R.W. TOMLINSON STITTSVILLE II PROPOSED QUARRY EXPANSION

TRAFFIC IMPACT STUDY

FINAL REPORT

Presented to:

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Project No. 7301

CASTLEGLENN CONSULTANTS LTD.

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The following Traffic Impact Study (TIS) report has been produced, reviewed, and is respectfully submitted for consideration to whom it has been addressed.

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1.0 INTRODUCTION

Castleglenn Consultants Inc. were retained to undertake a Traffic Impact Study (TIS) in support of the proposed Stittsville II Quarry expansion.

The proposed development represents an expansion in area of the existing quarry site which is located on Jinkinson Road approximately 1.5 km west of the Hazeldean Road & Jinkinson Road intersection, and just south of the Highway 7 corridor. All operations from the existing site would be moved to the expansion lands. There would be no change to the volume of operations nor vehicle traffic volumes generated by the site. The existing access to Jinkinson Road which is characterized as a collector roadway and a "full-loads"[1] truck route would continue to be used.

This traffic impact study includes the following components:

- A review of the study area, the quarry site location, the roadway and intersection configurations, adjacent land uses and existing accesses on Jinkinson Road within the vicinity of the proposed quarry expansion;
- A review of existing (2022) background traffic operational conditions within the study area. The study saw the collection of traffic count information from the following intersections:
  - Jinkinson Road & R.W. Tomlinson Stittsville Quarry Access (manual traffic count);
  - Hazeldean Road & Jinkinson Road;
  - Fernbank Road & Jinkinson Road;
- A description of the proposed extraction site development and its anticipated impact on future (2025) traffic operations;
- A site traffic forecast for the proposed development that reflected typical weekday morning and afternoon peak hour quarry operations. Intersection capacity analyses that were conducted assuming both existing and forecast operational morning and afternoon peak hours of travel demand within the study area;
- A review of sightlines at the existing site access;
- Left turn lane warrant analysis at the Jinkinson Road and Site Access, and Jinkinson Road and Hazeldean Road intersections; and
- Traffic signal warrant analysis at the Jinkinson Road and Hazeldean Road intersection.

The following sections describe the analyses of traffic operations associated with the proposed development and presents the resulting performance measures (levels, of service, (v/c) volume-to-capacity ratios, queue length and delay estimates) for the anticipated time of (2025) of the expansion of the existing quarry site.

1 "*Rural Truck Routes*" Map (01 March, 2022), City of Ottawa, Traffic Services

2.0 EXISTING CONDITIONS

2.1 STUDY AREA AND SITE LOCATION

Exhibit 2-1 illustrates the general location of the proposed development along Jinkinson Road south of the Highway 7 corridor. The proposed development is an expansion of the existing R.W. Tomlinson Stittsville Quarry Site (License #39958). Other uses on-site include an asphalt and ready-mix concrete plants. The expansion lands are located on the east and south sides of the existing quarry access. The expanded quarry will make use of the existing site's single access to Jinkinson Road.

Exhibit 2-1: Study Area Context

2.2 STUDY AREA ROADWAYS

The following sub-sections serve to characterize the primary roadways within the vicinity of the proposed development. Exhibit 2-2 illustrates the location of below study area roadways:

HIGHWAY 7:

- Highway 7 is an east-west provincial highway runing from Toronto to Ottawa. In the vicinity of the study area, the highway is a four-lane divided freeway with a posted speed limit of 100 km/h. The Highway 7 and Hazeldean Road interchange will be the primary access point to the highway for the development traffic

HAZELDEAN ROAD:

- Hazeldean Road is an east-west arterial road in the City of Ottawa, running from Spruce Ridge Road near Highway 7 in the west towards Eagleson Road in the east, where it becomes Robertson Road. In the vicinity of the study area, the road is a 2-lane roadway with a posted speed limit of 80 km/h and a rural cross-section. In the urban part of Ottawa, east of Stittsville Main Street, the road becomes a 4-lane divided roadway with an urban cross-section and a posted speed limit of 60 km/h. The road is designated as a full load truck route in the vicinity of the study area.

FERNBANK ROAD:

- Fernank Road is an east-west arterial road in the City of Ottawa, running from Dwyer Hill Road in the west towards Eagleson Road in the east. In the vicinity of the study area, the road is a 2-lane collector roadway with a posted speed limit of 80 km/h and a rural cross-section. The road is classified as an arterial east of Stittsville Main Street with speed limits ranging between 40 km/h and 60 km/h. Fernbank Road west of Jinkinson Road is classified as a restricted load truck route. Trucks are prohibited from using Fernbank Road east of Jinkinson Road.

JINKINSON ROAD:

- Jinkinson Road is a collector road between Hazeldean Road in the north and Fernbank Road in the south. A portion of the road runs parallel to the Highway 7 corridor and provides access to the existing Stittsvile II quarry development. The road is a 2-lane undivided roadway with a posted speed limit of 80 km/h and a rural cross-section. The road is designated as a full load truck route.

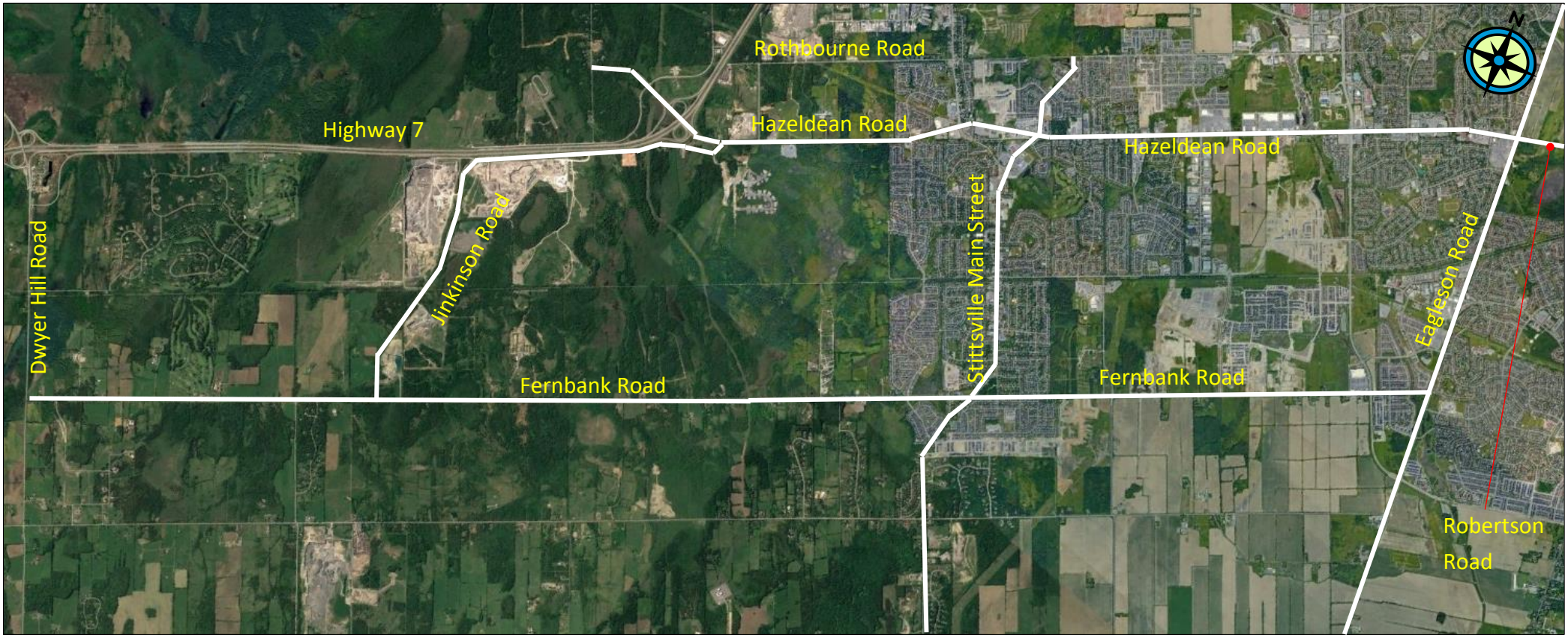


Exhibit 2-2: Study Area Roadways

2.3 STUDY AREA INTERSECTIONS

The following section summarizes the study area intersections.

1. JINKINSON ROAD / SITE ACCESS

- Exhibit 2-3 illustrates the 3-leg Jinkinson Road / Tomlinson Quarry Access intersection;
- It is STOP-controlled on the minor (south) leg of the intersection;
- Tomlinson Quarry Access is located on the south leg of the intersection while Jinkinson Road is on the east-west legs;
- Each approach of the intersection provides for one lane of shared through-turn movement and no auxiliary lanes;

Exhibit 2-3: Jinkinson Road and Site Access Intersection

2. JINKINSON ROAD / HAZELDEAN ROAD

- Exhibit 2-4 illustrates the Jinkinson Road / Hazeldean Road 3-leg intersection;
- It is STOP-controlled on the minor (south) leg of the intersection;
- Jinkinson Road is located on the south leg of the intersection while Hazeldean Road is on the east-west leg;
- Each approach of the intersection provides for one lane of shared through-turn movement and no auxiliary lanes.

Exhibit 2-4: Hazeldean Road / Jinkinson Road Intersection

3. JINKINSON ROAD / FERNBANK ROAD

- Exhibit 2-5 illustrates the 3-leg Jinkinson Road / Fernbank Road intersection;
- It is STOP-controlled on the minor (north) leg of the intersection;
- Jinkinson Road is located on the south leg of the intersection while Fernbank Road is on the east-west legs;
- Each approach of the intersection provides for one lane of shared through-turn movement and no auxiliary lanes;

Exhibit 2-5: Fernbank Road and Jinkinson Road Intersection

2.4 ADJACENT LAND USES

Exhibit 2-6 illustrates the general location of the proposed development site superimposed upon the City of Ottawa zoning by-law map[2]. An inspection of the exhibit shows the following:

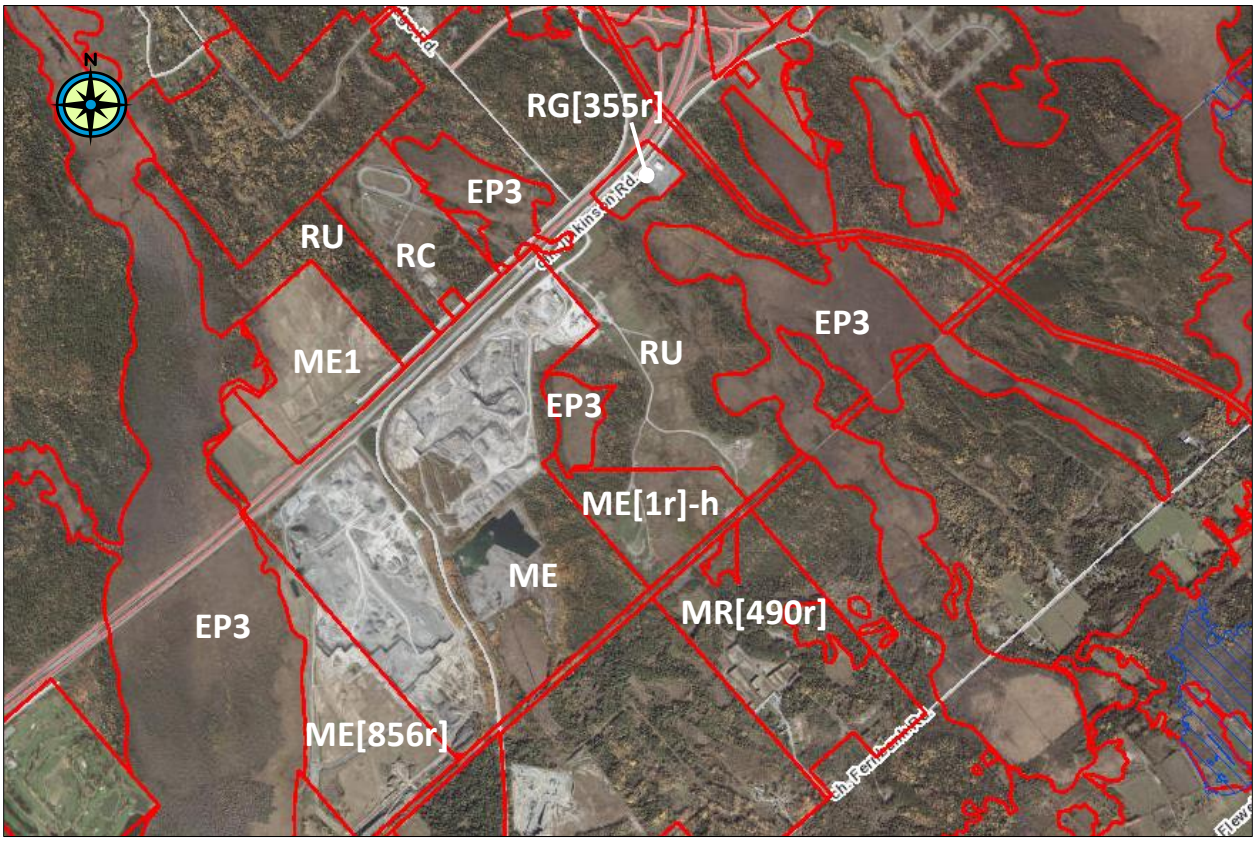


Exhibit 2-6: Adjacent Land Uses

2 Adopted from GeoOttawa online mapping tool – maps.ottawa.ca/geoottawa

- The proposed site is currently zoned "RU – Rural Countryside", "EP3 – Environmental Protection", and "ME[1r]-h – Mineral Extraction";
- The existing quarries to the west of the proposed expansion are zoned "ME" – Mineral Extraction Zone";
- A portion of land east of the proposed expansion along Jinkinson Road is zoned "RG[355r] – Rural General Industrial Zone". The parcels host two construction equipment rental businesses; and
- Land across Highway 7 is zoned "RC – Rural Commercial" and houses Capital City Raceway race track and a paintball play field.

2.5 ADJACENT DRIVEWAYS

Exhibit 2-7 illustrates the locations of the existing access/driveways along Jinkinson Road. The following provides a short description of each access/driveway:

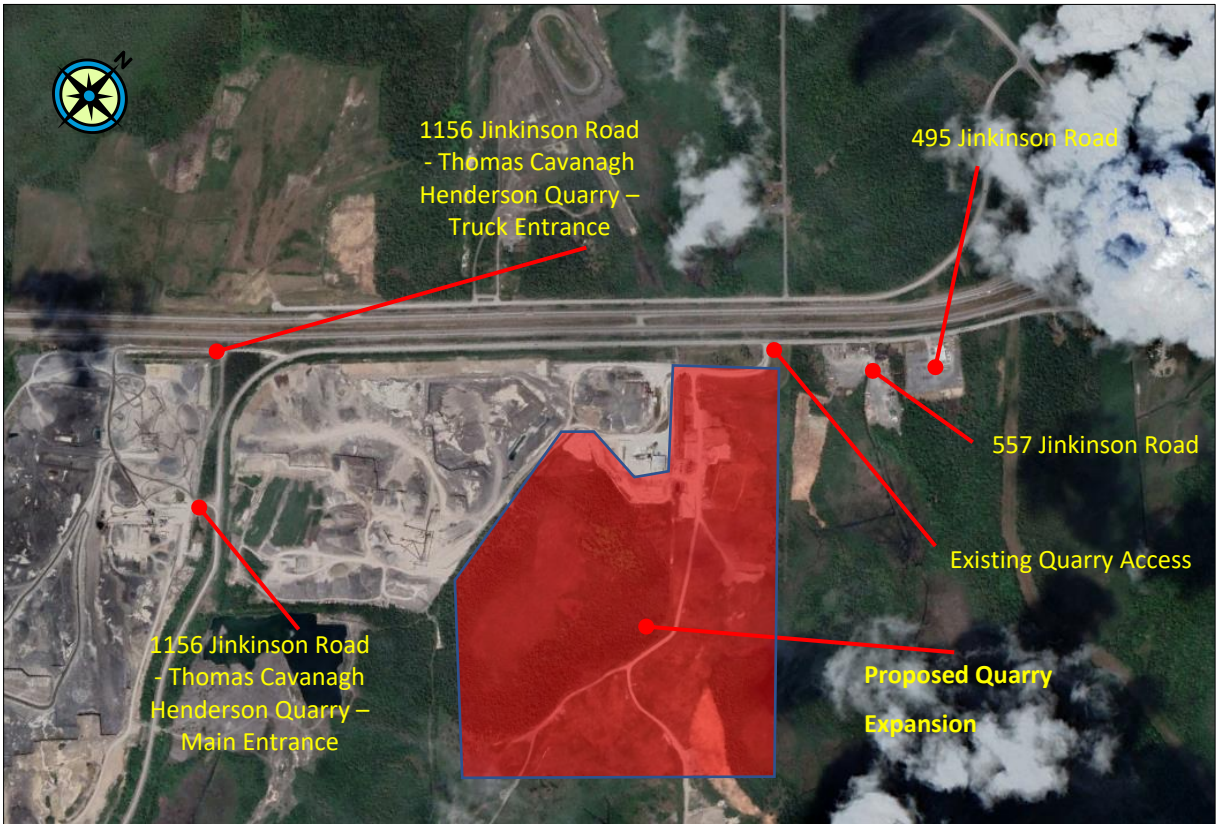


Exhibit 2-7: Adjacent Driveways

- **1156 Jinkinson Road** is an existing quarry operated by Thomas Cavanagh Construction Limited. The quarry is a Class "A" licensed quarry with authorized area

of 74.6 hectares[3]. The following two quarry accesses are nearest to the proposed expansion site:

- Truck-only access located approximately 1.3km west of the R.W. Tomlinson quarry access;
- Main access located 1.75km west of the R.W. Tomlinson quarry access;

- **557 Jinkinson Road** is a construction equipment rental business (Jason's & Son Construction Equipment Rentals), located approximately 280 meters east of R.W. Tomlinson quarry access;
- **495 Jinkinson Road** is a construction equipment dealership (J.R. Brisson Equipment), located approximately 440 meters east of R.W. Tomlinson quarry access.

2.6 EXISTING COLLISION INFORMATION

The City of Ottawa was contacted to provide recent (5-years between 2016 and 2020) collision information at the following locations:

- Jinkinson Road & Hazeldean Road intersection;
- Jinkinson Road & Fernbank Road intersection; and
- Jinkinson Road between Hazeldean Road and Fernbank Road (mid-block).

Table 2-1 provides a summary of the recorded (reported) collisions. Discussions with the City of Ottawa staff indicated that there were no collisions recorded at the Jinkinson Road & Hazeldean Road intersection between the years of 2016 and 2020 time period.

Table 2-1: Five -Year Collision History (January 1st, 2016 -to- December 31st, 2020)

Intersection / Mid-block Location		1. Jinkinson Road and Hazeldean Road	2. Jinkinson Road and Fernbank Road	3. Jinkinson Road between Hazeldean Road and Fernbank Road
Total Collisions		**0**	**3**	**30**
Collision Type	**Rear End**	0	0	1
	Angle	0	1	1
	Approach	0	0	1
	Animal Collision	0	1	5
	Ran off Road / Ditch	0	0	14
	Skidding / Sliding	0	0	6
	Other	0	1	2
Collision Severity	**Property Damage**	0	3	23
	Non-Fatal Injury	0	0	6
	Fatal	0	0	1
Intersection AADT (2019)		**7,500**	**2,300**	N/A
Collision Rate per MEV		**0**	**0.71**	N/A

3 Ministry of Northern Development, Mines, Natural Resources and Forestry GIS

Table 2-1 indicates a that there were 30 collisions along Jinkinson Road between Hazeldean Road and Fernbank Road, including a fatal accident involving a motorcyclist. It is worthwhile to note that of the 30 incidents along Jinkinson Road:

- Only 4-out-of-the total 30 collisions involved heavy vehicles;
- 19 were determined to involve a single-motor vehicle that either ran-off-the-road or skidded/slid and lost control;
- 5 collisions were single vehicle that involved an animal (wildlife);
- A review of the City of Ottawa's collision mapping tool indicated that most of the reported collisions occurred at the curve of Jinkinson Road, within 1 kilometer of the Jinkinson Road / Hazeldean Road intersection;
- Despite the large proportion of heavy vehicles recorded along Jinkinson Road (20%-45% depending on direction and time of day), 26 of the 30 incidents (87%) were found to involve passenger vehicles, motorcycles, or pick-up trucks.

There were 3 collisions reported at the intersection of Jinkinson Road and Fernbank Road, which resulted in a 0.71 collisions / MEV (million entering vehicles), and is not considered a concern.

2.7 STUDY HORIZONS

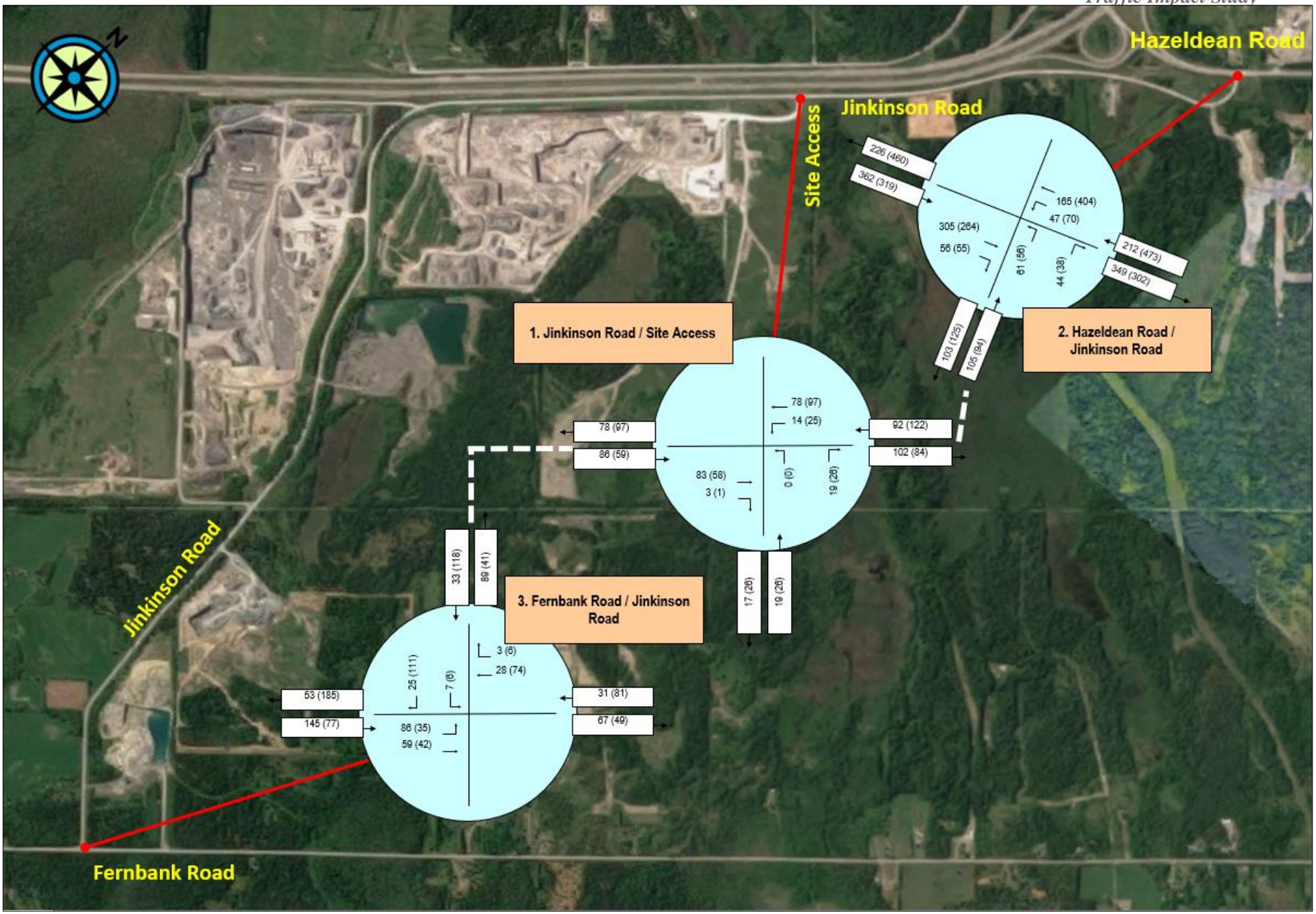
The expansion of the quarry site is proposed to be complete and operational by the end of 2025. This study considered the existing network travel demand (2022), as well as the operational (2025) horizon year.

2.8 EXISTING TRAFFIC VOLUMES (2022)

A manual traffic count was conducted on May 3, 2022 at the Jinkinson Road and R.W. Tomlinson Quarry Access intersection during the morning (7-to-9 AM) and afternoon (3:30-to-6 PM) peak periods of travel demand. The count recorded the number of passenger and heavy vehicles as well as pedestrians/cyclists (only 1 cyclist was recorded).

In addition, the City of Ottawa supplied traffic counts at the Jinkinson Road and Hazeldean Road (conducted on April 10, 2019) and the Jinkinson Road and Fernbank Road (conducted on April 30, 2019) intersections. These traffic counts were adjusted to the existing year (2022), by applying a 2% background traffic growth rate to all through movements along Hazeldean Road and all movements at the Jinkinson Road & Fernbank Road intersection.

Exhibit 2-8 illustrates the existing (2022) balanced intersection traffic volumes for the morning and afternoon peak hours of travel demand.



Morning (Afternoon)

Exhibit 2-8: Existing Intersection Traffic Volumes (Vehicles-per-Hour)

2.8.1 Adjacent Developments

The traffic counts received from the City of Ottawa were conducted in spring of 2019. A review of historical aerial photography indicated that there were two adjacent developments recently completed (location indicated within Exhibit 2-9). The anticipated traffic generation for each of these developments is summarized below. The traffic impacts associated with each of these developments were superimposes upon the adjacent Jinkinson Road & Hazeldean Road intersection.

1) 495 Jinkinson Road

- This recently completed (2019) development is a construction equipment dealership (J.R. Brisson Equipment). A review of the Planning Rationale prepared by McIntosh Perry[4] for this development indicated a development gross floor area size of 1,203 m^2. ITE's land use rate 110 – General Light Industrial was used. Table 2-2 summarizes the vehicle trip generation rates and the resulting number of trips.

Table 2-2: 495 Jinkinson Road Vehicle Trip Generation Rates

Land Use	ITE Land Use*	Size	Morning Peak Hour			Afternoon Peak Hour		
			Rate	In	Out	Rate	In	Out
Construction Equipment Dealership	110 – General Light Industrial	1,203 m^2 (12,949 ft^2)	0.70 (per 1000 ft^2)	88%	12%	0.63 (per 1000 ft^2)	13%	87%
			Trips	**In**	**Out**	**Trips**	**In**	**Out**
			9	8	1	8	1	7

*Source: ITE Trip Generation Handbook, 10th Edition

2) 557 Jinkinson Road

- This recently completed (2020) development is a construction equipment rental business (Jason's & Son Construction Equipment Rentals). A review of available aerial photography indicated that the gross floor area of the primary building on-site is approximately 2,000 square feet. Additionally, the site contains several storage trailers.
- To remail conservative in terms of traffic generation, a 7,000 square foot gross floor area was assumed. ITE's rate (Land Use 811 – Construction Equipment Rental Store) was adopted for this site. In the absence of a morning peak hour rate, the afternoon rate was used along with a reversed directional split.
- Table 2-3 summarizes the adopted traffic generation rates and resulting number of vehicle trips for the 557 Jinkinson Road development.

4. Planning Rationale 495 Jinkinson Road, McIntosh Perry Consulting Engineers Ltd., June 2018

Exhibit 2-9: Adjacent Proposed Developments in the Study Area

Table 2-3: 557 Jinkinson Road Vehicle Trip Generation Rates

Land Use	ITE Land Use*	Size	Morning Peak Hour**			Afternoon Peak Hour		
			Rate	In	Out	Rate	In	Out
Construction Equipment Rental	811 – Construction Equipment Rental Store	7,000 ft^2	0.99 (per 1000 ft^2)	72%	28%	0.99 (per 1000 ft^2)	28%	72%
			Trips	**In**	**Out**	**Trips**	**In**	**Out**
			7	5	2	7	2	5

*Source: ITE Trip Generation Handbook, 10th Edition
**Afternoon trip rate is used with reversed in/out split

The following is the proposed traffic breakdown of the adjacent development traffic:

- 15% of the traffic was assumed to be heading to/from the west (Fernbank Road)
  - No adjustments were made to the Jinkinson Road / Site Access traffic count, since the count was conducted in 2022 and already includes the traffic from both abovementioned developments
- 85% of the traffic was assumed to be heading to/from the east (Hazeldean Road)
  - A review of existing directional splits at the Jinkinson Road / Hazeldean Road intersection indicated the following directional split:
  - Morning peak hour: 61% to/from west towards Highway 7; 39% to/from east towards Hazeldean Road;
  - Afternoon peak hour: 58% to/from west towards Highway 7; 42% to/from east towards Hazeldean Road.

2.8.2 Other Developments

Exhibit 2-9 illustrates the following proposed developments in the study area:

3) 6310 Hazeldean Road

- This is a proposed mixed-use development with 1,630 m^2 of commercial space and 317 apartment units.
- The build-out and full occupancy horizon for this development is 2027, which is beyond this study's forecast horizons.
- A Transportation Impact Assessment (TIA) prepared by CGH in March 2022 indicated that the development is anticipated to produce 62 new vehicle trips during the morning peak hour of travel demand and 103 new vehicle trips during the afternoon peak hour of travel demand.
- The study also indicated that 5% of the traffic would be headed west on Hazeldean Road to, or from, the site. This would represent an increase in traffic of a total of 3 vehicles in the morning peak hour of travel demand and 5 vehicles in the afternoon peak hour of travel demand that would impact the Hazeldean Road corridor fronting Jinkinson Road.

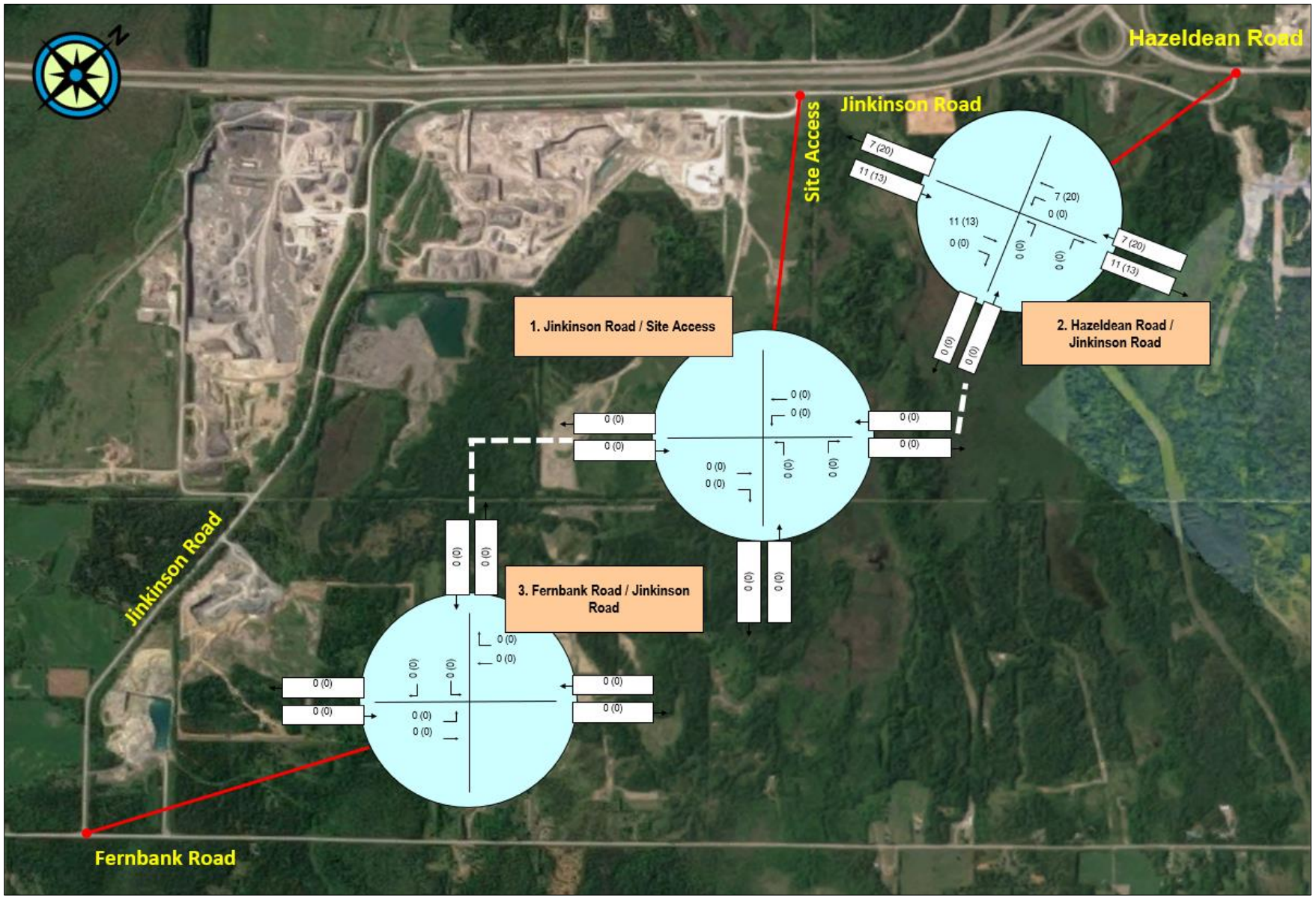
4) 1037 Carp Road

- This development would comprise a proposed two-storey office building with 14 office spaces and associated parking.
- Due to the development's small size, a TIA was not required for the Site Plan Control application. The development's trip generation is assumed to be included in the background growth assumptions.

5) 6171 Hazeldean Road

- This is a proposed subdivision development with a total of 529 apartment units. A Transportation Impact Assessment prepared by Exp in September 2021 indicated that the development is anticipated to produce 273 new vehicle trips during the morning peak hour of travel demand and 345 new vehicle trips during the afternoon peak hour of travel demand. The build-out and full occupancy horizon for this development is 2024, which is within this study's forecast horizons.
- The study also indicated that between 4% and 14% of the traffic will be headed west on Hazeldean Road (to, or from, the study area), depending on the time of day. This represents and increase in traffic of a total of 18 vehicles in the morning peak hour of travel demand and 33 vehicles in the afternoon peak hour of travel demand.

Exhibit 2-10 illustrates the anticipated traffic impact associated with the adjacent development traffic forecast within the study area.



Morning (Afternoon)

Exhibit 2-10: Estimate of Adjacent Development Traffic on Hazedean Road

2.9 EXISTING TRAFFIC ANALYSIS

Intersection capacity analysis for the three minor leg stop-controlled study area intersections was undertaken utilizing Synchro™ 10 analysis software. The software incorporates Highway Capacity Manual (HCM) 6th edition methodologies to determine level-of-service (delay-based) and volume-to-capacity (v/c) performance metrics. The analyses assumed a peak hour factor of 0.95 which simulates the busiest 15-minute-period of the overall peak hour. Appendix "C" documents the resulting Synchro output sheets indicating the existing operational performance.

Table 2-4 summarizes the intersection capacity analyses results that assume the existing traffic count information illustrated in Exhibit 2-8 and the existing intersection configurations. The table indicates that all the area intersections within the study area were found to operate at an acceptable level of service "C"-or-better in all directions during the peak hours of travel demand.

Table 2-4: Existing 2022 Intersection Capacity Analysis Result

Intersection		Control Type	Critical Approach/ Movement	Weekday Morning Peak Hour (Afternoon Peak Hour)			
				Average Delay per Vehicle (seconds)	Level of Service	95th Percentile Queue (m)	Volume-to-Capacity Ratio (v/c)
1.	Jinkinson Road and Site Access	Minor leg-STOP	Northbound - Site Access	9.6 (9.3)	A (A)	1 (1)	0.03 (0.03)
2.	Jinkinson Road and Hazeldean Road	Minor leg-STOP	Northbound - Jinkinson Road	15.1 (18)	C (C)	7 (8)	0.23 (0.26)
3.	Jinkinson Road and Fernbank Road	Minor leg-STOP	Southbound - Jinkinson Road	9.3 (9.4)	A (A)	1 (4)	0.04 (0.13)

3.0 THE DEVELOPMENT PROPOSAL

3.1 THE PROPOSED SITE

Exhibit 3-1 illustrates the proposed R.W. Tomlinson Limited Stittsville II Quarry expansion site. The expansion will add approximately 121 hectares of licensed boundary, of which 108 hectares will be used for extraction. Upon the completion of expansion, the operations will gradually move from the existing site to the expansion lands. No changes in the volume of quarry operations, vehicles accessing the site or traffic volumes are anticipated.

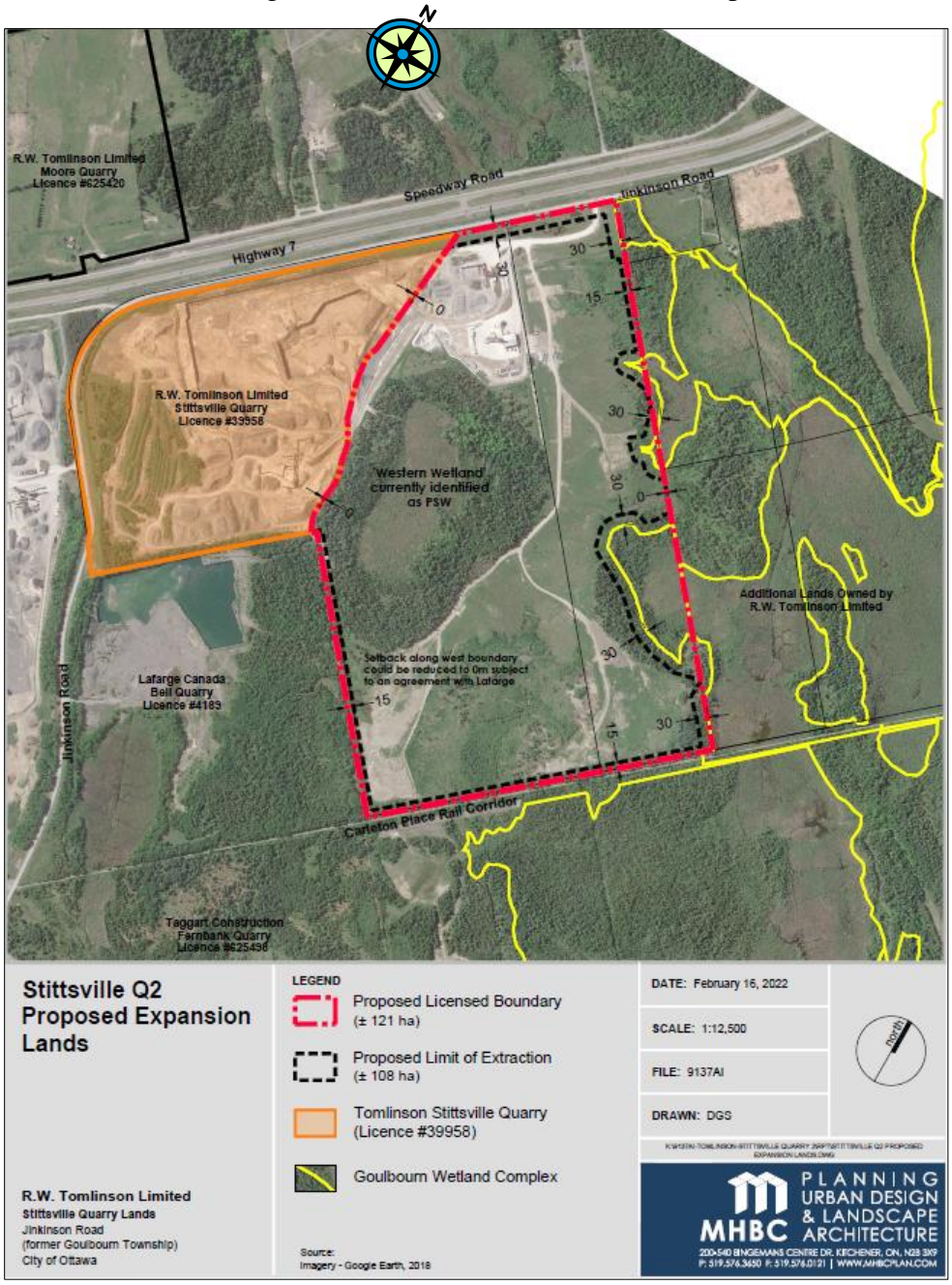


Exhibit 3-1: Proposed Tomlinson Quarry Expansion Area

3.2 PROPOSED OPERATIONS

Table 3-1 outlines the operational characteristics of the existing quarry. From the discussions with R.W. Tomlinson, it is understood that the expansion of the quarry is not anticipated to impact the operations, as the site traffic from the current licensed site is anticipated to simply relocate within the new expansion area.

Table 3-1: Extraction Site Operational Characteristics

Maximum Annual Haulage:	3 million (3,000,000) tonnes
Partial or Year-Round Operations?	Year-Round
Hours of Operations:	• 24 hours for 5 days/week; 12 hours on Saturday. • Total: 132 hours/week; • 6,864 hours/year
Primary hauling vehicle:	20-tonne highway truck
Trucks / hour:	22 trucks (one-way); or 44 trucks (two-way)
Concrete and Ready-Mix traffic:	8 trucks (one-way); or 16 trucks (two-way)
Total "worst-case" trucks / hour:	**30 trucks (one-way); or 60 trucks (two-way)**
Other vehicles (Assumed to arrive off-peak or circulate internally only):	• 5 loaders (circulate internally) • 5 rock trucks (circulate internally) • 3 passenger vehicles (arrive off-peak)

It is assumed that employees arrive to the site outside of the peak hours of travel demand and the loader and rock trucks operate on-site internally. The study assumes that the peak hour site traffic will consist exclusively of highway hauling trucks. The peak hour of operations based on maximum annual haulage is calculated to produce 44 two-way heavy vehicle trips per hour (22 inbound and 22 outbound). Any additional traffic from existing ready-mix concrete and asphalt plants on site was estimated to include at most 16 two-way heavy vehicle trips per hour (8 inbound and 8 outbound). The peak hour of site operations is therefore forecast to produce **60 two-way heavy vehicle trips-per-hour (30 inbound and 30 outbound)**. To remain conservative, the study assumes that the peak hour of site coincides with the peak morning and afternoon hours of adjacent streets travel demand.

4.0 TRAFFIC FORECASTING

4.1 BACKGROUND TRAFFIC GROWTH

A review of adjacent development initiatives indicated a new subdivision project at 6171 Hazeldean Road (as described in section 2.8.2), approximately 3 kilometers west of the Jinkinson Road & Hazeldean Road intersection. The background traffic growth rate assumed in the Transportation Impact Study for the development was adopted as 2 percent[5].

To remain conservative, the same background growth rate (2% non-compounded) was adopted for this study for all movements at all 3 study area intersections (excluding the movements coming in and out of the Tomlinson site).

4.2 HAUL ROUTES

The primary haul route for the proposed mineral extraction sites would involve travelling eastward along Jinkinson Road towards Highway 7. In discussions with R.W. Tomlinson Limited, the following traffic haul route breakdown was determined:

- 90% of the vehicles will travel to/from the east (Hazeldean Road and Highway 7 / 417), of which:
  - 70% of the vehicles will be headed to/from Highway 7; and
  - 20% of the vehicles will be headed to/from Hazeldean Road.
- 10% of the vehicles will travel to/from the west (Fernbank Road).

5 6171 Hazeldean Road Development – Traffic Impact Assessment. Exp Services Inc, September 2021

4.3 SITE TRAFFIC GENERATION

Table 4-1 summarizes the component of traffic volumes associated with the Stittsville II site. The traffic volumes include traffic generated by the quarry, as well as the asphalt and ready-mix concrete plants (existing uses on site).

Upon the completion of expansion, all operations from the existing site will be moved to the expansion lands. No additional traffic volume associated with operations or vehicle types are anticipated to occur.

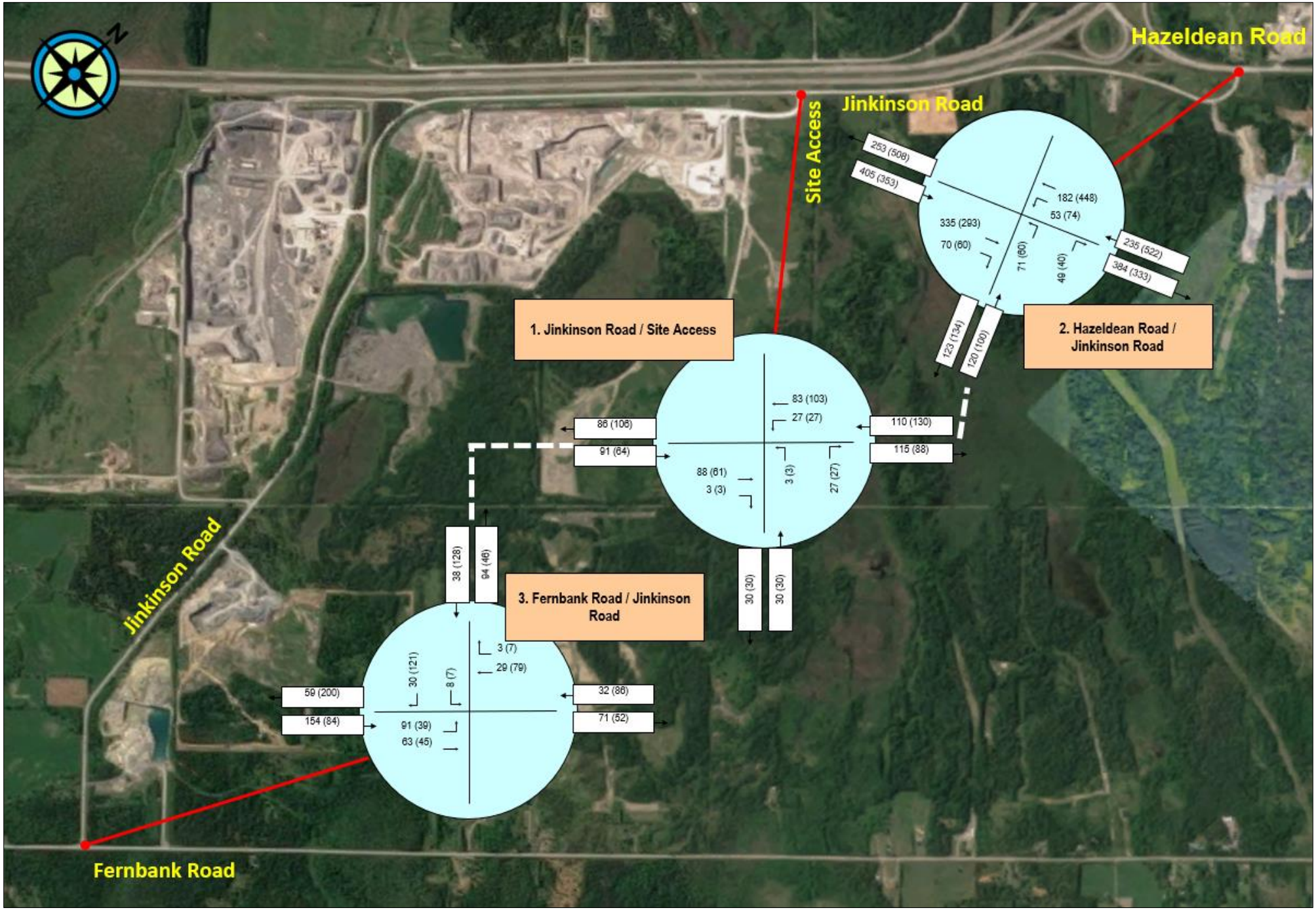
The peak hour volumes were calculated to be slightly higher than the surveyed volumes (from the traffic count conducted on May 3, 2022). The traffic entering and leaving the site was adjusted (increased) to match the calculated traffic volumes to assure that the peak hour operational traffic accounts for peak site operations. This effectively models the peak hour of the site coinciding with the peak hour of travel demand on adjacent streets.

Table 4-1: Traffic Generated by Site: 2025 Horizon Year (Vehicles-per-Hour)

Site	*Morning Peak Hour*			*Afternoon Peak Hour*		
	In	**Out**	**Total**	**In**	**Out**	**Total**
R.W. Tomlinson Stittsville II Quarry (Calculated)	30	30	60	30	30	60
R.W. Tomlinson Stittsville II Quarry (traffic count[1])	19	17	36	26	26	52
Peak Hour of Operations Upward Adjustment	**+11**	**+13**	**+24**	**+4**	**+4**	**+8**

[1]Includes traffic from the existing ready-mix concrete and asphalt plants (existing uses on-site)

Exhibit 4-1 illustrates the operational (2025) morning and afternoon peak hour traffic volume component of traffic that coincides with the site's peak hour of operations.



Morning (Afternoon)

Exhibit 4-1: Operational 2025 Forecast Traffic Volumes (Vehicles-per-Hour)

4.4 OPERATIONAL (2025) TRAFFIC ANALYSIS

Table 4-2 summarizes the intersection capacity analyses results assuming:

- the (2025) first year of quarry expansion's peak traffic information illustrated within Exhibit 4-1; and
- the existing intersection lane configurations.

Traffic operational analysis was undertaken utilizing Synchro™ 11 analysis software to simulate the busiest 15-minute-period of the overall morning and afternoon peak hours of travel demand. The Synchro output sheets for forecast 2025 operational traffic analysis are provided within Appendix "C".

Table 4-2 indicates that all the area intersections within the study area were found to continue to operate below capacity at a level of service "C" or better in all directions during the peak hours of travel demand assuming the peak site traffic coincides with the peak hour of travel on adjacent streets.

- Intersections of Jinkinson Road & Site Access and Jinkinson Road & Fernbank Road were found to operate at a level of service "B"-or-better with average delays ranging between 9.4-to-10.2 seconds.
- The intersection of Jinkinson Road & Hazeldean Road was found to operate at a level of service "C" with an average delay of 20.7 seconds during the afternoon peak hour of travel demand.

Table 4-2: Operational (2025) Intersection Capacity Analysis

	Intersection	**Control Type**	**Critical Approach/ Movement**	**Weekday Morning Peak Hour (Afternoon Peak Hour)**			
				Average Delay per Vehicle (seconds)	**Level of Service**	**95th Percentile Queue (m)**	**Volume-to-Capacity Ratio (v/c)**
1.	Jinkinson Road and Site Access	Minor leg-STOP	Eastbound	10.2 (10)	B (B)	1 (1)	0.04 (0.04)
2.	Jinkinson Road and Hazeldean Road	Minor leg-STOP	Northbound	17.6 (20.7)	C (C)	9 (10)	0.30 (0.32)
3.	Jinkinson Road and Fernbank Road	Minor leg-STOP	Southbound	9.4 (9.5)	A (A)	1 (4)	0.05 (0.15)

5.0 SUPPLEMENTAL ANALYSIS

5.1 ACCESS SIGHTLINES ANALYSIS

The proposed quarry expansion will use the existing R.W. Tomlinson Stittsville quarry access. Jinkinson Road in the vicinity of the existing access is a generally flat roadway with minimal vertical grades.

Exhibit 5-1, Exhibit 5-2 and Exhibit 5-3 provide a review of existing sightlines and illustrate that excellent sightlines are present in both east (500 meters) and west (over 1000 meters on a clear day) directions until horizontal curvature interferes.

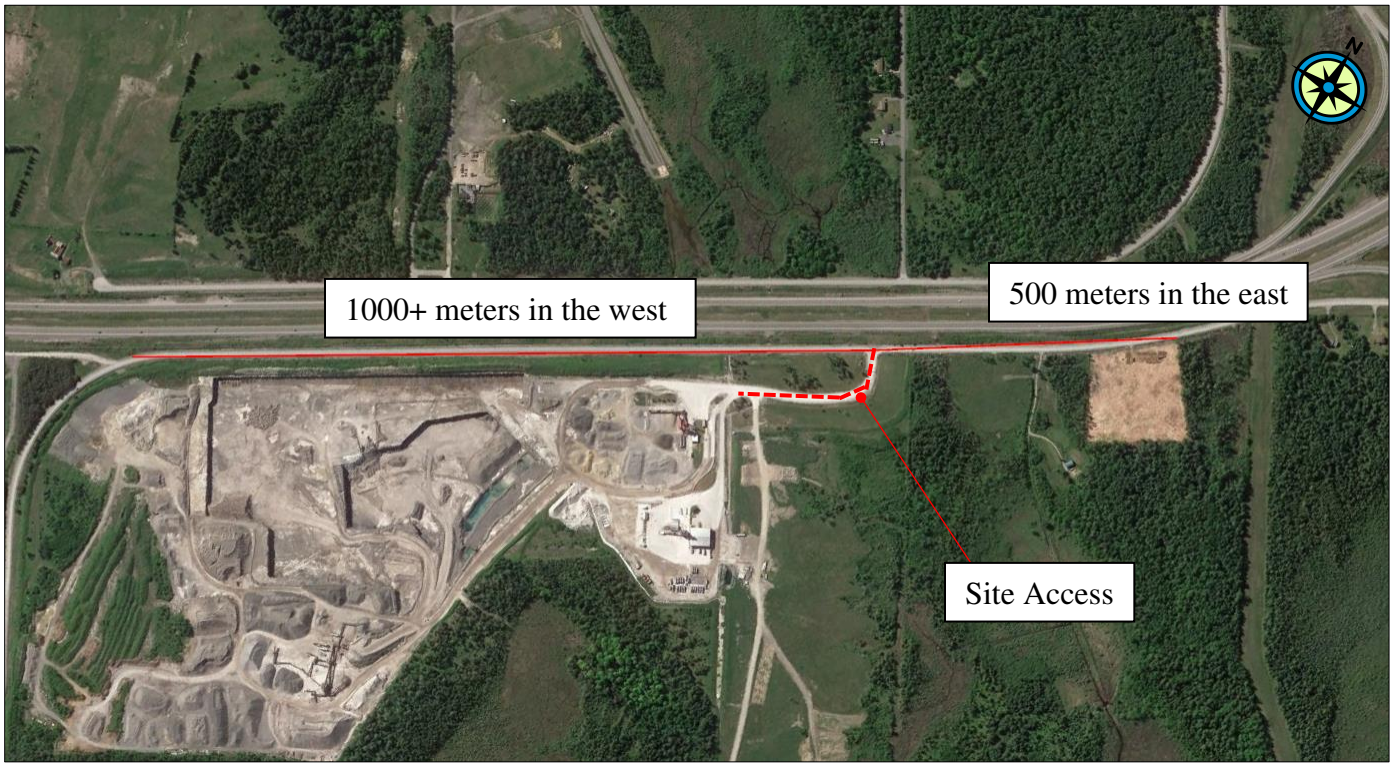


Exhibit 5-1: Access Sightlines Summary

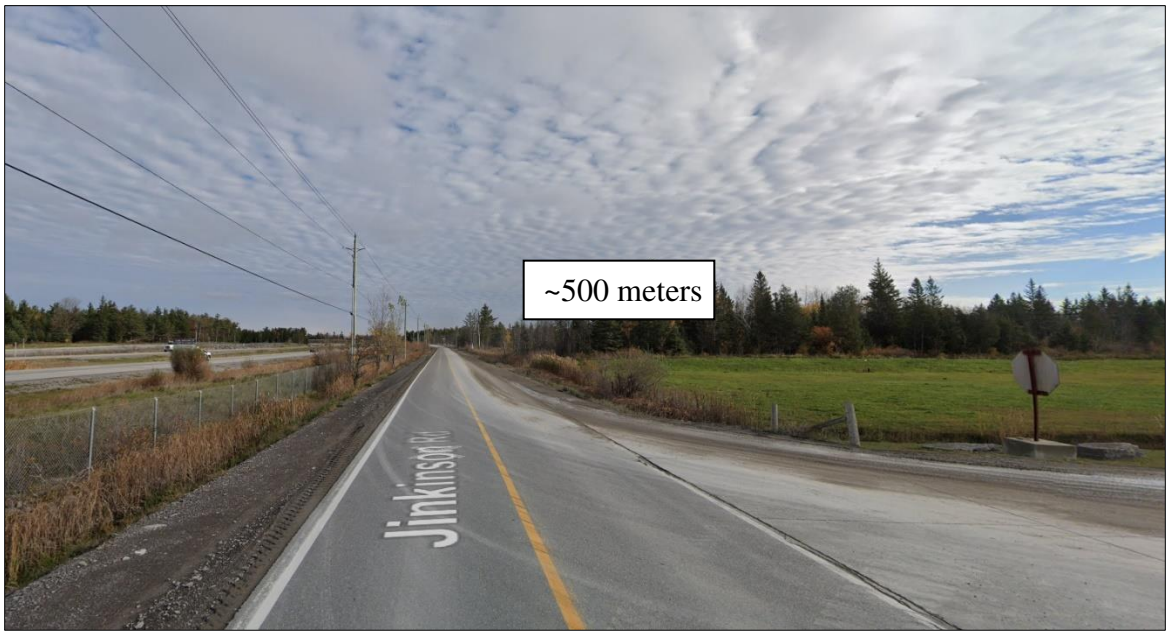


Exhibit 5-2: Google Street View Image of Access Sightlines to the East

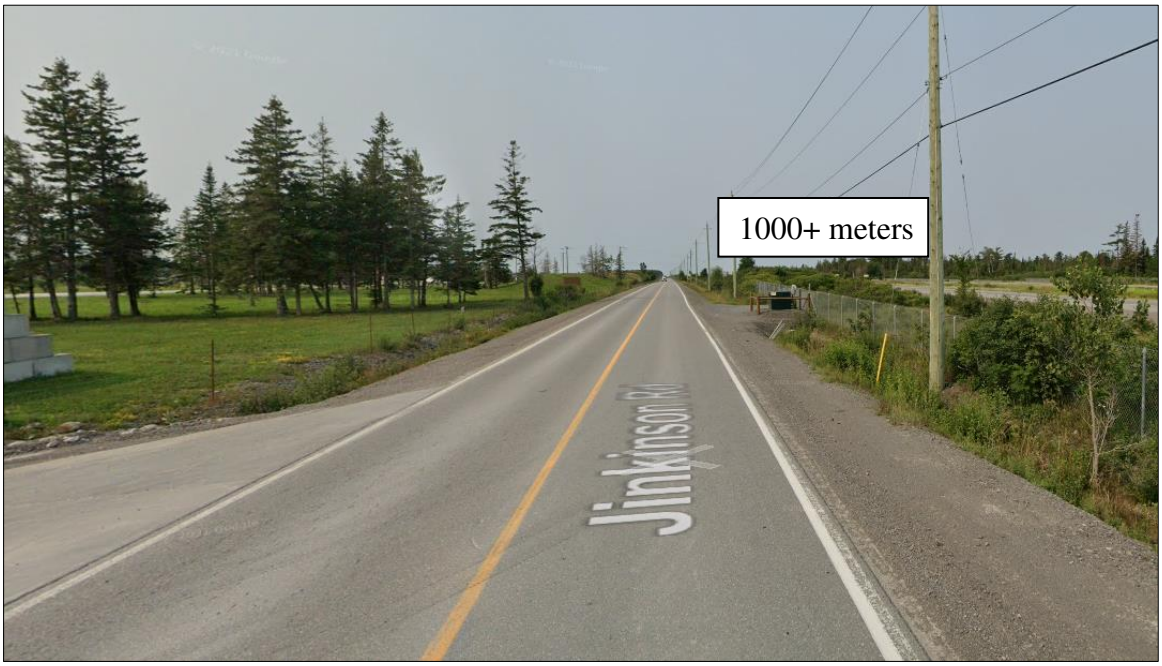


Exhibit 5-3: Google Street View Image of Access Sightlines to the West

5.2 LEFT TURN LANE WARRANT ANALYSIS

A turning lane warrant analysis was undertaken following geometric design standards[6] for Ontario highways. The warrants for left turn lanes are based on the left turn volume, the volume of opposing vehicles and the volume of advancing vehicles. The purpose of left turn auxiliary lanes is two-fold:

- to minimize that conflict between the advancing vehicles and the left turn vehicles during the left turn maneuver; and
- mitigate the delay for vehicles queued behind left turning vehicles.

The proposed quarry expansion would primarily be served by heavy vehicle truck traffic. A truck-to-passenger vehicle equivalency factor of 2.0 was applied to the left turn vehicles into the site. The left turn lane warrant analysis was conducted for two intersections: Jinkinson Road & Site Access, and Hazeldean Road & Jinkinson Road. The analysis assumes operational (2025) volumes as illustrated within Exhibit 4-1.

5.2.1 Jinkinson Road and Site Access Intersection

Exhibit 5-4 and Exhibit 5-5 illustrate the left turn warrant analysis for the morning and afternoon peak hours at the Jinkinson Road & Site Access intersection. It is assumed that heavy vehicles comprise 100% of the left turning traffic. The exhibits illustrate, and Table 5-1 indicates, that:

- during the morning peak hour of travel demand the percentage of left turns in the advancing volume was found to be approximately 40%. The left turn lane was **not** warranted due to low approaching and opposing volumes (under 150 vph each); and
- during the afternoon peak hour of travel demand the percentage of left turns in the advancing volume was found to be 35%. The left turn lane was **not** warranted due to low approaching and opposing volumes (under 200 vph each).

Table 5-1: Left Turn Lane Warrant Analysis – Jinkinson Road and Site Access -Full Operational Day (2025)

Parameter	*Morning Peak Hour*		*Afternoon Peak Hour*	
Left-Turn Volume	27 trucks/hour	56 PCU/hour	27 trucks/hour	56 PCU/hour
V_a, Number of vehicles approaching	110 vph	137 PCU/hr	130 vph	157 PCU/hr
V_o, Number of opposing vehicles	91 vph		64 vph	
LT%, Percentage of left-turning vehicles in approaching direction Rounded	--	40%	--	35%

vph – Vehicles-per-hour
pcu – Passenger Car Unit

6 *Appendix 9 for Chapter 9: Intersections,* MTO Design Supplement for TAC Geometric Design Guide for Canadian Roads, June 2017

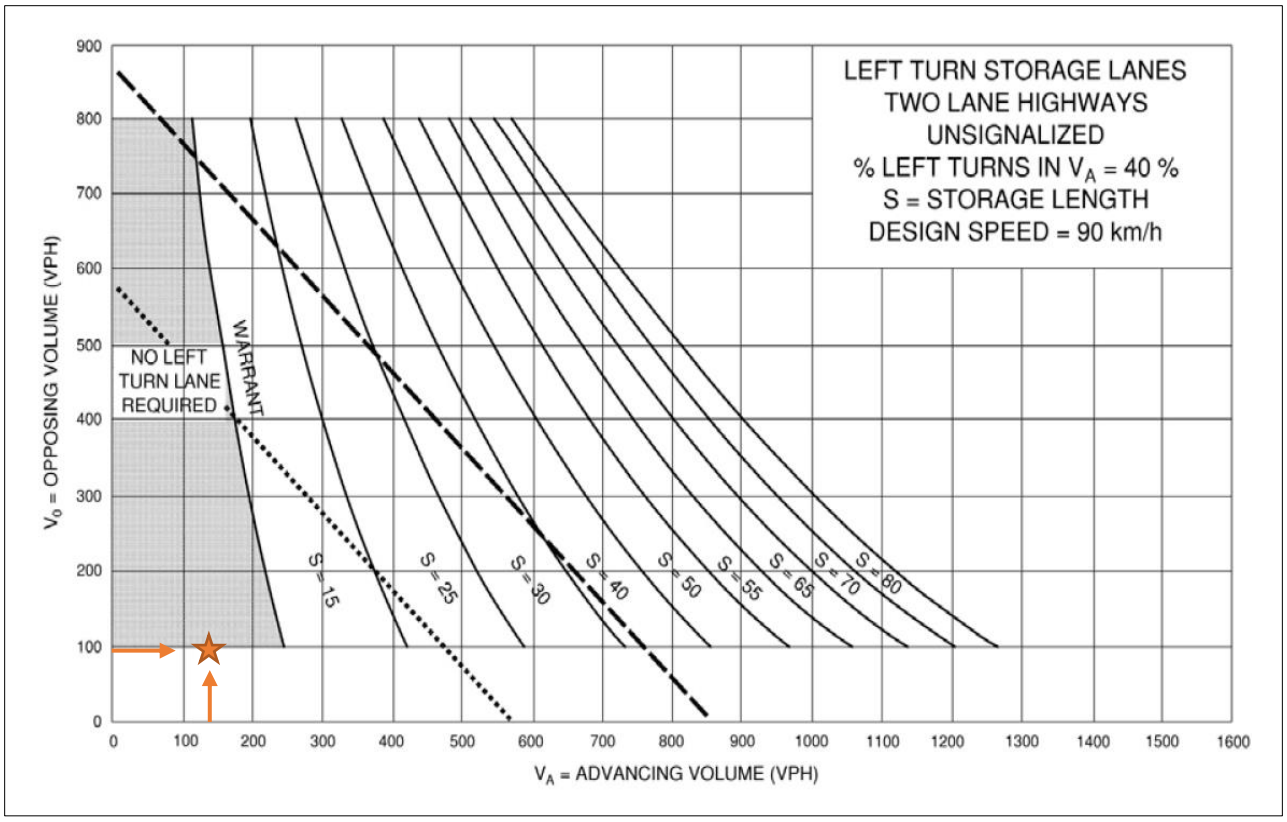


Exhibit 5-4: Left Turn Lane Warrant Analysis, Jinkinson Road and Site Access, AM peak hour

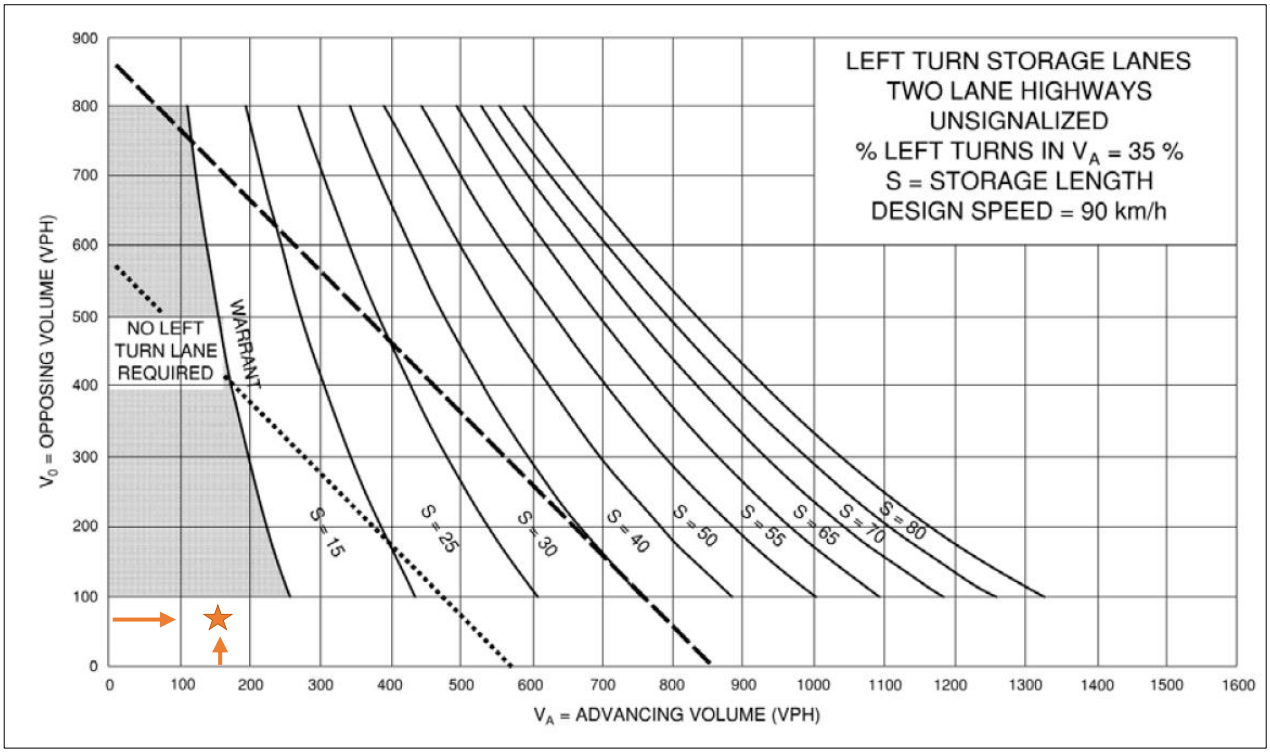


Exhibit 5-5: Left Turn Lane Warrant Analysis, Jinkinson Road and Site Access, PM peak hour

5.2.2 Jinkinson Road & Hazeldean Road – Existing (2019) Conditions

Exhibit 5-6 illustrates the left turn warrant analysis for the afternoon peak hour at the Jinkinson Road and Hazeldean Road intersection in the existing (2019) traffic volumes[7]. It is assumed that heavy vehicles comprise 5% of the left turning traffic (3 vehicles) during the afternoon peak hour of travel demand (consistent with the traffic count data). The exhibits illustrate, and Table 5-2 indicates, that:

- During the afternoon peak hour of travel demand the percentage of left turns in the advancing volume was found to be 15%. The left turn lane from Hazeldean Road onto Jinkinson Road with a minimum storage length of 25 meters is warranted in the existing (2019) conditions.

Table 5-2: Left Turn Lane Warrant Analysis – Jinkinson Road and Hazeldean Road – Existing 2019 Volumes

Parameter	*Afternoon Peak Hour*	
Left-Turn Volume	56 vph	59 PCU/hour
V_a, Number of vehicles approaching	437 vph	440 PCU/hour
V_o, Number of opposing vehicles	340 vph	
LT%, Percentage of left-turning vehicles in approaching direction Rounded	15%	

vph – Vehicles-per-hour
pcu – Passenger Car Unit

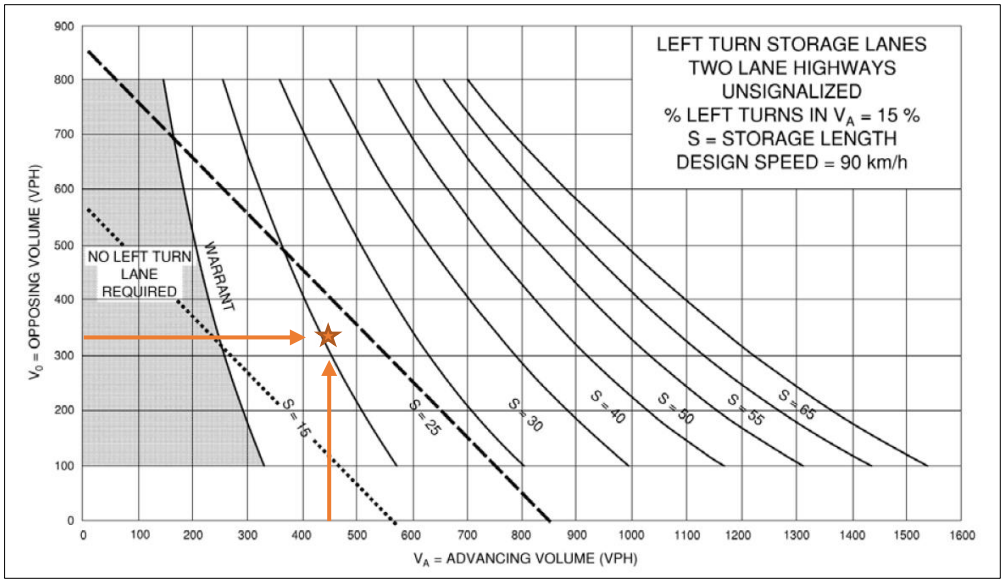


Exhibit 5-6: Left Turn Lane Warrant Analysis, Jinkinson Road & Hazeldean Road, [Afternoon Peak Hour: Existing (2019) conditions]

7 Volumes are taken as-is with no background growth applied to bring them to 2022 horizon

5.2.3 Jinkinson Road & Hazeldean Road Intersection - Forecast (2025) Condition

Exhibit 5-7 and Exhibit 5-8 illustrate the left turn warrant analysis for the morning and afternoon peak hours at the Jinkinson Road & Hazeldean Road intersection. It is assumed that heavy vehicles comprise 50% of the left turning traffic during the morning peak hour and 10% during the afternoon peak hour of travel demand. These assumptions are consistent with the traffic count from April 10, 2019 provided by the City of Ottawa.

The exhibits illustrate, and Table 5-3 indicates, that:

- during the morning peak hour of travel demand the percentage of left turns in the advancing volume was found to be approximately 30%. The left turn lane with a minimum storage length of 15 meters was warranted; and
- during the afternoon peak hour of travel demand the percentage of left turns in the advancing volume was found to be 15%. The left turn lane with a minimum storage length of 25 meters was warranted; and
- the afternoon peak hour is assumed to be the "worst-case" scenario for intersection traffic volumes, and warrants a left turning lane with a minimum storage length of 25 meters in 2025 operational conditions.

Table 5-3: Left Turn Lane Warrant Analysis – Jinkinson Road and Hazeldean Road Full Operational Day (2025)

Parameter	***Morning Peak Hour***		***Afternoon Peak Hour***	
Left-Turn Volume	53 vph	79 PCU/hour	74 vph	81 PCU/hour
V_a, Number of vehicles approaching	235 vph	261 PCU/hr	522 vph	529 vph
V_o, Number of opposing vehicles	405 vph		353 vph	
LT%, Percentage of left-turning vehicles in approaching direction Rounded	--	30%	--	15%

vph – Vehicles-per-hour
pcu – Passenger Car Unit

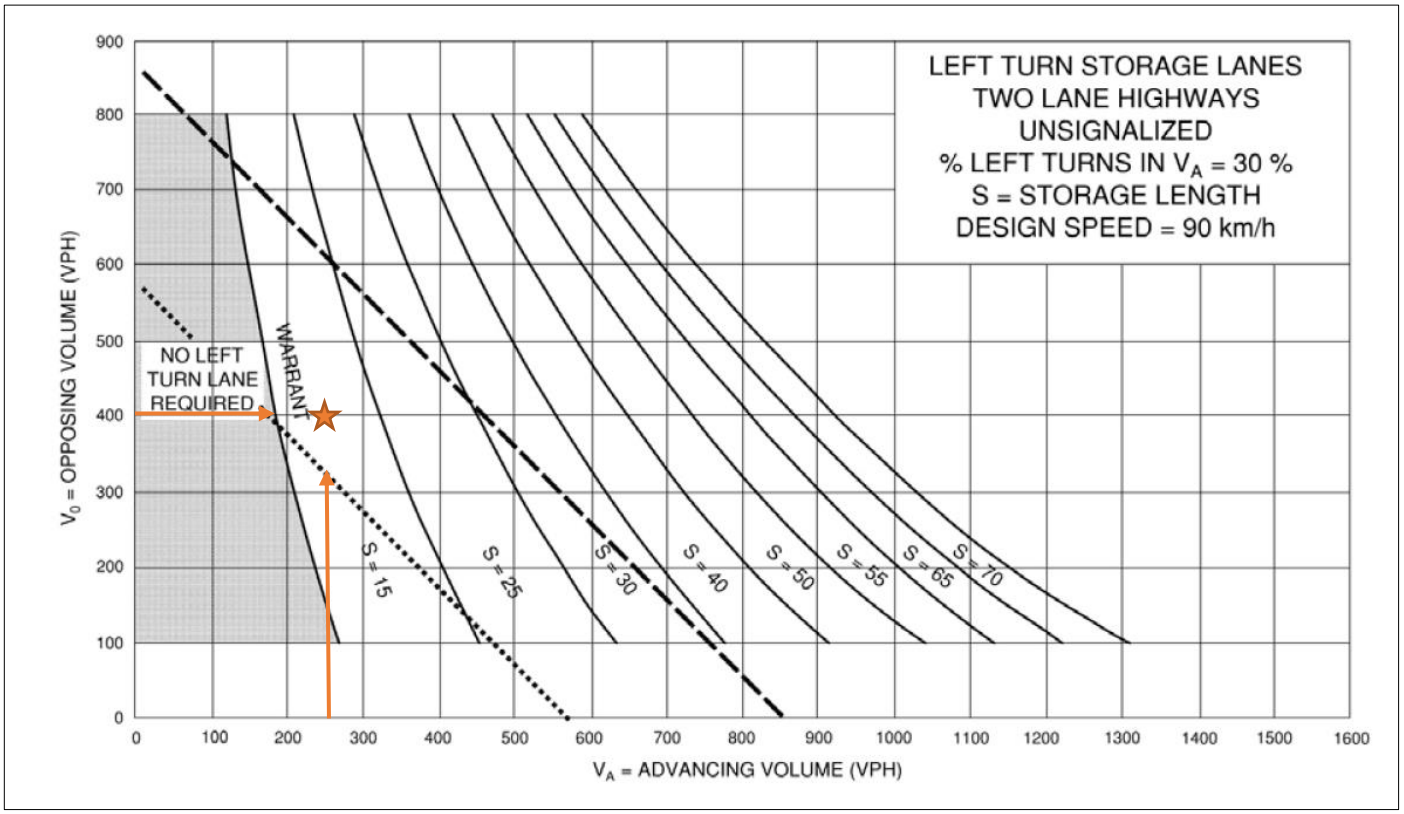


Exhibit 5-7: Left Turn Lane Warrant Analysis, Jinkinson Road and Hazeldean Road, AM peak hour

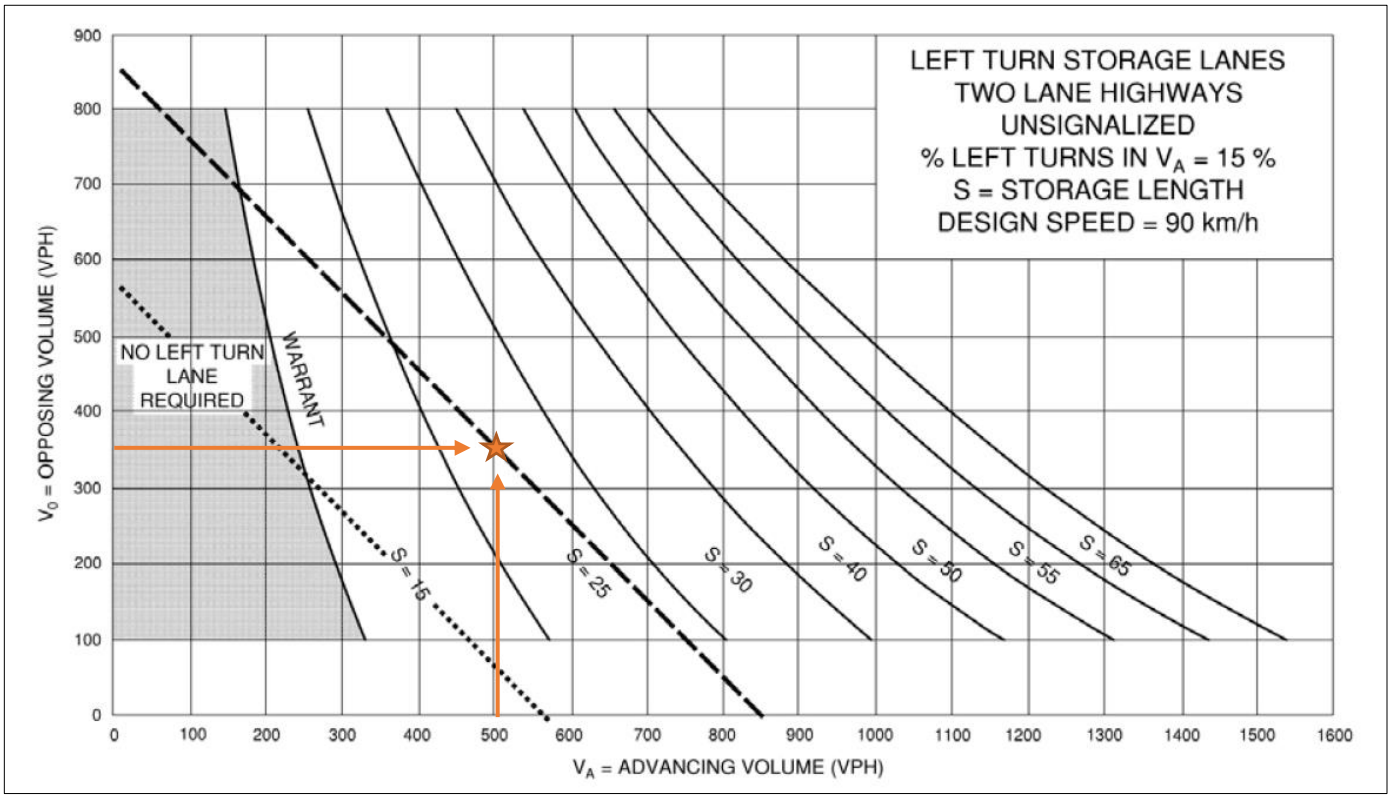


Exhibit 5-8: Left Turn Lane Warrant Analysis, Jinkinson Road and Hazeldean Road, PM peak hour

5.3 TRAFFIC SIGNAL WARRANT ANALYSIS

A traffic signal warrant analysis was undertaken for the minor leg-STOP-controlled Jinkinson Road & Hazeldean Road intersection. The analysis was undertaken using the Ministry of Transportation of Ontario (MTO, 2012) traffic warrants spreadsheet based on MTO's book 12 – traffic signals. Appendix "D" provides the detailed traffic signal justification sheets. The analysis adopted the 2019 traffic count volumes as the base layer. The analysis also considered future (2025) conditions with increased traffic volumes.

5.3.1 Jinkinson Road & Hazeldean Road – Existing (2019)

The traffic warrant analysis requires a full day traffic count to extract the morning, midday, and afternoon peak periods of travel demand. Morning and afternoon peak period consist of three continuous hours of traffic volumes, while the midday period consists of two continuous hours of traffic volumes. The three periods provide the peak 8-hour traffic demand utilized within the traffic signal warrant analysis.

A review of traffic signal warrant justification spreadsheet indicated that the traffic signal was **not** warranted in existing conditions. The critical justification 2B (delay to cross traffic, crossing volume) was found to be 73% compliant in existing conditions, while justification 1B (minimum vehicular volume, crossing volume) being 38% compliant. Justification 3 (combination) was not met, as it requires both justifications 1 and 2 to score over 80%. Justification 4 (4-hour volume) was 26% compliant.

5.3.2 Jinkinson Road & Hazeldean Road – Future Operational (2025)

Evaluation of the traffic signal warrant in future conditions requires an 8-hour traffic forecast. An off peak to peak hour factor was determined for each movement in each of the off-peak hours. Using these factors and a 2025 horizon year peak hour morning and afternoon forecasts, an 8-hour 2025 horizon traffic count was estimated.

A review of traffic signal warrant justification spreadsheet indicated that the traffic signal was **not** warranted in 2025 horizon year conditions. The critical justification 2B (delay to cross traffic, crossing volume) was found to be 99% compliant in existing conditions, while justification 1B (minimum vehicular volume, crossing volume) being 58% compliant. Justification 3 (combination) was not met, as it requires both justifications 1 and 2 to score over 80%. Justification 4 (4-hour volume) was 57% compliant. Given the 99% compliance for justification 2B, monitoring of traffic volumes at the intersection in the future horizon years is recommended.

6.0 FINDINGS AND RECOMMENDATIONS

6.1 SUMMARY OF FINDINGS

The Traffic Impact Study analysis resulted in the following findings:

- The proposed quarry expansion will expand the existing R.W. Tomlinson's Stittsville II site by year 2025, adding 121 hectares to the licensed boundary (of which 108 hectares will be used for extraction);
- The extent of future operations and traffic generated by the site will remain the same as in existing conditions. Upon the completion of Stittsville quarry, the operations will begin to move into the proposed expanded area with no changes to traffic volumes or haul rates anticipated;
- The peak hour of operations of the site is calculated to produce up to 60 two-way heavy vehicle trips (30 inbound and 30 outbound). This calculated value is higher than the site traffic observed during the count conducted on May 3, 2022;
- The three study area intersections (Jinkinson Road and Site Access, Jinkinson road and Hazeldean Road, Jinkinson Road and Fernbank Road) are operating with acceptable levels of service "C" or better in the existing (2022) conditions;
- The three study area intersections are forecast to operate with acceptable levels of service "C" or better in the operational (2025) conditions, assuming the site's peak traffic coincides with the peak hour of travel demand on the adjacent streets;
- The existing site access provides for adequate sightlines in both east and west directions of travel;
- A westbound left turn lane from Jinkinson Road into Site Access is **not warranted** in the operational (2025) conditions;
- A westbound left turn lane from Hazeldean Road onto Jinkinson Road is **warranted** in the existing (2019) conditions based on the traffic volumes collected by the City of Ottawa on April 10, 2019 in the afternoon peak hour of travel demand;
- A traffic signal is **not warranted** at the Jinkinson Road and Hazeldean Road in the existing (2019) conditions.
- A traffic signal is **not warranted** at the Jinkinson Road and Hazeldean Road in the operational (2025) conditions. However, the justification 2B of the traffic signal warrant was found to be 99% compliant. It is therefore prudent to keep monitoring the traffic volumes at this intersection in future years.
- Despite large heavy vehicle volumes, only 4 out of 30 collisions over the last 5 years (2016-2020) recorded along the 6 km stretch of Jinkinson Road between Hazeldean Road and Fernbank Road involved heavy vehicles.

6.2 SUMMARY OF RECOMMENDATIONS

It is recommended that the City of Ottawa:

- consider implementing a westbound left-turning lane from Hazeldean Road onto Jinkinson Road to address existing conditions;
- continue to provide a review of collision information along Jinkinson Road and consider implementing mitigation strategies to address the high proportion of single passenger vehicle incidents along the curved portions of the roadway nearest Hazeldean Road; and
- Continue to monitor traffic conditions at the Jinkinson Road & Hazeldean Road intersection to assess the need for future traffic signals and/or intersection improvements.

It is recommended that the Ministry of Natural Resources and Forestry, and relevant approval authorities:

- Permit the expansion of R.W. Tomlinson's existing Stittsville quarry site to proceed from a transportation/traffic standpoint.

APPENDIX A – BACKGROUND TRAFFIC COUNTS

Transportation Services - Traffic Services

Turning Movement Count - Study Results

HAZELDEAN RD/HAZELDEAN RD IC RAMP 62 @ HAZELDE

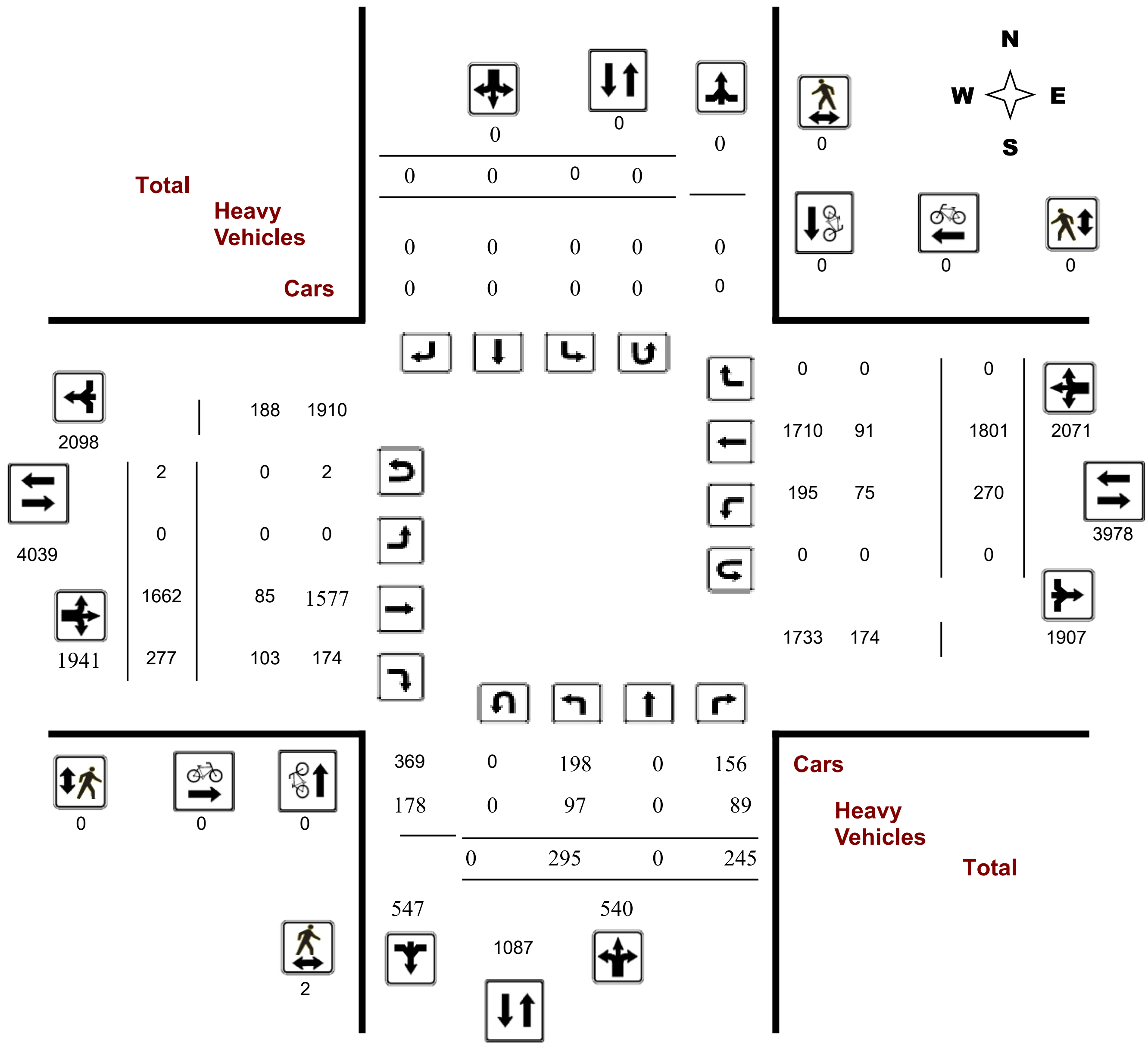
Survey Date: Wednesday, April 10, 2019

Start Time: 07:00

WO No: 38523

Device: Miovision

Full Study Diagram



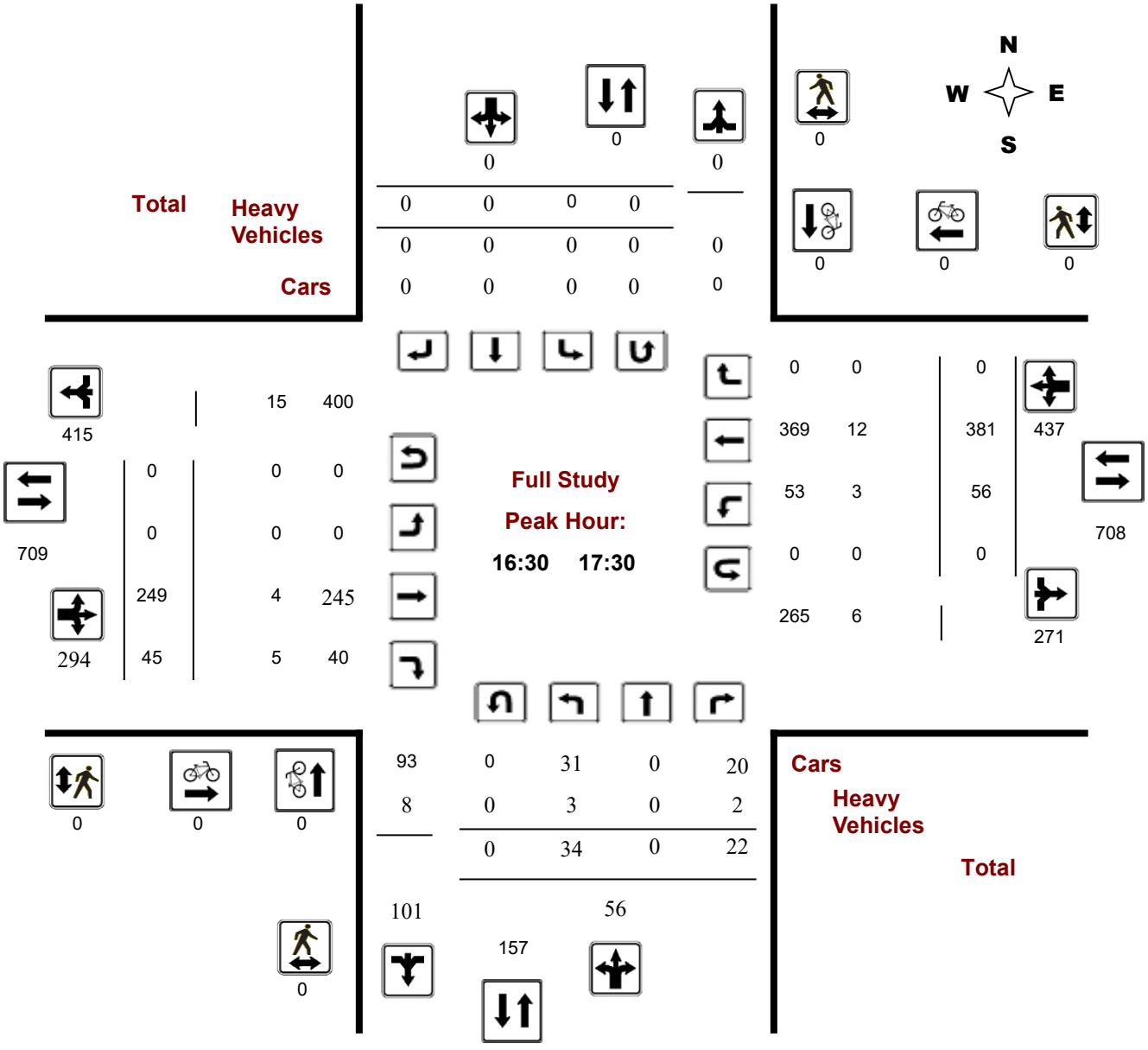
Transportation Services - Traffic Services

Turning Movement Count - Study Results

HAZELDEAN RD/HAZELDEAN RD IC RAMP 62 @ HAZELDE

Survey Date: Wednesday, April 10, 2019
Start Time: 07:00
WO No: 38523
Device: Miovision

Full Study Peak Hour Diagram



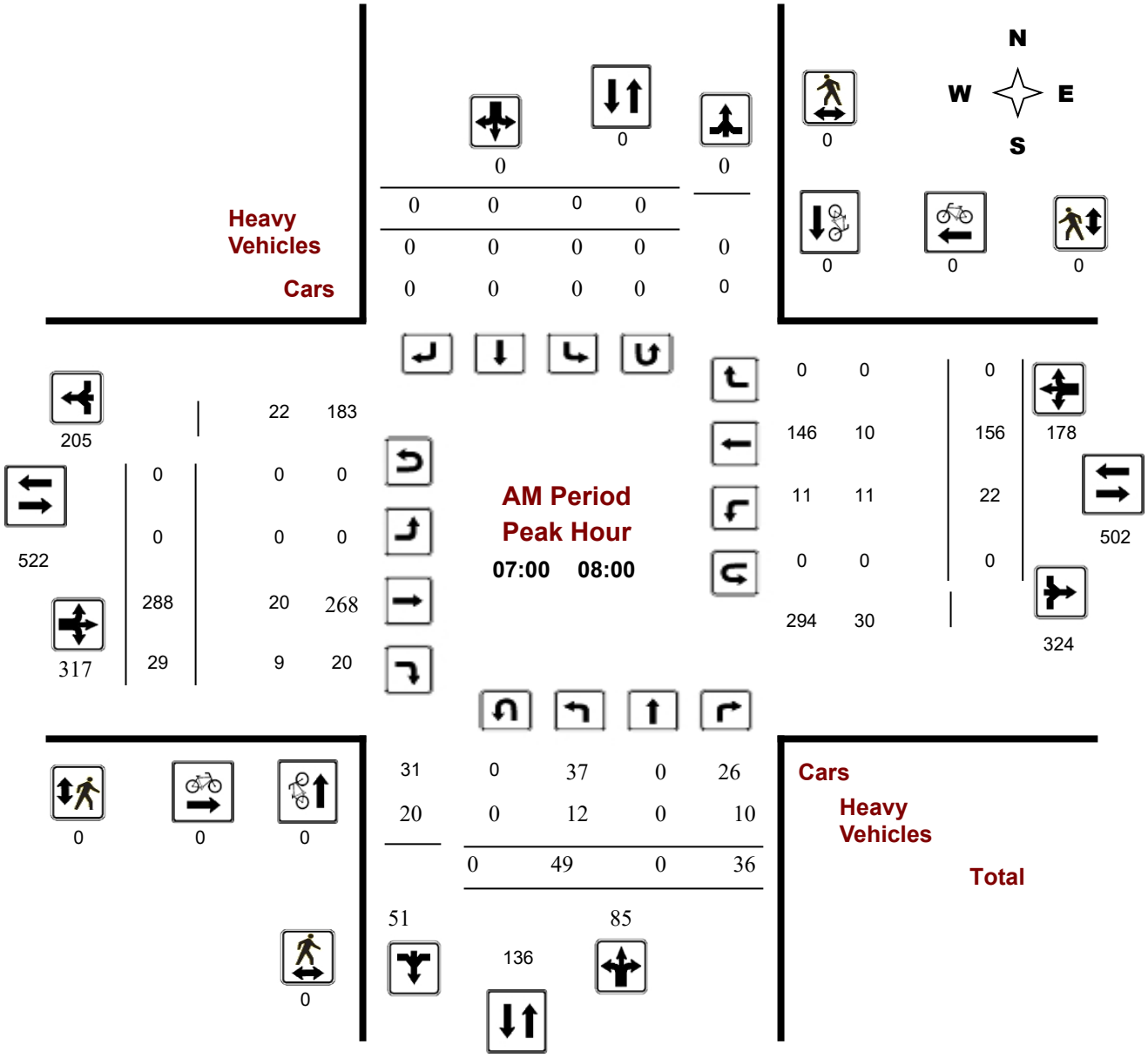
Transportation Services - Traffic Services

Turning Movement Count - Peak Hour Diagram

HAZELDEAN RD/HAZELDEAN RD IC RAMP 62 @ HAZELDE

Survey Date: Wednesday, April 10, 2019 **WO No:** 38523

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



Comments

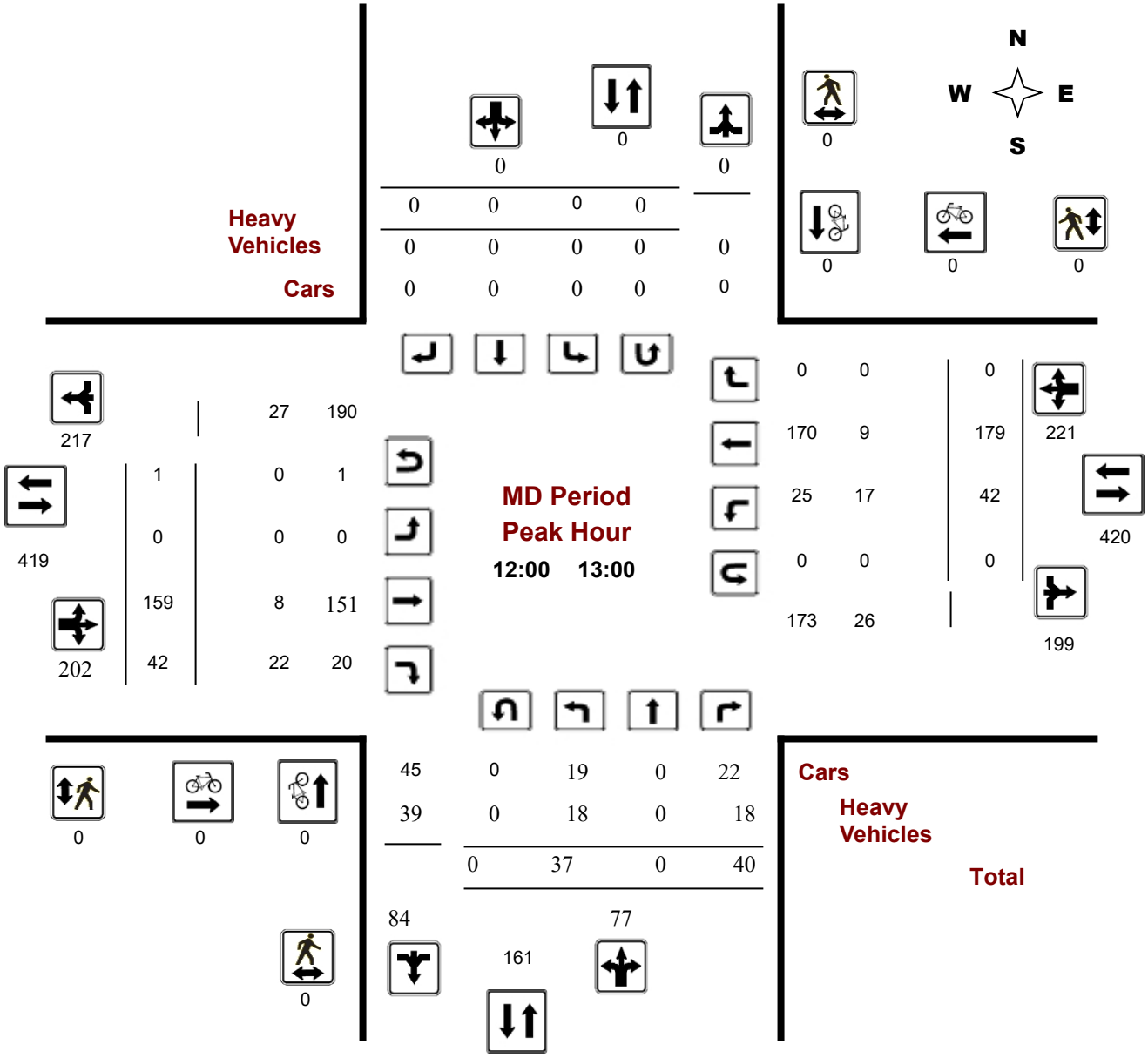
Transportation Services - Traffic Services

Turning Movement Count - Peak Hour Diagram

HAZELDEAN RD/HAZELDEAN RD IC RAMP 62 @ HAZELDE

Survey Date: Wednesday, April 10, 2019 **WO No:** 38523

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



Comments

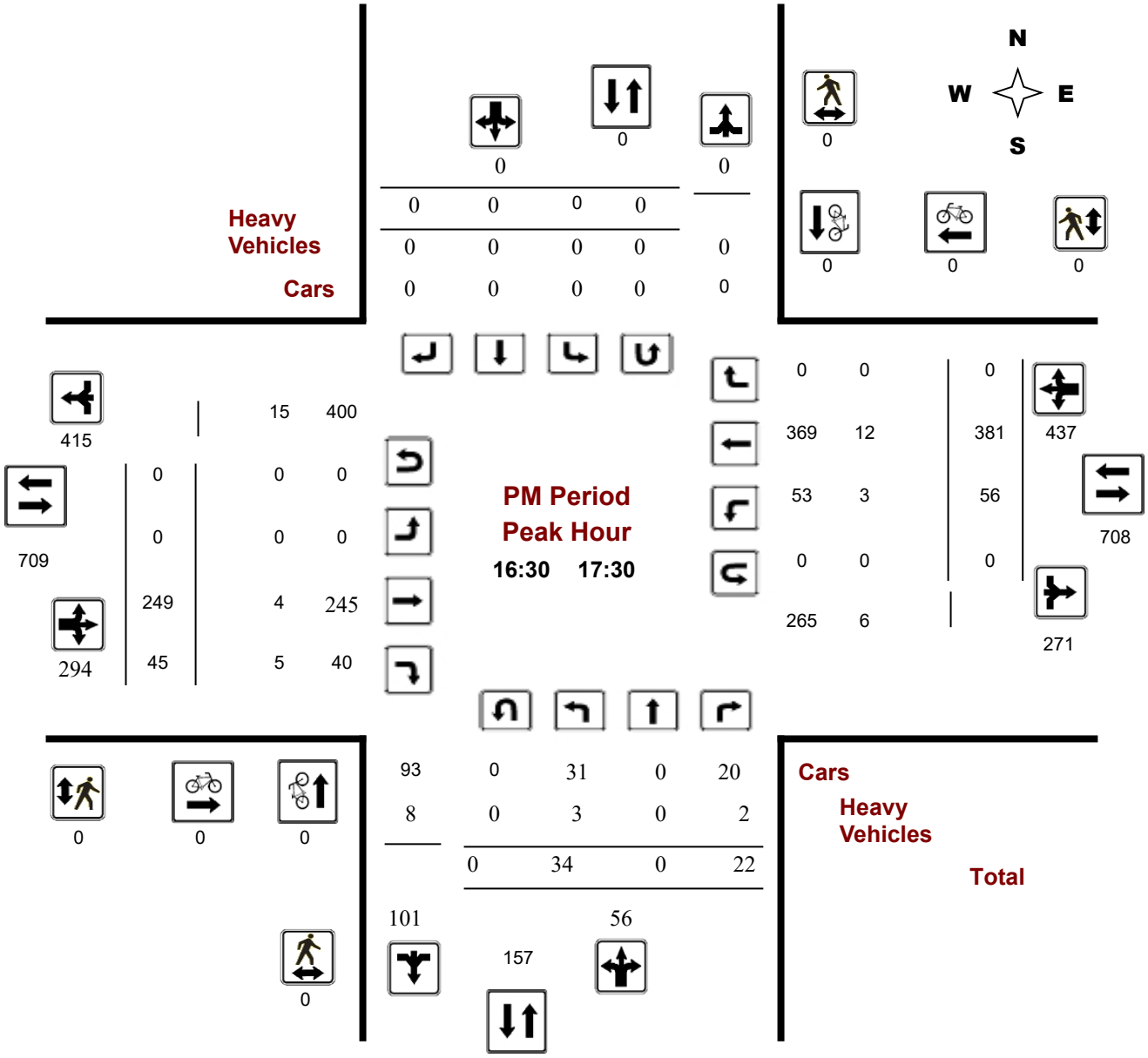
Transportation Services - Traffic Services

Turning Movement Count - Peak Hour Diagram

HAZELDEAN RD/HAZELDEAN RD IC RAMP 62 @ HAZELDE

Survey Date: Wednesday, April 10, 2019 **WO No:** 38523

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



Comments

Transportation Services - Traffic Services

Turning Movement Count - Study Results

HAZELDEAN RD/HAZELDEAN RD IC RAMP 62 @ HAZELDE

Survey Date: Wednesday, April 10, 2019 **WO No:** 38523

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

Full Study Summary (8 HR Standard)

Survey Date: Wednesday, April 10, 2019

Total Observed U-Turns

Northbound: 0 Southbound: 0

Eastbound: 2 Westbound: 0

AADT Factor

.90

	Northbound				Southbound					Eastbound				Westbound					
Period	LT	ST	RT	NB TOT	LT	ST	RT	SB TOT	STR TOT	LT	ST	RT	EB TOT	LT	ST	RT	WB TOT	STR TOT	Grand Total
07:00 08:00	49	0	36	**85**	0	0	0	**0**	**85**	0	288	29	**317**	22	156	0	**178**	**495**	**580**
08:00 09:00	53	0	32	**85**	0	0	0	**0**	**85**	0	243	27	**270**	20	155	0	**175**	**445**	**530**
09:00 10:00	36	0	27	**63**	0	0	0	**0**	**63**	0	191	36	**227**	23	130	0	**153**	**380**	**443**
11:30 12:30	31	0	34	**65**	0	0	0	**0**	**65**	0	153	42	**195**	30	164	0	**194**	**389**	**454**
12:30 13:30	29	0	36	**65**	0	0	0	**0**	**65**	0	151	29	**180**	41	181	0	**222**	**402**	**467**
15:00 16:00	40	0	28	**68**	0	0	0	**0**	**68**	0	186	35	**221**	34	313	0	**347**	**568**	**636**
16:00 17:00	28	0	32	**60**	0	0	0	**0**	**60**	0	223	46	**269**	59	376	0	**435**	**704**	**764**
17:00 18:00	29	0	20	**49**	0	0	0	**0**	**49**	0	227	33	**260**	41	326	0	**367**	**627**	**676**
Sub Total	295	0	245	**540**	0	0	0	**0**	**540**	0	1662	277	**1939**	270	1801	0	**2071**	**4010**	**4550**
U Turns	0			**0**	0			**0**	**0**	**2**			**2**	0			**0**	**2**	**2**
Total	295	0	245	**540**	0	0	0	**0**	**540**	2	1662	277	**1941**	270	1801	0	**2071**	**4012**	**4552**
EQ 12Hr	410	0	341	**751**	0	0	0	**0**	**751**	3	2310	385	**2698**	375	2503	0	**2878**	**5576**	**6327**
Note: These values are calculated by multiplying the totals by the appropriate expansion factor.														**1.39**					
AVG 12Hr	369	0	307	**676**	0	0	0	**0**	**676**	3	2079	346	**2428**	338	2253	0	**2591**	**5019**	**5695**
Note: These volumes are calculated by multiplying the Equivalent 12 hr. totals by the AADT factor.														**.90**					
AVG 24Hr	483	0	402	**885**	0	0	0	**0**	**885**	4	2723	453	**3180**	443	2951	0	**3394**	**6574**	**7459**
Note: These volumes are calculated by multiplying the Average Daily 12 hr. totals by 12 to 24 expansion factor.														**1.31**					

Note: U-Turns provided for approach totals. Refer to 'U-Turn' Report for specific breakdown.

Transportation Services - Traffic Services

Turning Movement Count - Study Results

HAZELDEAN RD/HAZELDEAN RD IC RAMP 62 @ HAZELDE

Survey Date: Wednesday, April 10, 2019 **WO No:** 38523

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

Full Study 15 Minute Increments

Time Period		Northbound				Southbound					Eastbound				Westbound					Grand Total
		LT	ST	RT	N TOT	LT	ST	RT	S TOT	STR TOT	LT	ST	RT	E TOT	LT	ST	RT	W TOT	STR TOT	
07:00	07:15		0	12			0	0		**26**		54	9			28	0		**97**	**123**
07:15	07:30		0	12			0	0		**22**		75	4			52	0		**133**	**155**
07:30	07:45		0	4			0	0		**18**		92	8			43	0		**151**	**169**
07:45	08:00		0	8			0	0		**19**		67	8			33	0		**114**	**133**
08:00	08:15		0	9			0	0		**18**		57	6			35	0		**100**	**118**
08:15	08:30		0	5			0	0		**20**		62	11			43	0		**126**	**146**
08:30	08:45		0	10			0	0		**27**		68	5			37	0		**113**	**140**
08:45	09:00		0	8			0	0		**20**		56	5			40	0		**106**	**126**
09:00	09:15		0	8			0	0		**13**		42	7			41	0		**99**	**112**
09:15	09:30		0	5			0	0		**12**		42	10			38	0		**93**	**105**
09:30	09:45		0	7			0	0		**18**		61	10			24	0		**104**	**122**
09:45	10:00		0	7			0	0		**20**		46	9			27	0		**85**	**105**
11:30	11:45		0	6			0	0		**13**		32	8			31	0		**81**	**94**
11:45	12:00		0	7			0	0		**13**		53	10			37	0		**102**	**115**
12:00	12:15		0	8			0	0		**16**		26	11			43	0		**95**	**111**
12:15	12:30		0	13			0	0		**23**		42	13			53	0		**112**	**135**
12:30	12:45		0	10			0	0		**20**		45	13			38	0		**110**	**130**
12:45	13:00		0	9			0	0		**18**		46	5			45	0		**106**	**124**
13:00	13:15		0	7			0	0		**13**		30	6			40	0		**83**	**96**
13:15	13:30		0	10			0	0		**14**		30	5			58	0		**103**	**117**
15:00	15:15		0	7			0	0		**19**		45	9			68	0		**131**	**150**
15:15	15:30		0	10			0	0		**17**		46	6			73	0		**131**	**148**
15:30	15:45		0	6			0	0		**20**		48	7			94	0		**160**	**180**
15:45	16:00		0	5			0	0		**12**		47	13			78	0		**146**	**158**
16:00	16:15		0	7			0	0		**10**		46	9			114	0		**188**	**198**
16:15	16:30		0	13			0	0		**21**		58	14			80	0		**164**	**185**
16:30	16:45		0	8			0	0		**16**		54	16			79	0		**161**	**177**
16:45	17:00		0	4			0	0		**13**		65	7			103	0		**191**	**204**
17:00	17:15		0	5			0	0		**12**		60	11			112	0		**197**	**209**
17:15	17:30		0	5			0	0		**15**		70	11			87	0		**182**	**197**
17:30	17:45		0	5			0	0		**9**		46	5			65	0		**121**	**130**
17:45	18:00		0	5			0	0		**13**		51	6			62	0		**127**	**140**
Total:		0	0	245	0	0	0	0	0	**540**	0	1662	277	0	0	1801	0	0	**540**	**4,552**

Note: U-Turns are included in Totals.

Transportation Services - Traffic Services

Turning Movement Count - Study Results

HAZELDEAN RD/HAZELDEAN RD IC RAMP 62 @ HAZELDE

Survey Date: Wednesday, April 10, 2019 **WO No:** 38523

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

Full Study Cyclist Volume

Time Period		Northbound	Southbound	Street Total	Eastbound	Westbound	Street Total	Grand Total
07:00	07:15	0	0	**0**	0	0	**0**	**0**
07:15	07:30	0	0	**0**	0	0	**0**	**0**
07:30	07:45	0	0	**0**	0	0	**0**	**0**
07:45	08:00	0	0	**0**	0	0	**0**	**0**
08:00	08:15	0	0	**0**	0	0	**0**	**0**
08:15	08:30	0	0	**0**	0	0	**0**	**0**
08:30	08:45	0	0	**0**	0	0	**0**	**0**
08:45	09:00	0	0	**0**	0	0	**0**	**0**
09:00	09:15	0	0	**0**	0	0	**0**	**0**
09:15	09:30	0	0	**0**	0	0	**0**	**0**
09:30	09:45	0	0	**0**	0	0	**0**	**0**
09:45	10:00	0	0	**0**	0	0	**0**	**0**
11:30	11:45	0	0	**0**	0	0	**0**	**0**
11:45	12:00	0	0	**0**	0	0	**0**	**0**
12:00	12:15	0	0	**0**	0	0	**0**	**0**
12:15	12:30	0	0	**0**	0	0	**0**	**0**
12:30	12:45	0	0	**0**	0	0	**0**	**0**
12:45	13:00	0	0	**0**	0	0	**0**	**0**
13:00	13:15	0	0	**0**	0	0	**0**	**0**
13:15	13:30	0	0	**0**	0	0	**0**	**0**
15:00	15:15	0	0	**0**	0	0	**0**	**0**
15:15	15:30	0	0	**0**	0	0	**0**	**0**
15:30	15:45	0	0	**0**	0	0	**0**	**0**
15:45	16:00	0	0	**0**	0	0	**0**	**0**
16:00	16:15	0	0	**0**	0	0	**0**	**0**
16:15	16:30	0	0	**0**	0	0	**0**	**0**
16:30	16:45	0	0	**0**	0	0	**0**	**0**
16:45	17:00	0	0	**0**	0	0	**0**	**0**
17:00	17:15	0	0	**0**	0	0	**0**	**0**
17:15	17:30	0	0	**0**	0	0	**0**	**0**
17:30	17:45	0	0	**0**	0	0	**0**	**0**
17:45	18:00	0	0	**0**	0	0	**0**	**0**
Total		0	0	**0**	0	0	**0**	**0**

Transportation Services - Traffic Services

Turning Movement Count - Study Results

HAZELDEAN RD/HAZELDEAN RD IC RAMP 62 @ HAZELDE

Survey Date: Wednesday, April 10, 2019 **WO No:** 38523

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

Full Study Pedestrian Volume

Time Period	NB Approach (E or W Crossing)	SB Approach (E or W Crossing)	Total	EB Approach (N or S Crossing)	WB Approach (N or S Crossing)	Total	Grand Total
07:00 07:15	0	0	**0**	0	0	**0**	**0**
07:15 07:30	0	0	**0**	0	0	**0**	**0**
07:30 07:45	0	0	**0**	0	0	**0**	**0**
07:45 08:00	0	0	**0**	0	0	**0**	**0**
08:00 08:15	0	0	**0**	0	0	**0**	**0**
08:15 08:30	0	0	**0**	0	0	**0**	**0**
08:30 08:45	0	0	**0**	0	0	**0**	**0**
08:45 09:00	0	0	**0**	0	0	**0**	**0**
09:00 09:15	0	0	**0**	0	0	**0**	**0**
09:15 09:30	0	0	**0**	0	0	**0**	**0**
09:30 09:45	0	0	**0**	0	0	**0**	**0**
09:45 10:00	0	0	**0**	0	0	**0**	**0**
11:30 11:45	0	0	**0**	0	0	**0**	**0**
11:45 12:00	0	0	**0**	0	0	**0**	**0**
12:00 12:15	0	0	**0**	0	0	**0**	**0**
12:15 12:30	0	0	**0**	0	0	**0**	**0**
12:30 12:45	0	0	**0**	0	0	**0**	**0**
12:45 13:00	0	0	**0**	0	0	**0**	**0**
13:00 13:15	0	0	**0**	0	0	**0**	**0**
13:15 13:30	0	0	**0**	0	0	**0**	**0**
15:00 15:15	1	0	**1**	0	0	**0**	**1**
15:15 15:30	1	0	**1**	0	0	**0**	**1**
15:30 15:45	0	0	**0**	0	0	**0**	**0**
15:45 16:00	0	0	**0**	0	0	**0**	**0**
16:00 16:15	0	0	**0**	0	0	**0**	**0**
16:15 16:30	0	0	**0**	0	0	**0**	**0**
16:30 16:45	0	0	**0**	0	0	**0**	**0**
16:45 17:00	0	0	**0**	0	0	**0**	**0**
17:00 17:15	0	0	**0**	0	0	**0**	**0**
17:15 17:30	0	0	**0**	0	0	**0**	**0**
17:30 17:45	0	0	**0**	0	0	**0**	**0**
17:45 18:00	0	0	**0**	0	0	**0**	**0**
Total	2	0	**2**	0	0	**0**	**2**

Transportation Services - Traffic Services

Turning Movement Count - Study Results

HAZELDEAN RD/HAZELDEAN RD IC RAMP 62 @ HAZELDE

Survey Date: Wednesday, April 10, 2019 **WO No:** 38523

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

Full Study Heavy Vehicles

		Northbound				Southbound					Eastbound				Westbound					
Time Period		LT	ST	RT	N TOT	LT	ST	RT	S TOT	STR TOT	LT	ST	RT	E TOT	LT	ST	RT	W TOT	STR TOT	Grand Total
07:00	07:15	2	0	4		0	0	0		**6**	0	3	1		1	1	0		**6**	**12**
07:15	07:30	2	0	2		0	0	0		**4**	0	9	3		2	5	0		**19**	**23**
07:30	07:45	4	0	0		0	0	0		**4**	0	4	3		4	0	0		**11**	**15**
07:45	08:00	4	0	4		0	0	0		**8**	0	4	2		4	4	0		**14**	**22**
08:00	08:15	2	0	5		0	0	0		**7**	0	2	1		0	0	0		**3**	**10**
08:15	08:30	5	0	1		0	0	0		**6**	0	5	6		3	6	0		**20**	**26**
08:30	08:45	7	0	6		0	0	0		**13**	0	3	2		2	4	0		**11**	**24**
08:45	09:00	4	0	1		0	0	0		**5**	0	2	2		3	3	0		**10**	**15**
09:00	09:15	2	0	4		0	0	0		**6**	0	2	4		3	8	0		**17**	**23**
09:15	09:30	3	0	5		0	0	0		**8**	0	1	6		2	6	0		**15**	**23**
09:30	09:45	8	0	2		0	0	0		**10**	0	2	6		5	2	0		**15**	**25**
09:45	10:00	6	0	5		0	0	0		**11**	0	3	7		2	1	0		**13**	**24**
11:30	11:45	2	0	3		0	0	0		**5**	0	1	3		3	2	0		**9**	**14**
11:45	12:00	2	0	4		0	0	0		**6**	0	3	6		1	1	0		**11**	**17**
12:00	12:15	5	0	2		0	0	0		**7**	0	2	7		9	1	0		**19**	**26**
12:15	12:30	4	0	5		0	0	0		**9**	0	1	5		2	6	0		**14**	**23**
12:30	12:45	4	0	6		0	0	0		**10**	0	3	8		4	0	0		**15**	**25**
12:45	13:00	5	0	5		0	0	0		**10**	0	2	2		2	2	0		**8**	**18**
13:00	13:15	3	0	4		0	0	0		**7**	0	2	3		4	4	0		**13**	**20**
13:15	13:30	2	0	7		0	0	0		**9**	0	4	2		4	4	0		**14**	**23**
15:00	15:15	6	0	2		0	0	0		**8**	0	4	4		3	3	0		**14**	**22**
15:15	15:30	2	0	4		0	0	0		**6**	0	4	3		2	3	0		**12**	**18**
15:30	15:45	4	0	1		0	0	0		**5**	0	4	3		2	3	0		**12**	**17**
15:45	16:00	2	0	0		0	0	0		**2**	0	2	4		3	3	0		**12**	**14**
16:00	16:15	1	0	4		0	0	0		**5**	0	2	1		1	3	0		**7**	**12**
16:15	16:30	2	0	1		0	0	0		**3**	0	1	3		1	3	0		**8**	**11**
16:30	16:45	1	0	1		0	0	0		**2**	0	1	2		0	3	0		**6**	**8**
16:45	17:00	0	0	0		0	0	0		**0**	0	1	1		0	5	0		**7**	**7**
17:00	17:15	1	0	1		0	0	0		**2**	0	2	1		2	3	0		**8**	**10**
17:15	17:30	1	0	0		0	0	0		**1**	0	0	1		1	1	0		**3**	**4**
17:30	17:45	0	0	0		0	0	0		**0**	0	2	0		0	1	0		**3**	**3**
17:45	18:00	1	0	0		0	0	0		**1**	0	4	1		0	0	0		**5**	**6**
Total:	None	97	0	89	**0**	0	0	0	**0**	**186**	0	85	103	**0**	75	91	0	**0**	**354**	**540**

Transportation Services - Traffic Services

Turning Movement Count - Study Results

HAZELDEAN RD/HAZELDEAN RD IC RAMP 62 @ HAZELDE

Survey Date: Wednesday, April 10, 2019 **WO No:** 38523

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

Full Study 15 Minute U-Turn Total

Time Period		Northbound U-Turn Total	Southbound U-Turn Total	Eastbound U-Turn Total	Westbound U-Turn Total	Total
07:00	07:15	0	0	0	0	**0**
07:15	07:30	0	0	0	0	**0**
07:30	07:45	0	0	0	0	**0**
07:45	08:00	0	0	0	0	**0**
08:00	08:15	0	0	0	0	**0**
08:15	08:30	0	0	0	0	**0**
08:30	08:45	0	0	0	0	**0**
08:45	09:00	0	0	0	0	**0**
09:00	09:15	0	0	0	0	**0**
09:15	09:30	0	0	1	0	**1**
09:30	09:45	0	0	0	0	**0**
09:45	10:00	0	0	0	0	**0**
11:30	11:45	0	0	0	0	**0**
11:45	12:00	0	0	0	0	**0**
12:00	12:15	0	0	1	0	**1**
12:15	12:30	0	0	0	0	**0**
12:30	12:45	0	0	0	0	**0**
12:45	13:00	0	0	0	0	**0**
13:00	13:15	0	0	0	0	**0**
13:15	13:30	0	0	0	0	**0**
15:00	15:15	0	0	0	0	**0**
15:15	15:30	0	0	0	0	**0**
15:30	15:45	0	0	0	0	**0**
15:45	16:00	0	0	0	0	**0**
16:00	16:15	0	0	0	0	**0**
16:15	16:30	0	0	0	0	**0**
16:30	16:45	0	0	0	0	**0**
16:45	17:00	0	0	0	0	**0**
17:00	17:15	0	0	0	0	**0**
17:15	17:30	0	0	0	0	**0**
17:30	17:45	0	0	0	0	**0**
17:45	18:00	0	0	0	0	**0**
Total		0	0	2	0	**2**

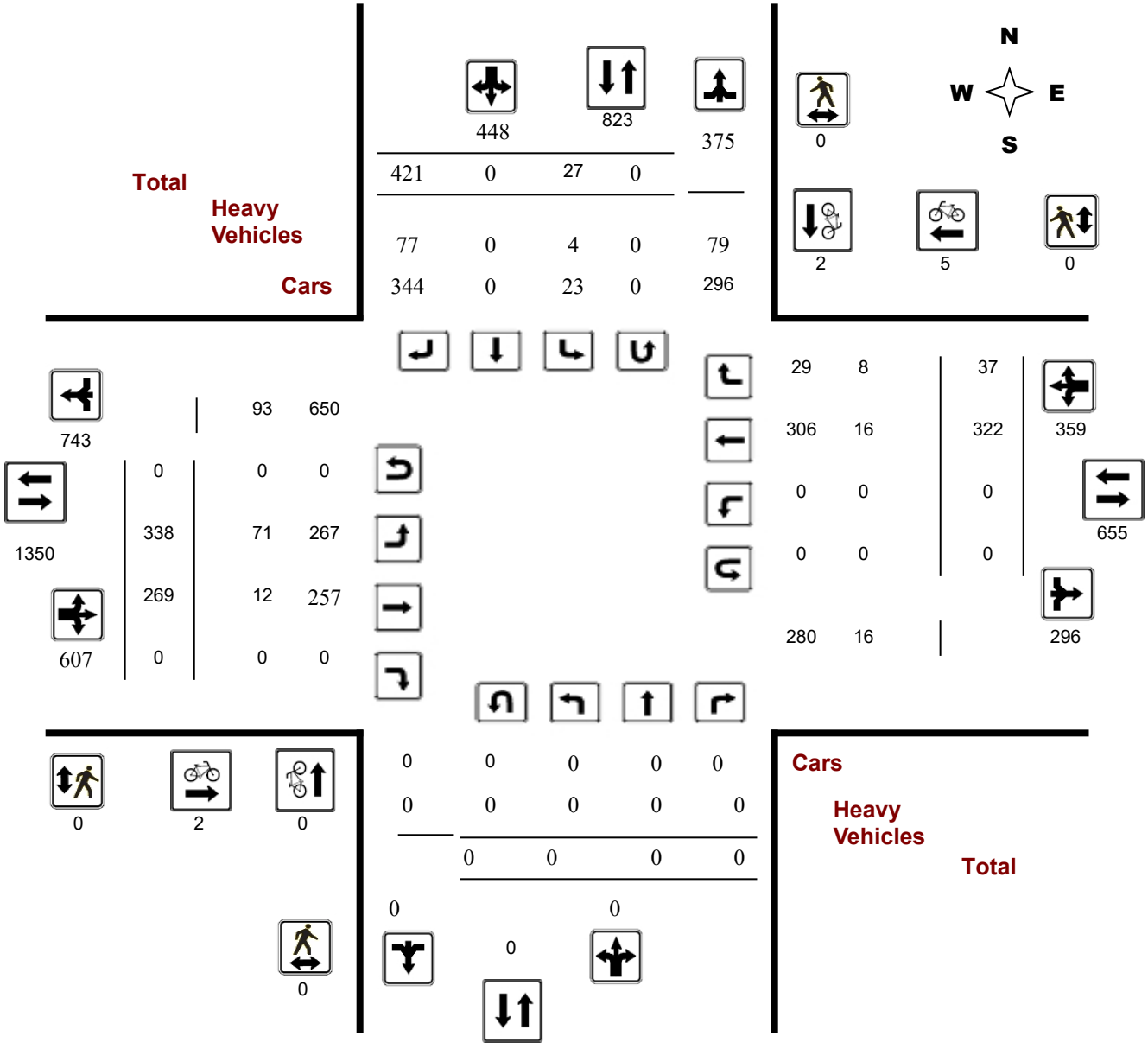
Transportation Services - Traffic Services

Turning Movement Count - Study Results

FERNBANK RD @ JINKINSON RD

Survey Date: Tuesday, April 30, 2019
Start Time: 07:00
WO No: 38586
Device: Miovision

Full Study Diagram



Transportation Services - Traffic Services

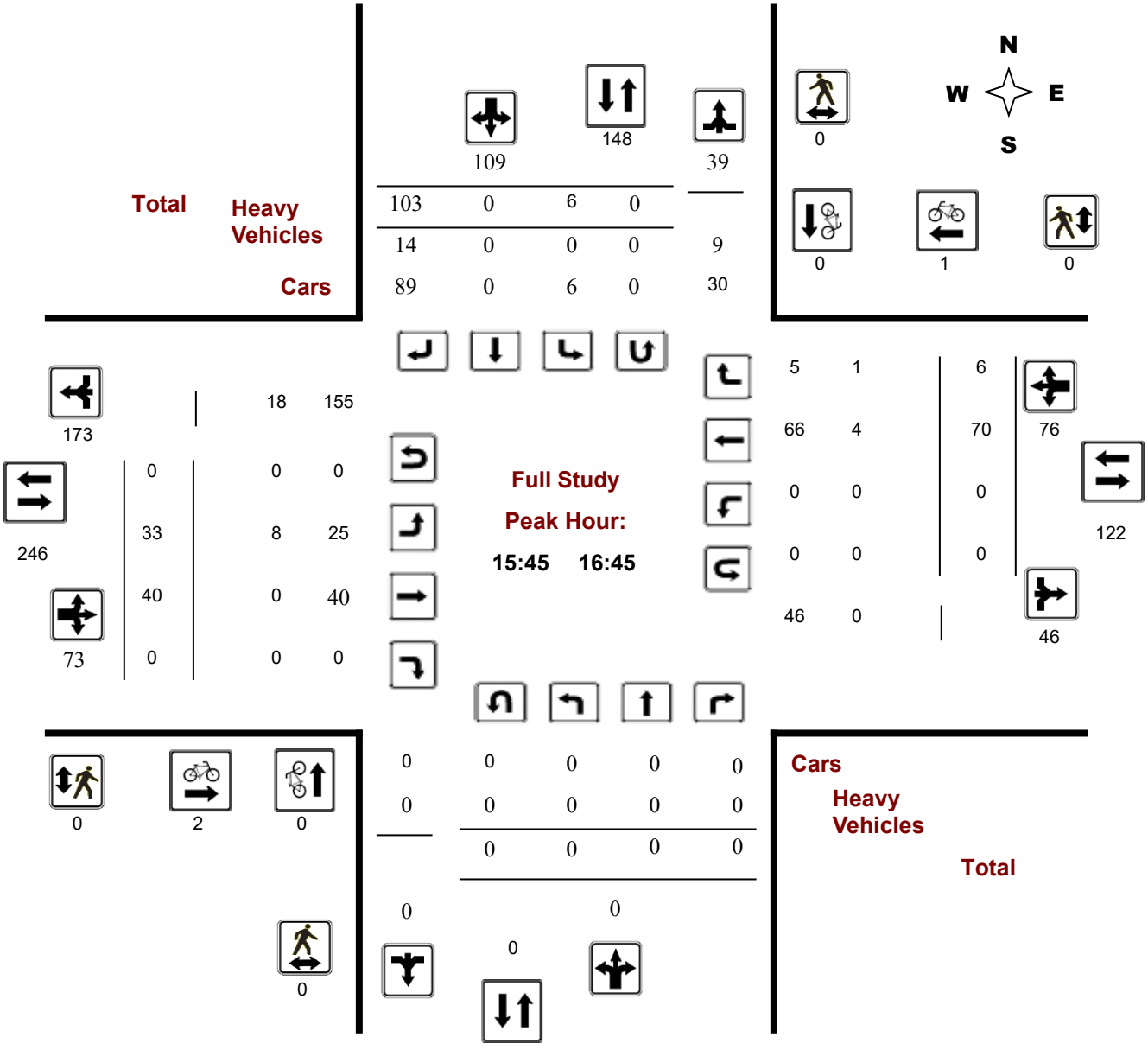
Turning Movement Count - Study Results

FERNBANK RD @ JINKINSON RD

Survey Date: Tuesday, April 30, 2019 **WO No:** 38586

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

Full Study Peak Hour Diagram



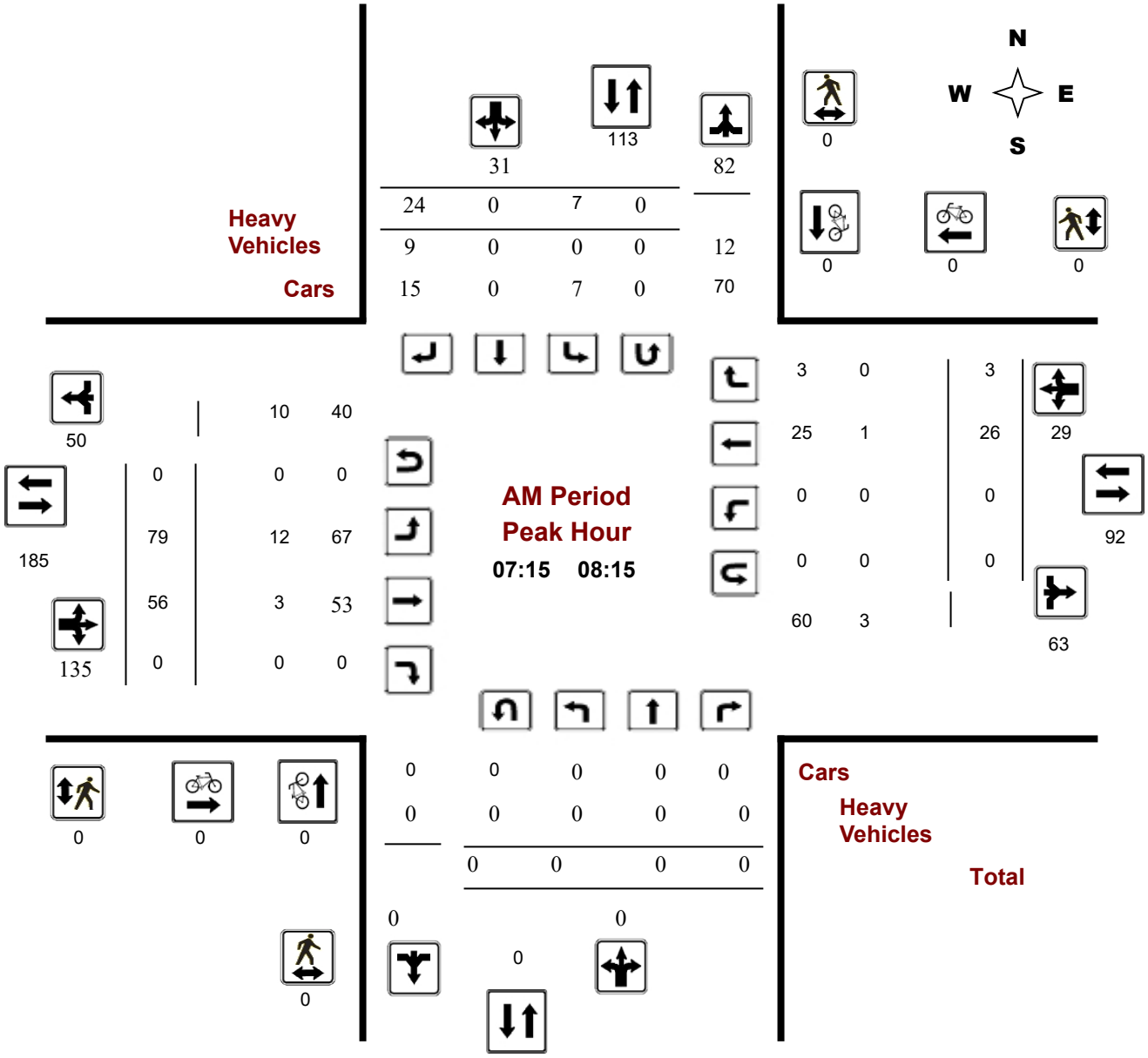
Transportation Services - Traffic Services

Turning Movement Count - Peak Hour Diagram

FERNBANK RD @ JINKINSON RD

Survey Date: Tuesday, April 30, 2019 **WO No:** 38586

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



Comments

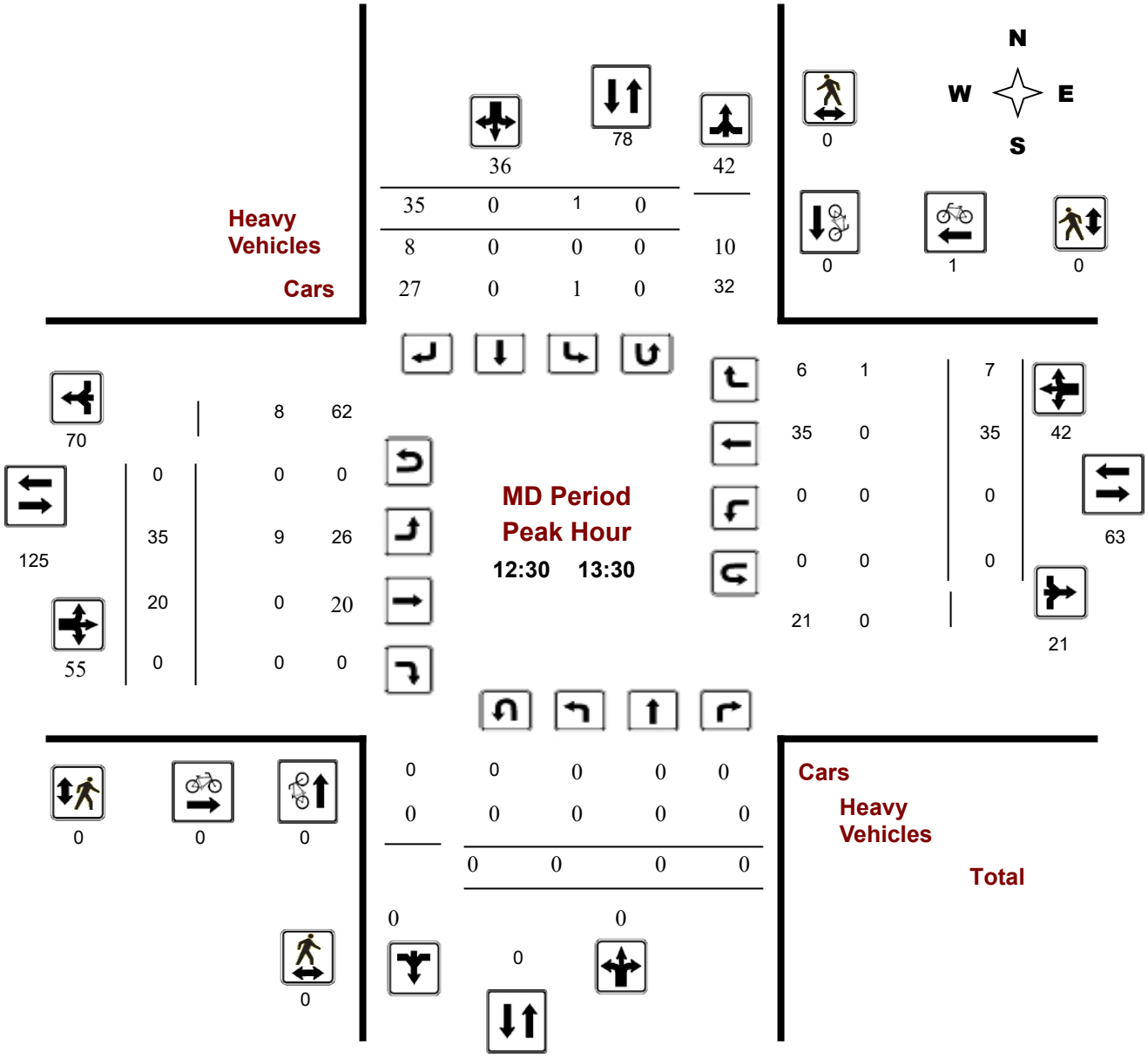
Transportation Services - Traffic Services

Turning Movement Count - Peak Hour Diagram

FERNBANK RD @ JINKINSON RD

Survey Date: Tuesday, April 30, 2019 **WO No:** 38586

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



Comments

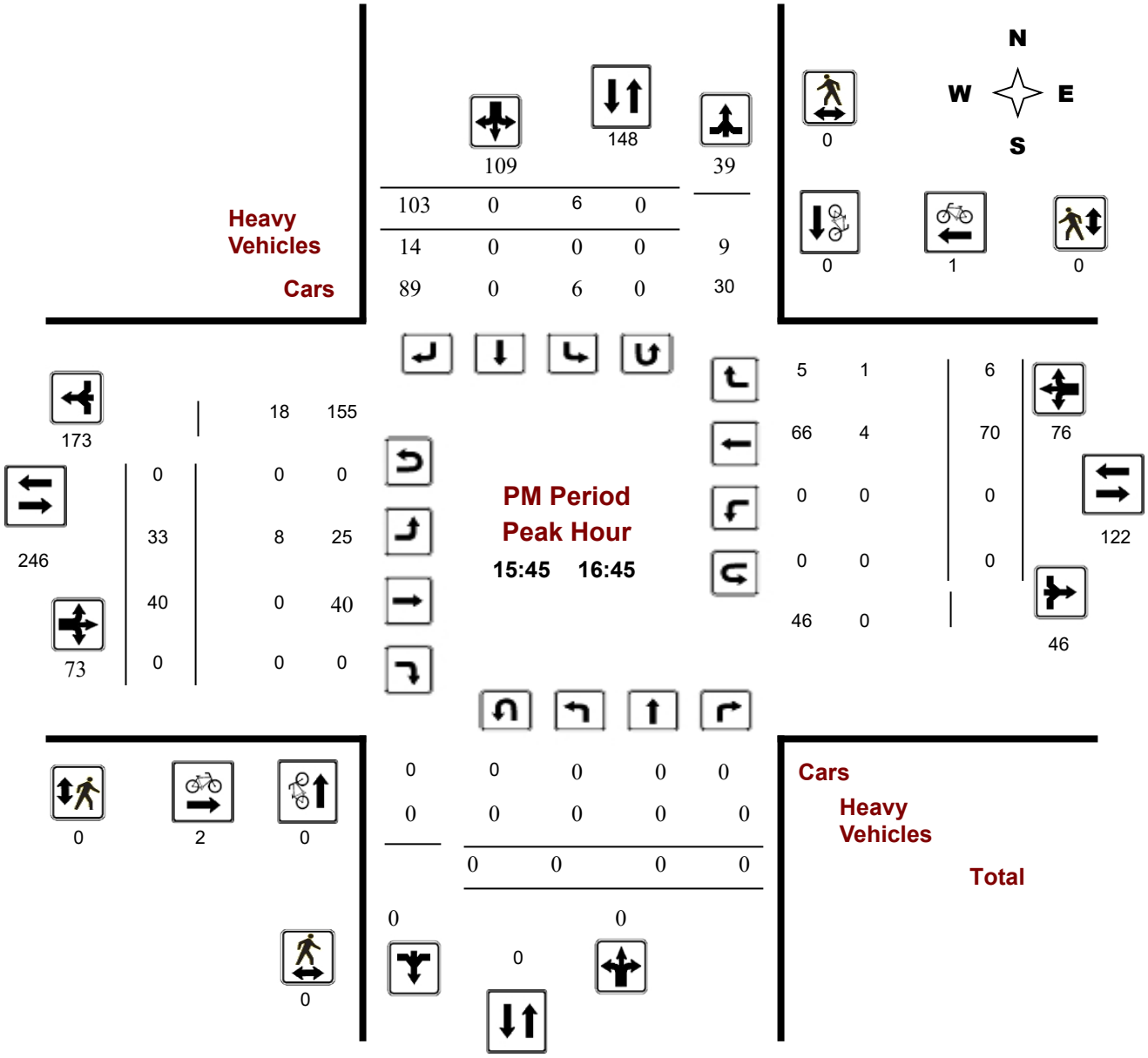
Transportation Services - Traffic Services

Turning Movement Count - Peak Hour Diagram

FERNBANK RD @ JINKINSON RD

Survey Date: Tuesday, April 30, 2019 **WO No:** 38586

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



Comments

Transportation Services - Traffic Services

Turning Movement Count - Study Results

FERNBANK RD @ JINKINSON RD

Survey Date: Tuesday, April 30, 2019 **WO No:** 38586

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

Full Study Summary (8 HR Standard)

Survey Date: Tuesday, April 30, 2019

Total Observed U-Turns

Northbound: 0 Southbound: 0

Eastbound: 0 Westbound: 0

AADT Factor

.90

	Northbound				Southbound					Eastbound				Westbound					
Period	LT	ST	RT	NB TOT	LT	ST	RT	SB TOT	STR TOT	LT	ST	RT	EB TOT	LT	ST	RT	WB TOT	STR TOT	Grand Total
07:00 08:00	0	0	0	**0**	7	0	29	**36**	**36**	75	52	0	**127**	0	21	3	**24**	**151**	**187**
08:00 09:00	0	0	0	**0**	1	0	29	**30**	**30**	63	46	0	**109**	0	22	8	**30**	**139**	**169**
09:00 10:00	0	0	0	**0**	3	0	31	**34**	**34**	39	19	0	**58**	0	40	3	**43**	**101**	**135**
11:30 12:30	0	0	0	**0**	5	0	32	**37**	**37**	31	25	0	**56**	0	23	5	**28**	**84**	**121**
12:30 13:30	0	0	0	**0**	1	0	35	**36**	**36**	35	20	0	**55**	0	35	7	**42**	**97**	**133**
15:00 16:00	0	0	0	**0**	2	0	61	**63**	**63**	32	36	0	**68**	0	59	4	**63**	**131**	**194**
16:00 17:00	0	0	0	**0**	5	0	104	**109**	**109**	34	41	0	**75**	0	66	6	**72**	**147**	**256**
17:00 18:00	0	0	0	**0**	3	0	100	**103**	**103**	29	30	0	**59**	0	56	1	**57**	**116**	**219**
Sub Total	0	0	0	**0**	27	0	421	**448**	**448**	338	269	0	**607**	0	322	37	**359**	**966**	**1414**
U Turns	0			**0**	0			**0**	**0**	**0**			**0**	0			**0**	**0**	**0**
Total	0	0	0	**0**	27	0	421	**448**	**448**	338	269	0	**607**	0	322	37	**359**	**966**	**1414**
EQ 12Hr	0	0	0	**0**	38	0	585	**623**	**623**	470	374	0	**844**	0	448	51	**499**	**1343**	**1966**
Note: These values are calculated by multiplying the totals by the appropriate expansion factor.													**1.39**						
AVG 12Hr	0	0	0	**0**	34	0	526	**560**	**560**	423	337	0	**760**	0	403	46	**449**	**1209**	**1769**
Note: These volumes are calculated by multiplying the Equivalent 12 hr. totals by the AADT factor.													**.90**						
AVG 24Hr	0	0	0	**0**	45	0	689	**734**	**734**	554	441	0	**995**	0	528	60	**588**	**1583**	**2317**
Note: These volumes are calculated by multiplying the Average Daily 12 hr. totals by 12 to 24 expansion factor.													**1.31**						

Note: U-Turns provided for approach totals. Refer to 'U-Turn' Report for specific breakdown.

Transportation Services - Traffic Services

Turning Movement Count - Study Results

FERNBANK RD @ JINKINSON RD

Survey Date: Tuesday, April 30, 2019 **WO No:** 38586

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

Full Study 15 Minute Increments

Time Period		Northbound				Southbound					Eastbound				Westbound					Grand Total
		LT	ST	RT	N TOT	LT	ST	RT	S TOT	STR TOT	LT	ST	RT	E TOT	LT	ST	RT	W TOT	STR TOT	
07:00	07:15		0	0			0	11		**12**		8	0			3	1		**22**	**34**
07:15	07:30		0	0			0	3		**6**		16	0			4	1		**43**	**49**
07:30	07:45		0	0			0	6		**8**		20	0			4	0		**48**	**56**
07:45	08:00		0	0			0	9		**10**		8	0			10	1		**38**	**48**
08:00	08:15		0	0			0	6		**7**		12	0			8	1		**35**	**42**
08:15	08:30		0	0			0	6		**6**		10	0			2	3		**29**	**35**
08:30	08:45		0	0			0	7		**7**		11	0			5	1		**31**	**38**
08:45	09:00		0	0			0	10		**10**		13	0			7	3		**44**	**54**
09:00	09:15		0	0			0	11		**11**		5	0			12	0		**25**	**36**
09:15	09:30		0	0			0	6		**7**		2	0			10	1		**26**	**33**
09:30	09:45		0	0			0	7		**7**		7	0			10	1		**29**	**36**
09:45	10:00		0	0			0	7		**9**		5	0			8	1		**21**	**30**
11:30	11:45		0	0			0	9		**10**		8	0			3	3		**29**	**39**
11:45	12:00		0	0			0	2		**4**		3	0			8	2		**19**	**23**
12:00	12:15		0	0			0	13		**14**		6	0			5	0		**16**	**30**
12:15	12:30		0	0			0	8		**9**		8	0			7	0		**20**	**29**
12:30	12:45		0	0			0	7		**7**		4	0			9	0		**21**	**28**
12:45	13:00		0	0			0	11		**11**		7	0			12	0		**27**	**38**
13:00	13:15		0	0			0	7		**8**		3	0			9	3		**24**	**32**
13:15	13:30		0	0			0	10		**10**		6	0			5	4		**25**	**35**
15:00	15:15		0	0			0	12		**12**		10	0			15	1		**33**	**45**
15:15	15:30		0	0			0	12		**12**		4	0			17	1		**27**	**39**
15:30	15:45		0	0			0	14		**14**		12	0			8	1		**33**	**47**
15:45	16:00		0	0			0	23		**25**		10	0			19	1		**38**	**63**
16:00	16:15		0	0			0	33		**36**		14	0			17	0		**40**	**76**
16:15	16:30		0	0			0	25		**25**		12	0			22	4		**45**	**70**
16:30	16:45		0	0			0	22		**23**		4	0			12	1		**26**	**49**
16:45	17:00		0	0			0	24		**25**		11	0			15	1		**36**	**61**
17:00	17:15		0	0			0	31		**32**		8	0			17	0		**34**	**66**
17:15	17:30		0	0			0	25		**26**		12	0			9	0		**29**	**55**
17:30	17:45		0	0			0	29		**30**		6	0			18	0		**30**	**60**
17:45	18:00		0	0			0	15		**15**		4	0			12	1		**23**	**38**
Total:		0	0	0	0	0	0	421	0	**448**	0	269	0	0	0	322	37	0	**448**	**1,414**

Note: U-Turns are included in Totals.

Transportation Services - Traffic Services

Turning Movement Count - Study Results

FERNBANK RD @ JINKINSON RD

Survey Date: Tuesday, April 30, 2019 **WO No:** 38586

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

Full Study Cyclist Volume

Time Period		Northbound	Southbound	Street Total	Eastbound	Westbound	Street Total	Grand Total
07:00	07:15	0	0	**0**	0	0	**0**	**0**
07:15	07:30	0	0	**0**	0	0	**0**	**0**
07:30	07:45	0	0	**0**	0	0	**0**	**0**
07:45	08:00	0	0	**0**	0	0	**0**	**0**
08:00	08:15	0	0	**0**	0	0	**0**	**0**
08:15	08:30	0	0	**0**	0	0	**0**	**0**
08:30	08:45	0	0	**0**	0	0	**0**	**0**
08:45	09:00	0	0	**0**	0	0	**0**	**0**
09:00	09:15	0	0	**0**	0	0	**0**	**0**
09:15	09:30	0	0	**0**	0	0	**0**	**0**
09:30	09:45	0	0	**0**	0	0	**0**	**0**
09:45	10:00	0	0	**0**	0	0	**0**	**0**
11:30	11:45	0	0	**0**	0	0	**0**	**0**
11:45	12:00	0	0	**0**	0	0	**0**	**0**
12:00	12:15	0	0	**0**	0	0	**0**	**0**
12:15	12:30	0	0	**0**	0	0	**0**	**0**
12:30	12:45	0	0	**0**	0	1	**1**	**1**
12:45	13:00	0	0	**0**	0	0	**0**	**0**
13:00	13:15	0	0	**0**	0	0	**0**	**0**
13:15	13:30	0	0	**0**	0	0	**0**	**0**
15:00	15:15	0	0	**0**	0	0	**0**	**0**
15:15	15:30	0	1	**1**	0	0	**0**	**1**
15:30	15:45	0	0	**0**	0	1	**1**	**1**
15:45	16:00	0	0	**0**	0	0	**0**	**0**
16:00	16:15	0	0	**0**	1	0	**1**	**1**
16:15	16:30	0	0	**0**	1	1	**2**	**2**
16:30	16:45	0	0	**0**	0	0	**0**	**0**
16:45	17:00	0	0	**0**	0	0	**0**	**0**
17:00	17:15	0	0	**0**	0	0	**0**	**0**
17:15	17:30	0	0	**0**	0	0	**0**	**0**
17:30	17:45	0	0	**0**	0	1	**1**	**1**
17:45	18:00	0	1	**1**	0	1	**1**	**2**
Total		0	2	**2**	2	5	**7**	**9**

Transportation Services - Traffic Services

Turning Movement Count - Study Results

FERNBANK RD @ JINKINSON RD

Survey Date: Tuesday, April 30, 2019 **WO No:** 38586

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

Full Study Pedestrian Volume

Time Period	NB Approach (E or W Crossing)	SB Approach (E or W Crossing)	Total	EB Approach (N or S Crossing)	WB Approach (N or S Crossing)	Total	Grand Total
07:00 07:15	0	0	**0**	0	0	**0**	**0**
07:15 07:30	0	0	**0**	0	0	**0**	**0**
07:30 07:45	0	0	**0**	0	0	**0**	**0**
07:45 08:00	0	0	**0**	0	0	**0**	**0**
08:00 08:15	0	0	**0**	0	0	**0**	**0**
08:15 08:30	0	0	**0**	0	0	**0**	**0**
08:30 08:45	0	0	**0**	0	0	**0**	**0**
08:45 09:00	0	0	**0**	0	0	**0**	**0**
09:00 09:15	0	0	**0**	0	0	**0**	**0**
09:15 09:30	0	0	**0**	0	0	**0**	**0**
09:30 09:45	0	0	**0**	0	0	**0**	**0**
09:45 10:00	0	0	**0**	0	0	**0**	**0**
11:30 11:45	0	0	**0**	0	0	**0**	**0**
11:45 12:00	0	0	**0**	0	0	**0**	**0**
12:00 12:15	0	0	**0**	0	0	**0**	**0**
12:15 12:30	0	0	**0**	0	0	**0**	**0**
12:30 12:45	0	0	**0**	0	0	**0**	**0**
12:45 13:00	0	0	**0**	0	0	**0**	**0**
13:00 13:15	0	0	**0**	0	0	**0**	**0**
13:15 13:30	0	0	**0**	0	0	**0**	**0**
15:00 15:15	0	0	**0**	0	0	**0**	**0**
15:15 15:30	0	0	**0**	0	0	**0**	**0**
15:30 15:45	0	0	**0**	0	0	**0**	**0**
15:45 16:00	0	0	**0**	0	0	**0**	**0**
16:00 16:15	0	0	**0**	0	0	**0**	**0**
16:15 16:30	0	0	**0**	0	0	**0**	**0**
16:30 16:45	0	0	**0**	0	0	**0**	**0**
16:45 17:00	0	0	**0**	0	0	**0**	**0**
17:00 17:15	0	0	**0**	0	0	**0**	**0**
17:15 17:30	0	0	**0**	0	0	**0**	**0**
17:30 17:45	0	0	**0**	0	0	**0**	**0**
17:45 18:00	0	0	**0**	0	0	**0**	**0**
Total	0	0	**0**	0	0	**0**	**0**

Transportation Services - Traffic Services

Turning Movement Count - Study Results

FERNBANK RD @ JINKINSON RD

Survey Date: Tuesday, April 30, 2019 **WO No:** 38586

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

Full Study Heavy Vehicles

		Northbound				Southbound					Eastbound				Westbound					
Time Period		LT	ST	RT	N TOT	LT	ST	RT	S TOT	STR TOT	LT	ST	RT	E TOT	LT	ST	RT	W TOT	STR TOT	Grand Total
07:00	07:15	0	0	0		1	0	3		**4**	0	2	0		0	1	0		**3**	**7**
07:15	07:30	0	0	0		0	0	1		**1**	4	1	0		0	0	0		**5**	**6**
07:30	07:45	0	0	0		0	0	2		**2**	4	2	0		0	0	0		**6**	**8**
07:45	08:00	0	0	0		0	0	3		**3**	2	0	0		0	1	0		**3**	**6**
08:00	08:15	0	0	0		0	0	3		**3**	2	0	0		0	0	0		**2**	**5**
08:15	08:30	0	0	0		0	0	1		**1**	3	2	0		0	0	0		**5**	**6**
08:30	08:45	0	0	0		0	0	4		**4**	3	1	0		0	0	0		**4**	**8**
08:45	09:00	0	0	0		0	0	4		**4**	4	2	0		0	0	1		**7**	**11**
09:00	09:15	0	0	0		0	0	4		**4**	3	0	0		0	0	0		**3**	**7**
09:15	09:30	0	0	0		0	0	3		**3**	2	0	0		0	3	0		**5**	**8**
09:30	09:45	0	0	0		0	0	2		**2**	4	0	0		0	0	0		**4**	**6**
09:45	10:00	0	0	0		1	0	3		**4**	0	0	0		0	1	1		**2**	**6**
11:30	11:45	0	0	0		1	0	5		**6**	6	0	0		0	0	2		**8**	**14**
11:45	12:00	0	0	0		0	0	1		**1**	2	0	0		0	0	1		**3**	**4**
12:00	12:15	0	0	0		1	0	2		**3**	0	0	0		0	1	0		**1**	**4**
12:15	12:30	0	0	0		0	0	3		**3**	4	0	0		0	0	0		**4**	**7**
12:30	12:45	0	0	0		0	0	1		**1**	3	0	0		0	0	0		**3**	**4**
12:45	13:00	0	0	0		0	0	3		**3**	1	0	0		0	0	0		**1**	**4**
13:00	13:15	0	0	0		0	0	1		**1**	3	0	0		0	0	0		**3**	**4**
13:15	13:30	0	0	0		0	0	3		**3**	2	0	0		0	0	1		**3**	**6**
15:00	15:15	0	0	0		0	0	2		**2**	1	1	0		0	0	0		**2**	**4**
15:15	15:30	0	0	0		0	0	1		**1**	1	0	0		0	2	0		**3**	**4**
15:30	15:45	0	0	0		0	0	2		**2**	4	0	0		0	1	1		**6**	**8**
15:45	16:00	0	0	0		0	0	5		**5**	2	0	0		0	0	0		**2**	**7**
16:00	16:15	0	0	0		0	0	4		**4**	2	0	0		0	2	0		**4**	**8**
16:15	16:30	0	0	0		0	0	1		**1**	3	0	0		0	1	1		**5**	**6**
16:30	16:45	0	0	0		0	0	4		**4**	1	0	0		0	1	0		**2**	**6**
16:45	17:00	0	0	0		0	0	1		**1**	0	0	0		0	0	0		**0**	**1**
17:00	17:15	0	0	0		0	0	2		**2**	2	0	0		0	2	0		**4**	**6**
17:15	17:30	0	0	0		0	0	3		**3**	2	1	0		0	0	0		**3**	**6**
17:30	17:45	0	0	0		0	0	0		**0**	1	0	0		0	0	0		**1**	**1**
17:45	18:00	0	0	0		0	0	0		**0**	0	0	0		0	0	0		**0**	**0**
Total:	None	0	0	0	**0**	4	0	77	**0**	**81**	71	12	0	**0**	0	16	8	**0**	**107**	**188**

Transportation Services - Traffic Services

Turning Movement Count - Study Results

FERNBANK RD @ JINKINSON RD

Survey Date: Tuesday, April 30, 2019 **WO No:** 38586

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

Full Study 15 Minute U-Turn Total

Time Period		Northbound U-Turn Total	Southbound U-Turn Total	Eastbound U-Turn Total	Westbound U-Turn Total	Total
07:00	07:15	0	0	0	0	**0**
07:15	07:30	0	0	0	0	**0**
07:30	07:45	0	0	0	0	**0**
07:45	08:00	0	0	0	0	**0**
08:00	08:15	0	0	0	0	**0**
08:15	08:30	0	0	0	0	**0**
08:30	08:45	0	0	0	0	**0**
08:45	09:00	0	0	0	0	**0**
09:00	09:15	0	0	0	0	**0**
09:15	09:30	0	0	0	0	**0**
09:30	09:45	0	0	0	0	**0**
09:45	10:00	0	0	0	0	**0**
11:30	11:45	0	0	0	0	**0**
11:45	12:00	0	0	0	0	**0**
12:00	12:15	0	0	0	0	**0**
12:15	12:30	0	0	0	0	**0**
12:30	12:45	0	0	0	0	**0**
12:45	13:00	0	0	0	0	**0**
13:00	13:15	0	0	0	0	**0**
13:15	13:30	0	0	0	0	**0**
15:00	15:15	0	0	0	0	**0**
15:15	15:30	0	0	0	0	**0**
15:30	15:45	0	0	0	0	**0**
15:45	16:00	0	0	0	0	**0**
16:00	16:15	0	0	0	0	**0**
16:15	16:30	0	0	0	0	**0**
16:30	16:45	0	0	0	0	**0**
16:45	17:00	0	0	0	0	**0**
17:00	17:15	0	0	0	0	**0**
17:15	17:30	0	0	0	0	**0**
17:30	17:45	0	0	0	0	**0**
17:45	18:00	0	0	0	0	**0**
Total		0	0	0	0	**0**

Intersection: Jinkinson Road / Tomlinson Quarry Access

Morning Peak Hour Results (May 3, 2022)

Heavy Vehicle Factor 1

	0:15	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
Time Period		Westbound							Northbound							Eastbound							Southbound							Total		All	Peak Hr Total
		RT		TH		LT			RT		TH		LT			RT		TH		LT			RT		TH		LT						
	From / To	Heavy	Passenger	Heavy	Passenger	Heavy	Passenger	Pedestrians	Heavy	Passenger	Heavy	Passenger	Heavy	Passenger	Pedestrians	Heavy	Passenger	Heavy	Passenger	Heavy	Passenger	Pedestrians	Heavy	Passenger	Heavy	Passenger	Heavy	Passenger	Pedestrians	Heavy	Passenger		
1	7:00 7:15	4	2			0	0	0	0	0	10	8			0							0			11	9	2	2	0	27	21	48	48
2	7:15 7:30	3	1			0	0	0	0	0	8	21			0							0			6	9	1	4	0	18	35	53	101
3	7:30 7:45	5	2			0	0	0	0	2	6	15			0							0			4	10	0	2	0	15	31	46	147
4	7:45 8:00	2	0			0	0	0	0	1	5	10			0							0			11	18	1	2	0	19	31	50	197
5	8:00 8:15	4	1			0	0	0	0	1	10	16			0							0			6	6	2	0	0	22	24	46	195
6	8:15 8:30	3	5			0	0	0	0	0	7	12			0							0			7	3	0	0	0	17	20	37	179
7	8:30 8:45	3	2			0	0	0	0	0	6	11			0							0			8	6	5	0	0	22	19	41	174
8	8:45 9:00	4	0			0	0	0	0	0	11	10			0							0			4	8	4	2	0	23	20	43	167
1	**7:00 8:00**	*<<<Calculated Peak Hour*																															
	AM Total	28	13	0	0	0	0	0	0	4	63	103	0	0	0	0	0	0	0	0	0	0	0	0	57	69	15	12	0	163	201	364	
	Heavy Vehicle %	68%		#DIV/0!		#DIV/0!			0%		38%		#DIV/0!			#DIV/0!		#DIV/0!		#DIV/0!			#DIV/0!		45%		56%			45%			
	AM Peak Hour	14	5	0	0	0	0	0	0	3	29	54	0	0	0	0	0	0	0	0	0	0	0	0	32	46	4	10	0	79	118	197	
	Heavy Vehicle %	74%		#DIV/0!		#DIV/0!			0%		35%		#DIV/0!			#DIV/0!		#DIV/0!		#DIV/0!			#DIV/0!		41%		29%			40%			
	AM Peak Hr Total	19		0		0			3		83		0			0		0		0			0		78		14						
	Peak Hr Approach To	19							86							0							92										

Afternoon Peak Hour Results (May 3, 2022)

	0:15	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
Time Period		Westbound							Northbound							Eastbound							Southbound							Total		All	Peak Hr Total
		RT		TH		LT			RT		TH		LT			RT		TH		LT			RT		TH		LT						
	From / To	Heavy	Passenger	Heavy	Passenger	Heavy	Passenger	Pedestrians	Heavy	Passenger	Heavy	Passenger	Heavy	Passenger	Pedestrians	Heavy	Passenger	Heavy	Passenger	Heavy	Passenger	Pedestrians	Heavy	Passenger	Heavy	Passenger	Heavy	Passenger	Pedestrians	Heavy	Passenger		
7	3:30 3:45	3	2			0	0	0	0	0	5	9			0							0			7	16	5	2	0	20	29	49	49
8	3:45 4:00	4	2			0	0	0	0	0	11	5			0							0			6	13	6	1	0	27	21	48	97
9	4:00 4:15	4	4			0	0	0	0	0	4	8			0							0			0	27	5	2	0	13	41	54	151
10	4:15 4:30	5	2			0	0	0	1	0	6	10			0							0			6	22	4	0	0	22	34	56	207
11	4:30 4:45	0	5			0	0	0	1	1	5	11			0							0			3	18	4	0	0	13	35	48	206
12	4:45 5:00	3	4			0	0	0	0	0	4	7			0							0			5	10	1	0	0	13	21	34	192
13	5:00 5:15	1	5			0	1	0	0	0	1	15			0							0			6	15	3	0	0	11	36	47	185
14	5:15 5:30	0	4			0	0	0	0	0	8	5			0							0			7	23	0	0	0	15	32	47	176
15	5:30 5:45	1	6			0	2	0	0	0	1	12			0							0			1	14	1	0	0	4	34	38	166
16	5:45 6:00	0	4			0	0	0	0	0	1	11			0							0			1	13	2	0	0	4	28	32	164
7	**3:30 4:30**	*<<<Calculated Peak Hour*																															
	PM Peak Period	21	38	0	0	0	3	0	2	1	46	93	0	0	0	0	0	0	0	0	0	0	0	0	0	42	171	31	5	0	142	311	453	
	Heavy Vehicle %	36%		#DIV/0!		0%			67%		33%		#DIV/0!			#DIV/0!		#DIV/0!		#DIV/0!			#DIV/0!		20%		86%			31%			
	PM Peak Hour	16	10	0	0	0	0	0	1	0	26	32	0	0	0	0	0	0	0	0	0	0	0	0	19	78	20	5	0	82	125	207	
	Heavy Vehicle %	62%		#DIV/0!		#DIV/0!			100%		45%		#DIV/0!			#DIV/0!		#DIV/0!		#DIV/0!			#DIV/0!		20%		80%			40%			
	PM Peak Hr Total	26		0		0			1		58		0			0		0		0			0		97		25						
	Peak Hr Approach To	26							59							0							122										

APPENDIX B – COLLISION DATA

Transportation Services - Traffic Services

Collision Details Report - Public Version

From: January 1, 2016 **To:** December 31, 2020

Location: FERNBANK RD @ JINKINSON RD

Traffic Control: Stop sign **Total Collisions:** 3

Date/Day/Time	Environment	Impact Type	Classification	Surface Cond'n	Veh. Dir	Vehicle Manoeuver	Vehicle type	First Event	No. Ped
2017-Feb-12, Sun,18:20	Snow	SMV other	P.D. only	Slush	West	Going ahead	Automobile, station wagon	Animal - wild	0
2018-Dec-13, Thu,09:51	Clear	Angle	P.D. only	Dry	South	Turning left	Truck - dump	Other motor vehicle	0
					East	Turning left	Passenger van	Other motor vehicle	
2018-Dec-27, Thu,10:20	Clear	SMV other	P.D. only	Wet	South	Going ahead	Pick-up truck	Ran off road	0

Transportation Services - Traffic Services

Collision Details Report - Public Version

From: January 1, 2016 **To:** December 31, 2020

Location: JINKINSON RD btwn FERNBANK RD & HAZELDEAN RD

Traffic Control: No control **Total Collisions:** 30

Date/Day/Time	Environment	Impact Type	Classification	Surface Cond'n	Veh. Dir	Vehicle Manoeuver	Vehicle type	First Event	No. Ped
2016-Aug-31, Wed,13:48	Clear	SMV other	Fatal injury	Dry	South	Going ahead	Motorcycle	Ran off road	0
2016-Aug-31, Wed,14:33	Clear	SMV other	P.D. only	Dry	South	Reversing	Pick-up truck	Pole (sign, parking meter)	0
2016-Sep-30, Fri,09:26	Clear	SMV other	P.D. only	Dry	North	Going ahead	Automobile, station wagon	Animal - wild	0
2016-Dec-12, Mon,06:46	Snow	Angle	Non-fatal injury	Loose snow	West	Turning right	Pick-up truck	Other motor vehicle	0
					North	Going ahead	Pick-up truck	Other motor vehicle	
2017-Jun-11, Sun,18:38	Clear	SMV other	P.D. only	Dry	South	Going ahead	Automobile, station wagon	Ran off road	0
2017-Nov-13, Mon,21:51	Clear	SMV other	P.D. only	Dry	South	Going ahead	Automobile, station wagon	Skidding/sliding	0
2018-Mar-07, Wed,22:21	Snow	SMV other	P.D. only	Loose snow	East	Going ahead	Automobile, station wagon	Ran off road	0
2018-May-16, Wed,15:15	Clear	SMV other	P.D. only	Dry	South	Going ahead	Delivery van	Ran off road	0
2018-May-30, Wed,12:29	Clear	SMV other	P.D. only	Dry	West	Going ahead	Automobile, station wagon	Ran off road	0
2018-Jun-25, Mon,13:44	Clear	SMV other	Non-fatal injury	Dry	West	Turning left	Motorcycle	Skidding/sliding	0
2018-Aug-10, Fri,15:31	Clear	SMV other	Non-fatal injury	Dry	South	Going ahead	Motorcycle	Ran off road	0
2018-Aug-20, Mon,18:10	Clear	SMV other	Non-fatal injury	Dry	West	Turning right	Automobile, station wagon	Ditch	0
2018-Sep-01, Sat,08:14	Clear	SMV other	P.D. only	Dry	North	Going ahead	Automobile, station wagon	Ran off road	0
2018-Dec-03, Mon,09:46	Snow	SMV other	P.D. only	Slush	South	Going ahead	Automobile, station wagon	Ditch	0
2018-Dec-12, Wed,09:35	Clear	Approaching	P.D. only	Dry	West	Unknown	Unknown	Other motor vehicle	0
					East	Going ahead	Truck - tractor	Other motor vehicle	
2019-Jan-05, Sat,11:35	Clear	SMV other	P.D. only	Dry	South	Going ahead	Automobile, station wagon	Animal - wild	0
2019-May-14, Tue,17:10	Rain	SMV other	Non-fatal injury	Wet	West	Going ahead	Automobile, station wagon	Ran off road	0
2019-May-17, Fri,21:55	Clear	SMV other	P.D. only	Dry	North	Going ahead	Automobile, station wagon	Animal - wild	0
2019-Jun-05, Wed,15:45	Clear	Other	P.D. only	Dry	South	Going ahead	Unknown	Other	0
					South	Going ahead	Pick-up truck	Debris falling off vehicle	

Transportation Services - Traffic Services

Collision Details Report - Public Version

From: January 1, 2016 **To:** December 31, 2020

Location: JINKINSON RD btwn FERNBANK RD & HAZELDEAN RD

Traffic Control: No control **Total Collisions:** 30

Date/Day/Time	Environment	Impact Type	Classification	Surface Cond'n	Veh. Dir	Vehicle Manoeuver	Vehicle type	First Event	No. Ped
2019-Jun-19, Wed,20:21	Rain	Rear end	P.D. only	Wet	West	Going ahead	Pick-up truck	Other motor vehicle	0
					West	Turning left	Truck - dump	Other motor vehicle	
2019-Jun-20, Thu,05:00	Clear	SMV other	P.D. only	Dry	West	Going ahead	Automobile, station wagon	Ran off road	0
2019-Jul-20, Sat,21:19	Clear	SMV other	P.D. only	Dry	East	Going ahead	Automobile, station wagon	Ran off road	0
2019-Sep-06, Fri,18:29	Clear	SMV other	Non-fatal injury	Dry	West	Going ahead	Automobile, station wagon	Ran off road	0
2019-Nov-22, Fri,12:52	Clear	SMV other	P.D. only	Mud	East	Going ahead	Truck - dump	Skidding/sliding	0
2019-Dec-01, Sun,07:33	Clear	SMV other	P.D. only	Dry	West	Going ahead	Automobile, station wagon	Skidding/sliding	0
2020-Jan-25, Sat,14:20	Rain	SMV other	P.D. only	Slush	West	Going ahead	Automobile, station wagon	Skidding/sliding	0
2020-Feb-23, Sun,18:15	Clear	SMV other	P.D. only	Loose snow	North	Going ahead	Automobile, station wagon	Animal - wild	0
2020-Jun-08, Mon,23:28	Clear	SMV other	P.D. only	Dry	South	Going ahead	Automobile, station wagon	Animal - wild	0
2020-Nov-25, Wed,11:32	Clear	SMV other	P.D. only	Slush	East	Going ahead	Truck - dump	Ran off road	0
2020-Dec-30, Wed,21:07	Rain	SMV other	P.D. only	Wet	North	Going ahead	Automobile, station wagon	Skidding/sliding	0

APPENDIX C - SYNCHRO TRAFFIC ANALYSIS
FORECAST EXISTING 2022 AND OPERATIONS 2025

Intersection	
Int Delay, s/veh	3

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	305	56	47	165	61	44
Future Vol, veh/h	305	56	47	165	61	44
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	7	31	50	6	24	28
Mvmt Flow	321	59	49	174	64	46

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	380	0	623	351
Stage 1	-	-	-	-	351	-
Stage 2	-	-	-	-	272	-
Critical Hdwy	-	-	4.6	-	6.64	6.48
Critical Hdwy Stg 1	-	-	-	-	5.64	-
Critical Hdwy Stg 2	-	-	-	-	5.64	-
Follow-up Hdwy	-	-	2.65	-	3.716	3.552
Pot Cap-1 Maneuver	-	-	958	-	416	637
Stage 1	-	-	-	-	666	-
Stage 2	-	-	-	-	726	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	958	-	392	637
Mov Cap-2 Maneuver	-	-	-	-	392	-
Stage 1	-	-	-	-	666	-
Stage 2	-	-	-	-	685	-

Approach	EB	WB	NB
HCM Control Delay, s	0	2	15.1
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	467	-	-	958	-
HCM Lane V/C Ratio	0.237	-	-	0.052	-
HCM Control Delay (s)	15.1	-	-	9	0
HCM Lane LOS	C	-	-	A	A
HCM 95th %tile Q(veh)	0.9	-	-	0.2	-

Intersection	
Int Delay, s/veh	4.6

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	86	59	28	3	7	25
Future Vol, veh/h	86	59	28	3	7	25
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	15	5	4	0	0	38
Mvmt Flow	91	62	29	3	7	26

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	32	0	-	0	275	31
Stage 1	-	-	-	-	31	-
Stage 2	-	-	-	-	244	-
Critical Hdwy	4.25	-	-	-	6.4	6.58
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.335	-	-	-	3.5	3.642
Pot Cap-1 Maneuver	1500	-	-	-	719	949
Stage 1	-	-	-	-	997	-
Stage 2	-	-	-	-	801	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1500	-	-	-	674	949
Mov Cap-2 Maneuver	-	-	-	-	674	-
Stage 1	-	-	-	-	934	-
Stage 2	-	-	-	-	801	-

Approach	EB	WB	SB
HCM Control Delay, s	4.5	0	9.3
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1500	-	-	-	871
HCM Lane V/C Ratio	0.06	-	-	-	0.039
HCM Control Delay (s)	7.6	0	-	-	9.3
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0.2	-	-	-	0.1

Intersection	
Int Delay, s/veh	1.8

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	83	3	14	78	0	26
Future Vol, veh/h	83	3	14	78	0	26
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	35	100	100	41	2	74
Mvmt Flow	87	3	15	82	0	27

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	90	0	201	89
Stage 1	-	-	-	-	89	-
Stage 2	-	-	-	-	112	-
Critical Hdwy	-	-	5.1	-	6.42	6.94
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	3.1	-	3.518	3.966
Pot Cap-1 Maneuver	-	-	1062	-	788	803
Stage 1	-	-	-	-	934	-
Stage 2	-	-	-	-	913	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1062	-	776	803
Mov Cap-2 Maneuver	-	-	-	-	776	-
Stage 1	-	-	-	-	934	-
Stage 2	-	-	-	-	899	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.3	9.6
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	803	-	-	1062	-
HCM Lane V/C Ratio	0.034	-	-	0.014	-
HCM Control Delay (s)	9.6	-	-	8.4	0
HCM Lane LOS	A	-	-	A	A
HCM 95th %tile Q(veh)	0.1	-	-	0	-

Intersection	
Int Delay, s/veh	2.5

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	264	55	70	404	56	38
Future Vol, veh/h	264	55	70	404	56	38
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	2	11	5	3	9	9
Mvmt Flow	278	58	74	425	59	40

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	336	0	880	307
Stage 1	-	-	-	-	307	-
Stage 2	-	-	-	-	573	-
Critical Hdwy	-	-	4.15	-	6.49	6.29
Critical Hdwy Stg 1	-	-	-	-	5.49	-
Critical Hdwy Stg 2	-	-	-	-	5.49	-
Follow-up Hdwy	-	-	2.245	-	3.581	3.381
Pot Cap-1 Maneuver	-	-	1207	-	309	717
Stage 1	-	-	-	-	730	-
Stage 2	-	-	-	-	550	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1207	-	284	717
Mov Cap-2 Maneuver	-	-	-	-	284	-
Stage 1	-	-	-	-	730	-
Stage 2	-	-	-	-	506	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.2	18
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	376	-	-	1207	-
HCM Lane V/C Ratio	0.263	-	-	0.061	-
HCM Control Delay (s)	18	-	-	8.2	0
HCM Lane LOS	C	-	-	A	A
HCM 95th %tile Q(veh)	1	-	-	0.2	-

Intersection	
Int Delay, s/veh	5

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	35	42	74	6	6	111
Future Vol, veh/h	35	42	74	6	6	111
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	24	0	6	17	0	14
Mvmt Flow	37	44	78	6	6	117

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	84	0	-	0	199	81
Stage 1	-	-	-	-	81	-
Stage 2	-	-	-	-	118	-
Critical Hdwy	4.34	-	-	-	6.4	6.34
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.416	-	-	-	3.5	3.426
Pot Cap-1 Maneuver	1385	-	-	-	794	947
Stage 1	-	-	-	-	947	-
Stage 2	-	-	-	-	912	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1385	-	-	-	773	947
Mov Cap-2 Maneuver	-	-	-	-	773	-
Stage 1	-	-	-	-	921	-
Stage 2	-	-	-	-	912	-

Approach	EB	WB	SB
HCM Control Delay, s	3.5	0	9.4
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1385	-	-	-	936
HCM Lane V/C Ratio	0.027	-	-	-	0.132
HCM Control Delay (s)	7.7	0	-	-	9.4
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0.1	-	-	-	0.5

Intersection	
Int Delay, s/veh	2.2

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	58	1	25	97	0	26
Future Vol, veh/h	58	1	25	97	0	26
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	45	100	80	20	2	62
Mvmt Flow	61	1	26	102	0	27

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	62	0	216	62
Stage 1	-	-	-	-	62	-
Stage 2	-	-	-	-	154	-
Critical Hdwy	-	-	4.9	-	6.42	6.82
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.92	-	3.518	3.858
Pot Cap-1 Maneuver	-	-	1162	-	772	858
Stage 1	-	-	-	-	961	-
Stage 2	-	-	-	-	874	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1162	-	753	858
Mov Cap-2 Maneuver	-	-	-	-	753	-
Stage 1	-	-	-	-	961	-
Stage 2	-	-	-	-	853	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.7	9.3
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	858	-	-	1162	-
HCM Lane V/C Ratio	0.032	-	-	0.023	-
HCM Control Delay (s)	9.3	-	-	8.2	0
HCM Lane LOS	A	-	-	A	A
HCM 95th %tile Q(veh)	0.1	-	-	0.1	-

Intersection	
Int Delay, s/veh	3.4

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	335	70	53	182	71	49
Future Vol, veh/h	335	70	53	182	71	49
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	7	37	56	6	33	32
Mvmt Flow	353	74	56	192	75	52

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	427	0	694	390
Stage 1	-	-	-	-	390	-
Stage 2	-	-	-	-	304	-
Critical Hdwy	-	-	4.66	-	6.73	6.52
Critical Hdwy Stg 1	-	-	-	-	5.73	-
Critical Hdwy Stg 2	-	-	-	-	5.73	-
Follow-up Hdwy	-	-	2.704	-	3.797	3.588
Pot Cap-1 Maneuver	-	-	895	-	365	598
Stage 1	-	-	-	-	622	-
Stage 2	-	-	-	-	683	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	895	-	339	598
Mov Cap-2 Maneuver	-	-	-	-	339	-
Stage 1	-	-	-	-	622	-
Stage 2	-	-	-	-	635	-

Approach	EB	WB	NB
HCM Control Delay, s	0	2.1	17.6
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	412	-	-	895	-
HCM Lane V/C Ratio	0.307	-	-	0.062	-
HCM Control Delay (s)	17.6	-	-	9.3	0
HCM Lane LOS	C	-	-	A	A
HCM 95th %tile Q(veh)	1.3	-	-	0.2	-

Intersection	
Int Delay, s/veh	4.7

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	91	63	29	3	8	30
Future Vol, veh/h	91	63	29	3	8	30
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	15	5	4	0	0	38
Mvmt Flow	96	66	31	3	8	32

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	34	0	-	0	291	33
Stage 1	-	-	-	-	33	-
Stage 2	-	-	-	-	258	-
Critical Hdwy	4.25	-	-	-	6.4	6.58
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.335	-	-	-	3.5	3.642
Pot Cap-1 Maneuver	1497	-	-	-	704	946
Stage 1	-	-	-	-	995	-
Stage 2	-	-	-	-	790	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1497	-	-	-	657	946
Mov Cap-2 Maneuver	-	-	-	-	657	-
Stage 1	-	-	-	-	928	-
Stage 2	-	-	-	-	790	-

Approach	EB	WB	SB
HCM Control Delay, s	4.5	0	9.4
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1497	-	-	-	866
HCM Lane V/C Ratio	0.064	-	-	-	0.046
HCM Control Delay (s)	7.6	0	-	-	9.4
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0.2	-	-	-	0.1

Intersection	
Int Delay, s/veh	2.3

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	88	3	27	83	3	27
Future Vol, veh/h	88	3	27	83	3	27
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	35	100	100	41	100	100
Mvmt Flow	93	3	28	87	3	28

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	96	0	238	95
Stage 1	-	-	-	-	95	-
Stage 2	-	-	-	-	143	-
Critical Hdwy	-	-	5.1	-	7.4	7.2
Critical Hdwy Stg 1	-	-	-	-	6.4	-
Critical Hdwy Stg 2	-	-	-	-	6.4	-
Follow-up Hdwy	-	-	3.1	-	4.4	4.2
Pot Cap-1 Maneuver	-	-	1056	-	578	749
Stage 1	-	-	-	-	732	-
Stage 2	-	-	-	-	692	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1056	-	562	749
Mov Cap-2 Maneuver	-	-	-	-	562	-
Stage 1	-	-	-	-	732	-
Stage 2	-	-	-	-	673	-

Approach	EB	WB	NB
HCM Control Delay, s	0	2.1	10.2
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	725	-	-	1056	-
HCM Lane V/C Ratio	0.044	-	-	0.027	-
HCM Control Delay (s)	10.2	-	-	8.5	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	0.1	-	-	0.1	-

Intersection	
Int Delay, s/veh	2.8

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	293	60	74	448	60	40
Future Vol, veh/h	293	60	74	448	60	40
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	2	11	5	3	10	9
Mvmt Flow	308	63	78	472	63	42

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	371	0	968	340
Stage 1	-	-	-	-	340	-
Stage 2	-	-	-	-	628	-
Critical Hdwy	-	-	4.15	-	6.5	6.29
Critical Hdwy Stg 1	-	-	-	-	5.5	-
Critical Hdwy Stg 2	-	-	-	-	5.5	-
Follow-up Hdwy	-	-	2.245	-	3.59	3.381
Pot Cap-1 Maneuver	-	-	1171	-	272	687
Stage 1	-	-	-	-	703	-
Stage 2	-	-	-	-	517	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1171	-	248	687
Mov Cap-2 Maneuver	-	-	-	-	248	-
Stage 1	-	-	-	-	703	-
Stage 2	-	-	-	-	470	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.2	20.7
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	333	-	-	1171	-
HCM Lane V/C Ratio	0.316	-	-	0.067	-
HCM Control Delay (s)	20.7	-	-	8.3	0
HCM Lane LOS	C	-	-	A	A
HCM 95th %tile Q(veh)	1.3	-	-	0.2	-

Intersection	
Int Delay, s/veh	5.1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	39	45	79	7	7	121
Future Vol, veh/h	39	45	79	7	7	121
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	24	0	6	17	0	14
Mvmt Flow	41	47	83	7	7	127

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	90	0	-	0	216	87
Stage 1	-	-	-	-	87	-
Stage 2	-	-	-	-	129	-
Critical Hdwy	4.34	-	-	-	6.4	6.34
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.416	-	-	-	3.5	3.426
Pot Cap-1 Maneuver	1378	-	-	-	777	939
Stage 1	-	-	-	-	941	-
Stage 2	-	-	-	-	902	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1378	-	-	-	753	939
Mov Cap-2 Maneuver	-	-	-	-	753	-
Stage 1	-	-	-	-	912	-
Stage 2	-	-	-	-	902	-

Approach	EB	WB	SB
HCM Control Delay, s	3.6	0	9.5
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1378	-	-	-	926
HCM Lane V/C Ratio	0.03	-	-	-	0.146
HCM Control Delay (s)	7.7	0	-	-	9.5
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0.1	-	-	-	0.5

Intersection	
Int Delay, s/veh	2.3

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	61	3	27	103	3	27
Future Vol, veh/h	61	3	27	103	3	27
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	45	100	100	20	100	100
Mvmt Flow	64	3	28	108	3	28

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	67	0	230	66
Stage 1	-	-	-	-	66	-
Stage 2	-	-	-	-	164	-
Critical Hdwy	-	-	5.1	-	7.4	7.2
Critical Hdwy Stg 1	-	-	-	-	6.4	-
Critical Hdwy Stg 2	-	-	-	-	6.4	-
Follow-up Hdwy	-	-	3.1	-	4.4	4.2
Pot Cap-1 Maneuver	-	-	1087	-	585	780
Stage 1	-	-	-	-	757	-
Stage 2	-	-	-	-	675	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1087	-	569	780
Mov Cap-2 Maneuver	-	-	-	-	569	-
Stage 1	-	-	-	-	757	-
Stage 2	-	-	-	-	657	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.7	10
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	752	-	-	1087	-
HCM Lane V/C Ratio	0.042	-	-	0.026	-
HCM Control Delay (s)	10	-	-	8.4	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	0.1	-	-	0.1	-

APPENDIX D – TRAFFIC SIGNAL WARRANT JUSTIFICATION SPREADSHEETS

2019 (April 10)

Hour Ending	Main Eastbound Approach			Minor Northbound Approach			Main Westbound Approach			Minor Southbound Approach			sum	
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT		
8:00		288	29	49		36	22	156					580	AM PEAK
9:00		243	27	53		32	20	155					530	
10:00		191	36	36		27	23	130					443	
12:30		153	42	31		34	30	164					454	
13:30		151	29	29		36	41	181					467	
16:00		186	35	40		28	34	313					636	
17:00		223	46	28		32	59	376					764	PM PEAK
18:00		227	33	29		20	41	326					676	
Total	**0**	**1,662**	**277**	**295**	**0**	**245**	**270**	**1,801**	**0**	**0**	**0**	**0**	**4,550**	

Peak hour factors

Hour Ending	Main Eastbound Approach			Minor Northbound Approach			Main Westbound Approach			Minor Southbound Approach			Pedestrians Crossing Main Road
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT	
8:00		1.00	1.00	1.00		1.00	1.00	1.00					
9:00		0.84	0.93	1.08		0.89	0.91	0.99					
10:00		0.66	1.24	0.73		0.75	1.05	0.83					
12:30		0.53	1.45	0.63		0.94	1.36	1.05					
13:30		0.68	0.63	1.04		1.13	0.69	0.48					
16:00		0.83	0.76	1.43		0.88	0.58	0.83					
17:00		1.00	1.00	1.00		1.00	1.00	1.00					
18:00		1.02	0.72	1.04		0.63	0.69	0.87					
Total													**0**

2025 (estimate based on peak hour factors)

Hour Ending	Main Eastbound Approach			Minor Northbound Approach			Main Westbound Approach			Minor Southbound Approach			Pedestrians Crossing Main Road	
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT		
8:00		335	70	71		49	53	182						AM PEAK
9:00		283	65	77		44	48	181						
10:00		222	87	52		37	55	152						
12:30		178	101	45		46	72	191						
13:30		198	38	62		45	51	216						
16:00		244	46	86		35	43	373						
17:00		293	60	60		40	74	448						PM PEAK
18:00		298	43	62		25	51	388						
Total	**0**	**2,052**	**510**	**515**	**0**	**321**	**448**	**2,131**	**0**	**0**	**0**	**0**	**0**	

Analysis Sheet

Input Sheet | Results Sheet | Proposed Collision

GO TO Justification:

Intersection: Jinkinson Road / Hazeldean Road Count Date: 2019-04-10

Justification 1: Minimum Vehicle Volumes

Free Flow Rural Conditions

Justification	Guidance Approach Lanes				Percentage Warrant								Total Across	Section Percent
	1 Lanes		2 or More Lanes		Hour Ending									
Flow Condition	FREE FLOW ☑	RESTR. FLOW ☐	FREE FLOW ☐	RESTR. FLOW ☐	8:00	9:00	10:00	12:30	13:30	16:00	17:00	18:00		
1A	480	720	600	900	580	530	443	454	467	636	764	676		
	COMPLIANCE %				100	100	92	95	97	100	100	100	784	98
1B	180	255	180	255	85	85	63	65	65	68	60	49		
	COMPLIANCE %				47	47	35	36	36	38	33	27	300	38
Free Flow Signal Justification 1:					Both 1A and 1B 100% Fulfilled each of 8 hours ☐ Yes ☑ No Lesser of 1A or 1B at least 80% fulfilled each of 8 hours ☐ Yes ☑ No									

Justification 2: Delay to Cross Traffic

Free Flow Rural Conditions

Justification	Guidance Approach Lanes				Percentage Warrant								Total Across	Section Percent
	1 lanes		2 or More lanes		Hour Ending									
Flow Condition	FREE FLOW ☑	RESTR. FLOW ☐	FREE FLOW ☐	RESTR. FLOW ☐	8:00	9:00	10:00	12:30	13:30	16:00	17:00	18:00		
2A	480	720	600	900	495	445	380	389	402	568	704	627		
	COMPLIANCE %				100	93	79	81	84	100	100	100	737	92
2B	50	75	50	75	49	53	36	31	29	40	28	29		
	COMPLIANCE %				98	100	72	62	58	80	56	58	584	73
Free Flow Signal Justification 2:					Both 2A and 2B 100% fulfilled each of 8 hours ☐ Yes ☑ No Lesser of 2A or 2B at least 80% fulfilled each of 8 hours ☐ Yes ☑ No									

Justification 3: Combination

Combination Justification 1 and 2

	Justification Satisfied 80% or More			Two Justifications Satisfied 80% or More	
Justification 1	Minimum Vehicle Volume	YES ☐	NO ☑	YES ☐	NO ☑
Justification 2	Delay Cross Traffic	YES ☐	NO ☑		NOT JUSTIFIED

Justification 4: Four Hour Volume

Justification	Time Period	Total Volume of Both Approaches (Main) X	Heaviest Minor Approach Y (actual)	Required Value Y (warrant threshold)	Average % Compliance	Overall % Compliance
Justification 4	8:00	495	85	292	29 %	26 %
	16:00	568	68	259	26 %	
	17:00	704	60	205	29 %	
	18:00	627	49	235	21 %	

Analysis Sheet

Input Sheet | Results Sheet | Proposed Collision

GO TO Justification:

Intersection: Jinkinson Road / Hazeldean Road Count Date: 2019-04-10

Justification 5: Collision Experience

Justification	Preceding Months	% Fulfillment	Overall % Compliance
Justification 5	1-12	0 %	0 %
	13-24	0 %	
	25-36	0 %	

Justification 6: Pedestrian Volume

Pedestrian Volume Analysis

8 Hour Vehicular Volume V_8		Net 8 Hour Pedestrian Volume				
		< 200	200 - 275	276 - 475	476 - 1000	>1000
Justification 6A	< 1440					
	1440 - 2600					
	2601 - 7000	Not Justified				
	> 7000					

Pedestrian Delay Analysis

Net Total 8 Hour Volume of Total Pedestrians		Net Total 8 Hour Volume of Delayed Pedestrians		
		< 75	75 - 130	> 130
Justification 6B	< 200	Not Justified		
	200 - 300			
	> 300			

Analysis Sheet

Input Sheet | Results Sheet | Proposed Collision

GO TO Justification:

Intersection: Jinkinson Road / Hazeldean Road Count Date: 2025 (estimate)

Justification 1: Minimum Vehicle Volumes

Free Flow Rural Conditions

Justification	Guidance Approach Lanes				Percentage Warrant								Total Across	Section Percent
	1 Lanes		2 or More Lanes		Hour Ending									
Flow Condition	FREE FLOW ☑	RESTR. FLOW ☐	FREE FLOW ☐	RESTR. FLOW ☐	7:00	8:00	9:00	10:00	15:00	16:00	17:00	18:00		
1A	480	720	600	900	760	697	605	634	610	826	975	868		
	COMPLIANCE %				100	100	100	100	100	100	100	100	800	100
1B	180	255	180	255	120	120	89	91	107	121	100	87		
	COMPLIANCE %				67	67	49	51	60	67	56	48	464	58
Free Flow Signal Justification 1:					Both 1A and 1B 100% Fulfilled each of 8 hours ☐ Yes ☑ No Lesser of 1A or 1B at least 80% fulfilled each of 8 hours ☐ Yes ☑ No									

Justification 2: Delay to Cross Traffic

Free Flow Rural Conditions

Justification	Guidance Approach Lanes				Percentage Warrant								Total Across	Section Percent
	1 lanes		2 or More lanes		Hour Ending									
Flow Condition	FREE FLOW ☑	RESTR. FLOW ☐	FREE FLOW ☐	RESTR. FLOW ☐	7:00	8:00	9:00	10:00	15:00	16:00	17:00	18:00		
2A	480	720	600	900	640	577	516	543	503	706	875	781		
	COMPLIANCE %				100	100	100	100	100	100	100	100	800	100
2B	50	75	50	75	71	77	52	45	62	86	60	62		
	COMPLIANCE %				100	100	100	90	100	100	100	100	790	99
Free Flow Signal Justification 2:					Both 2A and 2B 100% fulfilled each of 8 hours ☐ Yes ☑ No Lesser of 2A or 2B at least 80% fulfilled each of 8 hours ☑ Yes ☐ No									

Justification 3: Combination

Combination Justification 1 and 2

	Justification Satisfied 80% or More			Two Justifications Satisfied 80% or More	
Justification 1	Minimum Vehicle Volume	YES ☐	NO ☑	YES ☐	NO ☑
Justification 2	Delay Cross Traffic	YES ☑	NO ☐		NOT JUSTIFIED

Justification 4: Four Hour Volume

Justification	Time Period	Total Volume of Both Approaches (Main) X	Heaviest Minor Approach Y (actual)	Required Value Y (warrant threshold)	Average % Compliance	Overall % Compliance
Justification 4	7:00	640	120	230	52 %	57 %
	16:00	706	121	205	59 %	
	17:00	875	100	149	67 %	
	18:00	781	87	178	49 %	

Analysis Sheet

Input Sheet | Results Sheet | Proposed Collision

GO TO Justification:

Intersection: Jinkinson Road / Hazeldean Road Count Date: 2025 (estimate)

Justification 5: Collision Experience

Justification	Preceding Months	% Fulfillment	Overall % Compliance
Justification 5	1-12	0 %	0 %
	13-24	0 %	
	25-36	0 %	

Justification 6: Pedestrian Volume

Pedestrian Volume Analysis

8 Hour Vehicular Volume V_8		Net 8 Hour Pedestrian Volume				
		< 200	200 - 275	276 - 475	476 - 1000	>1000
Justification 6A	< 1440					
	1440 - 2600					
	2601 - 7000	Not Justified				
	> 7000					

Pedestrian Delay Analysis

Net Total 8 Hour Volume of Total Pedestrians		Net Total 8 Hour Volume of Delayed Pedestrians		
		< 75	75 - 130	> 130
Justification 6B	< 200	Not Justified		
	200 - 300			
	> 300			

APPENDIX E – CONSULTANT TEAM'S CVS

Castleglenn Consultants
Engineers, Project Managers & Planners

Arthur Gordon

B.A., B.Eng., P. Eng.

Principal

Recently Completed Projects, Education and Memberships

Mr. Gordon is President of CastleGlenn Consultants Inc. He has served in the capacity as Director and Manager of Transportation Planning within major Canadian consulting engineering firms.

He has been responsible for numerous transportation planning and engineering design studies throughout Canada requiring detailed analysis, establishment of existing and forecast travel patterns and the development of sound rationale and justification for transportation/transit related infrastructure solutions.

Mr. Gordon has recently led the Highway 43 (Fox Creek) Major FPS and Highway 16-Highway 21 Major FPS to successful completion. In each case, he led a multi-disciplinary team of engineers to deliver a high-quality transportation solution to meet the needs of local residents and the Province. He worked with Alberta Transportation in the coordination and conduct of three Multiple Account Evaluation Sessions that saw more then 3-dozen interchange concepts presented, analyzed and evaluated from a variety of factors.

Mr. Gordon recently received the (2019) Minister's Award for Transportation Innovation by the Alberta Provincial government. This evidences his extensive experience with the development of transportation infrastructure within urbanized environments involving criteria and approaches that assess mobility, accessibility, level of service, parking circulation, operations and transit/pedestrian circulation measures within nationally significant campus environments. As well, his background includes life cycle analysis, road inventory, asset inventory, environmental assessment, transportation and transit economics, cost estimating and transportation implementation systems.

Mr. Gordon provides extensive consulting management expertise in major transportation functional planning and transit engineering studies and projects. He has managed and directed large interchange, freeway, highway and municipal transportation infrastructure initiatives inclusive of master planning studies addressing river and rail crossings. He offers multi-modal experience incorporating truck, airport, light rail as well as cycling, pedestrian design, traffic management, traffic impact, parking, site evaluation, traffic forecasting and transportation safety projects.

Mr. Gordon offers substantial functional planning experience having completed over 55 major functional planning and design assignments throughout his career.

Mr. Gordon is experienced with the development of transportation infrastructure within an urbanized environment involving criteria and approaches to assess mobility, accessibility, level of service, parking circulation, tourism operations and pedestrian circulation patterns within nationally significant campus environments.

Mr. Gordon has been retained by the Province of Alberta on several occasions to provide a peer review of other consultants functional planning submissions to address issues related to functionality, design adherence, cost, economic development impacts and provide added innovation. In many cases these assignments required political endorsement of the constituent municipalities.

Mr. Gordon also offers significant expertise in addressing the impacts of heavy vehicle traffic. He was a co-project manager responsible for the City of Edmonton's "*Truck Route and Regulation Study*" and has undertaken the "*National Capital Area Goods Movement Study*" and the "*Oakville Truck Route and Regulation Study*".

Mr. Gordon has developed a reputation of excellence in the area of communication and presentation skills. This has been displayed through numerous public consultation/ outreach exercises, providing expert witness testimony and prepared presentations to municipal councils, tribunals, executive committees and has testified to the Alberta Land Compensation Board and the Ontario Municipal Board. Most recently, Mr. Gordon was involved with the Hwy 63 Atmore Land Compensation Board. Mr. Gordon is known for incorporating public participation within the engineering process having coordinated technical review committee and public focus groups aimed at developing solutions that are community driven. He has participated in numerous exercises involving peer review and value engineering aimed at undertaking reviews of infrastructure proposals and preliminary design plans on behalf of municipalities, Alberta Transportation and the Ministry of Transportation of Ontario.

For the Province of Newfoundland and Environment Canada, he undertook the "*Trans-Canada Highway Improvements in the Vicinity of Terra Nova National Park*" (Newfoundland) that was used to assess alternative

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Principal

Recently Completed Projects, Education and Memberships

corridors and their impacts upon a provincially significant national park and the adjacent communities.

Within the field of transportation planning within a municipal setting Mr. Gordon's experience is diverse and multi-faceted. He co-authored the "*Implementing Employer Based Transportation Demand Management (TDM) Programs"* on behalf of the City of Ottawa. He is currently working with the Edmonton International Airport (EIA) to assess their infrastructure requirements. Moreover, he provided transportation planning expertise on the "*Parliamentary Precinct Study*" in the National Capital.

In addition, he is thoroughly familiar with various evaluation frameworks which address infrastructure upgrading, safety, road-user benefit / cost analysis, level of service, socio-economic impact analysis, economic justification, and the requirements necessary to meet Federal EA processes.

Mr. Gordon's experience includes rigorous technical analysis involving surveys of all heavy registered commercial vehicles, comprehensive community involvement, and a thorough operational comparative impact evaluation and assessment. Variables such as the adjacent area land uses, roadway classification, the number of lanes, geometric features, intensity of pedestrian activity, level of congestion, access density, origin-destination demand, alternate route viability, route continuity and consistency economic simulation. He has developed numerous methodologies for determining forecast travel patterns and the requirements for producing sound justifications for proposed improvements within an urban setting.

Transportation Engineering/Planning – Alberta -

- Highway 16 Clover Bar Road Functional Planning Study
- Highway 43 Fox Creek Functional Planning Study
- Coal Loading Facility Functional Planning: Integration with Hwy 3/3X Provincial Plans Detailed Design (Blairmore)
- Detailed Roadway Design - Airport Road East from Sparrow Dr to 5th St (Leduc County)
- East Ramp Terminal Detailed Design - Hwy 2:32 Interchange at Airport Road (Leduc County)
- EIA Commercial Development TIS (Edmonton International Airport)
- Leduc County Annexation Review (Leduc County)
- Highway 2 Corridor Improvement Study CIS (Calgary to Edmonton)
- City of Leduc Transportation Master Plan (Leduc)
- Airport Road Interchange Functional Planning Study (Edmonton International Airport)
- QE II - 65th Ave Interchange FPS (Leduc)
- Highway 63:01 FPS (Boyle)
- Highway 1 FPS (Old Banff Coach Road) & Hwy 563
- Athabasca Truck Route Study
- Highway 43 FPS (Hwy 33 to Hwy 16)
- Hwy 22X FPS (Calgary to Indus)
- QE II/Hwy 27 FPS (Olds)
- Bypass Discussion Paper
- Safety Rest Area Discussion Paper
- Highway 63 Median Vehicle Inspection Station Design
- Highway 63 FPS
- Highway 28A/28 FPS (Gibbons)
- Highway 1-RR33 Interchange Design FPS
- Highway 855 Corridor FPS
- Highway 27 (Olds & Sundre) FPS
- QE II (Bowden) FPS
- QE II &Township Road 265 Partial Interchange (Airdrie)
- Highway 3 & 6 Interchange FPS (Pincher Creek)
- Highway 14 FPS (Wainwright)
- Lacombe/Blackfalds Traffic Impact Assessment (Lacombe County)
- Highway 2A FPS (Ponoka)
- Highway 27 & Olds FPS (Olds)
- Highway 2A Transportation Planning Study (Blackfalds to Lacombe)
- QE II Corridor Management Study (Calgary to Innisfail)
- Highway 2A Transportation Planning Study (Red Deer to Blackfalds)
- Highway 1 Dunmore FPS
- Highway 3 & 36 Taber Access Management Planning Study
- QE II & Hwy 3 FPS, Fort Macleod, Alberta Transportation
- Highway 1 FPS, Brooks, Alberta Transportation
- Highway Vicinity Access Management Agreement, Highway 11 East of Red Deer FPS
- Highway 11 Realignment Study, East of Red Deer
- Highway 34 & Highway 2 Interchange, Grand Prairie, Functional Design
- QE II & Hwy 11 Interchange Upgrades Red Deer
- Highway 11 Twinning
- Review of Ontario Access Management Policies
- Review of Interstate Highway (FHWA) Access Management Policies

Castleglenn Consultants
Engineers, Project Managers & Planners

Arthur Gordon

B.A., B.Eng., P. Eng.

Principal

Recently Completed Projects, Education and Memberships

- Edmonton Transportation Master Plan: Truck Route Study

In addition, Mr. Gordon has undertaken numerous studies within Ontario as well as work in British Columbia and Newfoundland. A few of the relevant design projects are listed below:

- Woodroffe Avenue Reconstruction Traffic Management Plan
- Ottawa Civic Hospital Parking Garage Evaluation
- Ottawa General Hospital Smyth Road Intersection Modifications Detailed Design
- 1450 & 1454 Merivale Road Detailed Design, Tender Document and Construction Administration
- Craig Henry and Greenbank Road Intersection Improvement - Detailed Design
- Silver Seven Road Median Preliminary and Detailed Design
- Hunt Club Road - New Proposed Development Access and Right-In/Right-Out Access East of Hawthorne Road
- Moodie Drive and Dibble Road Intersection Modifications
- Mer Bleue Roundabout Design
- Strandherd Drive Pavement Markings and Signage Plan
- 350 Cresthaven Retail Development Design

Memberships

- Association of Professional Engineers, Geologists and Geophysicists of Alberta
- Professional Engineers, Ontario
- Institute of Transportation Engineers, Past President, National Capital Section
- Transportation Association of Canada, Transportation Planning Committee

Education

- B.Eng. Civil Engineering, Carleton University, 1984
- B.A. Economics and Law, Carleton University, 1980
- Masters Courses
- Accredited Health and Safety Auditor – Alberta Construction Safety Association

Castleglenn Consultants
Engineers, Project Managers & Planners

Andrey Kirillov

B.Eng, EIT

Transportation Planner

Mr. Andrey Kirillov is a Transportation Planner with CastleGlenn Consultants Inc.
Mr. Kirillov offers extensive training within the field of transportation planning, traffic analysis and functional planning. He has developed a diverse set of skills in the fields related to transportation traffic engineering, infrastructure planning and engineering.
Mr. Kirillov has knowledge of analyzing multi-modal traffic streams with both macro-and-micro modelling techniques, having been involved in numerous traffic operations studies, and transportation impact assessments (TIA), as well as major functional planning studies (FPS), and Transportation Master Plans.

Major Planning Projects

- *Penhold Provincial Intersection Improvements (Town of Penhold, Alberta)*: This project involved a review of transportation network in the Town of Penhold accounting for projected future growth. Mr. Kirillov assisted with development of traffic generation zones and traffic generation assumptions for short-, medium- and long-term horizon caused by population growth and development in the Town of Penhold. Additionally, Mr. Kirillov was responsible for obtaining and collecting applicable traffic count information, including traffic surveyor's recruitment and training.

- *Highway 40 Network Review Study (Grande Praire, Alberta)*: This project was to address safety concerns over a 85 km stretch of Highway 40 corridor. Mr. Kirillov assisted with traffic modeling, intersection capacity analysis, communications and public engagement aspects of the project. His duties included refining future travel demand traffic model, and intersection capacity analysis of the proposed roundabouts. Additionally, Mr. Kirillov was responsible for organizing and promoting online public engagement sessions using Social Pinpoint interactive map tools, and zoom video conferencing software.

- *Leduc County Transportation Master Plan (TMP) (Leduc County, Alberta)*: Mr. Kirillov assisted with traffic analysis, communications and public engagement aspects of the project. His duties included production of GIS exhibits, communication with the county and project team, and report review. A major component of Mr. Kirillov's duties included assisting with organization of in- person public open houses, including preparation of public presentation materials, advertisement materials, and attendance at the two in-person open houses. A component of the TMP process involved identifying intersection upgrade requirements over the next 10 and 20-year time horizons throughout the entire county as well as addressing deficiencies in adherence to municipal design standards.

Transportation Impact Assessments

- *64 Barrack Street Mixed-Use Residential-Retail Development, (Kingston, Ontario):* Mr. Kirillov was the lead traffic analyst for this traffic study involving a proposed 25-storey residential building with ground floor retail component located in downtown Kingston, Ontario. The traffic study involved analysis of operational traffic conditions in different time horizons, including build-out, and build-out + 5 years. The study also involved analysis of circulation and parking provisions.

- *Chalk River Nuclear Laboratories Concrete Batch Plant (Chalk River, Ontario):* Mr. Kirillov was the lead traffic analyst for the study involving a proposed concrete batch plant for the ANMRC (Advanced Nuclear Materials Research Centre) construction project at the Canadian Nuclear Laboratories Chalk River campus. The analysis involved intersection capacity analysis of three intersections under two different scenarios: with the proposed plant in place and without the proposed plant (outsourcing the materials from a nearby city). A total of five different time horizons (historical pre-covid, existing, build-out, build-out + 5 year and build-out + 10 years horizons were analyzed), with future horizons analyzed under each operational scenario. Pre-pandemic traffic and post-pandemic traffic were compared to justify the worst-case traffic volumes appropriate for future horizon analysis. The study also involved access review, heavy vehicle turning movement review and recommendations regarding signal phasing optimization at the nearby signalized Highway 17 / Plant Road intersection.

- *150 Kanata Avenue-1200 Maritime Way Mixed-Use Development (Ottawa, Ontario):* Mr. Kirillov was the lead traffic analyst for this traffic study relating to the proposed 351-unit mixed-use residential and retail development. The study involved traffic forecasting and analysis of ten intersections accounting for existing, interim, and future design conditions (phase 1 build-out, full build-out, and build-out + 5 years horizons). The study also included screening of mitigation strategies, such as roadway widening, signal timing and traffic signal phase adjustments, and implementation of a roundabout configuration. Analysis of mitigated conditions was conducted using both Synchro™ and Sidra™ softwares.

- *424 Churchill Avenue North Condominium Development (Ottawa, Ontario):* Mr. Kirillov lead the traffic analysis component of the traffic study for the proposed 58-unit residential building in the Westboro neighborhood of Ottawa, Ontario. The proposed development aligned with Ontario's provincial policies on intensification in built-up urban areas. The traffic forecasting component of the study involved justification of existing and future mode shares. A major component of this study was not only ensuring the vehicular traffic entering and leaving the development can be accommodated, but also ensuring proper active transportation provisions were in place to accommodate the resulting mode

shares of the proposed residential building.

• *1124-1126 Pembroke St. E Commercial Development (Pembroke, Ontario)* Mr. Kirillov was the lead analyst responsible for the traffic analysis associated with the proposed commercial development in Pembroke, Ontario, consisting of several quick-serve restaurants, including one with provisions for drive-thru operations. The study involved traffic forecasting and analysis under three different future time horizons five different time horizons (existing, build-out, build-out + 5 year and build-out + 10 years) with careful consideration given for pass-by and diverted trips from nearby highway corridor. The study also involved access and internal circulation review to ensure the development conforms to MTO's highway access guidelines.

• *Stittsville II Quarry Expansion (Ottawa, Ontario).* Mr. Kirillov was the lead analyst responsible for the traffic analysis associated with the proposed expansion of a quarry located on the western edge of the City of Ottawa near the neighborhood of Stittsville. The study involved traffic analysis of existing and operational conditions along three study area intersections, as well as qualitative review of collision data along adjacent roadway corridors.

• *36B Harris Street Residential Development, (Perth, Ontario)*; Mr. Kirillov lead the traffic analysis component of the traffic study in Town of Perth (about 7,500 residents). The study involved traffic forecasting, assignment and distribution for proposed new residential developments, and the analysis of 8 signalized and unsignalized intersections for existing, interim and future conditions. The findings were summarized to determine the traffic impact of the proposed residential development on the community and the timing and impacts to adjacent intersections.

• *IHA Seniors' Residence Development (Alexandria, Ontario)* Mr. Kirillov assisted with traffic analysis on the senior housing development within a community of 3,000 persons. The impact of the 500-unit development upon the community was evaluated from a traffic perspective inclusive of pedestrian connectivity within the surrounding area. The development was phased to determine the timing/staging of infrastructure/ new accesses upon the community.

• *Westhaven Subdivision (Arnprior, Ontario)*: Mr. Kirillov was the lead traffic analyst for the Westhaven Subdivision Traffic Impact Study in the Town of Arnprior, ON (9,000 residents). The objective of the study was to evaluate the impact of the proposed residential subdivision on the adjacent road network. The analysis dealt with existing, future background and future design conditions using Synchro.

• *5329 Boundary Road Commercial Development (Ottawa, Ontario):* Mr. Kirillov was the senior traffic analyst for this TIA in support of the proposed major fuel/commercial development. The study was required to follow both municipal and Provincial requirements, and dealt with a review of existing traffic, site traffic, site circulation and access management effecting the design of both municipal and provincial infrastructure.

Key skills

• Excellent verbal communication skills;
• Experienced in planning and problem solving;
• Experienced in engaging with public and stakeholders;
• Proficient in technical writing;
• Strong analytical capacity; and
• *Proficient with…*
• Synchro versions 8/10/11;
• Sidra Roundabout Analysis;
• Rodel Roundabout Analysis;
• Microsimulation analysis using SimTraffic™ to model real-time vehicle conflicts and safety elements;
• HCM 2000/HCM 2010/HCM 6 Traffic Analysis; and
• ArcGIS and QGIS platforms.
• Google Earth, Google Maps and similar GIS Platforms
• Microsoft Word Suite (Word, Excel, PowerPoint, Outlook, etc.)
• *Also Experienced with…*
• Autodesk AutoCAD and AutoCAD Civil 3D
• Social Pinpoint tools for public and stakeholder engagement
• Streetlight Data tools for macro traffic simulations

Education

• B. Eng. Civil Engineering with Cooperative Education, Carleton University, Ottawa, ON, 2021

Castleglenn Consultants
Engineers, Project Managers & Planners

Konstantin Joulanov

B. ASc, M. Eng.

Transportation Planner

Mr. Konstantin Joulanov has recently joined Castleglenn Consultants Inc. as a *Transportation Planner* with

Mr. Joulanov joined Castleglenn Consultants Inc. in October 2021, and since then he has undergone an extensive training on transportation planning and analysis.

Mr. Joulanov has developed a diverse set of skills in the fields related to transportation planning and engineering. Mr. Joulanov has knowledge of analyzing multi-modal traffic streams with both macro-and-micro modelling techniques, having been involved primarily in traffic operations studies, and transportation impact assessments (TIA), as well as having had some exposure to functional planning studies (FPS), and Transportation Master Plans.

Major Planning Projects (Ongoing)

- *Leduc County Transportation Master Plan (TMP) (Leduc County, Alberta, 2021):* Mr. Joulanov assisted with public engagement aspects and report preparation of the project. His duties included summarization of various findings as well as report review.
- *Highway 40 Network Review (Alberta, 2021):* Konstantin conducted a thorough traffic analysis involving at least 10 highway intersections and 8 roundabouts along the Highway 40 corridor south of Grande Prairie for both 10-year and 20-year time horizons. The analysis was used to determine intersection configurations and staging leading to functional design and costing. Minimum level of services thresholds was established at the outset to assure acceptable traffic operations.

Transportation Impact Assessments

- *777 Silver Seven Commercial Development, (Ottawa, Ontario);* Mr. Joulanov conducted the traffic analysis component of this TIA which involved a 9-story building housing medial and general offices and a multi-story self-storage centre. The study involved traffic forecasting, assignment and distribution for the proposed development, as well analysis of 5 signalized and unsignalized intersections which required determination of existing traffic and ultimate traffic conditions. The findings were summarized to judge traffic impact of the proposed development upon the surrounding residential community.
- *150 Kanata Avenue-1200 Maritime Way Residential Development (Ottawa, Ontario);* Konstantin assisted in the traffic analysis of this study, which involved a 350-unit 7/8/9-storey multi-use residential-commercial-retail complex. The project saw an evaluation of 9 intersections within the study area including ramp terminal intersections with the major 417 freeway corridor. Existing and ultimate time horizons were evaluated both with and without the development in place to determine the necessary infrastructure upgrades. The study also included screening of mitigation strategies, such as roadway widening, signal timing/phasing, and operational assessment of a roundabout configured intersection. Analysis of mitigated conditions was conducted using Synchro™ and Sidra™.
- *Proposed Storyland Quarry (Renfrew, Ontario);* This project involved securing the necessary approvals to establish a quarry operation near a major Provincial highway corridor. Mr. Joulanov conducted the traffic analysis component of this project which required an assessment of alternative access locations and configurations taking into account sight line requirement and heavy vehicle operational characteristics. A total of 3 alternative access arrangements were considered taking into account the traffic impact of the proposed development upon the surrounding roadways.

Key skills

- Excellent verbal communication skills;
- Experienced in planning and problem solving;
- Proficient in technical writing;
- Strong analytical capacity; and
- Proficient with…
  - Synchro versions 8/10;
  - Sidra Roundabout Analysis;
  - HCM 2000/HCM 2010/HCM 6 Traffic Analysis;
  - ArcGIS and QGIS platforms.
  - Google Earth and similar GIS platforms; and
  - Microsoft Word Suite (Word, Excel, PowerPoint, Outlook, etc.)

Education

- Bachelor of Applied Science in Civil Engineering, University of Ottawa,
- Masters of Engineering, Carleton University