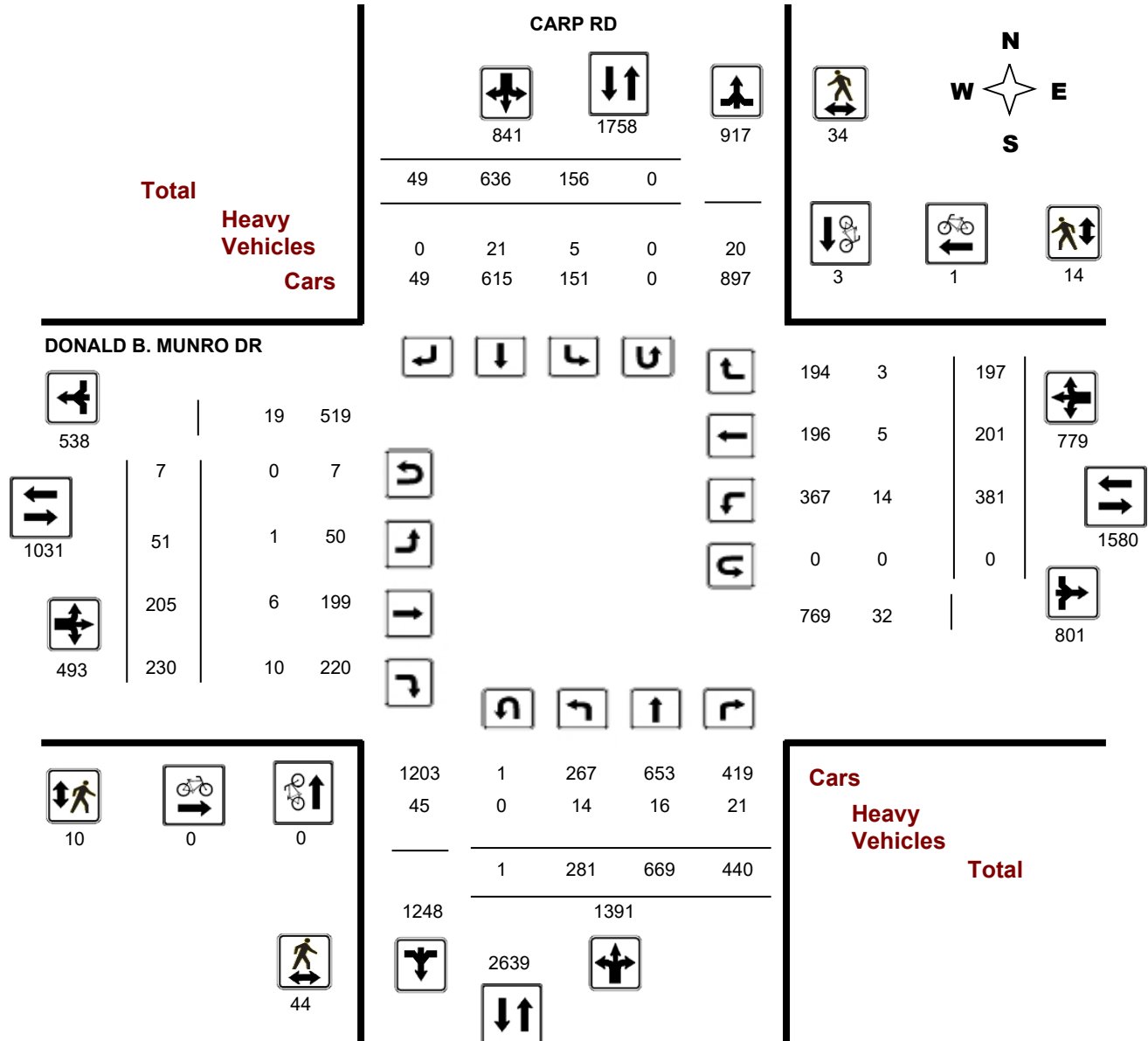
## Turning Movement Count - Full Study Diagram

### CARP RD @ DONALD B. MUNRO DR

**Survey Date:** Tuesday, April 02, 2019

**WO#:** 38471

**Device:** Miovision



## Turning Movement Count - AM Period Diagram

### CARP RD @ JUANITA AVE

**Survey Date:** Tuesday, April 02, 2019

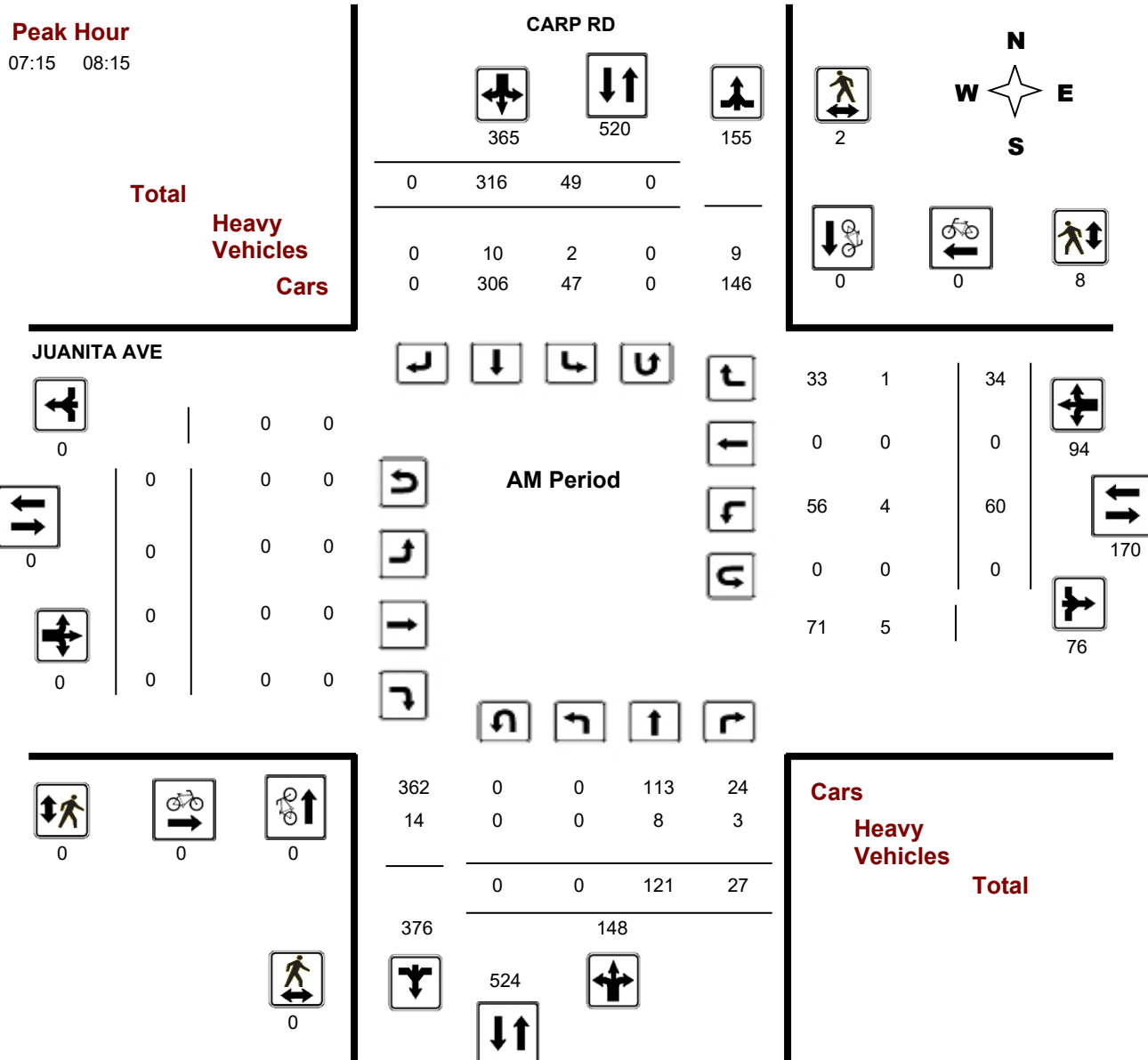
**Start Time:** 07:00

**WO#:** 38472

**Device:** Miovision

#### Peak Hour

07:15 08:15



## Turning Movement Count - Full Study Diagram

### CARP RD @ JUANITA AVE

**Survey Date:** Tuesday, April 02, 2019

**Start Time:** 07:00

**WO#:** 38472

**Device:** Miovision

#### Peak Hour

16:30 17:30

#### Total

#### Heavy Vehicles

#### Cars

#### CARP RD



776



1623

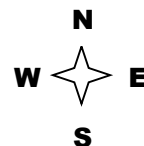


847

0	677	99	0	
0	19	3	0	14
0	658	96	0	833



2



1



5



23

#### JUANITA AVE



0



0



0

0 0

0 0

0 0

0 0

0 0

0 0



126 1

0 0

132 6

0 0

224 7

127

0

138

0



265



496



231

#### Full Study



791	1	0	707	128
25	0	0	13	4
1	0	720	132	

816

853



1669



0



0



2



1

#### Cars

#### Heavy Vehicles

#### Total

**Comments :**

## Turning Movement Count - MD Period Diagram

### CARP RD @ JUANITA AVE

**Survey Date:** Tuesday, April 02, 2019

**Start Time:** 07:00

**WO#:** 38472

**Device:** Miovision

#### Peak Hour

12:30 13:30

#### Total

#### Heavy Vehicles

#### Cars

#### CARP RD



157



321

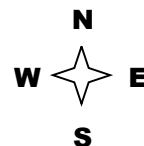


164

0	141	16	0	
0	4	1	0	1
0	137	15	0	163



0



0



3



4

#### JUANITA AVE



0



0



0

0 0

0 0

0 0

0 0

0 0

0 0



25 0

0 0

36 1

0 0

43 1

25

0

37

0



62



106



44

#### MD Period



174	1	0	138	28
5	0	0	1	0
1	0	139	28	

179

168



347



#### Cars

#### Heavy Vehicles

#### Total

**Comments :**

## Turning Movement Count - PM Period Diagram

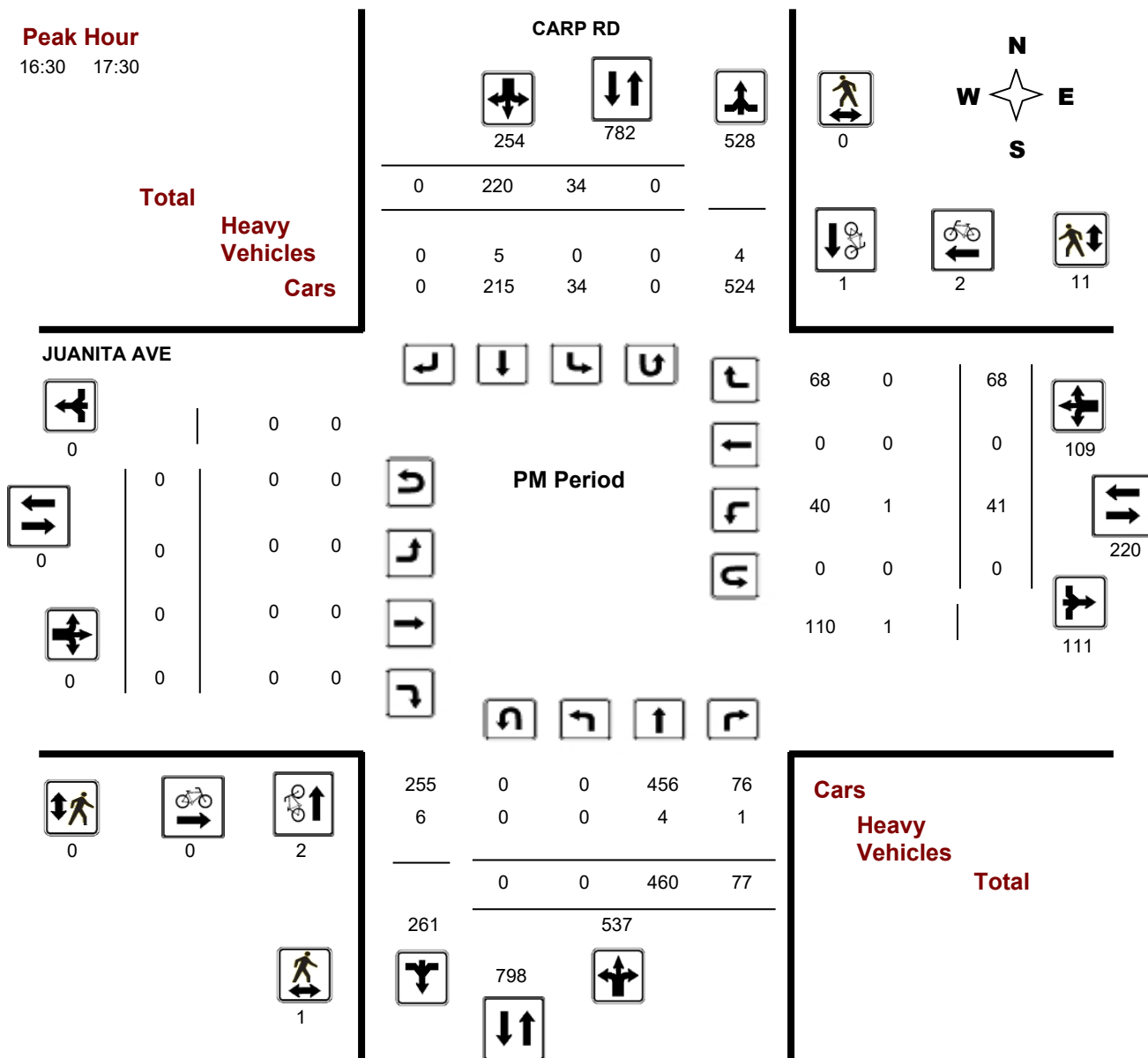
### CARP RD @ JUANITA AVE

**Survey Date:** Tuesday, April 02, 2019

**Start Time:** 07:00

**WO#:** 38472

**Device:** Miovision



**Comments :**

# Transportation Services - Traffic Services

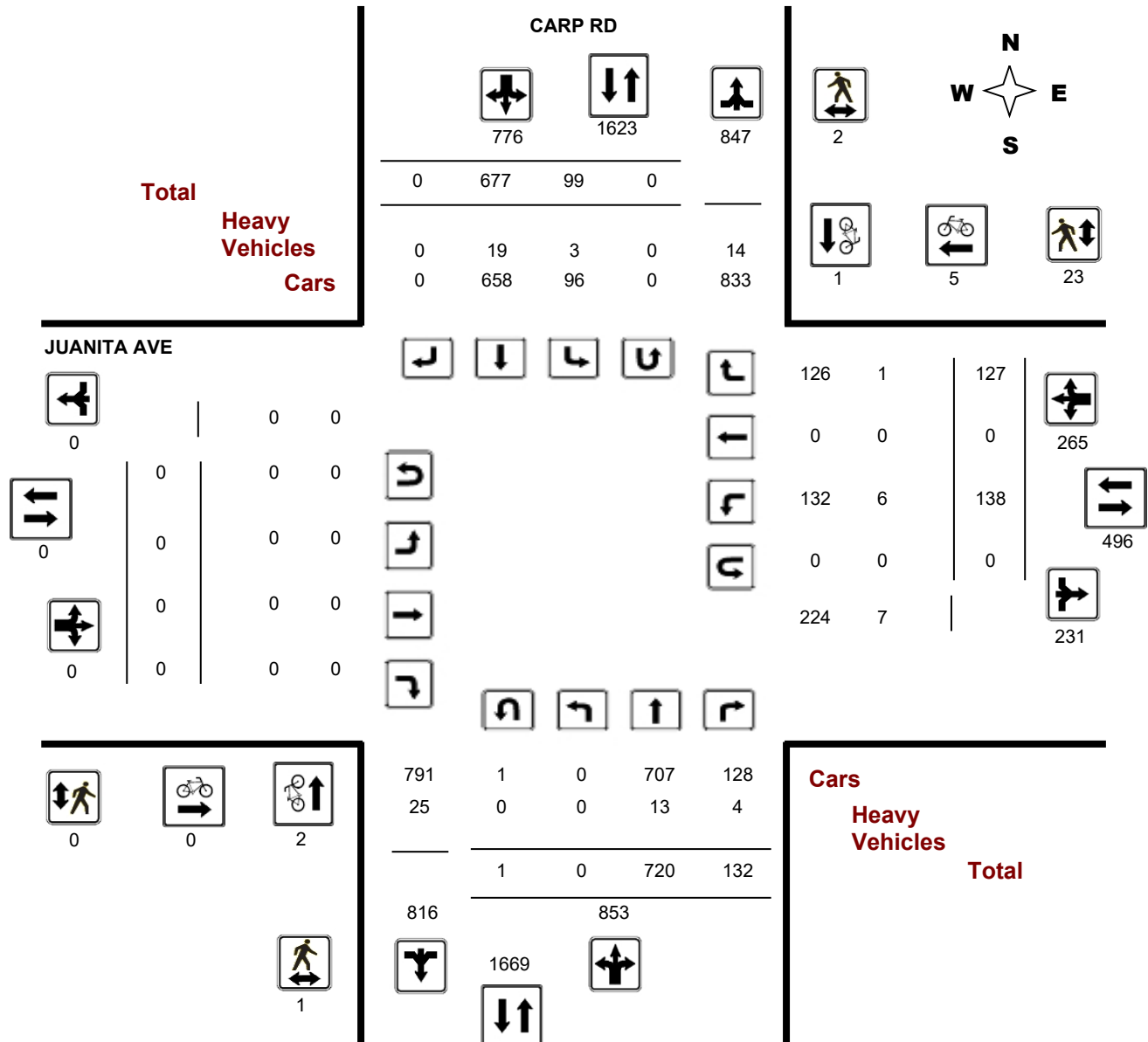
## Turning Movement Count - Full Study Diagram

### CARP RD @ JUANITA AVE

**Survey Date:** Tuesday, April 02, 2019

**WO#:** 38472

**Device:** Miovision





Municipality: City of Ottawa  
North/South Street    Langstaff Dr  
East/West Street    Frances Colbert

Time	NB Approach												SB Approach												EB Approach												WB Approach																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
	Cars			Trucks			Heavies			Ped	Cyclist	Cars			Trucks			Heavies			Ped	Cyclist	Cars			Trucks			Heavies			Ped	Cyclist	Cars			Trucks			Heavies																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right			Left	Thru	Right	Left	Thru	Right	Left	Thru	Right			Left	Thru	Right	Left	Thru	Right	Left	Thru	Right			Left	Thru	Right	Left	Thru	Right	Left	Thru	Right																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
07:00-07:15	0	1	1	1	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

16:00-16:15	0	6	5	0	1	0	0	0	0	0	0	0	3	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	2	0
16:15-16:30	0	12	7	0	1	0	0	0	0	0	0	0	6	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	2	0	
16:30-16:45	0	13	10	0	2	0	0	0	0	0	0	0	9	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	2	0		
16:45-17:00	0	13	5	0	0	0	0	0	0	0	0	0	8	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	1	1		
17:00-17:15	0	14	8	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	2	2			
17:15-17:30	0	11	14	0	0	0	0	0	0	0	0	0	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	1	0			
17:30-17:45	0	11	3	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	2	1				
17:45-18:00	0	19	7	0	0	0	0	0	0	0	0	2	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	0	0	0	0	6	0				

Municipality: City of Ottawa  
North/South Street    Langstaff Dr  
East/West Street    Donald B. Munro Dr

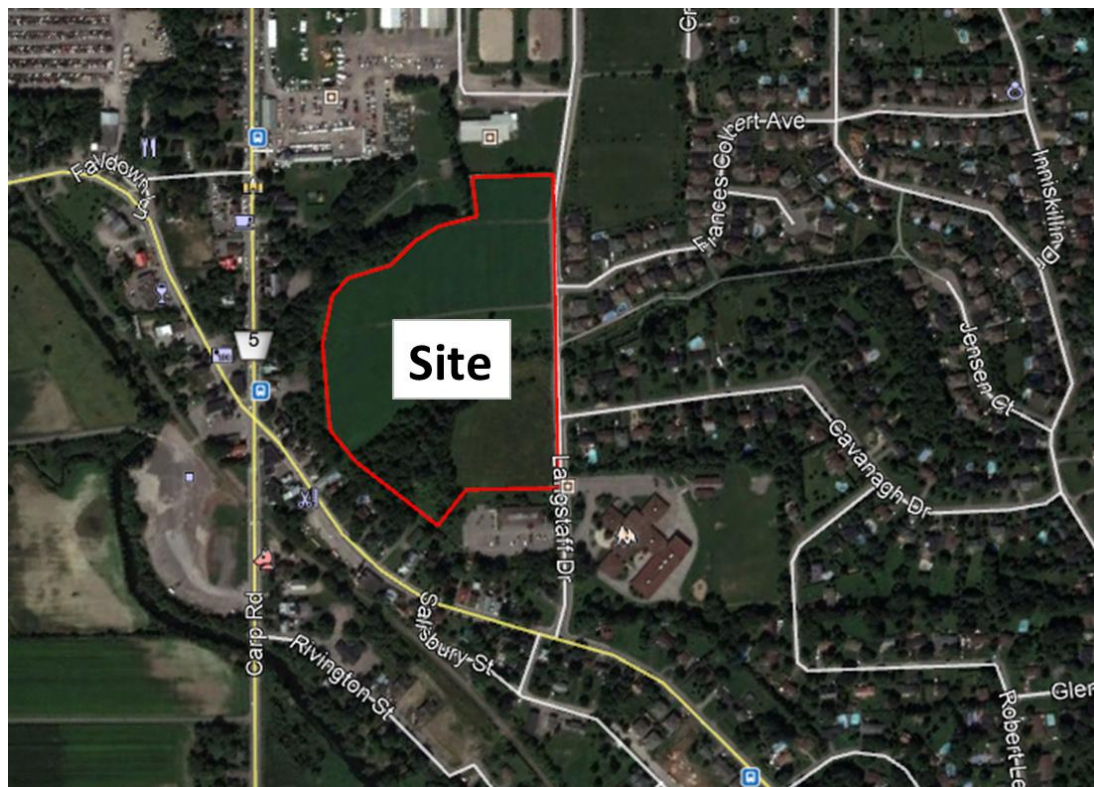
Time	NB Approach												SB Approach												EB Approach												WB Approach											
	Cars			Trucks			Heavies			Ped	Cyclist	Cars			Trucks			Heavies			Ped	Cyclist	Cars			Trucks			Heavies			Ped	Cyclist															
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right			Left	Thru	Right	Left	Thru	Right	Left	Thru	Right			Left	Thru	Right	Left	Thru	Right	Left	Thru	Right			Left	Thru	Right												
07:00-07:15	0	0	1	0	0	0	0	0	0	0	0	3	0	10	0	0	0	0	0	3	0	4	11	1	0	0	0	0	0	0	1	0	0	0	1	0	0	0	1	0								
07:15-07:30	1	0	1	0	0	0	0	0	0	0	0	7	0	2	0	0	1	0	0	0	1	0	7	11	1	0	0	0	0	0	0	0	2	2	3	0	0	0	0	0	0							
07:30-07:45	2	1	2	0	0	0	0	0	0	0	0	12	0	7	1	0	0	0	0	0	0	13	11	2	1	0	0	0	0	0	0	0	9	6	0	0	0	0	1	0								
07:45-08:00	1	0	2	0	0	0	0	0	0	0	0	16	0	8	2	0	1	0	0	0	1	0	10	9	0	0	1	0	0	0	0	0	10	6	0	0	4	0	0	1	0							
08:00-08:15	0	1	3	0	0	0	0	0	0	0	0	18	1	5	1	0	0	0	0	0	0	5	15	0	1	1	0	0	0	0	0	0	8	5	0	0	2	0	0	0	0							
08:15-08:30	2	0	1	0	0	0	0	0	0	0	0	14	0	5	2	0	0	0	0	0	0	10	2	0	0	0	0	0	0	0	0	0	12	11	0	0	1	0	0	0	0							
08:30-08:45	1	1	1	0	0	0	0	0	0	0	1	17	3	11	0	0	0	0	0	0	1	0	5	13	1	0	0	0	0	0	0	1	11	14	0	0	1	0	0	0	0							
08:45-09:00	0	0	2	0	0	0	0	0	0	0	1	11	1	13	2	0	1	0	0	0	1	0	11	16	0	0	0	0	0	0	0	0	1	11	5	0	1	2	0	0	1	0						

16:00-16:15	1	0	3	0	0	0	0	0	0	2	0	11	0	14	2	0	0	0	0	0	0	10	17	1	0	0	0	0	0	0	0	0	2	19	11	0	0	1	0	0	0	0	0	0
16:15-16:30	4	0	2	0	0	0	1	0	0	0	0	14	0	10	1	0	0	0	0	0	0	13	6	0	0	0	0	0	0	0	0	2	16	18	0	0	2	0	0	0	2	0	0	
16:30-16:45	0	0	3	0	0	0	0	0	0	0	0	11	1	9	2	0	0	0	0	0	1	0	14	15	0	1	0	0	0	0	0	2	18	21	0	0	2	0	0	0	0	0	0	
16:45-17:00	0	0	1	0	0	0	0	0	0	4	0	11	0	5	1	0	1	0	0	0	0	17	13	0	2	0	0	0	0	0	0	1	25	16	0	3	1	0	0	0	0	0	0	
17:00-17:15	2	0	3	0	0	0	0	0	0	0	0	15	1	7	0	0	0	0	0	0	0	12	7	0	0	1	0	0	0	0	0	3	20	17	0	0	0	0	0	0	0	0	0	
17:15-17:30	1	1	2	0	0	0	0	0	0	1	0	13	0	6	0	0	1	0	0	0	0	15	5	1	0	3	0	0	0	0	0	1	18	22	0	2	0	0	0	0	0	0	0	
17:30-17:45	0	1	1	0	0	0	0	0	0	0	0	7	0	8	0	0	0	0	0	0	4	0	11	20	0	0	0	0	0	0	0	1	19	17	0	0	1	0	0	0	2	0	0	
17:45-18:00	0	0	0	0	0	0	0	0	0	1	0	9	1	9	2	0	0	0	0	0	0	12	9	1	0	0	0	0	0	0	0	1	20	27	0	0	1	0	0	0	3	0	0	

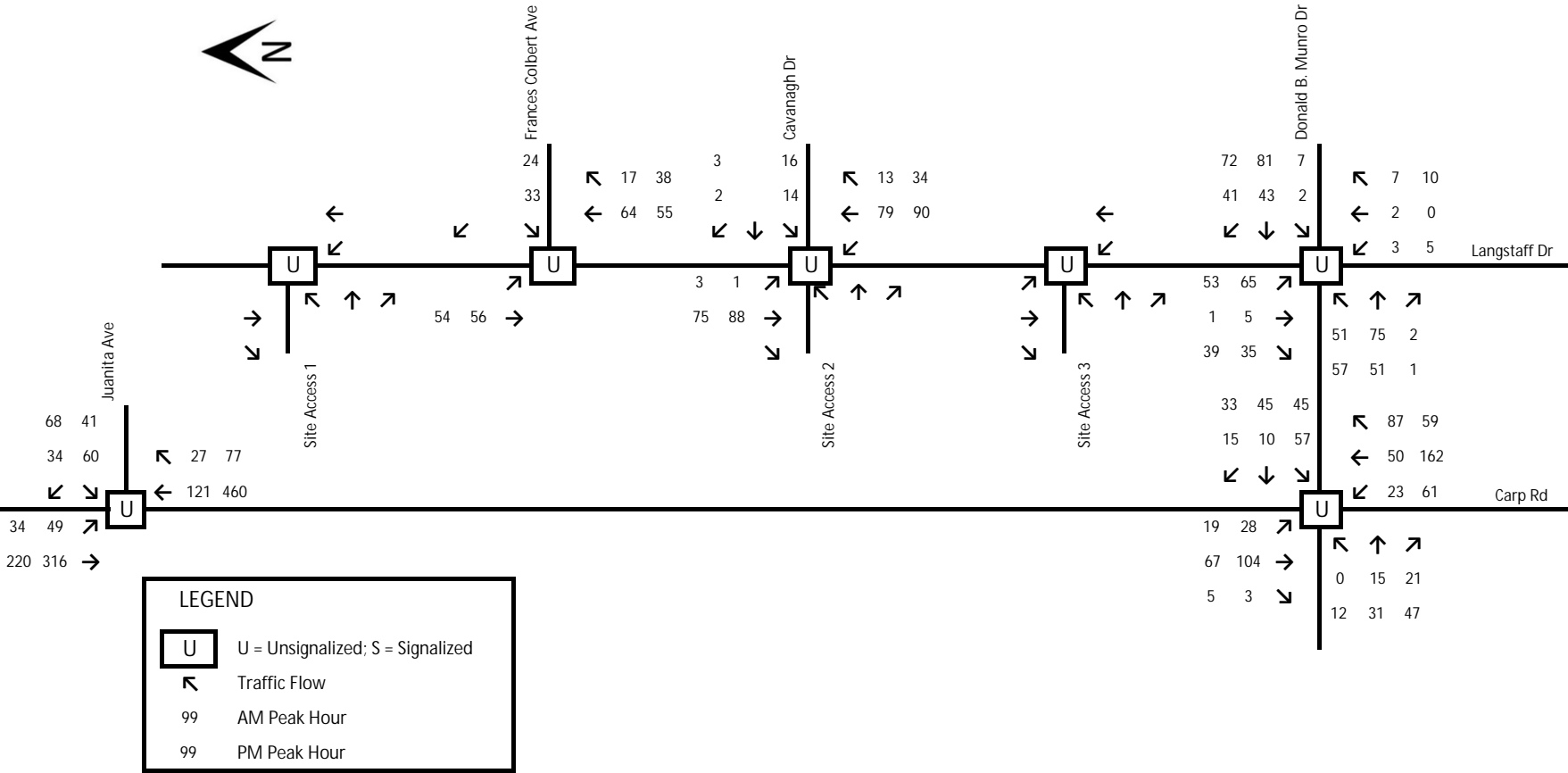
Municipality: City of Ottawa  
North/South Street    Cavanagh Dr  
East/West Street    Langstaff Dr

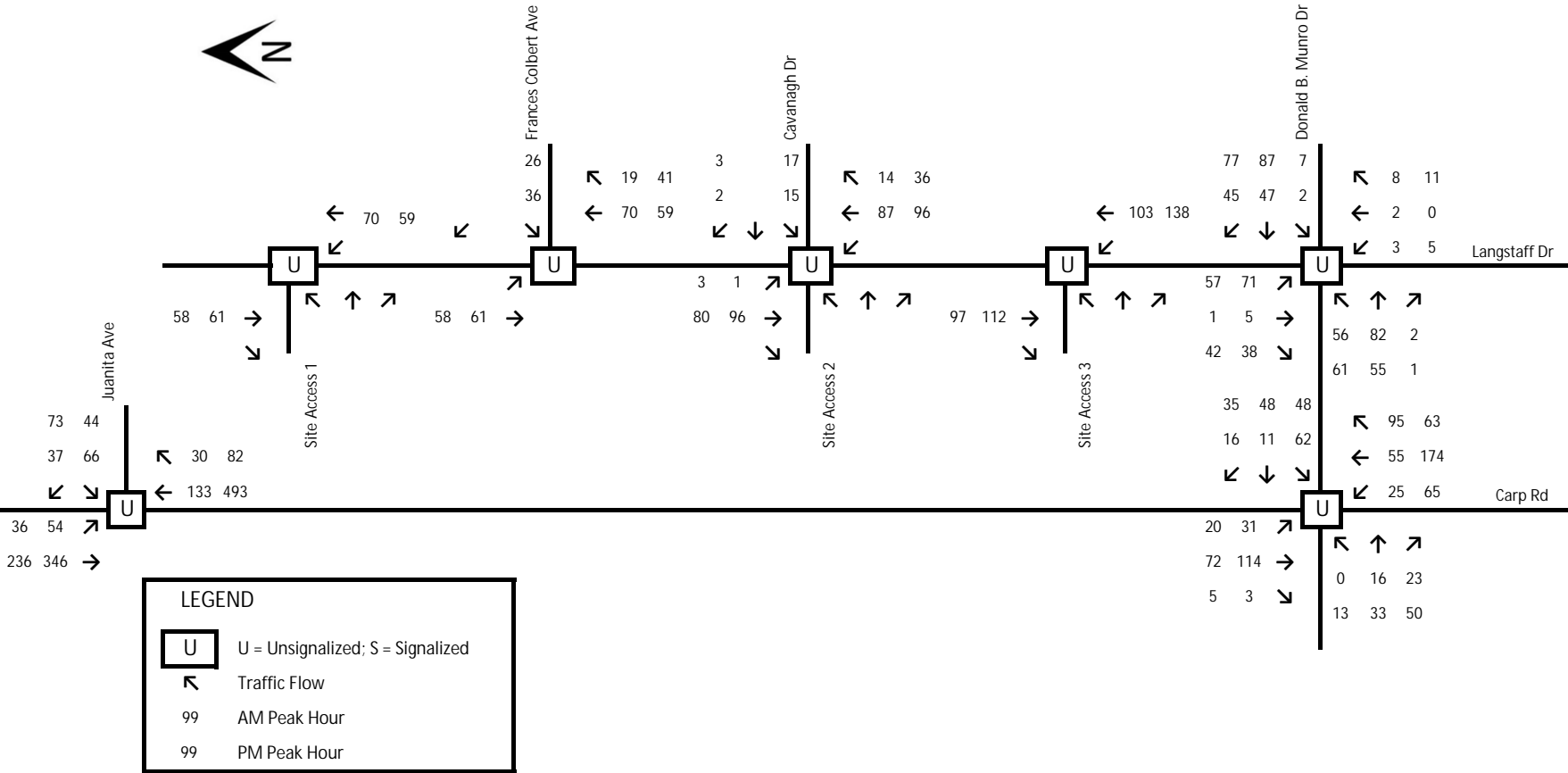
Time	NB Approach													SB Approach													EB Approach												WB Approach											
	Cars			Trucks			Heavies			Ped	Cyclist	Cars			Trucks			Heavies			Ped	Cyclist	Cars			Trucks			Heavies			Ped	Cyclist																	
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right			Left	Thru	Right	Left	Thru	Right	Left	Thru	Right			Left	Thru	Right	Left	Thru	Right	Left	Thru	Right			Left	Thru	Right														
07:00-07:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	8	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0	0	0	0							
07:15-07:30	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	2	0	0	0	10	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0	0	0	0						
07:30-07:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0				
07:45-08:00	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	1	0	0	20	0	0	2	0	0	0	0	0	0	0	0	0	6	1	0	2	0	0	0	0	0	0				
08:00-08:15	0	0	0	0	0	0	0	0	0	0	0	0	2	0	1	0	0	0	0	0	3	0	1	18	0	0	1	0	0	0	0	0	1	0	0	4	2	0	1	0	0	0	0	0	0					
08:15-08:30	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	15	0	0	2	0	0	0	0	0	1	0	0	7	1	0	1	0	0	0	0	0	0	0					
08:30-08:45	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	1	0	0	22	0	0	1	0	0	0	0	0	0	0	7	1	0	2	0	0	0	0	0	0	0	0				
08:45-09:00	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	1	1	2	14	0	0	2	0	0	0	0	0	0	7	0	0	2	0	0	0	0	0	0	0	0	0				

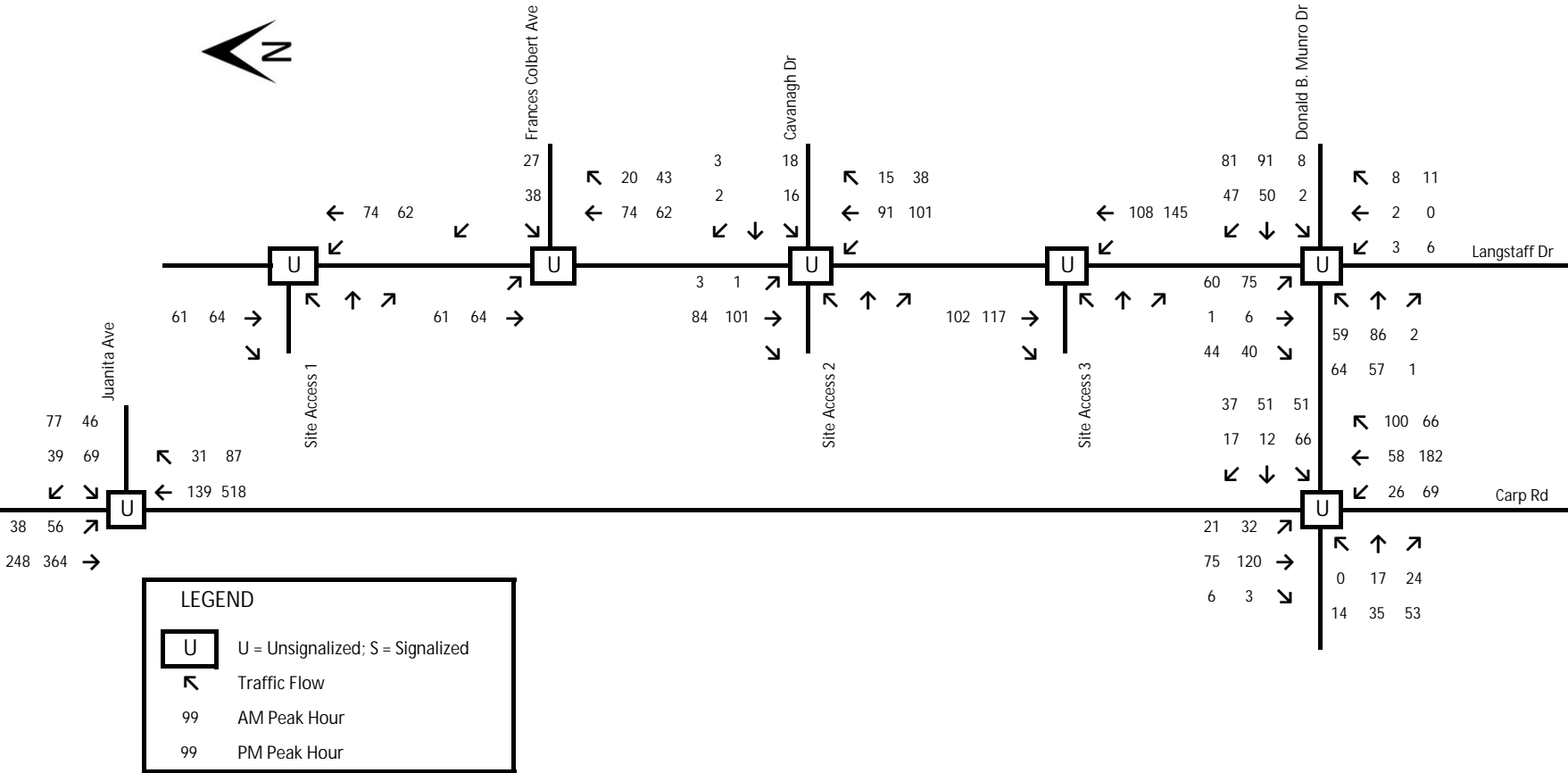
# TIA ANALYSIS REPORT: RESIDENTIAL DEVELOPMENT AT 147 LANGSTAFF ROAD

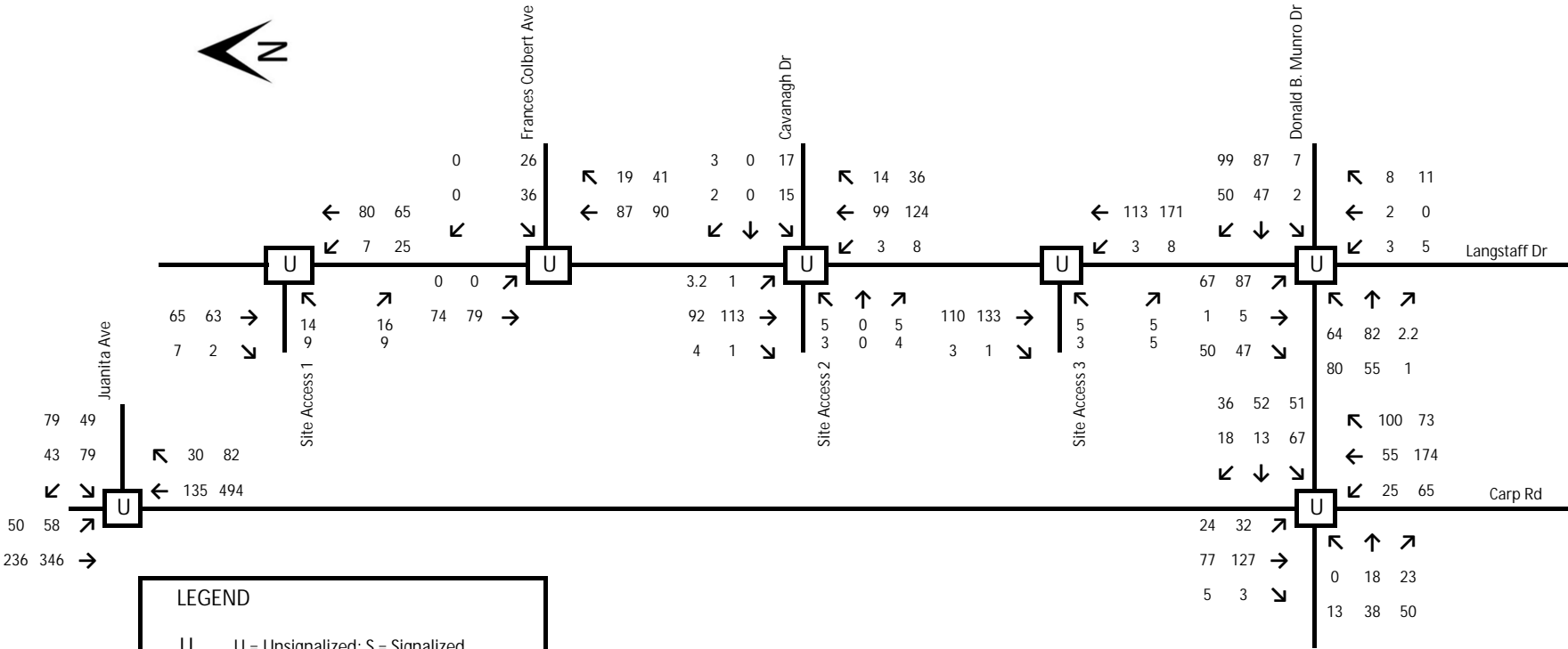


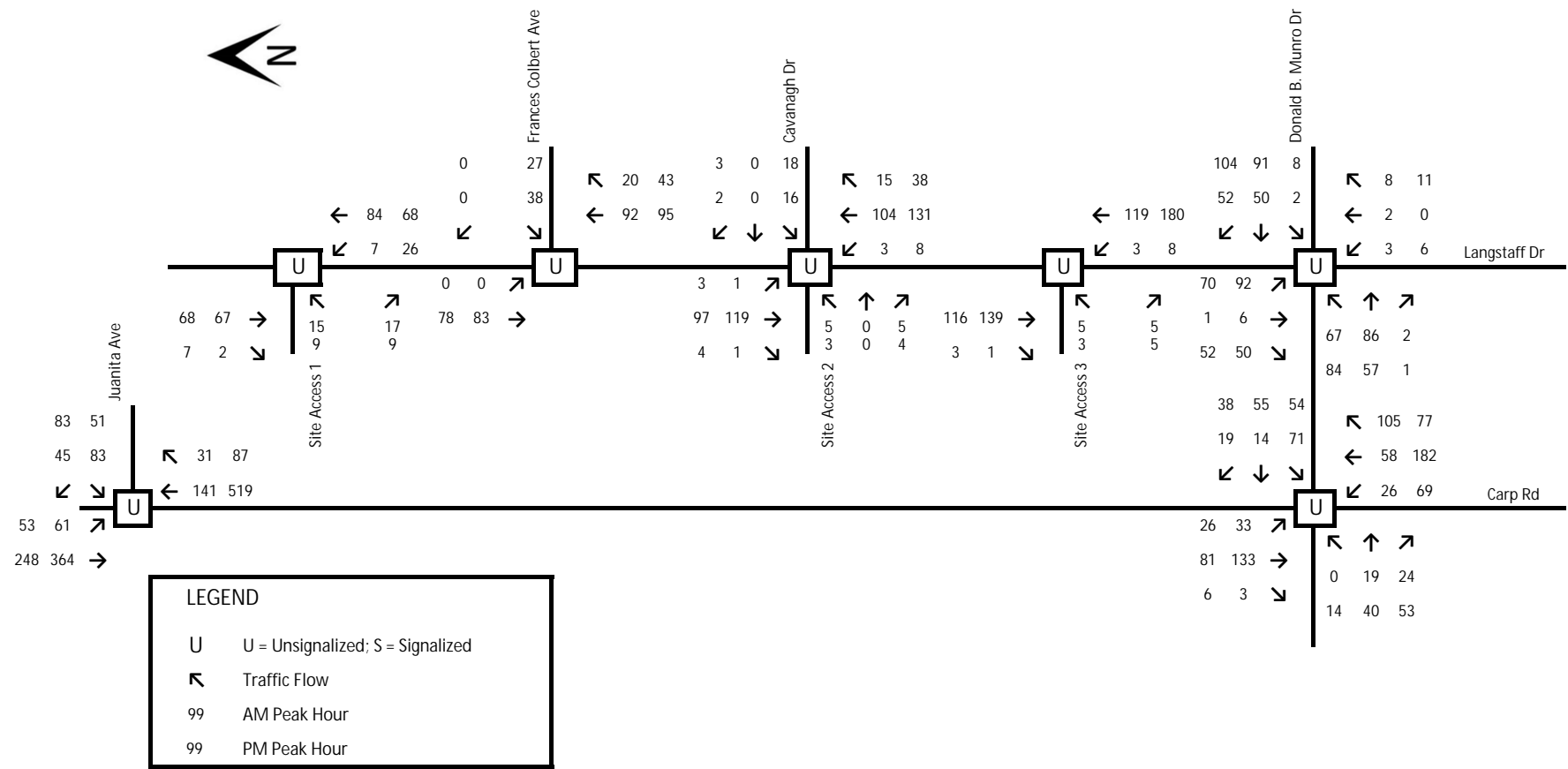
## APPENDIX D – TRAFFIC VOLUME FIGURES













# TIA ANALYSIS REPORT: RESIDENTIAL DEVELOPMENT AT 147 LANGSTAFF ROAD



















## APPENDIX E – SYNCHRO REPORTS

# HCM Unsignalized Intersection Capacity Analysis

## 2: Deugo St & Donald B. Munro Dr & Langstaff Dr

Background Traffic 2023

AM Peak










																				
Movement	EBL	EBT	EBR	WBL	WBT	WBR	SBL2	SBL	SBR	NWL	NWR	NWR2								
Lane Configurations																				
Sign Control		Stop			Stop			Stop		Stop										
Traffic Volume (vph)	56	82	2	2	47	45	71	5	38	3	2	8								
Future Volume (vph)	56	82	2	2	47	45	71	5	38	3	2	8								
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92								
Hourly flow rate (vph)	61	89	2	2	51	49	77	5	41	3	2	9								
Direction, Lane #	EB 1	WB 1	SB 1	NW 1																
Volume Total (vph)	152	102	123	14																
Volume Left (vph)	61	2	77	3																
Volume Right (vph)	2	49	41	9																
Hadj (s)	0.11	-0.25	-0.04	-0.31																
Departure Headway (s)	4.4	4.1	4.4	4.3																
Degree Utilization, x	0.19	0.12	0.15	0.02																
Capacity (veh/h)	783	824	758	772																
Control Delay (s)	8.5	7.7	8.2	7.4																
Approach Delay (s)	8.5	7.7	8.2	7.4																
Approach LOS	A	A	A	A																
Intersection Summary																				
Delay			8.2																	
Level of Service			A																	
Intersection Capacity Utilization			Err%	ICU Level of Service						H										
Analysis Period (min)			15																	

# HCM Unsignalized Intersection Capacity Analysis

## 3: Langstaff Dr & Frances Colbert Ave

Background Traffic 2023

AM Peak










						
Movement	WBL	WBR	SEL	SET	NWT	NWR
Lane Configurations						
Traffic Volume (veh/h)	36	0	0	61	70	19
Future Volume (Veh/h)	36	0	0	61	70	19
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	39	0	0	66	76	21
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	152	86	97			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	152	86	97			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	95	100	100			
cM capacity (veh/h)	839	972	1496			
Direction, Lane #	WB 1	SE 1	NW 1			
Volume Total	39	66	97			
Volume Left	39	0	0			
Volume Right	0	0	21			
cSH	839	1496	1700			
Volume to Capacity	0.05	0.00	0.06			
Queue Length 95th (m)	1.2	0.0	0.0			
Control Delay (s)	9.5	0.0	0.0			
Lane LOS	A					
Approach Delay (s)	9.5	0.0	0.0			
Approach LOS	A					
Intersection Summary						
Average Delay		1.8				
Intersection Capacity Utilization		14.8%		ICU Level of Service		A
Analysis Period (min)		15				

# HCM Unsignalized Intersection Capacity Analysis

## 5: Langstaff Dr & Cavanagh Dr

Background Traffic 2023

AM Peak

















						
Movement	WBL	WBR	SEL	SET	NWT	NWR
Lane Configurations						
Traffic Volume (veh/h)	15	2	1	96	87	14
Future Volume (Veh/h)	15	2	1	96	87	14
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	16	2	1	104	95	15
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	208	102	110			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	208	102	110			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	98	100	100			
cM capacity (veh/h)	779	953	1480			
Direction, Lane #	WB 1	SE 1	NW 1			
Volume Total	18	105	110			
Volume Left	16	1	0			
Volume Right	2	0	15			
cSH	795	1480	1700			
Volume to Capacity	0.02	0.00	0.06			
Queue Length 95th (m)	0.6	0.0	0.0			
Control Delay (s)	9.6	0.1	0.0			
Lane LOS	A	A				
Approach Delay (s)	9.6	0.1	0.0			
Approach LOS	A					
Intersection Summary						
Average Delay		0.8				
Intersection Capacity Utilization		15.8%		ICU Level of Service		A
Analysis Period (min)		15				

# HCM Unsignalized Intersection Capacity Analysis

## 10: Carp Rd & Donald B. Munro Dr

Background Traffic 2023

AM Peak










												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	0	16	23	62	11	16	31	114	3	25	55	95
Future Volume (vph)	0	16	23	62	11	16	31	114	3	25	55	95
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	17	25	67	12	17	34	124	3	27	60	103
Direction, Lane #	EB 1	WB 1	SE 1	NW 1								
Volume Total (vph)	42	96	161	190								
Volume Left (vph)	0	67	34	27								
Volume Right (vph)	25	17	3	103								
Hadj (s)	-0.32	0.07	0.07	-0.26								
Departure Headway (s)	4.5	4.8	4.5	4.2								
Degree Utilization, x	0.05	0.13	0.20	0.22								
Capacity (veh/h)	726	691	760	828								
Control Delay (s)	7.7	8.5	8.6	8.3								
Approach Delay (s)	7.7	8.5	8.6	8.3								
Approach LOS	A	A	A	A								
Intersection Summary												
Delay			8.4									
Level of Service			A									
Intersection Capacity Utilization			30.5%		ICU Level of Service				A			
Analysis Period (min)			15									

# HCM Unsignalized Intersection Capacity Analysis

Background Traffic 2023

15:

AM Peak

















						
Movement	SEL	SET	NWT	NWR	SWL	SWR
Lane Configurations						
Traffic Volume (veh/h)	54	346	133	30	66	37
Future Volume (Veh/h)	54	346	133	30	66	37
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	59	376	145	33	72	40
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	178				656	162
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	178				656	162
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	96				83	95
cM capacity (veh/h)	1398				412	883
Direction, Lane #	SE 1	NW 1	SW 1			
Volume Total	435	178	112			
Volume Left	59	0	72			
Volume Right	0	33	40			
cSH	1398	1700	509			
Volume to Capacity	0.04	0.10	0.22			
Queue Length 95th (m)	1.1	0.0	6.7			
Control Delay (s)	1.4	0.0	14.0			
Lane LOS	A		B			
Approach Delay (s)	1.4	0.0	14.0			
Approach LOS			B			
Intersection Summary						
Average Delay			3.0			
Intersection Capacity Utilization			45.9%	ICU Level of Service	A	
Analysis Period (min)			15			

# HCM Unsignalized Intersection Capacity Analysis

## 2: Deugo St & Donald B. Munro Dr & Langstaff Dr

Background Traffic 2023

PM Peak

																				
Movement	EBL	EBT	EBR	WBL	WBT	WBR	SBL2	SBL	SBR	NWL	NWR	NWR2								
Lane Configurations																				
Sign Control		Stop			Stop			Stop		Stop										
Traffic Volume (vph)	61	55	1	7	87	77	57	1	42	5	0	11								
Future Volume (vph)	61	55	1	7	87	77	57	1	42	5	0	11								
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92								
Hourly flow rate (vph)	66	60	1	8	95	84	62	1	46	5	0	12								
Direction, Lane #	EB 1	WB 1	SB 1	NW 1																
Volume Total (vph)	127	187	109	17																
Volume Left (vph)	66	8	62	5																
Volume Right (vph)	1	84	46	12																
Hadj (s)	0.13	-0.23	-0.11	-0.33																
Departure Headway (s)	4.5	4.1	4.5	4.4																
Degree Utilization, x	0.16	0.21	0.14	0.02																
Capacity (veh/h)	766	835	739	748																
Control Delay (s)	8.4	8.2	8.2	7.5																
Approach Delay (s)	8.4	8.2	8.2	7.5																
Approach LOS	A	A	A	A																
Intersection Summary																				
Delay			8.2																	
Level of Service			A																	
Intersection Capacity Utilization			Err%	ICU Level of Service		H														
Analysis Period (min)			15																	












# HCM Unsignalized Intersection Capacity Analysis

## 3: Langstaff Dr & Frances Colbert Ave

Background Traffic 2023

PM Peak










						
Movement	WBL	WBR	SEL	SET	NWT	NWR
Lane Configurations						
Traffic Volume (veh/h)	26	0	0	58	59	41
Future Volume (Veh/h)	26	0	0	58	59	41
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	28	0	0	63	64	45
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	150	86	109			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	150	86	109			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	97	100	100			
cM capacity (veh/h)	842	972	1481			
Direction, Lane #	WB 1	SE 1	NW 1			
Volume Total	28	63	109			
Volume Left	28	0	0			
Volume Right	0	0	45			
cSH	842	1481	1700			
Volume to Capacity	0.03	0.00	0.06			
Queue Length 95th (m)	0.8	0.0	0.0			
Control Delay (s)	9.4	0.0	0.0			
Lane LOS	A					
Approach Delay (s)	9.4	0.0	0.0			
Approach LOS	A					
Intersection Summary						
Average Delay		1.3				
Intersection Capacity Utilization		15.6%		ICU Level of Service		A
Analysis Period (min)		15				

# HCM Unsignalized Intersection Capacity Analysis

## 5: Langstaff Dr & Cavanagh Dr

Background Traffic 2023

PM Peak

















						
Movement	WBL	WBR	SEL	SET	NWT	NWR
Lane Configurations						
Traffic Volume (veh/h)	17	3	3	80	96	36
Future Volume (Veh/h)	17	3	3	80	96	36
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	18	3	3	87	104	39
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	216	124	143			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	216	124	143			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	98	100	100			
cM capacity (veh/h)	770	927	1440			
Direction, Lane #	WB 1	SE 1	NW 1			
Volume Total	21	90	143			
Volume Left	18	3	0			
Volume Right	3	0	39			
cSH	789	1440	1700			
Volume to Capacity	0.03	0.00	0.08			
Queue Length 95th (m)	0.7	0.1	0.0			
Control Delay (s)	9.7	0.3	0.0			
Lane LOS	A	A				
Approach Delay (s)	9.7	0.3	0.0			
Approach LOS	A					
Intersection Summary						
Average Delay		0.9				
Intersection Capacity Utilization		17.2%		ICU Level of Service		A
Analysis Period (min)		15				

# HCM Unsignalized Intersection Capacity Analysis

## 10: Carp Rd & Donald B. Munro Dr

Background Traffic 2023

PM Peak










												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	13	33	50	48	48	35	20	72	5	65	174	63
Future Volume (vph)	13	33	50	48	48	35	20	72	5	65	174	63
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	14	36	54	52	52	38	22	78	5	71	189	68
Direction, Lane #	EB 1	WB 1	SE 1	NW 1								
Volume Total (vph)	104	142	105	328								
Volume Left (vph)	14	52	22	71								
Volume Right (vph)	54	38	5	68								
Hadj (s)	-0.25	-0.05	0.05	-0.05								
Departure Headway (s)	4.9	5.1	5.0	4.6								
Degree Utilization, x	0.14	0.20	0.15	0.42								
Capacity (veh/h)	657	648	663	744								
Control Delay (s)	8.7	9.3	8.9	11.0								
Approach Delay (s)	8.7	9.3	8.9	11.0								
Approach LOS	A	A	A	B								
Intersection Summary												
Delay				10.0								
Level of Service				A								
Intersection Capacity Utilization				43.2%	ICU Level of Service	A						
Analysis Period (min)				15								

# HCM Unsignalized Intersection Capacity Analysis

Background Traffic 2023

15:

PM Peak

















						
Movement	SEL	SET	NWT	NWR	SWL	SWR
Lane Configurations						
Traffic Volume (veh/h)	36	236	493	82	44	73
Future Volume (Veh/h)	36	236	493	82	44	73
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	39	257	536	89	48	79
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	625				916	580
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	625				916	580
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	96				83	85
cM capacity (veh/h)	956				290	514
Direction, Lane #	SE 1	NW 1	SW 1			
Volume Total	296	625	127			
Volume Left	39	0	48			
Volume Right	0	89	79			
cSH	956	1700	398			
Volume to Capacity	0.04	0.37	0.32			
Queue Length 95th (m)	1.0	0.0	10.8			
Control Delay (s)	1.5	0.0	18.2			
Lane LOS	A		C			
Approach Delay (s)	1.5	0.0	18.2			
Approach LOS			C			
Intersection Summary						
Average Delay		2.6				
Intersection Capacity Utilization		56.4%	ICU Level of Service		B	
Analysis Period (min)		15				

# HCM Unsignalized Intersection Capacity Analysis

## 2: Deugo St/Langstaff Dr & Donald B. Munro Dr

Total Traffic 2023

AM Peak










												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	64	82	2	2	47	50	87	5	47	3	2	8
Future Volume (vph)	64	82	2	2	47	50	87	5	47	3	2	8
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	70	89	2	2	51	54	95	5	51	3	2	9
Direction, Lane #	EB 1	WB 1	SE 1	NW 1								
Volume Total (vph)	161	107	151	14								
Volume Left (vph)	70	2	95	3								
Volume Right (vph)	2	54	51	9								
Hadj (s)	0.11	-0.27	-0.04	-0.31								
Departure Headway (s)	4.5	4.2	4.5	4.4								
Degree Utilization, x	0.20	0.13	0.19	0.02								
Capacity (veh/h)	765	805	752	755								
Control Delay (s)	8.7	7.8	8.5	7.5								
Approach Delay (s)	8.7	7.8	8.5	7.5								
Approach LOS	A	A	A	A								
Intersection Summary												
Delay			8.4									
Level of Service			A									
Intersection Capacity Utilization			35.9%		ICU Level of Service				A			
Analysis Period (min)			15									

# HCM Unsignalized Intersection Capacity Analysis

## 3: Langstaff Dr & Frances Colbert Ave

Total Traffic 2023

AM Peak

















						
Movement	WBL	WBR	SEL	SET	NWT	NWR
Lane Configurations						
Traffic Volume (veh/h)	36	0	0	79	87	19
Future Volume (Veh/h)	36	0	0	79	87	19
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	39	0	0	86	95	21
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	192	106	116			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	192	106	116			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	95	100	100			
cM capacity (veh/h)	797	949	1473			
Direction, Lane #	WB 1	SE 1	NW 1			
Volume Total	39	86	116			
Volume Left	39	0	0			
Volume Right	0	0	21			
cSH	797	1473	1700			
Volume to Capacity	0.05	0.00	0.07			
Queue Length 95th (m)	1.2	0.0	0.0			
Control Delay (s)	9.7	0.0	0.0			
Lane LOS	A					
Approach Delay (s)	9.7	0.0	0.0			
Approach LOS	A					
Intersection Summary						
Average Delay		1.6				
Intersection Capacity Utilization		15.7%		ICU Level of Service		A
Analysis Period (min)		15				

# HCM Unsignalized Intersection Capacity Analysis

Total Traffic 2023

## 5: Langstaff Dr & Cavanagh Dr

AM Peak

















														
Movement	WBL2	WBL	WBR	SEL	SET	SER	NWL	NWT	NWR	NEL	NER	NER2		
Lane Configurations														
Traffic Volume (veh/h)	15	0	2	1	113	1	3	99	14	5	0	5		
Future Volume (Veh/h)	15	0	2	1	113	1	3	99	14	5	0	5		
Sign Control	Stop				Free				Free		Stop			
Grade	0%				0%				0%		0%			
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92		
Hourly flow rate (vph)	16	0	2	1	123	1	3	108	15	5	0	5		
Pedestrians														
Lane Width (m)														
Walking Speed (m/s)														
Percent Blockage														
Right turn flare (veh)														
Median type	None						None							
Median storage (veh)														
Upstream signal (m)														
pX, platoon unblocked														
vC, conflicting volume	252	248	116	123				124				249	254	124
vC1, stage 1 conf vol														
vC2, stage 2 conf vol														
vCu, unblocked vol	252	248	116	123				124				249	254	124
tC, single (s)	7.1	6.5	6.2	4.1				4.1				7.1	6.5	6.2
tC, 2 stage (s)														
tF (s)	3.5	4.0	3.3	2.2				2.2				3.5	4.0	3.3
p0 queue free %	98	100	100	100				100				99	100	99
cM capacity (veh/h)	696	653	937	1464				1463				702	647	927
Direction, Lane #	WB 1	SE 1	NW 1	NE 1										
Volume Total	18	125	126	10										
Volume Left	16	1	3	5										
Volume Right	2	1	15	5										
cSH	717	1464	1463	799										
Volume to Capacity	0.03	0.00	0.00	0.01										
Queue Length 95th (m)	0.6	0.0	0.0	0.3										
Control Delay (s)	10.2	0.1	0.2	9.6										
Lane LOS	B	A	A	A										
Approach Delay (s)	10.2	0.1	0.2	9.6										
Approach LOS	B				A									
Intersection Summary														
Average Delay				1.1										
Intersection Capacity Utilization				24.7%	ICU Level of Service				A					
Analysis Period (min)				15										



# HCM Unsignalized Intersection Capacity Analysis

## 10: Carp Rd & Donald B. Munro Dr

Total Traffic 2023  
AM Peak










												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	0	18	23	67	13	18	32	127	3	25	55	100
Future Volume (vph)	0	18	23	67	13	18	32	127	3	25	55	100
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	20	25	73	14	20	35	138	3	27	60	109
Direction, Lane #	EB 1	WB 1	SE 1	NW 1								
Volume Total (vph)	45	107	176	196								
Volume Left (vph)	0	73	35	27								
Volume Right (vph)	25	20	3	109								
Hadj (s)	-0.30	0.06	0.06	-0.27								
Departure Headway (s)	4.6	4.9	4.6	4.2								
Degree Utilization, x	0.06	0.14	0.22	0.23								
Capacity (veh/h)	708	682	751	816								
Control Delay (s)	7.9	8.7	8.9	8.5								
Approach Delay (s)	7.9	8.7	8.9	8.5								
Approach LOS	A	A	A	A								
Intersection Summary												
Delay				8.6								
Level of Service				A								
Intersection Capacity Utilization				31.9%	ICU Level of Service	A						
Analysis Period (min)				15								

# HCM Unsignalized Intersection Capacity Analysis

Total Traffic 2023

## 14: Langstaff Dr










AM Peak

						
Movement	SET	SER	NWL	NWT	NEL	NER
Lane Configurations						
Traffic Volume (veh/h)	63	2	7	80	14	16
Future Volume (Veh/h)	63	2	7	80	14	16
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	68	2	8	87	15	17
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			70		172	69
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			70		172	69
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			99		98	98
cM capacity (veh/h)			1531		814	994
Direction, Lane #	SE 1	NW 1	NE 1			
Volume Total	70	95	32			
Volume Left	0	8	15			
Volume Right	2	0	17			
cSH	1700	1531	901			
Volume to Capacity	0.04	0.01	0.04			
Queue Length 95th (m)	0.0	0.1	0.9			
Control Delay (s)	0.0	0.7	9.1			
Lane LOS		A	A			
Approach Delay (s)	0.0	0.7	9.1			
Approach LOS			A			
Intersection Summary						
Average Delay			1.8			
Intersection Capacity Utilization			20.0%	ICU Level of Service		A
Analysis Period (min)			15			

# HCM Unsignalized Intersection Capacity Analysis

## 17: Langstaff Dr

Total Traffic 2023  
AM Peak










						
Movement	SET	SER	NWL	NWT	NEL	NER
Lane Configurations						
Traffic Volume (veh/h)	133	1	3	113	5	5
Future Volume (Veh/h)	133	1	3	113	5	5
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	145	1	3	123	5	5
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			146		274	146
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			146		274	146
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	99
cM capacity (veh/h)			1436		714	902
Direction, Lane #	SE 1	NW 1	NE 1			
Volume Total	146	126	10			
Volume Left	0	3	5			
Volume Right	1	0	5			
cSH	1700	1436	797			
Volume to Capacity	0.09	0.00	0.01			
Queue Length 95th (m)	0.0	0.1	0.3			
Control Delay (s)	0.0	0.2	9.6			
Lane LOS		A	A			
Approach Delay (s)	0.0	0.2	9.6			
Approach LOS			A			
Intersection Summary						
Average Delay			0.4			
Intersection Capacity Utilization		18.4%		ICU Level of Service		A
Analysis Period (min)		15				

# HCM Unsignalized Intersection Capacity Analysis

Total Traffic 2023

20:

AM Peak





						
Movement	SEL	SET	NWT	NWR	SWL	SWR
Lane Configurations						
Traffic Volume (veh/h)	58	346	133	30	79	43
Future Volume (Veh/h)	58	346	133	30	79	43
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	63	376	145	33	86	47
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	178				664	162
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	178				664	162
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	95				79	95
cM capacity (veh/h)	1398				407	883
Direction, Lane #	SE 1	NW 1	SW 1			
Volume Total	439	178	133			
Volume Left	63	0	86			
Volume Right	0	33	47			
cSH	1398	1700	503			
Volume to Capacity	0.05	0.10	0.26			
Queue Length 95th (m)	1.1	0.0	8.4			
Control Delay (s)	1.5	0.0	14.7			
Lane LOS	A		B			
Approach Delay (s)	1.5	0.0	14.7			
Approach LOS			B			
Intersection Summary						
Average Delay			3.5			
Intersection Capacity Utilization		47.2%		ICU Level of Service		A
Analysis Period (min)		15				

# HCM Unsignalized Intersection Capacity Analysis

Total Traffic 2023

20:

PM Peak

















						
Movement	SEL	SET	NWT	NWR	SWL	SWR
Lane Configurations						
Traffic Volume (veh/h)	50	236	493	82	49	79
Future Volume (Veh/h)	50	236	493	82	49	79
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	54	257	536	89	53	86
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	625				946	580
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	625				946	580
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	94				81	83
cM capacity (veh/h)	956				274	514
Direction, Lane #	SE 1	NW 1	SW 1			
Volume Total	311	625	139			
Volume Left	54	0	53			
Volume Right	0	89	86			
cSH	956	1700	385			
Volume to Capacity	0.06	0.37	0.36			
Queue Length 95th (m)	1.4	0.0	12.9			
Control Delay (s)	2.1	0.0	19.5			
Lane LOS	A		C			
Approach Delay (s)	2.1	0.0	19.5			
Approach LOS			C			
Intersection Summary						
Average Delay			3.1			
Intersection Capacity Utilization			63.7%	ICU Level of Service		B
Analysis Period (min)			15			

# HCM Unsignalized Intersection Capacity Analysis

## 2: Deugo St & Donald B. Munro Dr & Langstaff Dr

Background Traffic 2028

AM Peak










																				
Movement	EBL	EBT	EBR	WBL	WBT	WBR	SBL2	SBL	SBR	NWL	NWR	NWR2								
Lane Configurations																				
Sign Control		Stop			Stop			Stop		Stop										
Traffic Volume (vph)	59	86	2	2	50	47	75	6	40	3	2	8								
Future Volume (vph)	59	86	2	2	50	47	75	6	40	3	2	8								
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92								
Hourly flow rate (vph)	64	93	2	2	54	51	82	7	43	3	2	9								
Direction, Lane #	EB 1	WB 1	SB 1	NW 1																
Volume Total (vph)	159	107	132	14																
Volume Left (vph)	64	2	82	3																
Volume Right (vph)	2	51	43	9																
Hadj (s)	0.11	-0.25	-0.04	-0.31																
Departure Headway (s)	4.5	4.2	4.5	4.4																
Degree Utilization, x	0.20	0.12	0.16	0.02																
Capacity (veh/h)	777	815	752	762																
Control Delay (s)	8.6	7.8	8.4	7.4																
Approach Delay (s)	8.6	7.8	8.4	7.4																
Approach LOS	A	A	A	A																
Intersection Summary																				
Delay			8.3																	
Level of Service			A																	
Intersection Capacity Utilization			Err%	ICU Level of Service	H															
Analysis Period (min)			15																	

# HCM Unsignalized Intersection Capacity Analysis

## 3: Langstaff Dr & Frances Colbert Ave

Background Traffic 2028

AM Peak










						
Movement	WBL	WBR	SEL	SET	NWT	NWR
Lane Configurations						
Traffic Volume (veh/h)	38	0	0	64	74	20
Future Volume (Veh/h)	38	0	0	64	74	20
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	41	0	0	70	80	22
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	161	91	102			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	161	91	102			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	95	100	100			
cM capacity (veh/h)	830	967	1490			
Direction, Lane #	WB 1	SE 1	NW 1			
Volume Total	41	70	102			
Volume Left	41	0	0			
Volume Right	0	0	22			
cSH	830	1490	1700			
Volume to Capacity	0.05	0.00	0.06			
Queue Length 95th (m)	1.2	0.0	0.0			
Control Delay (s)	9.6	0.0	0.0			
Lane LOS	A					
Approach Delay (s)	9.6	0.0	0.0			
Approach LOS	A					
Intersection Summary						
Average Delay		1.8				
Intersection Capacity Utilization		15.1%		ICU Level of Service		A
Analysis Period (min)		15				

# HCM Unsignalized Intersection Capacity Analysis

## 5: Langstaff Dr & Cavanagh Dr

Background Traffic 2028

AM Peak

						
Movement	WBL	WBR	SEL	SET	NWT	NWR
Lane Configurations						
Traffic Volume (veh/h)	16	2	1	101	91	15
Future Volume (Veh/h)	16	2	1	101	91	15
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	17	2	1	110	99	16
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	219	107	115			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	219	107	115			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	98	100	100			
cM capacity (veh/h)	769	947	1474			
Direction, Lane #	WB 1	SE 1	NW 1			
Volume Total	19	111	115			
Volume Left	17	1	0			
Volume Right	2	0	16			
cSH	784	1474	1700			
Volume to Capacity	0.02	0.00	0.07			
Queue Length 95th (m)	0.6	0.0	0.0			
Control Delay (s)	9.7	0.1	0.0			
Lane LOS	A	A				
Approach Delay (s)	9.7	0.1	0.0			
Approach LOS	A					
Intersection Summary						
Average Delay			0.8			
Intersection Capacity Utilization		16.1%		ICU Level of Service		A
Analysis Period (min)		15				



















# HCM Unsignalized Intersection Capacity Analysis

## 10: Carp Rd & Donald B. Munro Dr

Background Traffic 2028

AM Peak










												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	0	17	24	66	12	17	32	120	3	26	58	100
Future Volume (vph)	0	17	24	66	12	17	32	120	3	26	58	100
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	18	26	72	13	18	35	130	3	28	63	109
Direction, Lane #	EB 1	WB 1	SE 1	NW 1								
Volume Total (vph)	44	103	168	200								
Volume Left (vph)	0	72	35	28								
Volume Right (vph)	26	18	3	109								
Hadj (s)	-0.32	0.07	0.06	-0.27								
Departure Headway (s)	4.6	4.9	4.5	4.2								
Degree Utilization, x	0.06	0.14	0.21	0.23								
Capacity (veh/h)	715	683	753	820								
Control Delay (s)	7.8	8.6	8.8	8.5								
Approach Delay (s)	7.8	8.6	8.8	8.5								
Approach LOS	A	A	A	A								
Intersection Summary												
Delay				8.5								
Level of Service				A								
Intersection Capacity Utilization				31.5%	ICU Level of Service	A						
Analysis Period (min)				15								

# HCM Unsignalized Intersection Capacity Analysis

Background Traffic 2028

15:

AM Peak

















						
Movement	SEL	SET	NWT	NWR	SWL	SWR
Lane Configurations						
Traffic Volume (veh/h)	56	364	139	31	69	39
Future Volume (Veh/h)	56	364	139	31	69	39
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	61	396	151	34	75	42
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	185				686	168
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	185				686	168
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	96				81	95
cM capacity (veh/h)	1390				395	876
Direction, Lane #	SE 1	NW 1	SW 1			
Volume Total	457	185	117			
Volume Left	61	0	75			
Volume Right	0	34	42			
cSH	1390	1700	492			
Volume to Capacity	0.04	0.11	0.24			
Queue Length 95th (m)	1.1	0.0	7.3			
Control Delay (s)	1.4	0.0	14.6			
Lane LOS	A		B			
Approach Delay (s)	1.4	0.0	14.6			
Approach LOS			B			
Intersection Summary						
Average Delay			3.1			
Intersection Capacity Utilization			47.7%	ICU Level of Service		A
Analysis Period (min)			15			

# HCM Unsignalized Intersection Capacity Analysis

## 2: Deugo St & Donald B. Munro Dr & Langstaff Dr

Background Traffic 2028

PM Peak










																				
Movement	EBL	EBT	EBR	WBL	WBT	WBR	SBL2	SBL	SBR	NWL	NWR	NWR2								
Lane Configurations																				
Sign Control		Stop			Stop			Stop		Stop										
Traffic Volume (vph)	64	57	1	8	91	81	60	1	44	6	0	11								
Future Volume (vph)	64	57	1	8	91	81	60	1	44	6	0	11								
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92								
Hourly flow rate (vph)	70	62	1	9	99	88	65	1	48	7	0	12								
Direction, Lane #	EB 1	WB 1	SB 1	NW 1																
Volume Total (vph)	133	196	114	19																
Volume Left (vph)	70	9	65	7																
Volume Right (vph)	1	88	48	12																
Hadj (s)	0.13	-0.23	-0.10	-0.27																
Departure Headway (s)	4.6	4.1	4.6	4.5																
Degree Utilization, x	0.17	0.23	0.14	0.02																
Capacity (veh/h)	759	829	732	729																
Control Delay (s)	8.5	8.4	8.3	7.6																
Approach Delay (s)	8.5	8.4	8.3	7.6																
Approach LOS	A	A	A	A																
Intersection Summary																				
Delay			8.4																	
Level of Service			A																	
Intersection Capacity Utilization			Err%	ICU Level of Service		H														
Analysis Period (min)			15																	

# HCM Unsignalized Intersection Capacity Analysis

## 3: Langstaff Dr & Frances Colbert Ave

Background Traffic 2028

PM Peak










						
Movement	WBL	WBR	SEL	SET	NWT	NWR
Lane Configurations						
Traffic Volume (veh/h)	27	0	0	61	62	43
Future Volume (Veh/h)	27	0	0	61	62	43
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	29	0	0	66	67	47
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	156	90	114			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	156	90	114			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	97	100	100			
cM capacity (veh/h)	835	967	1475			
Direction, Lane #	WB 1	SE 1	NW 1			
Volume Total	29	66	114			
Volume Left	29	0	0			
Volume Right	0	0	47			
cSH	835	1475	1700			
Volume to Capacity	0.03	0.00	0.07			
Queue Length 95th (m)	0.9	0.0	0.0			
Control Delay (s)	9.5	0.0	0.0			
Lane LOS	A					
Approach Delay (s)	9.5	0.0	0.0			
Approach LOS	A					
Intersection Summary						
Average Delay		1.3				
Intersection Capacity Utilization		15.9%		ICU Level of Service		A
Analysis Period (min)		15				

# HCM Unsignalized Intersection Capacity Analysis

## 5: Langstaff Dr & Cavanagh Dr

Background Traffic 2028

PM Peak

















						
Movement	WBL	WBR	SEL	SET	NWT	NWR
Lane Configurations						
Traffic Volume (veh/h)	18	3	3	84	101	38
Future Volume (Veh/h)	18	3	3	84	101	38
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	20	3	3	91	110	41
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	228	130	151			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	228	130	151			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	97	100	100			
cM capacity (veh/h)	759	919	1430			
Direction, Lane #	WB 1	SE 1	NW 1			
Volume Total	23	94	151			
Volume Left	20	3	0			
Volume Right	3	0	41			
cSH	777	1430	1700			
Volume to Capacity	0.03	0.00	0.09			
Queue Length 95th (m)	0.7	0.1	0.0			
Control Delay (s)	9.8	0.3	0.0			
Lane LOS	A	A				
Approach Delay (s)	9.8	0.3	0.0			
Approach LOS	A					
Intersection Summary						
Average Delay		0.9				
Intersection Capacity Utilization		17.6%		ICU Level of Service		A
Analysis Period (min)		15				

# HCM Unsignalized Intersection Capacity Analysis

## 10: Carp Rd & Donald B. Munro Dr

Background Traffic 2028

PM Peak










												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	14	35	53	51	51	37	21	75	6	69	182	66
Future Volume (vph)	14	35	53	51	51	37	21	75	6	69	182	66
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	15	38	58	55	55	40	23	82	7	75	198	72
Direction, Lane #	EB 1	WB 1	SE 1	NW 1								
Volume Total (vph)	111	150	112	345								
Volume Left (vph)	15	55	23	75								
Volume Right (vph)	58	40	7	72								
Hadj (s)	-0.25	-0.05	0.04	-0.05								
Departure Headway (s)	5.0	5.1	5.1	4.7								
Degree Utilization, x	0.15	0.21	0.16	0.45								
Capacity (veh/h)	643	636	652	735								
Control Delay (s)	8.9	9.5	9.0	11.5								
Approach Delay (s)	8.9	9.5	9.0	11.5								
Approach LOS	A	A	A	B								
Intersection Summary												
Delay				10.3								
Level of Service				B								
Intersection Capacity Utilization				44.9%	ICU Level of Service			A				
Analysis Period (min)				15								

# HCM Unsignalized Intersection Capacity Analysis

Background Traffic 2028

15:

















PM Peak

						
Movement	SEL	SET	NWT	NWR	SWL	SWR
Lane Configurations						
Traffic Volume (veh/h)	38	248	518	87	46	77
Future Volume (Veh/h)	38	248	518	87	46	77
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	41	270	563	95	50	84
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	658				962	610
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	658				962	610
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	96				82	83
cM capacity (veh/h)	930				271	494
Direction, Lane #	SE 1	NW 1	SW 1			
Volume Total	311	658	134			
Volume Left	41	0	50			
Volume Right	0	95	84			
cSH	930	1700	378			
Volume to Capacity	0.04	0.39	0.35			
Queue Length 95th (m)	1.1	0.0	12.5			
Control Delay (s)	1.6	0.0	19.7			
Lane LOS	A		C			
Approach Delay (s)	1.6	0.0	19.7			
Approach LOS			C			
Intersection Summary						
Average Delay		2.8				
Intersection Capacity Utilization		59.1%	ICU Level of Service	B		
Analysis Period (min)		15				

# HCM Unsignalized Intersection Capacity Analysis

## 2: Deugo St/Langstaff Dr & Donald B. Munro Dr

Total Traffic 2028  
Am Peak

																				
Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR								
Lane Configurations																				
Sign Control		Stop			Stop			Stop			Stop									
Traffic Volume (vph)	67	86	2	2	50	52	92	6	50	3	2	8								
Future Volume (vph)	67	86	2	2	50	52	92	6	50	3	2	8								
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92								
Hourly flow rate (vph)	73	93	2	2	54	57	100	7	54	3	2	9								
Direction, Lane #	EB 1	WB 1	SE 1	NW 1																
Volume Total (vph)	168	113	161	14																
Volume Left (vph)	73	2	100	3																
Volume Right (vph)	2	57	54	9																
Hadj (s)	0.11	-0.27	-0.04	-0.31																
Departure Headway (s)	4.6	4.3	4.5	4.4																
Degree Utilization, x	0.21	0.13	0.20	0.02																
Capacity (veh/h)	758	797	746	744																
Control Delay (s)	8.8	7.9	8.7	7.5																
Approach Delay (s)	8.8	7.9	8.7	7.5																
Approach LOS	A	A	A	A																
Intersection Summary																				
Delay			8.5																	
Level of Service			A																	
Intersection Capacity Utilization			36.8%	ICU Level of Service		A														
Analysis Period (min)			15																	












# HCM Unsignalized Intersection Capacity Analysis

## 3: Langstaff Dr & Frances Colbert Ave

Total Traffic 2028

Am Peak

















						
Movement	WBL	WBR	SEL	SET	NWT	NWR
Lane Configurations						
Traffic Volume (veh/h)	38	0	0	83	92	20
Future Volume (Veh/h)	38	0	0	83	92	20
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	41	0	0	90	100	22
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	201	111	122			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	201	111	122			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	95	100	100			
cM capacity (veh/h)	788	942	1465			
Direction, Lane #	WB 1	SE 1	NW 1			
Volume Total	41	90	122			
Volume Left	41	0	0			
Volume Right	0	0	22			
cSH	788	1465	1700			
Volume to Capacity	0.05	0.00	0.07			
Queue Length 95th (m)	1.3	0.0	0.0			
Control Delay (s)	9.8	0.0	0.0			
Lane LOS	A					
Approach Delay (s)	9.8	0.0	0.0			
Approach LOS	A					
Intersection Summary						
Average Delay		1.6				
Intersection Capacity Utilization		16.1%		ICU Level of Service		A
Analysis Period (min)		15				

# HCM Unsignalized Intersection Capacity Analysis

## 5: Langstaff Dr & Cavanagh Dr

Total Traffic 2028

















Am Peak

												
Movement	WBL2	WBL	WBR	SEL	SET	SER	NWL	NWT	NWR	NEL	NER	NER2
Lane Configurations												
Traffic Volume (veh/h)	16	0	2	1	119	1	3	104	15	5	0	5
Future Volume (Veh/h)	16	0	2	1	119	1	3	104	15	5	0	5
Sign Control		Stop			Free			Free		Stop		
Grade		0%			0%			0%		0%		
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	17	0	2	1	129	1	3	113	16	5	0	5
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None						None					
Median storage (veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	264	259	121	129			130			260	266	130
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	264	259	121	129			130			260	266	130
tC, single (s)	7.1	6.5	6.2	4.1			4.1			7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	2.2			2.2			3.5	4.0	3.3
p0 queue free %	98	100	100	100			100			99	100	99
cM capacity (veh/h)	684	644	930	1457			1455			689	637	920
Direction, Lane #	WB 1	SE 1	NW 1	NE 1								
Volume Total	19	131	132	10								
Volume Left	17	1	3	5								
Volume Right	2	1	16	5								
cSH	704	1457	1455	788								
Volume to Capacity	0.03	0.00	0.00	0.01								
Queue Length 95th (m)	0.7	0.0	0.0	0.3								
Control Delay (s)	10.3	0.1	0.2	9.6								
Lane LOS	B	A	A	A								
Approach Delay (s)	10.3	0.1	0.2	9.6								
Approach LOS	B			A								
Intersection Summary												
Average Delay				1.1								
Intersection Capacity Utilization				25.0%	ICU Level of Service				A			
Analysis Period (min)				15								

# HCM Unsignalized Intersection Capacity Analysis

## 10: Carp Rd & Donald B. Munro Dr

Total Traffic 2028  
Am Peak











												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	0	19	24	71	14	19	33	133	3	26	58	105
Future Volume (vph)	0	19	24	71	14	19	33	133	3	26	58	105
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	21	26	77	15	21	36	145	3	28	63	114
Direction, Lane #	EB 1	WB 1	SE 1	NW 1								
Volume Total (vph)	47	113	184	205								
Volume Left (vph)	0	77	36	28								
Volume Right (vph)	26	21	3	114								
Hadj (s)	-0.30	0.06	0.06	-0.27								
Departure Headway (s)	4.6	4.9	4.6	4.2								
Degree Utilization, x	0.06	0.15	0.23	0.24								
Capacity (veh/h)	695	674	744	808								
Control Delay (s)	7.9	8.8	9.0	8.6								
Approach Delay (s)	7.9	8.8	9.0	8.6								
Approach LOS	A	A	A	A								
Intersection Summary												
Delay			8.7									
Level of Service			A									
Intersection Capacity Utilization			32.8%	ICU Level of Service		A						
Analysis Period (min)			15									

# HCM Unsignalized Intersection Capacity Analysis

Total Traffic 2028

## 14: Langstaff Dr

Am Peak










						
Movement	SET	SER	NWL	NWT	NEL	NER
Lane Configurations						
Traffic Volume (veh/h)	67	2	7	84	15	17
Future Volume (Veh/h)	67	2	7	84	15	17
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	73	2	8	91	16	18
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			75		181	74
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			75		181	74
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			99		98	98
cM capacity (veh/h)			1524		804	988
Direction, Lane #	SE 1	NW 1	NE 1			
Volume Total	75	99	34			
Volume Left	0	8	16			
Volume Right	2	0	18			
cSH	1700	1524	892			
Volume to Capacity	0.04	0.01	0.04			
Queue Length 95th (m)	0.0	0.1	1.0			
Control Delay (s)	0.0	0.6	9.2			
Lane LOS		A	A			
Approach Delay (s)	0.0	0.6	9.2			
Approach LOS			A			
Intersection Summary						
Average Delay			1.8			
Intersection Capacity Utilization			20.2%	ICU Level of Service		A
Analysis Period (min)			15			

# HCM Unsignalized Intersection Capacity Analysis

## 17: Langstaff Dr

Total Traffic 2028

Am Peak





						
Movement	SET	SER	NWL	NWT	NEL	NER
Lane Configurations						
Traffic Volume (veh/h)	139	1	3	119	5	5
Future Volume (Veh/h)	139	1	3	119	5	5
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	151	1	3	129	5	5
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			152		286	152
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			152		286	152
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	99
cM capacity (veh/h)			1429		702	895
Direction, Lane #	SE 1	NW 1	NE 1			
Volume Total	152	132	10			
Volume Left	0	3	5			
Volume Right	1	0	5			
cSH	1700	1429	787			
Volume to Capacity	0.09	0.00	0.01			
Queue Length 95th (m)	0.0	0.1	0.3			
Control Delay (s)	0.0	0.2	9.6			
Lane LOS		A	A			
Approach Delay (s)	0.0	0.2	9.6			
Approach LOS			A			
Intersection Summary						
Average Delay			0.4			
Intersection Capacity Utilization			18.7%	ICU Level of Service		A
Analysis Period (min)			15			

# HCM Unsignalized Intersection Capacity Analysis

Total Traffic 2028

20:

Am Peak

















						
Movement	SEL	SET	NWT	NWR	SWL	SWR
Lane Configurations						
Traffic Volume (veh/h)	61	364	139	31	83	45
Future Volume (Veh/h)	61	364	139	31	83	45
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	66	396	151	34	90	49
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	185				696	168
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	185				696	168
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	95				77	94
cM capacity (veh/h)	1390				388	876
Direction, Lane #	SE 1	NW 1	SW 1			
Volume Total	462	185	139			
Volume Left	66	0	90			
Volume Right	0	34	49			
cSH	1390	1700	483			
Volume to Capacity	0.05	0.11	0.29			
Queue Length 95th (m)	1.2	0.0	9.4			
Control Delay (s)	1.5	0.0	15.4			
Lane LOS	A		C			
Approach Delay (s)	1.5	0.0	15.4			
Approach LOS			C			
Intersection Summary						
Average Delay			3.6			
Intersection Capacity Utilization		49.1%		ICU Level of Service		A
Analysis Period (min)		15				

# HCM Unsignalized Intersection Capacity Analysis

## 2: Deugo St/Langstaff Dr & Donald B. Munro Dr

Total Traffic 2028

PM Peak










												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	84	57	1	8	91	104	70	1	52	6	0	11
Future Volume (vph)	84	57	1	8	91	104	70	1	52	6	0	11
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	91	62	1	9	99	113	76	1	57	7	0	12
Direction, Lane #	EB 1	WB 1	SE 1	NW 1								
Volume Total (vph)	154	221	134	19								
Volume Left (vph)	91	9	76	7								
Volume Right (vph)	1	113	57	12								
Hadj (s)	0.15	-0.26	-0.11	-0.27								
Departure Headway (s)	4.7	4.2	4.7	4.7								
Degree Utilization, x	0.20	0.26	0.17	0.02								
Capacity (veh/h)	740	817	712	696								
Control Delay (s)	8.8	8.6	8.6	7.8								
Approach Delay (s)	8.8	8.6	8.6	7.8								
Approach LOS	A	A	A	A								
Intersection Summary												
Delay				8.7								
Level of Service				A								
Intersection Capacity Utilization				40.9%	ICU Level of Service	A						
Analysis Period (min)				15								

# HCM Unsignalized Intersection Capacity Analysis

## 3: Langstaff Dr & Frances Colbert Ave

Total Traffic 2028

PM Peak

						
Movement	WBL	WBR	SEL	SET	NWT	NWR
Lane Configurations						
Traffic Volume (veh/h)	27	0	0	78	95	43
Future Volume (Veh/h)	27	0	0	78	95	43
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	29	0	0	85	103	47
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	212	126	150			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	212	126	150			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	96	100	100			
cM capacity (veh/h)	777	924	1431			
Direction, Lane #	WB 1	SE 1	NW 1			
Volume Total	29	85	150			
Volume Left	29	0	0			
Volume Right	0	0	47			
cSH	777	1431	1700			
Volume to Capacity	0.04	0.00	0.09			
Queue Length 95th (m)	0.9	0.0	0.0			
Control Delay (s)	9.8	0.0	0.0			
Lane LOS	A					
Approach Delay (s)	9.8	0.0	0.0			
Approach LOS	A					
Intersection Summary						
Average Delay		1.1				
Intersection Capacity Utilization		17.6%		ICU Level of Service		A
Analysis Period (min)		15				



















# HCM Unsignalized Intersection Capacity Analysis

## 5: Langstaff Dr & Cavanagh Dr

















Total Traffic 2028

PM Peak

												
Movement	WBL2	WBL	WBR	SEL	SET	SER	NWL	NWT	NWR	NEL	NER	NER2
Lane Configurations												
Traffic Volume (veh/h)	18	0	3	3	97	4	8	131	38	3	0	4
Future Volume (Veh/h)	18	0	3	3	97	4	8	131	38	3	0	4
Sign Control		Stop			Free			Free		Stop		
Grade		0%			0%			0%		0%		
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	20	0	3	3	105	4	9	142	41	3	0	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)												
pX, platoon unblocked												
vC, conflicting volume	298	296	162	183			109			296	314	107
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	298	296	162	183			109			296	314	107
tC, single (s)	7.1	6.5	6.2	4.1			4.1			7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	2.2			2.2			3.5	4.0	3.3
p0 queue free %	97	100	100	100			99			100	100	100
cM capacity (veh/h)	648	611	882	1392			1481			649	597	947
Direction, Lane #	WB 1	SE 1	NW 1	NE 1								
Volume Total	23	112	192	7								
Volume Left	20	3	9	3								
Volume Right	3	4	41	4								
cSH	671	1392	1481	792								
Volume to Capacity	0.03	0.00	0.01	0.01								
Queue Length 95th (m)	0.9	0.1	0.1	0.2								
Control Delay (s)	10.6	0.2	0.4	9.6								
Lane LOS	B	A	A	A								
Approach Delay (s)	10.6	0.2	0.4	9.6								
Approach LOS	B			A								
Intersection Summary												
Average Delay				1.2								
Intersection Capacity Utilization				29.5%	ICU Level of Service				A			
Analysis Period (min)				15								

# HCM Unsignalized Intersection Capacity Analysis 10: Carp Rd & Donald B. Munro Dr

Total Traffic 2028  
PM Peak










												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	14	40	53	54	55	38	26	81	6	69	182	77
Future Volume (vph)	14	40	53	54	55	38	26	81	6	69	182	77
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	15	43	58	59	60	41	28	88	7	75	198	84
Direction, Lane #	EB 1	WB 1	SE 1	NW 1								
Volume Total (vph)	116	160	123	357								
Volume Left (vph)	15	59	28	75								
Volume Right (vph)	58	41	7	84								
Hadj (s)	-0.24	-0.05	0.05	-0.07								
Departure Headway (s)	5.1	5.2	5.2	4.7								
Degree Utilization, x	0.16	0.23	0.18	0.47								
Capacity (veh/h)	628	624	639	726								
Control Delay (s)	9.1	9.8	9.3	11.9								
Approach Delay (s)	9.1	9.8	9.3	11.9								
Approach LOS	A	A	A	B								
Intersection Summary												
Delay			10.6									
Level of Service			B									
Intersection Capacity Utilization			45.0%	ICU Level of Service					A			
Analysis Period (min)			15									

# HCM Unsignalized Intersection Capacity Analysis

## 14: Langstaff Dr

Total Traffic 2028

PM Peak










						
Movement	SET	SER	NWL	NWT	NEL	NER
Lane Configurations						
Traffic Volume (veh/h)	68	7	26	68	9	9
Future Volume (Veh/h)	68	7	26	68	9	9
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	74	8	28	74	10	10
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None		None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			82	208		78
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			82	208		78
tC, single (s)			4.1	6.4		6.2
tC, 2 stage (s)						
tF (s)			2.2	3.5		3.3
p0 queue free %			98	99		99
cM capacity (veh/h)			1515	766		983
Direction, Lane #	SE 1	NW 1	NE 1			
Volume Total	82	102	20			
Volume Left	0	28	10			
Volume Right	8	0	10			
cSH	1700	1515	861			
Volume to Capacity	0.05	0.02	0.02			
Queue Length 95th (m)	0.0	0.5	0.6			
Control Delay (s)	0.0	2.1	9.3			
Lane LOS			A			
Approach Delay (s)	0.0	2.1	9.3			
Approach LOS			A			
Intersection Summary						
Average Delay			2.0			
Intersection Capacity Utilization			21.7%	ICU Level of Service		A
Analysis Period (min)			15			

# HCM Unsignalized Intersection Capacity Analysis

## 17: Langstaff Dr

Total Traffic 2028

PM Peak










						
Movement	SET	SER	NWL	NWT	NEL	NER
Lane Configurations						
Traffic Volume (veh/h)	116	3	8	180	3	5
Future Volume (Veh/h)	116	3	8	180	3	5
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	126	3	9	196	3	5
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			129		342	128
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			129		342	128
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			99		100	99
cM capacity (veh/h)			1457		651	923
Direction, Lane #	SE 1	NW 1	NE 1			
Volume Total	129	205	8			
Volume Left	0	9	3			
Volume Right	3	0	5			
cSH	1700	1457	798			
Volume to Capacity	0.08	0.01	0.01			
Queue Length 95th (m)	0.0	0.1	0.2			
Control Delay (s)	0.0	0.4	9.6			
Lane LOS		A	A			
Approach Delay (s)	0.0	0.4	9.6			
Approach LOS			A			
Intersection Summary						
Average Delay			0.5			
Intersection Capacity Utilization		26.0%		ICU Level of Service		A
Analysis Period (min)			15			

# HCM Unsignalized Intersection Capacity Analysis

Total Traffic 2028

20:

PM Peak

						
Movement	SEL	SET	NWT	NWR	SWL	SWR
Lane Configurations						
Traffic Volume (veh/h)	53	248	518	87	51	83
Future Volume (Veh/h)	53	248	518	87	51	83
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	58	270	563	95	55	90
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	658				996	610
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	658				996	610
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	94				78	82
cM capacity (veh/h)	930				254	494
Direction, Lane #	SE 1	NW 1	SW 1			
Volume Total	328	658	145			
Volume Left	58	0	55			
Volume Right	0	95	90			
cSH	930	1700	364			
Volume to Capacity	0.06	0.39	0.40			
Queue Length 95th (m)	1.6	0.0	14.9			
Control Delay (s)	2.2	0.0	21.3			
Lane LOS	A		C			
Approach Delay (s)	2.2	0.0	21.3			
Approach LOS			C			
Intersection Summary						
Average Delay			3.4			
Intersection Capacity Utilization		66.5%		ICU Level of Service		C
Analysis Period (min)		15				

# TIA ANALYSIS REPORT: RESIDENTIAL DEVELOPMENT AT 147 LANGSTAFF ROAD



## APPENDIX F – BUS ROUTE



# 303

## Local

### CARLINGWOOD DUNROBIN, CARP



#### Wednesday only / Mercredi seulement

Selected time periods

Périodes sélectionnées



Transitway & Station



PM Extension to Bayshore  
Prolongement en PM vers Bayshore



Park & Ride / Parc-o-bus

2018.09



**Schedule / Horaire.....613-560-1000**

**Text / Texto .....560560**

*plus your four digit bus stop number / plus votre numéro d'arrêt à quatre chiffres*

Customer Relations

Service à la clientèle ..... **613-741-4390**

Lost and Found / Objets perdus..... **613-563-4011**

Security / Sécurité ..... **613-741-2478**

**Effective Septembre 2, 2018**

**En vigueur 2 septembre 2018**



**INFO 613-741-4390**  
**octranspo.com**

# TIA ANALYSIS REPORT: RESIDENTIAL DEVELOPMENT AT 147 LANGSTAFF ROAD



## APPENDIX G – TDM CHECKLIST

## TDM-Supportive Development Design and Infrastructure Checklist: *Residential Developments (multi-family or condominium)*

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

TDM-supportive design & infrastructure measures: <i>Residential developments</i>		Check if completed & add descriptions, explanations or plan/drawing references
<b>1. WALKING &amp; CYCLING: ROUTES</b>		
<b>1.1 Building location &amp; access points</b>		
<b>BASIC</b>	1.1.1 Locate building close to the street, and do not locate parking areas between the street and building entrances	<input checked="" type="checkbox"/>
<b>BASIC</b>	1.1.2 Locate building entrances in order to minimize walking distances to sidewalks and transit stops/stations	<input checked="" type="checkbox"/> Building entrance located within 370m of bus stop
<b>BASIC</b>	1.1.3 Locate building doors and windows to ensure visibility of pedestrians from the building, for their security and comfort	<input checked="" type="checkbox"/> Building doors and windows provide visibility of pedestrians
<b>1.2 Facilities for walking &amp; cycling</b>		
<b>REQUIRED</b>	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 ( <i>see Official Plan policy 4.3.3</i> )	<input checked="" type="checkbox"/> Concrete sidewalks and pedestrian crossings are provided on-site. Connection to existing pedestrian facilities along Langstaff Drive and to bus stops provided
<b>REQUIRED</b>	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 ( <i>see Official Plan policy 4.3.12</i> )	<input checked="" type="checkbox"/> Concrete sidewalks and pedestrian crossings are provided on-site. Connection to existing pedestrian facilities along Langstaff Drive and to bus stops provided

TDM-supportive design & infrastructure measures: <i>Residential developments</i>		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 ( <i>see Official Plan policy 4.3.10</i> )	<input checked="" type="checkbox"/> Sidewalks are expected to be constructed of concrete to differentiate pedestrian areas from vehicle pathways.
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 ( <i>see Official Plan policy 4.3.10</i> )	<input checked="" type="checkbox"/> Sidewalks are expected to have gradual transitions, depressed curbs at the street corners and convenient access to extra-parking spaces.
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 ( <i>see Official Plan policy 4.3.11</i> )	<input checked="" type="checkbox"/> Pedestrian connects are provided near all entrances. No existing bike lanes are located on Langstaff Drive.
BASIC	1.2.6 Provide safe, direct and attractive walking routes from building entrances to nearby transit stops	<input checked="" type="checkbox"/> Access to transit stops is provided within the vicinity of the development sites via pedestrian facilities.
BASIC	1.2.7 Ensure that walking routes to transit stops are secure, visible, lighted, shaded and wind-protected wherever possible	<input checked="" type="checkbox"/> Walking routes to the transit stops are secure and visible
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	<input checked="" type="checkbox"/> Not Applicable
<b>1.3 Amenities for walking &amp; cycling</b>		
BASIC	1.3.1 Provide lighting, landscaping and benches along walking and cycling routes between building entrances and streets, sidewalks and trails	<input checked="" type="checkbox"/>
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)	<input checked="" type="checkbox"/>

TDM-supportive design & infrastructure measures: <i>Residential developments</i>		Check if completed & add descriptions, explanations or plan/drawing references
<b>2. WALKING &amp; CYCLING: END-OF-TRIP FACILITIES</b>		
<b>2.1 Bicycle parking</b>		
REQUIRED	2.1.1 Provide bicycle parking in highly visible and lighted areas, sheltered from the weather wherever possible ( <i>see Official Plan policy 4.3.6</i> )	<input type="checkbox"/>
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 ( <i>see Zoning By-law Section 111</i> )	<input type="checkbox"/>
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 ( <i>see Zoning By-law Section 111</i> )	<input type="checkbox"/>
BASIC	2.1.4 Provide bicycle parking spaces equivalent to the expected number of resident-owned bicycles, plus the expected peak number of visitor cyclists	<input checked="" type="checkbox"/> 4 bicycle trips expected during the peak hours. 58 bicycle stalls provided
<b>2.2 Secure bicycle parking</b>		
REQUIRED	2.2.1 Where more than 50 bicycle parking spaces are provided for a single residential building, locate at least 25% of spaces within a building/structure, a secure area (e.g. supervised parking lot or enclosure) or bicycle lockers ( <i>see Zoning By-law Section 111</i> )	<input checked="" type="checkbox"/>
BETTER	2.2.2 Provide secure bicycle parking spaces equivalent to at least the number of units at condominiums or multi-family residential developments	<input checked="" type="checkbox"/> 58 bicycle stalls provided
<b>2.3 Bicycle repair station</b>		
BETTER	2.3.1 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)	<input checked="" type="checkbox"/>
<b>3. TRANSIT</b>		
<b>3.1 Customer amenities</b>		
BASIC	3.1.1 Provide shelters, lighting and benches at any on-site transit stops	<input checked="" type="checkbox"/> There are no 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	<input checked="" type="checkbox"/>
BETTER	3.1.3 Provide a secure and comfortable interior waiting area by integrating any on-site transit stops into the building	<input checked="" type="checkbox"/>



TDM-supportive design & infrastructure measures: <i>Residential developments</i>		Check if completed & add descriptions, explanations or plan/drawing references
<b>4. RIDESHARING</b>		
<b>4.1 Pick-up &amp; drop-off facilities</b>		
<b>BASIC</b>	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	<input checked="" type="checkbox"/>
<b>5. CARSHARING &amp; BIKESHARING</b>		
<b>5.1 Carshare parking spaces</b>		
<b>BETTER</b>	5.1.1 Provide up to three carshare parking spaces in an R3, R4 or R5 Zone for specified residential uses (see <i>Zoning By-law Section 94</i> )	<input checked="" type="checkbox"/>
<b>5.2 Bikeshare station location</b>		
<b>BETTER</b>	5.2.1 Provide a designated bikeshare station area near a major building entrance, preferably lighted and sheltered with a direct walkway connection	<input type="checkbox"/>
<b>6. PARKING</b>		
<b>6.1 Number of parking spaces</b>		
<b>REQUIRED</b>	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	<input type="checkbox"/>
<b>BASIC</b>	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	<input checked="" type="checkbox"/>
<b>BASIC</b>	6.1.3 Where a site features more than one use, provide shared parking and reduce the cumulative number of parking spaces accordingly (see <i>Zoning By-law Section 104</i> )	<input checked="" type="checkbox"/>
<b>BETTER</b>	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 <i>Zoning By-law Section 111</i> )	<input checked="" type="checkbox"/>
<b>6.2 Separate long-term &amp; short-term parking areas</b>		
<b>BETTER</b>	6.2.1 Provide separate areas for short-term and long-term parking (using signage or physical barriers) to permit access controls and simplify enforcement (i.e. to discourage residents from parking in visitor spaces, and vice versa)	<input checked="" type="checkbox"/>